



EUROPEAN CENTRAL BANK

EUROSYSTEM

Financial Stability Review

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Foreword



Welcome to a revamped Financial Stability Review (FSR). Ever since the FSR was launched in 2004 by my late colleague Tommaso Padoa-Schioppa, the publication has continued to evolve and improve. The present issue introduces a number of new features, both in substance and in form. First, the *Overview* has been redesigned with the aim of offering a more thematic and comprehensive view of the key vulnerabilities for euro area financial stability, mirroring the discussion in the main chapters of the Review.

Second, the scope of the policy considerations presented in the *Overview* has been expanded beyond financial regulation to also include a section on *Recommendations and policy considerations* dedicated to issues relevant for financial stability in the euro area. Areas covered in this issue include housing markets, bank business models and non-performing loans, cybersecurity and the asset management sector.

Third, two new important systemic risk indicators are introduced which can be used as predictors of the consequences of financial instability for the real economy. The financial stability risk index (FSRI) predicts the near-term recessionary effects of financial stress, while the cyclical systemic risk indicator (CSRI) anticipates the medium-term consequences of financial instability (see Special Features A and B). The new systemic risk indicators will improve our ability to detect near to medium-term risks to financial stability in terms of “GDP-at-risk”. Other uses of these new indicators in calibrating the impact of macroprudential measures will be explored in the future, as the traditional credit-to-GDP gap has become less reliable. The methodology for assessing “GDP-at-risk” is fully in line with our definition of systemic risk. Systemic risk materialises when the ability of the financial system to provide essential financial products and services to the real economy is impaired to a point where economic growth and welfare may be materially affected.

Fourth, the scenario analysis in the chapter on *Euro area financial institutions* has been significantly changed. Previously, the section focused on measuring the impact on the solvency of banks and insurance companies of the various categories of identified risks in isolation. The main risks have now been mapped into two broad and internally coherent adverse scenarios to assess the resilience of the euro area banking sector. The chapter also includes the assessment of the non-bank financial sector, comprising euro area insurers and investment funds.

Fifth, a new chapter discusses developments in the *Regulatory framework* of the whole financial system in an all-encompassing manner. Financial regulation is the foundation of macroprudential policy because it deals with the design and calibration of instruments and the basic rules that impact the overall resilience of the financial system.

With analytical tools and recommendations, the FSR continues to fulfil its role in assessing developments relevant for financial stability, including identifying and prioritising the main sources of systemic risk and vulnerabilities for the euro area

financial system – comprising intermediaries, markets and market infrastructures. It does so to promote awareness of these systemic risks among policymakers, the financial industry and the public at large, with the ultimate goal of promoting financial stability. The FSR also plays an important role in relation to the ECB's microprudential and macroprudential competences, including the power to top up national macroprudential measures. By providing a financial system-wide assessment of risks and vulnerabilities, the Review 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. While the ECB's roles in the macroprudential and microprudential realms rely primarily on banking sector instruments, the FSR focuses on the 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 overview of current developments relevant for euro area financial stability, this Review includes eight boxes and three special features aimed at deepening the ECB's financial stability analysis and broadening the basis for macroprudential policymaking.

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

Vítor Constâncio
Vice-President of the European Central Bank

Overview

The financial stability environment in the euro area has remained favourable over the past six months. On the one hand, the economic expansion in the euro area has continued. As a result, the debt-servicing and loss-absorption capacities of sovereigns, firms, households and financial institutions have strengthened. The improvement in economic growth has also supported a moderate, albeit not excessive, pick-up in credit origination, which will support bank profitability. On the other hand, developments in asset prices require close monitoring as risk-taking continues to gain momentum in financial markets. At this stage no broad-based asset price misalignments can be observed across euro area financial and tangible assets. Some pockets of stretched valuations are, however, building up, particularly for lower-rated bonds and in certain real estate markets.

The euro area financial stability environment has continued to be favourable...

Supported by

- Robust economic expansion
- No signs of excessive credit growth
- Strengthened bank resilience

Challenged by

- Continued risk-taking in markets
- Pockets of stretched valuations in certain segments

... but risks remain over a 24-month horizon

- Spillovers from a disruptive repricing of term and other risk premia in global financial markets
- Hampered intermediation capacity of banks amid weak performance and structural challenges
- Public and private debt sustainability concerns amid historically high debt levels
- Liquidity risks in the non-bank financial sector, with contagion to the broader system

Summary indicators of systemic risk confirm a favourable financial stability environment. The composite indicator of systemic stress in financial markets (CISS) continues to signal that financial system stress is currently low, although it picked up

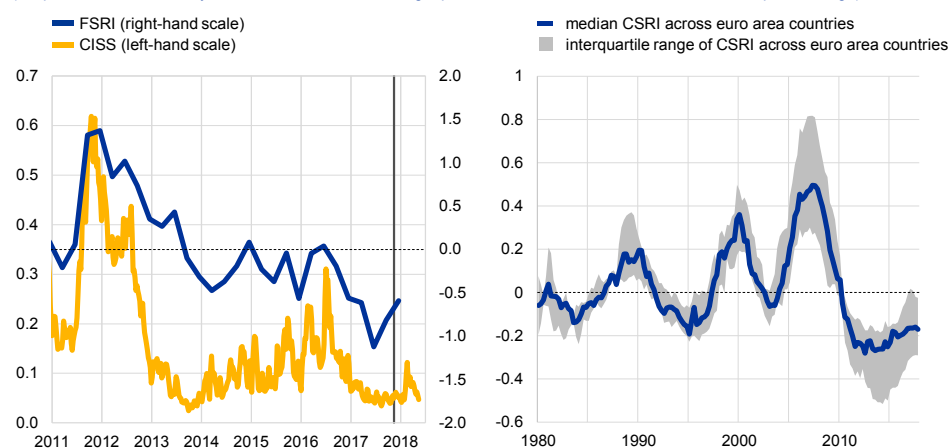
slightly in February following the turmoil in stock markets. This issue of the FSR introduces new indicators for gauging near and medium-term risks to euro area financial stability (for details, see [Special Feature A](#) and [Special Feature B](#)). The first is a composite financial stability risk index (FSRI) aimed at predicting large adverse shocks to the real economy in the near term (see [Chart 1](#) – left panel). The second is a composite cyclical systemic risk indicator (CSRI) designed to signal risks of a financial crisis over the medium term (see [Chart 1](#) – right panel). Both indicators have fluctuated at low levels in recent quarters, implying a low likelihood of systemic risks to the euro area materialising in the near-to-medium term. While recent readings have increased somewhat, they come at a time of upward revisions to consensus expectations for GDP growth.

Chart 1

Economy-wide and financial market indicators of near-term and medium-term systemic risk remained contained

Financial stability risk index for the euro area economy and composite indicator of systemic stress in financial markets (left panel) and median of cyclical systemic risk indicator across euro area countries (right panel)

(left panel: Jan. 2011 – May 2018; Q1 2011 – Q4 2017; right panel: Q1 1980 – Q4 2017, median and interquartile range)



Sources: Bloomberg, ECB, Eurostat and ECB calculations.

Notes: For details on the FSRI, see [Special Feature A](#). The scale in the left panel measures deviation from the historical mean expressed in multiples of the historical standard deviation. The CISS is normalised to lie between 0 and 1. FSRI: quarterly frequency; CISS: weekly frequency, two-week moving averages. The vertical line in the left panel represents the publication of the previous FSR on 29 November 2017. For details on the CSRI, see [Special Feature B](#). The scale in the right panel measures deviation from the historical median expressed in multiples of the historical standard deviation.

This FSR identifies four key risks to euro area financial stability over the next two years. The first risk relates to spillovers from a disruptive repricing of term and other risk premia in global financial markets. The second risk concerns a potential hampering of banks' intermediation capacity amid weak financial performance compounded by structural challenges. The third risk highlights public and private debt sustainability concerns amid historically high debt levels. Finally, the fourth risk relates to liquidity risks that could emerge in the non-bank financial sector, with contagion to the broader system. All four of these risks are intertwined and the materialisation of any one of them could potentially trigger the materialisation of the others.

Improved economic prospects

Since the November 2017 FSR, global economic growth prospects have further strengthened, but downside risks remain. The macroeconomic environment

outside the euro area has improved overall, supported by favourable financing conditions and strengthening labour markets. Confidence indicators suggest that the global economic outlook will continue on its positive trajectory in the near term. Downside risks to the global macro outlook could, however, materialise via a number of channels. First, growth could deteriorate if uncertainties surrounding the fiscal and monetary policy mix in the United States increase. Second, a significant escalation of trade tensions risks derailing the ongoing expansion in global trade and activity. Third, abrupt changes in market sentiment and repricing in asset markets could lead to a real economic downturn via confidence and balance sheet channels.

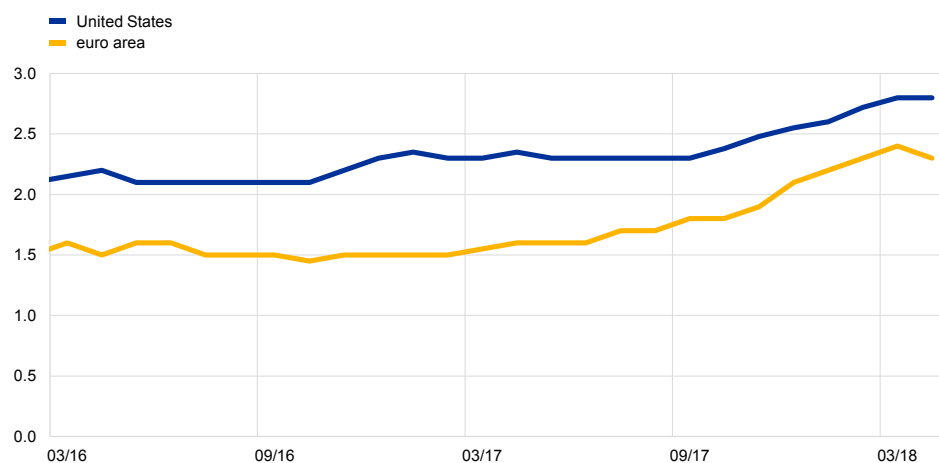
Financial stability in the euro area continues to benefit from a robust growth outlook (see Chart 2). Recent readings for the euro area confirm a solid and broad-based expansion of the euro area economy. Real GDP growth is expected to remain above potential until 2020. Downside risks to euro area real GDP growth continue to relate primarily to global factors, including developments in foreign exchange and other financial markets.

Chart 2

Improved economic growth prospects

US and euro area real GDP growth expectations for 2018

(Mar. 2016 – Apr. 2018; annual percentages)



Source: Bloomberg.

Note: Expectations of market analysts as surveyed by Bloomberg.

The resilience of the euro area economy has improved. Almost all euro area countries previously under stress in the crisis now have budget deficits below 3% of GDP. A broad-based improvement in primary balances can be observed, which has strengthened sovereigns' shock-absorption capacity. Current account deficits have turned into surpluses owing to both structural and cyclical factors. All in all, the euro area is more resilient and better prepared to weather possible financial shocks coming from the international environment.

High indebtedness across sectors in a number of countries poses risks to financial stability

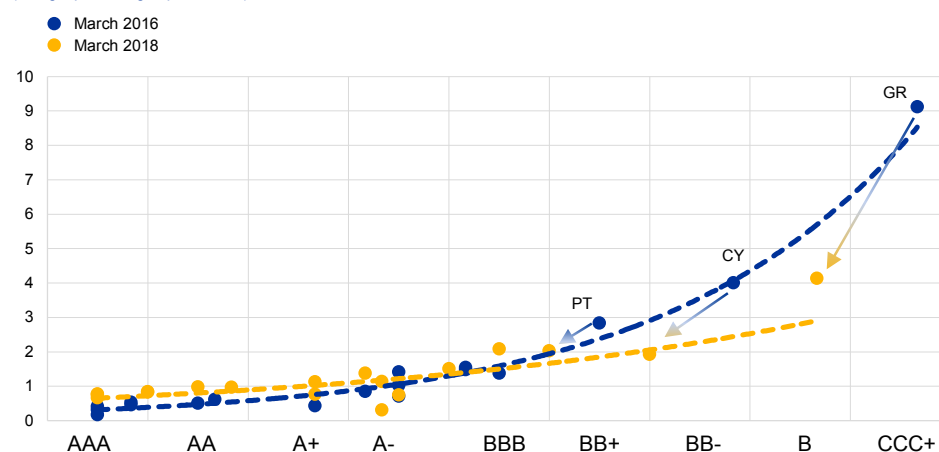
The improved macro outlook has benefited euro area sovereign financing costs. The creditworthiness of euro area sovereigns has improved, as confirmed by a number of rating upgrades. The brighter economic conditions, coupled with the overall favourable market sentiment, have contributed to lower financing costs across a number of euro area jurisdictions (see [Chart 3](#)).

Chart 3

Favourable financing costs for euro area sovereigns

Ten-year government bond yields and credit ratings of euro area sovereigns

(ratings; percentages per annum)



Sources: Standard & Poor's, Moody's, Fitch, ECB and ECB calculations.

Notes: The rating score represents the average rating by the three major rating agencies, Moody's, Standard & Poor's and Fitch. The bond yields indicate the long-term interest rate for convergence purposes (secondary market yields of government bonds with maturities of ten, or close to ten, years).

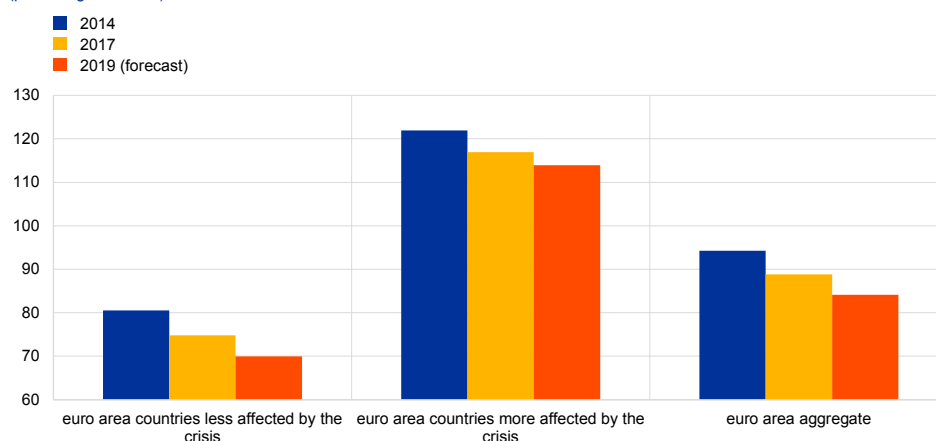
Despite the overall favourable developments in recent quarters, some euro area sovereigns remain vulnerable. Headline fiscal balances and the level of indebtedness across euro area countries are expected to improve over the coming years, strongly supported by the advantageous cyclical conditions. Some progress has been made across the euro area in reducing public debt levels, but in some countries they are still fairly elevated, highlighting the need to continue to maintain primary surpluses (see [Chart 4](#)). Going forward, risks mainly relate to a deterioration in the growth environment that could have a pronounced impact on the fiscal outlook and, by extension, on market sentiment towards some euro area sovereigns. Debt sustainability concerns may also be triggered by a possible rise in (geo)political risks. Uncertainties regarding the finalisation of the Brexit negotiations and possible adverse trade implications stemming from protectionist tendencies in advanced economies have the potential to challenge the economic outlook, which may push sovereign credit risk premia higher. These vulnerabilities and potential triggers notwithstanding, debt sustainability concerns for the euro area sovereign sector are currently assessed to be lower than they were at the time of the November 2017 FSR.

Chart 4

Sovereign debt levels have come down in recent years amid cyclical tailwinds, but sovereign indebtedness remains elevated in some euro area countries

General government debt-to-GDP ratios across the euro area

(percentages of GDP)



Sources: European Commission (AMECO Database) and ECB calculations.

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

The private sector has also benefited from the favourable macroeconomic conditions, with credit flows recovering at a moderate pace. Bank lending to the corporate sector remains on a recovery path, reflecting supportive financing conditions, strong business confidence and the ongoing economic expansion. On the supply side, lending terms and conditions have continued to ease, albeit with some cross-country heterogeneity. In particular, bank lending conditions for firms continue to be tighter in most of the countries in which both firm indebtedness and non-performing loan (NPL) ratios are high. The household sector has also continued to take on more debt in an environment of favourable financing conditions, rising house prices and a further improvement in labour markets. The rate of growth in consumer credit has been particularly pronounced. In euro area mortgage markets, a rising volume of repayments of older loans – reflecting ongoing deleveraging of households in some countries – has been concealing an increasing dynamism in new loan origination over the past two years. The strength in the origination of new loans for house purchase is closely correlated with the buoyant house price dynamics observed in recent years.

High indebtedness of households, firms and governments in a number of countries poses risks to financial stability. Deleveraging in the sovereign and non-financial private sectors has been relatively slow. As a result, debt-to-GDP ratios across sectors remain high relative to standard benchmarks in a number of countries, even in a context of contained credit growth (see [Chart 5](#)). Corporate indebtedness in particular remains high at the aggregate euro area level by both historical and international standards. The high indebtedness may lead to renewed debt sustainability concerns, especially in the event of a rapid worsening of growth prospects. Furthermore, there are risks that an intensification of vulnerabilities in one sector could spill over to other sectors, with negative repercussions for the banking system. That said, the introduction of the Bank Recovery and Resolution Directive

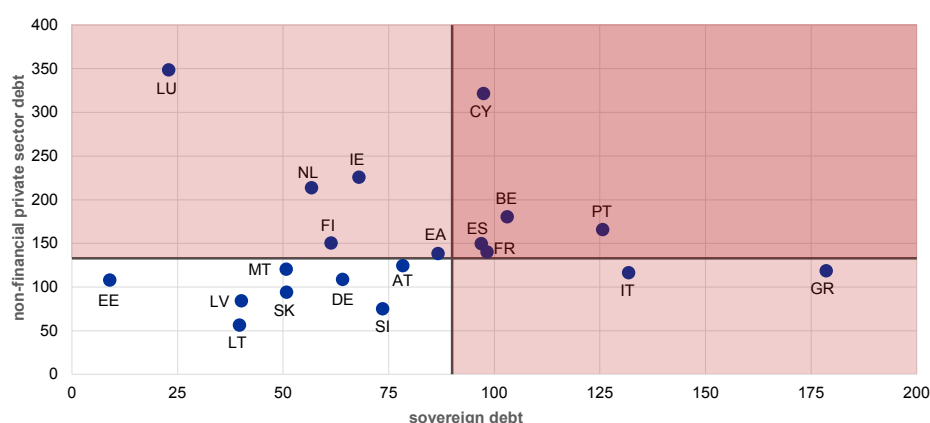
(BRRD), which has strengthened banks' loss-absorbing capacity, has reduced the likelihood of one possible spillover channel materialising – namely that between banks and sovereigns.

Chart 5

High indebtedness across households, non-financial firms and governments in several euro area countries

Indebtedness of the sovereign and non-financial private sectors

(Q4 2017; percentages of GDP)



Sources: ECB and ECB calculations.

Notes: The non-financial private sector comprises households and non-financial corporations, including debt relating to special-purpose entities (SPEs). Non-financial private sector debt figures are on a consolidated basis. The horizontal line represents the threshold of 133% of GDP for non-financial private sector debt based on the European Commission's MIP Scoreboard. The vertical line represents the threshold of 90% of GDP for sovereign debt and is based on findings in the empirical literature. See, for example, Checherita, C. and Rother, P., "The impact of high and growing government debt on economic growth – an empirical investigation for the euro area", *Working Paper Series*, No 1237, ECB, 2010. Consolidated non-financial corporate debt figures also include cross-border inter-company loans, which tend to account for a significant part of debt in countries where a large number of foreign entities, often multinational groups, are located (e.g. Belgium, Cyprus, Ireland, Luxembourg and the Netherlands). In the case of Ireland, GDP may not be the most representative scaling variable given the activities of foreign-owned multinational enterprises resident in the country. Alternative metrics that are more related to the domestic economy, such as the Modified Gross National Income (GNI*) or Modified Domestic Demand, would yield considerably higher levels of sovereign and non-financial private sector indebtedness.

Vulnerabilities are building up in some euro area national housing markets

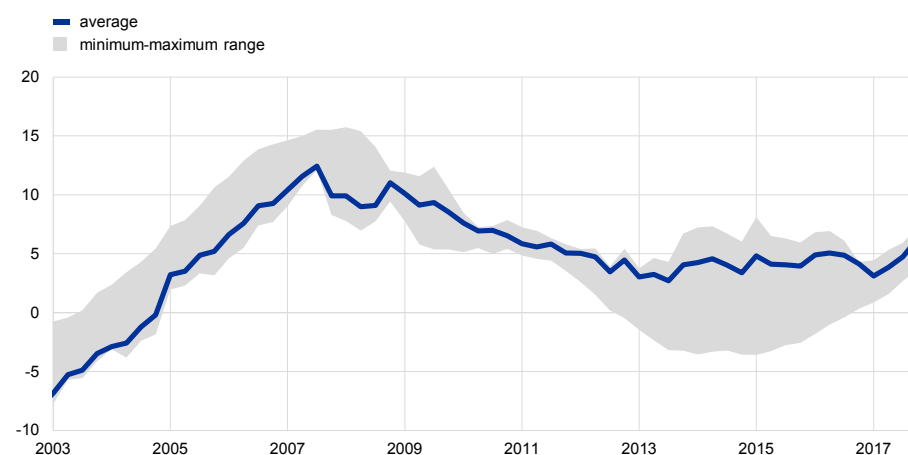
Some national real estate markets have experienced rapid price increases, exposing households and firms to vulnerabilities. In a number of countries and large cities, real estate prices have increased at a faster pace than household incomes. Indeed, prices in euro area residential real estate markets appear to be slightly above fundamental values (see [Chart 6](#)). Furthermore, prices in some euro area commercial real estate markets reached new highs, indicating potential misalignments vis-à-vis historical norms. Households and firms exposed to the real estate markets cannot expect past price performance to be a consistent indicator of future price developments. Thus, the build-up of vulnerabilities in the euro area real estate markets warrants careful monitoring with respect to the attendant financial stability risks in affected countries.

Chart 6

Euro area residential real estate prices slightly above those suggested by fair-value estimates amid measurement uncertainty

Residential property prices at the euro area level: deviations from estimated fair value

(Q1 2003 – Q4 2017; percentages, average valuations, minimum-maximum range across valuation estimates)



Sources: ECB and ECB calculations.

Notes: The fair-value estimations are based on four different methods: the price-to-rent ratio, the price-to-income ratio and two model-based methods, i.e. an asset pricing model and a new model-based estimate (Bayesian vector autoregression or BVAR). The average is based on the price-to-income ratio and the new model-based method. For details of the methodology, see Box 3 in *Financial Stability Review*, ECB, June 2011, and Box 3 in *Financial Stability Review*, ECB, November 2015.

Higher risk-taking in global financial markets

Developments in financial markets continue to signal growing optimism about the economic outlook, but vulnerabilities are building up in global markets.

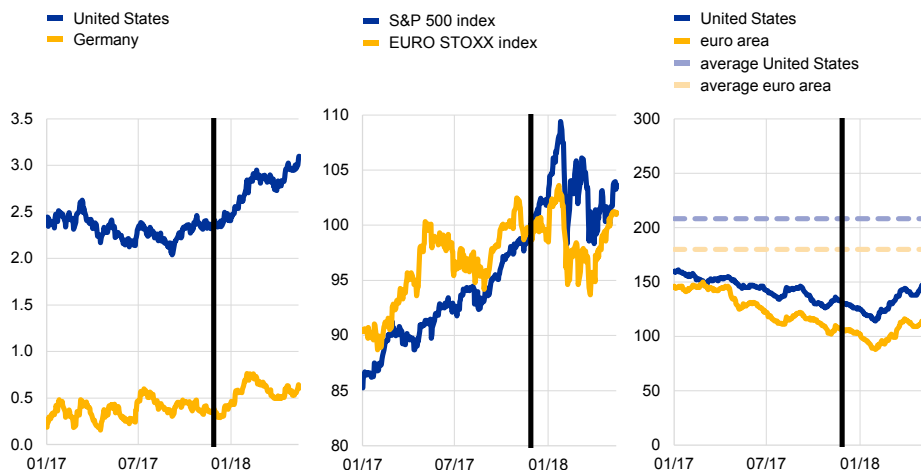
Long-term government bond yields in advanced economies increased in late 2017 and early 2018 on the back of solid growth prospects and news concerning the US tax reform (see [Chart 7](#)). US and euro area stock markets have experienced bouts of volatility over the past six months. Stock prices on both sides of the Atlantic benefited from overall robust earnings growth. At the same time, concerns about elevated US stock market valuations, upward revisions in monetary policy rate expectations and US trade policies contributed to slightly higher global equity risk premia. Overall, however, risk tolerance in global financial markets remains high. This is particularly noticeable in the riskier segments of the bond markets. For instance, non-investment-grade corporate bond spreads in advanced economies continue to hover at levels well below historical averages.

Chart 7

US and euro area bond yields edged up, while the upward trend in stock prices came to a halt

Ten-year sovereign bond yields, stock prices and BBB corporate bond spreads in the United States and the euro area

(Jan. 2017 – May 2018; left panel: percentages per annum; middle panel: index: 29 November 2017 = 100; right panel: basis points)



Sources: Bloomberg, Bank of America Merrill Lynch and ECB calculations.

Notes: The vertical lines refer to the publication of the previous FSR on 29 November 2017. The right panel shows averages since January 2002.

A surge in volatility in US stock markets in early February underscored the fragility of current market sentiment (see Chart 8). Following a prolonged period of rising stock prices and low volatility, US stock markets experienced a sharp sell-off in the first trading days of February. The drop in US stock prices was probably triggered by stronger than expected US labour market data which seem to have led to some pick-up in uncertainty about future inflationary pressures. Implied stock market volatility – a standard metric of future expected volatility derived from option prices – surged well above what historical patterns would suggest, given the actual drop in stock prices. The overshooting in volatility during this period was partly linked to technical factors. Hedging activities of financial products linked to the low-volatility environment (such as inverse VIX products) probably contributed to the amplified movement in implied stock market volatility. The risk that these products could amplify market fluctuations was highlighted in a special feature in the November 2017 FSR.¹ The turmoil did not have any material adverse financial stability implications. It was relatively short-lived and did not spill over to other asset classes. That said, the episode illustrated how abruptly market sentiment can change in the current environment of generally compressed risk premia. After the spikes in February, stock market volatility in the United States has hovered at slightly higher levels than in 2017 (see also **Box 3**, which examines the statistical pattern of US stock market volatility over the past 90 years). Further turbulence may materialise over the risk horizon of the FSR, possibly amplified by portfolio strategies linked to the level of volatility in markets.

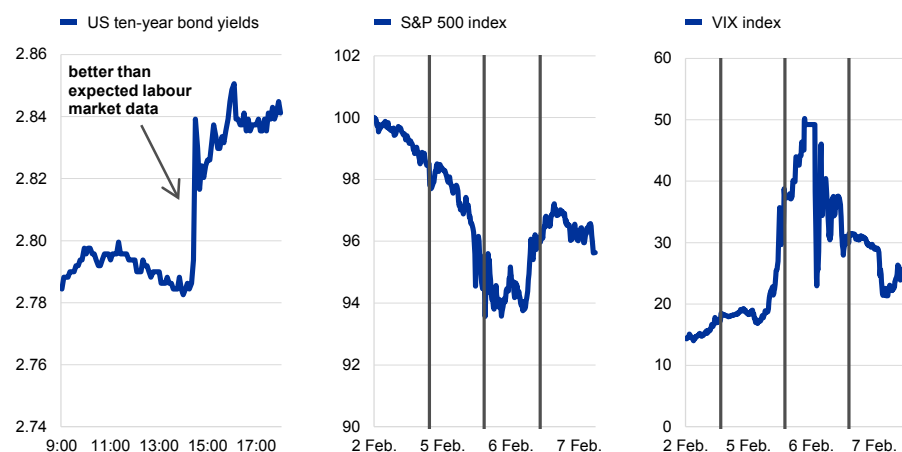
¹ See the special feature entitled “Higher future financial market volatility: potential triggers and amplifiers”, *Financial Stability Review*, ECB, November 2017.

Chart 8

Turmoil in US stock markets in early February 2018

US ten-year bond yields on 2 February 2018 (left panel), movements in US stock prices and the VIX index over the period 2-7 February 2018 (middle and right panels)

(five-minute intraday observations; left panel: percentages per annum; middle panel: index: stock prices on 2 February 2018 = 100; right panel: index points)



Sources: Bloomberg and ECB calculations.

Note: In the middle and right panels, the weekend of 3 and 4 February is omitted from the scale on the x-axis.

A reversal of the atypical US asset price developments for this stage of the business cycle could impact global asset prices more broadly.

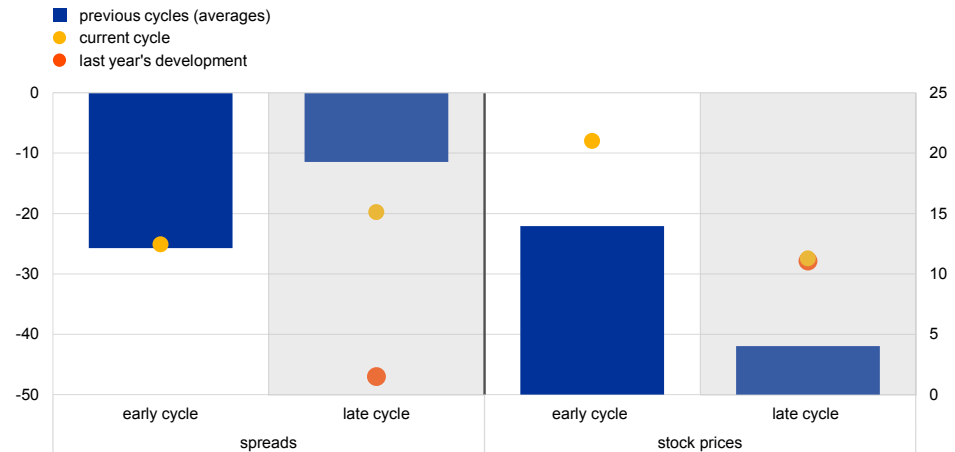
The United States has been in an expansionary phase since mid-2009. With the US economy running at close to full (or at full) capacity, inflationary pressures are gradually building up and policy rates are moving closer to a neutral stance. As a result, the US economy has possibly entered the latter part of the expansionary phase of the business cycle. Looking back in history, asset price performance tends to differ between the earlier and the later phases of business cycle expansions (see [Chart 9](#)). In the earlier part of expansions, stock prices have, on average, increased rapidly along with a significant narrowing of corporate bond spreads. In the late stage of the expansion, asset price increases tend to slow down, as inflationary pressures build up and monetary policy becomes less accommodative. The behaviour of US asset prices during the current “late cycle” phase differs somewhat from previous patterns. In fact, asset price gains have been stronger than what has been observed in the past. The somewhat atypical behaviour of US asset prices seems to indicate signs of “pricing for perfection”, pointing to a market perception that business cycle conditions will continue to improve for the foreseeable future and that there is a low probability of a turnaround in the business cycle. However, should a sharp reassessment of the maturity of the US business cycle occur, an abrupt reversal of US risk premia may take place, with possible spillover effects for the euro area.

Chart 9

Late cycle developments in US asset prices suggest that markets are “pricing for perfection”

Changes in US Baa corporate bond spreads and stock price returns for the S&P 500 index during the current and previous expansions

(left-hand scale: bond spreads, basis points; right-hand scale: stock prices, percentages per annum)



Sources: Bloomberg, National Bureau of Economic Research (NBER), Federal Reserve Economic Data (FRED) and ECB calculations.

Notes: Spreads are computed as the Baa corporate bond yield relative to the ten-year Treasury constant maturity rate. The cycles are defined according to the expansionary periods defined by the NBER since 1960. Early and late cycles are defined as the first and second half, respectively, of the expansionary periods. Changes in credit spreads and stock price returns are annualised. The current cycle is defined as the period from June 2009 to April 2018.

Higher risk-taking remains concentrated outside the euro area banking sector.

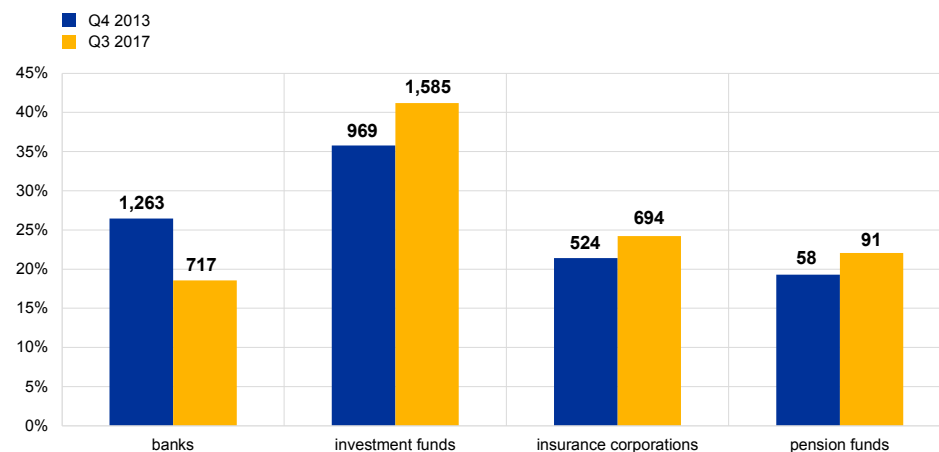
Apart from some temporary bouts of volatility, fluctuations in global asset markets have been exceptionally muted for a prolonged period, which has incentivised one-sided risk-taking. To preserve returns, euro area financial sectors (apart from the banking sector) have increased their holdings of lower-rated fixed income instruments (see [Chart 10](#)). In addition, the same sectors have increased the duration of their fixed income instruments, exposing them to the risk of larger capital losses should a sudden and sharp repricing materialise.

Chart 10

Most euro area financial institutions have increased their exposures to lower-rated bonds

Share of lower-rated financial and non-financial corporate bonds in financial institutions' bond portfolios

(percentages of total bond portfolio, € billions)



Sources: ECB Securities Holdings Statistics (SHS) and ECB calculations.

Notes: Corporate bonds issued globally by both financial and non-financial companies. Lower-rated bonds are BB- and below. The figures above the columns show the market value of lower-rated bond holdings.

Risks of an abrupt reversal of compressed term and risk premia remain high amid stretched valuations in several asset classes and geographical regions.

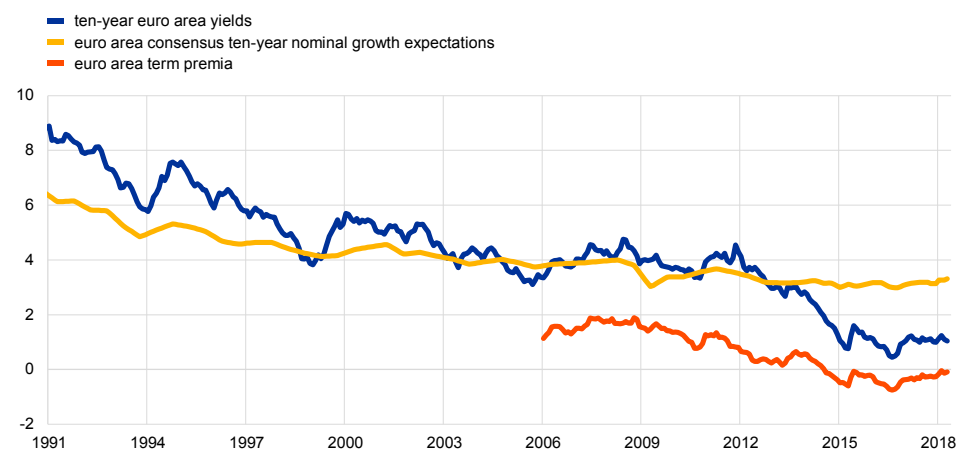
Estimates of term premia embedded in euro area long-term government bond yields continue to fluctuate at historically low levels and bond yields themselves are still well below nominal economic growth expectations, which are used as a yardstick for the equilibrium level of bond yields (see [Chart 11](#)). These observations point to upward risks to long-term bond yields in the coming years.

Chart 11

Upward risks to euro area long-term government bond yields

Long-term government bond yields, nominal GDP growth expectations and term premia in the euro area

(Jan. 1991 – Apr. 2018; percentages per annum, annual percentage changes)



Sources: Thomson Reuters, Consensus Economics and ECB calculations.

Notes: Before 1999, the euro area bond yields are approximated by ten-year bond yields in Germany. The euro area ten-year term premium shown in the chart is estimated on the basis of OIS rates using an affine term structure model following the methodology of Joslin, S., Singleton, K.J. and Zhu, H., "A New Perspective on Gaussian Dynamic Term Structure Models", *The Review of Financial Studies*, Vol. 24(3), March 2011, pp. 926-970.

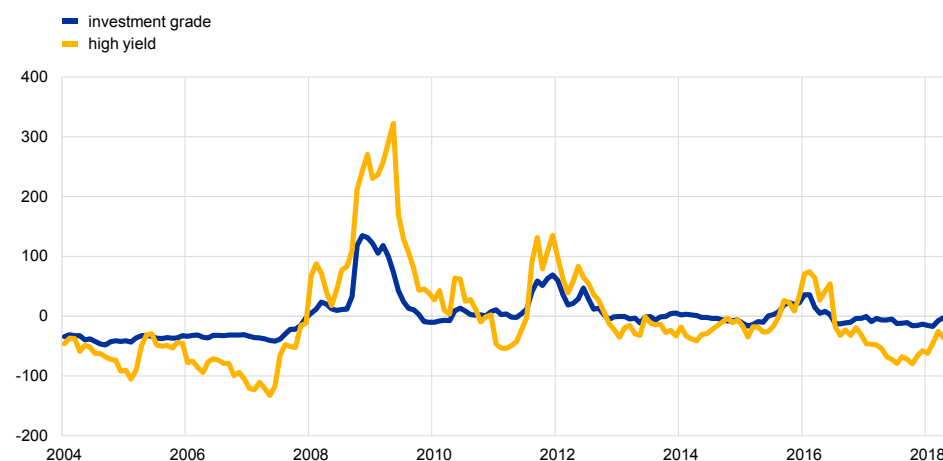
Similarly, for the high-yield corporate bond market segment, current levels of spreads are somewhat stretched vis-à-vis fundamentals (see Chart 12). Signs of potential mispricing are also evident in the larger leveraged loan market. As discussed in **Box 5**, a significant relaxation of underwriting standards for US and European leveraged loans has been observed in recent years. This increases the likelihood that defaults will be delayed and recovery rates will be lower should the creditworthiness of the borrowers deteriorate. At the same time, valuation models for euro area investment-grade bonds and aggregate stock price indices indicate broadly fair valuations (see **Chapter 2**). Nevertheless, investment-grade euro area non-financial corporates remain more levered than before the crisis, which leaves them vulnerable to a turnaround in the global economic outlook. Looking beyond the euro area, US corporate bond spreads are trading at levels below historical norms. Furthermore, as highlighted in previous issues of the FSR, US stock prices are still elevated when gauged using standard valuation metrics such as the cyclically adjusted price/earnings (CAPE) ratio.

Chart 12

Valuations somewhat stretched for euro area high-yield bonds

Excess bond risk premia on euro area investment-grade and high-yield non-financial sector bonds

(Jan. 2004 – Apr. 2018; basis points)



Sources: iBoxx and Moody's.

Notes: The excess bond premium (EBP) is defined as the deviation of credit spreads from measures of credit risk and liquidity risk at individual bond level. The series represent averages from two ECB models. For further details, see Chart 2.7 in Chapter 2.

Higher risk premia on euro area assets could be triggered by developments from both within and outside the euro area.

First, a faster than expected withdrawal of monetary policy accommodation globally has some potential to translate into higher risk premia, which could spill over to the euro area. Second, a significant reassessment of global economic growth prospects and the impact of fiscal policies or adverse implications stemming from rising protectionism all have the potential to trigger a repricing of risk. Third, a sharp, domestically driven slowdown in economic growth prospects may also drive risk premia higher in the euro area, particularly in countries and sectors where the level of indebtedness is high. Fourth, high valuations in some markets may themselves act as triggers. Once valuations reach levels that are excessively stretched compared with historical norms, a growing number of investors may start withdrawing exposures from these markets, possibly triggering abrupt normalisations.

Any sustained repricing of assets could be amplified by an increasingly large investment fund sector.

Both bond and equity fund flows in the euro area experienced some volatility around the turn of the year owing to rising yields and the more recent spike in equity volatility (see [Section 3.2](#)). The volatility did not adversely impact the functioning of the fund sector. That said, a prolonged period of negative returns in the future could trigger elevated investor outflows, eventually resulting in forced sales of fund portfolios. Data on liquid holdings show that bond funds domiciled in the euro area have reduced the buffers available to accommodate large outflows in recent years.

Improving cyclical outlook for euro area banks and insurers, but structural challenges remain

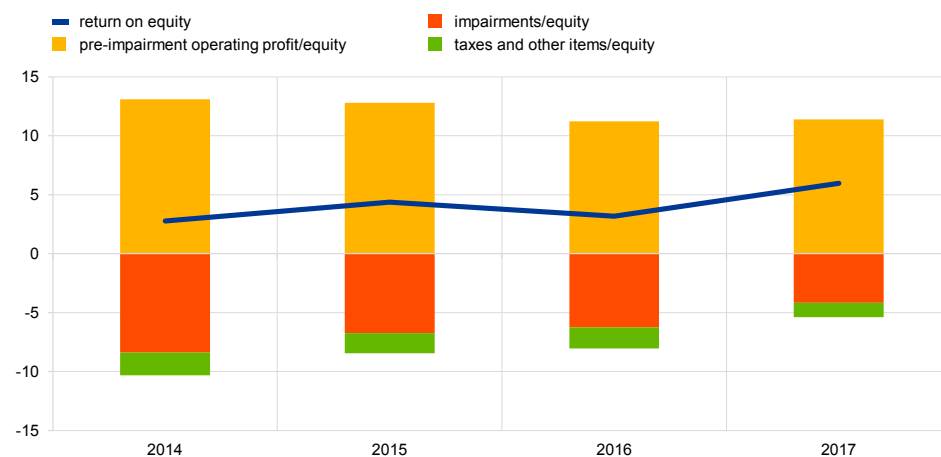
Bank profitability recovered in 2017, supported by the improvement in economic growth. After a prolonged period of low profitability, bank performance rebounded in 2017 (see [Chart 13](#)). Euro area significant institutions' aggregate return on equity increased to around 6% in 2017, compared with 3.5% one year earlier. The main driver of higher profitability was lower impairment costs, as new NPL formation slowed. Across countries, the bulk of the euro area-wide improvement was driven by banks operating in the countries most affected by the crisis.

Chart 13

Euro area bank profitability recovered in 2017, buoyed by improving cyclical prospects

Decomposition of euro area significant banks' aggregate return on equity

(2014-17, percentages, percentage point contributions)



Sources: ECB and ECB calculations.

Note: Based on an unbalanced sample of at least 103 euro area significant institutions.

Looking ahead, bank profitability is expected to improve further over the coming years, according to market analysts (see [Chart 14](#)). This

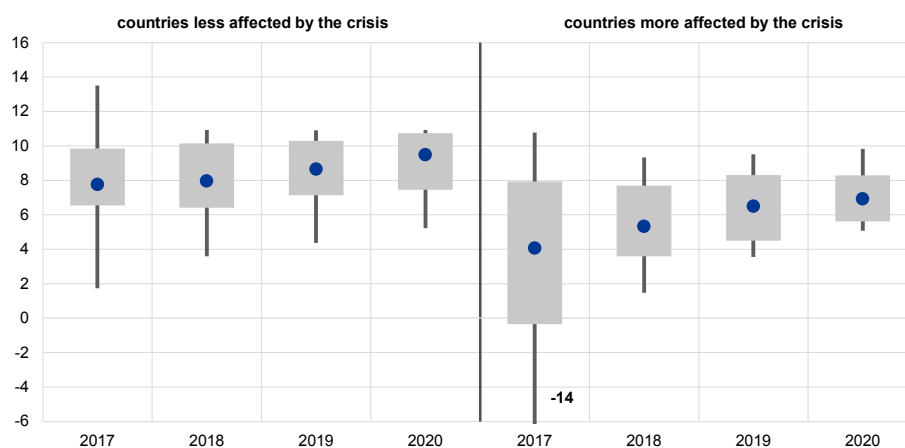
notwithstanding, for some banks, particularly in the countries most affected by the crisis, the return on equity is likely to continue to fluctuate below the corresponding cost of equity.

Chart 14

Analysts expect profitability to further improve over the next three years

Actual return on equity in 2017 and estimates for 2018-20 for euro area banks

(2017-20; percentages, 10th and 90th percentiles, interquartile distribution and median)



Sources: SNL Financial and S&P Capital IQ.

Note: Based on a sample of 41 euro area listed banks. Countries more affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Spain and Slovenia.

The stock of NPLs fell in 2017, but remains persistently high in some

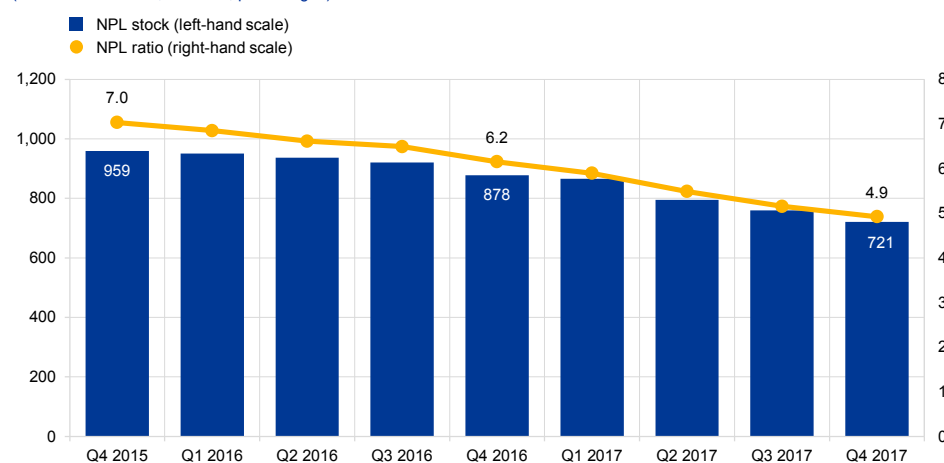
countries. Euro area significant institutions' aggregate NPL stocks and ratios decreased in 2017 (see [Chart 15](#)). The reduction was relatively broad-based across countries. Coverage ratios also increased in 2017, which suggests an improved ability of banks to absorb losses from NPL portfolios. Despite the overall improvement in asset quality, high NPLs are still a challenge in some jurisdictions, as they weigh on financing conditions and, ultimately, economic growth prospects. Further work is needed to bring them down to sustainable levels. Improving the functioning of the secondary NPL market could make a substantial contribution in this respect. As highlighted in [Box 7](#), liquidity in the secondary market for NPLs in Europe has improved in recent years, but continues to be afflicted by several types of market failure.

Chart 15

Progress in NPL reduction gained momentum in 2017

Euro area significant institutions' NPL stock and aggregate NPL ratio

(Q4 2015 – Q4 2017; € billions, percentages)



Source: ECB supervisory data.

Despite still weak performance, risk-taking appears to be limited in the euro area banking sector.

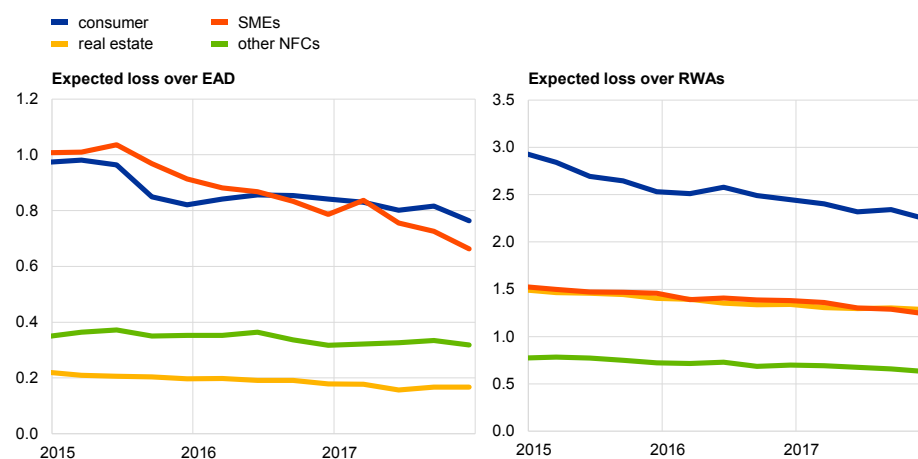
One avenue for banks to boost profitability in a (still) low interest rate environment is to engage in higher risk-taking. Bank credit risk measures, however, point to slightly lower reported credit risk over the past year for significant institutions (see [Chart 16](#) and [Section 3.1](#)). This is consistent with the improved economic outlook, which supports household disposable income and companies' earnings prospects. Some pockets of vulnerability do, however, exist. In particular, consumer lending is growing at double-digit rates in some countries. Such credit developments warrant close monitoring as risk-taking that is not properly compensated for by higher risk premia may lead to a build-up of vulnerabilities in the medium term. Euro area banks' aggregate exposure to interest rate risk is fairly limited. Some heterogeneity across banks can, nevertheless, be observed. For instance, banks operating in countries with predominantly fixed rate mortgages will be more vulnerable to higher interest rates than banks situated in countries where floating rates dominate. As discussed in [Special Feature C](#), there is evidence that banks are taking measures (i.e. hedging) to mitigate their exposure to interest rate risk.

Chart 16

Credit risk measures continue to drift lower

Expected loss relative to exposure at default (EAD) and risk-weighted assets (RWAs)

(Q1 2015 – Q4 2017; medians, percentages)



Sources: ECB supervisory data and ECB calculations.

Notes: Based on measures reported by banks on their internal ratings-based (IRB) portfolios. Excludes exposures in default. Cross-sectional median of a balanced sample of 52 significant institutions with IRB exposures. "Real estate" includes retail loans secured by immovable property; "consumer" includes qualified revolving loans and other non-secured retail credits.

High operating costs remain a key obstacle to achieving sustainable bank profitability.

Cost-efficiency across banks in the euro area remains low compared with that of their international peers. This holds true both when looking at accounting indicators (such as cost-to-income and cost-to-assets ratios) and when looking at results coming from cost function techniques that estimate banks' relative ability to convert inputs into outputs (for a discussion about the latter, see [Box 6](#)). The largest cost component for euro area banks relates to staff (making up around half of euro area banks' operating expenses). In recent years, however, non-staff costs have grown at a faster pace than staff-related costs. Part of the higher non-staff costs relates to higher IT costs and investment in digital technologies. It remains to be seen whether the short-term costs attached to such investment can bring long-term efficiency gains.

Notwithstanding an improving banking sector outlook, a sharp deterioration in economic or financial conditions could unearth stress.

First, an abrupt repricing of risk premia has the potential to increase stress in the banking sector via higher funding costs and capital losses. This, in turn, could impair banks' intermediation capacity and have an impact on the real economy. Second, substantially weaker economic developments may lead to deteriorating asset quality and earnings prospects. At the same time, the continued improvements observed in banks' solvency positions should mitigate stress stemming from possible adverse developments.

Similar to banks, the profitability and solvency positions of the insurance sector have benefited from a robust economic outlook.

Insurers' profitability continues to develop favourably, supported by the economic outlook (see [Chart 17](#)). For the life insurance sector, profitability has also benefited from increasing yields. For reinsurers, however, a number of costly natural catastrophe losses gave rise to a

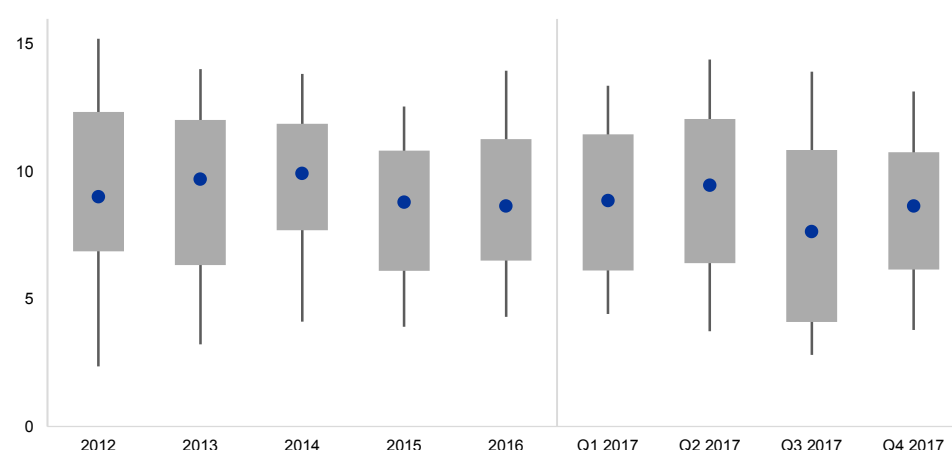
significant drop in profitability in the latter part of 2017. The fall in profitability is expected to be temporary and should not have any material impact on reinsurers' long-term profitability prospects. Solvency positions remain solid and well above regulatory requirements for the majority of euro area insurers.

Chart 17

Overall solid profitability for the insurance sector

Return on equity for a sample of large euro area insurers

(2012 – Q4 2017; percentages, 10th and 90th percentiles, interquartile distribution and median)



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

Notes: Quarterly data are annualised. Based on a sample of 27 large insurers and reinsurers with total combined assets of about €4.98 trillion in 2017, which represent around 62% of the assets of the euro area insurance sector. Quarterly data are only available for a sub-sample of these insurers.

A continuing low interest rate environment and signs of increased interconnectedness are giving rise to vulnerabilities for the insurance sector.

Even though the recent rise in long-term interest rates is reducing some of the cyclical challenges for insurers, long-term interest rates are in many cases still below the levels offered as guaranteed returns in the past. Some insurers have, therefore, taken on higher risk in order to boost returns. Such activities include a larger exposure to riskier debt instruments, a shift towards investments in the real estate sector and an extension of maturities in insurers' fixed income portfolios. More broadly, the non-bank sector as a whole has become more intertwined. For instance, the securities portfolios of insurance companies and investment funds show a high degree of similarity across euro area countries – both within and between the two sectors. This makes them vulnerable to contagion should stress emerge in either of the two sectors.

ECB analysis suggests that the United Kingdom's decision to withdraw from the European Union poses a limited overall risk to euro area financial stability.² Any impact on financial services is likely to differ across euro area countries, depending on the size of financial and real economy linkages with the United Kingdom, and it is more likely to be reflected in the cost of financial services and in costs for financial institutions than in a reduction in the availability of services.

² See the box entitled "Preparing for Brexit to secure the smooth provision of financial services to the euro area economy", *Financial Stability Review*, ECB, May 2017.

While the progress that has been achieved in the negotiations with the United Kingdom since the publication of the November 2017 FSR is a welcome development, the risk of an adverse outcome to the negotiations remains. Affected financial institutions should therefore continue to plan for all contingencies, including a hard Brexit scenario. Stakeholders' timely and adequate preparations remain a key mitigant against the risks of Brexit-related cliff-edge effects.

Scenario analysis

This FSR identifies two broad scenarios that could be used to test the resilience of financial institutions over a two-year horizon.³ Two plausible, albeit unlikely, adverse scenarios are run to illustrate the quantitative implications for bank solvency positions if the risks previously outlined in this chapter were to materialise (for more details about the scenarios, see **Section 3.3**).

Scenarios that could test the resilience of financial institutions

Global market turmoil propagating through the financial system

- Spillovers to the euro area from a disruptive repricing of term and other risk premia
- Increased public debt sustainability concerns
- Turmoil amplified by outflows from illiquid investment funds

Real economic downturn leading to

- Impaired intermediation capacity of banks amid weak performance and structural challenges
- Elevated private debt sustainability concerns

The first scenario entails an abrupt repricing of global risk premia. It envisages higher risk premia triggered by changes in market participants' expectations regarding economic policies in major economies outside the EU. The ensuing financial market turmoil then spills over to the euro area, and the resulting higher financing costs for the sovereign sector lead to a re-emergence of public debt sustainability concerns. The financial market turmoil is amplified in this scenario by a large sell-off of financial assets by the non-bank financial sector.

The second scenario is generated by a sharp economic slowdown. The main trigger in this scenario is a slowdown in economic growth prospects in the United

³ Owing to methodological, scenario and sample differences, the results presented in this chapter should not be compared with the results of supervisory stress-test exercises, such as those coordinated by the European Banking Authority (EBA) and ECB Banking Supervision.

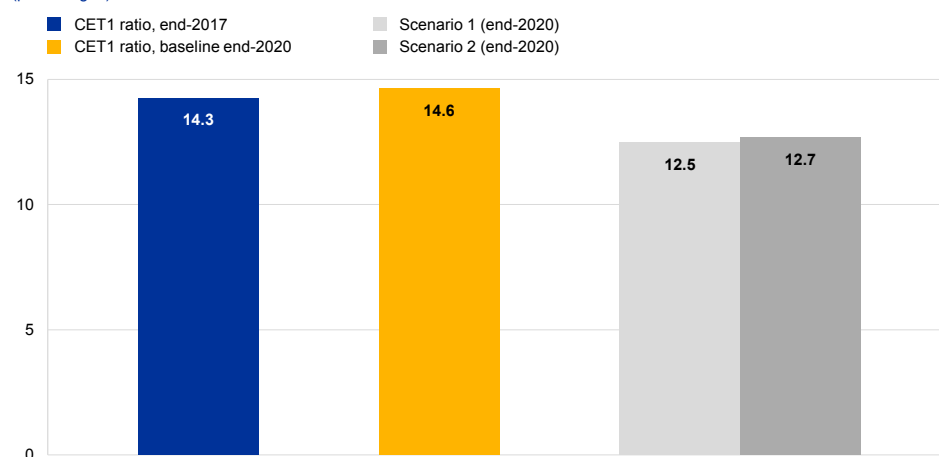
States and in emerging markets that spills over to euro area countries. This would be amplified by trade disruptions owing to more protectionist policies in some advanced economies. Aggregate demand falls, which leads to a sharp downturn in private consumption and investment. Households and firms face difficulties in paying back their debt, which leads to elevated debt sustainability concerns for the private sector.

Chart 18

The materialisation of key financial stability risks could lead to sizeable losses for banks, but aggregate capital positions would remain adequate

CET1 capital ratios of euro area banking groups under the baseline and adverse scenarios

(percentages)



Sources: Individual institutions' financial reports, EBA, ECB and ECB calculations.

Note: The scenario analysis covers about 100 large and medium-sized banking groups directly supervised by the ECB.

A materialisation of either of the two scenarios would lead to sizeable depletions of bank capital (see Chart 18). In aggregate terms, the euro area banking sector is assessed to be resilient to the materialisation of the main financial stability risks. In the first and second scenarios, the aggregate Common Equity Tier 1 (CET1) ratio would decline by 2.1 and 1.9 percentage points, respectively, compared with the baseline.⁴ Some differences across banks can be observed, but the majority of euro area significant institutions would maintain their CET1 capital ratio above the average capital requirement of 10% under the adverse scenario.⁵ While the implications of the materialisation of the two scenarios are broadly similar, the probability of the first scenario materialising is assessed to be higher than that of the second, given the continued higher risk-taking in financial markets and the positive macro news in recent quarters.

⁴ Under the assumption that banks would adjust their balance sheet in response to the baseline and adverse scenarios (dynamic balance sheet).

⁵ The 10% average requirement refers to the average total capital "supervisory demand" without systemic buffers (i.e. Pillar 1, Pillar 2 and capital conservation buffer); see the [SSM SREP Methodology Booklet – 2017 edition](#), ECB Banking Supervision, 2017.

Recommendations and policy considerations

Although the financial stability environment is currently benign, deliberate and decisive action is needed to address nascent and existing vulnerabilities. Many of the vulnerabilities discussed in this FSR can be dealt with through action by financial regulators and legislators, macroprudential authorities as well as market participants and the financial industry. The most relevant and pressing of these recommended actions are outlined below.

Policy considerations for cyclical systemic risks

Cyclical systemic risks remain contained, but on an upward trajectory, in most euro area countries and in the area as a whole. Credit growth rates are recovering across the board. Together with additional indicators of cyclical systemic risks, especially asset prices, these developments support the assessment that risks are gradually increasing. At the same time, deviations of credit-to-GDP ratios from their long-term trend (“credit gaps”) remain negative in most countries. Overall, therefore, a broad-based increase in countercyclical capital buffers (CCyBs) across the euro area is not warranted currently. Nevertheless, CCyB rates have been announced or activated in two euro area countries. Moreover, some other macroprudential authorities should be ready to act should cyclical systemic risks increase further.

Policy considerations for property markets

Macroprudential authorities are encouraged to step up efforts to prevent the materialisation of spirals of excessive and mutually reinforcing credit and property market dynamics. Against the backdrop of the recovery in residential real estate markets gaining momentum across the euro area, macroprudential authorities should consider activating borrower-based measures in countries where household balance sheets are weakening or where lending standards are showing early signs of deterioration. In this context, countries should ensure that legal frameworks for borrower-based measures are adopted and fully operational in line with the December 2016 Governing Council statement on macroprudential policies. Moreover, in countries where the residential real estate cycle is more advanced and “stock” vulnerabilities are more visible in the form of high household indebtedness and/or price overvaluation, macroprudential authorities should consider introducing capital measures targeting real estate exposures. Regarding potential risks in commercial real estate markets, countries should close data gaps in line with the 2016 ESRB recommendation⁶ in order to improve risk and policy analysis. In addition, countries should work towards sound risk assessment frameworks to support policy analysis.

⁶ See [Recommendation of the European Systemic Risk Board of 31 October 2016 on closing real estate data gaps \(ESRB/2016/14\)](#).

Policy considerations for banks

Banks need to make further progress towards adjusting their business models in order to achieve sustainable profitability. This adjustment should encompass both a better diversification of sources of revenue (to reduce reliance on interest income) and cost-cutting, including by reaping the benefits of increased digitalisation.

In the current favourable macroeconomic environment, banks should continue to step up their efforts to reduce NPL stocks. National authorities can support banks' efforts by implementing policies to support markets for NPLs and could facilitate the setting-up of NPL transaction platforms and consider securitisation schemes. In certain circumstances, asset management companies (AMCs) may be warranted. Banks should continue to pursue timely provisioning and write-off practices in line with supervisory expectations, also taking into account the addendum that the ECB published to its NPL guidance.⁷

Banks (and other financial institutions) need to ensure that sound cyber risk management is in place and fully integrated in their institution-wide operational risk management frameworks. As technological progress has made the financial system more complex and more deeply interconnected, banks need to reconsider their internal risk management practices in order to withstand cyber and associated IT risks. In this regard, international cooperation between institutions and authorities is essential.

Policy considerations for the asset management sector

Financial market participants need to be aware that the favourable market environment observed over the past few years may quickly change. In order to mitigate possible losses stemming from a sudden reversal in risk premia, market participants should conduct proper risk management that takes into account stressed scenarios such as abrupt changes to the correlation patterns across asset classes or a possible deterioration in liquidity conditions.

Policy considerations for highly indebted sovereigns and corporates

In view of the high debt ratios in some countries, it is important that fiscal authorities continue to ensure positive primary balances in the coming years, even under less favourable economic conditions. By the same token, as deleveraging by households and non-financial firms has scarcely materialised in the euro area, contrary to what has been seen in other major jurisdictions, it would be advisable for cash-rich private agents to reduce their current debt levels.

⁷ See [Addendum to the ECB Guidance to banks on non-performing loans: supervisory expectations for prudential provisioning of non-performing exposures](#), ECB Banking Supervision, March 2018.

Regulatory issues

The finalised Basel III package should be fully implemented across all jurisdictions in a timely fashion. As further experience with this common set of standards is gained, progress should be carefully monitored through a comprehensive evidence-based evaluation. In this regard, it will be important to maintain the current high level of international cooperation, as globally agreed standards are key to financial stability.

The ongoing review of the Capital Requirements Regulation (CRR) and the Capital Requirements Directive (CRD IV) should be used to strengthen and harmonise the European regulatory architecture. Alongside increased financial integration and progress towards banking union, regulators and legislators should achieve more progress in the harmonisation of national options and discretions and consider the introduction of cross-border capital waivers, subject to additional safeguards such as those suggested by the ECB in its Opinion.⁸ Moreover, regulators and legislators should consider introducing a requirement to establish an EU intermediate parent undertaking (IPU) and, to prevent regulatory arbitrage opportunities, require the inclusion of third-country branches in the regulatory EU sub-group under such an IPU. Otherwise, third-country groups could partially or fully circumvent the IPU requirement by operating in the EU primarily or entirely via branches. Finally, a full and timely implementation of internationally agreed supervisory standards is warranted.

The review of the CRR and CRD IV also provides an opportunity to revisit the design of the macroprudential framework. At present, the implementation of macroprudential policy is scattered across the CRR and CRD IV, leading to a wide range of practices regarding the use of the tools and their application by authorities. In this context, EU co-legislators should consider an ambitious set of targeted changes to the framework, with the aim of making it more coherent, consistent and operational.

The revised framework for crisis management and resolution should be swiftly adopted so as to enable risk reduction and risk-sharing. Completing the reform requires the agreement of the co-legislators, so it is essential that the Council and the European Parliament reach a position and then agree in the trialogue meetings. In addition, the co-legislators should make progress on the European Stability Mechanism (ESM) reform, including, in particular, its establishment as a backstop to the Single Resolution Fund (SRF), and reach an agreement on the European deposit insurance scheme (EDIS) as the missing third pillar of the banking union.

The regulatory and supervisory framework for non-banks needs to be strengthened. In view of the strong growth in the role of investment funds in financial intermediation and indications that the sector is assuming more risk, authorities need to be equipped with relevant powers to be able to mitigate structural vulnerabilities from asset management activities, in particular for situations where

⁸ See [Opinion of the European Central Bank of 8 November 2017 on amendments to the Union framework for capital requirements of credit institutions and investment firms](#) (CON/2017/46).

measures available to asset managers themselves would not be sufficient to address these. EU co-legislators should introduce macroprudential tools designed to address systemic risks related to liquidity mismatches and the use of leverage in investment funds. Moreover, large and complex investment firms, and in particular those with cross-border operations and those undertaking bank-like activities, should be subject to the same regulation and supervision as credit institutions.

1 Macro-financial and credit environment



Economic growth

Economic expansion in the euro area has continued at a robust pace, becoming more broad-based across countries and sectors of economic activity.

Euro area growth prospects remain favourable, supported by private consumption and investment as well as the broad-based global recovery that is boosting foreign demand.

While the risks to the overall growth outlook are balanced, **downside risks** primarily relate to global factors, such as overheating in the US, private debt sustainability in EMEs as well as renewed (geo)political stress, including the risk of growing trade protectionism.



Indebtedness

Credit risks in sovereigns, households and firms are being alleviated by robust growth and favourable financing conditions.

