2 Financial markets

Global financial markets have witnessed a number of sharp – but short-lived – asset price corrections in recent years. This trend has continued over the past six months, as demonstrated, in particular, by higher asset price volatility following the outcomes of the UK referendum and the US election. These outcomes increased political uncertainty in the European Union, notably concerning the willingness to push through growth-enhancing structural reforms going forward.

In addition to temporary bouts of volatility, global markets have been characterised by an environment of accommodative monetary policy and subdued growth expectations, which have led investors to search for yield. In this environment, global bond yields across the credit spectrum have remained low. In the low-yield environment, an increase in investors' preference for taking on higher duration in their portfolios has been observed. Furthermore, riskier assets, in particular equities, benefited from abating market worries about financial stability concerns originating from emerging market economies (EMEs). However, the likelihood that EMEs would be negatively affected by spillovers from advanced economies has recently increased.

The low-yield environment also prevailed in euro area bond markets, influenced by ECB asset purchases. Money markets remained fully functional and the high degree of monetary policy accommodation was smoothly transmitted to interbank rates and to lending rates for households and firms. At the same time, equity markets remained subject to occasional short-lived shocks. Sector-specific market concerns related to euro area banks led to elevated volatility during the summer months.

Notwithstanding the broad resilience of the financial system to recent market turbulence, risks of further asset price corrections have increased. The main triggers that could unearth an abrupt reversal in risk premia stem from: (i) heightened political uncertainties in advanced economies; (ii) continued fragilities in emerging markets as a whole that could trigger strong shifts in capital flows; or (iii) higher global asset price volatility stemming from any prospect of unforeseen shifts in market expectations relating to US monetary policy or inflation. As a result, investor buffers need to be capable of withstanding a possible reversal of risk premia. Reversals of risk premia have tended to be short-lived to date – indeed, the persistence of volatility shocks in euro area and global stock markets has fallen markedly in recent years, leading to a potential for complacency which could translate into undue risk-taking by investors.

2.1 Continued search for yield in global markets amid political uncertainty and financial sector concerns

Over the past six months, bond and stock markets have absorbed several short-lived bouts of elevated stress. In the early part of the review period, global

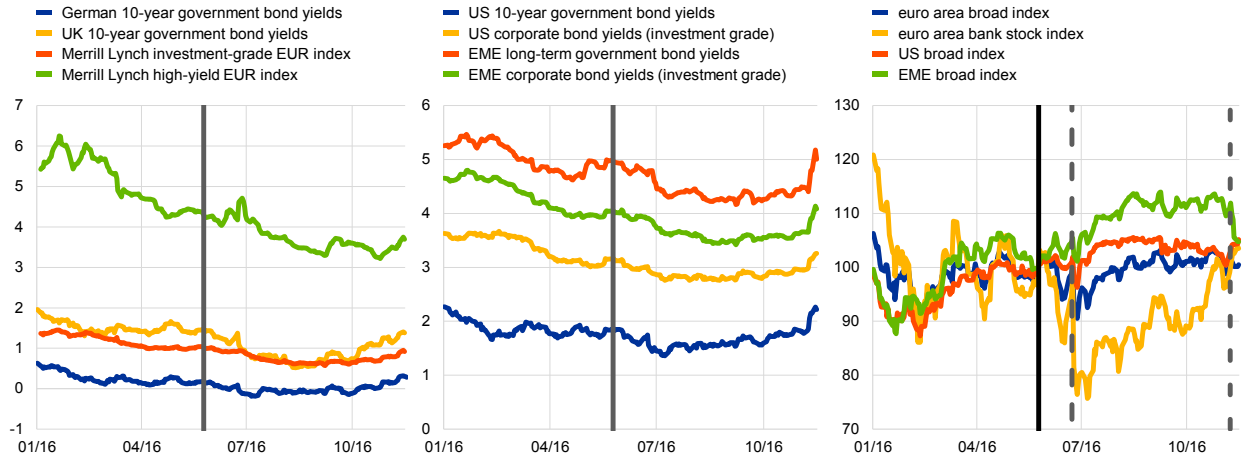
bond yields continued on their downward trajectories in an environment of still muted near-term global economic growth prospects and accommodative monetary policies around the world, coupled with yield-seeking behaviour by investors (see **Chart 2.1**). In October and early November, however, bond yields in advanced economies increased against a backdrop of somewhat higher global growth prospects. At the same time, stock prices in a number of advanced economies and EMEs increased over the review period. While this could point to stock markets' resilience, the high level of stock prices may also have an alternative interpretation – namely, a potentially over-optimistic pricing compared with firms' earnings prospects.