The **sustainability of public finances** may be challenged by a deterioration in economic conditions but also a slowdown of fiscal and structural reform efforts as well as a broader re-widening of risk premia.

Household debt remains elevated in some euro area countries. In countries with mainly variable rate loans, households are vulnerable to the risk of rising interest rates.

Corporate indebtedness remains high by both historical and international standards. Further balance sheet repair should help offset any risks related to a rise in debt servicing costs.

1.1 Robust euro area growth with a broadly balanced outlook

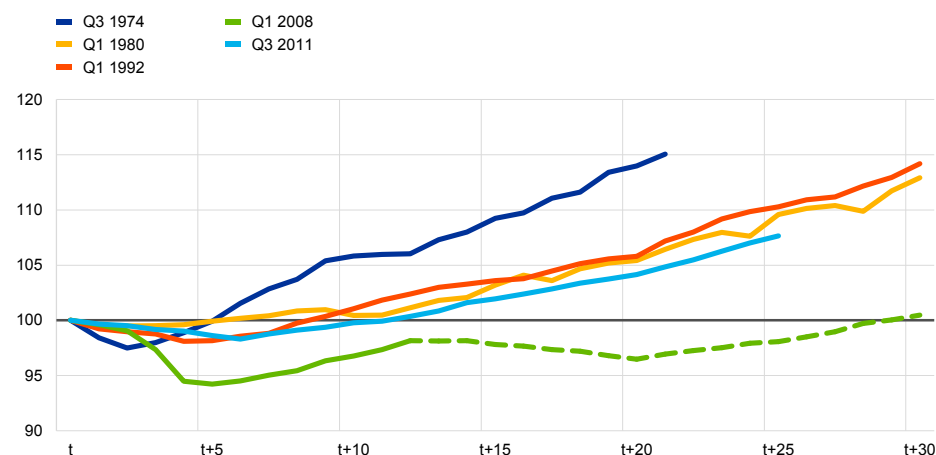
The euro area economy has continued to expand at a robust pace. Domestic demand has remained the main engine of economic growth. The ongoing recovery in labour and housing markets is bolstering private consumption via positive income and wealth effects, while very favourable financing conditions and rising corporate profitability are lending support to business investment. At the same time, a broad-based global expansion is supporting foreign demand for euro area goods and services. The cyclical euro area upturn is also being reinforced by strong (albeit more recently somewhat softening) business and consumer sentiment, as well as low macroeconomic uncertainty. After an exceptionally drawn-out recovery, the euro area economy is in an expansion phase and the output lost since the start of the downturn in 2008 has been restored (see [Chart 1.1](#)).

Chart 1.1

Relatively moderate economic recovery in the euro area since 2008 by historical standards

Real GDP patterns during various episodes of economic recovery in the euro area

(pre-recession peak = 100, number of quarters after the peak)



Source: Eurostat and ECB calculations.

Notes: The dashed line refers to the euro area sovereign debt crisis that followed the global financial crisis. This recession is also shown separately, starting in Q3 2011. Recessions are based on those identified by the CEPR Euro Area Business Cycle Dating Committee.

The broad-based nature of the economic expansion in the euro area underpins its resilience. The distribution of growth rates across both euro area countries and sectors of economic activity has continued to narrow, suggesting a broad-based and thus resilient economic expansion. Labour market conditions have also continued to improve. Employment gains have been similarly broad-based across countries and sectors and the aggregate euro area unemployment rate has dropped to the lowest level since late 2008. That said, heterogeneity across countries remains high, amid signs of increasingly binding labour supply shortages in some countries but also persistently elevated unemployment rates in others.

Fundamentals bode well for a continued economic expansion. Favourable financing conditions, past progress made in deleveraging and strong confidence across sectors signal robust economic growth ahead. Real GDP growth is expected to remain above potential until 2020. Nevertheless, based on the March 2018 ECB staff macroeconomic projections, real GDP growth is projected to slow from 2.4% in 2018 to 1.9% in 2019 and 1.7% in 2020, as some tailwinds gradually dissipate. Despite the strong cyclical momentum, the euro area growth environment continues to lag behind the more buoyant developments seen in the United States, particularly as regards inflation (see [Chart 1.2](#)).

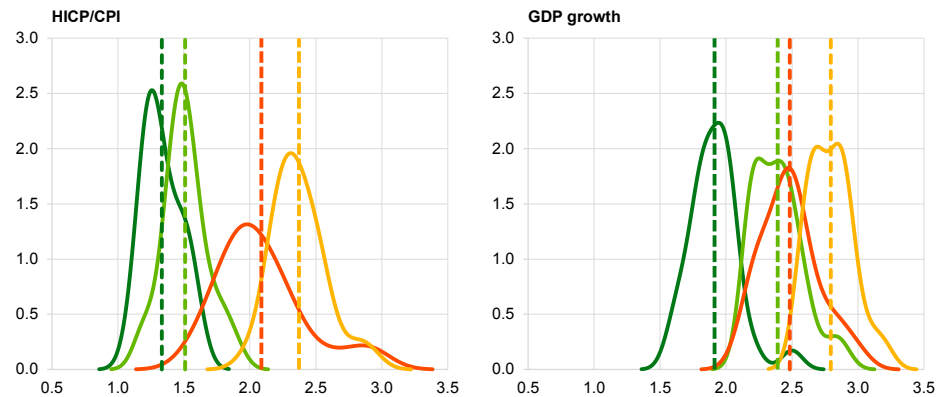
Chart 1.2

Higher expected real GDP growth and inflation for both the euro area and the United States reflect improved nominal growth prospects

Distribution of the 2018 real GDP growth and HICP/CPI forecasts for the euro area and the United States

(probability density)

- November 2017 forecast for 2018 for the euro area
- March 2018 forecast for 2018 for the euro area
- November 2017 forecast for 2018 for the United States
- March 2018 forecast for 2018 for the United States



Sources: Consensus Economics and ECB calculations.

Note: The dashed lines represent the average real GDP growth and HICP/CPI forecast values.

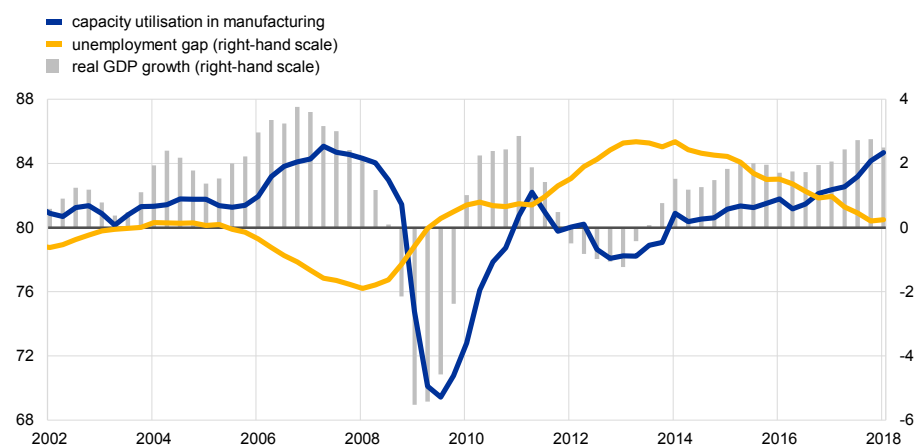
Euro area nominal growth prospects are set to improve gradually. Headline HICP inflation has been broadly stable at around 1.3% since the publication of the previous FSR. Looking ahead, on the basis of current futures prices for oil, annual rates of headline inflation are likely to hover around 1.5% for the remainder of the year. Measures of underlying inflation remain subdued but are expected to rise gradually, supported by the ECB's monetary policy measures, the ongoing economic expansion as well as the related gradual absorption of economic slack and increase in capacity utilisation (see [Chart 1.3](#)) leading to stronger wage growth. The March 2018 ECB staff macroeconomic projections for the euro area foresee headline inflation averaging 1.4% in 2018 and 2019, before rising to 1.7% in 2020.

Chart 1.3

Nominal pressures may be building up gradually as economic activity in the euro area gathers pace

Capacity utilisation, unemployment gap and real GDP growth

(Q1 2002 – Q1 2018, percentage of capacity utilisation, percentage points, annual percentage changes)



Sources: European Commission (AMECO database), European Commission Business and Consumer Surveys and ECB calculations. Notes: The unemployment gap is calculated as the difference between the unemployment rate and the non-accelerating wage rate of unemployment. The real GDP growth figure for the first quarter of 2018 is the flash estimate.

The global economy continued on a robust growth path. Underlying growth dynamics have become more broad-based and synchronised across the globe. Economic growth in advanced economies outside the euro area is being bolstered by supportive global financial conditions, upbeat confidence, favourable labour market conditions, an upswing in housing markets and receding headwinds from private sector deleveraging in several countries. In emerging markets, economic growth is also being supported by strong foreign demand and higher commodity prices. In fact, oil prices have reached almost USD 80 per barrel – the highest level since late 2014 – driven by both strong demand and continued supply restrictions.

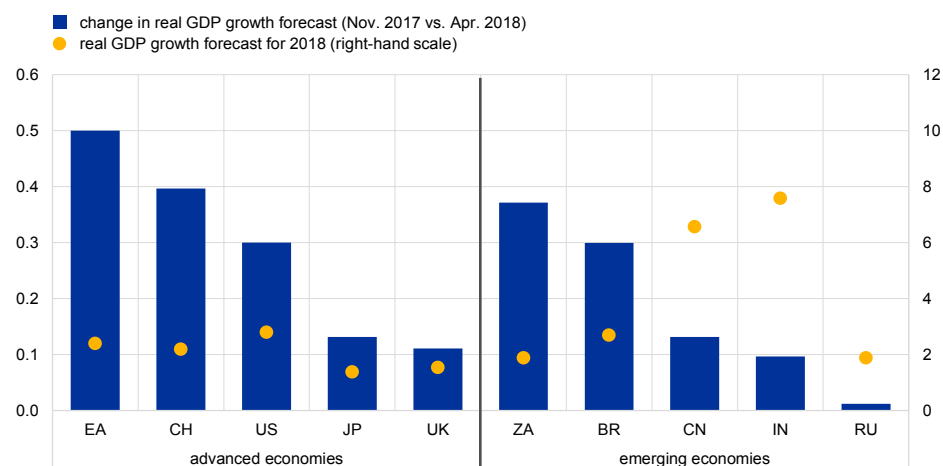
Global economic activity is expected to remain strong in the short run. Growth in the global economy is expected to accelerate in the near term (see [Chart 1.4](#)), but the pace of expansion will remain below pre-crisis rates, in line with lower potential growth estimates. Against the backdrop of overall supportive (albeit increasingly diverging) monetary policies, the outlook for advanced economies entails a robust expansion, boosted by the recent tax reform in the United States in the near term. Thereafter, output growth is projected to slow somewhat as the recovery matures. Economic activity in emerging market economies is expected to be supported by the ongoing gradual recovery from deep recessions in major commodity exporters (e.g. Brazil and Russia) and fairly resilient growth prospects in China and India.

Chart 1.4

Broad-based improvement in economic growth prospects across the globe

Change in real GDP growth forecasts for 2018 for major advanced and emerging economies

(Apr. 2018, changes vs. Nov. 2017; percentages, percentage points)



Sources: Consensus Economics and ECB calculations.

Note: EA: euro area; CH: Switzerland; US: United States; JP: Japan; UK: United Kingdom; ZA: South Africa; BR: Brazil; CN: China; IN: India; RU: Russia.

The upbeat baseline outlook for euro area growth is clouded by some risks emanating from global factors.

Downside risks primarily relate to global factors, although the sluggish pace of structural reforms or further balance sheet adjustment needs in the public and/or private sectors in some euro area countries also pose risks to the growth outlook. The uncertainties surrounding the fiscal and monetary policy mix in the United States and its implications for the US and global economy, lingering debt sustainability concerns in emerging market economies and a further rise in (geo)political uncertainties across the globe, particularly as regards trade policies, may weigh on the global and euro area growth momentum. These downside risks are broadly counterbalanced in the risk assessment by the possibility of stronger than expected domestic demand momentum, a looser fiscal stance or higher than expected euro area potential output.

An overheating of the US economy could lead to tighter global financial conditions.

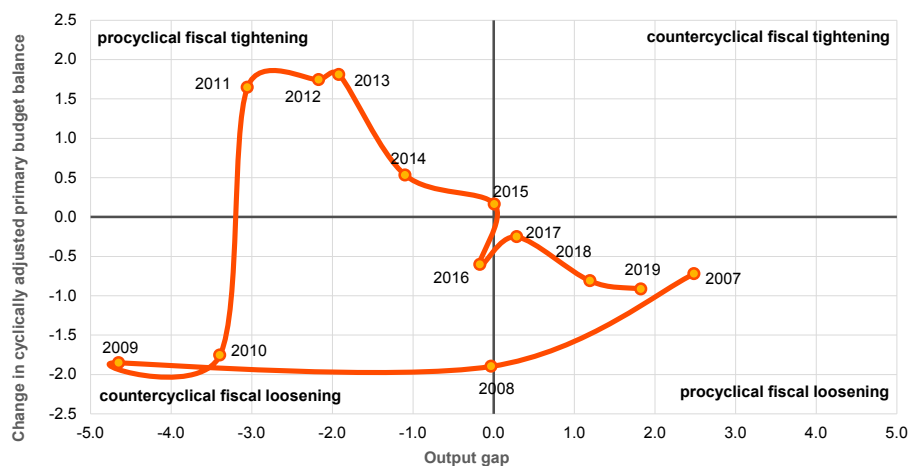
The significant US fiscal stimulus enacted at the turn of the year is expected to boost economic activity in the near term. The expansionary fiscal stance in the late phase of the business cycle (see [Chart 1.5](#)) may lead to an overheating of the economy, while the ensuing higher inflationary pressures could lead to a faster than expected monetary policy tightening in the United States. Tighter financing conditions in the United States would, in turn, spill over to global financing conditions, negatively affecting the global economy. The recent fiscal stimulus may also exacerbate concerns regarding the sustainability of public finances and lead to a reassessment of US sovereign risk, potentially translating into a repricing in global bond markets.

Chart 1.5

Expansionary fiscal policies in the United States may raise public debt sustainability and overheating concerns

Output gap and changes in the cyclically adjusted primary budget balance in the United States

(2007-19, percentages, percentage points)



Sources: IMF (World Economic Outlook Database) and ECB calculations.
Note: Data for 2018 and 2019 are projections.

Lingering vulnerabilities in emerging market economies remain a cause for concern.

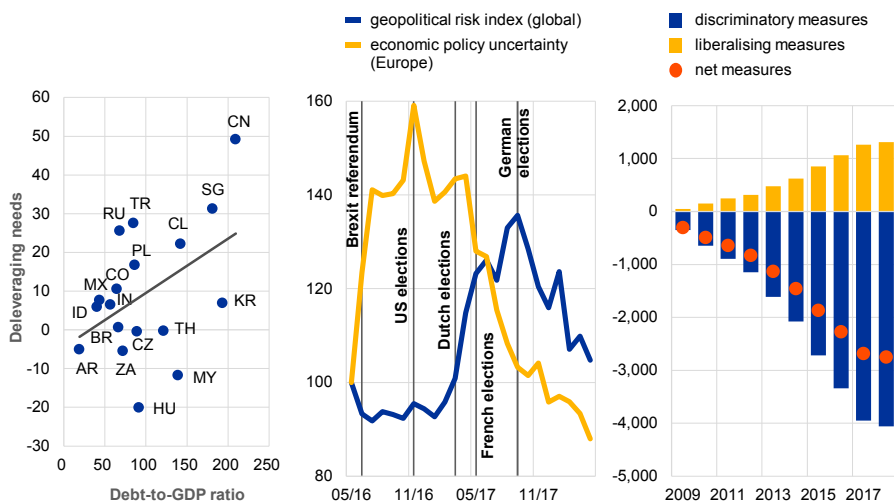
In general, emerging market economies are in an increasingly robust position to withstand external financial shocks given their improved fundamentals. However, past credit excesses and the related debt accumulation over the past decade (see [Chart 1.6](#) – left panel) may expose many emerging market economies to the risk of sudden capital flow reversals. Moreover, they render them more vulnerable to exchange rate shocks, particularly in the case of emerging market economies with notable US dollar liabilities, as reflected by the recent turmoil in Argentina and Turkey. That said, these developments have been driven by domestic factors and no wider emerging market sell-off has occurred to date in the wake of rising US long-term yields and the stronger US dollar. The prospective implications of further exchange rate turbulence could reverberate beyond emerging market economies given their growing economic and financial linkages with the rest of the world, in particular if an idiosyncratic, country-level event turns into a more broad-based increase in risk aversion vis-à-vis emerging markets (see [Box 1](#)).

Chart 1.6

Debt sustainability concerns in EMEs, a renewed flare-up of (geo)political risk and growing trade protectionism represent downside risks to global growth prospects

Non-financial private sector debt and deleveraging needs in emerging market economies, economic policy uncertainty and geopolitical risk index, and number of trade interventions

(left panel: Q4 2016, percentage of GDP, percentage points; middle panel: May 2016 – Apr. 2018, indices: May 2016 = 100, six-month moving averages; right panel: Jan. 2009 – Apr. 2018, cumulative number of measures)



Sources: policyuncertainty.com and Caldara and Iacoviello (2017), Global Trade Alert Database, ECB and ECB calculations. Notes: Left panel: Equilibrium debt level estimates are based on a panel co-integration model. Following Consolo and Pierluigi (2016) and Arellano et al. (2009), debt developments are explained with income (GDP), the cost of debt (lending rate), a measure of uncertainty (unemployment rate), and indicators of financial market development (bank deposits, equity market capitalisation and M2 – all relative to GDP). CN: China, SG: Singapore, KR: South Korea, MY: Malaysia, TH: Thailand, CL: Chile, HU: Hungary, TR: Turkey, PL: Poland, RU: Russia, CO: Colombia, MX: Mexico, IN: India, ID: Indonesia, BR: Brazil, ZA: South Africa, CZ: Czech Republic and AR: Argentina. Middle panel: 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. The geopolitical risk index of Caldara and Iacoviello is used. For more details, see Caldara, D. and Iacoviello, M., "Measuring Geopolitical Risk", working paper, Board of Governors of the Federal Reserve System, November 2017. Right panel: Measures capture trade in goods and services. Figures for 2018 cover data for the first quarter of 2018. First available data are for 2009.

Renewed (geo)political uncertainties have the potential to weigh on growth.

While economic policy uncertainty and geopolitical risk appear to have decreased in recent months (see Chart 1.6 – middle panel), a re-intensification of (geo)political risks may bear the potential to undermine confidence and sentiment with adverse repercussions for both financial markets and the real economy. In fact, policy uncertainties remain elevated in advanced economies, in particular as regards the ongoing negotiations on the future relations between the United Kingdom and the European Union. Moreover, a potential escalation of geopolitical tensions may have a severe impact on the global economy via deteriorating sentiment and a rise in risk aversion.

A significant escalation of trade tensions risks derailing the ongoing recovery in global trade and economic activity.

While strong global trade continues to underpin global growth prospects, a possible further strengthening of protectionist tendencies in advanced economies (see Chart 1.6 – right panel) could adversely impact global trade and growth, especially if accompanied by retaliatory measures by target countries and adverse confidence effects. According to ECB staff simulations, in such an escalation scenario, world trade in goods could fall by up to

3% in the first year after the change in tariffs and world GDP by up to 1%.⁹ That said, the precise impact on individual countries would primarily depend on their size, openness and trade intensity with the tariff-imposing country.

All in all, financial stability in the euro area could be challenged should these downside risks materialise. These factors may not only undermine the sustainability of the global and euro area recovery, but also have the potential to trigger tensions in global financial markets and prompt a disorderly unwinding of global search-for-yield flows. A weaker than expected growth environment could trigger the materialisation of any of the main risks to euro area financial stability and could reinforce global risk repricing, further challenge bank profitability or fuel debt sustainability concerns.

Box 1

The growing systemic footprint of Chinese banks

Prepared by Sandor Gardó, Benjamin Klaus and Thomas Kostka

Emerging market economies have experienced accelerated financial deepening since the onset of the financial crisis. Consequently, financial stability risks emanating from emerging markets may spill over more widely to the global financial system. A key focus in this regard has been China, not least given the sheer size of its banking sector and the country's growing role in international finance. Against this background, this box investigates the risks related to the growing size and systemic importance of Chinese banks and their possible implications for euro area financial stability.

Chinese banks have increased their weight and systemic relevance in the global financial system since 2008. The total assets of China's banking sector have increased from 205% to 305% of Chinese GDP over the last decade, while the market capitalisation of Chinese banks relative to the global stock market capitalisation of banks rose from 13% in 2008 to 20% in 2017. At individual bank level, this is reflected in the rapidly growing number of Chinese banks among the 100 largest banks in the world and in the growing number of Chinese banks in the Financial Stability Board's (FSB's) G-SIB list and their respective rankings (see **Chart A** – left panel). Moreover, metrics of systemic risk point to a growing systemic relevance of Chinese banks. Their SRISK – a measure of individual banks' contributions to the undercapitalisation of the global banking system in times of distress – has increased compared to the pre-crisis period and now exceeds that for banks in the euro area and other advanced economies (see **Chart A** – right panel), while more recently the SRISK measure has stabilised.¹⁰

⁹ For more details, see the panel contribution by Benoît Cœuré, member of the Executive Board of the ECB, at the 29th workshop on "The Outlook for the Economy and Finance", Villa d'Este, Cernobbio, 6 April 2018, and Quaglietti, L., "Implications of rising trade tensions for the global economy", *Economic Bulletin*, ECB, Issue 3, Box 1, 2018.

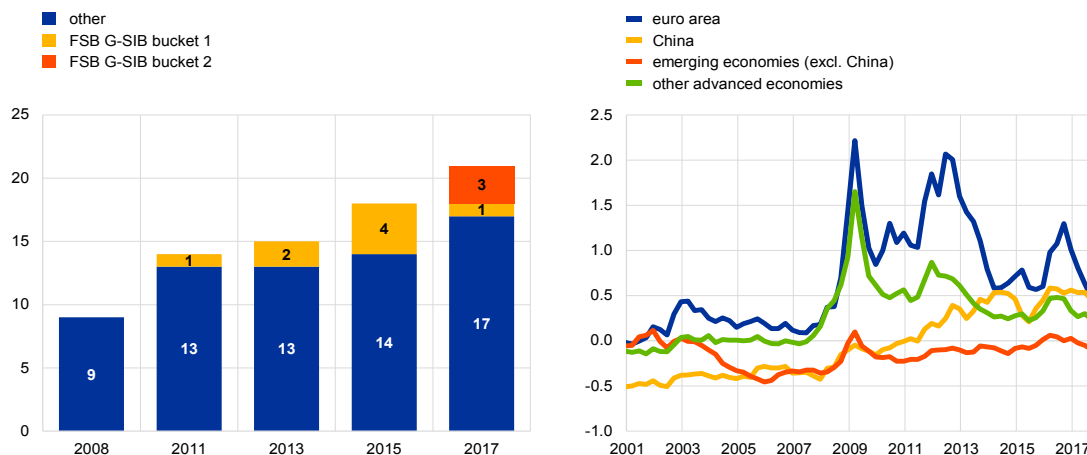
¹⁰ The aggregate SRISK measure includes 31 large banks from China and Hong Kong and therefore may underestimate the risks stemming from the large number of small to medium sized banks. As most banks in this aggregate are backed by the Chinese government, an elevated level of SRISK translates into higher sovereign risk – which might in turn spill back to the financial sector.

Chart A

Increasing weight of Chinese banks in the global financial system not only in terms of their size, but also as regards their systemic importance

Number of Chinese banks among the worlds' 100 largest banks based on total assets (left panel) as well as SRISK as a share of global stock market capitalisation (right panel)

(Left panel: 2008-17, number; right panel: Q1 2001 – Q4 2017, percentages)



Sources: FSB, SNL Financial, New York Stern V-Lab and ECB calculations.

Notes: The FSB's G-SIB list was introduced in 2011. G-SIBs are allocated to five buckets based on their systemic footprint as measured according to BCBS methodology. SRISK quantifies the capital shortfall conditional on a severe and prolonged stock market decline. A positive (negative) value of SRISK suggests an expected capital shortfall (surplus) of the underlying banks in the case of a systemic event. For further details on the computation of SRISK, see Brownlees, C. and Engle, R., "SRISK: A Conditional Capital Shortfall Measure of Systemic Risk", *The Review of Financial Studies*, Vol. 30, January 2017, pp. 48-79. Other advanced economies cover Australia, Canada, Norway, Japan, Denmark, Sweden, Switzerland, the United Kingdom and the United States.

Chinese banks have become more interconnected with the rest of the world via both direct and indirect financial and trade channels.

While China's transactions in international portfolio assets (such as equity and fixed income securities) remain subject to tight quota, bank loans, in particular Chinese banks' outbound investments, have been far less restricted. Zooming in on the euro area, direct euro area banking exposures to China remain negligible, in spite of having risen considerably in recent years both in absolute terms and relative to total assets. Supervisory data suggest that direct exposures of significant euro area institutions to the Chinese financial sector remain limited at below 1% of their total assets, with a strong concentration in France and Germany. Interconnectedness may, however, also arise on the liability side of euro area banks' balance sheets, where rollover risks may emerge to the extent that Chinese banks serve as providers of (wholesale/interbank) funding. Available data, while scarce, would suggest that this funding source for euro area banks is negligible at the current juncture.

Indirect exposures may be a cause for concern, as they can generate adverse repercussions for global financial markets.

This was demonstrated during the 2015 Chinese equity market turmoil that spilled over to global equity markets. Although in that episode the stock market correction did not originate in China's financial sector, a combined Chinese economic and financial crisis scenario might have a larger impact on global financial markets, including those in the euro area. Moreover, if stress in the Chinese banking sector were to reduce Chinese banks' capacity to finance the domestic economy, this might hamper global growth through trade channels which could have an impact on euro area banks via second round effects, such as higher credit risk.

Empirical evidence points to increased spillover risks from Chinese to euro area bank stock prices.

Of the various spillover channels outlined above, the indirect exposures appear to have the largest stress potential but are at the same time the most difficult to quantify. One way to proxy

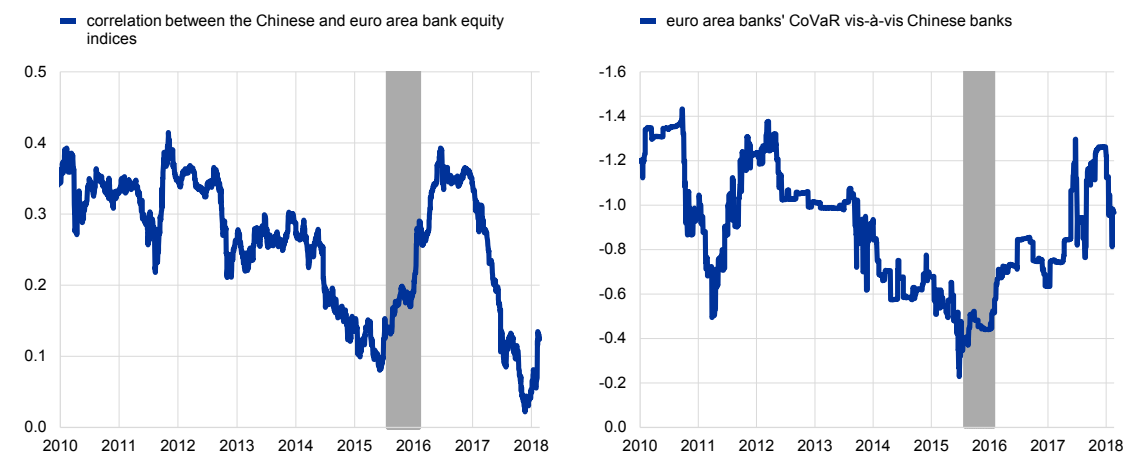
spillover risk is to look at the (tail) dependencies of euro area and Chinese banks' stock prices. To abstract from the potential impact of home-grown problems in the euro area banking sector (as indicated by marked corrections in euro area bank stock prices in early 2016) on changes in the (stock price) correlation, the focus is on the period from the middle to the end of 2015, which was characterised by a pronounced stock market correction in China. In general, the correlation of bank stock prices in the two jurisdictions has declined overall in recent years (see **Chart B** – left panel).¹¹ To better capture the tail dependencies and mitigate some of the shortcomings of the simple correlation approach, the more sophisticated conditional VaR (CoVaR) measure scaled by the prevailing level of market volatility is used. The results suggest that euro area bank equities have, in spite of lower correlations, become more sensitive to tail risks in the equity price of their Chinese peers since mid-2015 (see **Chart B** – right panel).

Chart B

Heightened co-movement in bank stock prices during stock price turmoil in China and increased sensitivity of euro area banks to tail risks in Chinese banks

Correlation between Chinese and euro area bank stock price indices (left panel) and euro area banks' CoVaR vis-à-vis Chinese banks (right panel)

(left panel: Jan. 2010 – Feb. 2018, correlation coefficient; right panel: Jan. 2010 – Feb. 2018; standard deviations (inverted scale))



Sources: Thomson Reuters and ECB calculations.

Notes: Left panel: The line shows the rolling correlation coefficient over a 260-day window between the euro area and the Chinese (international) bank equity indices. The shaded area represents the Chinese equity market turmoil in the second half of 2015 and early 2016. Right panel: The CoVaR corresponds to the median price change in the euro area bank equity index in response to the materialisation of the 5% lower tail of the return distributions of six large Chinese banks: Bank of China, Bank of Communications, China CITIC Bank, China Construction Bank, China Merchants Bank, and Industrial and Commercial Bank of China. The CoVaR measure is computed on a two year rolling window of daily observations and reported in terms of standard deviations of the Chinese bank index. See Adrian, T. and Brunnermeier, M.K., "CoVaR", *American Economic Review*, Vol. 106(7), July 2016, pp 1705-41.

All in all, increased spillovers from Chinese banks may have heightened financial stability implications for euro area banks. Increased spillover risks are likely to be a reflection of the growing size and systemic importance of Chinese institutions. A further increase in the systemic footprint of Chinese banks and the ever-increasing interconnectedness of the Chinese financial system with the rest of the world may generate adverse repercussions for the global financial system, including in the euro area, in the event of any future episode of financial stress.

¹¹ The dynamics of the correlation coefficient need to be put into perspective, as correlations are driven by the prevailing levels of volatility – see Forbes, K. and Rigobon, R., "No Contagion, Only Interdependence: Measuring Stock Market Comovements", *Journal of Finance*, Vol. 57(5), October 2002, pp. 2223-61.

1.2 Benign macro-financial conditions conceal underlying sovereign vulnerabilities

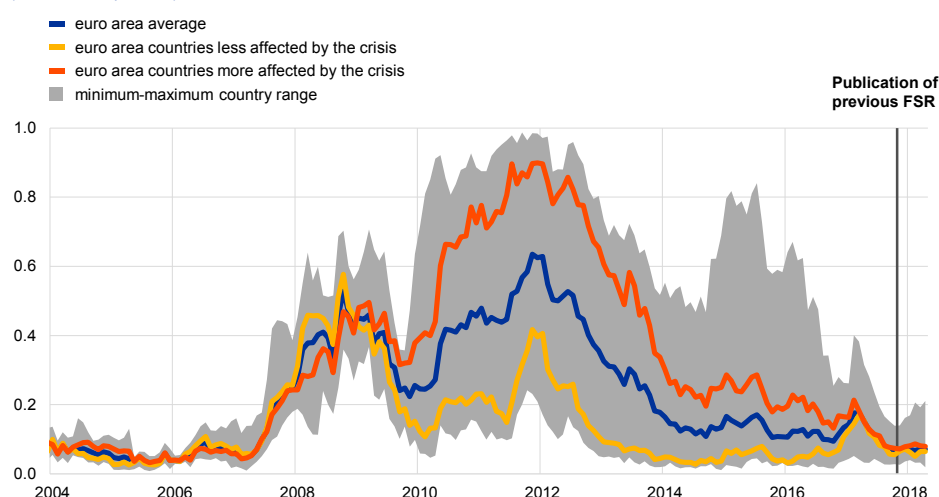
Stress remained subdued in euro area sovereign debt markets. The composite indicator of systemic stress for euro area sovereign bond markets has continued to hover at low levels amid relatively narrow cross-country dispersion (see [Chart 1.7](#)). In terms of the underlying drivers, volatility in euro area sovereign bond markets has remained relatively low. At the same time, liquidity conditions in government bond markets (measured by bid-ask spreads) have remained favourable against the backdrop of the ECB's public sector purchase programme, while sovereign credit risk has come down somewhat amid improving economic conditions, relatively low levels of political uncertainty and several sovereign rating upgrades (e.g. for Greece, Portugal and Spain).

Chart 1.7

Stress in euro area sovereign bond markets remained contained amid relatively low cross-country dispersion

Composite indicator of systemic stress in euro area sovereign bond markets

(Jan. 2004 – Apr. 2018)



Sources: ECB and ECB calculations.

Notes: The SovCISS measures the level of stress in euro area sovereign bond markets. It is available for the euro area as a whole and for 11 euro area countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain). Euro area countries more affected by the crisis comprise Greece, Ireland, Italy, Portugal and Spain, while euro area countries less affected by the crisis include Austria, Belgium, Finland, France, Germany and the Netherlands. The SovCISS combines data from the short end and the long end of the yield curve (two-year and ten-year 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.

While headline fiscal balances continue to improve, underlying fiscal efforts are waning. The aggregate euro area headline fiscal deficit has improved from 1.5% of GDP in 2016 to 0.9% of GDP in 2017, with only one country (Spain) above the Maastricht Treaty threshold of 3% of GDP. According to European Commission projections, the euro area headline balance is set to improve further over the 2018-19 horizon, albeit at a more moderate pace than in previous years. The improvement is, however, expected to be driven mainly by favourable cyclical conditions and, to a

lesser extent, by lower interest expenditures. The underlying structural fiscal stance in the euro area is expected to remain broadly neutral in 2018-19, but several countries are expected to loosen policies slightly. Indeed, a deterioration of structural balances is projected in most euro area countries that were more affected by the crisis. Several highly indebted countries are at risk of non-compliance with the structural fiscal efforts envisaged in the rules of the Stability and Growth Pact (i.e. Belgium, France, Italy and Portugal). Structural reform efforts have also lost momentum, and there is still a need to achieve a more growth-friendly composition of public finances across the euro area. Overall, the reliance of the projected improvement in fiscal balances on cyclical conditions renders the fiscal outlook – and by extension the market sentiment towards some euro area sovereign issuers – very sensitive to changes in the growth environment.

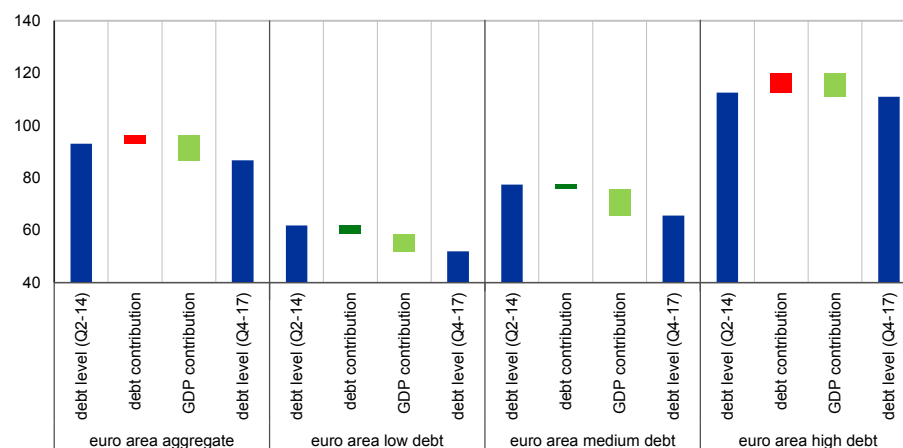
Government debt sustainability concerns remain despite signs of improvement. The euro area aggregate government debt-to-GDP ratio has been on a downward path since the peak in 2014 and dropped to 86.7% in 2017, mainly driven by developments in euro area countries with low and medium levels of debt (see [Chart 1.8](#)). The decomposition of the change in public debt levels suggests that all country groups have benefited from favourable cyclical conditions (denominator effect, labelled “GDP contribution” in the chart). However, in highly indebted euro area countries the stock of debt (numerator effect, labelled “debt contribution” in the chart) has continued to increase. Looking ahead, the aggregate indebtedness of the general government sectors in the euro area is projected by the European Commission to decline further to 84.1% of GDP by 2019. All euro area countries are projected to see a further decrease or stabilisation in their government debt ratios over the 2018-19 horizon underpinned by projected primary surpluses (except for France and Latvia) and a negative interest rate-growth differential (except for Italy). Such negative interest rate-growth differentials may, however, reverse and render highly indebted sovereigns more vulnerable to a prospective normalisation of interest rates and/or a possible worsening of economic conditions.

Chart 1.8

Highly indebted euro area countries are not taking advantage of the favourable economic conditions to reduce high public debt levels

Sovereign indebtedness in the euro area and underlying contributing factors

(percentage of GDP, percentage point contributions)



Sources: ECB (Government Finance Statistics) and ECB calculations.

Notes: The "low debt" category covers euro area countries with public debt levels below 60% of GDP (i.e. Estonia, Latvia, Lithuania, Luxembourg, Malta, the Netherlands and Slovakia) as at year-end 2017. Countries with public debt levels of between 60% and 90% of GDP (i.e. Austria, Finland, Germany, Ireland and Slovenia) are labelled "medium debt" countries, while countries with debt levels of over 90% (i.e. Belgium, Cyprus, France, Greece, Italy, Portugal and Spain) are referred to as "high debt" countries.

Relatively favourable sovereign financing conditions currently mitigate

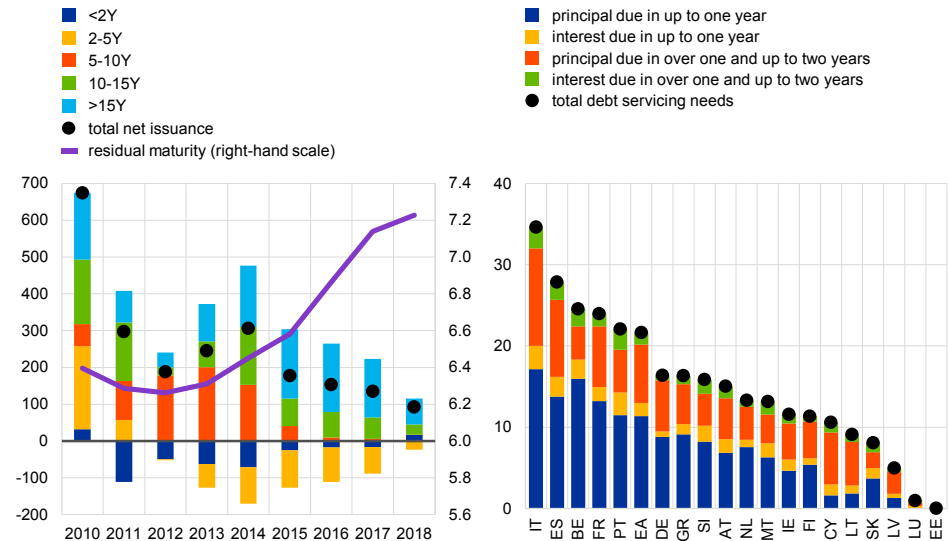
rollover risks. Pricing conditions have remained benign for euro area sovereigns against the backdrop of ongoing Eurosystem asset purchases. Moreover, the current low-yield environment continues to encourage strong issuance activity at long maturities, which results in a further increase of the average residual maturity of outstanding euro area government debt securities (see [Chart 1.9](#) – left panel). As a result, the debt servicing obligations of euro area sovereigns have declined, but remain high for several – in particular the most highly indebted – euro area countries (see [Chart 1.9](#) – right panel). This may suggest possible rollover risks in terms of both the availability and the cost of funding in the event of a reassessment of sovereign risk by market participants.

Chart 1.9

The shift of issuance activity towards long maturities continued, but debt servicing needs remain substantial for several euro area countries, highlighting rollover risks

Net issuance of government debt securities by original maturity (left panel) and total debt servicing needs due in two years (right panel)

(left panel: 2010-18, € billions, years; right panel: Mar. 2018, percentage of GDP)



Sources: ECB and ECB calculations.

Note: Left panel: Figures for 2018 cover data up to March 2018.

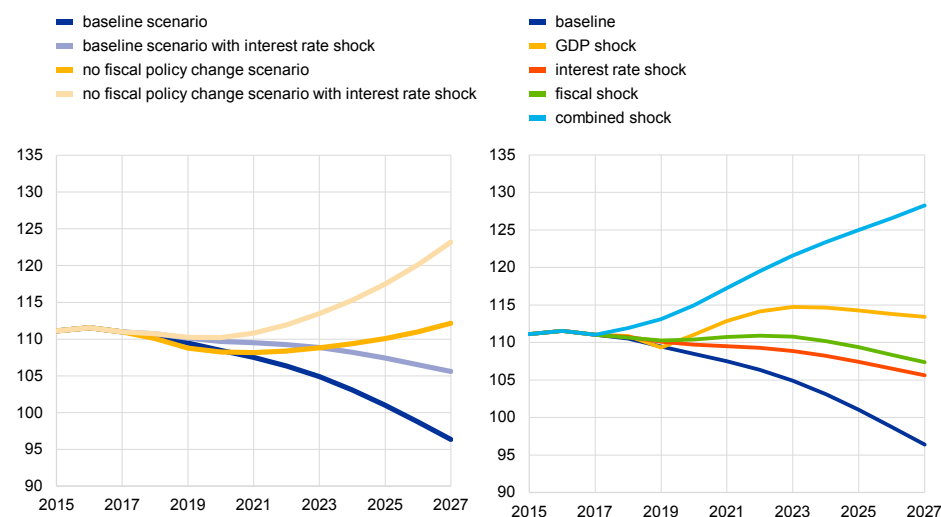
The implications of the vulnerabilities identified above can be illustrated with stylised scenarios. The baseline improvements in primary balances rely either on the continuation of favourable cyclical conditions or on additional adjustments in fiscal policy to maintain those balances. If these fail to materialise, this will not only lead to a deterioration in fiscal balances, it will also affect debt dynamics. In some of the scenarios, a two percentage point increase in interest rates is simulated. This is a quite unlikely eventuality over the simulation horizon, which is used only to simulate stressed conditions. The simulation results for highly indebted euro area countries suggest that such an interest rate shock would be particularly destabilising in the absence of additional fiscal consolidation efforts (see [Chart 1.10](#) – left panel). Sensitivity analyses also indicate that a one percentage point shock to potential GDP growth – which is also an unlikely outcome – would have the largest potential to reverse the downward trend in public debt levels in highly indebted euro area countries (see [Chart 1.10](#) – right panel). A combined macro, fiscal and interest rate shock would put the debt ratio on a clearly unsustainable path in highly indebted euro area countries.

Chart 1.10

An interest rate shock under a no fiscal policy change scenario or a combined macro, fiscal and interest rate shock would put the general government debt ratio on a clearly unsustainable path in highly indebted euro area countries

Scenario (left panel) and sensitivity (right panel) analyses for highly indebted euro area countries

(2015-27, percentage of GDP)



Sources: European Commission and ECB calculations.

Notes: Euro area countries with government debt-to-GDP ratios of over 90% of GDP (i.e. Belgium, Cyprus, France, Greece, Italy, Portugal and Spain) are considered as highly indebted. Left panel: In the baseline scenario, countries whose structural fiscal position is below (above) the medium-term objective (MTO) are assumed to undertake additional consolidation (stimulus) to converge to the MTO. In the no fiscal policy change scenario, no additional fiscal consolidation (stimulus) is assumed compared with what is implied by the European Commission's spring 2018 economic forecast. For these countries (i.e. with a structural balance below their MTO) this represents an adverse shock. An interest rate shock of +200 basis points is applied in each of the two scenarios as of 2018. To separate the effect of the shock, in the baseline scenario with interest rate shock, no additional consolidation to account for the higher interest expenditure (normally required under the SGP) is considered. Right panel: A one percentage point standard shock on potential GDP growth (permanent shock) and the structural primary balance, respectively, is considered. The interest rate shock of +200 basis points is the same as in the scenario analysis. The combined shock captures the simultaneous impact of the three individual shocks.

In sum, sovereign risks appear to have declined slightly owing to improved economic conditions, but concerns remain given persistent underlying vulnerabilities. Sovereign debt dynamics continue to benefit from the ongoing cyclical upturn and very favourable financing conditions in terms of both pricing and duration. However, public finances remain fragile in a number of countries. Going forward, higher long-term interest rates as a result of a sudden sovereign risk repricing, deteriorating macroeconomic conditions or waning structural and fiscal reform efforts may represent a challenge to public finances. The materialisation of any of these vulnerabilities – particularly in combination – may renew concerns regarding public debt sustainability in the more vulnerable euro area countries.

1.3 Cyclical tailwinds support household fundamentals

Euro area household income continued to strengthen amid improving cyclical conditions. Households' nominal disposable income growth is primarily being bolstered by improving labour market conditions (see [Chart 1.11](#)) and the related robust growth in labour income. To a lesser extent, it is also being supported by favourable profit and property income developments. Although higher inflation

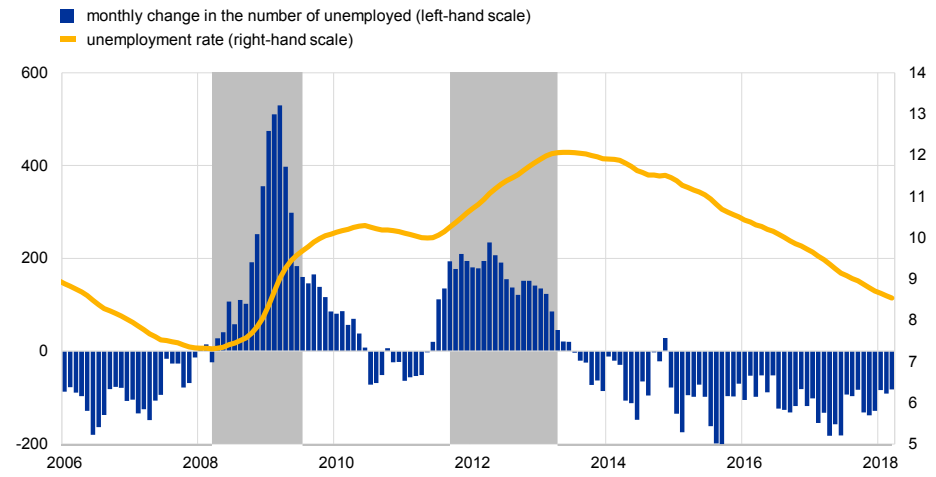
outturns have somewhat contained household real income growth in 2017, it continued to expand at above long-term average rates. Going forward, the expected further improvement in euro area labour markets bodes well for further alleviating households' income risks.

Chart 1.11

Improving labour market conditions suggest lower income risks for euro area households

Unemployment rate and monthly change in the number of unemployed

(Jan. 2006 – Mar. 2018, percentages, number in thousands, three-month moving averages)



Sources: Eurostat, ECB and ECB calculations.

Note: The grey shaded areas indicate euro area recessions as determined by the CEPR Euro Area Business Cycle Dating Committee.

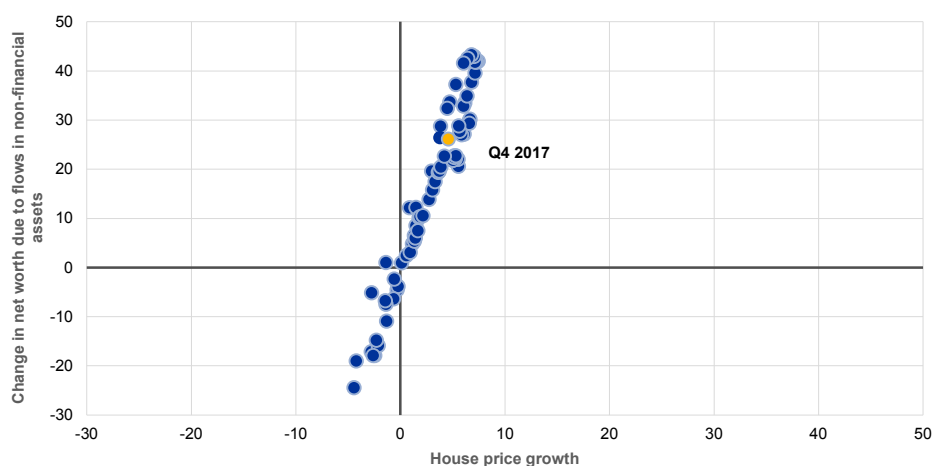
The net worth of euro area households has improved further, chiefly driven by the continued rise in euro area house prices. Strong valuation gains on real estate holdings, together with capital gains on direct equity and mutual fund holdings, continued to boost households' net worth. In fact, owing to leverage, even small changes in house prices can have marked effects on households' net worth relative to their income (see **Chart 1.12**). This could render households' financial positions very sensitive to sudden corrections in housing markets, which is particularly relevant in countries with overvalued property markets (see Chapter 2).

Chart 1.12

Rising euro area house prices have favourable wealth effects

Euro area house price growth and change in net worth due to flows in non-financial assets

(Q1 2000 – Q4 2017, annual percentage changes, percentage of gross annual income)



Sources: Eurostat, ECB and ECB calculations.

Notes: Changes in net worth due to flows in non-financial assets are four-quarter moving sums. Flows in non-financial assets mainly include holding gains and losses on real estate (including land).

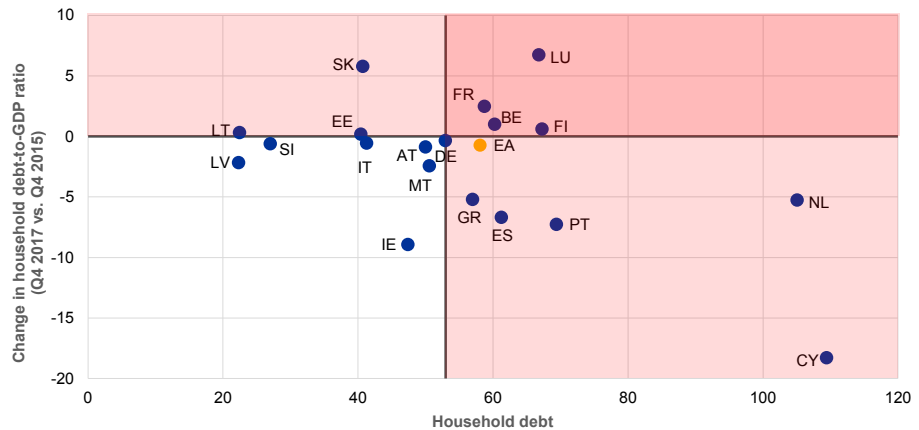
The indebtedness of euro area households has stabilised at the levels that prevailed before the financial crisis, but vulnerabilities remain at the country level. On aggregate, the indebtedness of euro area households has decreased from the 64% of GDP peak in 2009 to 58.1% of GDP at the end of 2017 – a level last seen in mid-2006. While this figure is not particularly high by international standards, it is still somewhat above the benchmark level of 53% of GDP associated with a debt overhang (see [Chart 1.13](#)). The euro area aggregate continues to mask marked cross-country heterogeneity. In the euro area countries that experienced major housing market corrections in the aftermath of the crisis, household indebtedness has declined in recent years driven by loan repayments and/or debt write-offs, while remaining above the aggregate euro area level. In some countries, however, household indebtedness has continued to inch up from elevated levels (e.g. Belgium, Finland, France and Luxembourg).

Chart 1.13

Elevated and rising household debt may represent a cause for concern in some euro area countries

Household indebtedness across the euro area

(Q4 2017, percentage of GDP, percentage point change in the debt-to-GDP ratio)



Sources: ECB euro area accounts and ECB calculations.

Notes: The red vertical line represents the estimated macroeconomic imbalance procedure (MIP) benchmark of 53% of GDP for household debt. The 133% of GDP MIP benchmark for fully consolidated non-financial private sector debt is split between households and firms based on their average past shares in the stock of non-financial private debt. In the case of Ireland, GDP may not be the most representative scaling variable given the activities of foreign-owned multinational enterprises resident in the country. Alternative metrics that are more related to the domestic economy, such as the Modified Gross National Income (GNI*) or Modified Domestic Demand, would yield considerably higher levels of households indebtedness.

The low interest rate environment alleviates debt sustainability concerns.

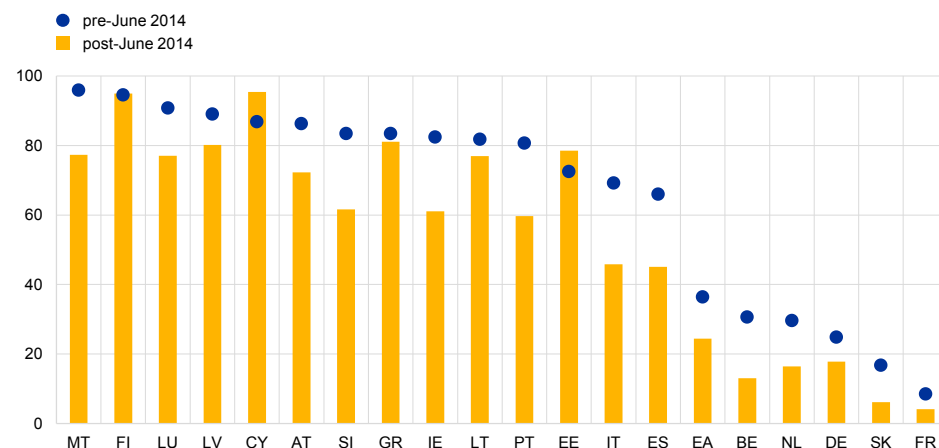
Continued high household debt levels suggest additional deleveraging needs in some countries, even if gradually improving income positions coupled with record low interest payment burdens currently buttress households' debt servicing capacity. The low interest rate environment has encouraged a shift towards longer rate fixation periods across countries (see [Chart 1.14](#)). However, especially in the event of an interest rate shock without a commensurate boost to household income, more vulnerable households might be challenged in countries where loans at floating rates or rates with rather short fixation periods predominate. Further balance sheet repair in countries with elevated levels of household debt should help mitigate the risks related to an eventual normalisation of interest rates and the ensuing rise in debt servicing costs.

Chart 1.14

The low interest rate environment has encouraged a shift towards longer rate fixation periods in most euro area countries

Share of new loans to households at a floating rate and with an interest rate fixation period of up to one year in total new loans

(percentages)



Sources: ECB (MIR statistics) and ECB calculations.

Notes: Loans to households comprise loans for house purchase, consumer lending and other lending. The pre-June 2014 period covers the 3.5 years before the introduction of the negative interest rates and the targeted longer-term refinancing operations by the Eurosystem, while the post-June 2014 period covers the time frame thereafter.

Credit market conditions are improving further in terms of both supply and demand.

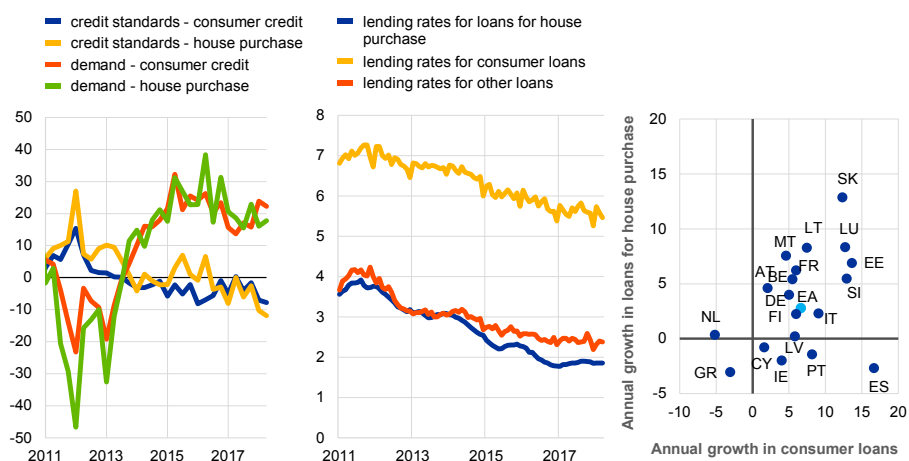
Credit standards continued to ease for both loans for house purchase and consumer credit (see **Chart 1.15** – left panel), driven primarily by increased competitive pressures and banks' lower risk perceptions. The rejection rates for housing and, even more so, consumer loans have decreased, pointing to a more forthcoming credit attitude on the part of banks. On the demand side, the recovery in housing and consumer lending is mainly supported by historically low bank lending rates in almost all household lending categories (see **Chart 1.15** – middle panel). At the same time, strong consumer confidence, favourable housing market prospects and increased financing needs for spending on durable consumer goods also continued to underpin increased demand for household loans.

Chart 1.15

Favourable demand and supply conditions as well as record low interest rates support the recovery of bank lending to euro area households

Credit standards and demand for household loans by type of credit, household lending rates by type of lending, and annual growth in loans for house purchase and consumer lending

(left panel: Q1 2011 – Q2 2018, weighted net percentages; middle panel: Jan. 2011 – Mar. 2018, percentages; right panel: Q4 2017, annual percentage changes)



Sources: European Commission and ECB calculations.

Notes: Left panel: A negative (positive) number for credit standards represents an easing (tightening). Right panel: Loans are adjusted for loan sales and securitisations.

Lending flows to households have continued to recover, but the underlying dynamics continue to diverge across lending types and countries.

At the aggregate euro area level, the recovery in household lending has continued gradually, broadly reflecting the overall dynamics of lending for house purchase. Consumer credit, however, has continued to expand at a brisker pace. The rapid pace of consumer loan expansion is not an immediate source of concern from a financial stability perspective though, given the relatively small share of consumer loans in total household loans for the euro area as a whole. Still, it may reflect increased risk-taking by banks due to higher margins in that business segment, and thus warrants monitoring going forward (see also [Section 3.1](#)). At the country level, consumer lending has expanded at double-digit rates in several euro area countries (see [Chart 1.15](#) – right panel), albeit in some cases from a relatively low base. The pace of lending for house purchase tends to be strong or accelerating in many of the countries which weathered the crisis without major house price corrections. Depending on the state of the house price cycle, some euro area countries have already implemented macroprudential measures to ensure that the quality of new lending remains sound.

All in all, euro area households are benefiting from the cyclical upswing in euro area property markets and the real economy, but stock imbalances remain in some countries.

The improving income position of euro area households coupled with continued favourable financing conditions are supporting households' debt servicing capacity. However, a sudden rise in interest rates may spark renewed debt sustainability concerns in countries with elevated levels of household debt and where floating rate contracts prevail, while the recent buoyancy of certain types of bank lending in some euro area countries warrants monitoring.

1.4 Corporate debt sustainability concerns remain despite lower credit risks

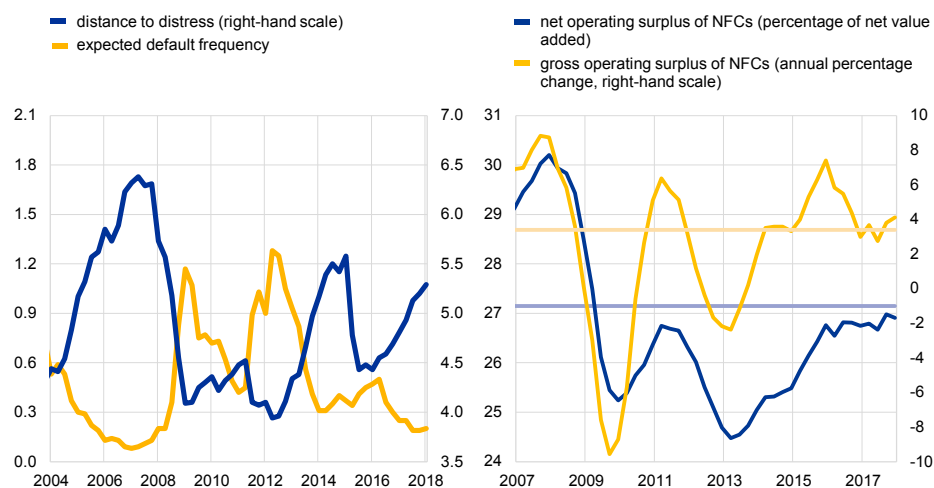
Credit risks in the euro area non-financial corporate sector appear to have declined. Expected default frequency and distance-to-distress measures currently signal relatively low levels of balance sheet risk for the euro area non-financial corporate sector (see **Chart 1.16** – left panel). This reflects the ongoing improvement in macroeconomic conditions and the low volatility environment prevailing in most asset classes, even after the equity market corrections in February this year. The improved creditworthiness of the corporate sector is also corroborated by lower earnings risks, as the broad-based economic growth across countries and sectors translates into gradually rising corporate profitability (see **Chart 1.16** – right panel). Favourable order books and increased capacity utilisation coupled with still moderate pressures from cost-push factors, such as higher wages and interest rates, bode well for further improvements in corporate profitability. That said, a sudden deterioration in economic growth prospects or a cost shock could undermine corporate profitability, while increased trade protectionism may hamper the profit-generating capacity of export-oriented firms. Also, high commercial real estate valuations may challenge the profitability of firms exposed to this market either directly or indirectly (see Chapter 2 and **Box 2**).

Chart 1.16

Market price-based measures of corporate balance sheet risks show clear improvement, as earnings risks subside amid gradually rising corporate profitability

Distance to distress and expected default frequencies for euro area NFCs (left panel), as well as gross and net operating surplus of euro area NFCs (right panel)

(left panel: Jan. 2004 – Mar. 2018, percentages, averages, weighted by total assets; right panel: Q1 2007 – Q4 2017, percentage of net value added, annual percentage changes)



Sources: Moody's, ECB euro area accounts and ECB calculations.

Note: Right panel: The horizontal lines illustrate the long-term averages for the respective indicators, covering the time span from Q1 1999 to Q3 2017.

A large stock of legacy debt continues to weigh on the euro area non-financial corporate sector. On aggregate, the level of non-financial corporate debt stood at 105.5% of GDP as at year-end 2017 on an unconsolidated basis – a level that remains high by both historical and international standards. While having decreased

since the peak in early 2015, corporate indebtedness at 80.6% of GDP on a fully consolidated basis has remained slightly above the 80% of GDP benchmark (derived from the European Commission's MIP Scoreboard) that can be associated with a debt overhang, albeit amid a high degree of heterogeneity across euro area countries. At the same time, other leverage measures such as debt-to-total assets and debt-to-equity ratios point to more favourable developments. They have declined markedly since mid-2012, now standing at or close to their historical lows. The decline in these measures can be mostly attributed to the increase in share prices, which has facilitated the deleveraging via the positive denominator effect.

The relevance of market-based debt has increased since the start of the crisis.

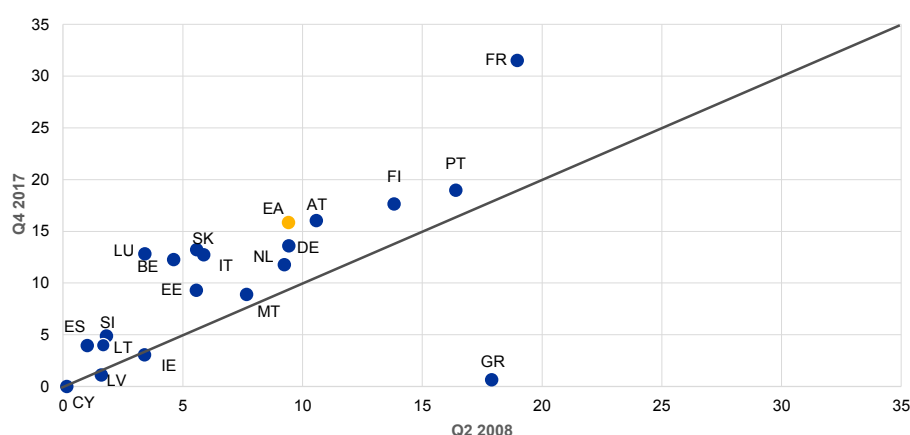
The decomposition of non-financial corporate indebtedness by instrument suggests an ongoing (possibly more structural) shift from MFI loans towards market-based funding since the financial crisis in a large number of euro area countries (see [Chart 1.17](#)). In general, this is a beneficial development as it leads to increased diversification of corporate funding sources. At the same time, the cost and availability of market-based funding may also be more prone to an abrupt increase in risk premia in global financial markets, whereas bank funding may typically buffer some of the short-term volatility in markets. Moreover, market-based funding is outside the scope of traditional macroprudential policies should signs of credit exuberance emerge.

Chart 1.17

Marked shift towards market-based financing in many euro area countries since the financial crisis

Share of debt securities issued in total market-based (debt securities issued) and bank (MFI loans) financing

(Q2 2008, Q4 2017; percentages based on outstanding stocks)



Sources: ECB euro area accounts and ECB calculations.
 Note: Figures for Spain do not include debt issuance through financial subsidiaries which account for a significant part of the debt securities funding of large corporates.

A favourable interest rate environment alleviates debt sustainability concerns.

Currently, euro area non-financial firms' debt servicing capabilities are underpinned by rising corporate profitability and record low corporate interest payment burdens. Still, further balance sheet repair would help offset any risks related to a rise in interest rates (especially in the absence of a commensurate improvement in

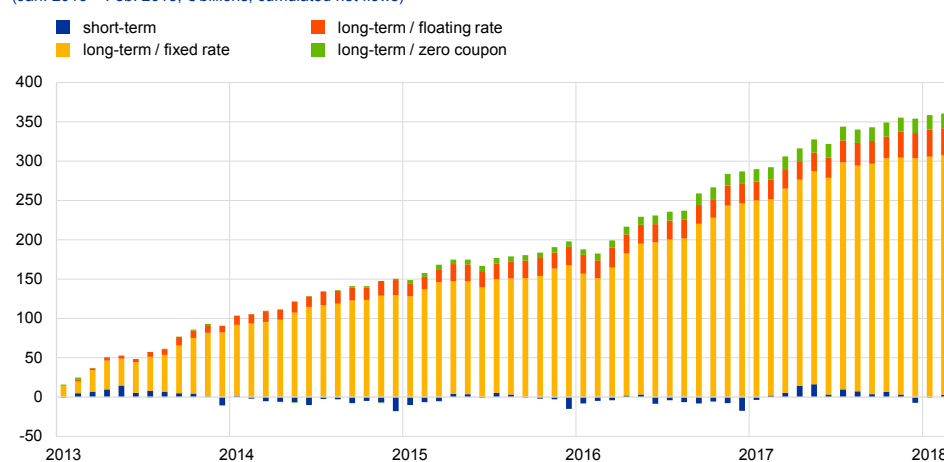
economic conditions) and the ensuing rise in debt servicing costs. In fact, unlike in the household sector, loans with floating rates or rates with rather short fixation periods continue to be the dominant type of loan for the euro area non-financial corporate sector. The related interest rate risk is partly mitigated by the ongoing shift towards market-based funding amid strong issuance activity at the long end of the maturity spectrum at fixed rates in recent years (see [Chart 1.18](#)).

Chart 1.18

Debt issuance at long-term fixed rates somewhat mitigates the risks related to a pick-up in interest rates

Cumulated net flows of debt securities issues by euro area non-financial corporations by maturity and interest rate type

(Jan. 2013 – Feb. 2018, € billions, cumulated net flows)



Sources: ECB and ECB calculations.

Bank lending flows to euro area non-financial firms strengthened gradually further, on the back of supportive demand and supply conditions.

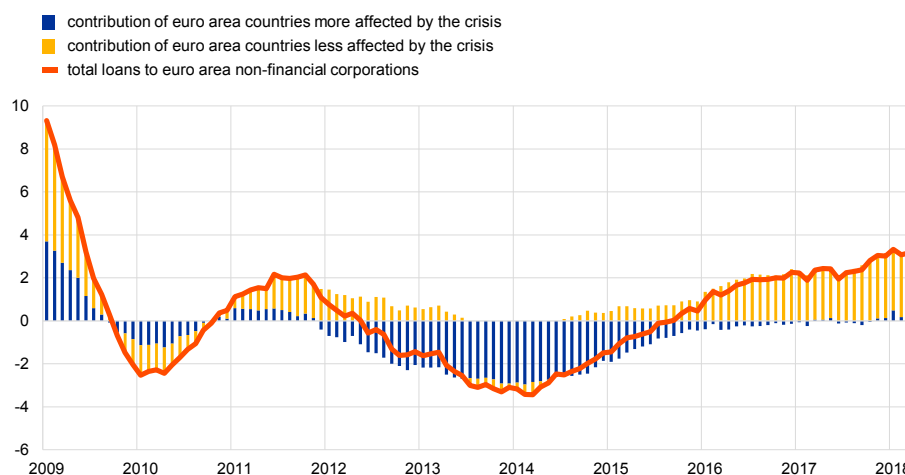
Developments have remained uneven across the euro area though, as relatively more dynamic lending activity in euro area countries that were less affected by the crisis contrasts with more muted developments in those countries that were more affected by the crisis (see [Chart 1.19](#)). Against the backdrop of increased competitive pressures and lower risk perceptions, banks have continued to ease their credit standards across maturities and firm sizes, but relatively more so for short-term loans and loans to large firms. Loan demand increased for loans to both SMEs and large firms, driven by an increase in fixed investment, the growth in inventories and working capital, as well as stepped-up M&A activity.

Chart 1.19

Expansion in lending to non-financial corporations is mainly driven by countries that were less affected by the crisis

Annual growth in loans to NFCs in the euro area

(Jan. 2009 – Mar. 2018, annual percentage changes, percentage point contributions)



Sources: ECB and ECB calculations.

Notes: Data are adjusted for loan sales and securitisations. Euro area countries more affected by the crisis comprise Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain, while the category less affected by the crisis captures all other euro area countries.

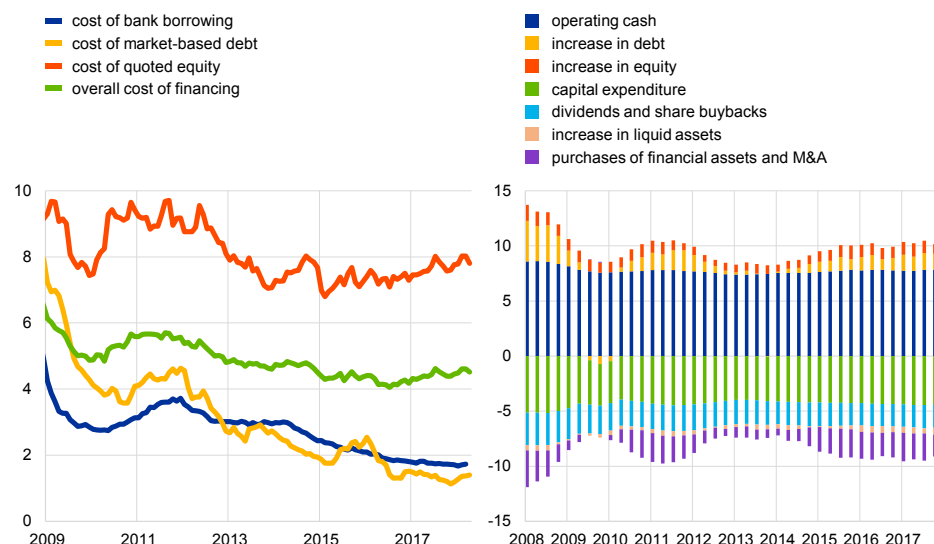
External financing from non-bank sources has remained favourable in terms of both the availability and the cost of funding. External financing from non-bank sources strengthened further, supported by the low overall cost of external financing – even if the latter has increased somewhat since early 2018 as a result of the observed repricing in equity and bond markets (see [Chart 1.20](#) – left panel). The net issuance of debt securities has remained relatively strong against the backdrop of both the ECB’s corporate sector purchase programme and the low cost of market-based debt. By contrast, the issuance of listed shares by NFCs continued to be rather modest given the comparatively high cost of quoted equity. In terms of the uses of funds, capital expenditures, purchases of financial assets, M&A activity as well as increases in liquid assets have gained in importance in recent years (see [Chart 1.20](#) – right panel). There has been no marked increase in the return of funds to shareholders via dividends and share buybacks.

Chart 1.20

External financing conditions remained favourable for euro area non-financial corporations, underpinning an increase in capital expenditures and purchases of financial assets

Nominal cost of external financing for NFCs (left panel), as well as sources and uses of funds for euro area NFCs (right panel)

(left panel: Jan. 2009 – Apr. 2018, percentages; right panel: Q1 2008 – Q4 2017, percentage of notional stocks of assets, four-quarter moving sums)



Sources: ECB, ECB euro area accounts, Merrill Lynch, Thomson Reuters and ECB calculations.

Notes: Left panel: The overall cost of financing for NFCs 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. Right panel: Liquid assets include currency and deposits. Equity is the sum of the gross issuance of listed shares and the net issuance of unlisted shares and other equity.

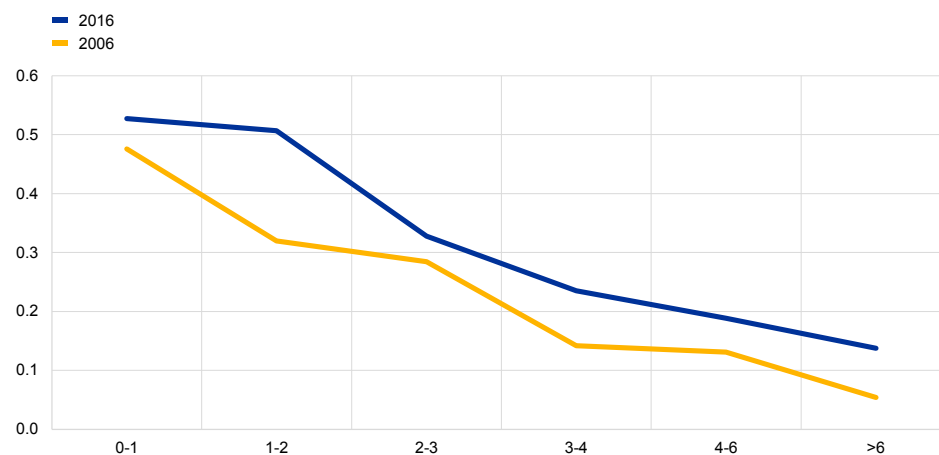
Internal financing sources of euro area firms remain ample. Corporate liquidity has increased further in the euro area to the new record high of around 30% of GDP as at year-end 2017, suggesting that non-financial firms can also rely on drawing down these buffers as a financing source, in addition to loans and debt securities. These high liquidity buffers may reflect a lack of attractive investment opportunities, as well as precautionary motives (i.e. mitigating the risk of limited access to external financing in the future) and the low opportunity cost of holding liquid assets. Overall, these internal sources of funding could make a significant contribution to both reducing leverage and boosting investment. That said, micro data suggest that more levered firms tend to have lower cash holdings, even if over time cash holdings have increased in all leverage buckets (see [Chart 1.21](#)). This suggests that firms that would be most exposed to a tightening in financing conditions are the least able to withstand it by using their own liquidity buffers.

Chart 1.21

More levered euro area firms tend to have lower cash holdings

Cash holdings of non-financial firms by leverage bucket

(2006, 2016; percentage of gross debt)



Sources: Thomson Reuters, Bloomberg and ECB calculations.

Notes: The sample consists of 154 investment-grade non-financial firms from the euro area, of which 45 are from France, 42 from Germany, 15 from Spain, 16 from Italy, 13 from the Netherlands and the rest from other euro area countries. Leverage is defined as gross debt over EBITDA.

All in all, euro area non-financial firms continue to benefit from the economic upswing and low funding costs, but underlying vulnerabilities remain. The strong underlying economic momentum underpins firms' profit-generation capacity.

Reinforced by the very accommodative monetary policy stance of the ECB, the financing conditions of euro area non-financial corporations remain favourable and supportive of both investment and debt servicing. However, rising interest rates (without a commensurate improvement in macroeconomic conditions) may spark renewed debt sustainability concerns, as corporate indebtedness remains high at the aggregate euro area level both historically and by international standards.

Box 2

Listed commercial real estate companies and real estate investment trusts: trends and implications for financial stability

Prepared by Álvaro Santos-Rivera and Pablo Gonzalez Dominguez

Assessing the dynamics of the euro area commercial real estate (CRE) sector¹² during the current cyclical upturn remains important for identifying potential financial stability risks.

The downturn in CRE markets played a significant role in the last financial crisis in many countries and contributed to the increase in the non-performing exposures of the banking sector. As part of this assessment, this box analyses the growing importance of listed CRE companies, and a sub-set thereof known as real estate investment trusts (REITs), in the euro area.

Over the last decade, the assets of listed CRE companies have grown rapidly in many euro area countries (see Chart A – left panel). Since 2009 the size of these companies has doubled

¹² Commercial real estate refers to already developed income-producing real estate and includes office, retail, logistics and multi-dwelling residential property.

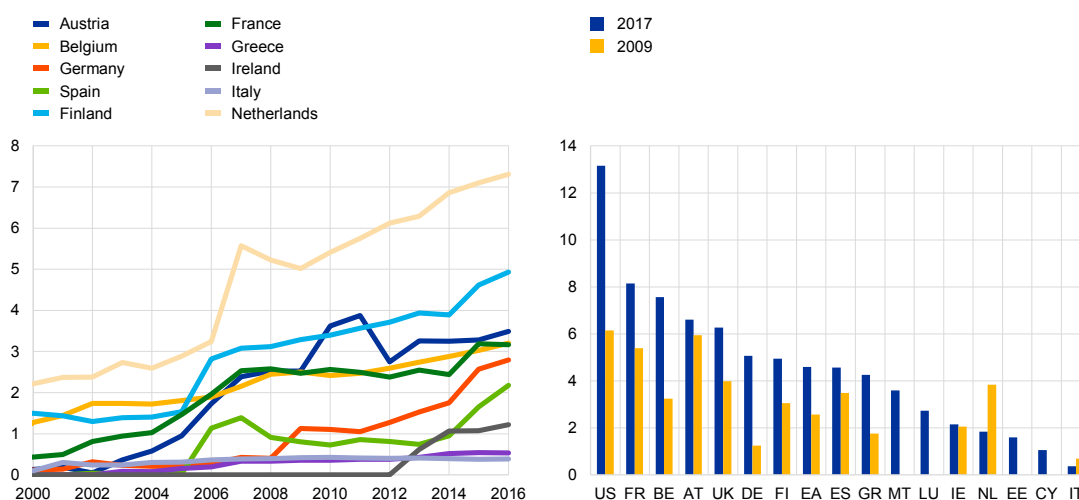
relative to the underlying commercial property sector in the euro area, although they remain small relative to their counterparts in the United States and the United Kingdom (see **Chart A** – right panel). In most euro area countries where listed CRE companies are relatively large vis-à-vis the size of the underlying CRE market REITs are the dominant form (e.g. in the Netherlands, France, Belgium, Spain and Ireland).¹³ The main exceptions are Germany and Austria, in which the largest listed CRE companies are not REITs.

Chart A

Both the assets of listed CRE companies and their weight relative to domestic CRE markets have grown markedly in many euro area countries since 2009

Relative size of listed CRE companies

(left panel: 2000-16; euro area FTSE EPRA/NAREIT index company assets as percent of GDP; right panel: 2009 and 2017; market capitalization of listed CRE companies as percent of total CRE assets)



Sources: Bloomberg company data for FTSE EPRA/NAREIT index companies, EPRA Total Markets Table and ECB calculations

Note: The drop for NL in the right-panel chart is due to the reclassification in the EPRA Total Markets Table of a large REIT as French after a merger. The same large company has, however, continued to be classified as Dutch in the FTSE EPRA/NAREIT index.

Listed CRE companies usually derive most of their corporate revenue from the rental income that they earn on a portfolio of real estate property that they own.

They have two distinctive features that render them attractive to investors. First, in the case of REITs, companies can either minimise or completely avoid paying corporate income tax by distributing most of their income as dividends, so that only the shareholders are taxed on their dividend income or capital gains. This allows REITs to offer higher dividend yields than other company stocks, whose issuers must pay taxes at the corporate level before distributing any dividends. Second, listed CRE companies, including REITs, are listed on a stock exchange, thereby offering investors exposure in a liquid and transparent way to a relatively illiquid underlying asset like commercial real estate.

Foreign investors are by far the most important source of both equity and debt funding for listed CRE companies in euro area countries (see Chart B – left panel). US asset management companies are the largest single source of equity inflows into listed euro area CRE companies, although other euro area countries still account for around 40% of foreign holdings of equity (see

¹³ “Dominant” means that in a specific country most of the companies included in the benchmark FTSE EPRA/NAREIT index are REITs. In the mid-1990s REIT regimes only existed in two euro area countries (Belgium and the Netherlands) and they began to expand across more countries only after 2007. Currently, specific national REIT legislation exists in ten euro area countries.

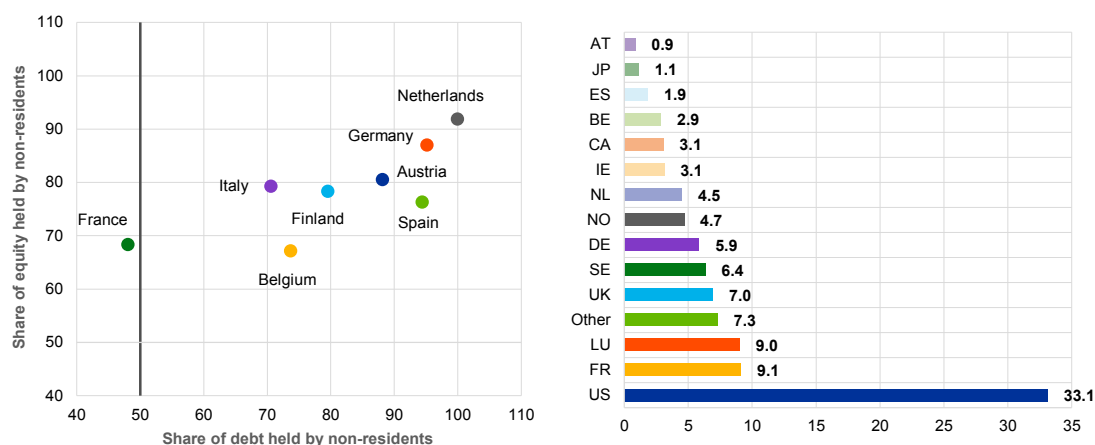
Chart B – right panel). In the current low global interest rate environment, foreign investors are attracted by the relatively high risk-adjusted returns offered by CRE company shares, through which they can also achieve a liquid exposure to a growing CRE sector.

Chart B

Foreign investors hold most of the equity and debt issued by listed euro area CRE companies, with US and French investors holding the largest equity stakes

Share of debt and equity in listed euro area CRE companies held by non-domestic investors (left panel) and foreign holdings of equity in listed euro area CRE companies by country of holder (right panel)

(2016; percentages)



Sources: Bloomberg, SHS, FTSE Russell and ECB calculations

Notes: Left panel: "Non-domestic" refers to investors from both inside and outside the euro area. Foreign holdings as a percentage of debt and equity issued by companies listed in the FTSE – EPRA NAREIT Europe Index and included in Securities Holdings Statistics (SHS). Right panel: Calculations are based on the weighted average of aggregate total assets in the euro area. Domestic holdings represent total holdings held by investors from the same country and foreign holdings represent total holdings held by investors from foreign countries (including in the euro area).

In general, the funding structure of listed CRE companies and the dominant role of foreign funding sources could be seen as tempering any concerns about euro area financial stability. First, there is no significant direct exposure of the banking system to this sector, as it is mostly funded by institutional investors and funds managed by global asset managers. Second, the main source of funding for the sector is equity, which reduces the risks typically associated with leveraged investment structures, such as debt rollover risk. In fact, listed CRE companies operate with relatively low leverage, and the average debt-to-assets ratio of these companies in the euro area is fairly stable at around 37%. Third, the geographical diversification of the holdings of equity and debt securities issued by CRE companies allows risk sharing in the event of the materialisation of losses, as they are spread across numerous euro area jurisdictions and among investors outside the euro area, rather than being concentrated in the home jurisdiction of the company.

Foreign capital flows into listed CRE companies may, however, be susceptible to a sudden stop or reversal of search-for-yield flows should global financial conditions change. The growth of investment transactions and prices in the most dynamic CRE markets currently appears to be influenced by increased commercial property purchases by these listed CRE companies. In this context, a sudden stop in the funding inflows into these companies could lead to disorderly price adjustments in commercial property markets themselves. Accordingly, looking ahead, monitoring the influence of developments in listed CRE companies and their potential impact on the dynamics of euro area CRE markets will remain an important part of the overall assessment of financial stability risks in the euro area.

2 Financial markets and valuations



Financial markets

The generalised **reach for yield** has intensified over the review period, supported by strong and globally synchronised economic growth.

A **surge in volatility** in US stock markets occurred in early February which underscored the fragility of current market sentiment.

The episode illustrated how abruptly **market sentiment can change** in the current environment of generally compressed risk premia.



Asset valuations and vulnerabilities

While there are **no general misalignments across asset classes** in the euro area, valuations continue to be stretched in several markets such as high yield bonds, leveraged loans, prime commercial real estate and US equities.

The potential **impact of a significant repricing has increased** due to euro area entities' rising exposure to lower-rated corporate debt.

Financial market participants should **lower their exposure to vulnerable sectors** and prepare for a situation in which the favourable market environment may no longer persist.

The February volatility surge had limited spillovers, but revealed a fragile financial system

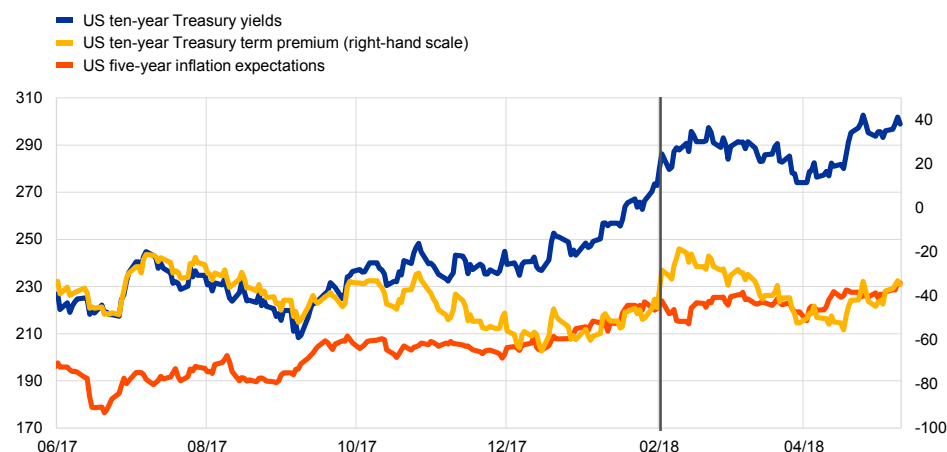
Global financial markets were rattled in early February by a surge in volatility originating in US equity markets. Following the passage of the US tax reform, US equities rose by close to 9% between the end of November and the end of January. However, stronger than expected US wage increases and non-farm payroll data on 2 February triggered an increase in US term premia linked to greater uncertainty about the pace of US monetary policy normalisation and future inflation levels (**Chart 2.1**). This, in turn, precipitated a US equity market sell-off, which was mirrored in global equity markets. This episode highlighted risks harboured by a low-volatility environment associated with investor complacency, search for yield and the build-up of leverage, as previously discussed in the November 2017 FSR. It also brought to the fore the extent to which volatility has become an asset class in its own right with the potential to amplify market movements.

Chart 2.1

The recent bout of volatility was partly triggered by stronger than expected US labour market data on 2 February

Ten-year US Treasury yields, ten-year US Treasury term premium and US five-year inflation expectations

(Jun. 2017 to May 2018, basis points)



Sources: Bloomberg and ECB calculations.

Notes: US inflation expectations are based on inflation swap rates on the headline CPI-U NSA. The vertical grey line indicates 2 February 2018.

The disproportionate rise in equity market volatility partly reflected the behaviour of investment products positioned on low volatility.

The more than doubling of the VIX on 2 February was far above what would have been expected based on similar past declines in the underlying S&P 500 equity index (Chart 2.2).¹⁴ While the VIX is not directly tradeable, there is an arbitrage relationship between options on the S&P 500 – which determine the VIX level – and VIX futures. This means that the VIX both determines and is affected by the pricing of VIX futures. Trading in the VIX via the futures markets is, in part, related to the activity of a small number of exchange-traded products (ETPs) targeting volatility. These products require daily rebalancing to ensure that they meet their target exposure.¹⁵ The sharp increase in the VIX in early February therefore required these ETPs to purchase significant amounts of VIX futures to meet their daily rebalancing requirements. The holders of inverse volatility ETPs are also likely to have put upward pressure on VIX futures prices as they tried to hedge their exposures. Ultimately, the volatility surge led to the implosion of some of these products, as daily losses in excess of pre-determined maximum thresholds – in some cases over 80% – triggered their closure.

¹⁴ The VIX index measures the expected volatility of the S&P 500 over the next 30 days and is a widely used barometer of market uncertainty. Its level is derived from puts and calls on the S&P 500 over a wide range of strike prices. While the VIX index is not directly tradable, the volatility measured by the index can be replicated with a portfolio of options on the underlying S&P 500 index.

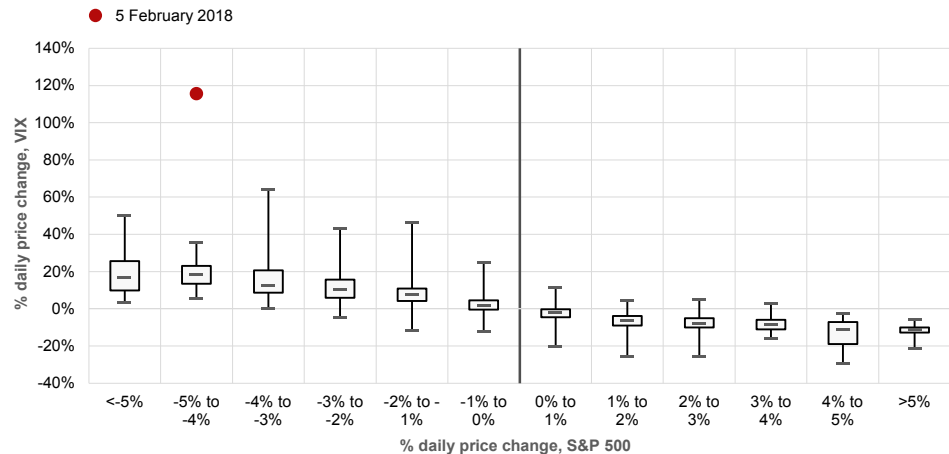
¹⁵ When the VIX rises, both levered long volatility and inverse volatility ETPs are required to buy VIX futures to maintain a target ratio of equity to futures notional. Long volatility funds need to buy more futures notional as the equity value increases, while inverse volatility funds need to do the same to reduce their net short position. See “Volatility is back”, *BIS Quarterly Review*, March 2018.

Chart 2.2

The relationship between the VIX and stock price returns broke down in early February

VIX median, interquartile range, and minimum and maximum changes in VIX levels for given daily changes in the S&P 500

(Nov. 2000 to 5 Feb. 2018; daily changes in price volatility; percentages)



Sources: Thomson Reuters and ECB calculations.

Note: The statistics for daily changes in VIX prices are shown in relation to daily S&P 500 price changes, sorted into buckets.

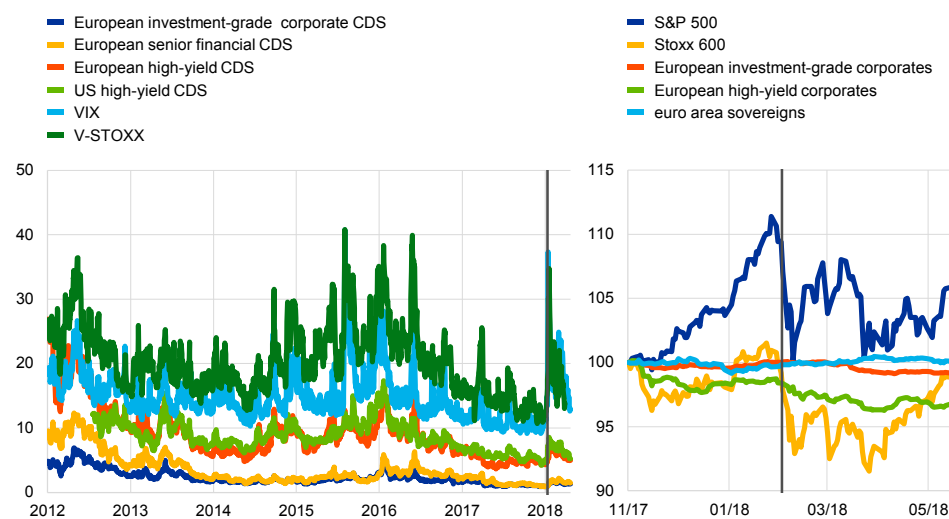
While immediate spillovers from the February episode were largely limited, some of the shock persisted. Both in Europe and in the United States, equity markets saw an immediate and relatively sharp correction. This probably reflected both a pullback following previous rapid price appreciation and a negative feedback loop between the VIX and its underlying S&P index (via dealer and investor hedging activities). High-quality corporate bond markets and euro area sovereign bonds were only affected marginally, while high-yield corporate credit spreads saw an orderly and persistent widening. The implied volatilities of the VIX and of European and US credit indices have decreased since the February peak, but remain relatively high, indicating that markets continue to price in considerable uncertainty over the short term (**Chart 2.3**). This suggests that the spillovers from the February episode may eventually extend beyond the initial market correction and that the pricing of volatility has regained its sensitivity to daily news, such as increased global trade war rhetoric from the United States. From a financial stability perspective, an orderly repricing that brings the valuation of certain asset classes more into line with their fundamental value is, nevertheless, positive.

Chart 2.3

While most European bond markets were unaffected by the bout of equity volatility, US and European equity and credit markets priced in higher volatility levels after the spike in February

Implied price volatility of selected European and US CDS and equity indices and estimated price performance for selected European and US equity and credit indices since November 2017

(left panel: Jan. 2012 to May 2018, price volatility in percentages per annum; right panel: index: 1 Nov. 2017 = 100)



Sources: Thomson Reuters, Citigroup (implied CDS index volatility) and ECB calculations.

Notes: Left panel: European investment-grade corporate CDS, investment-grade senior financials, high-yield CDS and US high-yield CDS index volatilities represent market-implied at-the-money price volatilities for six-month credit options on the five-year iTraxx Europe, five-year iTraxx Senior Financials, five-year iTraxx Crossover and five-year CDX.NA.HY, respectively. Yield volatilities have been converted to price volatilities to make credit volatility comparable with equity volatility. Right panel: the evolution of corporate and sovereign bond indices is based on iBoxx EUR Non-Financials, iBoxx EUR HY Non-Financials and iBoxx EUR Eurozone Sovereigns. The illustrated bond prices capture the reaction to the changes in the credit spread component only. The risk-free rate is kept constant as of 1 November 2017 to ensure that only the impact arising from changes in the credit spread levels are captured. In each panel, the vertical black line indicates 2 February 2018.

Past experience using US data suggests that the higher volatility since February is likely to persist. Box 3 finds that the period of low volatility preceding the February episode is not unusual from a historical perspective and that the persistently higher volatility since February is likely to mark a shift to a higher volatility regime.

Box 3

Regime shifts in stock market volatility: a historical perspective on the US market

Prepared by Manfred Kremer

After a period of about two years with fairly steady price increases and persistently low volatility, global stock markets experienced a notable price and volatility correction in early February 2018. Before this correction, policy authorities had become concerned about the benign volatility conditions, since low volatility may lead market participants to take on excessive risk and thereby create risks to financial stability (the “volatility paradox”).¹⁶ Against this background, a return to conditions of higher volatility could, on the one hand, be regarded as a welcome normalisation.

¹⁶ Such risks are discussed in more depth in Andersson, M., Hermans, L. and Kostka, T., “Higher future financial market volatility: potential triggers and amplifiers”, *Financial Stability Review*, ECB, November 2017, pp. 172-182.

On the other hand, a “disorderly” stock market correction with sharp price declines and large price fluctuations might itself pose risks to financial and economic stability.

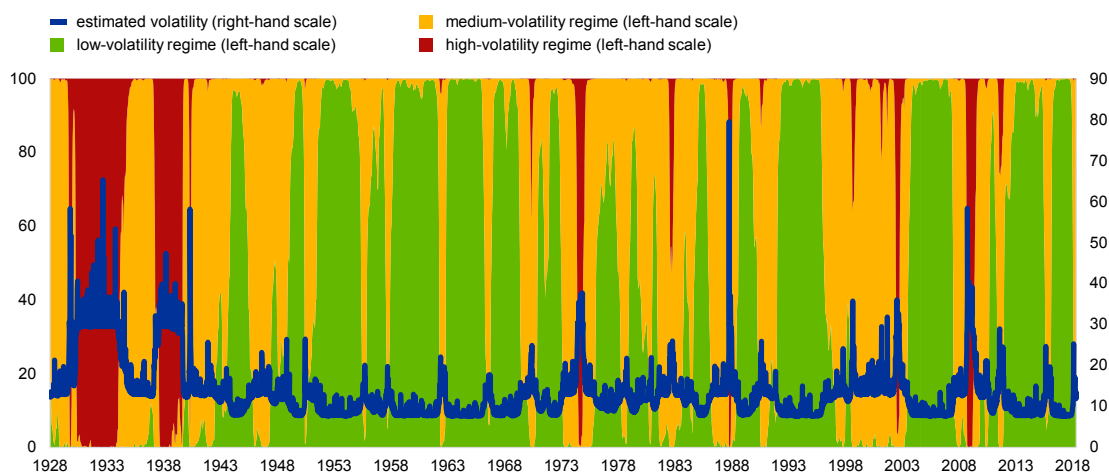
To put recent developments into a historical perspective, this box analyses stylised facts of stock market volatility derived from 90 years of US data. For this purpose, a model of weekly returns of the S&P 500 price index is estimated that allows for abrupt switches between three regimes in the volatility dynamics during the period from January 1928 to mid-May 2018 (low, medium and high-volatility regimes).¹⁷ Such regime-switching models are able to capture two well-known stylised facts of stock market volatility, namely that volatility can jump sharply upwards in a short amount of time, and that such jumps are followed by fairly rapid reversion to lower levels which, in turn, can vary over time.¹⁸

Chart A

Stock market volatility regimes are quite persistent historically

Estimated stock returns volatility and stacked regime probabilities

(Jan. 1928 – May 2018, weekly data; regime probabilities in percentages, annualised volatility in percentages)



Sources: Federal Reserve Economic Data (FRED) and ECB calculations.

Notes: The low, medium and high-volatility regime probability series are stacked onto each other such that they add up to 100%. The volatility series are computed as the square root of the probability-weighted average of regime-specific annualised conditional variances.

The model suggests that stock market volatility indeed tends to cluster around low, medium or very high levels. Chart A shows the estimated volatility of weekly S&P 500 returns (the blue series) along with the stacked probabilities of being in any of the three regimes (represented by the areas shaded in green, orange and red). Average volatility amounts to 9% in the low-volatility regime, 14% in the medium-volatility regime and 31% in the high-volatility regime. The estimated probability of staying in the same regime over the next period is high for all three regimes, but particularly so for the low and medium-volatility regimes. Accordingly, the expected duration for those two regimes is quite long at about 80 and 50 weeks, respectively. Historically, periods of low and medium volatility are the most common, occurring in 45% of all weeks in both cases. High-

¹⁷ A regime-switching autoregressive conditional heteroscedasticity (SWARCH) model is employed, as originally proposed in Hamilton, J.D. and Susmel, R., “Autoregressive conditional heteroskedasticity and changes in regime”, *Journal of Econometrics*, Vol. 64, 1994, pp. 307-333. In the conditional variance part, the model allows for three different regime levels and includes a leverage effect. The model errors are assumed to come from a Student’s *t*-distribution.

¹⁸ See, for example, Dueker, M.J., “Markov Switching in GARCH Processes and Mean-Reverting Stock-Market Volatility”, *Journal of Business & Economic Statistics*, Vol. 15, No 1, 1997, pp. 26-34.

volatility regimes, by contrast, tend to be much less frequent (10%) and much less persistent, apart from two episodes in the 1930s, the first of which was related to the Great Depression.

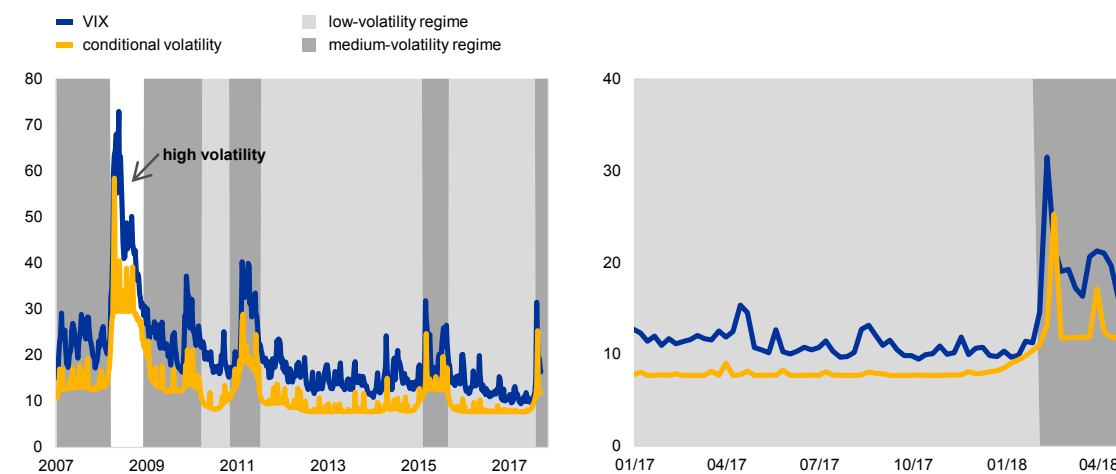
The stock market turbulence in early February 2018 interrupted a protracted, though not unusually long, period of low volatility. Growing uncertainty among market participants about the future course of monetary, fiscal and foreign trade policy in the United States may have been among the main drivers of recent spikes in estimated and expected market volatility, the latter represented by the options price-based Volatility Index (VIX) (see Chart B). While US stock prices fell by about 6.5% in one week, estimated volatility and the VIX surged to levels of 25% and 32%, respectively. However, volatility receded quickly, dropping to levels of around 12% for estimated volatility and 14% for the VIX at the end of the review period.

Chart B

Is the market heading towards a period of sustained higher volatility?

Estimated stock returns volatility and the VIX during different volatility regimes

(Jan. 2007 – May 2018, weekly data; annualised volatilities in percentages; regimes with the highest probability shaded)



Sources: Federal Reserve Economic Data (FRED) and ECB calculations.

Note: The estimated volatility series is computed as the square root of the probability-weighted average of regime-specific annualised conditional variances.

The regime-switching model suggests that the recent bout of turbulence did not bring about a shift towards a high-volatility regime. This notwithstanding, the turbulence caused a shift from a regime of low volatility to one of medium volatility. Accordingly, the probability of a medium-volatility regime increased from below 1% at the end of November 2017 to around 75% from early February 2018 onwards. The increased likelihood of a medium-volatility regime also raised the odds of extreme market turmoil, from practically zero at the end of 2017 to close to 1% by mid-May 2018. All in all, this box suggests, when taking a long-term historical perspective, that the most recent gyrations in US stock market volatility did not bring about a clear shift towards a regime of extremely high volatility, but they may still indicate heightened risks of higher volatility going forward in the United States and elsewhere in the world. From a financial stability perspective, a move to only moderately higher average volatility can be considered as a welcome normalisation.

The proliferation of short-volatility strategies highlighted by this episode illustrates the extent of search for yield. The protracted low-volatility environment is likely to have incentivised risky yield-enhancing strategies. These include short-

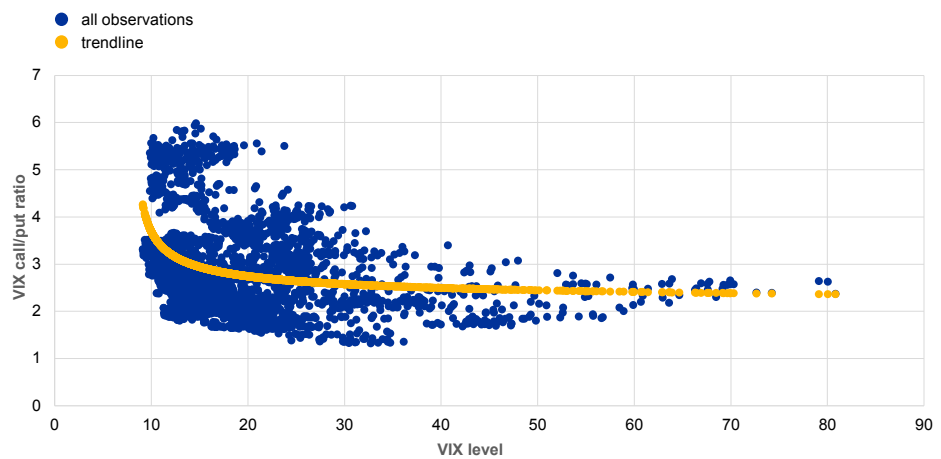
volatility trades involving the selling of call options for assets whose price is seen as expected to move in one direction only. **Chart 2.4** suggests that such strategies may have been employed in the case of the VIX. When the VIX is low, the number of call contracts sold relative to puts on the VIX index increases, which may also reflect call options sold under the expectation that the options would expire without being exercised. The February spike also illustrates the procyclicality of such strategies: sellers of such options probably compounded the buying pressure on VIX futures.¹⁹ Similar strategies may be employed in other, larger markets.

Chart 2.4

The higher ratio of call options to put options on the VIX during periods of low volatility may signal speculative actions

The VIX and the call-to-put ratio for options on the VIX

(Feb. 2006 to Feb. 2018, level of the VIX and the call-to-put ratio)



Sources: CBOE and ECB calculations

Note: The call-to-put ratio is computed as the 60-day moving average of the daily ratios.

Shifts in post-crisis risk management of investment portfolios may increase the risk that short-term spillovers will snowball into larger ones. The recent growth of risk management strategies seeking to protect portfolios from the types of losses experienced during the crisis may have increased the risk of contagion. Some funds employ risk parity strategies where the underlying asset classes contribute equally to the overall portfolio volatility; others target a certain constant portfolio volatility level. Some strategies also employ leverage to boost returns. **Chart 2.5** shows the pro-cyclical behaviour of such an index that can lever up to 1.5 times and rebalances daily. Such an index levers up when market volatility is low, typically in rising equity markets, and delevers when volatility increases, typically in declining equity markets, thereby acting procyclically.

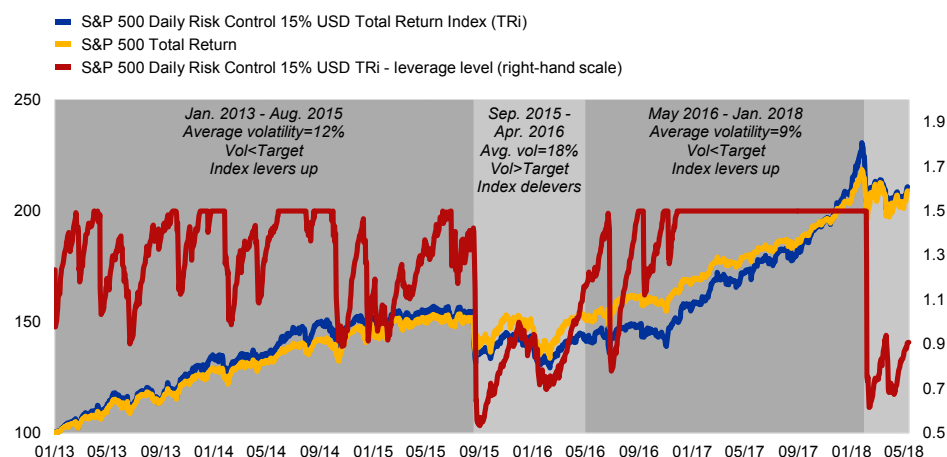
¹⁹ Delta hedging the exposure to short positions in call options on the VIX requires the purchase of an increasingly large amount of the underlying as options move closer to being in-the-money. This increases the price of VIX futures, the delta hedging ratio and the amount of notional that needs to be purchased.

Chart 2.5

The increasing use of volatility controlling strategies can lead to pro-cyclical behaviour and exacerbate market movements

Comparison between S&P 500 index and a risk control index based on the S&P 500

(Jan. 2013 to May 2018; index: 3 January 2013 = 100)



Sources: S&P, Bloomberg and ECB calculations.

Notes: The S&P 500 Daily Risk Control 15% USD Total Return Index has a target volatility of 15% and can lever up to 1.5 times; it rebalances daily. During January 2013 and August 2015, when the S&P 500's realised volatility was mostly below target, the total return index mostly levered up and outperformed the equity index. When volatility increased to or above the target, such as between September 2015 and April 2016, the index delevered below 1. Between May 2016 and January 2018, a period with mostly very low volatility, the index levered up for most of the time and outperformed the market, before sharply delevering to levels below 1 following the volatility surge in February.

Despite some repricing, valuations remain stretched in some markets

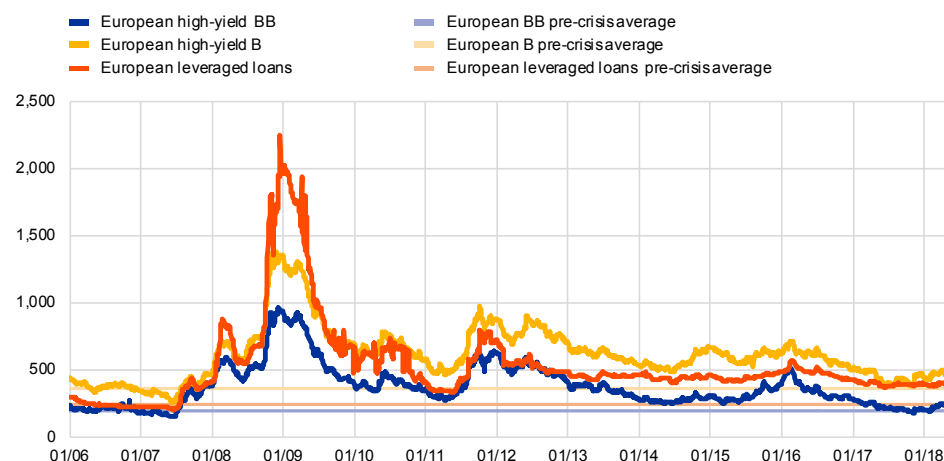
While there are no general misalignments across asset classes in the euro area, pockets of overvaluation are visible in certain segments and in some foreign markets. In the euro area, valuations appear stretched in the riskier segment of the non-financial corporate credit market and in prime commercial real estate. Beyond the euro area, US equities also have very high valuations by historical standards. Globally, some asset classes appear to be “priced to perfection”. This reflects several factors. First, growth expectations in several major countries have exceeded expectations. Second, the US tax reform has provided impetus to financial markets and to risky assets in particular. Third, markets seem to have taken comfort from central banks' very gradual exit from accommodative monetary policies. Fourth, significant amounts of funds appear to be available for deployment in an environment of already low returns.

Chart 2.6

Credit spreads of European high-yield bonds and leveraged loans have declined significantly recently

Evolution of European high-yield bond credit spreads by rating category and of European leveraged loan spreads

(Jan. 2006 to May 2018, basis points)



Sources: Thomson Reuters and ECB calculations.

Notes: The credit spreads for European high-yield B and BB-rated bonds represent asset swap spreads for the iBoxx EUR High Yield main Non-Financials ex crossover B and iBoxx EUR High Yield main Non-Financials ex crossover BB indices, respectively. The European Leveraged Loan Index shows the discount spread for the Thomson Reuters' Top 40 Leveraged EMEA index. Pre-crisis levels are computed as the simple average of daily spreads between Q4 2005 and Q1 2007.

The search for yield is particularly evident in the markets for riskier credit.

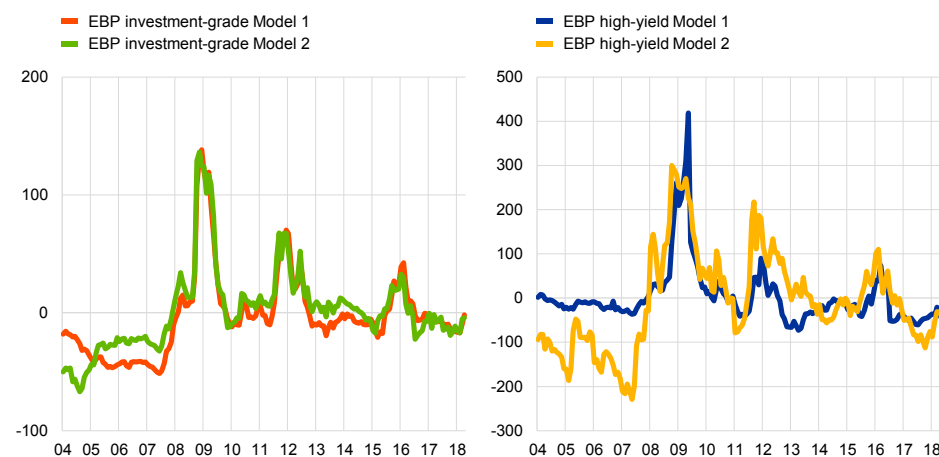
Spreads of BB European high-yield non-financial corporate bonds are at the average levels seen just before the crisis (**Chart 2.6**). The excess bond premium – defined as the difference between the credit spread required by investors and that implied by credit ratings – is negative and is low for European high-yield non-financial corporates by historical standards, despite having somewhat decreased following the widening of credit spreads after February (**Chart 2.7**). Similarly, European and US leveraged loan markets show signs of overvaluation (see also **Box 5**). Frothiness in this market segment is also evident in looser terms and conditions and in aggressive structuring practices.

Chart 2.7

There are signs of overvaluation in European high-yield bond markets

Excess bond premia in European investment-grade (left panel) and high-yield (right panel) non-financial bond markets

(Jan. 2004 to Apr. 2018; basis points)



Sources: Bank of America Merrill Lynch, Bloomberg, Moody's and ECB calculations.

Notes: The excess bond premium (EBP) assesses the difference between the bond asset swap spreads derived from market levels and measures of credit risk at individual bond level. A negative EBP suggests that market-derived credit spreads are lower than model-derived ones. The EBP under Model 1 follows Altavilla, C., Darraq Paries, M. and Nicoletti, G., "Loan supply, credit markets and the euro area financial crisis", *Working Paper Series*, No 1861, ECB, 2015. The EBP under Model 2 follows De Santis, R., "Credit spreads, economic activity and fragmentation", *Working Paper Series*, No 1930, ECB, 2016.

The cyclical upturn in euro area residential property markets gathered further momentum, but there are no signs so far of large and widespread misalignments. Bolstered by the low interest rate environment and the ongoing robust economic expansion, euro area residential property markets expanded at the highest rate since mid-2007 in the latter half of 2017. Developments across the euro area have continued to become more broad-based, with all euro area countries apart from Greece and Italy exhibiting positive annual rates of change in residential real estate prices (see [Chart 2.8](#)). In terms of valuations, euro area residential property prices are estimated to be slightly overvalued on aggregate. Still, the degree of uncertainty surrounding these estimates is large and developments are heterogeneous across countries and in some cases across regions within a country, largely depending on the depth and length of the correction phase in the aftermath of the crisis in each country, if any. Potential pockets of risk warrant closer monitoring in some countries, in particular if brisk house price developments are also mirrored by exuberance in credit (see Section 1.3) and the build-up of household debt. Macroprudential policies may help mitigate possible risks to financial stability at the country level.

Chart 2.8

On aggregate, euro area residential property prices are slightly overvalued, but cross-country dispersion is high

Valuation estimates and annual growth in residential property prices across the euro area

(Q3 2017; percentages; annual percentage change)



Sources: ECB and ECB calculations.

Notes: The valuation estimates for residential property prices are based on two different valuation methods: the price-to-income ratio and a model-based estimate (Bayesian inverted demand model). For details of the methodology, see Box 3 in *Financial Stability Review*, ECB, June 2011, and Box 3 in *Financial Stability Review*, ECB, November 2015. Valuation estimates are surrounded by a high degree of uncertainty, while their interpretation may be complicated at the country level, given national specificities like fiscal treatment or structural factors (e.g. tenure status).

Euro area commercial property markets have seen continued price growth, with signs of overvaluation in some segments.

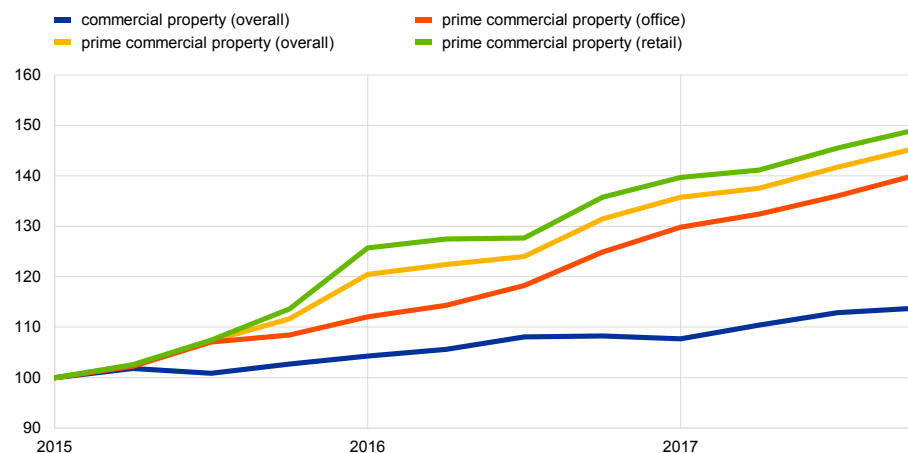
Commercial property price dynamics point to a continued bifurcation between relatively muted developments in the non-prime segment and strong price increases in prime markets (see [Chart 2.9](#)). Price developments in the prime retail segment have remained particularly ebullient in the context of the current low-yield environment and the ongoing search for yield. As in residential property markets, cross-country price variation has also continued to fall in prime commercial property markets as the adverse repercussions of multi-year corrections gradually recede at the country level. Overall, continued strong price increases have pushed euro area prime commercial real estate prices to new historical peaks, which points to overvaluation.

Chart 2.9

Buoyant developments in euro area prime commercial property markets, driven mainly by the retail segment

Commercial property price indices

(Q1 2015 – Q4 2017; index: Q1 2015 = 100)



Sources: Jones Lang Lasalle and experimental ECB estimates based on MSCI and national data. Note: Retail establishments include inter alia restaurants, shopping centres and hotels.

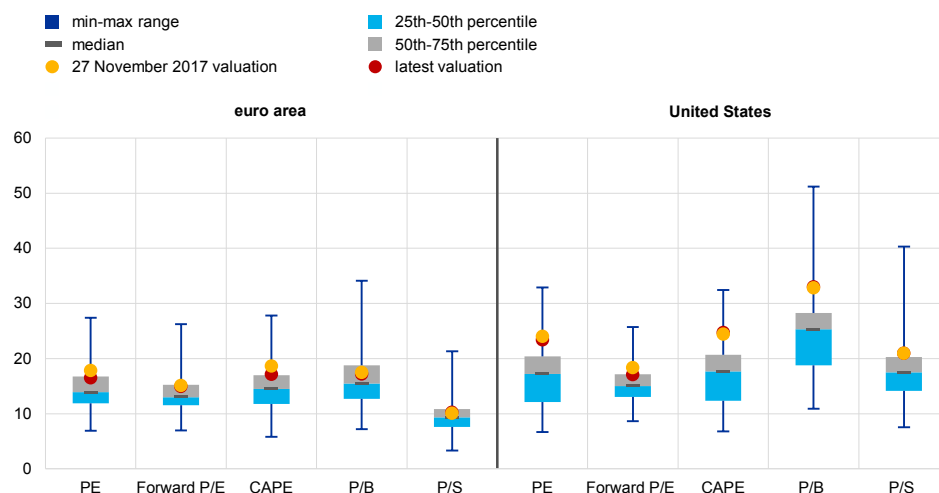
Valuations of US equities continue to be high. US equity valuations remain high, based on historical comparisons across several indicators (Chart 2.10). The valuation of European equities is, however, more in line with historical levels. The drivers of the recent equity price performance in the euro area and in the United States are discussed further in the last part of this chapter, which reviews market developments.

Chart 2.10

US equity valuations continue to be high by historical standards

Current values and historical distribution of accounting-based equity valuation metrics

(1985 to May 2018; ratios)



Sources: Thomson Reuters and ECB calculations

Notes: Valuation metrics have been recorded monthly since 1985, except for the forward-looking price/earnings (P/E) ratio for the euro area, which is available since 1989. The price-to-book (P/B) ratio and the price-to-sales (P/S) ratio are multiplied by a factor of ten. The latest observation is for 15 May 2018.

Nominal yields for longer-term government bonds in the euro area remain low, mainly on account of compressed term premia. At face value, a zero or negative term premium would imply that investors have full insight into the expected path of both monetary policy and inflation. Historically, investors have required some compensation for these risks. The decline in the euro area term premium (**Chart 11** in the Overview) can be explained by increased investor certainty around the future path of euro area policy and inflation rates, increased demand for government bonds driven by regulatory requirements such as the liquidity coverage ratio (LCR), and by the ECB's expanded asset purchase programme (APP).²⁰ The pricing of the term premium is discussed further in the last part of this chapter.

The magnitude and intensity of the search for yield in recent months has also been reflected in more exotic assets, such as crypto-assets. As discussed in Box 4, the combined valuation of crypto-assets increased fivefold over the last two quarters of 2017, before plunging significantly – with bitcoin losing almost two thirds of its value between January and February this year. Such price volatility reflects the largely speculative nature of investment in these assets. While not posing a financial stability risk, owing to their limited use so far, crypto-assets could pose financial stability concerns in the future if their use becomes more widespread.

Box 4

Financial stability implications of crypto-assets

Prepared by Mitsutoshi Adachi, Simon Kördel, Spyros Palligkinis, Lea Steininger and Anton van der Kraaij

This box assesses potential financial stability concerns related to the rapidly growing market for crypto-assets. Crypto-assets (e.g. bitcoin, ether and ripple) are a new, innovative and high-risk digital asset class.²¹ Recent price developments and market interest in crypto-assets have given rise to concerns about potential financial stability implications. This box presents key facts on crypto-assets, concluding that they do not currently pose a material risk to financial stability in the euro area, but warrant careful monitoring.

²⁰ See also "Assessment of quantitative easing and challenges of policy normalisation", speech by Peter Praet, Member of the Executive Board of the ECB, at "The ECB and Its Watchers XIX Conference", Frankfurt am Main, 14 March 2018.

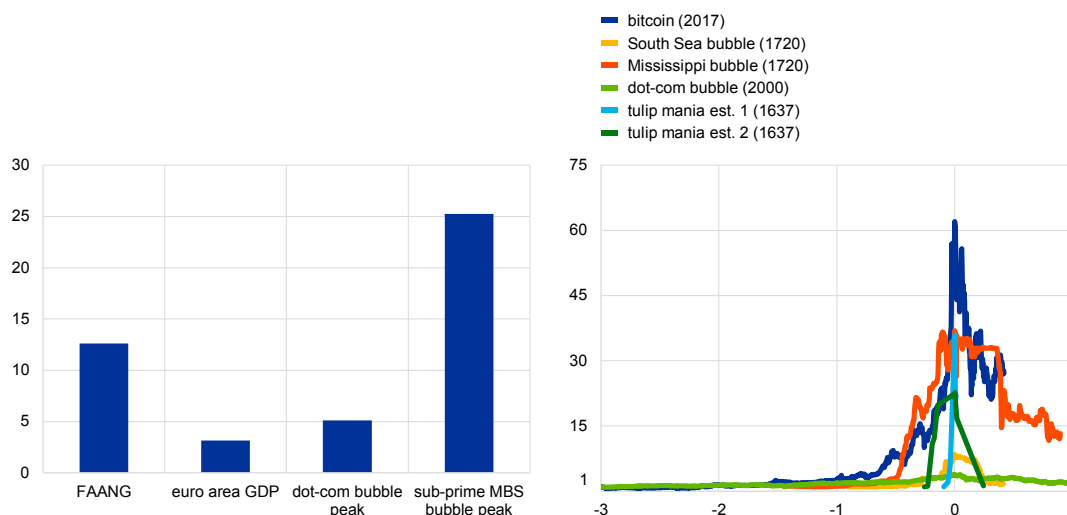
²¹ Crypto-assets use distributed ledger technology, which allows decentralised recording of transactions and holdings, keeping a repeated digital copy of data at multiple locations.

Chart A

Market capitalisation of crypto-assets remains modest despite price developments that are more extreme than those of historical bubbles

Total market capitalisation of crypto-assets as a percentage of FAANG, euro area GDP and past bubbles (left panel) and price changes before and after peaks for bitcoin and historical bubbles (right panel)

(left panel: percentages; 15 May 2018 for crypto-assets and FAANG, Q1 2018 for euro area GDP, market peaks for the dot-com bubble and sub-prime mortgage-backed securities; right panel: index; three years before peak = 1; three years before to one year after peak)



Sources: CoinMarketCap, Thomson Reuters, Haver Analytics, Sifma, Yale School of Management, ECB and ECB calculations.

Notes: Left panel: "FAANG" refers to Facebook, Apple, Amazon, Netflix and Google. The dot-com bubble peak refers to the level of the NASDAQ in March 2000 and the sub-prime peak to 2006. Sub-prime market size is defined as the sum of sub-prime, non-prime and Alt-A US non-agency residential real estate securities. Right panel: the chart shows price evolution, starting from a level of three years before the peak, over a period of four years. Owing to uncertainty about data on the tulip mania, two separate estimates of the size of that bubble are displayed. The years of the peaks are shown in brackets.

Crypto-asset markets have grown more than fivefold in size since July 2017, but they are still small compared to other asset markets. Despite the recent correction to an aggregate valuation of €330 billion from a peak of €680 billion, the market capitalisation of crypto-assets remains modest compared to the market capitalisation of top technology companies, euro area GDP or the size of historical bubbles (see **Chart A**, left panel).

Of the around 1,600 crypto-assets currently in circulation (up from seven in April 2013), bitcoin remains the largest in terms of market capitalisation. Nonetheless, its prominence has decreased in recent months and it now accounts for less than 40% of the market capitalisation of all crypto-assets.

Bitcoin's growth surpassed that of other historical bubbles before it crashed in early 2018, losing 65% of its value (see **Chart A**, right panel). The extreme price developments of bitcoin – with much higher volatility than that observed for traditional asset classes and commodities – mirror similar price changes across the crypto-asset universe. This highlights the poor suitability of these assets as a reliable store of value, useful medium of exchange or efficient unit of account.

Crypto-assets do not currently appear to pose a material risk to financial stability in the euro area. Overall market exposure appears to be modest, correlations with other markets are very low and interlinkages with the financial system and the real economy remain rather limited. Although a significant share of bitcoin's trading volume is settled in euro (around 12% since the beginning of 2018, see **Chart B**), anecdotal evidence suggests that financial institutions have refrained from acquiring sizeable exposures to crypto-assets. Furthermore, ownership of bitcoin is highly

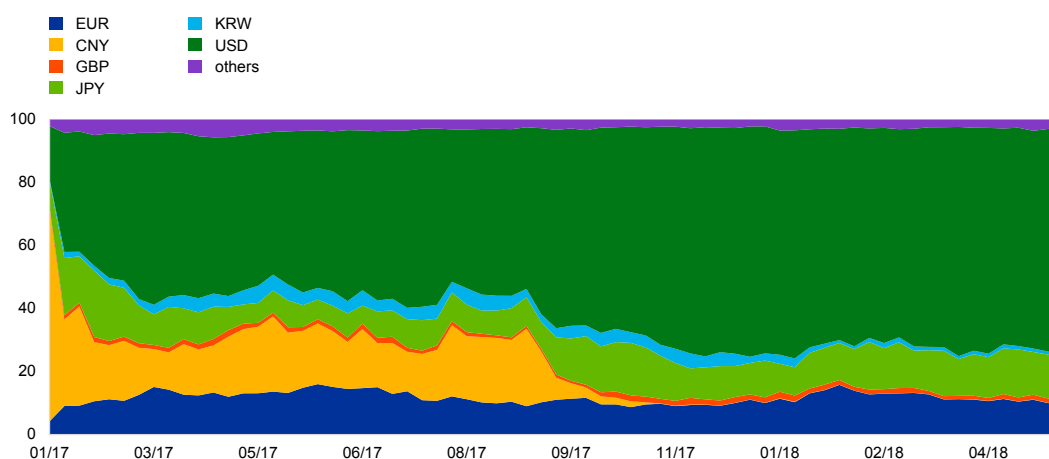
concentrated, which implies that losses from drastic price corrections, such as in the recent crash, are confined to a rather small group of investors.²²

Chart B

Bitcoin trading cleared in euro hovering around 12% since January 2018

Clearance of bitcoin trading volumes by currency

(percentages; 23 Jan. 2017 – 14 May 2018; weekly data)



Sources: Bitcoinity.org and ECB calculations.

Notes: Trading volume data based on aggregated information from bitcoin exchanges. Since no provider aggregates all the exchanges, the true figures may be somewhat different. For example, CoinMarketCap quoted 8% of trading volume in euro on 8 March 2018.

Several sources of potential vulnerability do, however, exist. Anecdotal evidence from outside Europe suggests that some retail investors may be taking on debt to invest in crypto-assets and that some new start-up lenders are accepting crypto-assets as collateral for lending. Retail investors in various jurisdictions also reportedly buy crypto-assets on margin, with some exchanges providing leverage of up to 25 times the principal. Moreover, novel developments, such as regulated bitcoin futures markets in the United States, may increase interlinkages with the financial sector. Other investment vehicles, such as trusts, exchange traded notes (ETNs) and contracts for difference (CFDs), offer crypto-asset exposure to European clients, although their market size is still quite small.

No major regulatory action has been taken so far from a financial stability perspective. The scope of regulatory response has, however, expanded from its initial focus on the prevention of illicit activities, such as money laundering and terrorist finance, to consumer and investor protection and ensuring market integrity, as demonstrated, for example, more recently by the joint warning of the European Supervisory Authorities.²³

The rapid evolution of the crypto-asset market warrants increased data collection and careful monitoring from a multitude of angles. These include: the potential entry by financial institutions into crypto-asset business by, for example, investing in these assets or providing related services; the use of crypto-assets as collateral; the provision of credit to individuals and firms

²² The top 10,000 addresses (0.05% of the total) hold 56% of all bitcoins, while the top 1,000 addresses (0.005% of the total) hold around 35% (source: [BitInfoCharts](#), retrieved on 15 May 2018). Moreover, these figures represent a lower bound on concentration, given that it is possible for the same investor to have multiple addresses.

²³ The warning can be found on the [European Securities and Markets Authority \(ESMA\) website](#).

investing in crypto-assets; and greater interlinkages with the rest of the financial system through crypto-asset derivatives trading and hedge fund/asset manager involvement. Coordinated data collection efforts are required to improve data gaps at both the EU and global level to facilitate effective monitoring and to prevent connections with the financial system from increasing to the point where crypto-assets could pose a risk to financial stability.

Vulnerabilities to a sharp repricing of risk are high and have increased

The repricing episode in February illustrates that the system remains vulnerable even to small shocks.

The immediate market reaction, even if contained and partially justified as an overdue correction to the rapid gains in US equity markets, was disproportionate to the magnitude of the shock. While investors no longer expect a low-volatility environment going forward, it is unclear whether speculative strategies similar to those shorting volatility have been unwound in other larger markets that entail higher financial stability risks.

A sharp rise in US interest rates or the US dollar exchange rate may transmit stress abroad.

In the latter part of the review period the US dollar exchange rate appreciated, in particular vis-à-vis the currencies of a few emerging market economies with high external vulnerabilities and domestic challenges on the fiscal and inflation fronts. However, as no wider emerging market sell-off occurred, the impact on the euro area was limited. Emerging market developments continue to require close monitoring with regard to their sensitivity to higher US yields and an appreciation of the dollar. A significant increase in US Treasury yields and the value of the US dollar going forward would imply a non-negligible risk of a wider sell-off in emerging economies' financial assets, in particular in those economies with large net US dollar liabilities.

Compared to the November 2017 FSR, vulnerabilities stemming from financial markets have increased.

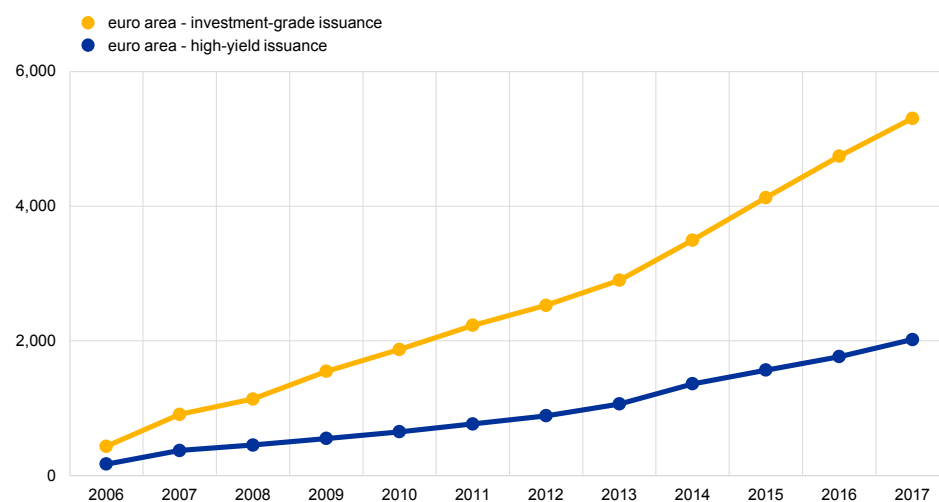
Despite a pullback in some markets, the search for yield continued over the review period, with the valuation of certain asset classes becoming more stretched. As such, investors are remunerated less for potential losses. In addition, the probability of an abrupt repricing of risk has also increased. Potential triggers include increased geopolitical tensions and the possibility of escalating tensions over global trade.