Chart 2.1

Yields on global bonds have continued to decline, while the prices of global equities have fluctuated sharply

Changes in global bond yields (left and middle panels) and stock prices (right panel) since the May 2016 FSR (vertical solid lines)

(1 Jan. 2016 – 15 Nov. 2016, daily observations; left and middle panels: percentage per annum; right panel: stock prices indexed to 100 on 24 May; the dashed lines in the right panel represent the dates of the UK referendum (23 June) and the US election (8 November))



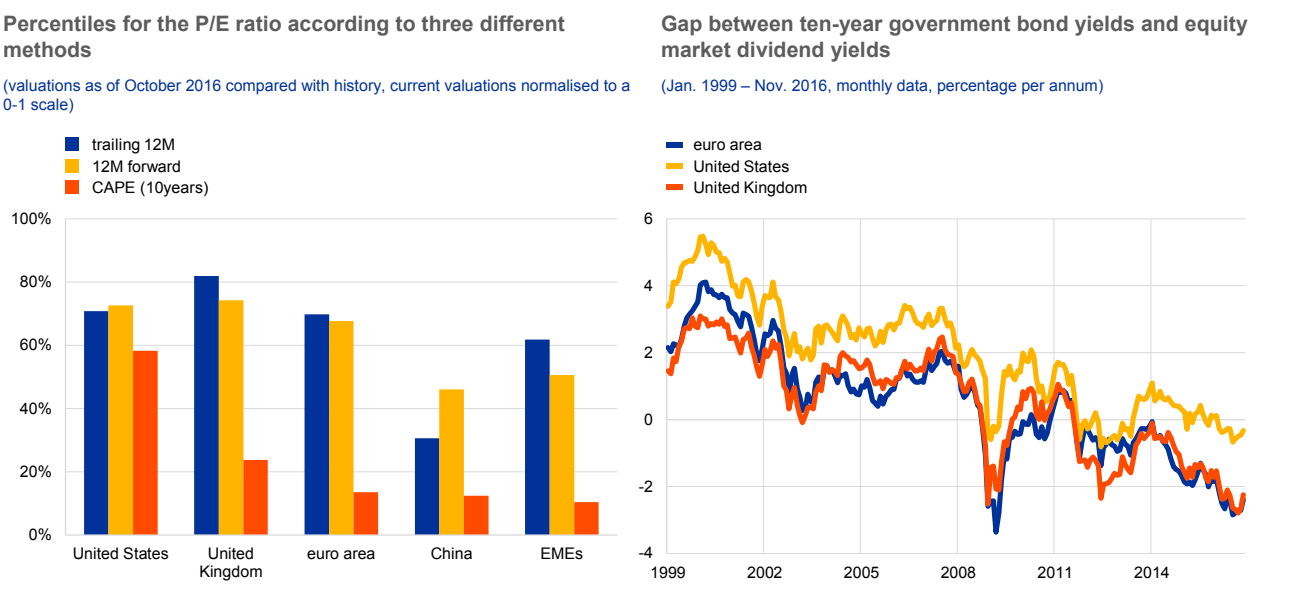
Sources: Bloomberg, Thomson Reuters Datastream and ECB calculations.

Higher political uncertainty impacted global asset prices over the review period. Both the UK referendum and the US election led to short-lived episodes of market turmoil followed by quick recoveries. This pattern was particularly pronounced following the UK referendum in June. The outcome initially sparked a strong reaction in global asset prices. This reaction was particularly noteworthy not only in the United Kingdom, but also in the euro area. The resulting drop in market participants' risk appetite was sharp and reflected in many ways a standard correction affecting stock markets, amid falling bond yields and a depreciation of the pound sterling. From a financial stability standpoint, though, the most noteworthy feature was the specific impact on assets linked to the UK commercial property markets and the euro area banking sector. Several open-end commercial property funds in the United Kingdom either temporarily suspended redemptions to protect the interests of long-term investors or introduced other measures to limit withdrawals (see also **Section 3.1.3**). Furthermore, as a result of the heightened risk aversion, "high beta" stocks underperformed significantly after the referendum. In particular, the euro area banking sector – amid low expected earnings and, in some cases, high non-performing loans – was hard-hit. The market reactions turned out to be mostly of a temporary nature, however, and most asset classes quickly recovered from their

initial losses (apart from the pound sterling, which still trades well below its pre-referendum levels). The improved market sentiment clearly benefited from a timely and forceful response of the Bank of England, which cut the bank rate and introduced a package of measures designed to provide additional monetary stimulus. Market movements in the week after the US election were less pronounced. The implications of the recent US election for euro area financial stability are highly uncertain at the current juncture. This notwithstanding, economic policies in the United States will likely become more inward-oriented, while the fiscal deficit may grow as a result of tax reductions and increased infrastructure and defence spending. In such a scenario, the euro area economy may be impacted via trade channels and by possible spillover effects from higher interest and inflation rate expectations in the United States.

Chart 2.2

Signs of inflated stock prices in some regions and valuations supported by low alternative returns in the bond markets



Sources: Thomson Reuters Datastream and ECB calculations.
Notes: Left panel: "trailing 12M" is a P/E ratio based on the last year's reported earnings (sample starts in 1985, for EMEs in 1995), "12M forward" is a P/E ratio based on earnings forecasts a year ahead (sample starts in 1990) and "CAPE (10 years)" is a cyclically adjusted P/E ratio with a ten-year moving average of reported earnings in the denominator (sample starts in 1985, for EMEs in 2005).