Chart 2.11

Issuance of riskier non-financial corporate debt has been strong since the crisis

Cumulative investment-grade and high-yield gross non-financial corporate debt issuance in the euro area between 2006 and 2017

(2006 to 2017; € billions)



Sources: Thomson Reuters, Dealogic, and ECB calculations

Notes: The issuance data sums up the primary market issuance of non-financial corporate bonds and loans. Investment-grade loan issuance represents gross primary market issuance of investment-grade syndicated loans; high-yield loan issuance represents gross issuance of leveraged loans, which are mostly syndicated. The cumulative issuance for US Alt-A and sub-prime mortgages covers the period 1996 to 2007.

The increasing exposure of euro area entities to lower-rated debt reflects the overall increase in high-yield corporate credit issuance compared to investment-grade debt.

Euro area entities held directly €1 trillion of non-financial corporate bonds rated BBB or lower as of the third quarter of 2017, up 60% since the fourth quarter of 2013. This has occurred amid strong increases in issuance in the high-yield segment. **Chart 2.11** shows that, taking into account non-financial corporate debt – both bonds and syndicated loans – high-yield gross debt supply over the period 2006-2017 has been around 40% that of the investment-grade debt in the euro area. In the United States, the cumulative high-yield gross debt supply is estimated to have accounted for an even larger share – about two thirds – of the cumulative gross debt issuance of investment grade corporate debt over the same period. This issuance, estimated at between €5 trillion and €8 trillion between 2006 and 2017, compares to cumulative gross issuance of US sub-prime and Alt-A mortgages of less than €3 trillion over the ten years preceding the crisis.²⁴ However, this comparison must be seen in the light of the different dynamics of the two markets and the fact that, particularly in the case of leveraged loans, the amount outstanding is likely to be significantly lower than the cumulative gross issuance owing to the large proportion of refinancing in gross debt issuance. In addition, since the crisis the leverage of non-financial corporates, measured as debt to EBITDA, has increased in Europe and, in particular, in the United States for both investment-grade and high-yield corporates (**Chart 2.12** and **Box 5**). For European investment-grade corporates, the higher post-crisis leverage partly reflects the significant decline in

²⁴ Estimates of the gross issuance of leverage loans differ across commercial data providers. See footnote 14 in Box 5.

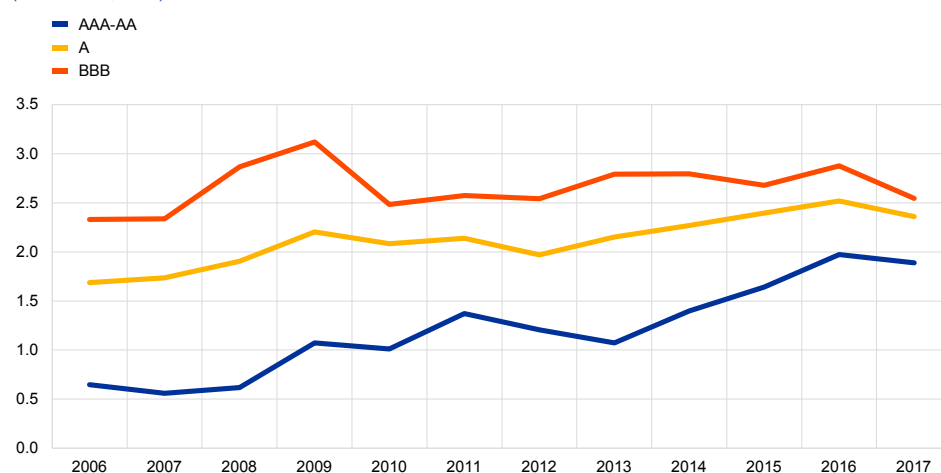
earnings during the crisis. The increase is less significant when measured on a net, instead of a gross, basis, as European corporates generally have higher cash levels than they had before the crisis (see also [Chart 1.21](#)). Nevertheless, the higher than pre-crisis leverage leaves corporations with less flexibility should future earnings decrease unexpectedly.

Chart 2.12

Gross leverage for European investment-grade non-financial corporates has been increasing across all credit ratings

Gross leverage ratios for European non-financial corporates, by investment-grade rating

(2006 to 2017; ratios)



Sources: Bloomberg, Thomson Reuters and ECB calculations

Notes: Leverage is computed as gross debt to annual EBITDA using median values of a constant sample of 203 European corporates: nine AAA-AA, 71 A and 123 BBB.

Box 5

Leveraged loans: a fast-growing high-yield market

Prepared by Claudiu Moldovan and Spyros Palligkinis

The market for leveraged loans is significant and recent developments may be generating financial stability risks.²⁵

In both Europe and the United States, the markets for leveraged loans issued by non-financial corporates are about five times larger than high-yield bond markets. In 2017 US leveraged loan issuance rose well above its pre-crisis levels, with gross issuance, depending on methodology and data source, estimated at between €500 billion and €1 trillion, while EU issuance, estimated at between €120 billion and €320 billion, is around the previous highs recorded in 2007 and 2014 (see [Chart A](#)).^{26,27}

²⁵ While there is a general understanding that a leveraged loan is a secured loan granted to a highly indebted (levered) company, there is no generally agreed definition. The industry defines leveraged loans as secured loans where the borrower is sub-investment-grade or the spread at issuance is higher than a certain threshold.

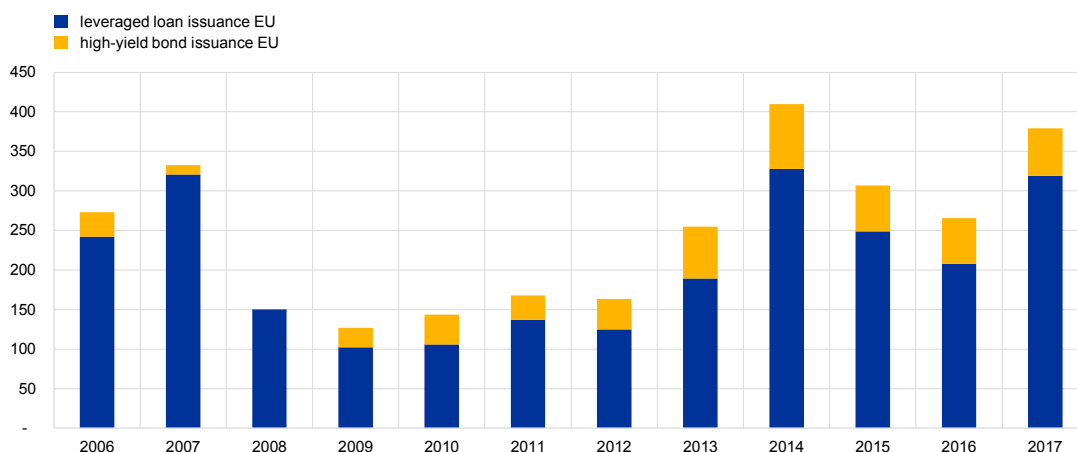
²⁶ The actual size of the market is likely to be even greater, as an increasing share of the leveraged loan market is accounted for by direct lending, a private, bilateral type of leveraged loan transaction where financing is provided by non-banks. Such loans are likely to be only partially captured by existing data sources.

Chart A

Since the crisis leveraged loan issuance has matched previous highs in the EU

Primary market gross issuance of non-financial corporate high-yield bonds and leveraged loans in the EU

(2006-2017; € billions)



Sources: Thomson Reuters for leveraged loans, Dealogic for bond issuance, and ECB calculations.

Notes: Primary market issuance data do not include borrowing by financial and project finance companies or by governmental entities. Thomson Reuters data on gross primary market issuance of leveraged loans include refinancing of leveraged loans that are carried out via amendments to pricing of loan agreements with existing investors.

High investor demand has allowed increasingly leveraged corporates to obtain financing in the leveraged loan market.

In the United States, corporate leverage for firms active in the leveraged loan market has already exceeded pre-crisis peaks and the same trend has been observed for first lien corporate leverage in the European market (see **Chart B**).²⁸ In many cases, actual leverage is likely to be significantly higher than reported leverage, given the increasingly common practice among borrowers of making optimistic adjustments to pro-forma EBITDA levels. At the same time, as in the high-yield bond market, valuations are tight (see **Chart 2.6**).

Non-price terms in the leveraged loan market also reveal a significant relaxation of underwriting standards.

In both Europe and the United States, the level of investor protection envisaged in leveraged loan contracts is low: covenant lite (cov-lite) transactions are now reported to account for around 80% of the issuance in both markets, compared to less than a quarter during the pre-crisis period (**Chart B**).²⁹ Since investors have fewer means of timely intervention to restrict borrower behaviour, this increases the likelihood that defaults will be delayed and recovery rates will

²⁷ The lower estimate of the gross issuance in the primary market is based on market data sources which capture refinancing via a repayment of the loan to existing investors followed by a re-syndication of the loan to new investors. The upper estimate also captures refinancing of leveraged loans carried out via amendments that change the pricing of the loans to existing investors. All else being equal, methodologies that include cashless amendments as part of refinancing activity result in higher gross issuance amounts. Some of the differences in the estimated primary market issuance among commercial data providers are probably also due to differences in the scope of data coverage.

²⁸ First lien leverage is leverage that considers the debt secured by the first claim on the underlying assets.

²⁹ Cov-lite leveraged loans have no maintenance covenants in the loan documentation to protect the borrower. Maintenance covenants require certain tests, such as maximum leverage, minimum interest coverage ratio and maximum capital expenditure limits, to be met by the borrower at all times. Cov-lite leveraged loans still maintain at least some incurrence covenants. Unlike maintenance covenants, incurrence covenants prevent the borrower from breaching certain thresholds only when undertaking certain actions, such as mergers, and thus offer weaker investor protection. Moreover, in recent years, investor protection has been further weakened by a marked decline in the number of incurrence covenants per loan.

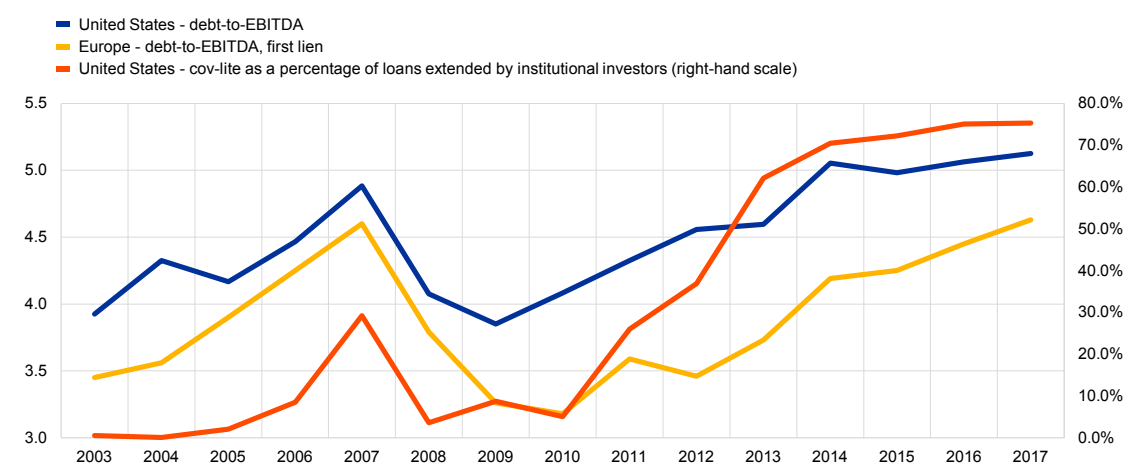
be lower. High borrower bargaining power has also led to other forms of weakened investor protection, such as restrictions on loan transferability in the secondary market and limits on the share of the issuance that can be held by any one investor.

Chart B

Corporate leverage in US and European leveraged loan markets is at a post-crisis high, while underwriting standards have deteriorated markedly

Corporate leverage levels in the European and US leveraged loan markets and the share of cov-lite loans in primary US leveraged loan market

(2000-2017; ratios and percentages)



Sources: S&P Ratings Direct and ECB calculations.

Note: Leverage is computed as gross debt divided by pro-forma EBITDA.

Credit standards in the European leveraged loan market closely mirror those in the United States, where the leveraged loan market is larger and at a more advanced stage of the credit cycle. Anecdotal evidence suggests that some of the more aggressive practices, in terms of both higher leverage and lower investor protection, are associated with transactions by cross-border US private equity sponsors, with transactions initiated by sponsors typically employing more leverage than the average. This probably reflects the high bargaining power of private equity sponsors, who account for 70-80% of the borrowing volumes.

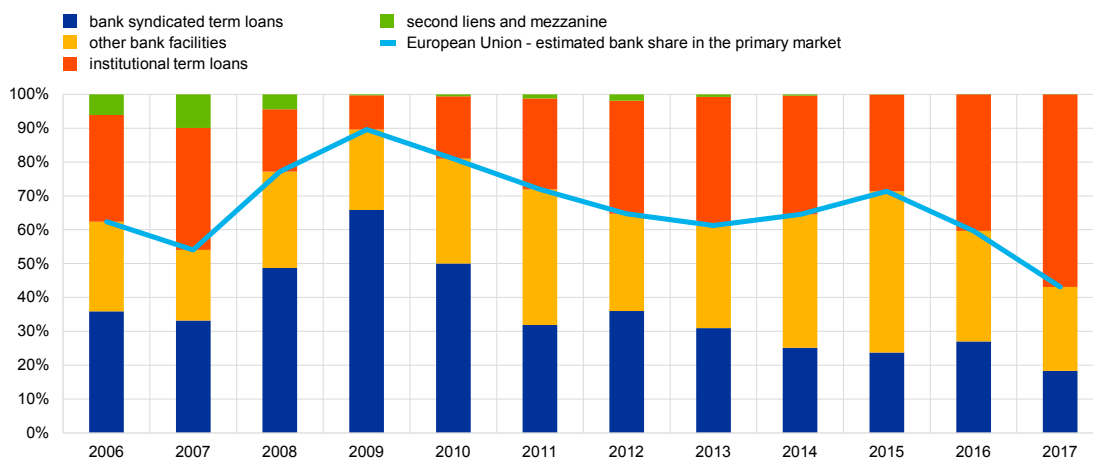
In the EU, non-bank investors have increasingly replaced banks in the financing of highly indebted companies. Chart C shows that, since the financial crisis, banks have reduced their share of financing in the primary market, with non-bank investors estimated to have provided more than half of the overall financing in 2017. This reflects both very high investor demand, as investors have increasingly purchased term loans and even bank facilities traditionally retained by banks, and higher capital charges and restrictions imposed on bank activities since the crisis.

Chart C

Non-banks in Europe have acquired increasingly large shares of leveraged loans in the primary market since the financial crisis

Breakdown of leveraged loan facilities in the EU market by type and estimated share of primary market loans extended by EU banks

(2006-2017; percentages)



Sources: Thomson Reuters and ECB calculations.

Notes: Institutional term loans cover term loans B, C, D and E, while bank syndicated term loans cover term loans A (TLAs). Other bank facilities cover bridge loans, revolving credit facilities, and capital expenditure (capex) and acquisition loans. Banks' share in the primary market is estimated as the share of term loans retained by the banks and of other bank facilities in the total volume of leveraged loans syndicated in the primary market.

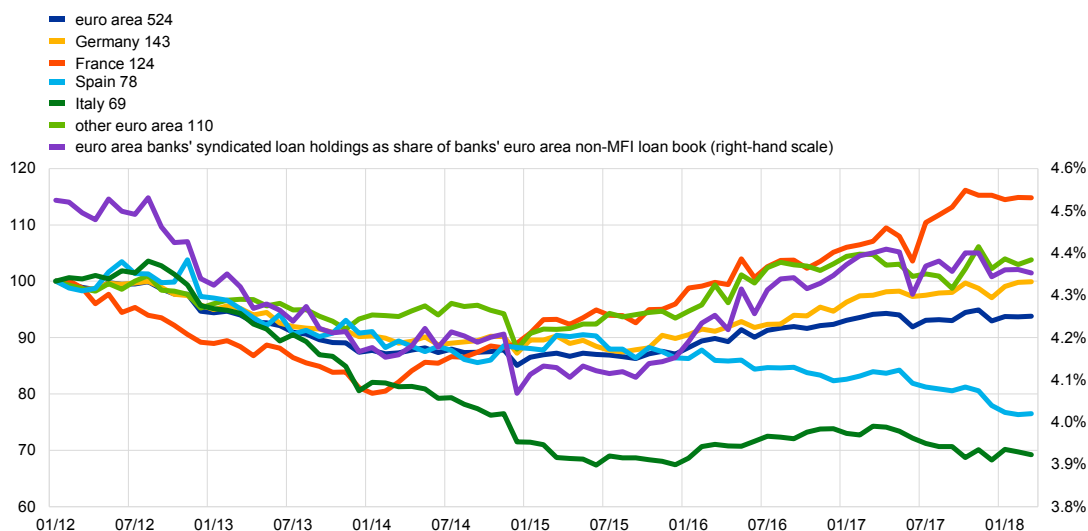
Despite accounting for a smaller overall market share, euro area banks may have increased their exposure to leveraged loan markets recently. As previously mentioned, banks have generally reduced their role as investors and arrangers in leveraged loan markets. Nevertheless, against the background of a resurgence in issuance, euro area banks' holdings of leveraged loans to euro area non-financial corporates may have picked up again. While statistics on the direct holdings of leveraged loans by euro area banks are not available, syndicated leveraged loans are estimated to account for about a third of the syndicated loans extended by euro area banks in major jurisdictions to euro area non-financial corporations. Syndicated loans accounted for 4.4% of the euro area banking sector's loan exposure to euro area non-MFIs in March 2018 (see **Chart D**). The absolute exposure amounted to €524 billion a 10% increase compared with levels at the end of 2014. German and, in particular, French banks are driving overall euro area bank exposure higher, while Spanish and Italian banks have decreased their holdings by around 20% and 30%, respectively, since the beginning of 2012.

Chart D

Some euro area banks' holdings of syndicated loans have been increasing recently

Euro area banks' holdings of syndicated loans extended to euro area corporates by country

(Jan. 2012-Mar. 2018; index: Jan. 2012 = 100 (left-hand scale); percentages per annum (right-hand scale))



Source: ECB MFI balance sheet items (BSI) statistics.

Notes: Numbers next to countries in the legend show country-level syndicated loan holdings in € billions in March 2018. Holdings of syndicated loans represent the stock of syndicated loans extended by euro area MFIs, excluding the Eurosystem, to euro area non-financial corporations at the end of each month. The syndicated loan data cover loans extended to both investment-grade and sub-investment-grade companies.

Developments in leveraged loan markets may create financial stability risks. In particular, the rollover of maturing loans into exposures with a significantly worse risk-return profile may create vulnerabilities. In addition, the distribution of risks beyond the banking sector is unknown, given the lack of statistical data. Finally, higher than expected potential losses in this sector may spill over to the wider economy. With these risks in mind, the ECB issued guidelines on leveraged transactions in May 2017 which set minimum supervisory expectations regarding loan origination, loan identification and the leveraged lending risk control framework for the banks under its remit.³⁰ In this context, all relevant credit institutions should be in a position to demonstrate how their loan origination and risk management practices reflect the ECB's expectations by November 2018.

The likelihood of international contagion and system-wide spillovers is elevated in the context of a global search for yield. Given the more advanced US credit cycle relative to Europe, developments in the US high-yield non-financial corporate sector and in US equities are of concern for euro area financial stability. While direct exposure to US equities accounts for around a quarter of the equity portfolios of euro area investment and pension funds (**Chart 3.28 (b)**), the wider contagion channels in the event of sharp declines in the US stock market are even more important.

³⁰ See *Guidance on leveraged transactions*, ECB, May 2017.

Looking more broadly, markets have adjusted well to faster than expected monetary policy normalisation and year-end effects

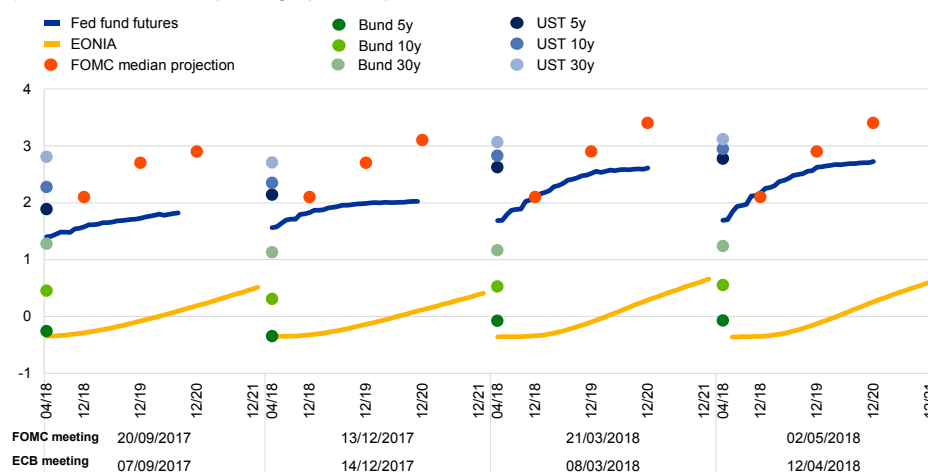
Looking across financial markets, global risk-free rates have repriced higher as markets have factored in faster monetary policy normalisation. In the euro area, longer-term rates started to rise in December, following strong economic data, evidence of globally synchronised growth, and some anticipation that the ECB’s forward guidance could be revised earlier than expected. Longer-dated yields declined somewhat in February and March, as markets were reassured of a gradual exit, despite the removal at the ECB’s March Governing Council meeting of the “easing bias” in the APP communication. Both short and long-term rates remained relatively well anchored during the period under review, reflecting confidence in the pace and sequencing of the ECB’s steps to exit its monetary policy accommodation (**Chart 2.13**). In the United States, the Federal Reserve System raised its policy rate twice to 1.75%, and gradually moved up its expected Fed funds path for 2019 and 2020 in line with the strengthening growth and inflationary outlook. The long and, in particular, the short end of the US risk-free curve rose over the review period, and the spread between the FOMC and market expectations for the Fed funds rate narrowed, even as the Federal Reserve signalled a more sustained tightening path.

Chart 2.13

In the euro area, policy rate expectations and longer-term bond yields remain well anchored, while the US market has converged towards the FOMC’s view of higher policy rates

Fed funds futures, EONIA forward rates, and 5, 10 and 30-year US Treasury and German Bund yields

(Dec. 2008 to 28 Feb. 2018; percentages per annum)



Sources: Bloomberg, Federal Reserve System and ECB calculations.
Note: The curves show market-implied pricing levels one day after the FOMC meeting.

Markets have responded well to the gradual approach central banks have taken towards the removal of accommodative monetary policies. In particular, the price of risky assets generally rose during December 2017 and January 2018, when most of the repricing of policy expectations and of the risk-free curve took

place. This reflected expectations that the withdrawal of central bank stimulus would be faster in an environment of strong global growth. The developments suggest that central bank reaction functions to changes in economic activity are currently well understood by market participants, as is also reflected in the low and stable term premia discussed above.

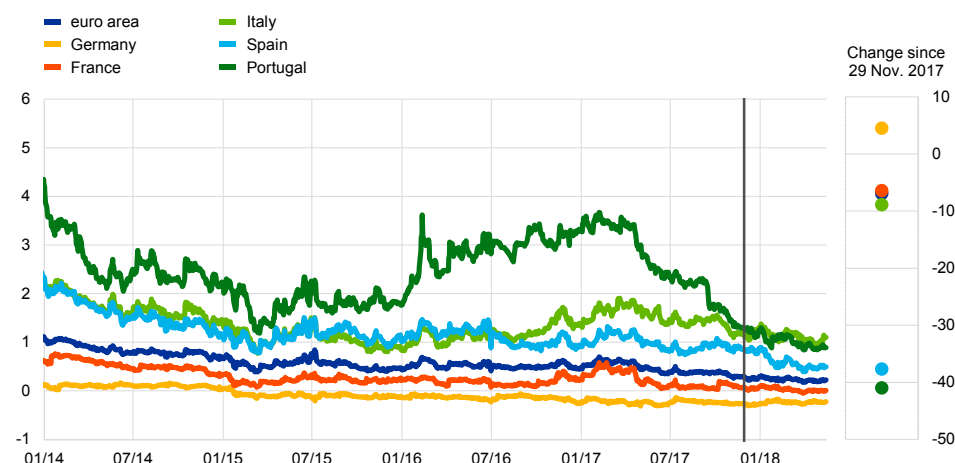
Sovereign spreads have continued to tighten, reflecting improved euro area fundamentals. The ratings of a number of countries more affected by the crisis were upgraded over the review period.³¹ The narrowing of euro area sovereign spreads (**Chart 2.14**) also reflects the market’s positive view of the continued commitment to completing the banking union and to increasing the resilience of the euro area by completing its institutional architecture. While the inconclusive outcome of the election in Italy on 4 March did not precipitate a significant market reaction, sovereign yields came under pressure later in the review period as markets grew concerned about the prospective coalition’s policy agenda.

Chart 2.14

Euro area sovereign spreads have continued to narrow

Ten-year sovereign yield spreads versus the OIS rate

(Jan. 2014 to May 2018; left-hand scale: spread in percentages per annum; right-hand scale: change in basis points)



Source: ECB calculations.

Notes: The spread is calculated by subtracting the OIS rate from the sovereign yield. “Euro area” refers to the GDP-weighted average of ten-year sovereign yields in the euro area. The vertical line indicates the publication of the previous Financial Stability Review on 29 November 2017. The latest observation is for 15 May 2018.

Despite some retrenching since February, US equity prices remain close to all-time highs, while euro area equity prices have declined over the review period.

The section on valuations discussed the fact that, at the current levels, the valuation of US equities remains high, while equity valuations in the euro area are in line with historical levels. **Chart 2.15** shows that the recent rise in US equity prices has been mainly due to growth in expected corporate earnings. A second driver has been a decline in the US equity risk premium, which started in November and partially offset

³¹ Fitch upgraded Portugal’s rating to investment grade in December, following a similar action by S&P in September; Greece’s ratings were upgraded by one to two notches by the three main ratings agencies between January and February, and by DBRS in May. In January Fitch was the first rating agency to upgrade Spain post crisis, later followed by DBRS, S&P and Moody’s.

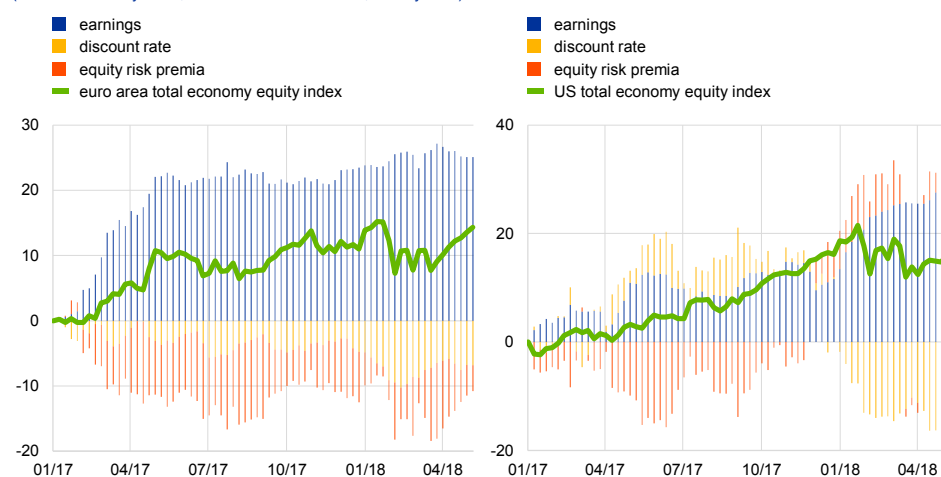
the increase in the risk-free discount rate that started in December. The decline in the equity risk premium can be explained by greater confidence around the path of future earnings growth, following broad-based fourth quarter positive earnings surprises and the approval of lower US corporate taxes in December. By contrast, euro area equity prices were relatively flat over the review period, as the impact of higher earnings expectations was more than offset by the twin effect of a higher discount rate and higher equity risk premium following February's volatility episode.

Chart 2.15

The increase in market volatility in February affected euro area equities more than US equities

Drivers of equity prices in the euro area (left panel) and United States (right panel)

(Jan. 2017 to May 2018; index: 1 Jan. 2017 = 100; weekly data)



Sources: Thomson Reuters and ECB calculations.

Notes: The charts show the decomposition of indices for the broad euro area (1,446 companies) and US (993 companies) economies. The decomposition is based on an approximation of the three-stage dividend discount model (DDM). The latest observation is for 11 May 2018.

European money markets have generally functioned well in the period under review, and some market segments exhibited higher resilience to year-end tensions than in 2016.

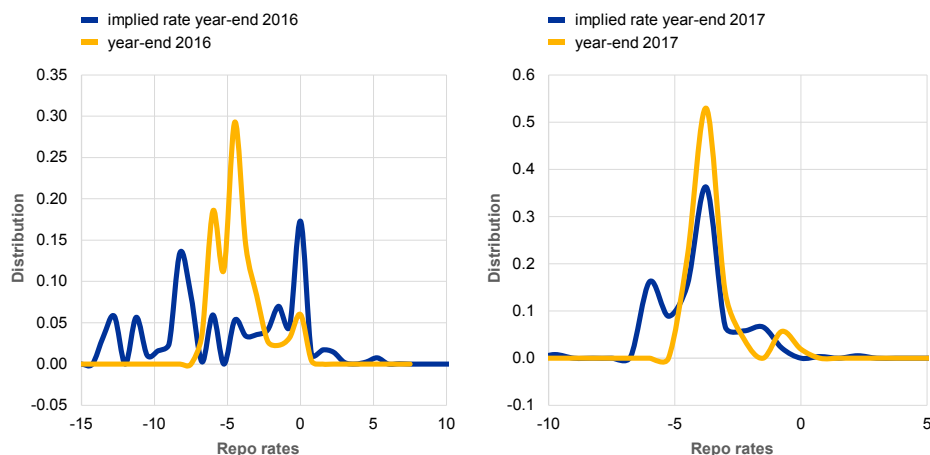
In particular, a marked improvement could be seen in the repo market in a year-on-year comparison. Balance sheet rationing continued to play a key role in reducing repo market activity over the year-end, pushing the repo rate significantly lower than usual. Nevertheless, the end of 2017 saw less disruptive developments than at the end of 2016, as market participants anticipated year-end tensions more accurately and made appropriate preparations. **Chart 2.16** shows that the implied repo market rates for transactions spanning the 2017 year-end were more closely aligned with realised rates than in 2016. On the other hand, some year-end tensions were also visible in the foreign exchange swap market, where the cost of borrowing USD against EUR in a three-month transaction increased more than in previous years (**Chart 2.17**). This probably also reflects regulatory optimisation of banks' balance sheets – in particular in response to the G-SIB methodology, which is based on year-end balance sheet data – that large USD liquidity providers, mainly US banks, may face when providing USD funding at the year-end via FX swaps.

Chart 2.16

The functioning of the European repo market was more orderly at the end of 2017 than at the end of 2016

German collateral repo realised and implied rates at the year-end

(Dec. 2016 and Dec. 2017, percentages per annum)



Source: ECB calculations based on MMSR data.

Notes: Charts show the distribution, by repo volumes, of overnight and T+1 repo rates implied by transactions taking place on the 24 December in 2016 and 2017 and spanning the year-end.

The likely discontinuation of the EONIA raises financial stability concerns, given the transition complexities and short time frame.

The decision of the European Money Market Institute (EMMI) on 1 February to cease EONIA reform efforts owing to a lack of feasibility had no visible market impact, which may suggest market anticipation that the EONIA will be replaced with a suitable reference rate in a timely manner.^{32,33} However, the lack of a reform solution for the existing benchmark, and the need to transition to a new one, raises some financial stability concerns, given the need to identify suitable alternatives within the tight deadline of 1 January 2020 set by the Benchmarks Regulation³⁴ and the complexities of the transition to one or more new benchmarks.³⁵ Work has started, via the working group on euro risk-free rates, on identifying suitable EONIA replacements.

³² EMMI reached its decision after attempts to enhance EONIA's volumes on the lending side and to improve the geographical and bank concentration of EONIA proved unsuccessful. EMMI acknowledged that, as long as the definition and calculation methodology of EONIA remain unchanged, EONIA's compliance with the Benchmark Regulation could not be guaranteed should market conditions and dynamics remained unchanged. See also "State of play of the EONIA Review", EMMI, February 2018, and the presentation by EMMI's working group on EURIBOR of 26 February 2018, available at http://www.ecb.europa.eu/paym/initiatives/interest_rate_benchmarks/WG_euro_risk-free_rates/html/index.en.html.

³³ See the box entitled "Update on reference rate reforms in the euro area", *Financial Stability Review*, ECB, November 2017.

³⁴ Regulation (EU) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds and amending Directives 2008/48/EC and 2014/17/EU and Regulation (EU) No 596/2014 (OJ L 171, 29.6.2016, p. 1).

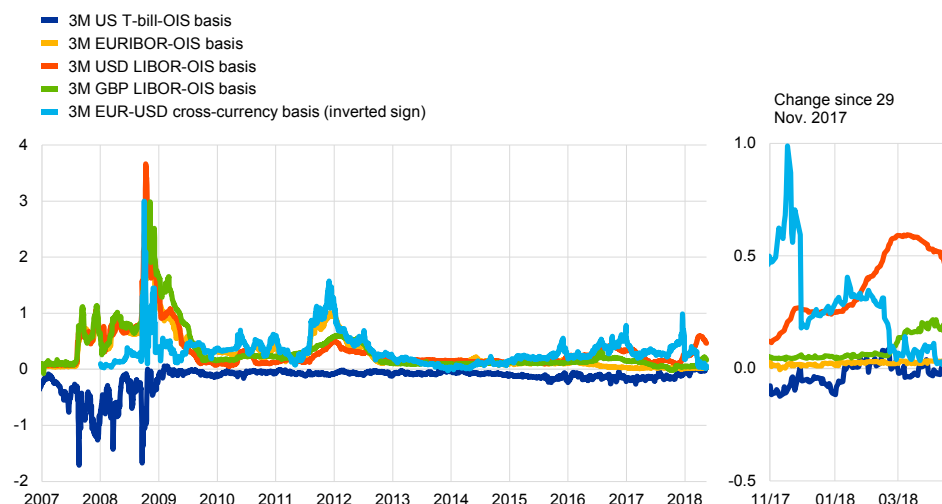
³⁵ The Benchmarks Regulation allows the use of EONIA as a reference rate until 31 December 2019, after which its provider, EMMI, can only provide it if authorised by its regulator, the Belgian Financial Services and Markets Authority (FSMA), and only for use in legacy contracts. EMMI's conclusion that EONIA cannot achieve compliance with the Benchmark Regulation implies a need to have an alternative viable reference rate in place by 1 January 2020.

Chart 2.17

Unlike during the crisis, the increase in short-term USD interbank funding costs has decoupled them from funding costs in other currencies

Spreads of selected three-month interbank funding rates and the three-month T-bill rate to the three-month OIS rate and the three-month EUR/USD FX basis

(Jan. 2007 to May 2018; percentages per annum)



Sources: Bloomberg and ECB calculations.

Money market and forex swap developments suggest that the recent increase in the USD LIBOR-OIS spread does not reflect increased bank risk or a decrease in the availability of USD funding to European banks. Chart 2.17

shows that, unlike during the crisis, comparable funding premia in euro did not increase in line with the rise in the USD LIBOR-OIS spread. Moreover, the three-month cross-currency EUR-USD basis has not widened (disregarding the year-end effect), unlike during the crisis periods when some European banks had difficulty in accessing USD funding. Finally, outside balance sheet reporting dates, the demand for USD at the ECB's liquidity providing operations has generally remained subdued this year. The recent widening of the three-month USD LIBOR-OIS basis probably reflects an increase in overall short-term funding rates in the United States, also visible in the less negative basis between the three-month T-bill yield and the three-month OIS swap rate. This is probably driven by idiosyncratic factors linked to the US tax reform.

3 Euro area financial institutions



Banks

Bank profitability picked up amid improving cyclical conditions and **solvency positions** strengthened further.

Banks need, however, to make further progress in **business model adjustment** in order to achieve sustainable profitability.

There is **no broad-based evidence of excessive risk-taking** by banks in response to profitability pressures.

Increasing exposures towards some **riskier segments** (e.g. consumer lending, leveraged loans) warrant closer monitoring.

NPL reductions accelerated in 2017 but banks should take advantage of current favourable macroeconomic conditions to increase their efforts to reduce NPL stocks.



Scenario analysis

The materialisation of **two stylised adverse scenarios** - capturing an abrupt repricing of global risk premia and a strong economic slowdown - would result in solvency difficulties for only a few small banks.



Non-bank financial sector

Increased risk-taking and common asset exposures have rendered a larger part of the euro area non-bank financial sector vulnerable to a potential shock in global financial markets.

Rising yields are bolstering the profitability outlook for **life insurers**, while **reinsurers** sustained exceptionally costly catastrophes in 2017.

Some **bond and equity funds** have suffered outflows since the end of 2017 due to rising yields and an increase in equity volatility.

Over the past years, **liquidity and maturity transformation among bond funds** has grown, increasing the funds' sensitivity to changes in interest rates and larger outflows.

3.1 Banks' profitability and resilience improved, but further progress is needed in addressing structural challenges

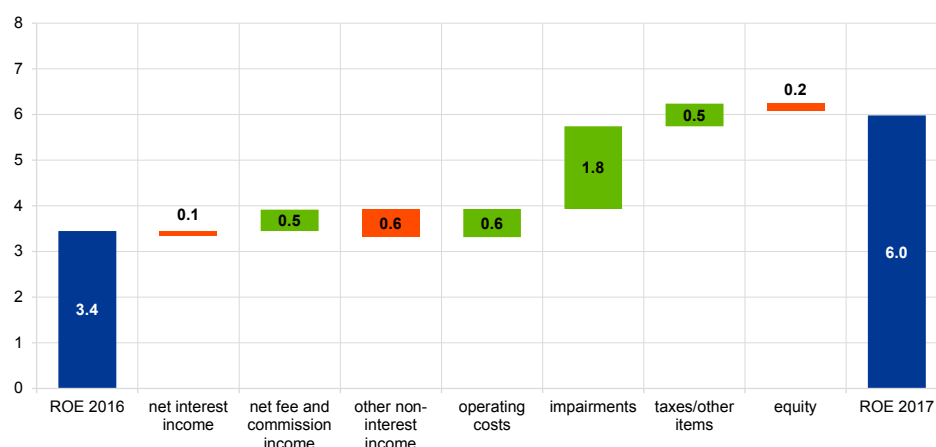
Euro area significant banks' profitability picked up in 2017 amid improving macroeconomic conditions.³⁶ Significant institutions' aggregate return on equity (ROE) reached 6% in 2017, a level similar to that in 2010, i.e. before the onset of the sovereign debt crisis.³⁷ The annual improvement in banks' financial performance was mainly driven by lower impairment costs (see [Chart 3.1](#)). This in turn reflects a better macroeconomic backdrop, as new non-performing loan (NPL) formation has slowed, but it is also due to base effects as some banks booked large one-off impairment charges in 2016 relating to NPL reductions.

Chart 3.1

Bank profitability improved in 2017, mainly due to lower impairments

Decomposition of the change in euro area significant institutions' aggregate ROE from 2016 to 2017

(2016-17, percentage points)



Sources: ECB and ECB calculations.

Notes: Based on a balanced sample of 112 significant institutions (adjusted for mergers and acquisitions). The green and red bars denote positive and negative contributions, respectively.

The overall contribution of operating profits to the improvement in banks' aggregate profitability was modest. On the revenue side, net interest income slightly declined (following a more marked drop in 2016), as continued pressure on margins was largely, but not fully, offset by expanding volumes. By contrast, the growth of net fee and commission income picked up as banks benefited from the increased cross-selling of fee-generating products (e.g. investment funds, insurance). At the same time, other non-interest income items made an overall negative contribution to the change in profitability, with the positive impact of

³⁶ The analysis of profitability developments in 2017 is based on a balanced sample of 112 significant institutions (adjusted for mergers and acquisitions).

³⁷ The aggregate ROE of 74 significant institutions (SIs) representing around 90% of total SI assets was 5.8% in 2010.

increasing trading income being outweighed by declines in other income items.³⁸ On the cost side, the moderate reduction of operating expenses also contributed to the improvement in banks' aggregate profitability, although this masks some heterogeneity at bank level, with more than half of significant banks reporting increases in costs.

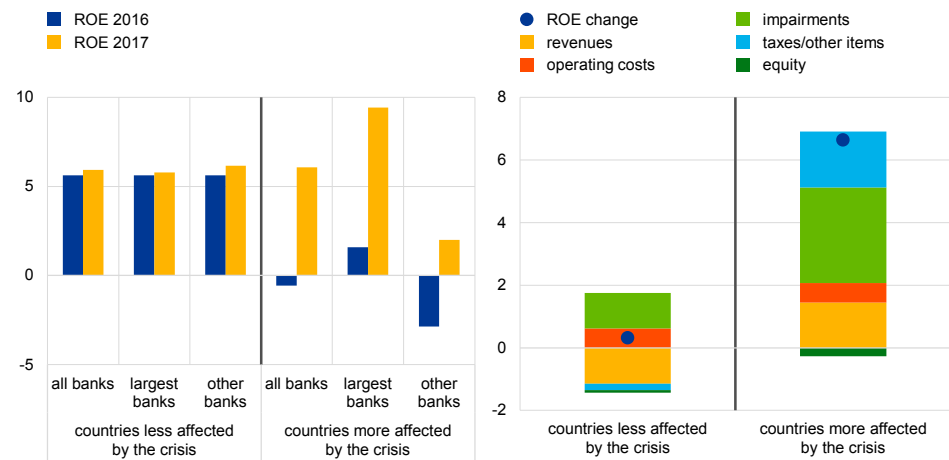
Looking at a breakdown of recent profitability trends by country group, much of the improvement was driven by banks in the countries more affected by the crisis (see Chart 3.2). On aggregate, bank profitability in these countries recovered thanks to lower impairment costs, increasing revenues as well as some one-off factors.³⁹ That said, the bulk of the improvement in these countries was concentrated within the largest banks, while profitability levels remained subdued at other banks (see Chart 3.2 – left panel). At the same time, the aggregate profitability of banks in countries less affected by the crisis remained broadly stable as the positive impact of declining impairment and operating costs was offset by somewhat lower revenues.

Chart 3.2

Much of the overall improvement was driven by banks in countries more affected by the crisis

Change in significant institutions' aggregate ROE from 2016 to 2017 and main drivers by country group

(2016-17, percentages, percentage points)



Sources: ECB and ECB calculations.

Notes: Based on a balanced sample of 112 significant institutions (adjusted for mergers and acquisitions). Countries more affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Spain and Slovenia. The largest banks are defined as those with at least €500 billion of total assets.

Financial performance improved across most (though not all) business models, although profitability levels continued to diverge somewhat (see Chart 3.3). Universal banks tended to outperform banks with other business models in

³⁸ These offsetting negative effects were mainly related to gains/losses on financial instruments designated at fair value through profit or loss, as well as gains/losses on financial instruments not measured at fair value (e.g. available-for-sale assets) and, to a lesser extent, exchange differences.

³⁹ The largest one-off items include the recognition of negative goodwill resulting from a merger (i.e. the negative difference between the share purchase price and the fair value of net assets), capital gains related to asset disposals and a public cash contribution related to the acquisition of certain assets of liquidated banks.

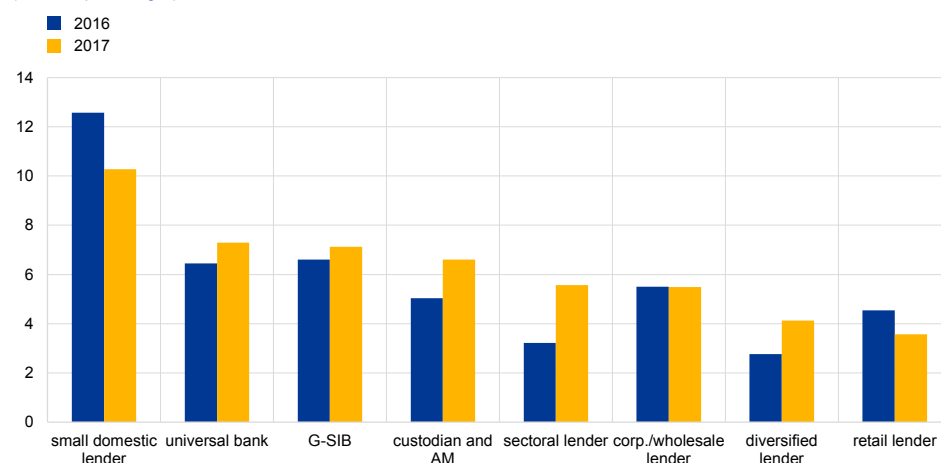
2017, possibly benefiting from a greater diversification of their business activities. At the other end of the spectrum, retail lenders and diversified lenders typically displayed lower profitability levels than banks in other categories, partly due to their greater reliance on net interest income-generating activities. It should be added, however, that divergences in profitability levels across business models partly reflect disparities between country groups as the majority of banks classified under the weaker-performing business models (diversified and retail lenders) are located in the countries more affected by the crisis. By contrast, retail banks in the countries less affected by the crisis were among the better performers within their country group.

Chart 3.3

Recent profitability trends diverged across business models

Median ROE of significant institutions by business model

(2016-17, percentages)



Sources: ECB and ECB calculations.

Notes: Based on a sample of 108 SIs. G-SIB stands for global systemically important bank and AM for asset manager.

Analysts expect a continuation of the gradual improvement in bank profitability in the next few years.

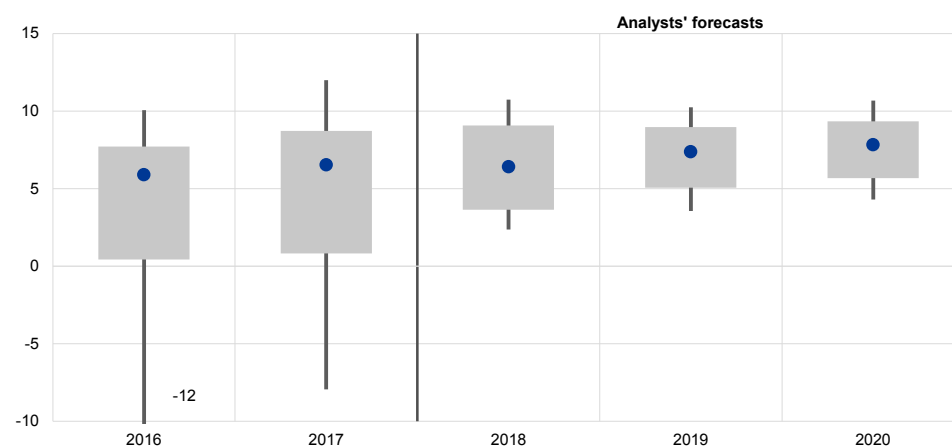
The median ROE for listed euro area banks (based on a sample of 41 SIs) is expected to be in the range of 6-7% in 2018 and 2019, before reaching 8% in 2020 (see [Chart 3.4](#)). The cross-sectional dispersion of profitability is expected to narrow somewhat, with gradual improvements anticipated also for weaker banks. Analysts' expectations of higher bank earnings partly reflect robust growth prospects, and thus a better revenue outlook, as well as lower provisioning needs, in particular in high-NPL countries, driven by expectations of further progress in balance sheet repair. That said, profitability for a number of banks is still expected to remain at subdued levels, suggesting that cyclical improvements may not be sufficient for these banks to reach a sustainable level of profitability, which highlights the importance of tackling structural challenges.

Chart 3.4

Analysts' forecasts suggest a gradual improvement in bank profitability in the next few years

Actual ROE for 2016-17 and mean ROE estimates for 2018-20 for euro area banks

(2016-20, percentages; median (blue dot), interquartile range and 10th-90th percentile range)



Sources: SNL and S&P Capital IQ.

Note: Based on a sample of 41 listed SIs.

Turning to one of the key challenges in this regard, despite recent and ongoing restructuring efforts, euro area banks have been unable to cut costs significantly.

Taking a longer-term perspective, euro area significant institutions' operating expenses have grown by over 5% since 2010, despite a 3% decline in total assets in the same period.⁴⁰ Focusing on more recent developments, SIs' aggregate cost-to-assets ratio has remained broadly unchanged over the last two years (at around 1.4%). However, cost developments have diverged markedly across business models over this period. For instance, euro area G-SIBs and small domestic lenders were more successful in reducing their cost-to-assets ratios than other SIs, while corporate/wholesale lenders and diversified lenders saw the strongest increases in cost-to-assets ratios (see [Chart 3.5](#)).

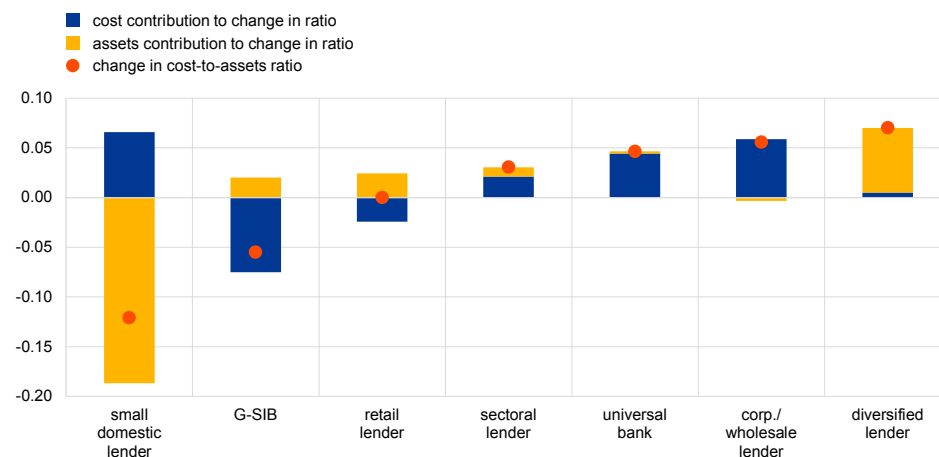
⁴⁰ Based on a sample of 88 SIs.

Chart 3.5

Costs have increased across all business models in the last two years, with the exception of G-SIBs

Change in the cost-to-assets ratio and contributions of the cost and assets components broken down by type of bank

(change from 2015 to 2017, weighted aggregates, percentage point changes)



Sources: ECB and ECB calculations.
Note: Based on a balanced sample of 93 SIs.

Looking at cost structures, the growth of non-staff operating expenses has outpaced that of staff costs since 2010.

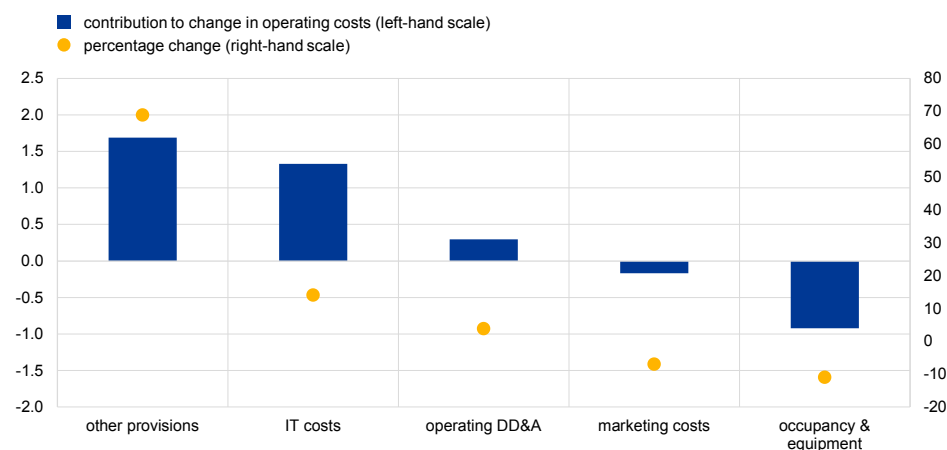
Euro area SIs' aggregate staff costs increased by close to 3% between 2010 and 2016, as the impact of headcount reductions was more than offset by an increase in staff costs per employee. In the same period, banks' non-staff costs have increased by 10%. Public disclosures for a sub-sample of SIs suggest that the growth in non-staff-related expenses has been mainly driven by other provisions and IT costs (see [Chart 3.6](#)). For this sample of banks, IT costs still only amount to 10% of total operating costs, but their relatively rapid growth (14%) reflects increased investments in digital technologies. At the same time, occupancy and equipment costs – mainly related to office and branch space – have declined over the last seven years driven by branch closures of over 10%.

Chart 3.6

Other provisions and IT costs have contributed the most to the growth of non-staff costs since 2010

Change in selected non-staff cost items between 2010 and 2016 and their contribution to the change in operating costs (for a sub-sample of SIs)

(2010-16, percentage point contributions and percentage changes)



Sources: SNL and ECB calculations.

Notes: Sample includes 48 SIs covering close to 50% of total SI assets. Operating DD&A stands for operating depreciation, depletion and amortisation.

The rapid pace of technological advances in finance, along with a change in the competitive landscape, represent a key strategic challenge for banks in the medium-to-long term. On the one hand, a further shift away from physical branch networks to digital banking may offer a structural cost saving opportunity for banks (see **Box 6**). However, the ability of banks to cut costs by exploiting digital banking will vary across countries depending on structural factors, such as labour laws, market structure (with fragmented banking systems offering more scope for cost savings) as well as branch efficiency (with over-branched countries having more opportunities for cost savings). On the other hand, technological innovation and heightened competition from other players (e.g. digital banks, fintech companies) may also increase pressure on retail banking revenues (e.g. via more intense price competition for deposits or a potential loss of overdraft and payments-related income).

Box 6

Cost efficiency of euro area banks

Prepared by Ivan Huljak, Reiner Martin and Diego Moccero

Improving operating efficiency is key if euro area banks are to raise their profitability to sustainable levels. The FSR has been consistently reporting on the basis of accounting indicators, such as the cost-to-income ratio (CIR) and the cost-to-assets ratio, that, on aggregate, euro area banks' cost efficiency has deteriorated somewhat since 2010. While the improving cyclical environment is supporting bank profitability, raising it to levels that can ensure banks are able to provide financing to the real economy in a sustainable manner would benefit from improving their cost efficiency.

This box uses frontier analysis to estimate banks' cost efficiency, focussing on the parameters that are under the effective control of management.⁴¹ This approach is a useful

complement to the accounting indicators typically used to assess efficiency in the banking sector.⁴²

A cost function is used to estimate banks' relative ability to convert inputs into outputs while minimising costs. The most efficient bank is the one that incurs the lowest cost to generate a given amount of output at predetermined input prices. An advantage of this technique is that the resulting measure of cost efficiency controls for the fact that banks produce different outputs (loans and investments) and pay different prices for inputs (financial capital, labour and fixed assets), thereby allowing a better comparison across banks of different size, ownership structure, specialisation, etc. The bank on the frontier represents best practice in the banking sector and the remaining banks are measured against this benchmark.⁴³ Importantly, the technique distinguishes persistent inefficiency from time-varying inefficiency.

The analysis is based on a comprehensive set of euro area banks. The sample consists of commercial, cooperative and savings banks from 17 euro area countries over the period from 2006 to 2015 gathered from Bankscope.⁴⁴ After removing institutions with unreliable or low quality data and institutions that might have been misclassified, the resulting sample is an unbalanced panel of between 1,727 and 2,248 banks, depending on the year.⁴⁵

The scope for efficiency gains by emulating best performers is sizeable (Chart A). The relative cost efficiency of the median euro area bank fluctuated between 82% and 83% over the period from 2006 to 2015. These findings suggest that if the median bank operated on the efficiency frontier, it could produce the same level of output at only 82% to 83% of its current costs.⁴⁶ In other words, about 17-18% of costs can be attributed to cost inefficiency relative to the most cost-efficient bank. Looking across bank specialisations, overall efficiency is lower for commercial banks than for cooperative and saving banks on account of lower persistent inefficiency in the latter two (see below). There is also wider dispersion of efficiency within the commercial bank category than in the other categories.

⁴¹ The analysis is based on Kumbhakar, S.C., L. Gudbrand and J.B. Hardaker (2014), "Technical efficiency in competing panel data models: a study of Norwegian grain farming", *Journal of Productivity Analysis*, Vol. 41, Issue 2, pp. 321–337. It is assumed that banks use funds (liabilities), labour and fixed assets to produce loans and investments. To control for risk and technical change, the equity ratio and a time trend are included as semi fixed inputs. The function used is a standard trans-log cost function with the price of labour used to normalize the dependent variable and all input prices.

⁴² While very easy to compute, caution is needed when using accounting indicators as a measure of efficiency. The average cost for a bank is highly dependent on the business model of the institution, its size and various country-specific factors which are outside the control of bank management. The CIR captures simultaneously several aspects of bank performance, such as productivity, efficiency and various bank-specific and country-specific factors. The CIR is also affected, at least indirectly, by credit risk, which distorts the estimation of efficiency.

⁴³ Efficiency scores in frontier analysis are relative in nature and are scaled to the best-performing bank. An additional caveat with measures based on frontier analysis is that it approximates total banking activities with loans and investments, while in reality banks offer a variety of products.

⁴⁴ In this analysis, banks are classified as commercial if they are active mainly in retail, wholesale and private banking (i.e. universal banks), while savings and cooperative banks are mainly active in retail banking (the latter having a cooperative ownership structure).

⁴⁵ The following types of bank were dropped from the sample: banks that recorded a change in the gross value of total assets of more than 50% in a particular year; banks which have less than one third of their total assets in the form of gross loans (in order to remove institutions that do not perform maturity transformation or do not provide loans to the economy); and very small banks, i.e. those with average assets for the whole period of below €50 million.

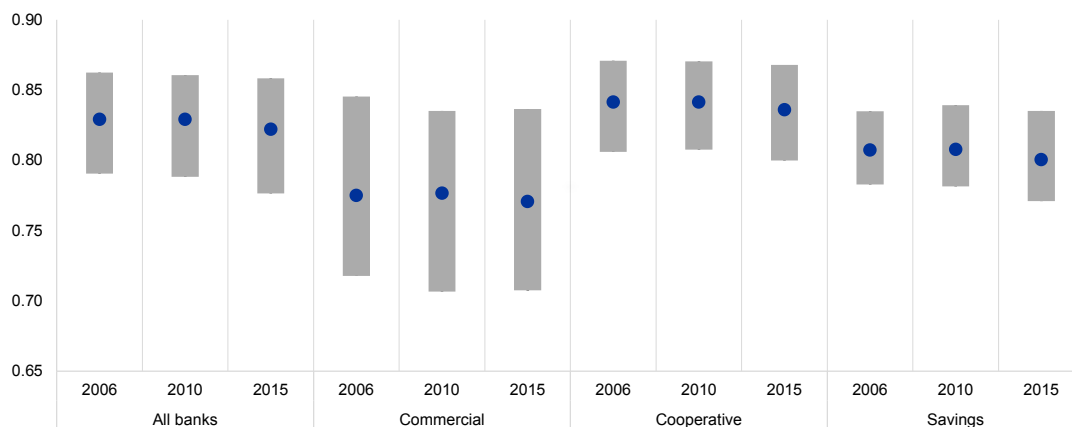
⁴⁶ Overall bank efficiency is computed as the product of persistent (time invariant) and residual (time variant) efficiency. Efficiency scores are computed on the basis of a common frontier across bank categories.

Chart A

Overall efficiency has declined slightly in the euro area banking sector

Overall efficiency by bank specialisation

(percentages; 25th, 50th and 75th percentile for all banks and each bank specialisation)



Sources: Bankscope and ECB calculations.

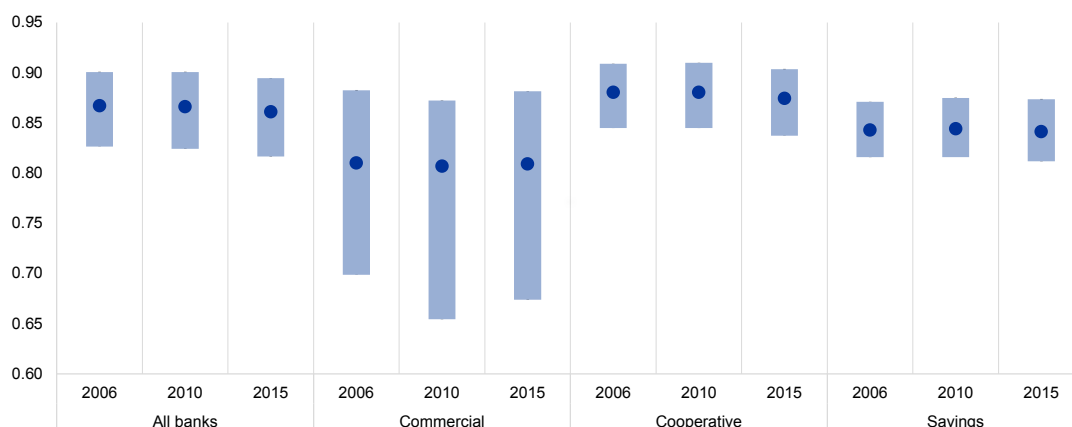
The results also suggest that the relative efficiency of the median bank has decreased over time, as the overall efficiency score fell by about 0.8 percentage points between 2010 and 2015. The decline in efficiency is observed across all three categories of bank. The results also confirm previous findings in the FSR suggesting that progress to date in the area of cost efficiency gains remains limited.

Chart B

Persistent inefficiency is the largest component of overall inefficiency

Persistent efficiency by bank specialisation

(percentages; 25th, 50th and 75th percentile for all banks and bank specialisation)



Sources: Bankscope and ECB calculations.

The largest contribution to bank inefficiency comes from persistent inefficiency (see Charts B and C). In fact, persistent efficiency scores point to inefficiency levels in banks of between 11.9% and 20.4% (across time and business models), whereas the results for time-varying inefficiency

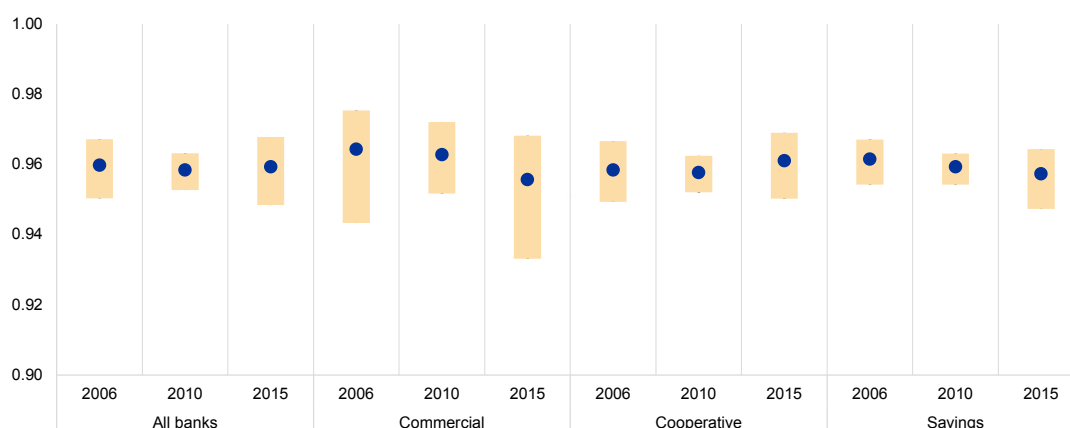
suggest that the median bank uses only between 3.6% and 4.4% of its resources (across time and business models) inefficiently as a result of time-varying factors.⁴⁷ Looking at the evolution of time-varying efficiency across bank specialisations, the largest decline can be seen in commercial banks between 2010 and 2015.

Chart C

Time-varying efficiency has declined, particularly for commercial banks

Time-varying efficiency by bank specialisation

(percentages; 25th, 50th and 75th percentile for all banks and each bank specialisation)



Sources: Bankscope and ECB calculations.

These results suggest that long-term structural factors, such as location, client structure, macroeconomic environment, regulation, etc., play a significantly bigger role in bank efficiency than time-varying factors.⁴⁸ They also underline the importance to improve structural efficiency. Options could include (further) branch network and staff rationalisation, increased digitalisation (particularly in the case of countries where the distribution of banking products remains overly reliant on branch networks) and mergers and acquisitions both within countries and at the euro area level (to achieve economies of scope and scale).

⁴⁷ Looking across business models, there seems to be little difference in time-varying efficiency, while the differences are larger for persistent efficiency (which is lower for commercial banks than for cooperative and savings banks). This is probably due to the fact that commercial banks (which are larger institutions) are more difficult to manage. At the same time, the methodology utilises two outputs (namely loans and other earning assets), while commercial banks tend to also be involved in other activities (such as derivatives trading, asset management, etc.) that are not counted as outputs in this framework but still generate additional costs.

⁴⁸ Likely reasons for this finding are that there are large sunk costs associated with starting a bank and several years of deposit base formation are required to succeed in the business. Moreover, it tends to be very costly to restructure a bank (downsize the number of staff, merge with another institution, etc.) and banks have a heavy reliance on information technologies, which can take a long time to put in place.

NPL reductions accelerated in 2017, but further progress is needed

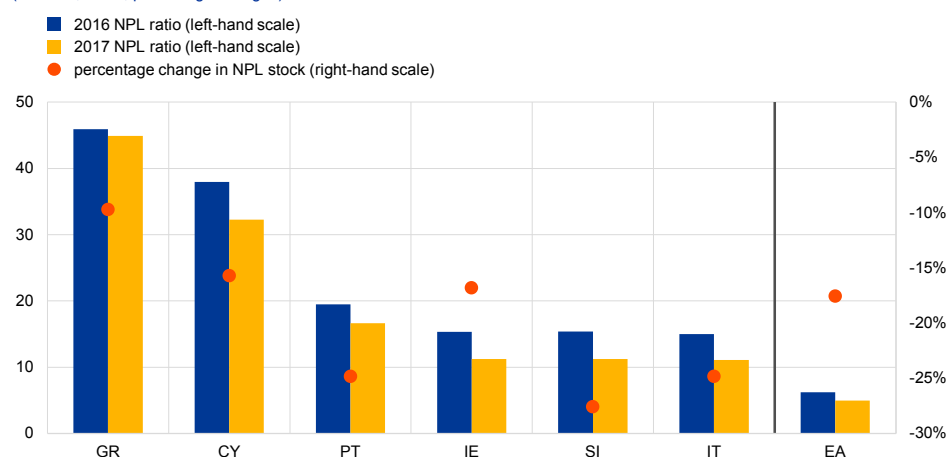
The reduction of NPL stocks gathered pace in 2017. Euro area significant institutions' aggregate NPL stock shrunk by over €150 billion last year, nearly twice as much as in 2016, while their aggregate NPL ratio dropped to 5% (see [Chart 15](#) in the Overview). The improvement in asset quality metrics was broad-based across countries, reflecting banks' increased efforts to address legacy NPL portfolios as well as favourable macroeconomic conditions. The rate of progress varied across high-NPL countries, with NPL ratio declines ranging between 1 and 5.7 percentage points, while the reduction in the absolute stock of NPLs ranged between 10% and 28% (see [Chart 3.7](#)). NPL declines in the NFC sector accounted for over 70% of the overall reduction in the NPL stock in 2017, almost equally split between SME and other NFC loans.

Chart 3.7

The rate of progress in NPL reduction varied across countries

Change in NPL ratios and stocks in high-NPL countries between 2016 and 2017

(2016-17, ratios, percentage changes)



Source: ECB.

Notes: Based on country-level aggregates for SIs. In line with FINREP reporting on non-performing exposures, loans and advances also include cash balances at central banks and other demand deposits.

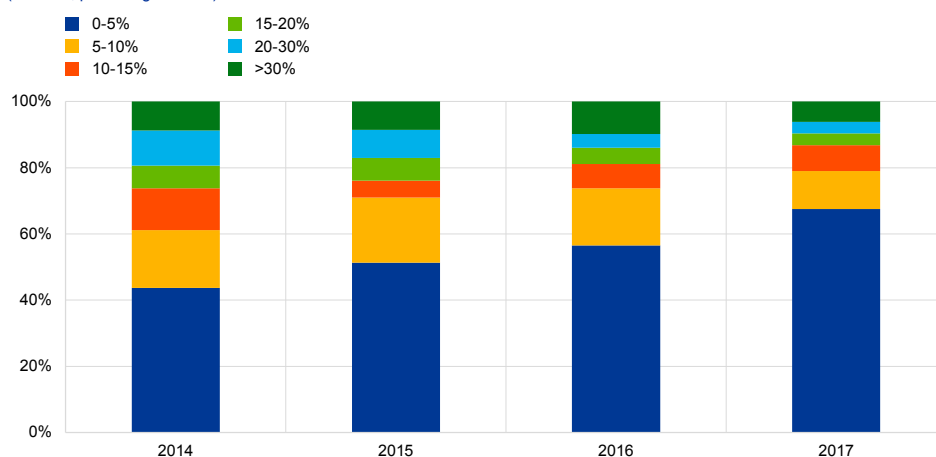
Notwithstanding these improvements, a number of banks are still burdened with high NPLs and need to accelerate NPL reductions. While the share of significant institutions with double-digit NPL ratios has nearly halved over the last three years (see [Chart 3.8](#)), a number of banks need to continue to strengthen their efforts to bring down NPL ratios to sustainable levels. To this end, banks with elevated NPL levels are implementing ambitious NPL reduction plans over the next few years. For a sample of 17 high-NPL banks publicly disclosing their quantitative targets, the median reduction in NPL ratios would be around 7 percentage points by the end of their target horizon (varying from 2019 to 2022).

Chart 3.8

The share of significant institutions with double-digit NPL ratios has nearly halved in the last three years, but a number of banks need to accelerate NPL reductions

Share of euro area significant institutions by NPL ratio bracket

(2014-17, percentage shares)



Source: ECB.

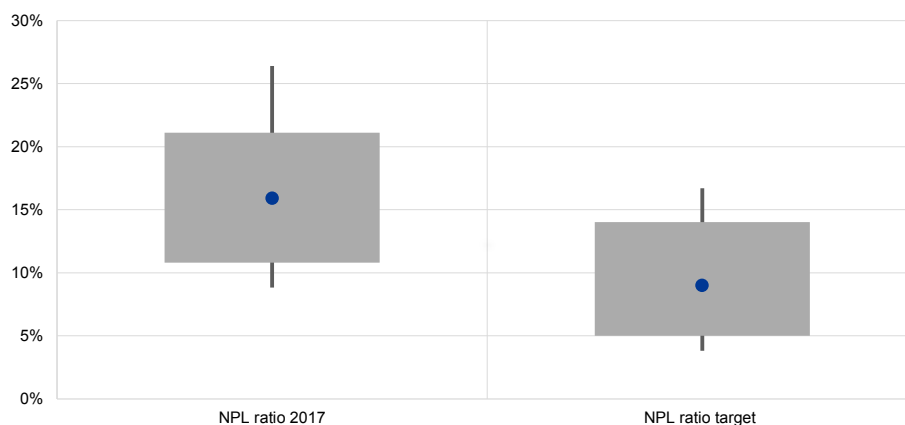
NPL coverage continued to edge up in high-NPL countries, partly reflecting the first-time adoption of IFRS 9. While the aggregate NPL coverage ratio remained broadly stable in 2017, NPL coverage continued to improve in the majority of high-NPL countries, with the median coverage ratio increasing from 47% to 49% over the last year. Furthermore, a number of banks used the first-time adoption of IFRS 9 rules to significantly improve the coverage of NPLs as of 1 January 2018. Based on public disclosures for a sub-set of high-NPL banks applying transitional arrangements under IFRS 9, the median estimated increase in NPL coverage due to IFRS 9 first-time adoption from the beginning of 2018 was 4 percentage points relative to stated end-2017 coverage levels.

Chart 3.9

A number of banks target significant NPL reductions in the medium term

End-2017 NPL ratios versus medium-term targets for selected banks

(percentages; median, interquartile range and 10th-90th percentile range)



Source: Individual banks' disclosures.

Notes: Based on a sample of 17 high-NPL banks.

Policy initiatives underway aim to address legacy NPLs and to prevent the build-up of high NPL stocks in the future.

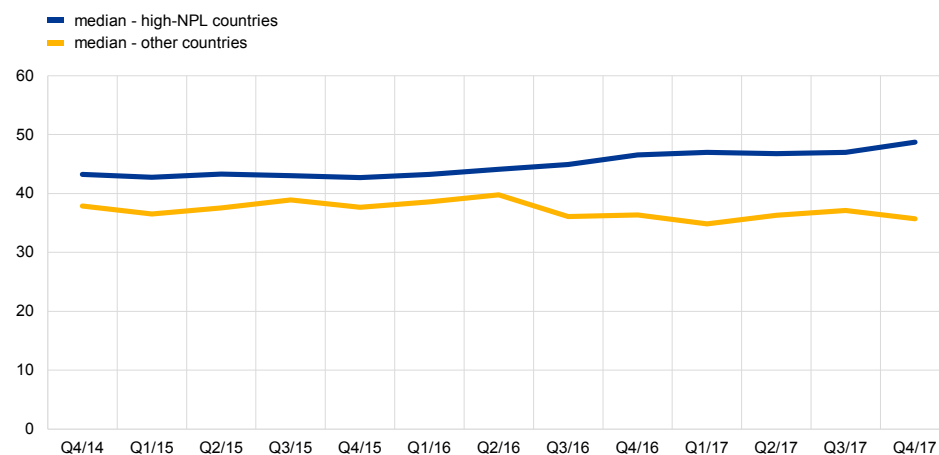
Significant progress has been made in implementing the EU Council's NPL action plan, including the European Commission's proposal on a prudential provisioning backstop for newly originated loans that become non-performing (applying to loans originated after 14 March 2018), measures aimed at fostering growth of secondary NPL markets by removing undue impediments to selling NPLs (see **Box 7**), as well as guidance on a blueprint for national asset management companies. For its part, the SSM published an addendum to its NPL guidance setting out its supervisory expectations for the prudential provisioning of new NPLs (applying to NPLs which were classified as such after 1 April 2018). National authorities could complement these measures with initiatives to foster the development of NPL markets, such as setting up NPL transaction platforms (see Special Feature A of the November 2017 FSR).

Chart 3.10

Coverage ratios continued to improve in the majority of high-NPL countries

Median coverage ratios in high-NPL and other countries

(Q4 2014 – Q4 2017, percentages)



Source: ECB.

Notes: Based on country-level aggregates for significant institutions. High-NPL countries include Cyprus, Greece, Ireland, Italy, Portugal and Slovenia.

Box 7

Recent developments in pricing of non-performing loan portfolio sales

Prepared by Maciej Grodzicki, Julian Metzler and Edward O'Brien

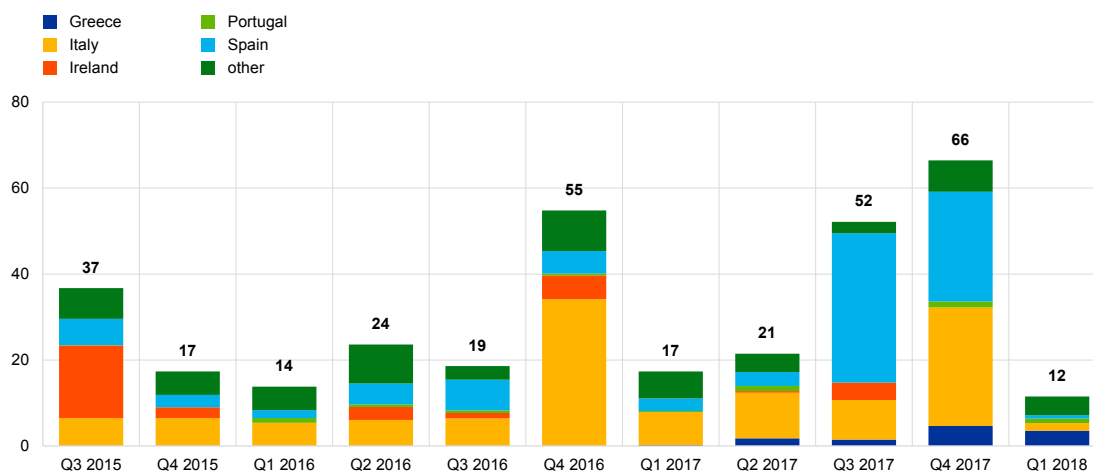
The market for NPLs in Europe has become more active in recent years. The total amount and volume of transactions has continuously increased in the last three years (see **Chart A**), although part of the increase in volumes can be attributed to just a few large transactions. Italy and Spain account for the majority of the market turnover. However, the geographical scope of NPL markets in the euro area has also widened, with transactions starting in Greece in 2017 and in Cyprus in 2018. At the same time, market activity in more mature NPL markets, such as Ireland, has weakened against the backdrop of a diminishing supply of NPLs.

Chart A

Transaction volumes in secondary markets for NPLs are on the rise

Total gross book value of traded NPL portfolios in the euro area

(Q3 2015 – Q1 2018; EUR billions)



Sources: KPMG Debt Sales Monitor and ECB calculations.

Notes: €115 billion of transactions were reported as ongoing at the cut-off date of this FSR. Numbers above bars indicate total European transaction volumes for each quarter.

Data on actual NPL portfolio sales can be brought to bear to estimate the rates of return demanded by investors in recent transactions. The transaction prices reported for around 30 portfolio sales⁴⁹ were matched with supervisory data on provision and collateral coverage reported by seller banks at the time of the transaction to estimate the spread between the sale price and the net book value at which the seller held the NPLs. To account better for the differences in collateralisation levels of various portfolios, the internal rate of return (IRR) achieved by the NPL buyers was also estimated. In doing so, it is assumed that the NPL investor will recover the book value of collateral, taking on average four years until the recoveries materialise. Moreover, it is assumed that the unsecured part of the NPL portfolios will produce recoveries of 5%.⁵⁰

Contrary to anecdotal evidence, the data do not show that increased market activity is accompanied by a tightening of the spreads between the book and market values of NPLs.

These spreads are to a large degree explained by market frictions and information asymmetry, which give rise to a market scenario in which investors take advantage of market power. Earlier ECB analysis placed these spreads in the region of 20-40% of the gross book value of NPLs in high-NPL euro area countries.⁵¹ Recently observed sale prices corroborate these estimates and show that these spreads have not declined substantially over the last few quarters (see **Chart B**). The dispersion of the estimated spreads remains wide.

⁴⁹ This bespoke dataset was collected from several market sources, including in particular Banca IFIS Market Watch, KPMG Debt Sales Monitor and individual bank announcements. It covers transactions related mainly to commercial real estate and corporate loan portfolios.

⁵⁰ This is broadly equivalent to the assumption that NPLs are valued on a gone-concern basis, that is, the recoveries would be derived mainly from collateral and that the unsecured part would generate very limited cash flows. As data on recoveries from unsecured corporate loans are not available, the assumed 5% recovery rate on the unsecured part is based on market pricing of unsecured consumer loans.

⁵¹ See Fell, J., Grodzicki, M., Krušec, D., Martin, R. and O'Brien, E., "Overcoming non-performing loan market failures with transaction platforms", *Financial Stability Review*, ECB, November 2017, pp. 130-144.

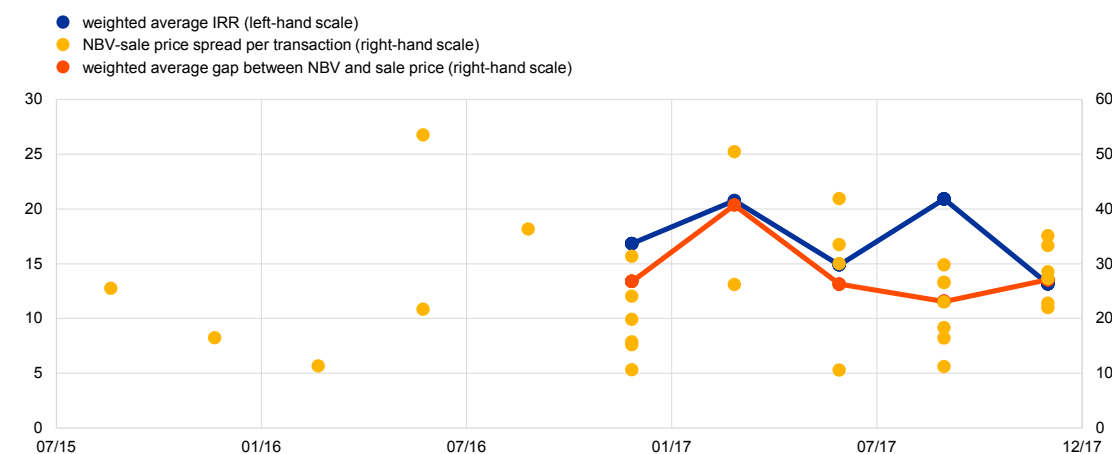
NPL transaction prices do not imply any clear downward trend in IRRs. Pricing is consistent with average IRRs within a range of 13% to 20% over the past few quarters (see **Chart B**). As with spreads, estimated transaction-level IRRs are widely dispersed. The interquartile range of the IRR of transactions executed in 2017 lies between 9% and 19%. However, these results may not be fully conclusive, owing to three types of limitation. First, the sample of transactions is small and possibly not fully representative. Second, detailed data on the composition of NPL portfolios sold is not available, and it is therefore simply assumed that these portfolios are homogenous with the portfolios retained by banks. Finally, it is assumed that the time needed to complete recoveries is constant for all portfolios and across time.

Chart B

Pricing of NPL sales does not show a clear improvement over time

Estimated IRRs earned by NPL buyers and spreads between net book value and sale price

(Q3 2015 – Q4 2017; percentages, spread in percentages of gross book value)



Sources: KPMG, Banca IFIS Market Watch, bank announcements and ECB calculations.

Notes: NBV – net book value. Averages are not calculated prior to the fourth quarter of 2016 owing to the very limited number of observations.

From a policy perspective, these results support the view that the secondary market for NPLs continues to be afflicted by several types of market failure. The increase in market turnover has not translated into substantially lower bid-ask spreads. This further reinforces the case for determined implementation of the European Council's NPL Action Plan and for accompanying national reforms that would facilitate debt recovery, speed up insolvency processes and increase transparency around the value of NPLs.

Recovery in bank lending continues, but there are few signs of a significant increase in risk-taking

Aggregate credit risk measures reported by banks continued to improve in 2017. The riskiness of banks' loan books, as measured by the global charge

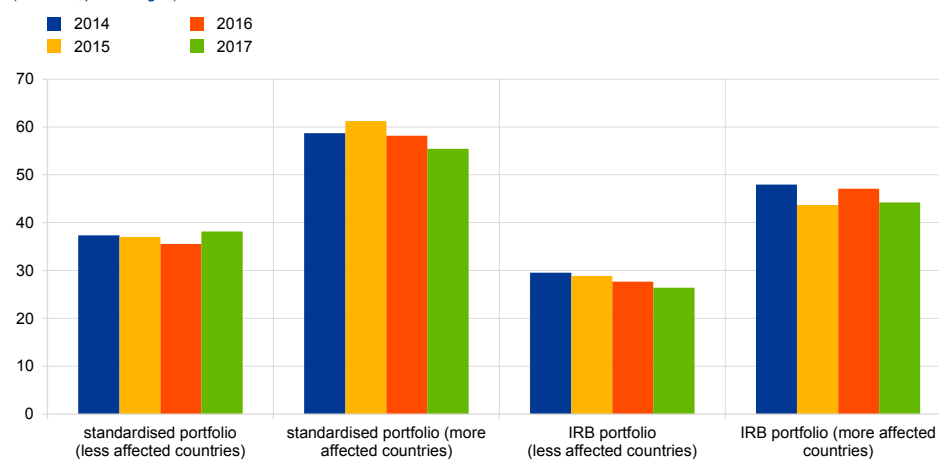
indicator⁵², declined in most portfolios between 2016 and 2017 amid improving cyclical conditions (see [Chart 3.11](#)). At the same time, the recovery of bank lending to the private sector has continued, with consumer lending growing at a faster pace than other types of credit. Increasing risk-taking in this segment may have been motivated by profitability considerations as consumer loans offer higher lending margins than other loans (see [Chart 1.15](#) in Section 1.3). Strong consumer lending growth was broad-based in the euro area, albeit with some dispersion across countries, with some countries experiencing double-digit growth rates over the past year (see Section 1.3). Such credit developments warrant close monitoring as higher risk-taking – if not fully compensated for by higher risk premia – may lead to a build-up of vulnerabilities in the medium term.

Chart 3.11

Measures of credit risk reported by banks continued to improve in 2017

Global charge indicator for non-defaulted standardised and IRB credit risk exposures

(2014-17, percentages)



Sources: ECB and ECB calculations.

Notes: The global charge indicator is calculated as $(\text{risk-weighted assets} + 12.5 \times \text{expected losses}) / \text{exposure at default}$ and $(\text{risk-weighted assets} + 12.5 \times \text{impairments}) / \text{exposure at default}$ for the IRB (internal ratings-based) and standardised approaches, respectively. Excludes exposures in default; based on weighted averages for a sample of 101 SIs. Countries more affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

The acceleration of consumer lending was accompanied by an increase in the average duration of newly originated loans (see [Chart 3.12](#)). Countries with above-average consumer lending growth tend to have a higher share of loans with longer repricing periods (above one year). On the one hand, this development may benefit household borrowers by reducing their vulnerability to interest rate increases – and consequently banks' credit risk – in the next few years. The flipside of the lengthening duration of banks' consumer loan portfolios is that it may expose banks to higher interest rate risk under a scenario of rising rates. At the same time, the results of the ECB's bank lending survey do not signal a broad-based easing of

⁵² The global charge indicator is a measure of risk relative to the size of exposures that allows standardised and IRB portfolios to be jointly taken into account in a meaningful way. It is calculated as $(\text{risk-weighted assets} + 12.5 \times \text{expected losses}) / \text{exposure at default}$ and $(\text{risk-weighted assets} + 12.5 \times \text{impairments}) / \text{exposure at default}$ for the IRB and standardised approaches, respectively.

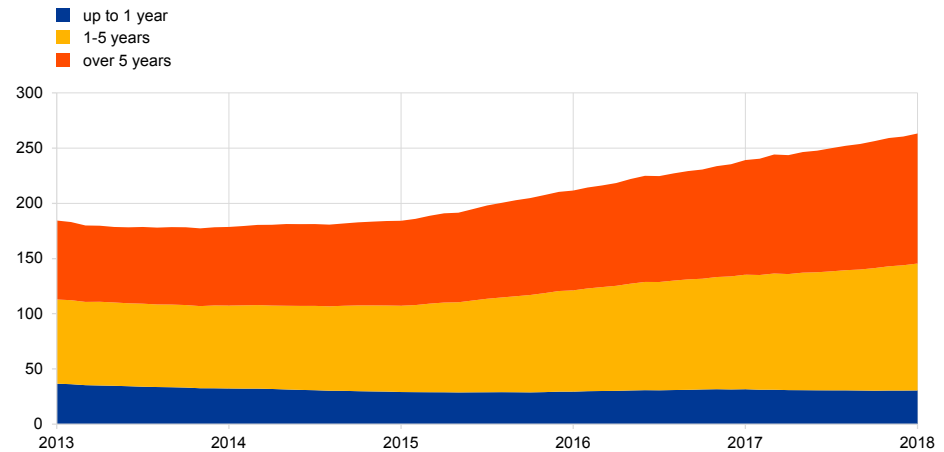
credit standards over the past year and there appears to be no relationship between lending growth and credit standards at the country level (with one exception).

Chart 3.12

Rapid growth in consumer lending along with a lengthening of average interest rate fixation periods

New business volumes for consumer lending by interest rate fixation period

(Jan. 2013 – Jan. 2018, € billions, 12-month cumulated new business)



Source: ECB.

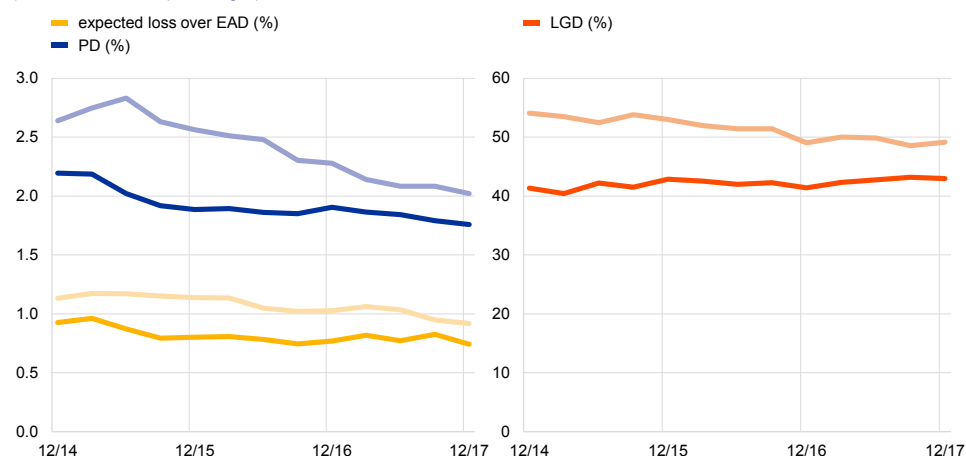
Growth in consumer lending is being spearheaded by banks that are lending to riskier borrowers. Based on IRB portfolios, the median bank's expected losses on consumer loans (when measured in terms of exposure at default (EAD) or risk-weighted assets (RWAs)) are the highest of all loan portfolios, but they have remained broadly stable over the past year (see [Chart 16](#) in the Overview). At the individual bank level, credit risk measures are higher for banks with stronger consumer loan growth, which may suggest that these lenders are adopting more aggressive loan origination practices, including targeting riskier borrowers. This notwithstanding, the gap in both reported probabilities of default (PDs) and losses given default (LGDs) narrowed between this group of banks and other institutions (see [Chart 3.13](#)).

Chart 3.13

Credit risk measures are higher for banks with stronger consumer loan growth

Expected losses as a percentage of EAD, PDs and LGDs on consumer loans by group of banks

(Q4 2014 – Q4 2017, percentages)



Sources: ECB and ECB calculations.

Notes: Based on 45 SIs with consumer loans in IRB portfolios. The lighter-coloured lines represent the top quartile of banks that saw a stronger increase in the ratio of consumer loans to total assets in the last two years.

The banks with the strongest consumer lending typically charge higher lending spreads (see Chart 3.14).

While this partly reflects the fact that consumer lending growth was among the strongest in some of the countries more affected by the crisis – where borrower PDs remain higher relative to other countries⁵³ – the pricing behaviour of these banks appears to be commensurate with the higher credit risk in their portfolios. However, this analysis is subject to some caveats. First, it is based on information extracted only from banks' IRB portfolios. Second, different types of consumer loan have different risk characteristics and pricing, but there is a lack of granular data on the composition of consumer loan portfolios.

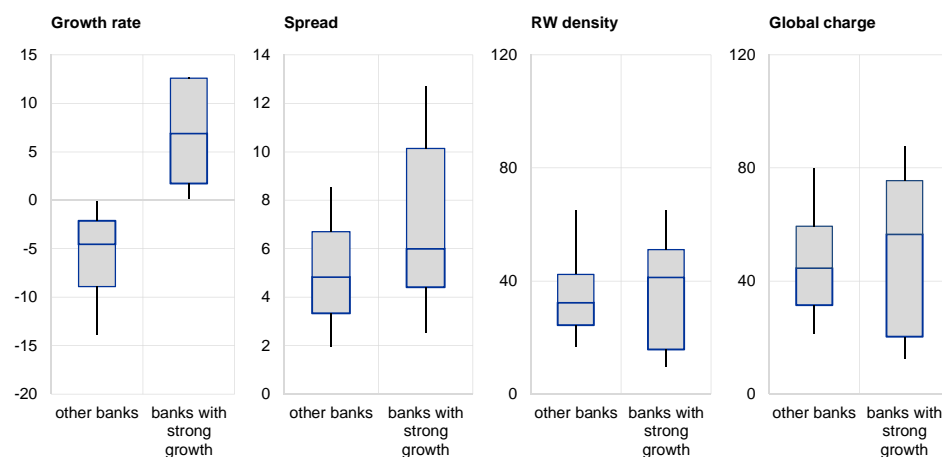
⁵³ In 2017, the weighted average PD of IRB portfolios was 2.5% in the countries more affected by the crisis, compared with 1.1% in the other countries.

Chart 3.14

Banks with the strongest consumer lending growth typically charge higher lending spreads

Lending growth, loan-deposit spread and prudential credit risk measures for banks with stronger consumer lending versus other banks

(2017, percentages; median, interquartile range and 10th-90th percentile range)



Sources: ECB and ECB calculations.

Notes: "Banks with strong growth" represent the top quartile of banks in terms of loan growth for consumption and other purposes. RW stands for risk weight.

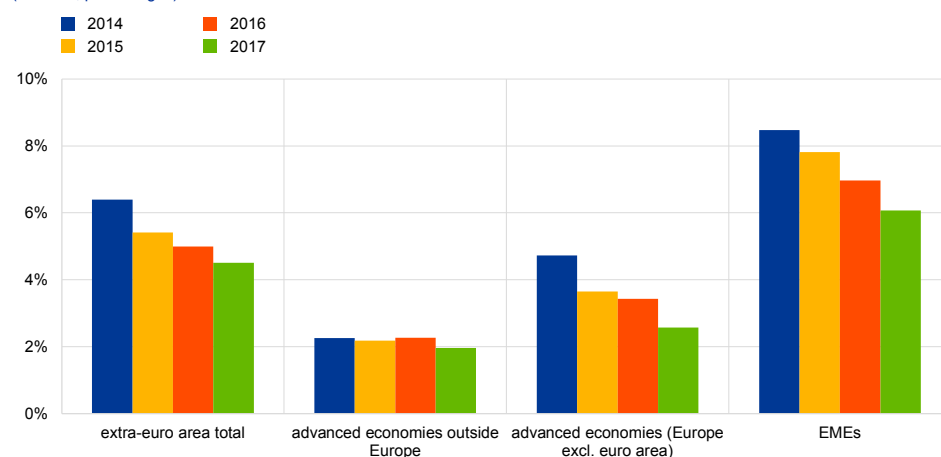
Banks' lending activity in regions outside the euro area declined slightly in 2017. Euro area significant institutions' loans to the non-financial private sector in these regions dropped by 2% in 2017, mainly driven by reduced credit exposures to the US. Banks' exposure towards EMEs remained broadly stable, with increases towards emerging Europe largely offsetting declines for most other EME regions. Amid favourable conditions in the global economy, asset quality improved across most advanced economy and EME regions (see [Chart 3.15](#)). On aggregate, banks' NPL ratio on loans in economies outside the euro area stood at 4.5% at end-2017.

Chart 3.15

Euro area banks' asset quality improved across most advanced economy and EME regions

Euro area significant institutions' NPL ratios in regions outside the euro area

(2014-17, percentages)



Source: ECB.

Taking a closer look at banks' credit exposures to the UK, their share remained stable at around 7% of total loans with exposures concentrated in a limited number of banks.

By sector, loans to the non-financial private sector accounted for 51% of significant institutions' total UK loans at end-2017, followed by interbank loans (24%), loans to other financial corporations (15%) and claims on government and the central bank (10%). Asset quality has improved over the last two years and banks' aggregate NPL ratio for UK loans stood at a low level at end-2017 (1.3%). This improvement was broad-based across sectors and loan types, with the exception of consumer loans where the NPL ratio edged up in 2017. Looking at other exposures, despite a 33% decline over the last two years, euro area significant institutions' UK-based derivative exposures accounted for over 30% of total derivatives. Therefore, without sufficient mitigating actions, a "hard Brexit" scenario could have an adverse impact on the euro area banking sector and more broadly on the end-users of centrally cleared derivatives due to their current reliance on UK central counterparties (in particular for interest rate swaps).

Turning to banks' exposures to interest rate risk, on aggregate, risks in the banking book associated with potentially rising interest rates remain limited for euro area significant institutions.

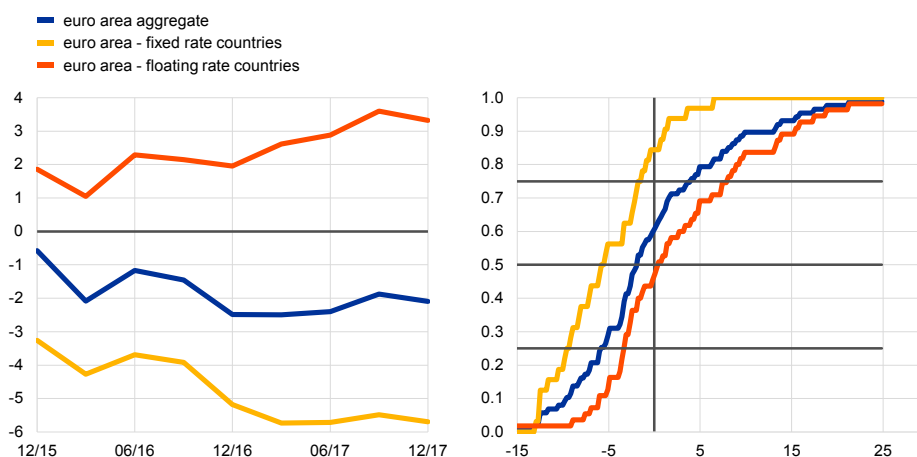
Under the scenario of an upward parallel interest rate shift of 200 basis points (bps), the change in the economic value of the banking book would equal only around 2% of own funds (see [Chart 3.16](#) – left panel). Similarly, banks' interest rate risk, on aggregate, remains moderate when measured by the sensitivity of their net interest income to rising interest rates (see Special Feature C).

Chart 3.16

Interest rate risk of significant institutions remains limited on aggregate, with banks in countries with fixed rate loans more vulnerable to rising interest rates

Change in the economic value of the banking book given a parallel upward interest rate shift of 200 basis points

(left panel: Q4 2015 – Q4 2017, percentages; right panel: Q4 2017; x-axis: percentages; y-axis: percentiles)



Sources: ECB and ECB calculations.

Notes: The chart shows the evolution over time of the impact of a rise in interest rates (left panel) and the empirical cumulative distribution of this impact for the most recent reporting period across individual banks (right panel). The impact of a rise in interest rates is measured by the change in economic value of the banking book as a share of regulatory own funds. The analysis is based on a sample of significant institutions which is split into fixed and floating rate countries based on the share of floating rate loans in total loans for house purchase. Fixed rate countries include Belgium, France, Germany, the Netherlands and Slovakia, while in all other euro area countries floating rates are considered to prevail. The black horizontal lines in the right panel represent the 25th, 50th and 75th percentiles of the distribution across individual banks.

Limited aggregate exposures, however, mask substantial heterogeneity at bank level, mainly driven by differences in loan-rate fixation practices. In particular, significant institutions operating in countries with predominantly fixed interest rates would be, on aggregate, adversely affected under the scenario of rising interest rates, with an estimated decline in economic value of close to 6% of own funds. By contrast, banks in floating rate countries appear to benefit on aggregate from rate increases, with an estimated economic value increase of over 3% of own funds. Banks' interest rate risk exposures also vary significantly across institutions within these two country groups. For instance, around 25% of the significant institutions operating in fixed rate countries report a present value loss of more than 10% of own funds, while more than 40% of significant institutions in floating rate countries would see a decline (rather than an increase) in economic value (see [Chart 3.16](#) – right panel).

Bank solvency positions continued to improve, mainly due to increases in capital

The resilience of euro area banks continued to improve in 2017. The strengthening of banks' capital positions accelerated somewhat in 2017 following only a modest improvement in 2016. As a result, by end-2017, euro area significant institutions' aggregate fully loaded common equity Tier 1 (CET1) ratio reached a solid level of above 14%. While the improvement was broad-based across countries,

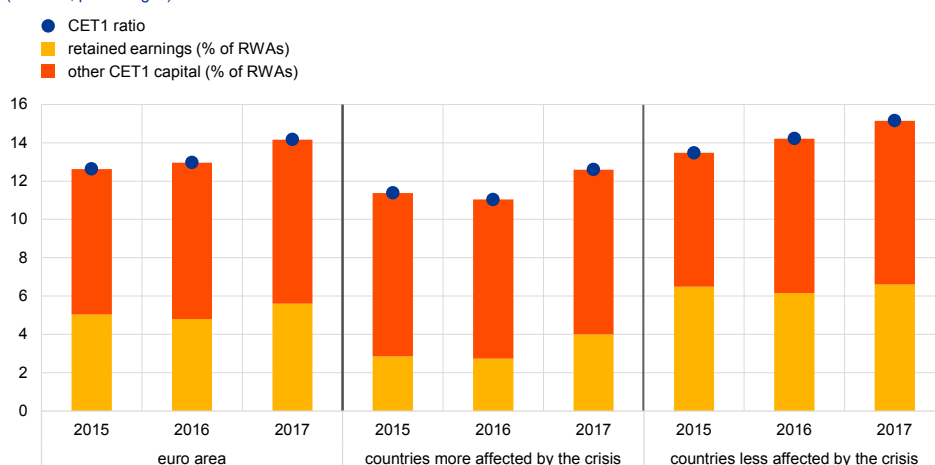
differences remain in banks' capital strength between country groups in the euro area. On aggregate, banks' fully loaded CET1 ratio in the countries more affected by the crisis remained well below that of banks in the other countries, mainly reflecting the lower level of internal capital generation through retained earnings (see **Chart 3.17**).

Chart 3.17

Solvency ratios continued to increase in 2017, but some heterogeneity remains in the levels, partly reflecting differences in internal capital generation

Euro area significant institutions' aggregate fully loaded CET1 ratios and the composition of CET1 capital

(2015-17, percentages)



Sources: ECB and ECB calculations.

Notes: Based on a balanced sample of 100 SIs. Countries more affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

The improvement in solvency ratios in 2017 was mainly driven by increases in capital, while asset deleveraging contributed to a lesser extent. A decomposition of changes in banks' aggregate fully loaded CET1 ratio reveals that higher retained earnings accounted for more than half of the annual improvement (see **Chart 3.18**), driven by banks in the countries more affected by the crisis (see also the section on profitability).⁵⁴ Regarding other factors, a decline in total assets made a positive contribution (driven by banks in the countries less affected by the crisis), while patterns in average risk weights diverged between the two country groups.

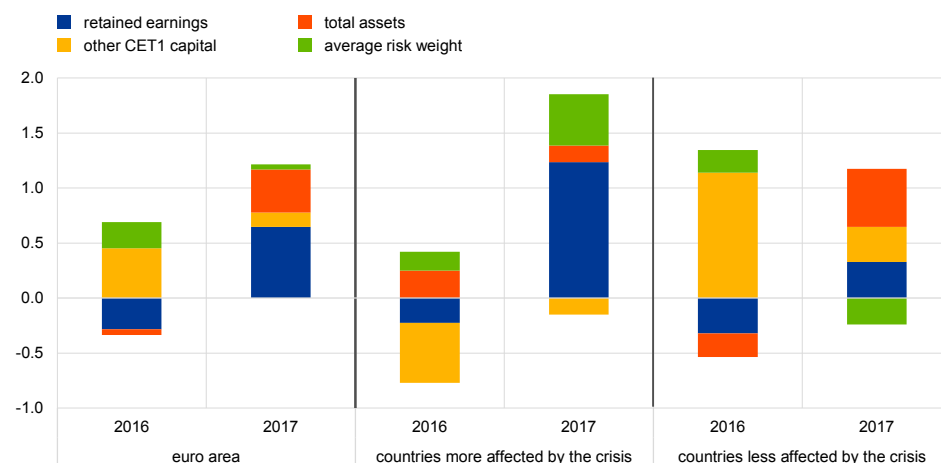
⁵⁴ The negative contribution of retained earnings in 2016 in the countries more affected by the crisis was mainly due to an aggregate loss recorded by banks in this country group.

Chart 3.18

The improvement in banks' aggregate fully loaded CET1 ratio in 2017 was mainly driven by increases in capital

Decomposition of changes in euro area significant institutions' aggregate fully loaded CET1 ratios in 2016 and 2017

(2016-17, percentage point contributions)



Sources: ECB and ECB calculations.

Notes: Changes in average risk weights and total assets are shown with the opposite sign as their decline (increase) indicates a positive (negative) contribution to the capital ratios. Based on a balanced sample of 100 SIs. Countries more affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

Looking ahead, banks' capital requirements will be impacted by the revised

Basel III framework. The impact assessment carried out by the EBA showed that, under the revised international standards, the minimum required capital for the EU sample subject to the exercise would increase by around 13% (on aggregate), corresponding to a 0.6 percentage point decline in the aggregate CET1 ratio. According to the EBA's analysis, the aggregate output floor is the main driver of the capital impact under the new standards, while revisions to the credit risk and operational risk frameworks have a more moderate impact.⁵⁵

Debt funding costs remain close to historical lows, but spreads on hybrid debt instruments may be susceptible to repricing

Conditions remained favourable across all segments of the market for bank

debt. Euro area bank bond spreads remained close to historical lows despite a bout of volatility in financial markets in February. Looking over a longer time horizon, spreads on subordinated bonds have narrowed significantly since mid-2016 in a period when the prices of most risky global asset classes have increased (see **Chart 3.19**). That said, the cost of hybrid securities in the euro area may be susceptible to repricing, as illustrated by, for instance, the decoupling of the price behaviour of additional Tier 1 (AT1) instruments from historical patterns as well as by the markedly increased sensitivity of AT1 spreads to changes in bank default risk (see **Box 8**).

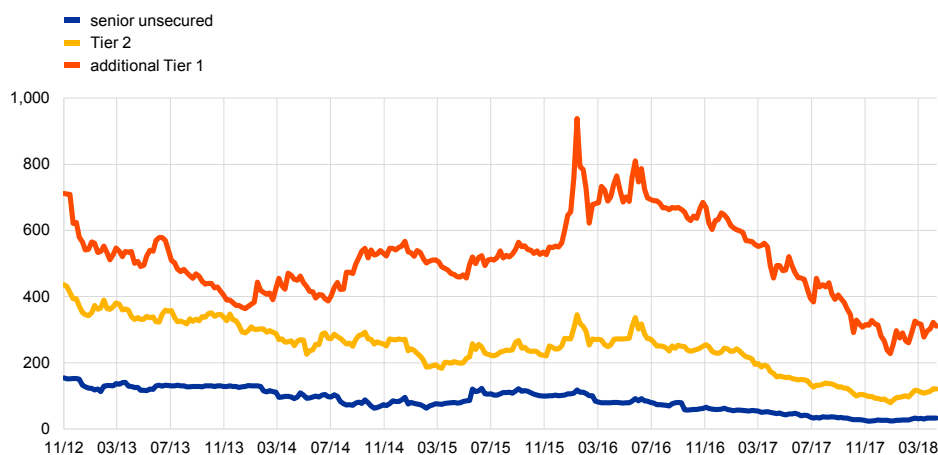
⁵⁵ See "Ad hoc cumulative impact assessment of the Basel reform package", EBA, 20 December 2017.

Chart 3.19

Bank bond spreads remain close to historical lows

Bond spreads of large euro area banks by debt instrument

(Nov. 2012 – May 2018, median Z-spreads in basis points)



Sources: Bloomberg and ECB calculations.

Notes: Based on a sample of 21 large euro area banks. Z-spreads are defined as the difference (in basis points) between the yield to maturity of a bank's bond and the yield of a maturity-matched euro swap.

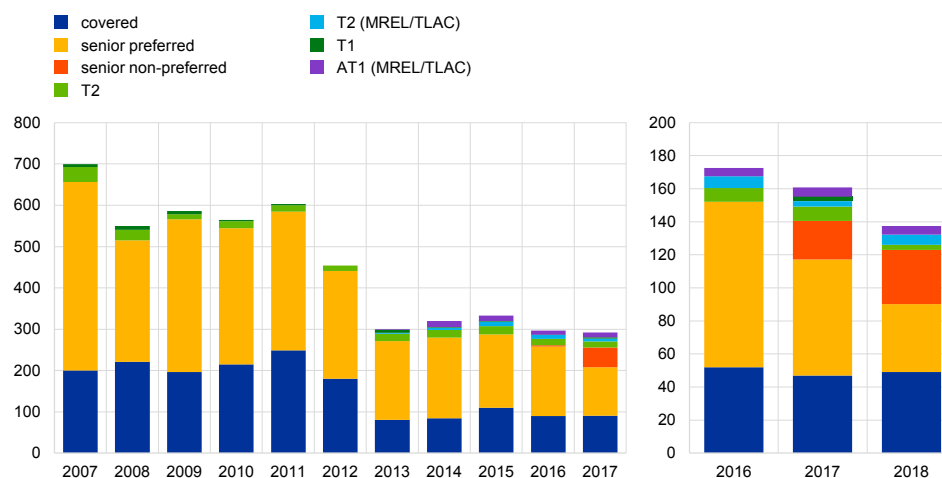
At the same time, banks' debt issuance activity is increasingly focused on building up loss-absorbing capacity. In particular, the share of non-preferred senior debt in total debt issuance further increased to around 25% in the first five months of 2018, more than double the share in the same period last year (see [Chart 3.20](#)). In the market for subordinated bonds, the share of Tier 2 (T2) debt increased at the expense of AT1 instruments, with issuance activity in the latter segment being affected by the bout of higher market volatility in February.

Chart 3.20

Banks' bond issuance is increasingly being driven by efforts to build up loss-absorbing capacity

Bond issuance by euro area banks by debt type

(2007-18, € billions; left panel: full-year; right panel: year-to-date)



Source: Dealogic.

Note: MREL stands for minimum requirement for own funds and eligible liabilities and TLAC for total loss-absorbing capacity.

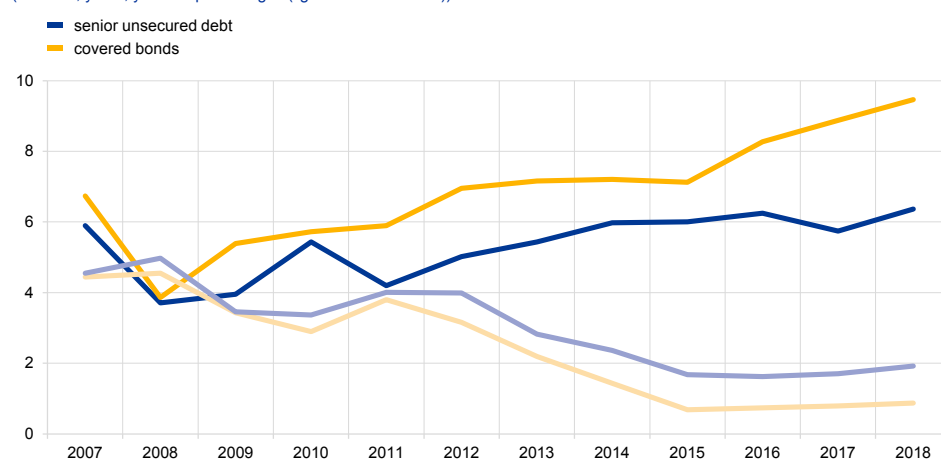
In the past few years there has also been a notable extension in the maturity of newly issued debt. The share of debt with an original maturity of less than five years has nearly halved since 2014, with banks aiming to lock in low debt funding costs for a longer period. The lengthening of bond maturities has been accompanied by a lowering of the cost of debt issuance since 2014 in both senior unsecured debt and covered bond markets (see [Chart 3.21](#)).

Chart 3.21

Banks have lengthened the maturities of newly issued bonds in a period of low funding costs

Yield at issuance and original maturity of senior unsecured debt and covered bonds

(2007-18, years, yields in percentages (lighter-coloured lines))



Sources: Dealogic and ECB calculations.
Note: Excludes non-preferred senior debt.

Nevertheless, a significant part of bank debt will mature in the next few years.

Close to one-third of outstanding bank debt will mature in the period from May 2018 to end-2020 (see [Chart 3.22](#)). Therefore, banks' funding costs remain vulnerable to an unexpected rise in long-term yields and risk premia, in particular in the market for subordinated bonds where pricing appears to have become increasingly sensitive to default risk (see [Box 8](#)). In addition, the market's ability to absorb the still significant volumes of MREL-eligible non-preferred senior debt that need to be issued could also be tested in an environment of reduced risk appetite, especially regarding issuances by banks with weaker fundamentals.⁵⁶

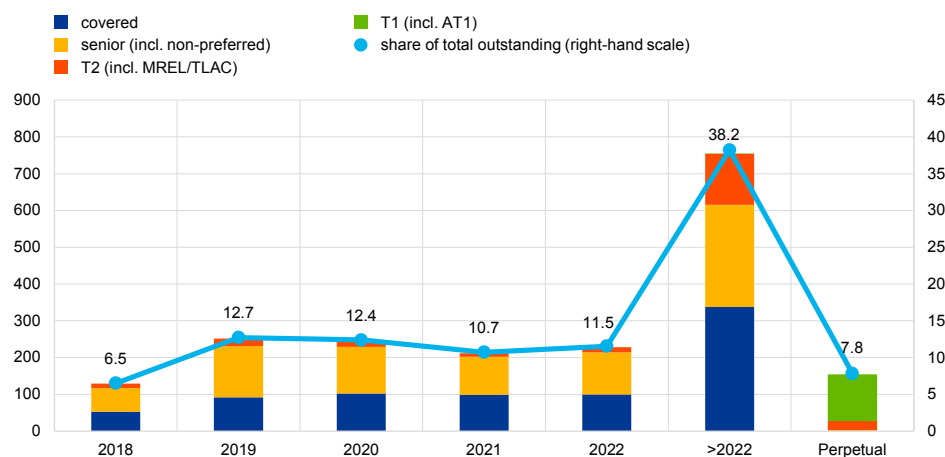
⁵⁶ See also the article entitled "MREL: financial stability implications", *Macprudential Bulletin*, Issue 4, ECB, December 2017.

Chart 3.22

A significant part of outstanding bank debt will mature in the next few years

Outstanding bank debt by year of maturity and debt type

(€ billions and percentages)



Sources: Dealogic and ECB calculations.

Regulatory liquidity ratios have increased over the last year and remain at solid levels.

Euro area significant institutions' aggregate liquidity coverage ratio (LCR) stood at 144% at end-2017, up from 136% a year earlier. The improvement was mainly driven by the significant increase in LCRs in euro, from 135% to around 160%. Regarding liquidity positions in the most significant foreign currencies, however, LCRs have declined over the last year or remained below 100%. In particular, banks' aggregate USD-based LCR dropped to 84% from 91% at end-2016, with some heterogeneity at bank level. This implies that while overall LCRs remain at comfortable levels, banks with LCRs of below 100% in foreign currencies (in particular USD) rely – to a varying extent – on well-functioning FX swap markets to cover short-term foreign currency mismatches, thereby leaving them vulnerable to periods of stress in these markets.

Box 8

Assessing the financial stability risks of a possible repricing in the market for subordinated bank bonds

Prepared by Magnus Andersson, Benjamin Klaus and Cristian Perales

The cost of subordinated bank debt in the euro area is low and may be susceptible to repricing.

Euro area bank bond yields and spreads have narrowed significantly since mid-2016, reaching levels last observed prior to the global financial crisis. The reductions have been particularly noticeable in the markets for subordinated bonds.⁵⁷ Against this background, this box first evaluates whether there are indications that the prices of these bonds may be vulnerable to a correction. It then assesses the potential financial implications stemming from a spread reversal in euro area subordinated bank bonds. The box focuses in particular on the holders of these

⁵⁷ It should be noted that this trend is not specific for the banking sector. Euro area non-financial firms' financing costs have also developed favourably over the same period.

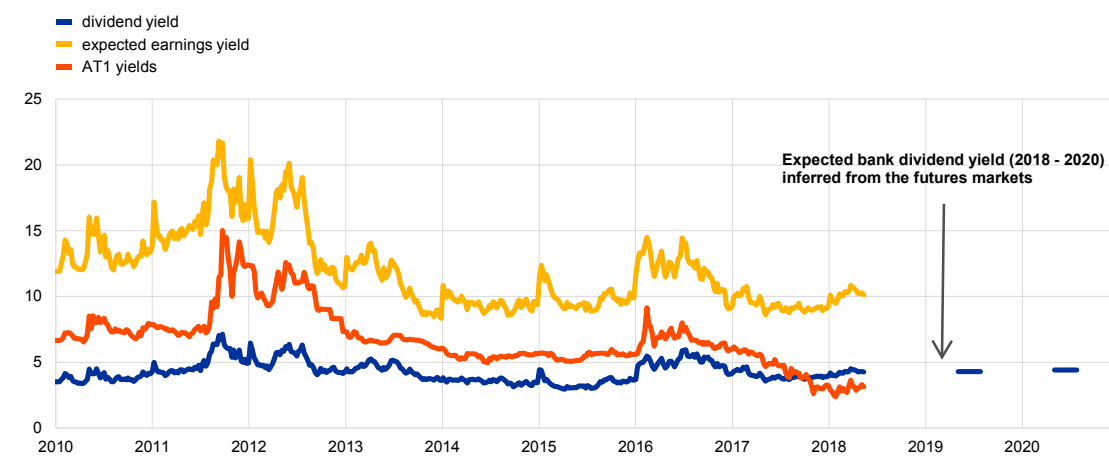
instruments and examines the sectors that may be particularly vulnerable to a turnaround in this market.

Chart A

Yields on subordinated bank debt decoupling from expected returns on bank equities

One-year-ahead dividend and earnings yield expectations and AT1 yields for euro area banks

(Jan. 2010 – May 2018; percentages per annum, median AT1 yield, index-average of earnings yield)



Sources: Bloomberg and ECB calculations.

Notes: The dividend and earnings yield series are based on the EURO STOXX bank index. The AT1 sample of banks consists of 21 large euro area banks.

The price behaviour of euro area subordinated bank debt has decoupled from historical patterns. Additional Tier 1 (AT1) bonds bear some similarities to bank equity owing to their hybrid features, and it would not be unreasonable to expect these similarities to be mirrored in the expected returns on AT1 debt and bank equity. Indeed, until mid-2016, yields on these instruments fluctuated broadly in tandem. Since then, however, yields on AT1 bonds have dropped sharply, thereby decoupling from the stable expected returns observed for bank equities (see **Chart A**).⁵⁸ This suggests that there is scope for a widening of spreads in AT1 bonds should the historical relationship be reinstated.⁵⁹ Furthermore, the sensitivity of AT1 spreads to changes in bank credit default swap (CDS) spreads (the latter being an indicator of bank default risk) has increased markedly in the past few years (see **Chart B**). This suggests that the introduction of the Bank Recovery and Resolution Directive (BRRD) may have clarified the level of risk attached to bank bonds and the relative riskiness of different instruments. At the same time, it points to sizeable upward risks to spreads on subordinated bank debt instruments should markets reassess the outlook for bank solvency.

⁵⁸ Some caution should be taken when interpreting dividend yields from a valuation perspective as banks (and non-financial corporations) tend to smooth their dividends out by varying the payout ratio.

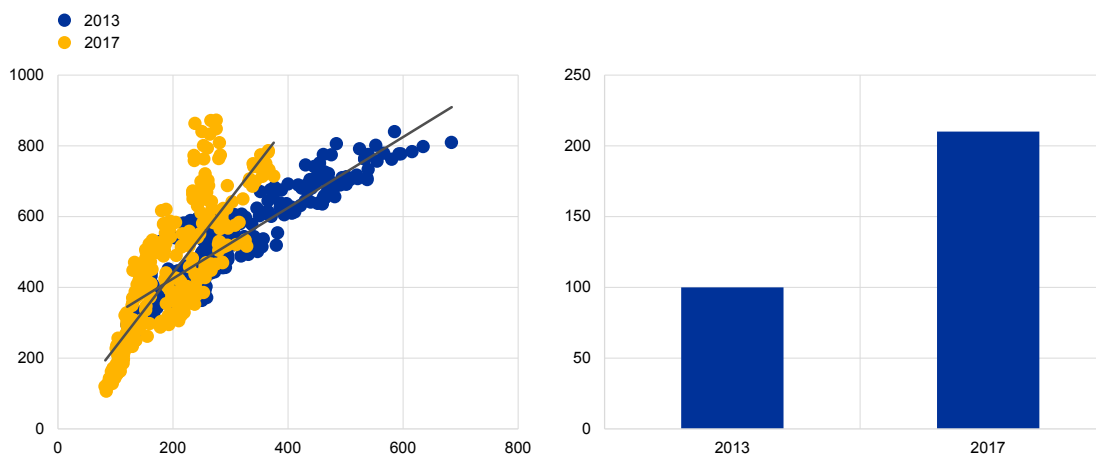
⁵⁹ When drawing inferences from this historical relationship, the significant differences in liquidity in the respective markets need to be borne in mind.

Chart B

The pricing of subordinated bank debt is increasingly sensitive to default risk

AT1 bond spreads (y-axis) against CDS spreads (x-axis) (left panel) and impact of a 100 bp CDS spread shock on AT1 spreads (right panel)

(2013 and 2017; weekly data; basis points)



Sources: Bloomberg and ECB calculations.

Notes: The AT1 sample of banks consists of 21 large euro area banks. CDS spreads are for five-year subordinated instruments. The impact of a CDS spread shock on AT1 spreads as shown in the right panel reflects the relationship of both variables in each year as shown in the left panel.

Euro area investors have increased their holdings of subordinated bonds issued by euro

area banks, but with marked differences across sectors. The market for subordinated debt has grown sharply since 2013⁶⁰ (see **Chart C** – left panel). Both supply and demand factors can explain this increase. From a bank perspective, these instruments have gained in importance owing to regulatory changes aimed at enhancing the resilience of the banking system, such as the minimum requirement for own funds and eligible liabilities (MREL). From an investor viewpoint, these instruments can provide an attractive vehicle to earn somewhat higher returns compared to other fixed-income assets in a low interest rate environment. Two significant dynamics across sectoral holdings can be observed over the same period (see **Chart C** – right panel). First, investment funds have increased their holdings of AT1 debt considerably and have become the main investors in these instruments, representing 62% of total euro area holdings in the second quarter of 2017, up from 15% in the fourth quarter of 2013. Second, the reliance of banks on household funding for subordinated debt has been reduced quite significantly since 2013. Nonetheless, the household sector still accounted for 22% of euro area holdings of Tier 2 (T2) instruments in the second quarter of 2017, down from 38% in the fourth quarter of 2013.

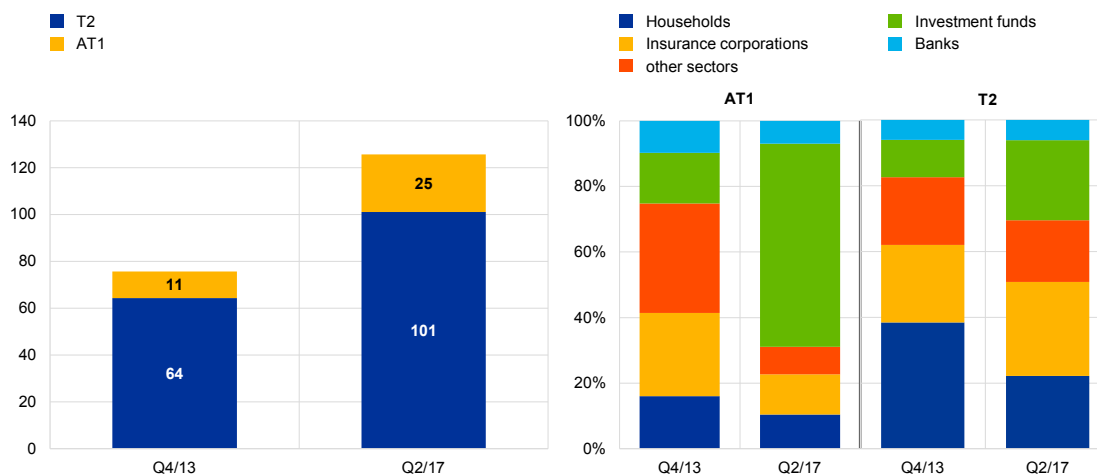
⁶⁰ The first reference period is the fourth quarter of 2013 as this is the first period for which the securities holdings statistics data are available. In addition, this period reflects the portfolio holdings of the different sectors ahead of the implementation of the BRRD.

Chart C

Euro area investors have increased their holdings of subordinated bank debt and the investor base has shifted substantially towards investment funds

Euro area holdings of debt securities of significant banks by type of debt (left panel) and euro area holdings of debt securities of significant banks by holding sector and type of debt (right panel)

(Q4 2013 and Q2 2017; EUR billions and percentages)



Sources: Bloomberg, ECB and ECB calculations.

Notes: The sample consists of around 100 euro area significant banks. The large share of AT1 bonds held by “other sectors” in the fourth quarter of 2013 (right panel) was due to a government intervention in an ailing bank.

The financial stability implications of a potential increase in spreads on euro area bank bonds partly depend on who the holders of these bonds are.

Although investment funds are professionally managed and should therefore have a sufficient understanding of the risks of investing in such assets, they are often “open-ended” funds which promise investors daily liquidity. Consequently, they could amplify price movements as a result of outflows if the bonds trigger losses. Furthermore, if the widening of bank bond spreads is associated with profound concerns about a bank’s solvency, large household exposures to T2 instruments might reduce the resolvability and loss-absorption capacity of the issuing bank owing to, for example, concerns about mis-selling and associated legal liabilities.⁶¹ This may render a market solution and resolution more difficult. Finally, banks themselves have very low exposures to T2 instruments, and this limits the scope for direct contagion effects in such a scenario.

3.2 The non-bank financial sector continues to become larger, more interconnected and more exposed to risks

Assets of the key components of the non-bank financial sector continued to grow in the second half of 2017. The investment fund sector expanded by close to 4% over this period and thus continued on its longer-term growth path. This sector

⁶¹ See [Opinion of the European Central Bank of 8 November 2017 on revisions to the Union crisis management framework \(CON/2017/47\)](#).

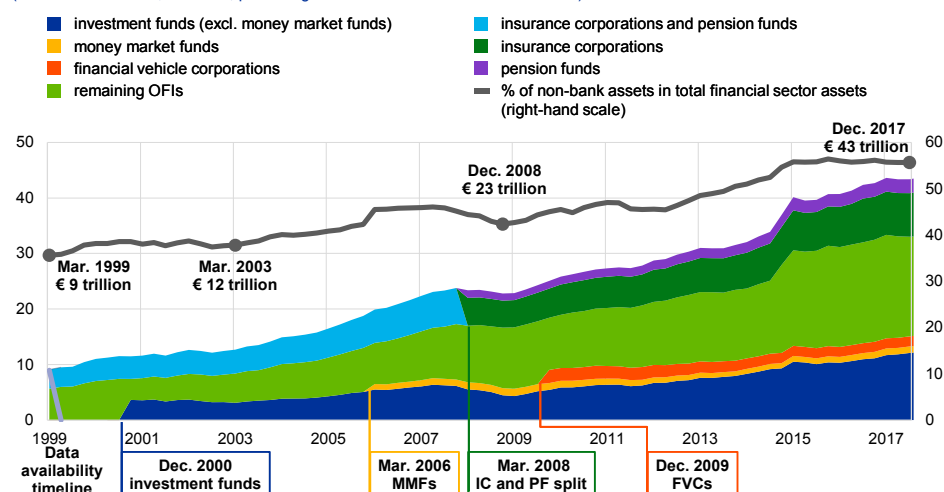
has accounted for much of the expansion of the non-bank financial sector since the crisis (see [Chart 3.23](#)). The assets of insurers and pension funds also grew in the last two quarters of 2017, but at a slower pace. The rapid growth of the broader non-bank financial sector seen after the global financial crisis nevertheless stalled in the second half of 2017, mainly reflecting a decline in the assets of the remaining other financial institutions (residual OFIs). At the end of 2017, the share of total financial sector assets held by the broader non-bank financial sector stood at about 56% though some of these assets are closely linked to the banking sector – for instance, through asset management operations controlled by banks or through banks’ securitisation activities.

Chart 3.23

Key components of the euro area non-bank financial sector continued to grow in the second half of 2017

Assets of the non-bank financial sector

(Q1 1999 – Q4 2017, € trillions, percentage of total assets of the financial sector)



Sources: ECB (euro area accounts and balance sheet data of individual sectors) and ECB calculations.

Notes: A breakdown of data for investment funds, money market funds, financial vehicle corporations, and insurance corporations and pension funds is available only from the indicated dates onwards. Remaining OFIs (sometimes also referred to as the “OFI residual”) refer to non-monetary financial corporations excluding the sectors depicted in the chart (where data for these sectors are available).

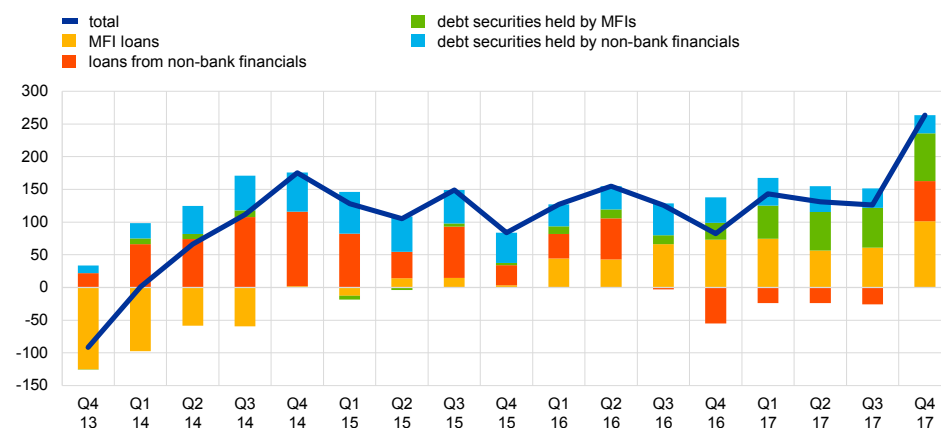
The medium-term growth of the non-bank financial sector reflects its role in financing the euro area economy. In the aftermath of the euro area sovereign debt crisis, non-bank financial institutions continued to provide funding to non-financial corporations (NFCs) when the net flow of bank loans turned negative (see [Chart 3.24](#)). More recently, the share of non-bank financials in lending to the euro area economy has declined, as lending by banks has been recovering. At the same time, non-banks continue to provide a steady net flow of financing to NFCs, especially through the purchase of debt securities, which helps NFCs to diversify their funding sources.

Chart 3.24

The relative importance of non-banks in the financing of the euro area economy has declined somewhat

Debt financing of NFCs from the euro area financial sector

(Q4 2013 – Q4 2017, € billions, annual flows)



Sources: ECB euro area accounts and ECB calculations.

The increasing size of the non-bank financial sector has also been accompanied by greater interconnectedness within this sector.

Insurance corporations and pension funds (ICPFs) represent by far the largest and most rapidly growing investor base for investment funds (see [Chart 3.25](#)). At the end of 2017, they held around €3.3 trillion of investment fund shares, accounting for 34% of ICPFs' financial assets, up from €2.0 trillion at the end of 2012.⁶² Furthermore, investment funds themselves invest 18% of their portfolio in other investment funds. These intra-sectoral holdings have doubled over the past five years, amounting to almost €2.0 trillion at the end of 2017. This contrasts with the relatively low exposure of banks to investment funds, which accounts for only around 1% of their financial assets.

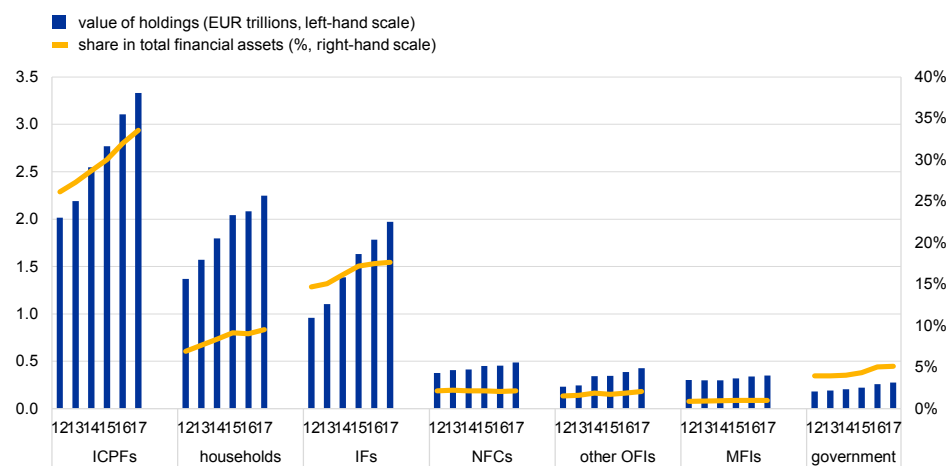
⁶² ICPFs have various incentives to invest their asset holdings in funds. For instance, the Deutsche Bundesbank has recently pointed out that such incentives can be related to a specific institutional framework. In the case of German life insurers, fund earnings that are paid out are recognised as income and are required to be allocated among policyholders and shareholders. However, earnings retained by a fund are not taken to insurers' income statements and, therefore, can be used by insurers to cushion possible future losses. See [Financial Stability Review 2017](#), Deutsche Bundesbank, p. 93.

Chart 3.25

Euro area non-bank entities are highly interconnected through direct exposures...

Holdings of investment fund shares by euro area sectors

(Q4 2012 – Q4 2017, € trillions (left-hand scale), percentage of total financial assets of the corresponding sector (right-hand scale))



Sources: ECB euro area accounts and ECB calculations.