Despite temporary bouts of stress, global risk sentiment has improved overall as concerns about an unravelling of imbalances in EMEs have abated somewhat. In particular, anxiety in the markets about a sharp economic slowdown in China subsided somewhat as continued monetary accommodation and fiscal stimulus provided support to the economy in the near term, albeit at the risk of a further build-up of medium-term vulnerabilities as credit continued to outpace GDP growth (see also **Chart 1.10**). The riskier segments of global asset markets also benefited from the recovery in oil and other commodity prices from the low levels recorded in early 2016.

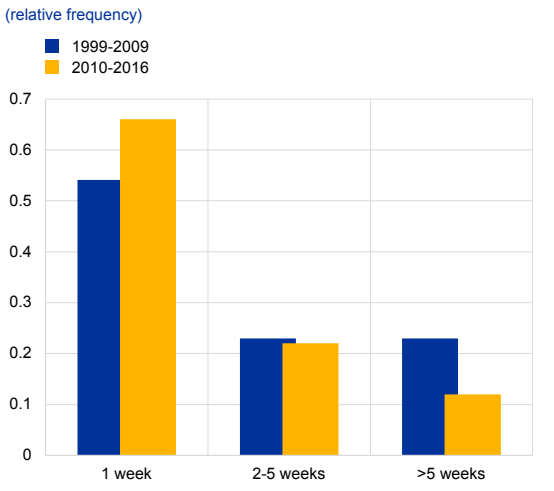
The prices in some of the riskier global asset segments have begun to signal stretched valuations, as the short-lived nature of volatility spikes in recent

years points to a potential underpricing of risk. The prices in some equity markets have begun to signal stretched valuations. Valuation measures – including the cyclically adjusted price/earnings (CAPE) ratio, arguably the best indicator of valuation based on earnings – are in some regions hovering at levels which, in the past, have been harbingers of impending large corrections. In the United States, three common price/earnings metrics are elevated (see **Chart 2.2**). Moreover, it cannot be ruled out that favourable earnings yields in stock markets compared with the declining yields on debt instruments have supported stock price valuations. Furthermore, as discussed in **Box 3**, the persistence of volatility shocks in global stock markets has fallen markedly in recent years. Going forward, should this become a regular pattern, market participants may become complacent as they see a lower likelihood of prolonged stock market corrections. Such complacency could translate into undue risk-taking by investors and potentially contribute to a further stretching of asset price valuations.

Box 3
Have global uncertainty shocks become less persistent?

Global financial markets have been marked by a number of short-lived episodes of elevated volatility in recent years. Strong corrections in asset markets can have adverse financial stability implications for the financial system owing to the losses that have to be absorbed, thereby reducing available buffers. A prolonged period of volatile and falling asset prices may also weaken the real economy via wealth effects and confidence channels. While large or persistent shocks to asset price volatility can cause clear harm to financial stability, so too might seemingly more insidious short-lived corrections. Indeed, amid surges in market volatility that are short-lived and quick to fade, investors are more likely to take undue risks.

Chart A
Fewer episodes of protracted increases in S&P 500 volatility



Sources: Bloomberg and ECB calculations.
Notes: Weeks until elevated volatility of the US S&P 500 index reverts back to its five-year moving average. The volatility of the S&P 500 index is derived using a GARCH(1,1) estimation of daily returns.

As the global financial crisis fades, periods of elevated financial market uncertainty have become increasingly short-lived in recent years. Looking at the US stock markets, in the past six years there have been fewer protracted episodes of high volatility of the S&P 500 index than in the pre-financial crisis era. In particular, only one out of ten surges in the S&P index's return volatility has persisted for more than five weeks, down from two out of ten in the late phase of the so-called "Great Moderation" between 1999 and 2009 (see **Chart A**). Conversely, the occurrence of short-lived surges, when volatility declined back to average levels within a week, has increased.

This falling duration of shock impacts also becomes evident in a systematic econometric analysis. Chart B shows, for US and euro area stock markets, respectively, time-varying estimates of the share of a one-standard-deviation shock to the return volatility of the US