Non-banks' interconnectedness through common asset holdings has been on the rise, which has increased the risk of contagion via this channel. Both ICPFs and investment funds (IFs) tend to allocate their portfolio holdings more broadly across countries and sectors compared with banks that invest a larger share of assets domestically. As a result, the securities portfolios of ICPFs and IFs show a high degree of similarity across euro area countries – both within and between the two sectors (see [Chart 3.26](#)). Compared with the end of 2013, the similarity indicator has increased significantly, mostly across ICPFs and IFs, indicating higher cross-border interconnectedness through common asset holdings. The degree of portfolio similarity exhibited in the banking sector is smaller, but indirect contagion via common exposures may still play a role if asset prices are correlated across countries or sectors. In general, cross-border investments of euro area non-banks have the benefit of international portfolio diversification, but they may also become a channel for inward spillovers originating from shocks in global financial markets.⁶³

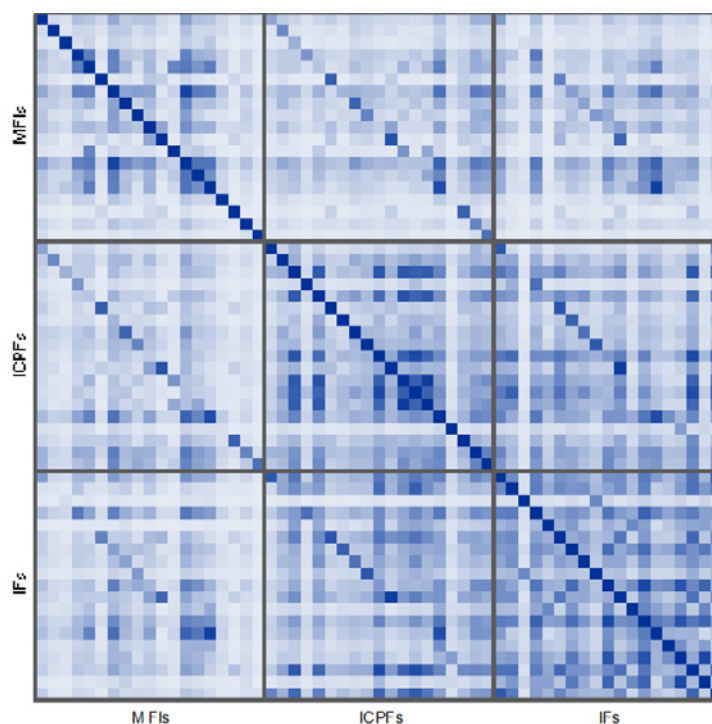
⁶³ See [Financial integration in Europe](#), ECB, May 2018, Special Feature B.

Chart 3.26

...and the same applies to indirect exposures via common asset holdings

Similarity of portfolios

(white colour = no similarity, dark blue colour = identical portfolios; Q3 2017)



Sources: ECB Securities Holdings Statistics by Sector and ECB calculations.

Notes: Based on the cosine similarity indicator, which measures the level of commonality between pairs of portfolios (see Getmansky, M., Girardi, G., Hanley, K.W., Nikolova, S. and Pelizzon, L., 2016, "Portfolio similarity and asset liquidation in the insurance industry", working paper). The indicator equals zero (white colour) if the portfolio allocations of two country-sectors are uncorrelated and equals one (dark blue colour) if they are the same. Colours within this range quantify the degree of similarity. Assets belong to the same group if they are issued in the same country/region, by the same sector and are of the same instrument type. The chart is symmetric. Euro area countries (not shown) are ordered alphabetically.

Shifts in the composition of the corporate bond portfolios of euro area non-banks suggest that risk-taking has gone up. The exposure of euro area non-banks to credit risk – as measured by credit ratings – has increased over the past few years (see **Chart 3.27**). 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 holdings, rather than by a decline in the rating quality of the securities held.⁶⁴ Between the end of 2013 and mid-2017, the share of riskier financial and non-financial corporate bonds – namely those with a credit rating of BBB or below – in the total bond portfolio of ICPFs and investment funds and within their corporate bond portfolios has increased, while decreasing sharply for banks (see **Chart 3.28**). These developments expose ICPFs and investment funds to greater credit and market risk against the backdrop of potentially stretched valuations in high-yield corporate bond markets (see Chapter 2).

Investment funds have also significantly increased the duration of their portfolios, as proxied by residual maturity (see **Chart 3.27**). These portfolio shifts

⁶⁴ See [Financial Stability Review](#), ECB, November 2015, Box 7.

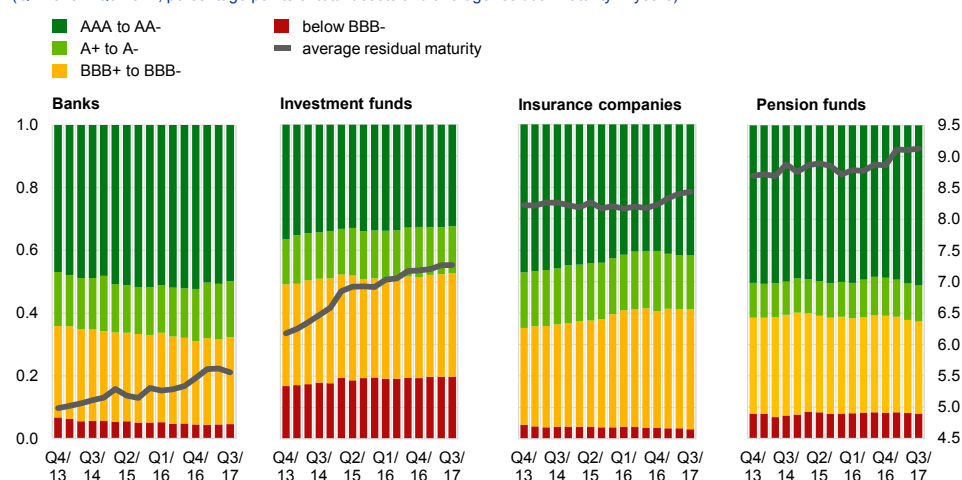
have further exacerbated the maturity mismatch among bond funds offering daily redemptions and increased their sensitivity to changes in interest rates. By contrast, the slight increase in the duration of ICPFs' portfolios is less of a concern, given that many euro area ICPFs have a negative duration gap and so an increase in the duration of assets may actually reduce duration risk on ICPFs' balance sheets.

Chart 3.27

Investment funds increased their holdings of lower-rated debt securities and the residual maturities of their portfolios

Euro area financial institutions' holdings of debt securities, broken down by rating and sector

(Q4 2013 – Q3 2017; percentage points of total assets and average residual maturity in years)



Sources: ECB Securities Holdings Statistics by Sector and ECB calculations.

Notes: The first three rating categories correspond to credit quality steps defined in accordance with the Eurosystem credit assessment framework (ECAAF). A fourth category is added which includes all rated securities with a rating below credit quality step three (i.e. below BBB-). 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. Long- and short-term, euro- and foreign currency-denominated debt securities are included in the computation of residual maturity only if they have an ISIN reported, are considered "alive" and have a residual maturity of up to 30 years. Banks hold a particularly large share of securities with a reported maturity exceeding 30 years for which precise information is less reliable (e.g. for securities without a definite date of maturity) and which are therefore excluded. 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.

Increasing exposures to US corporate bonds and equities account for a significant part of the shift in non-bank portfolios (see Chart 3.28).

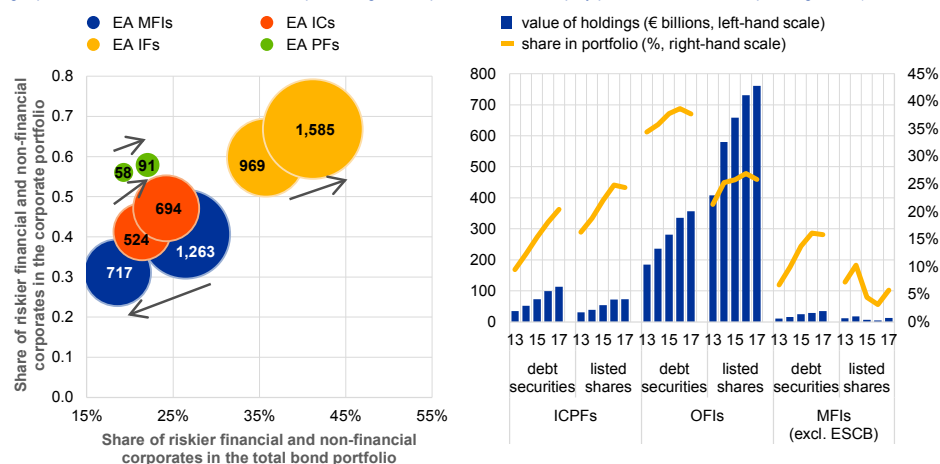
In the euro area, the OFI sector (including investment funds) is the main holder of US corporate bonds and listed shares in terms of both volume and the share of these securities in total holdings. US corporate bonds and listed shares currently represent about 40% and 25% respectively of OFIs' corporate bond and equity portfolios. ICPFs and MFIs have also increased their exposures to US non-financial corporates in recent years. US equity valuations are historically high and have further increased over the review period (see Chapter 2). These exposures can represent an elevated risk in non-banks' portfolios in the event of a sudden correction.

Chart 3.28

Euro area non-banks have increased exposures to riskier corporate bonds and to US corporate bonds and equity

Holdings of riskier corporate bonds (left panel) and US corporate securities (right panel)

(left panel: Q4 2013 – Q3 2017, € billions, y-axis: percentage of corporate bond portfolio; x-axis: percentage of total bond portfolio; right panel: Q4 2013 – Q4 2017, € billions, percentage of corporate bond and equity portfolios of the corresponding sector)



Sources: ECB Securities Holdings Statistics by Sector and ECB calculations.

Notes: "Riskier" bonds refer to BBB and lower-rated bonds, as well as unrated bonds. The size of the bubble reflects the value of risky corporate bonds. The MFI sector excludes the European System of Central Banks (ESCB). US corporate bonds and equities refer to bonds and equities issued by US non-financial firms only.

Euro area non-bank financial institutions are also exposed to vulnerabilities in the real estate market, which are high in some countries. As previously

highlighted in the FSR, mortgage lending to households by euro area non-bank financial institutions grew over the last decade and has reached significant volumes in some euro area countries. For instance, in the Netherlands, ICPFs financed 28% of new mortgages in 2016.⁶⁵ According to EIOPA, insurers are exposed to the real estate sector, both directly by investing in mortgages and in loans and equity of real estate corporations, and indirectly via shares of investment funds operating in real estate.⁶⁶ Such exposure accounts for around 7% of the total assets of the euro area insurance sector but is much more pronounced in some countries, particularly those with stretched property prices. In particular, insurers in the Netherlands (17%), Finland (13%), Belgium (12%) and Austria (11%) have the largest exposures and these were all countries which received a warning on residential real estate vulnerabilities from the ESRB in 2016.⁶⁷

Euro area insurers continued to weather the low-yield environment and sustained exceptionally costly catastrophes in 2017

The market outlook for euro area insurers differs across insurer types. Life insurers' equity prices continued to appreciate during most of the review period,

⁶⁵ See [Financial Stability Review](#), ECB, May 2017, Box 7.

⁶⁶ See [Financial Stability Report](#), EIOPA, December 2017, Box 5.

⁶⁷ See [Vulnerabilities in the EU residential real estate sector](#), ESRB, November 2016.

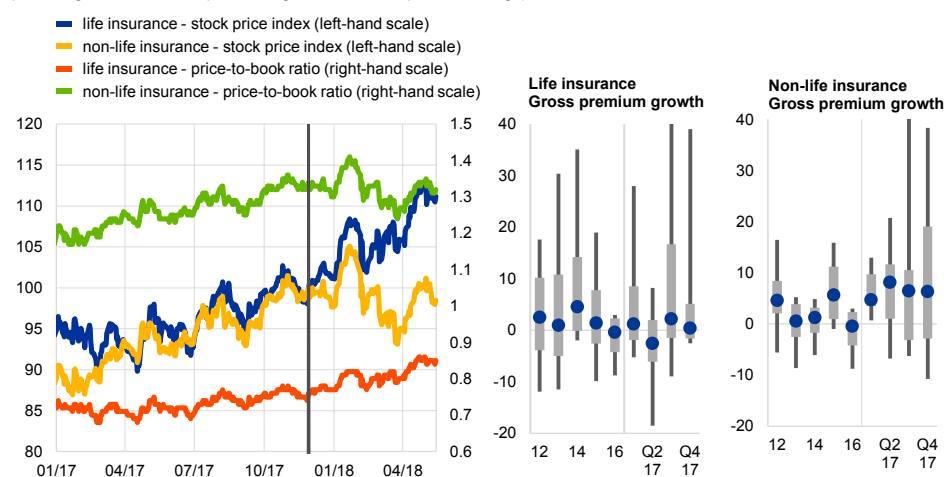
supported by stronger economic growth, favourable global financial sentiment and solid premium growth (see [Chart 3.29](#)). This was also reflected in improving price-to-book ratios of life insurers, which climbed from around 0.7 to over 0.8 over the last year. By historical standards, however, the price-to-book ratios remain at very low levels as life insurers continue to face profitability headwinds from the still low level of yields. By contrast, price-to-book ratios of non-life insurers have been hovering above 1 in recent years since non-life business is somewhat less affected by the prevailing low-yield environment. In early 2018, the ratios declined slightly, owing inter alia to exceptionally large catastrophe costs in the second half of 2017, but they rebounded to over 1.3 towards the end of the review period.

Chart 3.29

Financial performance differed by type of business

Stock prices, price-to-book ratios and gross premium growth

(left panel: 1 Jan. 2017 – 4 May 2018, daily observations, stock prices indexed to 100 on 29 Nov. 2017; right panel: 2012 – Q4 2017, percentages, median, interquartile range and 10th-90th percentile range)



Sources: Thomson Reuters Datastream, Bloomberg, individual institutions' financial reports and ECB calculations. Notes: The vertical line in the left panel indicates the publication date of the November 2017 FSR (29 November 2017). The right panel is based on a sample of 27 large insurers and reinsurers with total combined assets of about €4.98 trillion in 2017, which represent around 62% of the assets in the euro area insurance sector. Quarterly data are only available for a sub-sample of these insurers.

Recently rising yields are bolstering the profitability outlook for the life insurance sector.

Increasing yields help life insurers with a significant share of guaranteed-rate policies to overcome recent difficulties in generating investment returns above the average guaranteed rate on existing business. In addition to this slow-moving “income channel”, higher long-term yields also have an immediate effect on the valuation of insurers’ balance sheets (“balance sheet channel”). Specifically, an increase in the “risk-free” rate of interest induces declines in the values of both assets and liabilities but the drop on the liabilities side typically exceeds that on the assets side, thereby resulting in a positive balance sheet effect. Although life insurers have shifted their product mix away from policies with guaranteed rates towards unit-linked products, i.e. products in which investment risk is borne by the policyholder (see [Chart 3.30](#)), new business represents only a small fraction of existing policies. So the recent rise in yields is likely to have been an important driver of the overall improving outlook for life insurers. However, future rises in yields – should they be too abrupt and pronounced – could also bring some

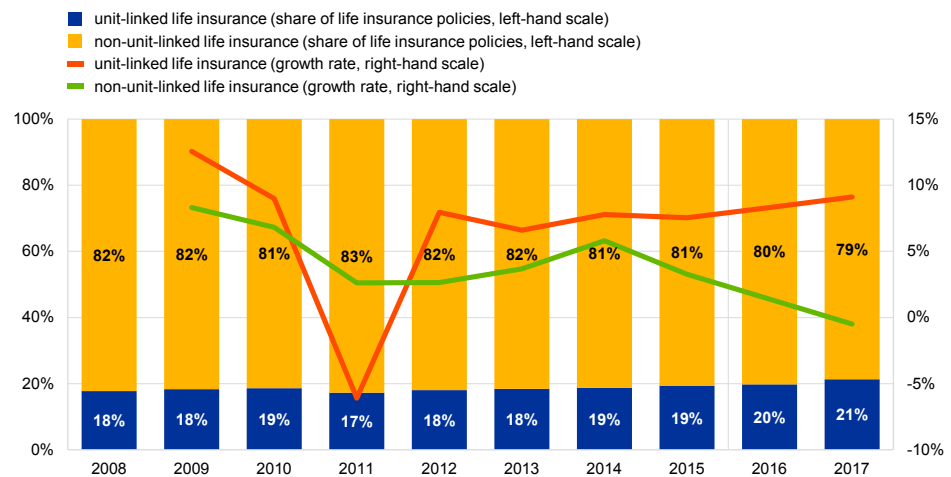
drawbacks such as an increase in policy lapses, i.e. premature terminations of insurance policy contracts.

Chart 3.30

Unit-linked life insurance business has been growing

Life insurance business broken down by product type

(2008-17, percentage of life insurance policies (left-hand scale), annual growth rate (right-hand scale))



Sources: ECB (insurance corporation balance sheet statistics) and ECB calculations.

Notes: The solid vertical line indicates a structural break due to the changes in the ECB's insurance corporation balance sheet data. The growth rates in 2016 are interpolated using the values in 2015 and 2017.

On the non-life insurance side, reinsurers weathered in 2017 the most costly year on record in terms of insured natural catastrophe losses.⁶⁸ The

exceptionally large losses dented in particular the earnings of the three large euro area reinsurers in the third quarter of 2017, with negative repercussions for their return on equity (see [Chart 3.31](#)). The costs also pushed up the combined ratios of reinsurers to levels over 100% in that quarter.⁶⁹ But overall, they only had a limited impact on Solvency Capital Requirement (SCR) ratios, which remained well above 200% for all three large euro area reinsurers. In January 2018, reinsurance premiums increased on the back of elevated demand for reinsurance after the string of large catastrophes – but at a lower rate than anticipated by some market participants. As a result, the outlook for reinsurers' profitability has not changed materially.

⁶⁸ According to Swiss Re, insured natural catastrophe losses in 2017 totalled USD 144 billion and were pushed up by a number of devastating Atlantic hurricanes (Hurricanes Harvey, Irma and Maria). For more details, see [Financial Stability Review](#), ECB, November 2017, pp. 86-88.

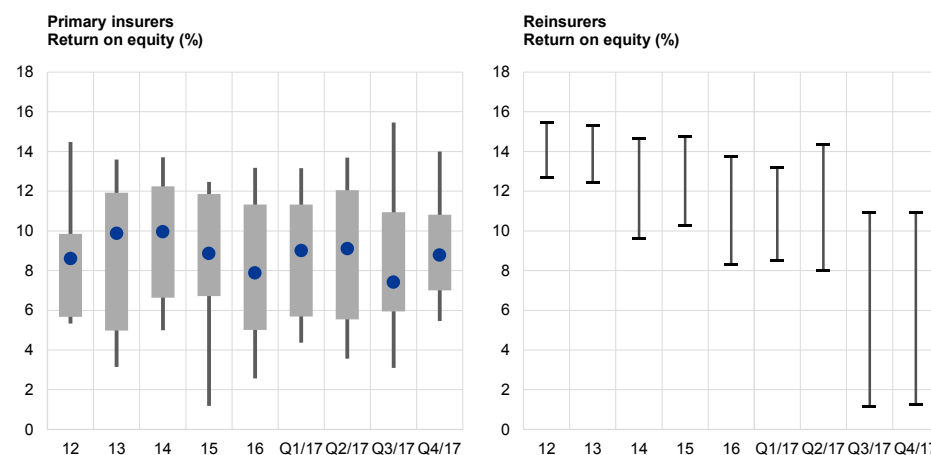
⁶⁹ Combined ratios measure incurred losses and expenses as a proportion of premiums earned, so that values above 100% indicate that incurred losses and expenses exceeded premiums earned. Typically, a one-off rise in combined ratios due to exceptionally large losses is not a source of concern. But combined ratios that remain above 100% over a prolonged period may indicate that insurers are not managing the balance between the costs and underwriting profits of their ongoing business in a sustainable manner.

Chart 3.31

Reinsurers' return on equity dropped in the second half of 2017, owing to high catastrophe costs

Return on equity for a sample of large euro area insurers

(left panel: 2012 – Q4 2017, percentages, median, interquartile range and 10th-90th percentile range; right panel: 2012 – Q4 2017, percentages, minimum and maximum)



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

Notes: Quarterly data are annualised. Based on a sample of 24 large insurers and 3 reinsurers with total combined assets of about €4.98 trillion in 2017, which represent around 62% of the assets in the euro area insurance sector. Quarterly data are only available for a sub-sample of these insurers.

The solvency positions of euro area insurers vary widely across countries, but the majority of SCR ratios remain well above the regulatory requirement of 100% (see [Chart 3.32](#)). In some countries, SCR ratios have even been increasing slightly, owing to rising yields. However, the comparability of reported SCR ratios is affected by several factors such as the option to use (full or partial) internal models and a number of long-term guarantee (LTG) and equity risk measures.⁷⁰ In particular, a recent report published by EIOPA confirms a high degree of cross-country heterogeneity both in terms of the type and number of measures used and of the impact they have on the solvency position.⁷¹ Overall, the results show that the LTG measures produce lasting positive effects on the regulatory solvency position of some insurers even in situations of low market volatility. EIOPA is conducting impact assessments to consider whether a revision of the rules is warranted.

⁷⁰ The LTG and equity risk measures that affect the calculation of the SCR ratio include the volatility and matching adjustments, the symmetric adjustment mechanism to the equity risk charge, extrapolation and transitional benefits. These measures mitigate artificial volatility in insurers' balance sheets, but they also make the reported SCR ratios more difficult to compare.

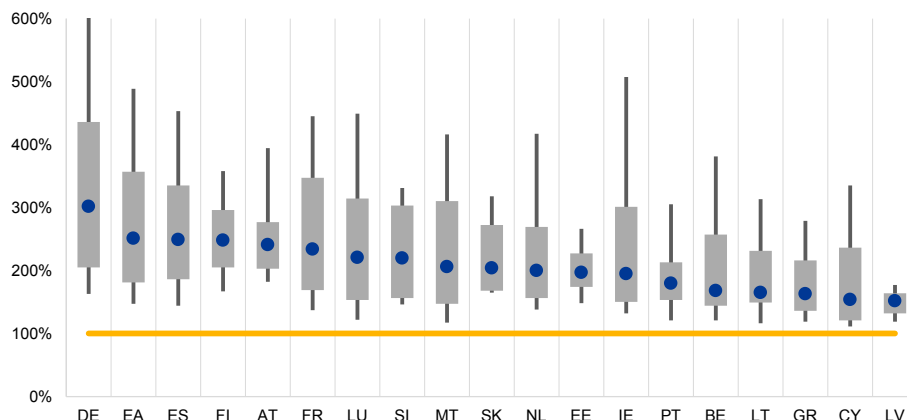
⁷¹ See "[Report on long-term guarantees measures and measures on equity risk](#)", EIOPA, 20 December 2017.

Chart 3.32

SCR ratios vary widely across countries, but remain well above the regulatory requirement of 100% for the majority of euro area insurers

SCR ratios

(Q3 2017, percentages, median, interquartile range and 10th-90th percentile range)



Sources: EIOPA (quarterly solo data) and ECB calculations.

Notes: The SCR ratio (sometimes referred to as the “Solvency II ratio”) is calculated as total available capital resources over the Solvency Capital Requirement (SCR). The latter is calibrated using the value at risk (VaR) of the basic funds of a company subject to a confidence level of 99.5% over a one-year period. A ratio over 100% indicates that an insurance firm has available capital resources that exceed the SCR, i.e. the capital levels exceed the regulatory requirement for a “healthy” insurer.

Although several indicators suggest that insurers continue to cope with the prevailing low-yield environment, this has been accompanied by increased risk in investment portfolios of some firms. Looking ahead, these portfolio shifts need to be monitored carefully, also in light of the potential pro-cyclicality of insurers’ investment behaviour which might aggravate the impact of a potential repricing of risk premia in global financial markets.⁷²

Investment fund inflows weaken in the wake of rising yields, lower returns and increased volatility

Bond fund returns have gradually deteriorated since the beginning of last year and have recently become negative. Taking on more credit and duration risk over the past few years has helped asset managers generate attractive returns on a risk-adjusted basis amid generally low yields across the globe. Average returns for euro area bond funds deteriorated markedly over the past year due to rising yields in global bond markets. These funds were on average still yielding a significant gain on an annual basis (see [Chart 3.33](#)). But incentives to place new money in these funds have gradually diminished, due to stretched bond valuations and the slowly vanishing advantage of holding bond fund shares compared with holding cash. The performance of high-yield and investment-grade corporate bond funds, as well as emerging market funds, deteriorated further in the review period.

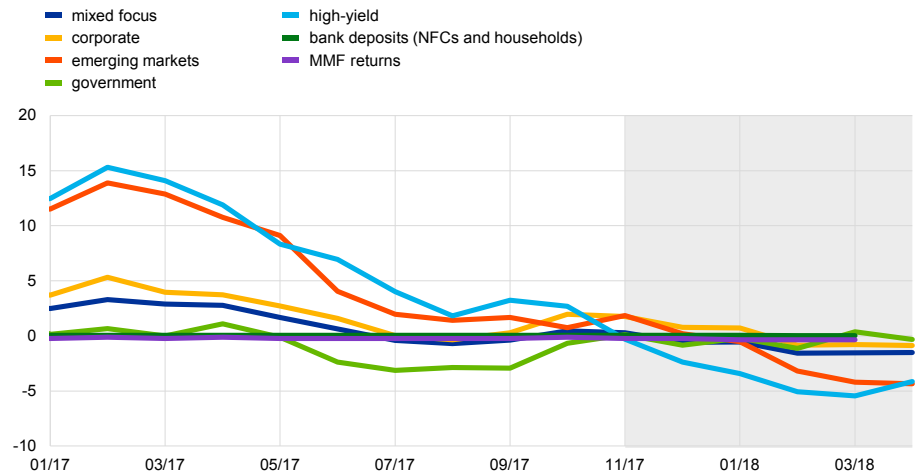
⁷² See [Financial Stability Review](#), ECB, November 2017, Chapter 2 and Box 5.

Chart 3.33

Average returns for all bond fund types declined substantially during the last year

Annual returns for euro area bond funds in comparison with bank deposits and MMF returns

(Jan. 2017 – Apr. 2018, percentages)



Sources: Lipper, EPFR, ECB and ECB calculations.

Notes: Based on a selected sample of traditional bond funds and exchange-traded funds (ETFs); euro area fund domicile. Annual returns are weighted by the fund value. The grey-shaded area indicates the period since the last FSR was published in November 2017.

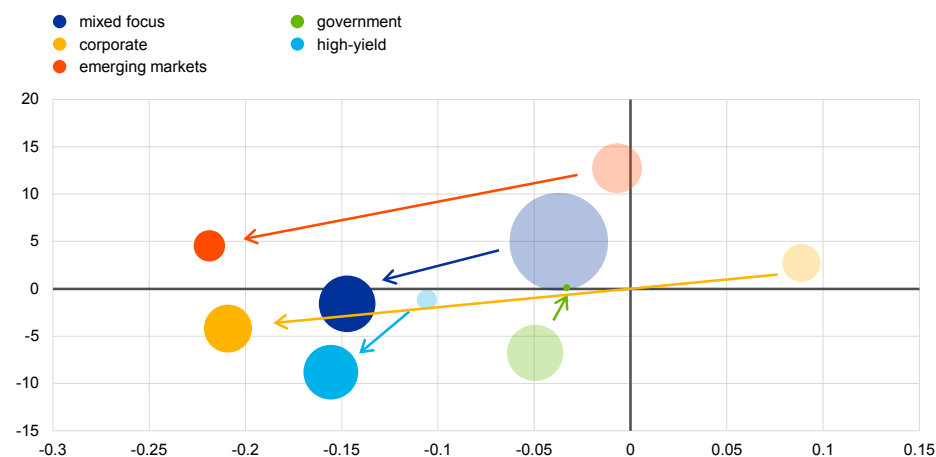
Broader-based outflows from bond funds could be observed as returns have deteriorated since the end of last year. Since November 2017, most bond fund types have experienced net outflows, except for emerging market bond funds which continued to receive net inflows, although much less than previously (see [Chart 3.34](#)). In addition, the outflows from government bond funds observed before November 2017 have attenuated in response to better performance. Interestingly, most bond funds still attracted net inflows until November 2017, which was exceptional from a historical perspective, as investors responded to deteriorating returns by withdrawing their money much later compared with previous episodes.

Chart 3.34

Broader-based net outflows from bond funds as returns deteriorated since the end of last year

Performance and cumulative flows of euro area bond funds for selected periods

(Jan. – Nov. 2017, Dec. 2017 – Apr. 2018; x-axis: average monthly returns; y-axis: cumulative flows as a percentage of NAV)



Sources: Lipper and ECB calculations.

Notes: Based on a selected sample of traditional bond funds and ETFs; euro area fund domicile. The size of the bubbles corresponds to cumulated net flows for the respective period. The transparent bubbles represent the period Jan.-Nov. 2017, while the solid bubbles represent the period Dec. 2017-Apr. 2018 (i.e. the period since the last FSR was published in November 2017). The arrows indicate shifts over time.

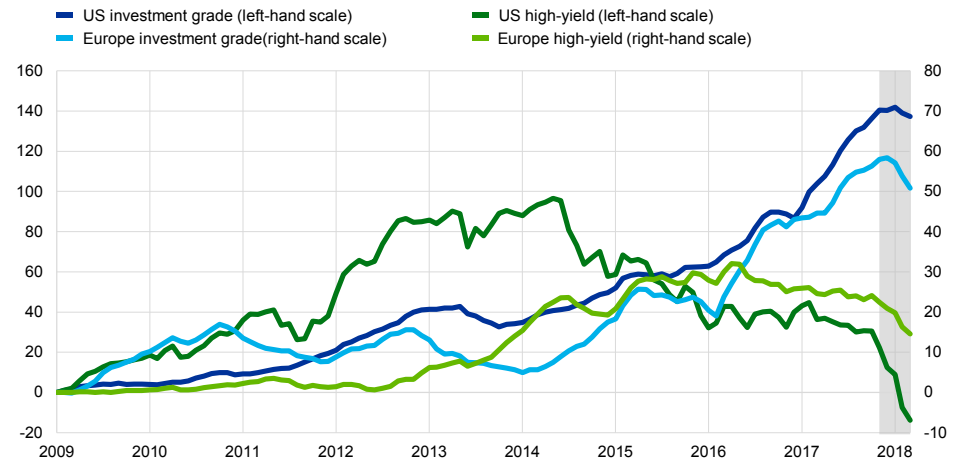
Earlier this year, the corporate bond fund sector experienced some more pronounced net outflows. From February, high-yield and investment-grade bond funds experienced outflows as credit spreads widened from previously very low levels. In particular, funds invested in the US high-yield segment – and to a lesser extent in the investment-grade segment – experienced significant outflows following a repricing of risk at the beginning of February (see [Chart 3.35](#)). Following the volatility spike in early February, high-yield corporate credit spreads saw an orderly and persistent widening, while high-quality corporate bonds and euro area sovereign bonds were only affected marginally (see [Chapter 2](#)). Correspondingly, outflows from high-yield bond funds started to accelerate, while net flows into funds focusing on investment-grade corporates turned just negative. Outflows from ETFs invested in high-yield and investment-grade corporate debt were, on average, smaller than those from non-ETFs invested in the same asset classes, while net asset value (NAV) spreads widened.

Chart 3.35

Acceleration of outflows from high-yield bond funds and a possible turning point for investment-grade funds

Cumulative net inflows into high-yield and investment-grade corporate bond funds invested in the US and Europe

(Jan. 2009 – Apr. 2018, USD billions)



Source: EPFR.

Notes: Cumulative net inflows into corporate bond funds, traditional investment funds and ETFs; global domicile. Investment-grade corporate bond funds represent the sum of funds invested over the short, medium and long term. The grey-shaded area indicates the period since the last FSR was published in November 2017.

Despite the outflows from bond funds, the broader investment fund sector

continued to grow. Euro area equity funds, mixed funds, hedge funds and other funds continued to receive net inflows over the review period (see [Chart 3.36](#)).

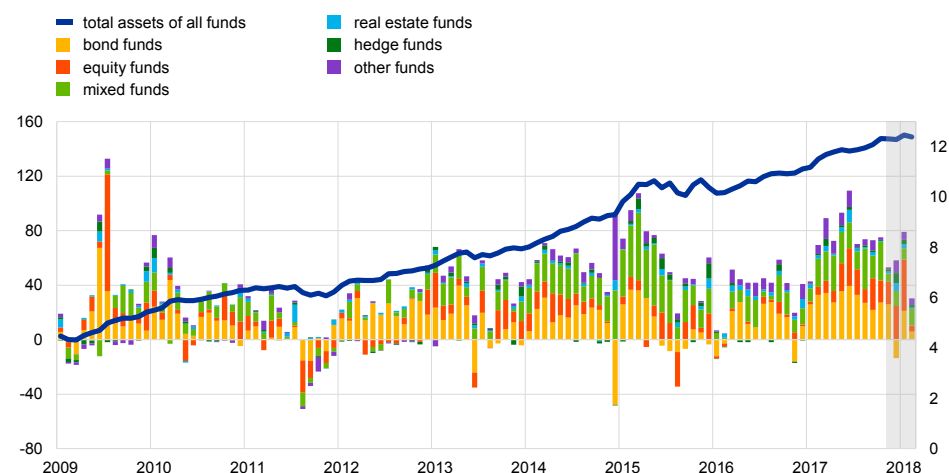
Anecdotal evidence during the recent volatility spike in US equity markets in February this year suggests that some investors withdrew money from euro area equity funds, in particular from those invested in US markets. Against this background, it remains to be seen whether the secular trend of prolonged growth in the sector will continue amid periods of increased market volatility and intermittent outflows.

Chart 3.36

The broader investment fund sector continued to grow

Monthly net flows by type of fund and total assets

(Jan. 2009 – Feb. 2018, net flows in € billions (left-hand scale), total assets in € trillions (right-hand scale))



Source: ECB investment fund statistics.

Notes: The data do not cover money market funds. The grey-shaded area indicates the period since the last FSR was published in November 2017.

Investors speculating on a continued low-volatility environment were caught by surprise in February, suffering significant losses. Exchange-traded products (ETPs), such as leveraged and inverse volatility ETPs linked to the VIX, were affected the most.⁷³ The resulting losses forced asset managers to withdraw some of the well-known inverse volatility products from the market (see Chapter 2). The abrupt and sizeable increase in the VIX in early February also created difficulties among leveraged ETPs trying to hedge their positions in a timely manner. Over the recent years, growth in these products has been reflected in increased holdings also by euro area counterparties. But exposures of euro area investors to this market segment remain very small and are concentrated among a few market participants. Considering some larger products which comprise more than USD 5 billion in total net assets, only about 2-4% is held by euro area counterparties. Losses of, and outflows from, the much larger segment of ETFs tracking the underlying S&P 500 index were significant, yet still within the range of historical experience (see [Chart 3.37](#)).

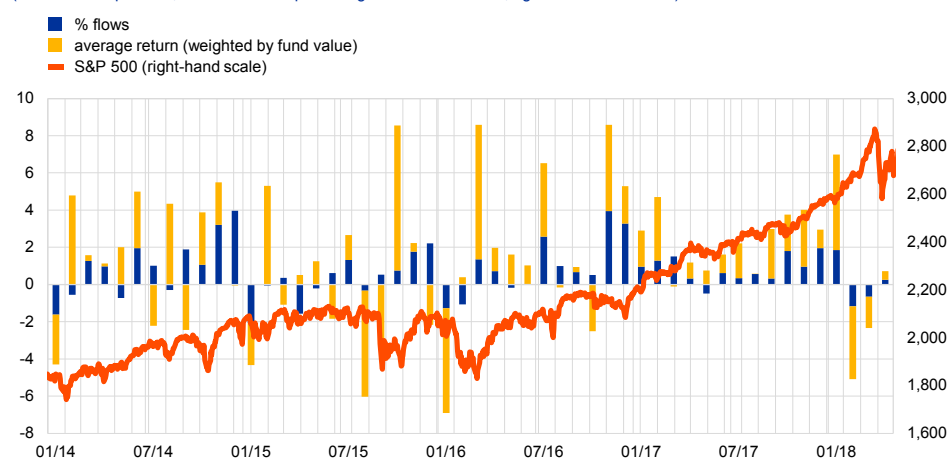
⁷³ See Sushko, V. and Turner, G., “The equity market turbulence of 5 February – the role of exchange-traded volatility products”, *BIS Quarterly Review*, March 2018.

Chart 3.37

The recent spike in volatility also affected traditional ETFs tracking the S&P 500

Performance and flows of US equity ETFs versus the S&P 500

(Jan. 2014 – Apr. 2018; left-hand scale: percentage of total net assets; right-hand scale: index)



Sources: Lipper, Bloomberg and ECB calculations.

Notes: Weighted averages of net flows and returns for a sample of 1,114 US equity ETFs; monthly data for flows and return; daily data for index.

The low-volatility environment has engendered risk-taking by asset managers in the form of short volatility and long-carry strategies.

Such strategies are implemented in both equity and fixed income markets. They include, for instance, low volatility risk premia strategies, some risk parity and volatility targeting strategies, as well as strategies implemented by some commodity trading advisors (CTAs). These strategies, which typically benefit from a low-volatility environment, are likely to respond in a pro-cyclical manner if volatility rises (see Chapter 2).

Investors in funds position themselves in a pro-cyclical manner in line with the signals that they receive from past returns.

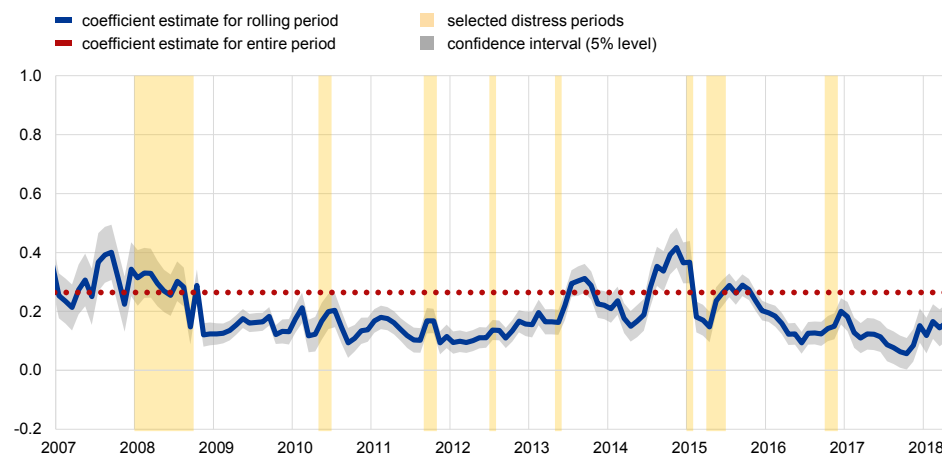
Net flows tend to rise when returns increase and tend to fall when returns deteriorate. This flow-return correlation has weakened over the past year, as bond funds in the euro area experienced sustained inflows despite deteriorating performance (see Chart 3.38). Flow-return correlations for bond funds have increased recently, in line with previous periods of market stress when the correlation between flows and returns increased. Outflows may spike again in the event of a large repricing, thus adding to the pro-cyclical nature of investor behaviour and to selling pressures on the underlying instruments.

Chart 3.38

Flow-return correlations have increased recently

Estimated sensitivity of flows to past returns for euro area bond funds

(Jan. 2007 – Mar. 2018; coefficient estimates and confidence interval)



Sources: Lipper IM and ECB calculations.

Notes: Highlighted periods include: acceleration of sub-prime crisis/Lehman collapses (Jan.-Sep. 2008); emergence of sovereign debt crisis/start of the Securities Markets Programme (May/June 2010); deepening of sovereign debt crisis/Italian bond yields peak (Sep.-Oct. 2011); ECB President's speech (26 July 2012); Fed talks of tapering (22 May 2013); PSPP announcement (22 Jan. 2015); German Bund sell-off (Apr.-May 2015); Greek sovereign crisis re-emerges (June 2015); reversal of yields/US presidential election (Oct./Nov. 2016). The sample includes all euro area bond funds covered by Lipper IM. The blue (dotted red) line depicts the beta coefficient estimates (β) for a fixed effects panel regression $flows_{i,t} = \alpha_i + \beta returns_{i,t-1} + \varepsilon_{i,t}$ using a 12-month rolling window (fixed period).

A shock to bond prices would give rise to first- and second-round losses for bond funds, particularly those invested in less liquid markets and with low liquidity buffers.

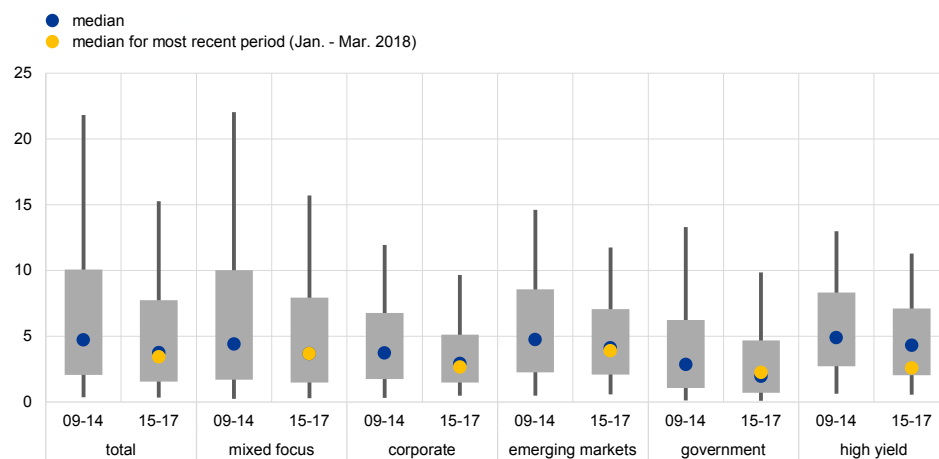
Cash buffers available in euro area bond funds have been gradually shrinking across all market segments since 2009 (see [Chart 3.39](#)). In addition, sector-wide data point to a broader-based decrease in funds' most liquid positions, including debt securities issued by euro area governments. From a systemic risk perspective, losses could propagate through the financial system if negative returns trigger investor outflows, eventually resulting in forced sales of less liquid securities. Such sales have the potential to amplify the original shock to bond prices, with wider financial stability implications in the form of impaired market liquidity and possible spillovers to the real economy via negative wealth and confidence effects.

Chart 3.39

Bond funds' liquidity buffers remain low across all main types of bond funds

Cash holdings for bond funds domiciled in the euro area

(percentage of total assets, median and interquartile range)



Sources: Lipper IM and ECB calculations.

Notes: The sample of the first period (2009-14) consists of end-of-year fund-level holdings from December 2009 to December 2014. The second period (2015-17) contains the end-of-year holdings for December 2015 to December 2017. The median for the most recent period (Jan.-Mar. 2018) is shown as a yellow dot. The boxplots show the 10th, 25th, 50th, 75th and 90th percentiles of the distributions.

3.3 In aggregate terms, the euro area banking sector is assessed to be resilient to the materialisation of the main financial stability risks

This section provides a quantitative assessment of the resilience of euro area financial institutions to a materialisation of the main systemic risks identified in this review. The assessment of the impact of macro-financial shocks on euro area banks is based on a macroprudential simulation exercise involving top-down stress-testing models⁷⁴ and covers about 100 large and medium-sized banking groups directly supervised by the ECB. More specifically, the main risks presented in the Overview are mapped into two adverse scenarios to assess the resilience of the euro area banking sector. Owing to methodological, scenario and sample differences, the results presented in this section should not be compared with the results of supervisory stress-test exercises, such as those coordinated by the European Banking Authority and the Single Supervisory Mechanism (SSM) or those conducted in the context of the IMF Financial Sector Assessment Program (FSAP). Due to the limited availability of disaggregated data on assets, liabilities, capital and profitability of non-bank financial institutions, this section does not assess the resilience of these parts of the financial sector.

⁷⁴ For a more detailed description of the tools, see Dees, S., Henry, J. and Martin, R. (eds.), "STAMPE: Stress-Test Analytics for Macroprudential Purposes in the euro area", ECB, February 2017.

Main features of the adverse macro-financial scenarios

The assessment of the resilience of the euro area banking sector is based on two adverse scenarios. These adverse scenarios have been designed using the ECB stress-testing models.⁷⁵ The narratives of the scenarios have been developed so as to reflect the materialisation of the systemic risks presented in the Overview. Although the scenarios are assumed to be independent of each other in the analysis presented in this section, the materialisation of the first scenario might also lead to the materialisation of the second scenario. The mapping between the main exogenous shocks assumed to trigger these scenarios and the main financial stability risks is summarised in **Table 3.1**. The impact of the adverse scenarios is assessed with reference to a baseline scenario, which is mainly based on the December 2017 Eurosystem staff macroeconomic projections.⁷⁶

Table 3.1

Mapping the main systemic risks into exogenous triggers of the adverse macro-financial scenarios

	Risk	Exogenous shocks triggering the scenarios
Scenario 1	<ul style="list-style-type: none"> Spillovers from a disruptive repricing of term and other risk premia in global financial markets Public debt sustainability concerns amid historically high debt levels Liquidity risks in the non-bank financial sector, with contagion to the broader system 	<ul style="list-style-type: none"> Shock to risk-free bond yields in global markets Shock to sovereign credit spreads in the euro area Shock to stock prices in global markets Shock to Expected Default Frequencies (EDF) of the largest insurance and investment funds in the euro area Shock to household wealth in the euro area Shock to consumption Shock to foreign demand
Scenario 2	<ul style="list-style-type: none"> Lower than expected growth Impaired intermediation capacity of banks amid weak performance and structural challenges Private debt sustainability concerns amid historically high debt levels 	<ul style="list-style-type: none"> Shock to foreign demand Shock to private investment in euro area countries Shock to private consumption in euro area countries Shock to corporate bond spreads in euro area countries Shock to residential property prices in euro area countries

Source: ECB.

The first scenario is triggered by an abrupt repricing of global risk premia, entailing very strong financial contagion to the euro area. Changes in market participants' expectations regarding economic policies in major economies outside the EU are assumed to trigger an abrupt repricing of risk premia which spills over to the euro area economy mainly via financial contagion in equity and bond markets. Yield curves steepen and credit spreads widen both in advanced and emerging economies. The generalised increase in sovereign bond yields triggers a re-emergence of public debt sustainability concerns for countries with lower credit

⁷⁵ For a more detailed description of the scenario design toolkit, see Dees et al. (op. cit.) and Henry, J and Kok, C. (eds.), "A macro stress testing framework for assessing systemic risks in the banking sector", *Occasional Paper Series*, No 152, ECB, October 2013.

⁷⁶ For more details on the baseline projections, see the [December 2017 Eurosystem staff macroeconomic projections for the euro area](#). Eurosystem staff projections have been used for the main macroeconomic variables for EU countries. For other non-EU countries, the baseline projections are based on the October 2017 IMF World Economic Outlook or the *November 2017 OECD Economic Outlook*.

ratings, leading to a greater widening of risk premia in those countries. At the same time, stock prices fall in global financial markets and the fall is amplified by a large sell-off of equities by the non-bank financial sector. Financial shocks spill over to the real economy via wealth effects. In addition, a rise in risk aversion increases precautionary savings and dampens aggregate demand.

The second scenario is generated by a strong economic slowdown resulting in a negative feedback loop between the banking sector and the real economy.

Lower than expected economic growth in the United States and in emerging economies is assumed to spill over to euro area countries via trade channels. The slowdown of economic growth is amplified by trade disruptions due to more protectionist policies in some advanced economies. This generates domestic demand confidence shocks, negatively affecting private consumption and investment. Corporate bond yields increase sharply, reflecting higher levels of risk in the non-financial corporate sector. Unemployment also increases more abruptly than in the past due to the preponderance of flexible working contracts. As a consequence, households and firms face difficulties in paying back their debt, especially in countries with highly indebted private sectors. Difficulties for households in making mortgage repayments together with the slowdown in aggregate demand cause a drop in property market activity, both in the residential and commercial property segments, which diminishes the collateral value of mortgages.

The two scenarios result in different overall real economic effects. The second scenario would have the strongest impact on euro area economic activity, as reflected in real GDP growth being 5.1% below the baseline level at the end of the scenario horizon (see **Table 3.2**). A somewhat milder, though non-negligible, real GDP impact is entailed in the first scenario, which would imply a fall in GDP of 2.8% with respect to the baseline, mainly driven by foreign demand. The adverse scenarios already account for the endogenous response of banks to the scenario, as their calibration is based on historical data.⁷⁷ The analysis presented in the remainder of this section allows the contribution of the second-round effects due to banks' endogenous responses to the scenario to be disentangled. The contributions of the second-round effects are reported in **Table 3.2** and account for -0.3% and -0.6% in terms of real GDP deviation from the baseline.⁷⁸

⁷⁷ A caveat to this is the fact that the models used for the scenario design are estimated on a long data sample and do not allow for stochastic volatility or time-varying coefficients. For this reason, the second-round effects already accounted for in the scenario might be under-estimated.

⁷⁸ The Stress Test Elasticities (STEs) used to design the scenario for macroeconomic variables do not allow the contribution of credit growth to the decline of GDP to be identified. For this reason, a dynamic stochastic general equilibrium (DSGE) model is also employed to calculate the contributions of the second-round effects. These contributions are constructed by rescaling the domestic real shocks of the scenario. The additional decline of real GDP under the assumption of a dynamic response of banks to the scenario coincides with the additional impact of real GDP as estimated by the DSGE model.

Table 3.2

Overall impact of the two adverse scenarios on euro area macroeconomic variables

	Baseline 2020 - change with respect to end-2017	Scenario 1		Scenario 2	
		Total deviation from baseline level	Contribution of second-round effects	Total deviation from baseline level	Contribution of second-round effects
Real GDP	+5.9%	-2.8%	-0.3%	-5.1%	-0.6%
Unemployment rate	-1.8 p.p.	+0.5 p.p.	+0.1 p.p.	+1.8 p.p.	+0.4 p.p.
Residential property prices	+11.6%	-6.0%	-1.0%	-22.1%	-5.4%
Commercial property prices	+9.1%	0.0%	0.0%	-31.4%	-6.1%
Investment	+11.0%	-5.8%	-0.8%	-16.9%	-2.6%
Credit to the private sector	+6.2%	-2.8%	-2.8%	-5.6%	-5.6%

Source: ECB.

Notes: The table reports the euro area weighted average deviation from the baseline levels of some macroeconomic variables at the end of the scenario horizon. To calculate the implied decline of credit under the adverse scenario, it is assumed that banks would adjust credit in line with GDP growth in each country of exposure. The baseline growth of credit to the private sector does not reflect the credit growth assumed in the Eurosystem staff macroeconomic projections. This is due to the assumption that credit grows in line with real GDP.

In addition to the real economic impact, the scenarios also differ in terms of their effects on financial markets (see [Table 3.3](#)). The first scenario is characterised by the strongest financial shocks. The drop in equity prices would be significant across all euro area countries, reaching on average -36%. The yield curve would steepen by 50 bps on average in the euro area, exhibiting a large cross-country dispersion which would reflect debt sustainability concerns. The second scenario would be characterised by much milder financial shocks whereby stock prices would decline moderately by about 8% and interest rates and government bond yields would also slightly decrease by 12 basis points compared with baseline levels. Corporate bond yields and banks' credit default swap (CDS) spreads would increase in both scenarios, but more prominently in the second one reflecting a higher credit risk of the non-financial corporation and banking sectors.

Table 3.3

Evolution of financial variables under the adverse scenarios

	Scenario 1 – deviation from the baseline level	Scenario 2 – deviation from the baseline level
Average euro area increase in short-term interest rates (basis points, peak deviation from baseline)	24	-6
Average euro area increase in one-year government bond yields (basis points, peak deviation from baseline)	66	-2
Average euro area increase in ten-year government bond yields (basis points, peak deviation from baseline)	116	-12
Average increase in the iTraxx non-financial index (basis points, peak deviation from baseline)	16	60
Average euro area increase in banks' CDS spreads (basis points, peak deviation from baseline)	56	80
Change in euro area equity prices (% deviation from baseline)	-36	-8

Source: ECB.

Notes: The table reports the euro area weighted average of the shocks (measured as deviations from the baseline levels) in the peak quarter. Some of the effects reported in the table coincide with exogenous shocks which trigger the scenario. The other effects correspond to endogenous responses of these variables to the triggers of the scenario.

Solvency results for euro area banking groups

The scenarios are analysed in terms of their impact on the main drivers of individual banks' CET1 capital ratios. The main variables that determine banks' solvency, such as credit and market risk parameters, profits and risk-weighted assets, are projected using bank-level stress-testing models. The scenario analysis covers about 100 large and medium-sized banking groups directly supervised by the ECB. The starting point for the analysis is end-December 2017. The calculations follow to a large extent the EBA methodology for the 2016 EU-wide stress test, even if some assumptions have been relaxed. Notably, the main variables of banks' balance sheets are projected in the adverse scenario both under the assumption that they remain unchanged (static balance sheet) and that they adjust, reacting to the specific scenario (dynamic balance sheet). The static balance sheet assumption makes it possible to disentangle the effects of a scenario on banks' solvency, abstracting from individual banks' endogenous reactions. This assumption is in line with the EBA methodology. However, banks might react to a scenario, for example, by changing their credit exposures, raising capital or restructuring part of their activities. For this reason, results are also presented under the assumption that banks would adjust credit to the private sector in line with real GDP growth in each country of exposure, i.e. applying a dynamic balance sheet assumption. In line with this assumption, caps and floors on the interest rate pass-through have been relaxed to allow for a consistent evaluation of the impact of credit and interest rate developments on net interest income. In addition, the analysis is conducted under the assumption that both fiscal and monetary policy authorities do not endogenously respond to the scenario developments.

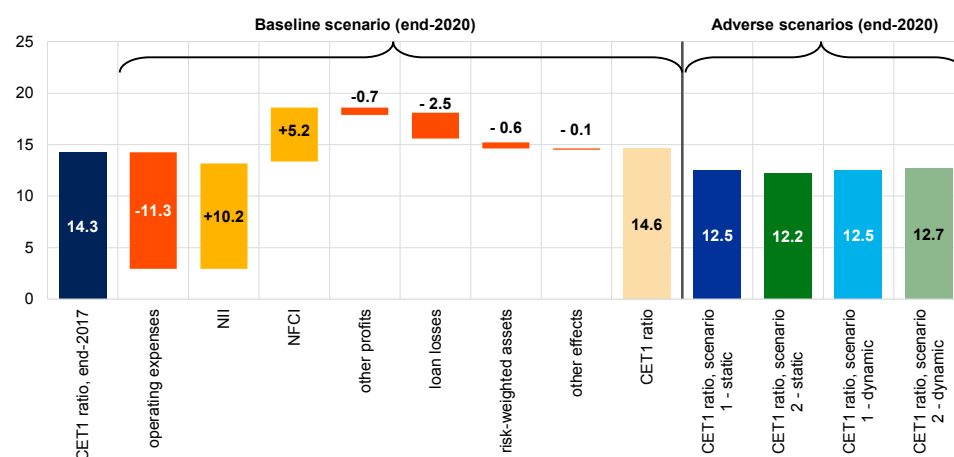
Under the baseline scenario, the solvency position of the sample of euro area significant institutions is projected to improve in line with the economic recovery. The aggregate CET1 capital ratio is projected to increase by about 0.3 percentage point, to 14.6% by the end of 2018 (see **Chart 3.40**). This improvement would be driven by net interest income and net fee and commission income, which would positively contribute 10.2 and 5.2 percentage points, respectively, to the overall increase in the CET1 capital ratio. These positive effects would, however, be partially offset by operating expenses (-11.3 percentage points). The overall positive contribution of operating profits would still outweigh the negative contribution of credit losses by about 0.9 percentage point. In the baseline projections, banks are assumed to adjust their balance sheet positions (dynamic balance sheet assumption) and, in particular, to adjust credit growth in line with GDP growth in each country of exposure. Due to the very positive baseline projections for economic growth, this would imply significant credit growth, which would lead to a negative contribution of risk-weighted assets to the CET1 capital ratio of 0.6 percentage point. Other effects on capital play a marginal role in this setting.

Chart 3.40

Under the baseline scenario, the euro area bank solvency position would continue to improve, but the materialisation of risks could lead to sizeable losses

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 and adverse scenarios

(percentages, percentage point contributions)



Sources: Individual institutions' financial reports, EBA, ECB and ECB calculations.

Notes: NII stands for net interest income and NFCI for net fee and commission income. The contribution of operating expenses is independent of the specific scenario as it is calculated in accordance with the 2016 EBA stress-test methodology and thus reflects the average of the previous five years.

In aggregate terms, the euro area banking sector is assessed to be resilient to the materialisation of the main financial stability risks, but could be hit by severe losses. In the two adverse scenarios, the aggregate CET1 ratio would decline by 2.1 and 2.4 percentage points, respectively, compared with the baseline (see **Chart 3.40**), under the assumption that banks would not adjust their balance sheet in response to the downturn (static balance sheet). Under the assumption of dynamic balance sheets, there are two main countervailing effects on banks' solvency with regard to the static balance sheet case: on the one hand, the reduction of credit growth with respect to the baseline would reduce risk-weighted assets; on

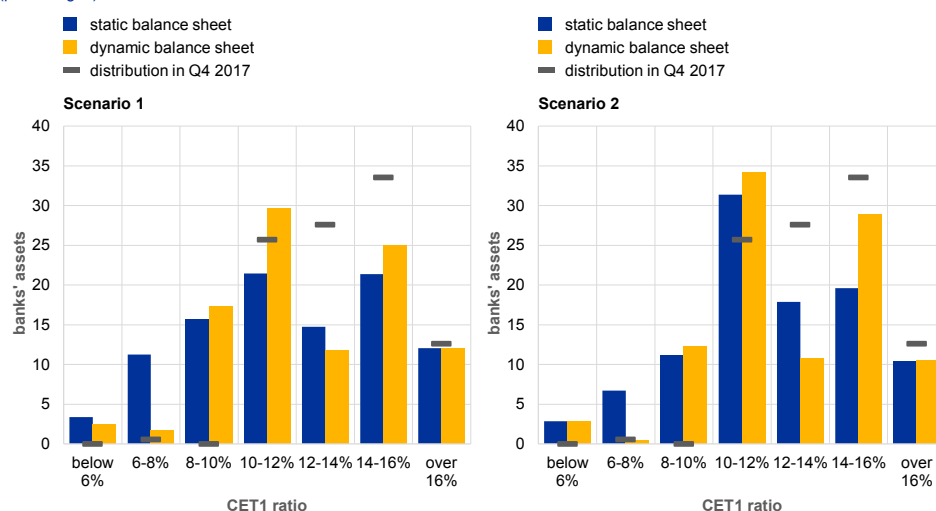
the other hand, net interest income would also decline in line with the exposures. The impact of the overall reduction in credit growth with respect to the baseline appears to dominate, especially in the second scenario where the economic slowdown is stronger. In this case, the CET1 capital ratio would decline by 2.1 and 1.9 percentage points in the first scenario and second scenario, respectively.

Chart 3.41

A very small group of banks would need additional capital under the adverse scenarios

Distribution of banks' assets by CET1 capital ratio

(percentages)



Source: ECB calculations.

The majority of euro area significant institutions would maintain their CET1 capital ratio above the average capital requirements of 10% under the adverse scenarios.⁷⁹ Nevertheless, under the static balance sheet assumption, banks representing about 30% and 20% of total assets would fall below the 10% CET1 capital ratio level under first scenario and second scenario, respectively (see Chart 3.41). These shares would be reduced to 20% and 15% when assuming a dynamic balance sheet. Only a few small banks would face severe solvency difficulties under the adverse scenarios, falling below a 6% CET1 ratio.

Different segments of the banking sector would be hit by the two scenarios asymmetrically and reflecting the composition of their lending book and portfolios (see Chart 3.42).⁸⁰ Under the first scenario, *G-SIBs* experience the largest decline in their CET1 ratios with respect to the baseline (-238 bps). These banks have larger trading portfolios than other banks and, for this reason, the decline in the CET1 ratio in both scenarios would be driven by severe losses on the

⁷⁹ The 10% average requirement refers to the average total capital “supervisory demand” without systemic buffers (i.e. Pillar 1, Pillar 2 and capital conservation buffer); see the *SSM SREP Methodology Booklet*, 2017 edition.

⁸⁰ For simplicity, the analysis of the main drivers of changes in the CET1 capital ratio is based only on the assumption of a dynamic balance sheet so that the adverse and baseline scenarios both account for the contribution of changes in risk-weighted assets.

sovereign exposures in the available-for-sale (AFS) portfolio, which is reflected in the revaluation of securities (-78 bps). In addition, the strong repricing of risk premia in the first scenario would also lead to losses in net trading income, which is included in the “Other effects” category. This would be partially netted out by the effects on the risk-weighted assets also included in the “Other effects” category (about -47 bps). Credit losses would also contribute significantly to the capital depletion (-103 and -111 bps in the first scenario and second scenario, respectively). Banking groups classified as *diversified lenders* would be strongly hit by both credit losses and the AFS losses on sovereign exposures. The latter component drives the negative contribution of the revaluation of securities in the first scenario (-100 bps). The contribution of credit losses to the CET1 ratio depletion with respect to the baseline ranges from -106 bps in the first scenario to -195 bps in the second scenario. In addition, these banking groups are those suffering the most severe net interest income losses in both scenarios (-50 and -94 bps, respectively), but also exhibit the largest offsetting effects from the reduction in RWAs – captured under the “Other effects” category.⁸¹ *Retail lenders* are strongly affected by credit losses, which contribute between -117 and -177 bps to the difference of the CET1 ratio with respect to the baseline. The losses on the AFS sovereign portfolio would significantly contribute to the decline in the CET1 ratio in the first scenario, driving the revaluation of securities by -119 bps. Finally, *specialised lenders* and *universal banks* would be the banking groups less affected by the adverse scenarios, with capital depletion between 134 and 163 bps, and would present a more homogenous distribution of the different factors contributing to the decline of the CET1 ratio.

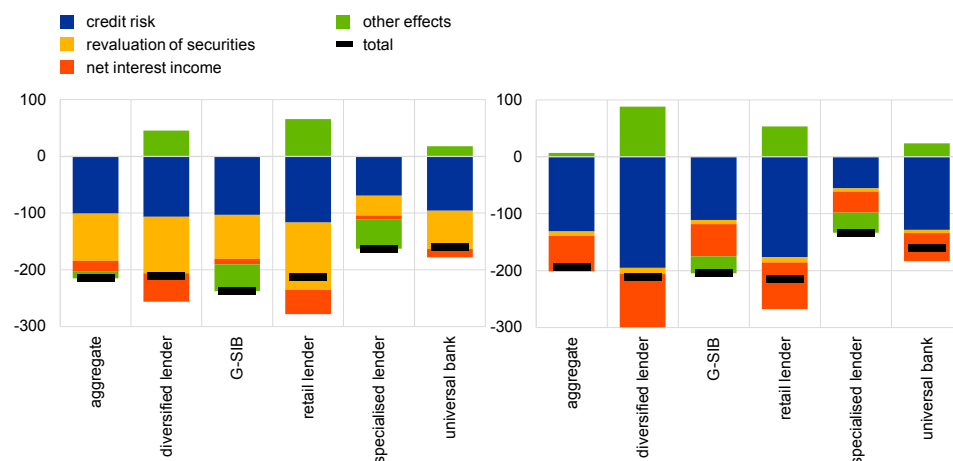
⁸¹ While the category “credit risk” takes into account the deterioration of credit quality and the effects of the scenario on credit losses, the assumption of a dynamic balance sheet also implies a reduction in the credit to the private sector with respect to the baseline. This effect contributes positively to the CET1 ratio and is accounted for in the “Other effects” category.

Chart 3.42

Impact on the CET1 ratio explained by the variation of the main P&L elements

Contributions to changes in CET1 capital ratios compared with the baseline by group of banks under the dynamic balance sheet assumption for scenario 1 (left panel) and scenario 2 (right panel)

(basis points)



Source: ECB calculations.

Notes: Credit risk includes additional impairments on loans and the increase in risk exposure amounts. Revaluation of securities includes sovereign debt and other securities held as available for sale and designated at fair value through profit and loss. These effects are gross of tax and prudential filters. Other effects mainly include trading income, changes in risk-weighted assets, fee and commission income, operational risk, taxes and dividends. The black lines indicate the total change in the CET1 ratio.

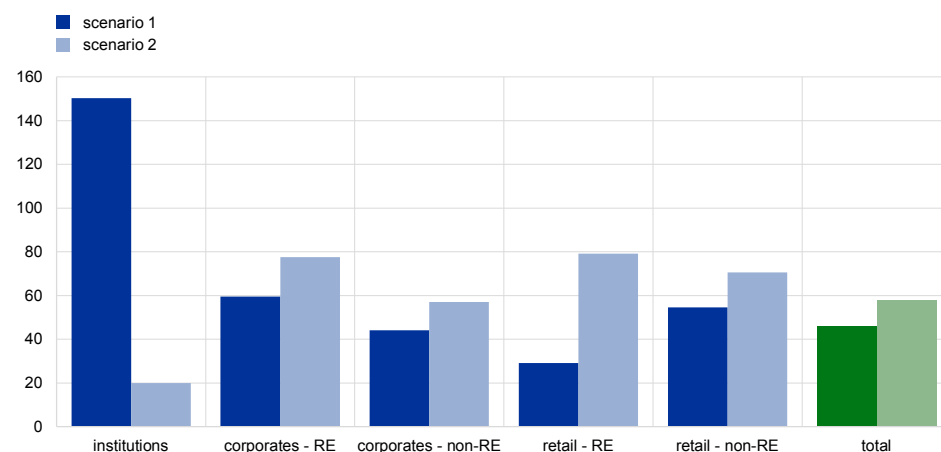
The cost of credit risk would increase in both adverse scenarios with respect to the baseline. Credit losses would play a larger role in explaining the capital depletion in the second scenario, where GDP declines almost twice as much as in the first scenario (see [Chart 3.42](#)). Higher impairment provisions on loans are one of the largest contributing factors to the reduction in the aggregate CET1 capital ratio, declining by between 1.0 and 1.3 percentage points compared with the baseline result under the first scenario and second scenario, respectively. These provisions would be highest in the second scenario, reflecting the relative size of the shocks to the real economy. Aggregate credit losses would increase by between 50% and 60% with respect to the baseline in both scenarios (see [Chart 3.43](#)). The distribution of NPLs in the lending book would change significantly between the two scenarios. In the first scenario, NPLs in credit to institutions would more than double due to the substantial increase of long-term interest rates and the decline of stock prices. However, this would not imply a substantial increase in absolute terms and consequently would not likely lead to intra-financial contagion effects. In the second scenario, credit losses would be more concentrated in corporate and retail lending, especially if related to real estate activity.

Chart 3.43

The stock of NPLs increases by about 50% under both scenarios

Increase of NPLs with respect to the baseline by sector of exposures

(percentages)



Source: ECB calculations.

Notes: "Institutions" indicates exposures towards other MFIs. RE stands for real estate. Although the increase in NPLs for institutions is very high in terms of percentage changes, in absolute terms the exposures towards other MFIs are much lower than other exposures at the aggregate level.

Net interest income would contract under both adverse scenarios, but most prominently in the second scenario.

The decline of net interest income would contribute 0.6 percentage point to the drop in the CET1 capital ratio with respect to the baseline in the second scenario. This would reflect high banking sector funding cost shocks and foregone interest due to higher credit default rates and the low degree of steepening of the yield curve. Weaker effects on net interest income are observed under the first scenario, where net interest income falls by about 0.2 percentage point compared with the baseline.

Losses on securities would be an important factor under the first scenario.

The impact of losses on securities on the CET1 capital ratio would be on average 0.8 percentage point in the first scenario. The losses on sovereign exposures held in the AFS portfolios drive the negative contribution of the revaluation of securities. Severe losses would also materialise in net trading income in both scenarios and are included in the "Other effects" category. At the aggregate level, the negative impact on the CET1 capital ratio of losses in net trading income would be to a large extent offset by the positive contribution of risk-weighted assets, which is also included in the "Other effects" category (see [Chart 3.42](#)). The impact of the revaluation of securities in the second scenario would be negligible as this scenario is characterised by very mild asset price declines.

4 Regulatory framework



Bank regulation

A full and timely **implementation of the Basel III package** across all jurisdictions is key to financial stability. Continued international cooperation also in the implementation phase is crucial.

The ongoing **review of the CRR and CRD IV** should be used to strengthen and harmonise the European regulatory architecture.

An ambitious set of targeted changes in the **EU macroprudential framework** should also be introduced in the context of the CRR/CRD IV review.



Non-bank financial sector regulation

The **regulatory and supervisory framework for non-banks** needs to be strengthened, including by adding macroprudential instruments on leverage and liquidity for investment funds.

The European Commission's decision to foster innovation and more coordinated approaches to standards for **fintech** is welcome.



Cyber security

Cyber threats have become a key financial stability concern with the increased adoption of technologies in the financial sector and a rising level of technical interconnectedness in financial markets.

Owing to the global nature of the phenomenon, **international cooperation and coordination** between institutions and authorities is essential.

Banking reform

A package of reforms to finalise the Basel III Accord was agreed in December 2017. The Basel III finalisation package agreed by the Governors and Heads of Supervision (GHOS) of the Basel Committee on Banking Supervision (BCBS) aims

at reducing unwarranted risk weight variability and maintaining risk sensitivity. It thereby also upholds the GHOS commitment to avoid a significant overall increase in capital requirements. Completing Basel III is an important step towards restoring confidence in banks' risk-weighted capital ratios, which in turn will foster confidence in the banking sector more broadly.

A full and timely implementation of the Basel III package across all jurisdictions is key to financial stability. The high level of international cooperation that has characterised the post-crisis work on a global set of common standards should also apply in the implementation phase. Moreover, the process should be carefully monitored through comprehensive evidence-based evaluation.

The European Commission has put forward a comprehensive package of banking regulation reforms. The package, which was published on 23 November 2016, will implement in European legislation important elements of the global regulatory reform agenda, such as new global standards on bank capital adequacy and liquidity and other outstanding elements. The details of the package were looked at in the May and November 2017 issues of the FSR, and discussions on the package are ongoing in the Council of the European Union and in the European Parliament.

The ECB has contributed to deliberations on the package by publishing a related ECB Opinion.⁸² EU co-legislators are invited to consider the positions put forward in this Opinion in their trilogues. In particular, they should consider introducing a requirement to establish an intermediate EU parent undertaking (IPU) for third-country groups with large operations in the EU and, to prevent regulatory arbitrage opportunities, require the inclusion of third-country branches in the regulatory EU sub-group under the IPU. Otherwise, third-country groups could partially or fully circumvent the IPU requirement by operating in the EU primarily or entirely via branches. Furthermore, once the Banking Union becomes sufficiently mature, more progress might be achieved in the harmonisation of national options and discretions as well as the introduction of cross-border capital waivers, subject to additional safeguards such as those suggested by the ECB in its Opinion.

With the aim of helping banks finance their lending activities, the European Commission has published a legislative proposal for an EU framework on covered bonds. The initiative is part of a broader Capital Markets Union (CMU) Action Plan launched in 2015 and revised in 2017⁸³ to strengthen capital markets and investment in the EU.

⁸² See [Opinion of the European Central Bank of 8 November 2017 on amendments to the Union framework for capital requirements of credit institutions and investment firms](#) (CON/2017/46).

⁸³ The CMU mid-term review was aimed at identifying new priorities and revised the 2015 CMU Action Plan accordingly. See [Communication from the Commission on the Mid-Term Review of the Capital Markets Union Action Plan](#) (COM(2017) 292 final).

Macroprudential review

The European Commission's package on the CRR/CRD IV review includes a number of proposals on the Pillar 2 framework that are also relevant from a macroprudential policy perspective. Notably, the package clarifies that Pillar 2 requirements (P2R) should be implemented by microprudential authorities and not be used for macroprudential purposes. The removal of Pillar 2 from the macroprudential toolkit should be accompanied by targeted revisions of the macroprudential framework to ensure that authorities have all the necessary tools to address existing and emerging systemic risks.⁸⁴

EU co-legislators should agree on an ambitious set of targeted changes in the EU macroprudential framework, in the context of the CRR/CRD IV review. While a broad review of the framework is not foreseen in the short-term, a comprehensive review of the regulatory setup is necessary over the medium term, with the aim of making the current framework more coherent, consistent and operational. Given the uncertainty about the impact of individual measures, there is a need for an appropriate mix of tools, which can include both borrower-based measures, such as limits on loan-to-value or debt-to-income ratios, and tighter risk weights for bank exposures and capital requirements. Some of these instruments are not provided for in the CRD IV/CRR, but the review should give consideration to enlarging the set of macroprudential policy tools and simplifying the procedure for activating the macroprudential tools provided for in Article 458 of the CRR, thereby allowing macroprudential authorities to act in an efficient, effective and timely manner.

As regards the ongoing review of the European Supervisory Authorities (ESAs) and the ESRB, the ECB supports efforts aimed at fostering effective and consistent prudential supervision and regulation across Europe. In response to the package of proposals published by the European Commission to strengthen the European System of Financial Supervision (ESFS), the ECB published its opinions on the ESRB and the EBA in March and April, respectively.⁸⁵

The review of the ESRB is of particular importance from a macroprudential perspective. Since its inception, the ESRB has played a central and successful role in preventing and mitigating systemic risks to financial stability in the Union. The ECB therefore supports a limited number of targeted changes to the ESRB's governance and operational framework proposed by the European Commission. A case in point relates to the formalisation of ECB Banking Supervision participation in the ESRB's General Board, Steering Committee and Advisory Technical Committee. However, the ECB would support further efforts to avoid overlaps between the ESRB

⁸⁴ See "ECB contribution to the European Commission's consultation on the review of the EU macroprudential policy framework", ECB, December 2016.

⁸⁵ See [Opinion of the European Central Bank of 2 March 2018 on a proposal for a regulation of the European Parliament and of the Council amending Regulation \(EU\) No 1092/2010 on European Union macro-prudential oversight of the financial system and establishing a European Systemic Risk Board \(CON/2018/12\)](#) and [Opinion of the European Central Bank of 11 April 2018 on a proposal for a regulation of the European Parliament and of the Council amending Regulation \(EU\) No 1093/2010 establishing a European Supervisory Authority \(European Banking Authority\) and related legal acts \(CON/2018/19\)](#).

and the ECB by reaping the synergies of the ECB's role in risk assessment with respect to the euro area banking sector.

Crisis management and resolution of banks

The comprehensive package of banking regulation reforms includes revisions to the Union crisis management framework. The proposed changes are particularly aimed at implementing international standards for global systemically important institutions (G-SIIs).⁸⁶ In the related Opinion, the ECB presents its views on several amendments to MREL and on the need for transitional arrangements for MREL. The Opinion also includes concrete suggestions for removing the overlap between supervisory measures under the CRD and the SSM Regulation and the early intervention measures provided for in the BRRD, as it creates significant practical challenges.

A swift adoption of the revised framework is warranted, in order to enable risk reduction and risk sharing to move in parallel and to facilitate the completion of the Banking Union. It is important that the European Stability Mechanism (ESM) becomes a credible backstop to the SRF, covering solvency as well as liquidity support in resolution. Equally important is the setting up of the EDIS, which is necessary in order to align responsibility for and control of deposit insurance with supervision and resolution responsibilities and to ensure that deposits enjoy an equally high level of confidence throughout the euro area.

Initiatives have also been launched in the crisis management and resolution domain at the international level. The FSB has published consultations on the Funding Strategy Elements of an Implementable Resolution Plan and on Principles on Bail-in Execution.^{87,88} The main purposes of the principles are (i) to aid the development of an implementable resolution funding plan to support the ongoing work of authorities to operationalise resolution strategies and plans; and (ii) to identify actions that authorities should take as part of ex ante resolution planning to ensure that a bail-in can be implemented in a manner that is credible, timely, consistent across home and host jurisdictions, and transparent to market participants. Following the consultation, both FSB guidelines are expected to be published in the summer of this year. Authorities should subsequently make use of these FSB guidelines, as they have been developed to support the orderly resolution of G-SIBs and are important in order to achieve a level playing field at a global level.

The European Commission's package of measures to tackle high NPL ratios was published on 14 March 2018.⁸⁹ The package includes a proposal for a directive on credit servicers, credit purchasers and the recovery of collateral which

⁸⁶ See [Opinion of the European Central Bank of 8 November 2017 on revisions to the Union crisis management framework](#) (CON/2017/47).

⁸⁷ See ["Funding Strategy Elements of an Implementable Resolution Plan"](#), FSB, 30 November 2017.

⁸⁸ See ["Principles on Bail-in Execution"](#), Consultative Document, FSB, 30 November 2017.

⁸⁹ See ["Commission measures to address the risks related to NPLs"](#), European Commission, March 2018.

would remove legal impediments to the transfer of NPLs by banks to non-banks, including simplification of the licensing requirements for third-party loan servicers, a proposal for a regulation amending the CRR which would introduce minimum levels of provisioning for future NPLs directly in the applicable regulation, and a blueprint on the setting up of national asset management companies (AMCs). The ECB supports swift progress on the legislative proposals contained in the package which are key elements of the EU's Action plan to tackle NPLs.⁹⁰

Asset managers

IOSCO is currently operationalising the FSB recommendations to address risks associated with asset management activities. The FSB recommendations focus mainly on addressing vulnerabilities related to (i) the mismatch between the liquidity of fund investments and the redemption terms and conditions for fund units, and (ii) leverage within investment funds.⁹¹ On 1 February 2018 IOSCO published its final report which is primarily addressed to asset managers.⁹² As highlighted in the FSB recommendations, responsible authorities should have an important role in addressing structural vulnerabilities in the asset management sector and in providing further guidance on liquidity risk management.

The ESRB has also published recommendations addressing systemic risks related to liquidity mismatches and the use of leverage in investment funds.⁹³ The ESRB advocates the introduction of additional liquidity management tools, further supervisory requirements and tighter liquidity stress testing practices to address risks from liquidity mismatches. The ESRB also considers it important to operationalise macroprudential limits on leverage in order to address risks arising from excessive leverage in the investment funds sector.

The European Commission has published a legislative proposal for the prudential regulation of all investment firms. The proposal published on 20 December 2017 is aimed at addressing problems in the investment firm regulation by introducing more appropriate and risk-sensitive requirements for investment firms and a streamlined regulatory toolkit. Under the proposals put forward by the Commission, the vast majority of investment firms in the EU would no longer be subject to rules that were originally designed for banks. At the same time, by amending the definition of what is considered a “credit institution” in the CRR, the largest and most systemic investment firms would be subject to the same regulatory regime as European banks and to ECB supervision.

⁹⁰ See “[Council conclusions on Action plan to tackle non-performing loans in Europe](#)”, Council of the European Union, July 2017.

⁹¹ See “[Policy Recommendations to Address Structural Vulnerabilities from Asset Management Activities](#)”, FSB, January 2017.

⁹² See “[Recommendations for Liquidity Risk Management for Collective Investment Schemes](#)”, IOSCO, February 2018.

⁹³ See [Recommendation of the European Systemic Risk Board of 7 December 2017 on liquidity and leverage risks in investment funds \(ESRB/2017/6\)](#).

In view of the growing importance of non-bank financial intermediation, large and complex investment firms should fall under the same regulation and supervision as credit institutions. To prevent risks to EU financial stability, this particularly concerns large and complex investment firms with cross-border operations and those undertaking bank-like activities.

Regulatory initiatives for the insurance sector

EIOPA has published two sets of advice to the European Commission on the Solvency Capital Requirement (SCR) standard formula. The main goal of the advice is to reduce the complexity of the formula while retaining a proportionate, technically robust, risk-sensitive and consistent supervisory regime for the insurance sector. The review of the SCR standard formula, as part of the Solvency II review, should be finalised by December 2018.

EIOPA and, at international level, the International Association of Insurance Supervisors (IAIS) have initiated work on systemic risk and macroprudential policy in insurance. Specifically, EIOPA initiated the publication of a series of papers with the aim of (i) contributing to the discussion on ways in which systemic risk can be created or amplified and (ii) ensuring that any extension of this debate to the insurance sector reflects the specific nature of the insurance business. To this end, EIOPA published a first report which aims to identify and analyse the sources of systemic risk in insurance from a conceptual point of view.⁹⁴ At the same time, the IAIS is developing an activities-based approach to systemic risk in the insurance sector.

Financial market infrastructures (FMIs)

The term FMI typically refers to payment systems/instruments (PSs), central counterparties (CCPs), central securities depositories (CSDs), securities settlement systems (SSSs) and trade repositories (TRs).

Payment services

The revised Payment Services Directive (PSD2)⁹⁵ enhances the security of payment transactions and the protection of consumer data and supports innovation and competition in retail payments. EU Member States had to transpose PSD2 into national law by 13 January 2018. The main objectives of PSD2 are to contribute to a more integrated and efficient European payments market, to

⁹⁴ See “Systemic risk and macroprudential policy in insurance”, EIOPA, February 2018.

⁹⁵ See Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015).

improve the level playing field for payment service providers by including new types of services, to make payments safer and more secure and to enhance the protection of European consumers and businesses.

Supplementary technical standards and EBA Guidelines foster financial stability through harmonised, efficient and transparent requirements for the licensing and ongoing supervision of payment services and complement the PSD2 through detailed operational and security related requirements.⁹⁶

Central securities depositories (CSDs)

According to the new regulatory framework, the Central Securities Depositories Regulation (CSDR)⁹⁷, all EU CSDs need to undergo an **authorisation process**. CSDs had to submit their application for authorisation to the relevant competent authority by the end of September 2017.

The Eurosystem, as the central bank of issue for the euro, is to be consulted in the authorisation process. The Eurosystem assesses each CSD on aspects relevant for the smooth functioning of other market infrastructures, the implementation of its credit operations, public confidence in the currency and, more generally, financial stability in the euro area. More specifically, the Eurosystem assessment covers the CSD's settlement process in euro, securities safekeeping processes, default procedures, operational set-up and legal soundness and the general conduct of business. For CSDs that also provide banking type ancillary services, the Eurosystem assesses whether the associated credit and liquidity risks are adequately managed. The first two CSDs authorised under the CSDR were Nasdaq CSD and VP Securities in September and December 2017 respectively. The authorisation of other CSDs is ongoing.

Fintech

The European Commission has published a FinTech action plan.⁹⁸ The action plan, which was unveiled on 8 March 2018, aims to foster innovation in the financial industry and EU-wide provision of financial services by improving the clarity of the regulatory framework and promoting harmonisation of national approaches consistent with the goal of a capital markets union (CMU). It was accompanied by a legislative proposal on crowdfunding which is also part of the broader CMU initiative.

⁹⁶ See [Opinion of the European Banking Authority on the transition from PSD1 to PSD2](#) (EBA/Op/2017/16) and [Commission Delegated Regulation \(EU\) No .../... of XXX supplementing Directive 2015/2366 of the European Parliament and of the Council with regard to regulatory technical standards for strong customer authentication and common and secure open standards of communication](#) (C(2017) 7782 final).

⁹⁷ See [Regulation \(EU\) No 909/2014 of the European Parliament and of the Council of 23 July 2014 on improving securities settlement in the European Union and on central securities depositories and amending Directives 98/26/EC and 2014/65/EU and Regulation \(EU\) No 236/2012](#). The Regulation entered into force on 17 September 2014.

⁹⁸ See ["FinTech action plan: For a more competitive and innovative European financial sector"](#), European Commission, March 2018.

The EBA also published a “FinTech Roadmap”⁹⁹ on 15 March, in line with with the European Commission’s FinTech Action Plan.

The European Commission’s decision to foster innovation and cross-border crowdfunding as well as more coordinated approaches to standards for fintech by liaising and working with major standard-setting bodies is welcome.

Interoperability of evolving fintech solutions with competing incumbent systems is particularly important in the area of financial market infrastructures and payment systems. The ECB is committed to working with other authorities and market stakeholders to avoid fragmentation and foster integration of the EU financial system.¹⁰⁰ The adoption of innovative technologies and new business models should progress without compromising the rigour of prudential requirements, as the benefits, risks and challenges of fintech innovation have yet to be fully understood and assessed. The proposed legislation on crowdfunding should enable cross-border scaling of crowdfunding services while ensuring sustainable financial intermediation.

Crypto-assets

G20 Finance Ministers and Central Bank Governors have called on international standard-setting bodies (SSBs) to continue their monitoring of crypto-assets and related risks and to assess multilateral responses.

The FSB has been tasked to report in July 2018 on its work on crypto-assets in consultation with other SSBs, including the Committee on Payments and Market Infrastructures (CPMI) and IOSCO, and the Financial Action Task Force. In February 2018 concerns about emerging price bubbles in the crypto-assets market and the rapid growth of initial coin offerings (ICOs) prompted the ESAs to publish a series of regulatory warnings to consumers on the risks of crypto-assets and ICOs. At the European level, the Commission’s plan to continue monitoring developments in the area of crypto-assets and ICOs is useful in order to assess whether regulatory action at EU level is required.¹⁰¹

The ECB supports continued rigorous monitoring of and more comprehensive data collection on crypto-assets, given their rapidly evolving nature.

Financial stability concerns currently appear limited (see **Box 4**). Nevertheless, the transmission channels to the financial sector, such as through financial institutions’ exposure to crypto-assets, market infrastructures and payment systems, as well as wealth effects might develop rapidly. In this respect, a proactive forward-looking approach is also warranted from a financial stability perspective, including reviews of the prudential treatment of such assets and consideration of measures to protect market integrity and financial market infrastructures.

⁹⁹ See “EBA publishes its Roadmap on FinTech”, EBA, March 2018.

¹⁰⁰ See “Guide to assessments of fintech credit institution licence applications”, ECB, March 2018.

¹⁰¹ Although sometimes referred to as “virtual currencies”, crypto-assets lack the key attributes of sovereign currencies and should not be seen as a means of payment. See, for example, [Opinion of the European Central Bank of 12 October 2016 on a proposal for a directive of the European Parliament and of the Council amending Directive \(EU\) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and amending Directive 2009/101/EC \(CON/2016/49\)](#).

Cybersecurity

Cyber threats have become a key financial stability concern with the increased adoption of technologies in the financial sector and a rising level of technical interconnectedness in financial markets. Cyber threats are a type of operational risk that has become increasingly prominent in the past few years. A cyber incident can jeopardise the confidentiality, integrity or availability of information in a given system, such as a computer network or an infrastructure. Cybersecurity consists of measures to prevent and counteract such incidents.

A cyber incident could trigger a systemic event if it impacts a significant financial institution or an FMI or is propagated to a large number of market participants. Increased interconnectedness and digitalisation increase the vulnerability of financial market participants to cyber incidents. The channels through which a cyber incident could develop into a systemic event include a potentially large disruption of central services or a loss of confidence in financial markets.¹⁰²

Reaping the full benefits from digital innovation requires strong resilience against cyber threats at individual and collective levels. Institutions need to ensure that sound cyber risk management is in place and fully integrated in the institution-wide operational risk management framework. The Cyber Resilience Oversight Expectations for FMIs launched by the ECB in April provide further insight into how these frameworks can be strengthened.¹⁰³ Furthermore, financial institutions can perform Threat-Intelligence Based Ethical Red teaming (TIBER-EU) tests, which mimic the real life tactics, techniques and procedures of attackers and allow financial institutions to assess their protection, detection and response capabilities.¹⁰⁴ At a collective level, institutions and relevant stakeholders need to work closely together to enhance individual entity and sector capabilities, as well as to increase cyber awareness. Owing to the global nature of the phenomenon, international cooperation and coordination between institutions and authorities is essential.¹⁰⁵

Sustainable finance

The European Commission has published an Action Plan on financing sustainable growth.¹⁰⁶ The Action Plan, which was published on 8 March 2018, is part of the broader CMU initiative to build deeper and more integrated capital markets and sets out an EU strategy to integrate sustainability into financial decision-

¹⁰² See the box entitled “Financial stability vulnerabilities stemming from cyber risks within financial market infrastructures”, *Financial Stability Review*, ECB, May 2016.

¹⁰³ See “[ECB launches public consultation on cyber resilience oversight expectations](#)”, ECB, April 2018.

¹⁰⁴ See “[TIBER-EU framework How to implement the European framework for Threat Intelligence-based Ethical Red Teaming](#)”, ECB, April 2018.

¹⁰⁵ See “[CPMI-IOSCO – Guidance on cyber resilience for financial market infrastructures](#)”, BIS, June 2016; and “[G7 fundamental elements of cyber security for the financial sector](#)”, October 2016.

¹⁰⁶ See [Communication from the Commission – Action Plan: Financing Sustainable Growth](#) (COM(2018) 97 final).

making. It contains a roadmap which envisages ten actions to be completed by the end of 2019, starting with a proposal for a regulation with principles and scope for an EU taxonomy for sustainable activities in May 2018.

The Commission's proposal to integrate sustainability into financial decision making is welcome, but this should be done without compromising on prudential regulation standards. Climate-related risks stemming from the increasing severity and frequency of natural catastrophes as well as the transition to a low-carbon economy may have a significant impact on financial stability. However, prudential regulation should not be used to attract capital towards green assets in the absence of any evidence of lower riskiness of such assets. Instead, direct policy tools such as taxes or subsidies may be more effective.

Special features

A A new Financial Stability Risk Index (FSRI) to predict near term risks of recessions

Prepared by Andrea Deghi, Peter Welz and Dawid Żochowski

The real economy repercussions of financial crises are the ultimate focus of financial stability monitoring and policymakers. By extending a standard set of financial stability indicators with indicators capturing spillover and contagion risks, this special feature proposes a financial stability risk index (FSRI) that has predictive power for the near-term risk of deep recessions. It is shown that the empirical performance of the index benefits from combining a large set of macro-financial indicators and, notably, that the information content of the spillover and contagion risk indicators is important.

Introduction

Identifying, measuring and reducing systemic risk is an important part of the task of macroprudential authorities and central banks of safeguarding financial stability.

Historical developments have shown that systemic risk can evolve into systemic stress and financial turmoil, with adverse consequences for economic growth and welfare. The large economic cost triggered by the recent global financial crisis is reminiscent of such developments. Therefore, to be able to take appropriate action, policymakers can benefit from an aggregate measure which can adequately capture the potential for instability in the financial system to develop into a large economic downturn.

This special feature builds on recent empirical advances in systemic risk modelling and combines indicators into a composite financial stability risk index (FSRI) to predict near-term large adverse shocks to the real economy.

Recent studies suggest that financial condition indicators can provide valuable information about risks to future economic growth, because frictions and fragilities in the financial sector can amplify initial adverse shocks.¹⁰⁷ The magnitude of a financial crisis is thus a result both of the level of imbalances in the economy and the financial sector prior to the crisis and of the extent to which an initial shock is amplified during the crisis. Other studies demonstrate that aggregating various systemic risk indicators can improve the accuracy of forecasting economic activity, in particular in the case of severe recessions.¹⁰⁸ Building on this literature, this special feature presents an FSRI for the euro area that has good near-term predictive power

¹⁰⁷ See Adrian, T., Boyarchenko, N. and Giannone, D., “Vulnerable Growth”, *Staff Reports*, No 794 (revised), Federal Reserve Bank of New York, 2017.

¹⁰⁸ See Giglio, S., Kelly, B. and Pruitt, S., “Systemic risk and the macroeconomy: An empirical evaluation”, *Journal of Financial Economics*, Vol. 119(3), 2016, pp. 457-471.

for deep recessions. The index is derived by extracting co-movement information from a large set of indicators covering information both on financial imbalances and on potential amplification risks that may be realised in an ongoing financial turmoil. Combining the information from both types of indicators should enable analysts to make more accurate predictions about adverse economic outcomes. Indeed, tentative results presented in this special feature suggest that the predictive power for near-term risks to GDP growth shocks of this new index is superior to that of individual macro-financial indicators used in financial stability monitoring.

Systemic risk is a multifaceted phenomenon that can be divided into two broad phases.¹⁰⁹ The first phase relates to the build-up of systemic risk, which is characterised by increasing financial imbalances, leverage and exuberance, involving asset price misalignments in the economy. This is often monitored using business and financial cycle measures and their interaction.¹¹⁰ The second phase relates to the materialisation of systemic risk, i.e. when the transmission of a shock is endogenously amplified by fragilities and frictions within the system. Such amplification and contagion risk is more closely linked to the interconnectedness of financial institutions, whose direct or indirect business relationships may eventually contribute to the level of systemic stress experienced during a crisis. In the monitoring of risks to financial stability, the focus is on assessing the probability that a systemic crisis will materialise, whereas in the monitoring of spillover and contagion risks, the effort is put on assessing the overall damage that a shock could inflict on the financial system.¹¹¹ Hence, the risk build-up is usually measured in the time dimension, while shock amplification is seen in terms of the cross-sectional or cross-border dimension (see Figure A.1).

Figure A.1
The multifaceted nature of systemic risk justifies a broad-based analytical approach

Topology of systemic risk and the mapping of modelling approaches

Phase	Type of systemic risks	Measurement focus	Dimension	Examples of vulnerabilities/ externalities	Modelling approach
Risk build-up	Cyclical risks	Probability of default	Time	Asset price misalignment, excessive leverage, maturity mismatch	Time series models, early warning models, market-based indicators
Amplification of shocks	Contagion and spillovers	Loss given default	Cross-sectional, cross-border	Interconnectedness, commonalities in exposures	Networks, spillover models, conditional loss probabilities, structural

Source: ECB.

¹⁰⁹ See also Constâncio, V., “Principles of Macroprudential Policy”, speech at the ECB-IMF Conference on Macroprudential Policy, Frankfurt am Main, 26 April 2016; and the special feature entitled “Systemic risk methodologies”, *Financial Stability Review*, ECB, June 2011.

¹¹⁰ See, for example, Schöler, Y.S., Hiebert, P.P. and Peltonen, T.A., “Characterising the financial cycle: a multivariate and time-varying approach”, *Working Paper Series*, No 1846, ECB, 2015.

¹¹¹ However, the magnitude of cyclical imbalances will also have a bearing on the size of a potential economic downturn.

This special feature focuses on the near-term predictive properties of financial stability indicators. The approach presented here combines information on cyclical systemic risks with information on contagion and spillover risks, not only with a view to anticipating an imminent downturn, i.e. in the next quarter, but also with the aim of assessing how large the downturn could be. For that purpose, it extends a standard set of macro-financial variables on measuring systemic risk¹¹² with indicators designed to capture contagion and spillover risk. Meanwhile, Special Feature B focusses on cyclical systemic risk and therefore on a longer prediction horizon of two to three years for the likelihood of a financial crisis.

Review and taxonomy of existing indicators

A broad-based analytical approach is beneficial for effective monitoring of systemic risk. Asset price misalignments, excessive leverage and maturity mismatches are examples of cyclical vulnerabilities, while a high degree of interconnectedness, e.g. lending and funding relationships involving sizable volumes, and overlapping portfolios could give rise to adverse second-round effects. For cyclical systemic risk monitoring, models based on time series are the most appropriate analytical device. These include early warning models based on credit and financial market indicators. Monitoring of contagion and spillover risks is usually based on network, spillover and contagion models or reduced-form conditional loss probability models. These models make use of cross-sectional information.

The main value of financial stability indicators lies in whether they predict severe recessions caused by amplifications of financial imbalances. The effects of materialising systemic risk concern the left tail of the real economic growth density when an initial shock is endogenously aggravated by the activation of multiple vicious spirals, such as the bank-sovereign nexus, macro-financial negative feedback loops, liquidity spirals and fire sales. Vulnerability indicators that are good predictors of the materialisation of systemic crises are well documented in the literature.¹¹³ However, there has been less research on the extent to which financial stability or systemic risk measures are useful in gauging the magnitude of a crisis.¹¹⁴

A comprehensive set of financial stability indicators should cover both cyclical and cross-sectional measures. This special feature uses the taxonomy shown in Figure A.2.¹¹⁵ It divides the set of macro-financial variables into four buckets, the first three being standard categories of indicators for systemic risk monitoring: (i) valuation pressures and risk appetite, which cover indicators that mostly reflect asset

¹¹² See Aikman, D., Kiley, M., Lee, S.J., Palumbo, M.G., Warusawitharana, M., “Mapping heat in the U.S. financial system”, *Journal of Banking & Finance*, Vol. 81, 2017, pp. 36-64.

¹¹³ See, for instance, Claessens, S., Kose, M.A. and Terrones, M.E., “What happens during recessions, crunches and busts?”, *Economic Policy*, No 24 (60), 2009, pp. 653-700; Alessi, L. and Detken, C., “‘Real time’ early warning indicators for costly asset price boom/bust cycles – a role for global liquidity”, *Working Paper Series*, No 1039, ECB, 2009; or Drehmann, M., Borio, C. and Tsatsaronis, K., “Anchoring Countercyclical Capital Buffers: The Role of Credit Aggregates”, *International Journal of Central Banking*, No 7(4), 2011, pp. 189-240.

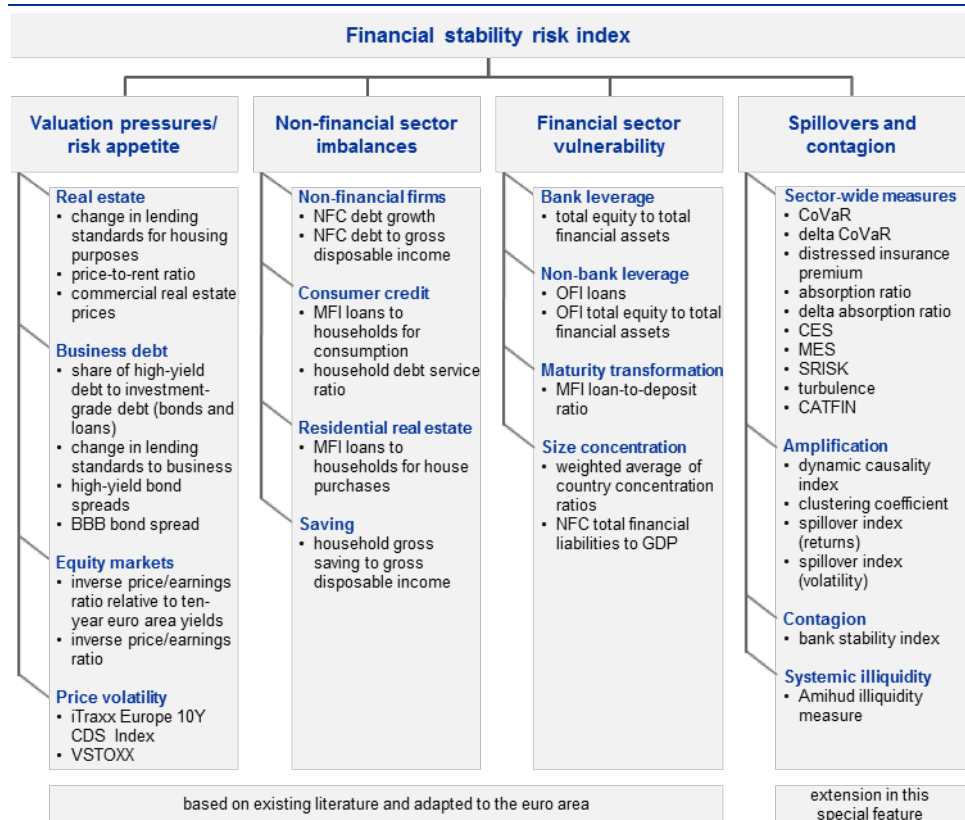
¹¹⁴ Special Feature B also provides some evidence on the magnitude of crises.

¹¹⁵ The first three buckets are based on Aikman et al., op. cit.

price developments, (ii) non-financial sector imbalances, which are captured mostly by debt developments in that sector, (iii) financial sector risks, which are measured by a set of leverage indicators and concentration measures. The fourth is a new category introduced in this special feature consisting of a set of 16 measures of spillover and contagion risks that may serve as yardsticks for the potential amplification of initial shocks.

Figure A.2

Taxonomy of macro-financial indicators for financial stability analysis



Sources: Aikman et al. (2017) and ECB.

Note: See Table A.1 for an explanation of spillover and contagion measures.

The measures of spillovers and contagion could be further classified into four broad sub-categories. Sector-wide measures cover the indicators of overall systemic risk that can also be decomposed into the contributions of individual financial institutions. Interconnectedness or amplification measures are standard network indicators assessing the importance of the nodes or network concentration, such as the degree of the centrality of the networks. Contagion measures are based on simulation of default cascades in the networks, while systemic risk-taking indicators relate to systemic liquidity in the financial system. The indicators and the

purpose of their measurement are summarised in Table A.1. Overall, this four bucket approach can also be distilled from the broad literature on systemic risk indicators.¹¹⁶

Yardsticks of spillovers and contagion risks could be useful in assessing the potential magnification effect of an initial shock. Measures of spillovers and contagion may contain information about the degree by which risks could be amplified when they materialise. As such, they could be helpful in assessing the cost of crises in terms of the scale of economic downturns.¹¹⁷

Table A.1
Measures of cross-sectional systemic risks

Classification and characteristics of cross-sectional systemic risk indicators		
Name	Paper	Description
Sector-wide measures		
Marginal expected shortfall (MES)	Acharya et al. (2017)	MES quantifies the risk that an individual bank stock price will decrease when the overall banking sector stock price index decreases. The indicator identifies banks and their contributions to the materialisation of financial sector-wide risks.
Conditional VaR (CoVaR) and delta conditional VaR (delta CoVaR)	Adrian and Brunnermeier (2016)	This indicator indicates how the banking sector stock price index reacts to an individual bank stock price decline. It is based on the rate of return of the individual stock, the banking sector's stock price index and a number of macroeconomic variables. The delta CoVaR is the period-by-period change in the CoVaR.
Component expected shortfall (CES)	Banulescu and Dumitrescu (2015)	The CES of a financial institution measures in absolute terms the institution's contribution to the expected shortfall of the financial system.
Conditional capital shortfall measure of systemic risk (SRISK)	Brownlees and Engle (2016)	SRISK measures the capital shortfall of an institution conditional on a severe decline in market return. It is a function of institution size, leverage and risk. The indicator identifies banks that contribute to financial sector-wide risks when risk materialises and measures the magnitude of banks' contributions to overall risk in the financial sector.
Distressed insurance premium (DIP)	Huang et al. (2009)	The DIP is an ex ante systemic risk metric representing a hypothetical insurance premium against systemic financial distress, which is defined as total losses exceeding a given threshold (e.g. 15% of total liabilities).
CATFIN	Allen et al. (2012)	This measure computes the time-varying value at risk (VaR) of financial institutions at the 99% confidence level using the cross-sectional distribution of returns on the equity of financial firms in each period.
Absorption ratio and delta absorption ratio	Kritzman et al. (2012)	This measure is calculated as the fraction of the total variance of banks' market returns explained by a fixed number of eigenvectors. The measure captures the extent to which markets are unified. The delta absorption ratio is measured as the period-by-period change in the absorption ratio.
Turbulence	Kritzman et al. (2012)	Financial turbulence is defined as a condition in which asset prices behave in an uncharacteristic fashion given their historical pattern, including extreme price moves, decoupling of correlated assets, and convergence of uncorrelated assets.
Spillovers and contagion		
Dynamic causality index	Billio et al. (2012)	This index is a metric of connectedness in the financial system based on principal components analysis and Granger causality networks.
Spillover index (returns and volatility based)	Diebold and Yilmaz (2014)	This index uses outward returns spillovers of institutions to measure the contribution of individual institutions to systemic risk. The indicator has good in-sample forecasting properties for systemic stress, but does not identify the underlying spillover channels, except those between institutions.
Clustering coefficient	Jackson (2010)	The clustering coefficient is a measure of the degree to which nodes on a graph tend to cluster together.

¹¹⁶ See Benoit, S., Colliard, J.-E., Hurlin, C. and Pérignon, C., "Where the Risks Lie: A Survey on Systemic Risk", *Review of Finance*, Vol. 21(1), 2017, pp. 109-152, who review 220 papers on systemic risk and identify four branches around which the literature can be classified: systemic risk measures, contagion, amplification mechanisms and systemic risk taking.

¹¹⁷ This relates to the finding that large drops in GDP can be attributed to the amplification mechanisms in the financial sector outlined in Adrian et al. (2017), op. cit.

Name	Paper	Description
Contagion		
Banking Stability Index (BSI)	Segoviano and Goodhart (2009)	The BSI reflects the expected number of banks becoming distressed given that at least one bank has become distressed. A higher number suggests increased instability in the system.
Systemic illiquidity		
Amihud illiquidity measure	Amihud (2002)	This indicator is constructed as the average of the daily absolute return to the trading volume ratio. It can be interpreted as the daily price response associated with one dollar of trading volume, thus serving as a rough measure of search costs, transaction price and execution risk of trade. ¹

Source: ECB calculations.

Notes: Bibliographical references:

Acharya, V.V., Pedersen, L.H., Philippon, T. and Richardson, M., "Measuring Systemic Risk", *The Review of Financial Studies*, Vol. 30(1), 2017, pp. 2-47.

Adrian, T. and Brunnermeier, M.K. "CoVaR", *American Economic Review*, Vol. 106(7), 2016, pp. 1705-1741.

Allen, L., Bali, T.G. and Tang, Y., "Does Systemic Risk in the Financial Sector Predict Future Economic Downturns?", *The Review of Financial Studies*, Vol. 25(10), 2012, pp. 3000-3036.

Amihud, Y., "Illiquidity and stock returns: cross-section and time-series effects", *Journal of Financial Markets*, Vol. 5(1), 2002, pp. 31-56.

Banulescu, G.-D., and Dumitrescu, E.-I., "Which are the SIFIs? A Component Expected Shortfall approach to systemic risk", *Journal of Banking & Finance*, Vol. 50, 2015, pp. 575-588.

Billio, M., Getmansky, M., Lo, A.W. and Pelizzon, L., "Econometric measures of connectedness and systemic risk in the finance and insurance sectors", *Journal of Financial Economics*, Vol. 104(3), 2012, pp. 535-559.

Brownlees, C. and Engle, R.F., "SRISK: A Conditional Capital Shortfall Measure of Systemic Risk", *The Review of Financial Studies*, Vol. 30(1), 2017, pp. 48-79.

Diebold, F.X. and Yilmaz, K., "On the network topology of variance decompositions: Measuring the connectedness of financial firms", *Journal of Econometrics*, Vol. 182(1), 2014, pp. 119-134.

Huang, X., Zhou, H. and Zhu, H., "Systemic Risk Contributions", *Journal of Financial Services Research*, Vol. 42(1-2), 2012, pp. 55-83.

Jackson, M.O., *Social and Economic Networks*, Princeton University Press, 2010.

Kinlaw, W., Kritzman, M. and Turkington, D., "Toward Determining Systemic Importance", *The Journal of Portfolio Management*, Vol. 38(4), 2012, pp. 100-111.

Segoviano, M.A. and Goodhart, C.A.E., "Banking Stability Measures", *IMF Working Paper*, No 09/4, International Monetary Fund, 2009.

1) Surges in search costs, transaction prices and execution risks of trades are signs of market liquidity vaporising in times of turmoil, as evidenced in the recent financial crisis (see, for example, Gârleanu, N. and Pedersen, L.H., "Liquidity and Risk Management", *American Economic Review*, Vol. 97(2), 2007, pp. 193-197; and Brunnermeier, M.K. and Pedersen, L.H., "Market Liquidity and Funding Liquidity", *The Review of Financial Studies*, Vol. 22(6), 2009, pp. 2201-2238). These stem from heightened information and agency frictions, such as adverse selection, spreading through an interconnected financial system. Amihud market illiquidity captures such contagion of uncertainty and information frictions in interconnected markets (see Amihud, Y., op. cit.).

Box A

Construction and estimation of a financial stability risk index by means of partial quantile regression

This box describes in more detail the specific methodology used to construct the FSRI. The analysis is split into two main steps: (i) condensing relevant information contained in the broad set of indicators and systemic risk measures into a small number of components, and (ii) evaluating the predictive power of these components for large economic downturns.

The large set of variables and indicators is aggregated into a small number of factors that capture the salient features of the underlying data. Specifically, for each of the four classes of indicators in the taxonomy shown in Figure A.2, one factor is extracted. At the technical level, reducing the data dimension has the objective of retrieving information from the underlying indicators which may otherwise be obscured by measurement error. This allows a robust predictive relationship with real economic developments, notably large downturns, to be established. In addition, relative to including a large set of indicators in regression analysis, the extracted common signal should mitigate in-sample overfitting problems.

The forecast target for real economic outcomes is shocks to quarterly real GDP growth one quarter ahead. The purpose of this special feature is not to predict the level of GDP growth, as the systemic risk indicators and the macro-financial indicators are unlikely to contain sufficient information for that purpose. However, if these variables are useful for systemic risk analysis, they should be informative for large unexpected shocks to GDP growth. An empirical measure of such

shocks can be approximated by the residuals from an autoregressive process for quarter-on-quarter real GDP growth.¹¹⁸ This strips out variation that can be predicted from past realisations of GDP alone and preserves the purely unexpected portion to be forecast by the FSRI. In the next step, a quantile regression is carried out in which the factor summarising the systemic risk and macro-financial variables is used to predict the left tail of the GDP growth density.

For the predictor, information from the comprehensive set of indicators is aggregated into the FSRI using partial quantile regression. This dimension reduction prevents data-overfitting issues caused by having a large number of indicators as predictors. It extends the concept of partial least squares to quantile regression and proceeds in two stages. The common component or factor across variables is computed in the first stage. In the second stage, the GDP disturbances one period ahead are regressed on the factor from the first stage. In the first stage, the quantile-specific slope coefficients of each explanatory variable x_{it} with respect to the GDP shocks z_{t+1} are found through quantile regressions.¹¹⁹ The factor estimate at each point in time is then computed from a recursive regression of the explanatory variables on the slope coefficients. Effectively, this implies that the factor is computed as the cross-sectional covariance estimate of the explanatory variables with the slope estimates. In the second stage, the factor serves as the explanatory variable in the predictive quantile regression of the GDP shocks.¹²⁰ The construction of factors and the predictive regression are carried out recursively over time in order to avoid the inclusion of future information in parameter estimates.¹²¹

The forecast performance is evaluated by a goodness-of-fit measure akin to R^2 in linear regression but amended for the quantile set-up. Specifically, the quantile R_τ^2 used here is defined as

$$R_\tau^2 = 1 - \frac{\frac{1}{T} \sum_t \rho_\tau(\hat{\varepsilon}_{t+1})}{\frac{1}{T} \sum_t \rho_\tau(z_{t+1} - q_\tau)}$$

where the numerator of the fraction captures the loss from the quantile regression computed from the estimated residuals $\hat{\varepsilon}_t$ and $\rho_\tau(\cdot)$ is the quantile loss function with respect to the quantile τ .¹²² The denominator captures the unconditional quantile estimate, i.e. the loss associated with the difference between GDP shocks and their τ -th quantile. That is, in this setting the statistical significance of the out-of-sample estimates is assessed by comparing the conditioning information (the numerator) with the unconditional historical quantile (the denominator).

¹¹⁸ Specifically, at each point in time the regression $(y_t - y_{t-1}) = \sum_{i=1}^p \alpha_i (y_{t-i} - y_{t-i-1}) + z_t$ is estimated, where y_t is the logarithm of real GDP and p denotes the number of included lags. The GDP shocks are then computed as the residuals from this fitted regression.

¹¹⁹ The explanatory variables are standardised by removing the mean and dividing by the standard deviation.

¹²⁰ Formally, the two stages can be expressed by the following equations: Stage 1(a): $z_{t+1} = c_1 + \gamma_{it} x_{it} + \vartheta_{it+1}^1$, 1(b): $x_t = c_{2t} + f_t \hat{\gamma}_t + \vartheta_t^2$, where x_t is a vector that contains the explanatory indicators from stage 1(a) and $\hat{\gamma}_t$ is the associated row-vector of estimated slope coefficients from that stage. Stage 2: $z_{t+1} = c_{3t} + \beta_t \hat{f}_t + \varepsilon_{t+1}$, where \hat{f}_t is the estimated factor from the first stage. The time indexation of the coefficients is associated with the recursive out-of-sample methodology.

¹²¹ The index constitutes a consistent quantile forecast (see Giglio et al., op. cit.). In particular, the index provides a forecast of one-quarter-ahead shocks to GDP growth after scaling by its predictive sensitivity and adding a constant term. Both the predictive sensitivity and the constant term are recursively calculated with information up to time t .

¹²² The loss function is defined as $\rho_\tau(x) = x(\tau - I_{x < 0})$, where τ is the quantile and I_x is an indicator function that is equal to 1 when the condition $x < 0$ is fulfilled and zero otherwise.

As a robustness check, two alternative data reduction methods for the first stage of the analysis were tested and they led to similar results to the partial quantile regression approach.

The first alternative approach uses principal component analysis to extract a common component from the macro-financial indicators. The principal component methodology condenses the information in the macro-financial indicators according to the covariance among them.¹²³ The second approach is based on a dynamic factor model with time-varying parameters.¹²⁴ This methodology extends the principal component analysis to allow for autocorrelation in the factor and assumes a priori that parameters are time-varying, as opposed to the recursive estimations where the a priori assumption is that the parameters of the model are constant. The detailed results of these alternative ways of computing the factor in the first stage are not reported in this special feature, but the results are qualitatively similar to those obtained from the partial quantile regression approach. However, the results of the latter are superior to those of the two alternative approaches according to the goodness-of-fit criteria.

A financial stability risk index for the euro area

The proposed FSRI for the euro area incorporates relevant information extracted from the large set of indicators of cyclical and cross-sectional vulnerabilities.

Specifically, data dimension reduction is applied to efficiently aggregate information across indicators, which is useful for predicting large economic downturns. Box A explains the methodology for the construction of the index and the methodology for the assessment of its performance in predicting large economic downturns in greater detail. The remainder of this section presents the new index and its empirical properties (see Chart A.1).

¹²³ This approach is also used by Giglio et al., op. cit.

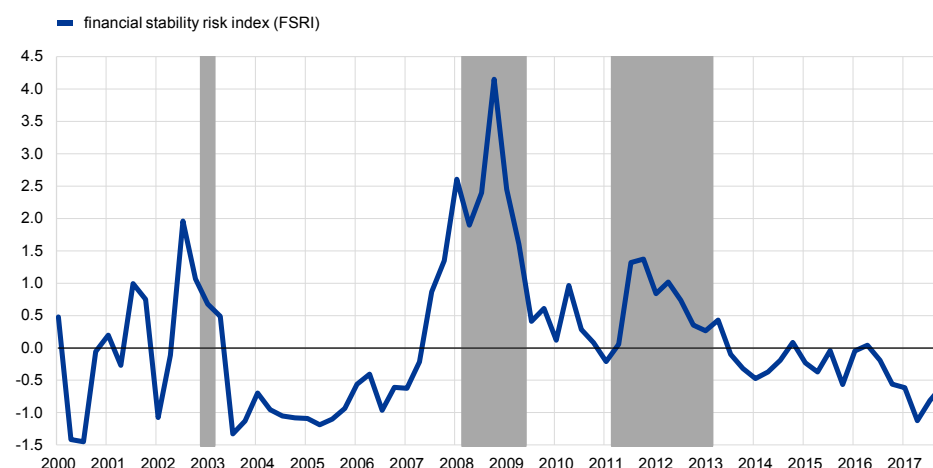
¹²⁴ Koop, G. and Korobilis, D., "A new index of financial conditions", *European Economic Review*, Vol. 71, 2014, pp. 101-116.

Chart A.1

The FSRI rises just before large economic downturns

FSRI and large recessions

(index: Q1 2000 – Q4 2017)



Sources: ECB and ECB calculations.

Notes: The grey-shaded areas show periods in which quarterly GDP growth was below the 20th percentile of the historical distribution of GDP growth rates from 1995 to 2017. At each point in time the index is standardised by its historical mean and standard deviation. The standardisation of the first 12 quarters is for that period.

The proposed FSRI provides a comprehensive view on the level of near-term financial stability risks with negative repercussions for the real economy. The level of the index suggests that systemic risk in the euro area has decreased since the sovereign debt crisis in 2011/12 and that it has been below its long-term average since the second half of 2013. Nevertheless, the average level of the index observed in that period exceeded levels observed in the period between the middle of 2003 and the end of 2006. This is in contrast to the readings from other financial stability indicators based mostly on market prices, which, owing to currently depressed risk premiums, signal a low level of risk. Because it also includes non-price-based indicators, the new index is less susceptible to the volatility paradox, whereby crises are often preceded by periods of very low volatility in financial markets.

The FSRI captures well the most important events during the recent crisis episodes. It increases at the outbreak of the sub-prime crisis in the third quarter of 2007 and reaches a first peak in the first quarter of 2008 when Bear Stearns was bailed out. Indeed, following this peak quarterly real GDP growth turned negative to -0.4% in the second quarter of 2008, reaching the 20th percentile of the historical growth distribution. The index reaches an all-time high in the fourth quarter of 2008, when the global economy began collapsing after the default of Lehmann Brothers in September 2008. Afterwards, quarterly GDP growth fell to its lowest observed value of -2.9% in the first quarter of 2009. The index increased again at the height of the euro area sovereign debt crisis in 2011 and 2012, when market analysts speculated about redenomination risk in the euro area. Quarterly GDP growth rates were negative between the fourth quarter of 2011 and the first quarter of 2013, since when the index has been gradually receding (see Chart A.1).

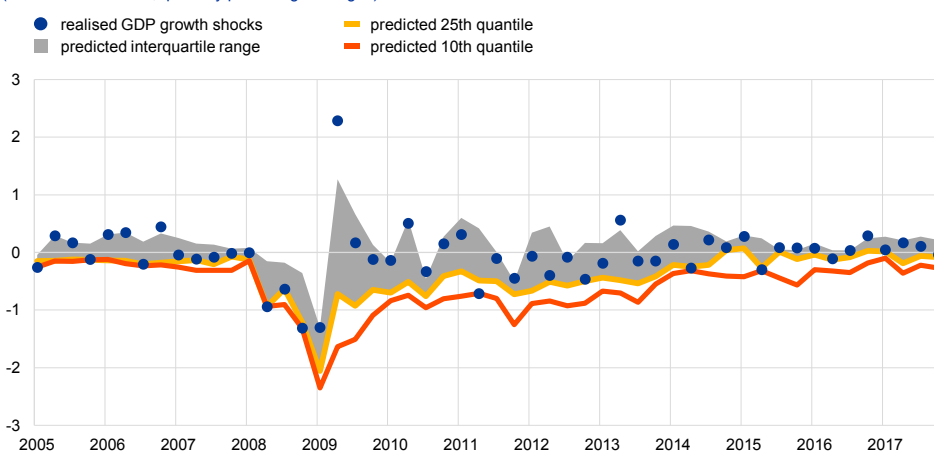
The index provides accurate short-term predictions of large economic downturns. While the build-up of vulnerabilities may take time, the precise timing of the eruption of a systemic crisis is hard to pinpoint, as the initial triggers of such events are unpredictable. Nevertheless, spillovers and contagion effects may shed light on the extent of possible amplification once the negative shock materialises. The FSRI seems to perform well in predicting large negative readings of GDP growth by providing accurate short-term forecasts of negative shocks to GDP growth (see Chart A.2).

Chart A.2

The FSRI provides accurate near-term predictions of deep recessions ...

One-quarter out-of-sample forecasts of shocks to euro area real GDP growth

(Q1 2005 to Q4 2017; quarterly percentage changes)



Sources: ECB and ECB calculations.

Note: The one-quarter-ahead out-of-sample forecast is aligned with the realised quarterly shock.

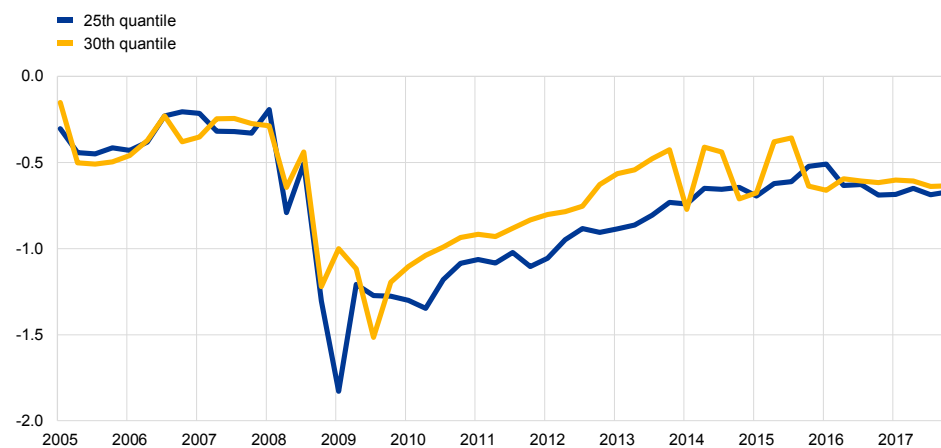
The sensitivity of the index increases around episodes of large economic downturns. Since the indicators of spillovers and contagion provide information about the potential for the amplification of the initial shock, their information content could be particularly relevant during episodes of systemic stress. This is mirrored by more negative regression coefficients of the quantile factors, which point to higher sensitivity of the indicator in explaining GDP growth shocks. These coefficients reached significantly more negative values in 2008 and remained low during the periods of the global financial crisis and the euro area sovereign debt crisis before recovering again in 2012 (see Chart A.3).

Chart A.3

... and its sensitivity increases around systemic crises

Recursive quantile regression coefficients of one-quarter out-of-sample forecasts

(Q1 2005 to Q4 2017; coefficient values)



Sources: ECB and ECB calculations.

Note: Quantile process coefficients multiplying the factor in recursive quantile regressions starting in the first quarter of 2005.

Large economic downturns are better predicted by aggregating information embedded in individual indicators. Combining efficiently all individual indicators together into a synthetic measure of financial stability improves its predictive power compared to the aggregation of individual risk indicators. The index outperforms the forecasting power of individual indicators and their subsets. Sub-indices derived for the four risk categories according to the proposed taxonomy (see Figure A.2) and using the same aggregation method perform worse than the overall index in predicting shocks to real GDP growth (see Chart A.4).

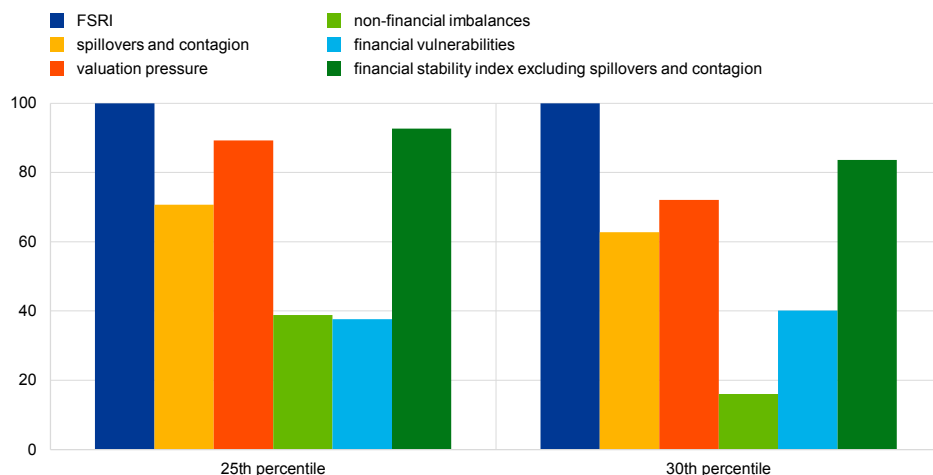
Indicators of spillover and contagion do have predictive power, in particular for large economic downturns. Among the sub-indices, cross-sectional systemic risk valuation pressure indicators tend to contain the most information for explaining large economic declines as measured by the 25th percentile of shocks to GDP growth. Notably, a sub-index constructed from all cyclical indicators and the spillover and contagion risk sub-index perform similarly well in predicting large economic downturns. However, both sub-indices are outperformed by the overall index (see Chart A.4).

Chart A.4

Aggregating individual indicators into an FSRI improves overall predictive power ...

One quarter out-of-sample forecast accuracy of the index and its sub-indices

(normalised predictive accuracy; percentage points)



Source: ECB calculations.

Notes: Out-of-sample forecast goodness-of-fit calculated relative to a historical quantile model. The forecasting performance of the FSRI is normalised to 100%. The sample period is from the first quarter of 2000 to the fourth quarter of 2017.

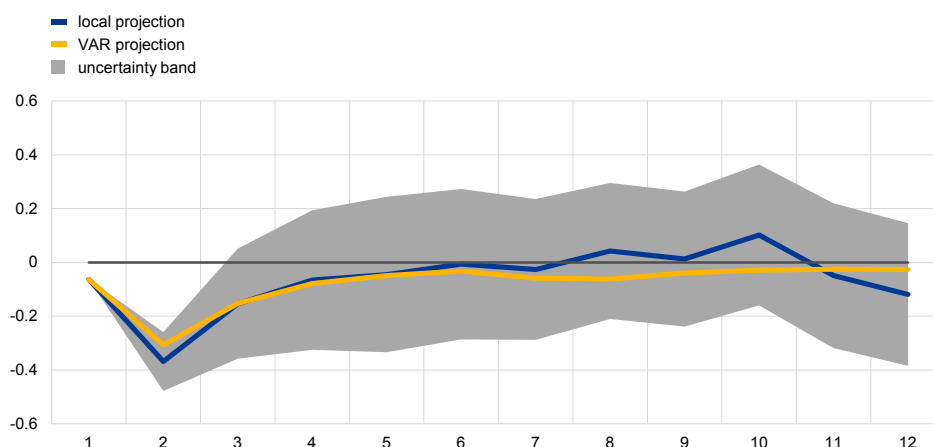
The forecasting power of the FSRI is strongest in the short term. Impulse response analysis suggests that GDP growth drops after an increase in the value of the indicator. The impact is significant, but phases out within one year. By design it is to be expected that the index will perform better for near-term predictions than over longer prediction horizons. The significant negative impulse responses within a year after the initial shock add evidence of the favourable near-term predictive properties of the index (see Chart A.5).

Chart A.5

... while its forecasting power is concentrated in the short term

Impulse responses to a one standard deviation shock to the FSRI

(x-axis: quarters; y-axis: percentage points)



Source: ECB calculations.

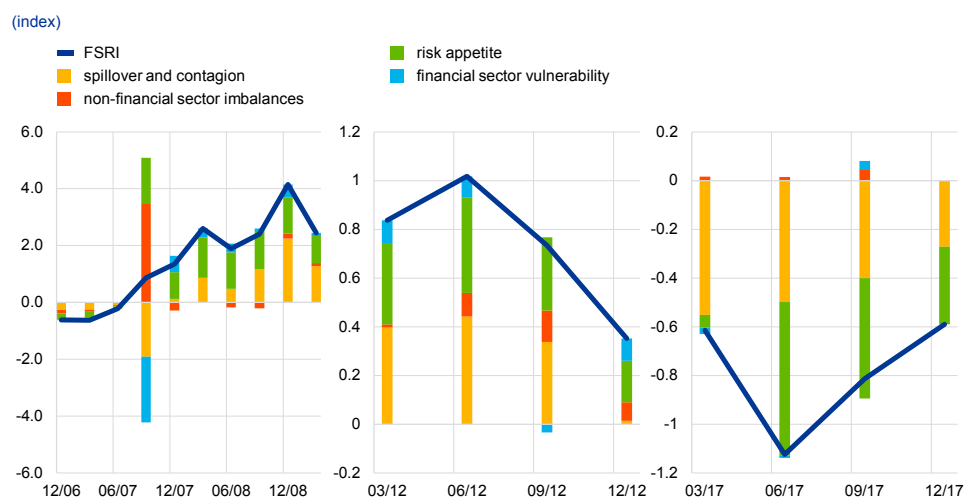
Notes: The impulse responses are measured as the response of quarterly GDP growth to a one standard deviation shock in the FSRI. The vector autoregression (VAR) is estimated with two lags and shocks are identified by Cholesky decomposition. The local projections are computed as in Jordà, Ó., "Estimation and Inference of Impulse Responses by Local Projections", *American Economic Review*, No 95(1), 2005, pp. 161-182. The uncertainty band is computed from the local projections as +/- one standard deviation.

The most recent readings of the index point to a moderate increase in systemic risk owing to higher risk appetite and higher contagion and spillover risk. A low level of the indicator signals an overall contained level of systemic risk in the euro area in the short run, even if it has not declined to the levels observed before the financial crisis. The recent rise in the value of the FSRI is primarily driven by higher risk appetite and an increased contribution from spillover and contagion risks (see Chart A.6). While these two categories are still a drag on the overall level of the index from a historical perspective, their negative contributions declined in the second half of 2017. These categories were also the major contributors to systemic risks in the period 2007-2009 and during the sovereign debt crisis.

Chart A.6

The level of the FSRI is strongly influenced by spillover and contagion and risk appetite indicators

Breakdown of the FSRI into its major components for selected periods



Sources: ECB and ECB calculations.

The overall dynamics of the index correspond to those of the composite indicator of systemic stress in financial markets (CISS), but there are distinct differences in the levels. The CISS dropped to historically low levels after the ECB's Outright Monetary Transactions (OMT) announcement, which assuaged tensions in financial markets, while the FSRI receded more slowly (see Chart A.7).

Chart A.7

The FSRI has exceeded the indicator of financial market stress in recent periods

FSRI and CISS

(7 Jan. 2000 to 11 May 2018; Q1 2000 to Q4 2017)



Sources: ECB and ECB calculations.

Notes: The composite indicator of systemic stress in financial markets (CISS) is normalised to lie between 0 and 1. FSRI: quarterly frequency. CISS: weekly frequency, two-week moving average. At each point in time the index is standardised by its historical mean and standard deviation. The standardisation of the first 12 quarters is for that period.

Conclusions

This special feature proposes a new financial stability risk index (FSRI) that has near-term predictive power for deep recessions. Including the information content of spillover and contagion indicators seems to improve the performance of such a composite index in predicting economic tail events, i.e. episodes of financial turmoil that lead to deep recessions. The index presented here provides information on the impact that systemic risk could have on the real economy in the near term. A desirable extension would be to extend the prediction horizon. Such an application focusing on cyclical vulnerabilities is presented in Special Feature B.

B Predicting the likelihood and severity of financial crises over the medium term with a Cyclical Systemic Risk Indicator (CSRI)

Prepared by Carsten Detken, Stephan Fahr and Jan Hannes Lang¹²⁵

This special feature presents a tractable, transparent and broad-based cyclical systemic risk indicator (CSRI) that captures risks stemming from domestic credit, real estate markets, asset prices, external imbalances and cross-country spillovers. The CSRI increases on average several years before the onset of systemic financial crises and its level is highly correlated with measures of crisis severity. Model estimates suggest that high values of the CSRI contain information about large declines in real GDP growth three to four years down the road, as it precedes shifts in the entire distribution of future real GDP growth and especially of its left tail. Given its timely signals, the CSRI is a useful analytical tool for macroprudential policymakers to complement other existing analytical tools.

Introduction

The global financial crisis has shown that the unravelling of systemic risk can have large detrimental effects on the output and welfare of societies. Lo Duca et al. (2017) estimate that output losses during past systemic financial crises in EU countries amounted to 8% of GDP on average, and Laeven and Valencia (2012) estimate that during past banking crises across a large sample of countries worldwide output losses amounted on average to 23% of GDP.¹²⁶ In order to prevent systemic financial crises or mitigate their impact in the future, it is therefore essential to have measures of systemic risk that provide sufficient lead time for policymakers to act in a countercyclical manner.

The total credit-to-GDP gap of the Basel III framework (the “Basel gap”)¹²⁷ provides a useful starting point for measuring the cyclical dimension of systemic risk. According to the classification in Borio (2003)¹²⁸, the cyclical dimension of systemic risk is concerned with the build-up of macro-financial imbalances over time, while the cross-sectional dimension of systemic risk is concerned with the build-up of risk due to the (micro) structure of the financial system. Various studies have shown that the Basel gap is a useful measure of

¹²⁵ The analysis and results of this special feature are partly based on Lang, J.H., Izzo, C., Fahr, S. and Ruzicka, J., “Anticipating the bust: A new cyclical systemic risk indicator to assess the likelihood and severity of financial crises”, mimeo, 2018.

¹²⁶ See Lo Duca, M., Koban, A., Basten, M., Bengtsson, E., Klaus, B., Kusmierczyk, P., Lang, J.H., Detken, C. and Peltonen, T., “A new database for financial crises in European countries”, *Occasional Paper Series*, No 194, ECB, July 2017; and Laeven, L. and Valencia, F., “Systemic Banking Crises Database: An Update”, *IMF Working Paper*, No WP/12/163, IMF, June 2012.

¹²⁷ The “Basel gap” refers to the total credit-to-GDP gap, which is obtained as the cyclical component from a recursive HP filter with a smoothing parameter of 400,000 applied to the total credit-to-GDP ratio.

¹²⁸ Borio, C., “Towards a macroprudential framework for financial supervision and regulation?”, *BIS Working Papers*, No 128, BIS, February 2003.

cyclical systemic risk, as it provides good aggregate early warning signals for systemic banking crises.¹²⁹

However, the Basel gap has some shortcomings when it comes to measuring cyclical systemic risk. First, the Basel gap can be biased downward after prolonged credit booms, because the longer the boom period persists the greater will be the portion of the credit excesses contained in the estimate of the trend.¹³⁰ Second, the Basel gap is sensitive to the length of the underlying time series, reducing the robustness of the signal for some euro area countries owing to short credit series of 10-15 years. Third, issues of interpretation and communication may arise, as the Basel gap can decrease in situations where the credit-to-GDP ratio increases strongly but does so at a slower pace than the trend component. In view of these shortcomings, there is a need to develop complementary measures of cyclical systemic risk.

This special feature presents a new composite cyclical systemic risk indicator (CSRI) with high predictive power for both the likelihood and the severity of systemic financial crises over the medium term. The CSRI is a tractable, transparent, and broad-based composite indicator that captures risks from developments in domestic credit, real estate markets, asset prices, external imbalances and cross-country spillovers. The indicator increases on average several years before the onset of historical systemic financial crises in euro area countries and its level is highly correlated with measures of crisis severity, such as declines in real GDP. Estimates based on econometric models suggest that high CSRI values contain information about large declines in real GDP growth three to four years down the road and especially about the left tail of the GDP growth distribution.