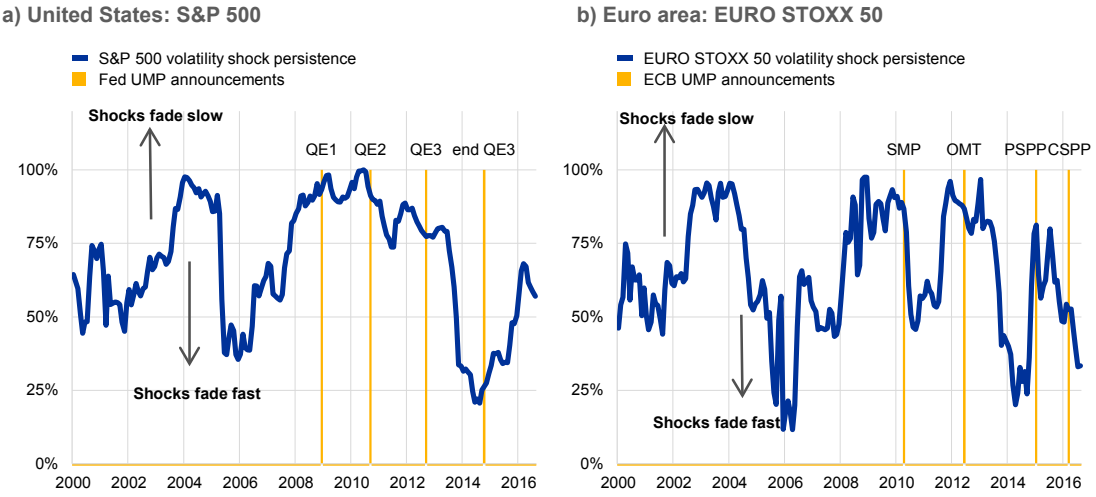
and euro area equity markets that persists beyond ten trading days, derived from a univariate GARCH model. A higher measure indicates that shocks to volatility are slower to fade and vice versa.

The credibility and efficacy of monetary policy measures may have been a contributor to this observed decline in protracted stock market volatility. Dynamics of volatility persistence estimates over time suggest that monetary policy accommodation may have influenced the persistence of shocks to market uncertainty. **Chart B** also shows the timing of major unconventional monetary policy measures in the two economies. Indeed, the different dynamics in this indicator appear to reflect the different stages of unconventional monetary policy accommodation across the two economies. For the United States, volatility persistence gradually declined after the introduction of the various asset purchase programmes (QE 1-3), but rose again after the Federal Reserve ceased to engage in large-scale asset purchases in October 2014. Likewise, volatility persistence in the euro area stock market declined after major non-standard measures were announced by the ECB. Recently, the decline in persistence coincided with the adoption of the ECB's public sector purchase programme and corporate sector purchase programme.

Chart B

Time-varying estimates of persistence implied in GARCH(1,1) stock market volatility

(share of shock to volatility persisting beyond ten trading days)



Sources: Bloomberg and ECB calculations.
Notes: The y-axis shows the percentage share of a shock to stock market volatility, derived from the impulse response function (IRF) of a GARCH(1,1) model for the respective stock index, estimated over a one-year rolling window of daily information. UMP stands for unconventional monetary policy, QE for quantitative easing, SMP for Securities Markets Programme, PSPP for public sector purchase programme and CSPP for corporate sector purchase programme.

From a financial stability viewpoint, neither extremely high levels, nor extremely low levels of volatility persistence appear to be desirable. If volatility is highly persistent, as was the case during the global financial crisis and the euro area sovereign debt crisis, adverse shocks to financial market confidence are long-lasting and potentially self-feeding as markets are slow to recover from asset price turmoil. In these situations, central bank actions are likely to be stabilising for financial markets and the economy at large. However, low volatility persistence can incentivise risk-taking, as experienced in the run-up to the global financial crisis when both persistence and the overall level of volatility were very low for an extended period of time. Specifically, shorter durations of elevated volatility mechanically compress backward-looking risk measures, which shape investors' risk

management decisions. The decline in the price of risk changes the relative price of assets with a given risk/return trade-off and may lead to portfolio rebalancing in favour of riskier assets.[13]

Monetary policy alone does not explain this falling persistence – clearly, other factors could also affect the persistence of uncertainty shocks. Monetary policy is likely not the sole factor determining the persistence of shocks to market uncertainty. In general, high levels of economic uncertainty as well as uncertainty about the political economy might explain a higher persistence of uncertainty shocks. Conversely, overall low levels of economic and policy uncertainty are likely to be associated with lower levels of shock persistence as investors are quick to digest any negative news and refocus on an overall sound economic outlook. Moreover, changes in market liquidity could help to explain varying degrees of shock persistence. In particular, a more liquid market should ceteris paribus contribute to absorbing adverse shocks faster and vice versa. Finally, the level of investor leverage might be another determinant; if investors, whether banks or non-banks, are highly leveraged, balance sheet losses incurred as a result of market turmoil are more likely to necessitate fire sales of assets which could reinforce the initial shock. Hence, declining shock persistence, as recently recorded for the overall euro area equity market, might reflect higher capital buffers of banks as well as the increased (decreased) share of asset managers (e.g. hedge funds) among investors with generally lower (higher) levels of leverage.

All in all, there have been significant changes in the persistence of shocks to market volatility over the last years. A standard GARCH-based approach applied to global stock markets finds evidence that volatility since 2010 has tended to return more quickly to its long-term mean (compared with the pre-crisis situation). Clearly, the factors explaining this are manifold, ranging from stronger regulatory standards amid an evolving financial market microstructure, elements of the macro-financial environment, to the efficacy of monetary policies. The latter, in particular, appears to be associated with the fact that there have been fewer manifestations of financial instability in recent years. While this suggests strong monetary policy credibility and efficacy, these policies should not inadvertently lead to insufficiently vigilant risk management at an entity level. Clearly, countercyclical policy settings will need to internalise this to avoid any undue build-up of system-wide risk.

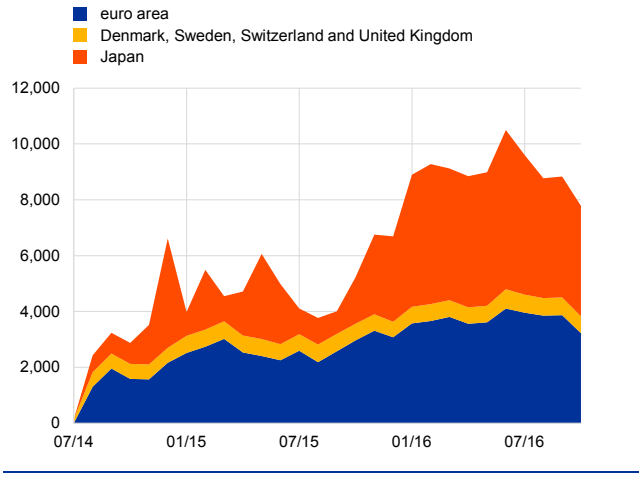
Notwithstanding the benefits of low yields in supporting the economic recovery, they might produce negative externalities in financial markets in the form of excessive risk-taking – particularly if protracted. The share of government bonds trading with a negative yield has increased rapidly in recent years. In October 2016, the total amount of outstanding government bonds with negative yields stood at USD 8.4 trillion. Across economies, the bulk of bonds trading with negative yields mainly emanated from the euro area and Japan (see **Chart 2.3**). To date, negative effects in the euro area appear contained as euro area asset prices are still recovering from stress a few years ago. Looking forward, however, a prolonged period of very low bond yields could entail risks. In particular, the scope for particularly low yield levels to hamper market participants' ability to accurately price risk requires monitoring. For example, very low or negative interest rates make standard net present value calculations less informative and thus obfuscate not only

[13] For a more detailed discussion of that channel, see Box 3 entitled "Financial market volatility and banking sector leverage", *Financial Stability Review*, ECB, November 2014.

real investment decisions, but also the interpretation of common valuation metrics such as the dividend discount model.

Chart 2.3

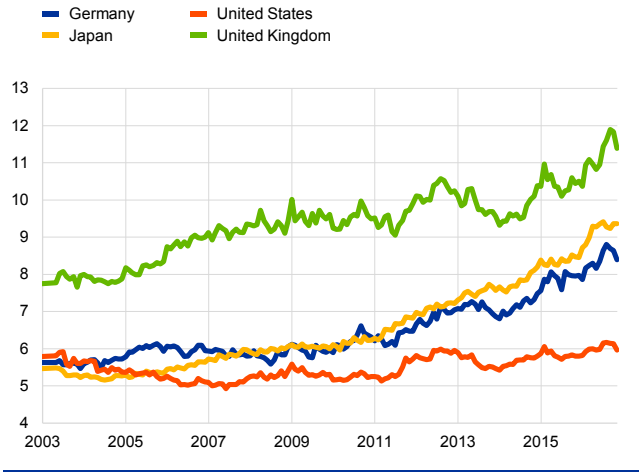
Share of bonds with negative yields is on the rise…



Sources: Dealogic, Bloomberg and ECB calculations.

Chart 2.4

…and durations are steadily trending up



Source: Bloomberg.
Note: The durations have been computed for all outstanding bonds using the Macaulay methodology.

In order to preserve returns in the very low interest rate environment, investors have increased the duration of their portfolios. Evidence based on securities holdings statistics in the euro area suggests that investment funds, in particular, have extended their duration in recent years (see **Chart 3.36** in **Section 3.1.3**). This observation is also consistent with issuer statistics from various treasuries. Average durations of German, Japanese, US and UK government securities have increased markedly, by around two years since early 2011 (see **Chart 2.4**). From an issuer perspective, however, this development is beneficial as long-term financing can be locked in at low costs.