The remainder of this special feature presents the features and empirical properties of the CSRI in more detail. The CSRI is designed to indicate the build-up of cyclical systemic risk in a timely manner in order to allow preventive macroprudential policy action. It complements the financial stability risk index (FSRI) presented in Special Feature A, which focuses on a much shorter lead time ahead of financial stress by also exploring the information on the cross-sectional dimension of systemic risk contained in financial market prices. Both indicators together thus provide comprehensive model-based information to support the assessment of financial stability risks at any point in time for different prediction horizons.

¹²⁹ See for example Borio, C. and Lowe, P., "Asset prices, financial and monetary stability: exploring the nexus", *BIS Working Papers*, No 114, July 2002; Borio, C. and Drehmann, M., "Assessing the risk of banking crises – revisited", *BIS Quarterly Review*, March 2009; and Aldasoro, I., Borio, C. and Drehmann, M., "Early warning indicators of banking crises: expanding the family", *BIS Quarterly Review*, March 2018. See also Detken, C. et al., "Operationalising the countercyclical capital buffer", *Occasional Paper Series*, No 5, European Systemic Risk Board (ESRB), June 2014, for EU evidence; and Alessi, L. and Detken, C., "Quasi real time early warning indicators for costly asset price boom/bust cycles", *European Journal of Political Economy*, Vol. 27(3), 2011, pp. 520-533, regarding global credit gaps.

¹³⁰ For a detailed exposition of this problem with the Basel gap, see the special feature entitled "[Measuring credit gaps for macroprudential policy](#)", *Financial Stability Review*, ECB, May 2017.

Box A

A generic procedure for constructing a tractable composite systemic risk indicator

This box presents a generic procedure for constructing a broad-based systemic risk indicator that is tractable, transparent, and easily interpretable for policy use. Tractability and transparency are considered to be important characteristics for a composite systemic risk indicator in order to ease interpretation and communication of systemic risk signals. Furthermore, policy action using granular macroprudential instruments requires a means to easily identify the drivers behind risk signals in order to address the specific sources of systemic risks.

The generic procedure has four building blocks and combines methods employed in the early warning literature with a simple and intuitive aggregation method. The four general building blocks are: (i) selection of a set of relevant indicator categories for the risk of interest; (ii) selection of the optimal early warning indicator for each of the indicator categories; (iii) normalisation of each optimal early warning indicator based on the pooled median and standard deviation across countries and time; and (iv) linear aggregation of the normalised early warning indicators into a composite systemic risk indicator based on optimal indicator weights.

Formally, the generic composite systemic risk indicator (SRI) is defined as a weighted average of the normalised sub-indicators:

$$SRI_{i,t} = \sum_{j=1}^K \omega^j \cdot \tilde{x}_{i,t}^j,$$

where $\tilde{x}_{i,t}^j = (x_{i,t}^j - x_M^j) / x_{SD}^j$ represents the normalised sub-indicator, with i indicating a country, t the time period, and j the sub-indicator. ω^j represents the relative weight in the composite indicator attributed to the sub-indicator. Pooled indicator normalisation and constant weights across countries and time implicitly assumes that there are common indicator patterns across the crises experienced by individual European countries at different points in time which, once extracted, are useful in identifying the build-up of systemic risk. These risk signals based on common patterns can then be complemented by expert judgement, taking into account country-specificities in a detailed manner.

The weights for aggregating sub-indicators are chosen to optimise the early warning properties of the composite systemic risk indicator. The optimal sub-indicator weights ω^j are obtained by running a linear regression of a crisis vulnerability indicator on the normalised sub-indicators and using the estimated coefficients as weights, after constraining them to sum to 1.¹³¹ This regression approach provides the optimal linear combination of the underlying sub-indicators to identify vulnerable periods. Country-specific weights are difficult to estimate, owing to the scarcity of crises at the country level.

The generic procedure for constructing a composite systemic risk indicator can be applied to different sectors of the economy or different systemic risk categories. By varying the crisis episodes of interest and the relevant categories for the early warning indicators, the focus of the early warning assessment can be adjusted. For example, in the context of domestic cyclical

¹³¹ The optimal sub-indicator weights are computed by dividing each regression coefficient by the sum of all estimated regression coefficients. This procedure ensures that weights sum to 1. For the application of this generic procedure to the measurement of domestic cyclical systemic risks (i.e. the domestic systemic risk indicator presented in this special feature), a minimum weight for each sub-indicator of 5% is imposed.

systemic risks, relevant indicator categories include credit developments, real estate markets and asset prices. For monitoring systemic risks within the banking sector, indicator categories could include capital adequacy, liquidity and asset quality.

A cyclical systemic risk indicator for euro area countries

The new cyclical systemic risk indicator (CSRI) is constructed in a three-step procedure to capture both domestic and cross-country spillover risks. First, a domestic systemic risk indicator (d-SRI) is constructed at the country level to capture the build-up of cyclical imbalances in the domestic non-financial private sector. Second, an exposure-based spillover systemic risk indicator (e-SRI) is constructed to capture a country's exposure to the build-up of imbalances abroad. Third, the d-SRI and the e-SRI are combined as sub-components of the CSRI. Each of these three steps is discussed in more detail in the following paragraphs.

The design of the d-SRI follows the generic procedure outlined in Box A and covers a broad range of risk categories capturing domestic vulnerabilities.

BCBS guidance, the CRD IV and ESRB Recommendation ESRB/2014/1 assign a central role to the credit-to-GDP gap in the measurement of cyclical systemic risks. However, additional risk indicator categories can cover other dimensions of cyclical systemic risks and complement signals from the Basel gap. Therefore, as recommended by the ESRB, the d-SRI considers: (a) measures of potential overvaluation of property prices; (b) measures of credit developments; (c) measures of external imbalances; (d) measures of private sector debt burden; and (e) measures of potential mispricing of risk.¹³²

For each of the categories chosen for risk monitoring, the best univariate early warning indicator is identified and included in the d-SRI (see Box B).¹³³ The six sub-indicators that make up the d-SRI are: (i) the two-year change in the bank credit-to-GDP ratio; (ii) the two-year growth rate of real total credit (CPI-deflated); (iii) the two-year change in the debt service ratio (DSR); (iv) the three-year change in the residential real estate (RRE) price-to-income ratio; (v) the three-year growth rate of real equity prices (CPI-deflated); and (vi) the current account-to-GDP ratio. All of the sub-indicators of the d-SRI are in either two-year or three-year transformations, as these are found to have the best overall early warning properties, i.e. they perform better than shorter-term transformations or HP-filtered gaps.¹³⁴

¹³² For an overview of risk categories that are recommended to national designated authorities to quantitatively assess cyclical systemic risks, see [ESRB Recommendation on guidance for setting countercyclical buffer rates \(ESRB/2014/1\)](#).

¹³³ The exception to this rule is credit: two indicators, one based on bank credit and the other based on total credit, are included in the d-SRI, owing to the prominent role of credit in the context of measuring cyclical systemic risks.

¹³⁴ The use of such simple medium-term transformations for filtering is also supported by the findings in Hamilton, J., "Why you should never use the Hodrick-Prescott filter", *NBER Working Paper*, No 23429, 2017, which argues forcefully against using the HP filter.

Box B

Selection of useful early warning indicators for signalling systemic financial crises

This box presents the results of a comprehensive evaluation exercise for a large set of early warning indicators using the new ECB/ESRB EU crises database.¹³⁵ This new database for financial crises in European countries was developed by the substructures of the ECB's Financial Stability Committee (FSC) and the ESRB's Advisory Technical Committee (ATC) with the specific purpose of supporting the calibration of models for macroprudential analysis.

The baseline definition of financial crises encompasses all systemic crises that are not purely imported, as the focus of the evaluation exercise is on the build-up of domestic imbalances. For the early warning exercise, the crises variable is converted into a vulnerability indicator that takes the value 1 during a time window of twelve to five quarters before the start of a crisis and zero otherwise. This window is set to cover up to three years of pre-crisis horizon so as to give policymakers sufficient lead time to take action. The relevant sample for the early warning exercise comprises all euro area countries plus Denmark, Sweden and the United Kingdom and covers the period from the first quarter of 1970 to the fourth quarter of 2016.

Various statistical transformations are tested for a large set of underlying indicators covering credit, real estate, asset prices, debt service, and external imbalances considered relevant for the build-up of cyclical systemic risks. The following transformations are used: one-quarter, one-year, two-year and three-year growth rates and/or changes in ratios to GDP,¹³⁶ one-sided HP-filtered gaps with a smoothing parameter of 400,000 and 26,000, and the levels of the variables if deemed relevant. Only indicators that have at least 1,500 country-quarter observations are considered.

The early warning indicators are evaluated on the basis of a combination of their in-sample and out-of-sample signalling performance. The in-sample early warning properties are evaluated with the AUROC¹³⁷ for a pre-crisis horizon of twelve to five quarters.¹³⁸ The out-of-sample early warning properties are evaluated using the relative usefulness measure¹³⁹ based on a recursive quasi real-time exercise starting in the first quarter of 2000 for the same vulnerability indicator and balanced policymaker preferences between missing crises and issuing false alarms.

¹³⁵ See Lo Duca et al. (2017), op. cit.

¹³⁶ All indicators are expressed as annualised averages, e.g. three-year changes are divided by three and two-year changes are divided by two.

¹³⁷ The area under the receiver operating characteristics curve (AUROC) is a global measure of the signalling performance of an early warning indicator. It is computed as the area under the receiver operating characteristics (ROC) curve, which plots the noise ratio (false positive rate) against the signal ratio (true positive rate) for every possible signalling threshold value. An AUROC value of 0.5 indicates an uninformative indicator and a value of 1 indicates a perfect early warning indicator.

¹³⁸ The relative performance of the indicators is robust to considering alternative predictive horizons of sixteen to five quarters based on the benchmark crisis definition from the new ECB/ESRB EU crises database or of twelve to five quarters based on the crisis definition in Detken et al. (2014).

¹³⁹ The relative usefulness measure represents the difference between the loss that a policymaker would get when using the early warning model and the loss when ignoring the model, expressed as a share of the maximum achievable difference. The measure thus gives an idea of how close the early warning model is to a perfect model of crisis prediction for a policymaker with a given preference between type I errors (missing crises) and type II errors (issuing false alarms). See Alessi and Detken (2011), op. cit., regarding usefulness; and Sarlin, P., "On policymakers' loss functions and the evaluation of early warning systems", *Working Paper Series*, No 1509, ECB, 2013, regarding the relative usefulness measure.

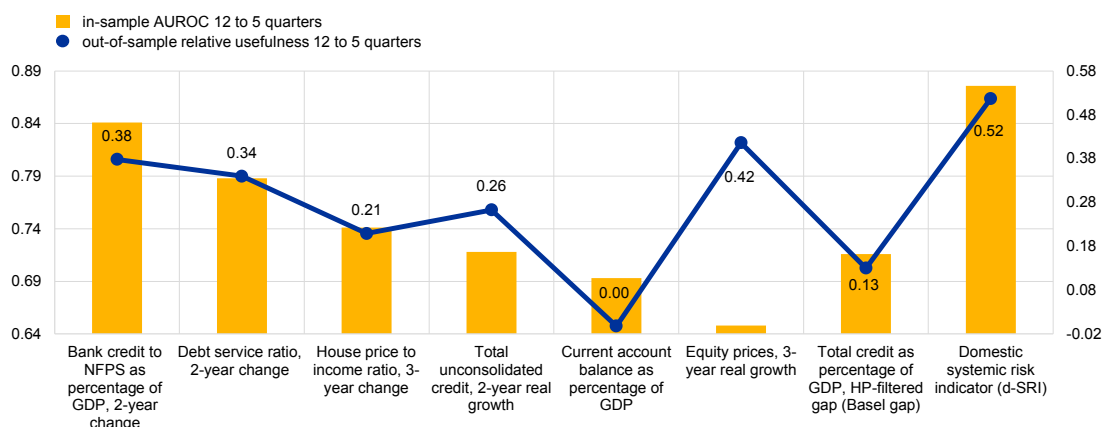
The main result of the evaluation exercise is that simple transformations of credit and asset price variables can have similar or even better early warning properties than the Basel gap for the set of selected EU countries as a whole (Chart A). For domestically driven systemic financial crises in euro area countries, Denmark, Sweden and the United Kingdom, bank credit indicators tend to have better early warning properties than total credit indicators. Moreover, two or three-year changes in credit-to-GDP ratios tend to have better signalling properties than “gaps” derived using a recursive HP filter. Overall, the two-year change in the bank credit-to-GDP ratio is the best performing univariate early warning indicator for domestic systemic financial crises with an in-sample AUROC of 0.84 and an out-of-sample relative usefulness of 0.38. The two-year change in the debt service ratio (DSR) or three-year change in the residential real estate (RRE) price-to-income ratio have slightly better in-sample and out-of-sample early warning performance than the Basel gap.

Chart A

Simple credit and asset price indicators have similar or even better early warning properties for domestic financial crises in euro area countries than the total credit-to-GDP gap

In-sample and out-of-sample early warning properties of the best univariate indicators and the Basel gap

(left-hand scale: in-sample AUROC; right-hand scale: out-of-sample relative usefulness)



Source: ECB calculations based on the ECB/ESRB EU crises database.

Notes: The relevant sample for the early warning performance metrics comprises all euro area countries plus Denmark, Sweden and the United Kingdom for the period from Q1 1970 to Q4 2016. “NFPS” stands for “non-financial private sector”. “AUROC” stands for “area under the receiver operating characteristics curve”, which is a global measure of the early warning performance of an indicator. A perfect indicator has an AUROC of 1 and an uninformative indicator an AUROC of 0.5. The in-sample AUROC is computed for a pre-crisis horizon of 12 to 5 quarters based on all systemic financial crises that are not purely foreign-induced from the new ECB/ESRB EU crises database. The out-of-sample early warning properties are evaluated with the relative usefulness for balanced preferences based on a recursive quasi real-time exercise starting in Q1 2000 for the same pre-crisis horizon of 12 to 5 quarters. “Basel gap” refers to the standardised credit-to-GDP gap, which is obtained as the cyclical component of a recursive HP filter with a smoothing parameter of 400,000 applied to the total credit-to-GDP ratio.

Combining early warning indicators into a composite domestic systemic risk indicator further improves the in-sample and out-of-sample early warning properties. The finding that composite risk indicators improve on the early warning performance of single indicators confirms findings in the literature (see, for example, Detken et al. (2014) and references therein).

The d-SRI is constructed as the optimal weighted average of six well-performing normalised early warning indicators. Indicator normalisation is performed by subtracting the median and dividing by the standard deviation of the

pooled indicator distribution across countries and time.¹⁴⁰ Indicator weights are chosen to maximise the early warning performance of the d-SRI for domestically-driven systemic financial crises identified in Lo Duca et al. (2017) with a lead time of 12 to 5 quarters (see Box A for technical details). The optimal weighting procedure for the d-SRI assigns the largest weight to the bank credit-to-GDP change (36%), followed by the current account balance (20%), the RRE price-to-income ratio change (17%), real equity price growth (17%), the DSR change (5%), and real total credit growth (5%).

The units of the d-SRI reflect the weighted average deviation of the sub-indicators from their median in multiples of the standard deviation. Hence, assuming that all sub-indicators display the same level of imbalance, a d-SRI value of +1 can be interpreted as all sub-indicators being one standard deviation above their median value from the pooled historical indicator distribution across euro area countries.

To complement the information from the d-SRI, the e-SRI is designed to capture the direct exposure of a country to the build-up of cyclical systemic risks abroad. To capture this notion of cross-country spillover risks, the e-SRI is constructed as an exposure-based weighted average of the d-SRI across all foreign countries from the point of view of the country of interest. For this purpose, the d-SRI is calculated for 45 countries worldwide. The weights for constructing the e-SRI are country-specific and vary over time based on the direct asset-side exposure of each national banking system to all of the other foreign countries.¹⁴¹ The e-SRI thus captures the country-specific exposure to the build-up of cyclical systemic risks in foreign countries from across the world.

In a final step, the CSRI is obtained as the optimal weighted average of the d-SRI and the e-SRI. In particular, the optimal weights of the two systemic risk indicators are chosen to maximise the early warning performance of the CSRI for all systemic financial crises identified in Lo Duca et al. (2017), with a lead time of 12 to 5 quarters. The set of crises considered for the CSRI is thus broader than the set of “domestic” crises considered for the d-SRI and includes systemic financial crises that were induced by foreign factors.

¹⁴⁰ For the current account, the normalised indicator is multiplied by -1 so that higher values indicate more risk. The normalisation based on pooled data moments does not alter the dynamics or the early warning properties of the d-SRI compared to using the raw underlying early warning indicators to compute the d-SRI. The advantage of this normalisation is, however, that the units of the d-SRI have an intuitive interpretation as the weighted average deviation from the historical median, measured in multiples of the historical standard deviation. In addition, owing to the normalisation, the d-SRI weights have a direct interpretation as the contribution of each indicator to the variation of the d-SRI. Robustness exercises show that normalisation with pooled cross-country data moments leads to better quasi-real time early warning performance than normalisation with country-specific data moments.

¹⁴¹ This method of taking into account cross-country risk spillovers is based on Lang, J.H., “Cross-Country Linkages and Spill-overs in Early Warning Models for Financial Crises”, mimeo, 2015. Exposure to foreign countries is measured by banking sector total claims vis-à-vis each foreign country and is taken from the BIS locational banking statistics. The foreign exposure measure is expressed as a share of total credit provided to the domestic non-financial private sector. Banking sector asset-side exposure is chosen as a proxy for cross-country financial linkages, given the dominant role of banks in the financial system of most euro area countries.

Information content of the cyclical systemic risk indicator about the likelihood of systemic financial crises

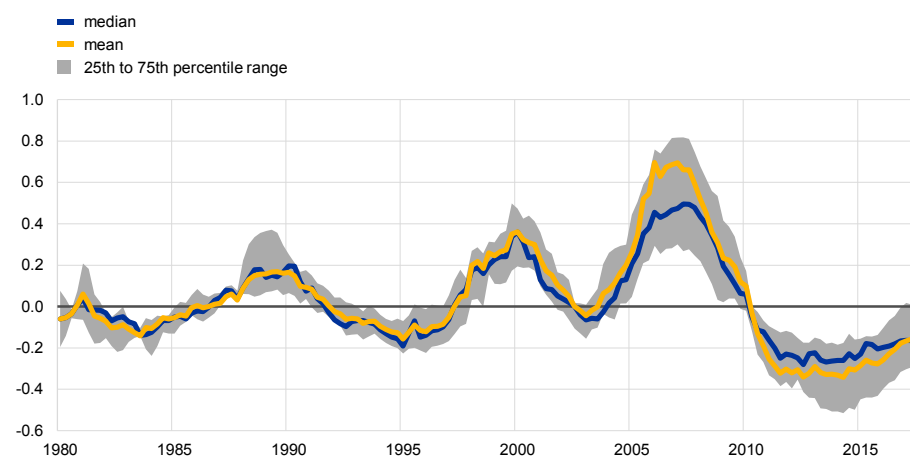
The CSRI displays long cycles across euro area countries and tends to increase well before the onset of systemic financial crises (Charts B.1 and B.2). Since the early 1980s the median CSRI across euro area countries displays three peaks with a marked increase before the global financial crisis and subsequent bust (Chart B.1). Currently, the median CSRI still remains at subdued levels, with a large dispersion across individual euro area countries. An inspection of the evolution of the CSRI across past systemic financial crises shows that the indicator starts to increase on average around five years ahead of a crisis and reaches its peak around four to eight quarters before the onset of a systemic financial crisis (Chart B.2). This pattern illustrates the timely risk signals provided by the CSRI.

Chart B.1

The CSRI displays long cycles with three peaks since the early 1980s across euro area countries

Cross-country mean, median and interquartile range of the CSRI over time

(x-axis: time; y-axis: CSRI)



Source: ECB calculations based on various data sources.

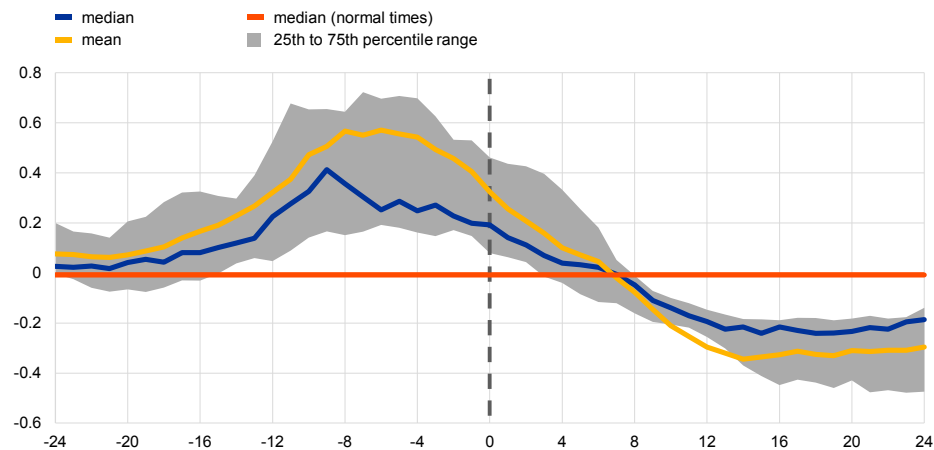
Notes: The grey shaded area indicates the interquartile range of the CSRI across euro area countries. The CSRI is constructed as a weighted average of the d-SRI and the e-SRI.

Chart B.2

The CSRI starts to increase on average around five years before a financial crisis

Cross-country distribution of CSRI values around past systemic financial crises

(x-axis: quarters before/after the start of systemic financial crises; y-axis: CSRI)



Source: ECB calculations based on various data sources.

Notes: The grey shaded area indicates the interquartile range of the CSRI across euro area countries during the 24 quarters before and after systemic financial crises. The orange line indicates the median of the CSRI across euro area countries in "normal times" (not within +/- 6 years of the start of a systemic financial crisis). The dating of systemic financial crises in the chart is based on the ECB/ESRB EU crises database described in Lo Duca et al. (2017).

The early warning properties of the CSRI for systemic financial crises across euro area countries as a whole are superior to those of the credit-to-GDP gap.

If one considers all systemic financial crises in the sample, the CSRI attains an AUROC of around 0.85 for a prediction horizon of 12 to 5 quarters, while the total credit-to-GDP gap reaches an AUROC of 0.67.¹⁴² If one considers only domestically-induced systemic financial crises, the d-SRI achieves an AUROC of 0.88 for a prediction horizon of 12 to 5 quarters (see Box B). Moreover, the d-SRI also attains a high out-of-sample relative usefulness of 0.52 based on a quasi-real-time early warning exercise starting in the first quarter of 2000.

The cross-country spillover e-SRI can significantly change the overall cyclical systemic risk assessment for countries with sizeable cross-border exposures (Chart B.3).

For example, in the case of Germany, domestic vulnerabilities, as represented by the d-SRI, were subdued ahead of the global financial crisis and would not have indicated heightened cyclical systemic risks. However, risks from foreign spillovers, as measured by the e-SRI, increased considerably between 2003 and 2008, owing to the increasing foreign exposures of the German banking system and the build-up of cyclical systemic risks abroad. A breakdown of the CSRI into the domestic and cross-border spillover components can therefore inform macroprudential policy authorities about the sources of systemic risk.

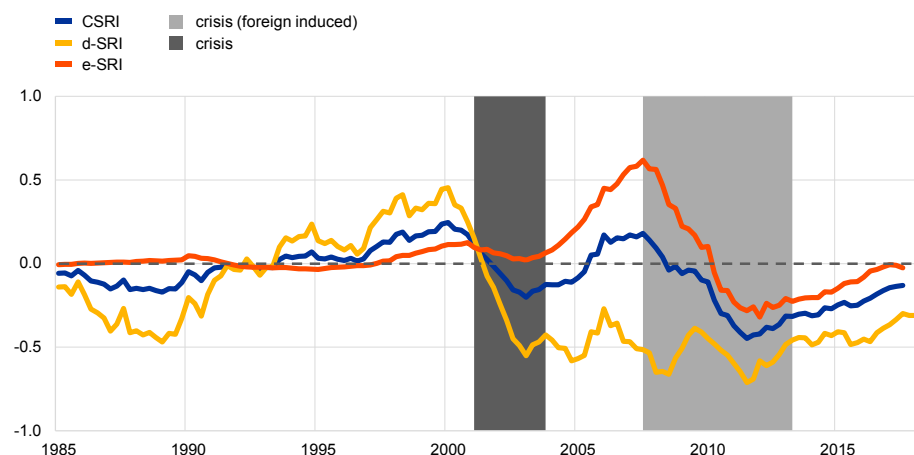
¹⁴² Compared to the d-SRI, the AUROC of the CSRI for all crisis events is higher by 0.04. See notes to Chart A in Box B for an explanation of the AUROC concept.

Chart B.3

The domestic and foreign spillover dimensions of cyclical systemic risks provide complementary information, as shown by the example of Germany

CSRI, d-SRI and e-SRI for Germany

(x-axis: time; y-axis: deviation from median)



Source: ECB calculations based on various data sources.

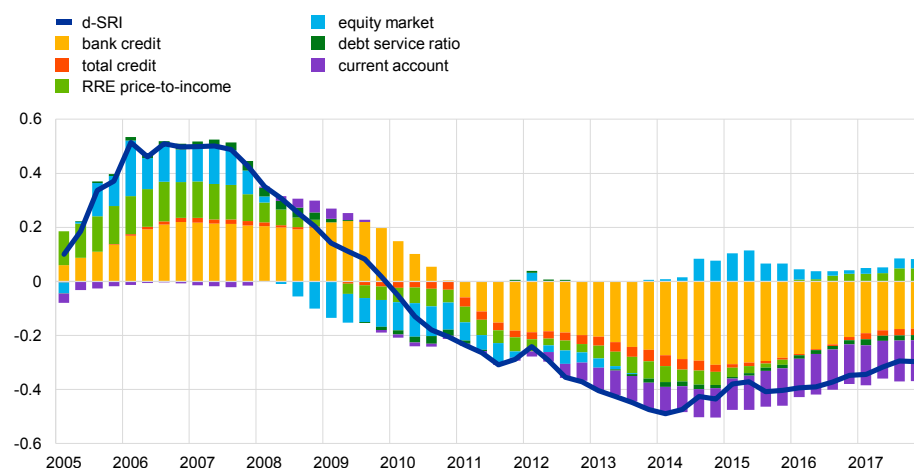
Notes: The dates of systemic financial crises on the chart are based on the ECB/ESRB EU crises database described in Lo Duca et al. (2017). The dark grey bar indicates a systemic crisis that was due to domestic factors, while the light grey bar indicates a systemic crisis that was induced purely by foreign factors.

Chart B.4

The d-SRI can be decomposed into its underlying driving factors, which can help to arrive at a risk narrative and support communication of risk assessments

Decomposition of the d-SRI for the euro area aggregate

(x-axis: date; y-axis: d-SRI and contributions of d-SRI components)



Source: ECB calculations based on various data sources.

Notes: The decomposition is based on the d-SRI sub-indicator values in combination with their optimal weights (indicated in brackets): bank credit-to-GDP change (36%), current account balance (20%), RRE price-to-income ratio change (17%), real equity price growth (17%), DSR change (5%), and real total credit growth (5%).

In addition, the tractable nature of the d-SRI allows a straightforward decomposition into driving factors which can help develop an overall risk narrative (Chart B.4). Owing to the weighted linear aggregation of the d-SRI, it can be decomposed into its fundamental driving factors. Such a decomposition can be used to identify whether the domestic cyclical systemic risk build-up is broad-based

or driven by selected risk factors and whether individual factors accentuate or attenuate the overall vulnerability. Positive contributions imply that a risk factor is above the cross-country historical median, while negative contributions imply that it is below the median.

Information content of the cyclical systemic risk indicator about the severity of systemic financial crises

The level of the d-SRI around the start of past systemic financial crises

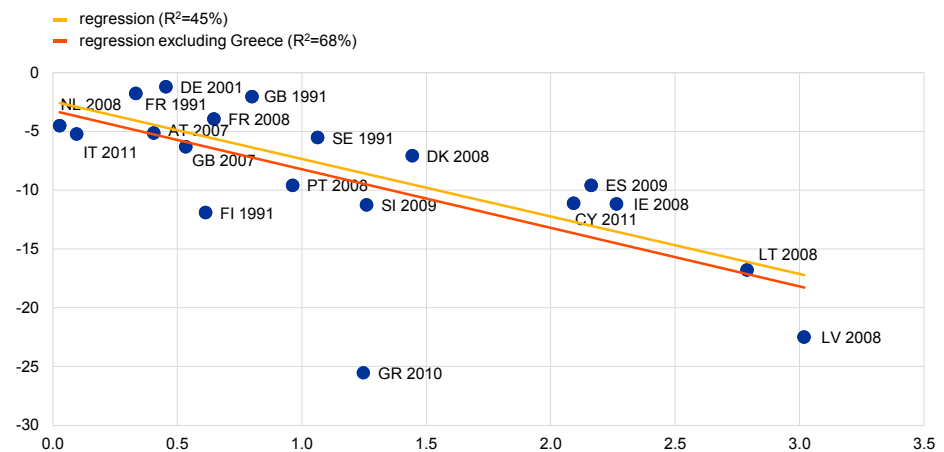
contains information about the subsequent severity of a crisis. For example, the maximum value of the d-SRI within a six-quarter pre-crisis window displays a high correlation with the subsequent maximum drop in real GDP during systemic financial crises (Chart B.5). Hence, for the 19 domestically-driven systemic financial crises for which d-SRI data are available, large non-financial private sector imbalances, as measured by large values of the d-SRI, have tended to be associated with more severe financial crises, as measured by the maximum output loss.

Chart B.5

The level of the d-SRI around the start of past systemic financial crises is highly correlated with output losses that materialised during those crises

Relationship between the d-SRI and drops in real GDP during past systemic financial crises

(x-axis: maximum d-SRI value before a crisis; y-axis: maximum drop in real GDP during a crisis)



Source: ECB calculations based on various data sources.

Notes: The chart shows the peak level of the d-SRI around the start of a systemic financial crisis (defined as six quarters pre-crisis up to the start of a crisis) plotted against the maximum drop in real GDP from peak to trough that materialised during that crisis. The dating of systemic financial crises shown on the chart is based on the new ECB/ESRB EU crises database described in Lo Duca et al. (2017). Purely foreign-induced crises are excluded. In total there are 19 systemic financial crises events in the sample for which d-SRI data are available. Five of these crises materialised before the global financial crisis (FI 1991, FR 1991, GB 1991, SE 1991, DE 2001).

Formal model estimates based on local projections suggest that high values of the CSRI have predictive power for large declines in real GDP growth over the medium term (Chart B.6). For example, across euro area countries, Denmark, Sweden and the United Kingdom, an elevated CSRI value of one standard deviation implies a decline in future real GDP growth of around 4 percentage points three to

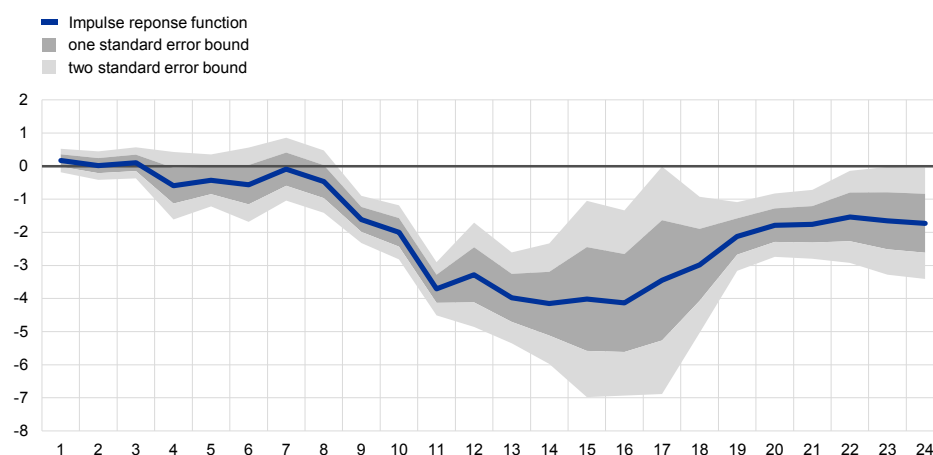
four years down the road.¹⁴³ The predictive power of the CSRI for future GDP growth is statistically significant at the nine quarters ahead horizon and beyond. The strongest predictive power of the CSRI for real GDP growth occurs between 11 and 16 quarters in the future. At shorter horizons it becomes less pronounced, but is still present at the six-years-ahead horizon.

Chart B.6

A CSRI value of one standard deviation today leads on average to a decrease in future real GDP growth of around 4 percentage points three years down the road

Local projection impulse response of future real GDP growth to current values of the CSRI

(x-axis: forecast horizon in quarters; y-axis: one-year-ahead real GDP growth rate)



Source: ECB calculations based on various data sources.

Notes: The chart displays the impulse response function (IRF) of one-year-ahead real GDP growth to a one standard deviation shock in the CSRI. The IRF is obtained from local projections as proposed by Jordà (2005), controlling for ten lags of one-year-ahead GDP growth rates, ten lags of the CSRI, and country fixed effects. Yellow areas indicate the one and two standard error bounds.

In addition to average real GDP growth, the CSRI has predictive power in particular for the left tail of the growth distribution over the medium term.

Quantile impulse responses (Chart B.7) show that the drop in average real GDP growth three to four years ahead shown in chart B.6 is due to a shift of the entire GDP growth distribution, and especially due to a shift in the left tail. For a horizon of 11 to 18 quarters ahead, a one standard deviation value of the CSRI predicts a reduction in the 10th percentile of the real GDP growth distribution by up to 6 percentage points, compared to a range of -2 to -4 percentage points for the 75th and 25th percentiles. Examining quantile loss measures, it is found that the explanatory power of the CSRI for future real GDP growth is strongest for the left tail, proxied by the 10th percentile, and at horizons of 4 to 12 quarters. The foreign CSRI contributes to the explanatory power at horizons of about 12 quarters ahead and beyond.

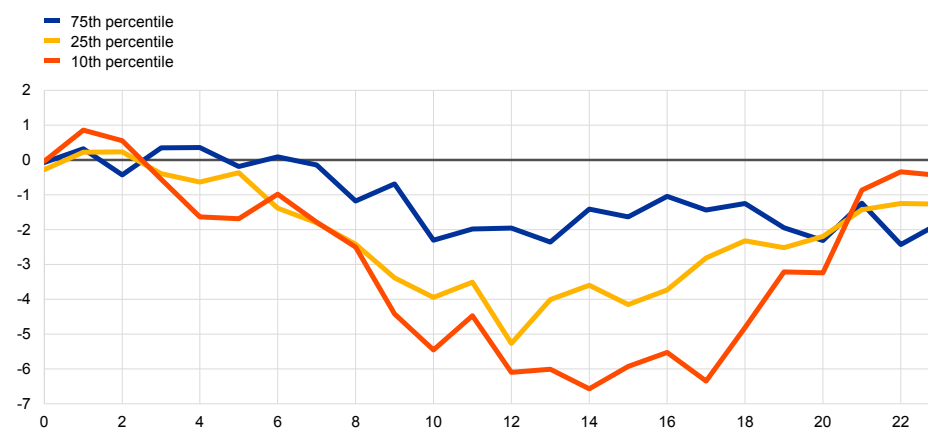
¹⁴³ The estimation is based on local projections as proposed by Jordà, Ò., "Estimation and Inference of Impulse Responses by Local Projections", *American Economic Review*, Vol. 95(1), 2005, pp. 161-182, using the sample of euro area countries plus Denmark, Sweden and the United Kingdom between the first quarter of 1970 and the fourth quarter of 2016.

Chart B.7

The CSRI has predictive power for the entire future real GDP growth distribution, and in particular for the left tail of the growth distribution

Quantile regression impulse responses of real GDP growth to current values of the CSRI

(x-axis: forecast horizon in quarters; y-axis: one-year-ahead real GDP growth rate quantile)



Source: ECB calculations based on various data sources.

Notes: The IRF is obtained via local projections based on quantile regressions with ten lags of one-year-ahead GDP growth rates and ten lags of the CSRI.

Conclusion

Overall, the CSRI is a tractable and interpretable cyclical systemic risk indicator that contains useful information about the likelihood and severity of systemic financial crises over the medium term. Its main strengths reside in its intuitive decomposition into the macro-financial driving forces of imbalances and in its predictive power for large declines in real GDP growth several years ahead. The CSRI complements the information from other risk signals such as credit-to-GDP gaps, multivariate logit early warning models, financial cycle estimates, semi-structural models of credit excesses, and country-specific indicators. For a detailed systemic risk assessment in the euro area, the CSRI and other formal financial stability indicators will continue to benefit from qualitative information, such as market intelligence. At the same time, refinements are being made to formal systemic risk indicators to raise their predictive performance further, for example by considering variables in levels or country-specific indicator normalisations.

C The distribution of interest rate risk in the euro area

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This special feature analyses the distribution of interest rate risk in the euro area economy using balance sheet data and information on derivatives positions from significant credit institutions. On aggregate, banks' interest rate risk exposure is small relative to their loss absorption capacity, but exposure varies across institutions. This variation is driven by loan rate fixation practices at country level. Banks use derivatives for hedging, but retain residual interest rate risk exposures. In fixed-rate countries the main vulnerability to rising interest rates lies with the banks that have the greatest interest rate risk, while households would be directly affected in countries with predominantly variable-rate loans. In the latter case, increased loan servicing costs due to rising interest rates could affect banks through lower asset quality.

Introduction

The distribution of interest rate risk in the economy is important from a financial stability perspective. The extent to which banks, households and non-financial corporations (NFCs) are exposed to interest rate risk is a priori ambiguous. Loans, for example, can be granted at fixed or variable interest rates, giving rise to different interest rate sensitivities for instruments with similar maturities. Depending on banks' market power, sight deposits can be relatively insensitive to changes in interest rates, despite having a zero maturity. In addition, banks can use derivatives to offset the impact of existing maturity mismatches on their balance sheets. From a financial stability perspective, it is important to understand which entities bear interest rate risk and whether they are able to absorb the impact of changes in interest rates. Financial stability could be affected if specific entities or sectors with limited loss absorption capacity have a large exposure to interest rate risk.

Past experience motivates an in-depth analysis of the distribution of interest rate risk in the euro area. One episode that illustrates the perils of concentrated interest rate risk is the savings and loans crisis in the United States in the 1980s. After funding long-term mortgages with short-term liabilities, savings and loans institutions incurred losses following sharp, unexpected increases in interest rates. This is illustrated in Chart C.1, which shows the erosion of banks' net interest margin over the period 1986-89 and the contemporaneous increase in assets held by savings and loan institutions under resolution.¹⁴⁴

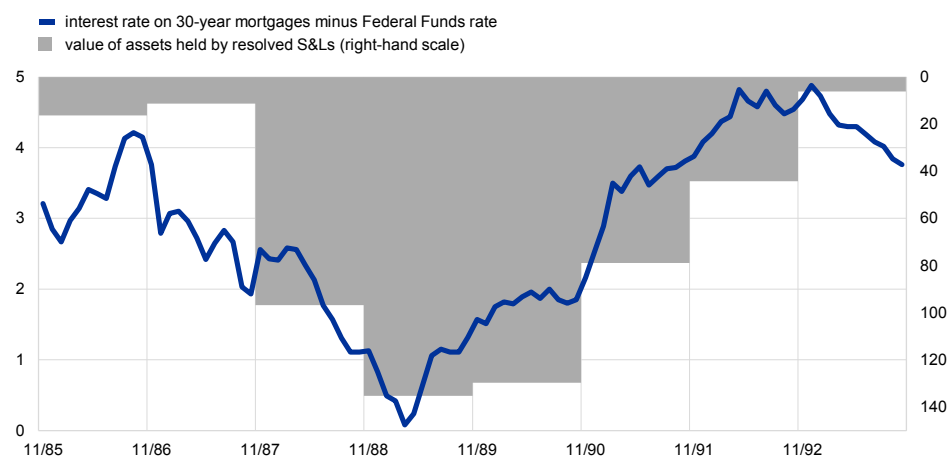
¹⁴⁴ In the period 1986-89, the Federal Reserve System increased its benchmark policy rate by approximately 400 basis points. Consequently, the cost of deposit funding increased, while income from fixed-rate mortgages remained constant. In combination with low levels of capitalisation, these interest rate changes triggered widespread insolvencies. Resolution authorities in the United States subsequently resolved more than 1,000 savings and loans institutions, causing the industry to shrink by approximately one-third.

Chart C.1

Savings and loans institutions in the United States were vulnerable to increases in interest rates in the 1980s

Interest rate margin and assets held by resolved savings and loans institutions

(1985-1993; percentage points (left-hand scale), USD billions (right-hand scale))



Sources: Federal Reserve System and Federal Deposit Insurance Corporation (FDIC).

As the macroeconomic recovery strengthens in the euro area and price pressures gradually build up, financial market participants are likely to bring forward their expectations of higher interest rates. Accordingly, the exposure of different sectors of the economy to interest rate risk justifies a detailed analysis of the associated financial stability risks.¹⁴⁵ While banks are naturally centre stage owing to their role in maturity transformation, interest rate risk can also be borne by other sectors. Insofar as those sectors are leveraged, their exposure to interest rate risk can lead to credit risk for banks and other lenders.

This special feature investigates the distribution of interest rate risk across euro area banks, households and NFCs.¹⁴⁶ Two measures of interest rate risk – net worth sensitivity and income sensitivity – are defined and calculated for a sample of 104 euro area significant institutions. While the aggregate exposure is small, there is significant variation across banks, in large part due to cross-country differences in interest rate fixation practices. There is evidence that banks hedge their interest rate risk in the derivatives market, but hedging is incomplete, and banks retain residual exposures. The analysis is then broadened to include the risk exposures of other sectors, which vary across countries according to the characteristics of loan contracts offered by banks. In a scenario of rising interest rates, banks tend to be more adversely affected in fixed-rate countries, while households are more vulnerable to interest rate increases in countries with predominantly variable rates.

¹⁴⁵ The ECB recently published the findings of a supervisory exercise in which it assumed six hypothetical scenarios for the future path of interest rates. See "Sensitivity Analysis of IRRBB – Stress test 2017 – Final results", European Central Bank, October 2017, available on the ECB's banking supervision website.

¹⁴⁶ The analysis is based on Hoffmann, P., Langfield, S., Pierobon, F. and Vuillemy, G., "Who bears interest rate risk?", *Working Paper Series*, ECB, forthcoming (currently available at [SSRN](https://ssrn.com)).

Households with already stretched balance sheets are particularly vulnerable to rate increases, which could in turn affect the asset quality of banks.

Interest rate risk in banks

The analysis is based on two measures of interest rate risk that are commonly used by practitioners, supervisors and academics. The first measures the sensitivity of bank net worth (defined as the present value of assets minus liabilities) to an increase in interest rates. For a given balance sheet, it is computed as the change in net worth following an upward shift in the yield curve by one basis point.¹⁴⁷ The second measure, called the income gap, is defined as the difference between assets and liabilities with a duration of less than one year, multiplied by an increase in interest rates of one basis point. In broad terms, the income gap quantifies how much a bank's interest income is expected to change over one year in response to changes in interest rates. These two measures are closely related. For example, a bank with a positive duration gap (i.e. the duration of its assets is higher than the duration of its liabilities) will typically exhibit a negative change in net worth following an increase in interest rates because the present value of assets will decrease relative to liabilities. The income gap will typically also be negative, as short-term liabilities re-price before longer-term assets.¹⁴⁸ For comparability across institutions, both measures are expressed relative to a bank's total assets.¹⁴⁹

Two datasets are combined to measure interest rate risk. The analysis is restricted to exposures in the banking book denominated in euro.¹⁵⁰ On-balance sheet exposures are obtained from supervisory filings of euro area significant institutions. These data provide an extensive overview of the maturity and repricing frequency of banks' assets and liabilities. Each balance sheet item (e.g. loans or term deposits) is broken down into 14 maturity buckets, which allows precise measurement of the duration of each instrument class. For fixed-rate instruments, data correspond to the residual maturity; for variable-rate instruments, data correspond to the next repricing date. Off-balance sheet exposures are measured using transaction-level data on banks' outstanding interest rate swaps.¹⁵¹ These data

¹⁴⁷ This measure is sometimes referred to as the "change in the economic value of equity" (ΔEVE), "duration gap", or DV01. In the analysis, a perfect pass-through of risk-free rates to other interest rates is assumed.

¹⁴⁸ Bank supervisors look at both present-value and income-related measures. While present-value-based measures, such as the change in net worth, capture the entire balance sheet, they do not account for the fact that only a subset of items in the banking book are marked to market. On the other hand, income-based measures, such as the income gap, capture only a fraction of the balance sheet.

¹⁴⁹ **Alternative measures of interest rate risk focus on the sensitivity of certain components of net worth.** For example, the banking literature has assessed the interest rate sensitivity of stock market capitalisation. This is qualitatively similar to an analysis focused on economic value, but has the disadvantage that stock market data are not available for unlisted banks.

¹⁵⁰ This choice is supported by additional analyses that reveal that exposures to interest rate risk from the trading book are quantitatively small. In addition, only a few euro area banks have significant exposures to interest rate risk in other currencies.

¹⁵¹ Attention is restricted to interest rate swaps referencing the euro overnight index average (EONIA) or the euro interbank offered rate (EURIBOR), as these constitute the vast majority of derivatives used to manage interest rate risk relating to the euro yield curve. See "Shedding light on dark markets: First insights from the new EU-wide OTC derivatives dataset", *Occasional Paper Series*, No 11, European Systemic Risk Board, September 2016.

are available to the ECB under the European Market Infrastructure Regulation (EMIR).¹⁵² For each contract, the dataset includes information on the identity of the counterparties involved, the residual maturity of the contract, the underlying benchmark rate (e.g. 6-month EURIBOR), and the fixed rate agreed upon at trade execution.

Since both data sources were created recently, historical information is limited and the cross-sectional dimension provides the main informational content.

The primary reference period for the analysis is the end of 2015, but the findings are qualitatively robust to different sample periods. After merging the two datasets, the sample covers 104 euro area significant institutions. The total assets of these banks amount to €21.3 trillion, representing 97% of the total assets of all significant institutions directly supervised by the ECB. These banks were engaged in around 595,000 interest rate swap (IRS) contracts as at 31 December 2015, representing a gross notional value of close to €32.5 trillion. This amounts to over 40% of the global market for euro-denominated IRS contracts.

The behaviour of sight deposits is calibrated using stress test data. While sight deposits have a contractual maturity of zero, they behave differently in practice. This is particularly true for retail deposits, which tend to be less sensitive to interest rates than other liabilities. To account for this effect, the behaviour of sight deposits is modelled on the basis of bank-level supervisory information. In the case of retail loans, it is assumed that 5% are subject to early repayment each year.¹⁵³

Banks' aggregate exposure to interest rate risk is small. Chart C.2 depicts the cross-sectional distributions of the two measures of interest rate risk for the 104 institutions. The average change in bank net worth is -0.09 basis points relative to total assets. Given an average ratio of book equity to assets of around 7%, an interest rate increase of 200 basis points – a standard reference magnitude used by supervisors – would lead to a decline in bank capital of 2.57%. The income gap averages -0.002 basis points, which is much smaller in magnitude than the net worth sensitivity, given that this measure only captures the impact over one year.

There is substantial heterogeneity in banks' exposure to interest rate risk.

While the average bank has a small exposure, certain institutions bear significant interest rate risk, as indicated by the pronounced tails of both distributions in Chart C.2. Whereas some institutions benefit from higher interest rates (both in terms of net worth and income), others lose. Accordingly, the near-zero aggregate effect is a result of substantial individual exposures cancelling each other out at the level of the banking sector.

¹⁵² These data are obtained from two trade repositories, DTCC-DDRL and Regis-TR, which cover the vast majority of trades in interest rate swaps by entities resident in the euro area.

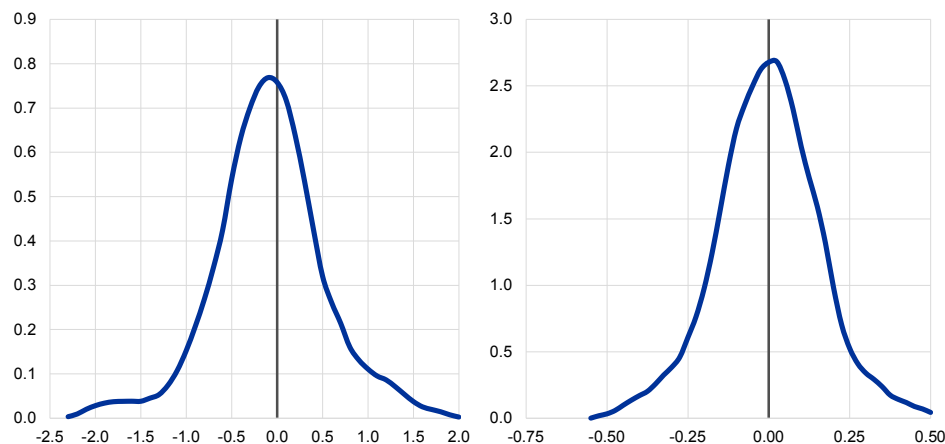
¹⁵³ This is broadly in line with information from the ECB's recent stress test, which found an average prepayment rate of 7% for *all* modelled loans (not only retail loans). More generally, the empirical relevance of this assumption is secondary to that for sight deposits.

Chart C.2

On average, euro area banks bear little interest rate risk based on net worth and income gap sensitivity

Cross-sectional distribution of the change in bank net worth (left panel) and in the income gap (right panel) following a one basis point increase in interest rates

(Q4 2015; x-axis: basis points; y-axis: probability density)



Source: Hoffmann, Langfield, Pierobon and Vuillemeys (forthcoming).

Notes: This figure plots a kernel density estimate (with optimal bandwidth) of the cross-sectional distribution of banks' net worth sensitivity (left panel) and income gap sensitivity (right panel) for 104 euro area significant institutions. Left panel: the change in bank net worth (expressed in basis points as a fraction of a bank's total assets) is based on a one basis point parallel increase in interest rates. Right panel: the income gap is defined as the net position (assets minus liabilities) with a re-pricing maturity of less than one year times 1/10,000 (expressed in basis points as a fraction of a bank's total assets).

Loan-rate fixation practices are a significant driver of heterogeneity in bank-level exposures. Importantly, the type of interest rate fixation in loan contracts (i.e. fixed versus variable rates) varies significantly across jurisdictions.¹⁵⁴ These practices affect the interest rate risk borne by banks. Chart C.3 (left panel) plots the cross-sectional distribution of the change in bank net worth for two groups of banks, depending on whether they are domiciled in a fixed-rate country or a variable-rate country. Chart C.3 (right panel) plots the corresponding distributions for the income gap. These charts illustrate a close connection between loan rate fixation and the direction of banks' interest rate risk exposure. Banks in fixed-rate countries are more likely to hold long-duration assets (i.e. fixed-rate mortgages), which leads to greater maturity mismatch. Accordingly, the net worth and income of these banks is hurt by an increase in interest rates. The opposite is true for banks in variable-rate countries, as the relatively short duration of loans means that their assets tend to re-price before their liabilities, such that higher interest rates translate into higher income and higher net worth.

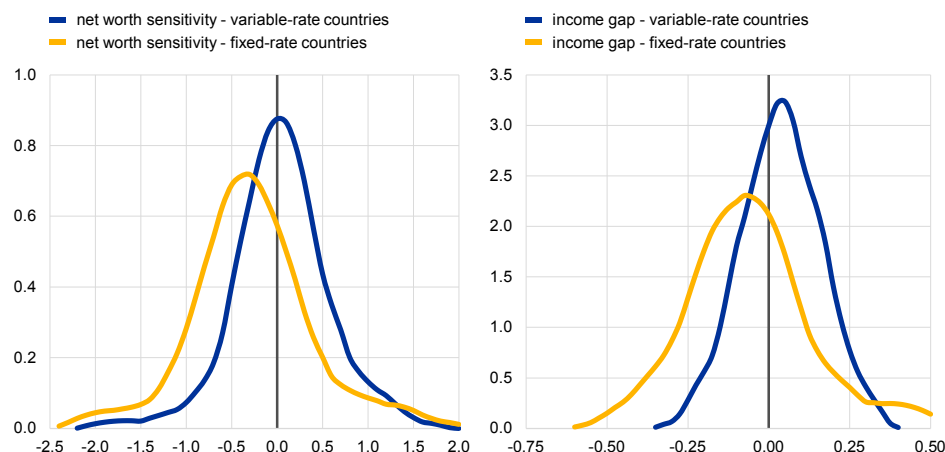
¹⁵⁴ For further details, see Hoffmann, Langfield, Pierobon and Vuillemeys, op. cit.

Chart C.3

Exposures are heterogeneous, with loan-rate fixation practices playing a major role

Cross-sectional distribution of the change in bank net worth (left panel) and in the income gap (right panel) following a one basis point increase in interest rates – for fixed and variable-rate countries

(Q4 2015; x-axis: basis points; y-axis: probability density)



Source: Hoffmann, Langfield, Pierobon and Vuillemeij (forthcoming).

Notes: This figure plots a kernel density estimate (with optimal bandwidth) of the cross-sectional distribution of banks' net worth sensitivity (left panel) and income gap sensitivity (right panel) for 104 euro area significant institutions, separated into two groups of countries. Left panel: the change in bank net worth (expressed in basis points as a fraction of a bank's total assets) is based on a one basis point parallel increase in interest rates. Right panel: the income gap is defined as the net position (assets minus liabilities) with a re-pricing maturity of less than one year times 1/10,000 (expressed in basis points as a fraction of a bank's total assets). Fixed-rate countries include Belgium, Germany, France, the Netherlands and Slovakia, while in all other countries variable rates predominate.

Similar conclusions are obtained when considering a steepening of the yield curve. Such a scenario is modelled by assuming an increase in interest rates of one basis point only for maturities of more than five years. In this scenario, the two main conclusions – limited exposures for the aggregate banking sector and significant heterogeneity owing to loan-rate fixation conventions – continue to hold. Higher long-term interest rates have a negative effect on the net worth of banks in fixed-rate countries, as they hold a large share of long-term assets, the present value of which decreases in such a scenario. In contrast, banks in variable-rate countries hold assets with much shorter durations, making their net worth less vulnerable to higher interest rates.

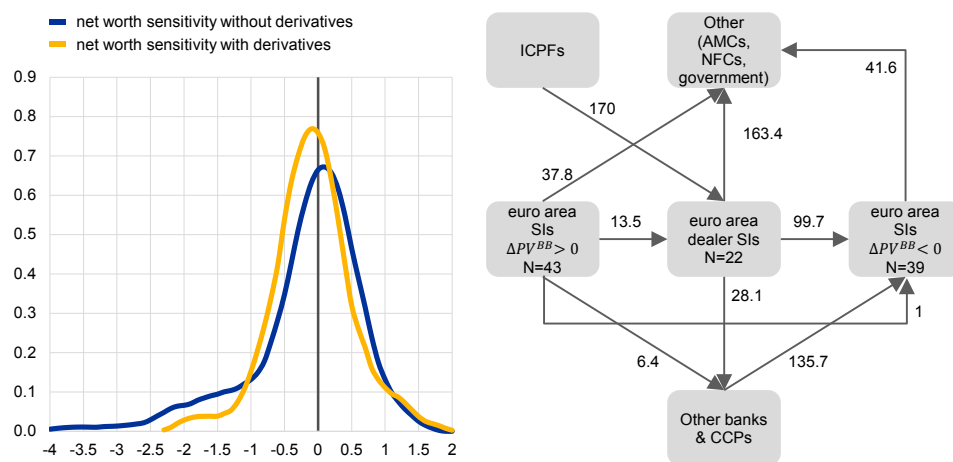
Banks' positions in interest rate swaps are used to hedge their interest rate exposures. To illustrate the effects of risk management via derivatives, the change in bank net worth can be decomposed into two components, one arising from on-balance sheet exposures (loans and securities held on the asset side, and deposits and securities issued on the liability side) and one due to interest rate swap positions. The effect of interest rate swaps can then be assessed by contrasting banks' exposure to interest rate risk before and after hedging. Chart C.4 (left panel) reveals that banks' use of interest rate swaps leads to a reduction in interest rate risk. In particular, the left tail of the distribution is curtailed after accounting for interest rate swaps. This indicates that swaps are used for hedging, particularly by banks with large exposures to interest rate risk. Banks use interest rate swaps to hedge irrespective of the sign of their balance sheet exposure, with the result that the cross-sectional distribution narrows towards zero from both sides.

Chart C.4

Euro area banks engage in mutual risk-sharing in the interest rate swap market, reducing on-balance sheet exposures by one quarter on average

Cross-sectional distribution of net worth sensitivities before and after accounting for hedging with interest rate swaps (left panel) and value transfers across sectors following a one basis point increase in interest rates (right panel)

(Q4 2015; left panel: x-axis: basis points; y-axis: probability density; right panel: € millions)



Source: Hoffmann, Langfield, Pierobon and Vuillemeij (forthcoming).

Notes: Left panel: this figure plots a kernel density estimate (with optimal bandwidth) of the cross-sectional distribution of banks' net worth sensitivity before and after accounting for positions in interest rate swaps. The sample comprises 104 euro area significant institutions. Right panel: this figure plots the value transfers across sectors based on outstanding euro-denominated interest rate swap contracts as at the end of 2015. The 104 euro area significant institutions (SIs) are split into three groups: 22 dealer SIs, 43 SIs with a positive on-balance sheet exposure, and 39 SIs with a negative on-balance sheet exposure.

Heterogeneous on-balance sheet exposures facilitate risk-sharing through derivatives markets.

Institutions with exposures of opposite signs can enter into contracts that reduce interest rate risk for both counterparties. This is shown in Chart C.4 (right panel), which indicates the value transfers owing to interest rate swaps arising from a one basis point upward shift in the yield curve. Banks with on-balance-sheet positions that benefit from an increase in interest rates (i.e. a positive change in net worth) share risk with banks with the opposite configuration (i.e. a negative change in net worth). While some of this risk sharing occurs through bilateral contracts, most is intermediated by a subset of banks that act as dealers in derivatives markets.

Interest rate risk in the non-financial private sector

Banks' balance sheets also reveal information about the interest rate risk exposures of other sectors of the economy.

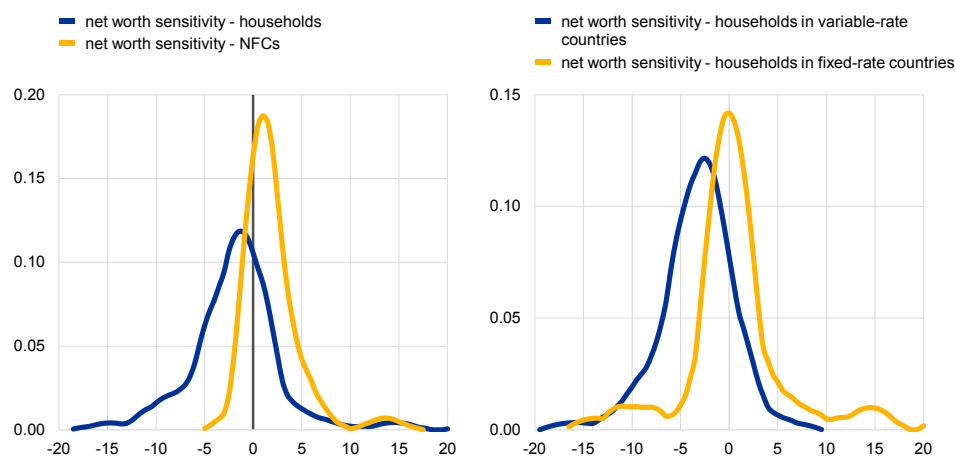
Assets held by banks constitute the liabilities of other agents, and vice versa. For example, a mortgage loan is a liability for households. Accordingly, decomposing bank balance sheets at the sector level allows the computation of exposures for households and NFCs. Chart C.5 (left panel) depicts the distribution of the net worth sensitivities of households and NFCs based on their financial contracting with 104 credit institutions.

Chart C.5

The household sector is vulnerable to increases in interest rates, particularly in countries with predominantly floating-rate mortgages

Distribution of the net worth sensitivity following a one basis point increase in interest rates for households and NFCs (left panel) and for households in fixed and variable-rate countries (right panel)

(Q4 2015; x-axis: basis points; y-axis: probability density)



Source: Hoffmann, Langfield, Pierobon and Vuillemeij (forthcoming).

Notes: Left panel: this figure plots a kernel density estimate of the cross-sectional distribution of net worth sensitivities for households and NFCs based on their financial contracting with 104 euro area significant institutions. Numbers are expressed in basis points and relative to total bank assets. Right panel: this figure plots a kernel density estimate of the cross-sectional distribution of net worth sensitivities for households from two groups of countries, based on their financial contracting with 104 euro area significant institutions. Numbers are expressed in basis points and relative to total bank assets. Fixed-rate countries include Belgium, Germany, France, the Netherlands and Slovakia, while in all other countries variable rates predominate.

The household sector appears more vulnerable to interest rate increases than the corporate sector.

The exposure arises because a considerable portion of household liabilities is indexed to short-term interest rates, while deposits are relatively insensitive to changes in the yield curve owing to banks' market power. In contrast, NFCs have exposures with the opposite sign and a somewhat lower magnitude. However, this aggregate picture masks heterogeneity with respect to firm size. For example, there is evidence that smaller firms tend to hedge less, leading to greater interest rate risk exposures for such firms.¹⁵⁵

In the household sector, vulnerabilities to interest rate increases are concentrated in variable-rate countries.

This is shown in Chart C.5 (right panel), which separates households' exposures into two groups based on the location of the lending bank. In line with the results in the previous section, the liabilities of households in variable-rate countries have a significantly shorter duration, thus pushing their overall exposure into negative territory. In some of the countries with predominantly variable interest rates, households exhibit high levels of indebtedness and high debt service-to-income ratios (see Chart C.6), rendering those households more vulnerable to negative shocks to their net worth. In contrast, households in fixed-rate countries tend to have lower levels of indebtedness and debt servicing burdens, with the exception of the Netherlands.

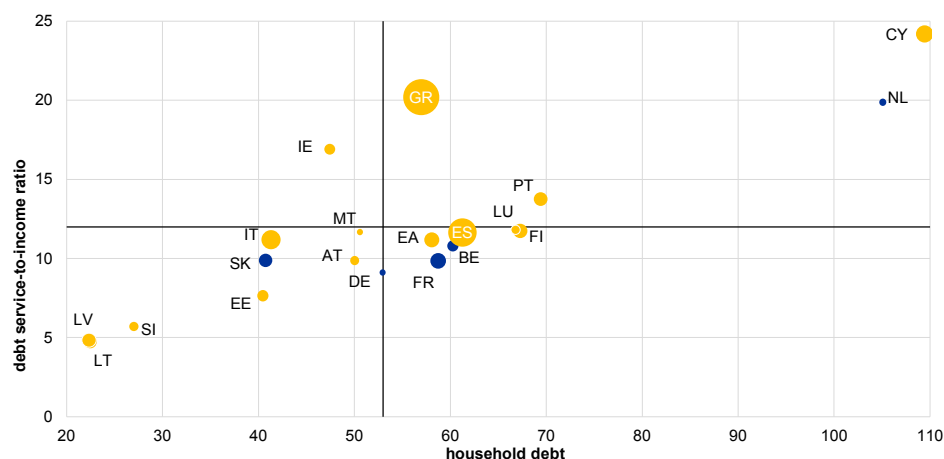
¹⁵⁵ See, for example, Guay, W. and Kothari, S., "How much do firms hedge with derivatives?", *Journal of Financial Economics*, Vol. 70, 2003, pp. 423-461.

Chart C.6

The combination of stretched balance sheets and variable interest rates makes some households vulnerable to rising rates

Indebtedness and debt service-to-income ratios of euro area households

(Q4 2017; percentages of GDP and percentages)



Sources: ECB and ECB calculations.

Notes: Countries with predominantly variable interest rates are highlighted in yellow. The size of the bubble represents the unemployment rate. The vertical line represents the estimated macroeconomic imbalance procedure (MIP) benchmark of 53% of GDP for household debt. The 133% of GDP MIP limit for fully consolidated non-financial private sector debt is split between firms and households based on their average past shares in the stock of non-financial private sector debt. The debt service-to-income (DSTI) ratio is equal to the fixed debt service costs of an instalment loan divided by income. Fixed debt service costs assume identical repayment of the principal during the average maturity of the debt and an average interest rate, and are a factor of outstanding debt. The threshold for the DSTI ratio is obtained from a univariate signalling model such that values exceeding the threshold have been associated with the onset of systemic financial crises in the following 5 to 12 quarters. Data on these threshold values are taken from "A new database for financial crises in European countries – ECB/ESRB EU crises database", *Occasional Paper Series*, No 13, European Systemic Risk Board, July 2017.

Including items from household balance sheets that do not arise from their financial contracting with banks would change the measurement of their interest rate risk exposure. On the liability side these non-bank items are small, but on the asset side many households have assets other than deposits with banks (e.g. other financial assets and real estate). These assets typically have long duration, so including them would make the sensitivity of household net worth to higher interest rates more negative. While the magnitude of this effect would differ across households, home ownership rates tend to be higher in variable-rate countries, suggesting that the inclusion of non-bank assets would amplify cross-country heterogeneity.

Conclusion

While the interest rate risk exposure of euro area banks is limited on aggregate, banks operating in countries with predominantly fixed-rate loans would be more adversely affected by rising rates. The fact that aggregate exposures are small does not imply that there are no implications for financial stability. Some banks bear significant interest rate risk, although the direction of that exposure varies across banks. While this implies that the banking sector as a whole is diversified, sharp and unexpected increases in interest rates could nevertheless generate financial instability by depleting a large share of equity for a subset of banks.

The assumptions underlying banks' models for sight deposits can have a sizeable impact on their interest rate risk. One potential concern relates to the accuracy of banks' models regarding the stability of their deposit funding. Sight deposits are a source of profits for banks because they are less interest rate sensitive than their contractual maturity suggests – a phenomenon usually attributed to household inertia. To maximise profits, banks typically model the behaviour of these liabilities on the basis of past data and choose the maturity structure of their assets accordingly. However, given that interest rates have been low for a prolonged period of time, there could be uncertainty about whether models would capture the adjustment to higher interest rates satisfactorily.¹⁵⁶

Regarding the non-financial private sector, households appear to be more vulnerable to rising interest rates in countries with variable rates. Higher interest rates could translate into debt servicing difficulties for some households, particularly those that are heavily indebted. This might in turn have adverse consequences for the asset quality of financial institutions, some of which are already managing high levels of non-performing loans. While non-financial corporations might have a higher share of variable rate loans, in particular the large corporations could alleviate their interest rate risk through hedging.

¹⁵⁶ This uncertainty could work in either direction. On one hand, models that have been calibrated on the basis of a prolonged period of low interest rates might underestimate sensitivities in a scenario of rising rates. On the other hand, models might overestimate sensitivities insofar as banks have absorbed part of the decline in market rates via lower margins owing to the effective zero lower bound on retail deposit rates. This could imply more inertia when interest rates are raised from negative territory, as banks first restore their interest rate margins.

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