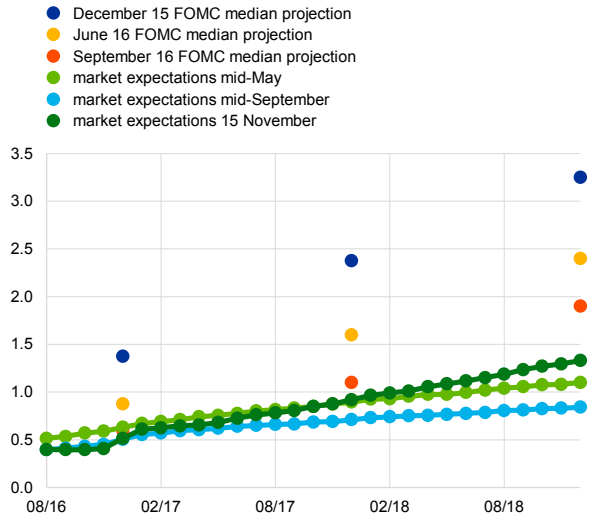
Investors' increasing exposure to low-yielding instruments and the high duration of their investments make them progressively vulnerable to a shift in market sentiment. Three potential triggers, in particular, could unearth vulnerabilities and push global risk premia higher. First, heightened political uncertainties in advanced economies have the potential to increase market volatility. Second, continued fragilities in emerging markets as a whole could trigger shifts in capital flows, which may result in elevated financial market volatility. Third, the divergence between financial markets' and the Federal Open Market Committee (FOMC) members' views on the path of future policy rates has declined somewhat since May. This notwithstanding, the deviation indicates the possibility of global asset price volatility stemming from unforeseen shifts in market expectations relating to US monetary policy or inflation (see **Chart 2.5**).

Chart 2.5

Despite the upward revisions over the review period, market participants still see a lower likelihood of rate hikes than FOMC members

US federal funds rate forecasts by the FOMC and financial markets

(FOMC median projections and market expectations)



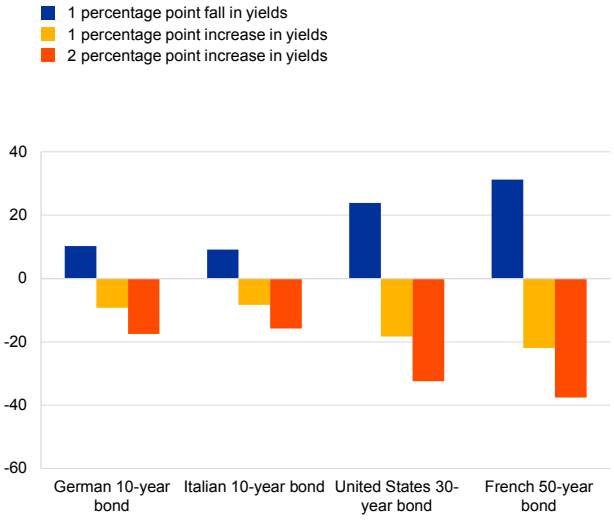
Sources: Bloomberg, Federal Reserve Board and ECB calculations.

Chart 2.6

Capital losses for low-yielding/high-duration portfolios could be substantial if sentiment were to worsen

Capital gains/losses following muted movements in bond yields

(capital gains/losses as at 15 November, percentage)



Source: Bloomberg.

A sharp upward adjustment of global risk premia could be amplified by herding behaviour, potentially resulting in large capital losses for portfolios highly exposed to low-yielding debt instruments. The possibility of herding behaviour, where more investors are chasing the same types of assets, has increased gradually as investors are finding it increasingly difficult to find value-generating assets. Increased correlations across asset classes (see **Chart 7** in the **Overview**) are indeed providing indications that one-directional moves in asset classes have become more common in recent years. Should market sentiment deteriorate, the high correlations between assets may act as an amplifier and lead to an even stronger correction of asset prices. Furthermore, owing to the non-linear relationship between prices and interest rates (i.e. bond convexity), there is higher price sensitivity when interest rates are very low or negative. As a result, losses for investors highly exposed to low-yielding bonds with long maturities can be large even for relatively limited movements in underlying interest rates (see **Chart 2.6**).

More generally, price irregularities in financial markets have become more prominent in recent years, complicating the derivation of policy-relevant information from market prices. Price anomalies have become particularly pronounced in various swap instruments. Throughout the crisis years, cross-currency basis swaps (CCBSs) have traded in negative territory for a number of currencies vis-à-vis the US dollar. In theory, large non-zero spreads represent a

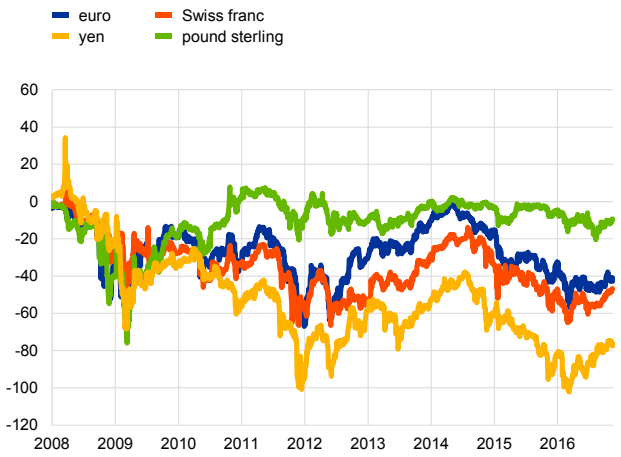
violation of an arbitrage condition.[14] These swap spreads signal the relative preference for one currency over another and thus the increasingly negative spread reflects the premium that foreign banks with limited access to US dollar deposits are willing to pay to obtain US dollar liquidity in the interbank market (see **Chart 2.7**).

Chart 2.7

Cross-currency basis swaps moved further into negative territory, partly reflecting strong hedging demand

Five-year cross-currency basis swap spreads against the US dollar

(1 Jan. 2008 – 15 Nov. 2016, daily data)



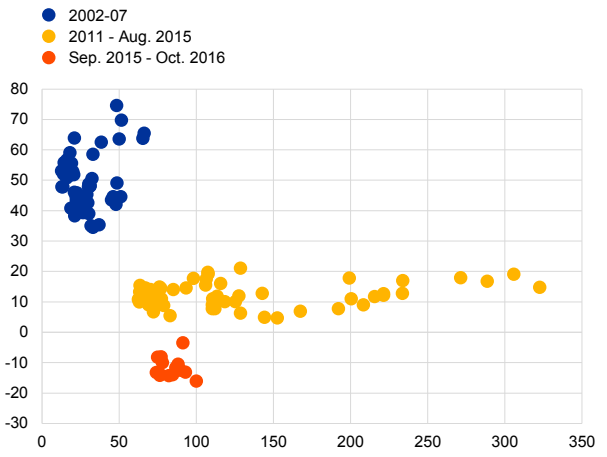
Source: Bloomberg.

Chart 2.8

The relationship between swap spreads and banks' credit risk has broken down since 2011

Ten-year US swap spreads and large US banks' CDS spreads

(Jan. 2002 – Oct. 2016, monthly data, basis points; x-axis: US bank CDS spreads; y-axis: ten-year US swap spreads)



Source: Bloomberg.
Note: Bank credit spreads are represented by the average of the five-year credit default swap (CDS) spreads for Goldman Sachs, Morgan Stanley, JP Morgan, Citigroup, Bank of America and Wells Fargo.

Part of the widening of the basis spreads in 2016 can be attributed to regulatory changes. In particular, stricter regulations for US prime money market funds (MMFs), aimed at avoiding runs during crisis situations, have contributed to an increase in the cost of unsecured US dollar funding.[15] Another part of the implicit increase in the US dollar funding premium can be attributed to the potential for increased monetary policy divergence between the United States and other advanced economies. Relatively higher US dollar yields have boosted foreign investments in US dollar assets. Hedging these investments against US dollar downside risk increases the demand for taking a corresponding position in a CCBS contract. Conversely, US corporates, seeking lower funding costs abroad, have recently issued large amounts of euro-denominated debt (while also benefiting from lower credit spreads in euro asset markets). To avoid (potential) currency mismatches on their balance sheets,

[14] A non-zero spread amounts to a violation of the so-called "covered interest parity", according to which there is a no-arbitrage relationship between (i) two countries' interest rate differentials and (ii) the observed spot and forward rates.

[15] In contrast to MMFs invested in short-term sovereign paper, MMFs invested in short-term bank debt (e.g. commercial paper) were required to adopt a floating net asset value system with effect from 14 October 2014. As a consequence, many MMFs have shifted large portfolio shares from USD-denominated commercial paper to US Treasury bills.

these issuers might hedge against the risk of dollar depreciation, further widening the CCBS spread. Adding to these factors, there might be strong intraday gyrations in CCBS markets stemming from temporary impairments to market liquidity. For example, market analysis has suggested that following the UK referendum, some market-makers partially withdrew from the CCBS markets in a context of higher uncertainty.

Price anomalies are not restricted to currency swaps – current prices of plain-vanilla interest rate swaps also indicate price dislocations. In early 2016 the interest rate on the fixed leg of ten-year US interest rate swaps began to trade below the rate on comparable US Treasuries. In theory, negative swap spreads (measured as the difference between the rate on the fixed leg of the swap and comparable Treasury rates) would indicate that investors perceive the credit risk of US banks (usually the counterparty in the swap transactions) to be lower than for the US government. Market sources suggest that a confluence of factors have contributed to this somewhat abnormal pricing behaviour. First, one cyclical driver might be related to strong demand of corporate debt issuers to swap their interest payments on their long-term debt (i.e. the fixed leg) into (still) lower floating rates (i.e. the variable leg). Second, longer-term structural factors may have played a role as well. For instance, the counterparty risk implied in swap contracts, which had warranted a positive swap spread in the past because they were traded in the over-the-counter (OTC) markets, has been reduced as these trades now tend to be cleared at central counterparties. Indeed, the relationship between ten-year US swap spreads and market-perceived credit risk for large US banks has broken down in recent years (see **Chart 2.8**).

2.2 Euro area market developments

Euro area government and corporate bond yields have remained at low levels since May, reflecting the subdued nominal growth outlook and reduced credit risk. Amid Eurosystem bond purchases, money markets have functioned effectively, with interest rates on unsecured and secured instruments hovering close to the ECB deposit facility rate in an environment of high excess liquidity in the system. Similarly, liquidity conditions in the government bond markets have remained solid. By contrast, some signs of tight liquidity conditions have appeared in the euro area corporate bond markets, while euro area stock markets have experienced bouts of volatility with strong price discrimination across economic sectors.

Policy expectations derived from financial market instruments have tightened somewhat since May. Market-based expectations of future EONIA rates have shifted up since the May FSR (see **Chart 2.9**), reflecting a slight pick-up in real interest rates on the back of a perceived improvement in global growth prospects as well as an increase in inflation expectations, particularly in the wake of the US presidential election. ECB operations (mainly the second series of targeted longer-term refinancing operations, TLTRO-II, and the expanded asset purchase programme) boosted excess liquidity, which reached around €1 trillion at the beginning of September 2016 and increased further to €1.1 trillion by mid-November. The high excess liquidity in the system has contributed to pushing money market

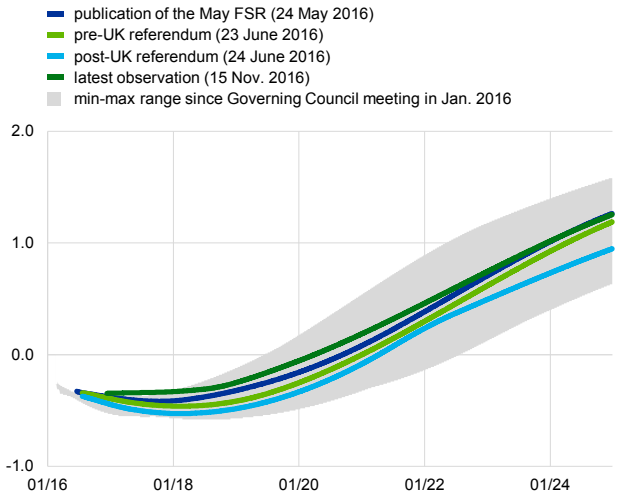
rates lower. In the unsecured segment, the share of overnight interbank borrowing at rates below the deposit facility rate grew larger, but was still relatively low. In the context of growing excess liquidity, some banks have offered institutions with no access to the ECB facilities (e.g. non-euro area banks, euro area corporate customers and institutional investors) the possibility to deposit their cash with them at rates significantly below the ECB deposit facility rate. Such deposits were then placed at the central bank at the ECB deposit facility rate.

Chart 2.9

Monetary policy is expected to remain accommodative for the foreseeable future

EONIA forward yield curve estimated from overnight index swaps

(percentage per annum)



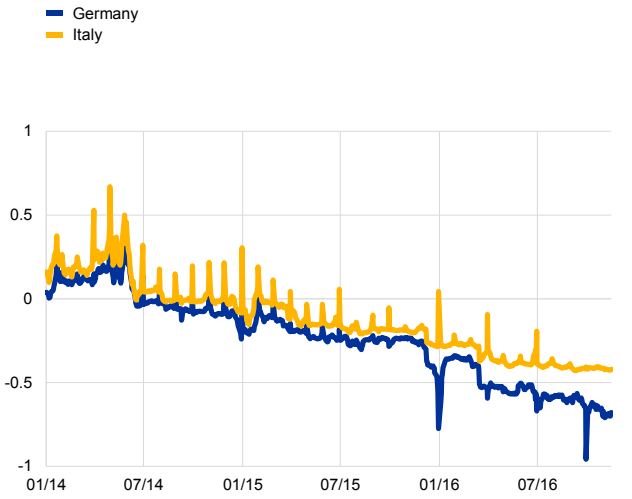
Sources: Thomson Reuters Datastream and ECB calculations.

Chart 2.10

Repo rates continued to trend downwards

Repo funding rate for Germany and Italy

(1 Jan. 2014 – 15 Nov. 2016, daily data, percentage points)



Source: ICAP.

The excess liquidity in the system has also pushed interest rates on secured money market funding lower. Market participants attributed the lower rates on general collateral repurchase agreements to several factors: (i) the build-up of cash holdings by market participants which lack access to the ECB deposit facility and hence are willing to lend at lower rates; and (ii) the ability of some counterparties to borrow euro in the foreign exchange swap market at levels significantly below the ECB deposit facility rate which are then lent in repo markets at higher rates close to but below the deposit facility rate. In addition, the diverging movements in repo rates around balance sheet reporting dates continued, reflecting supply-demand imbalances in the market for high-quality collateral (see **Chart 2.10**).

Euro area long-term government bond yields remained at low levels over the review period, although displaying some volatility as a result of policy factors (see Chart 2.11). A renewed focus on additional monetary policy easing by leading central banks provided a supportive backdrop for global fixed income markets during the first half of the review period. The outcome of the UK referendum drove euro area market sentiment in June. Furthermore, following the initial announcement of the Bank of England asset purchase programme in August, there was a further

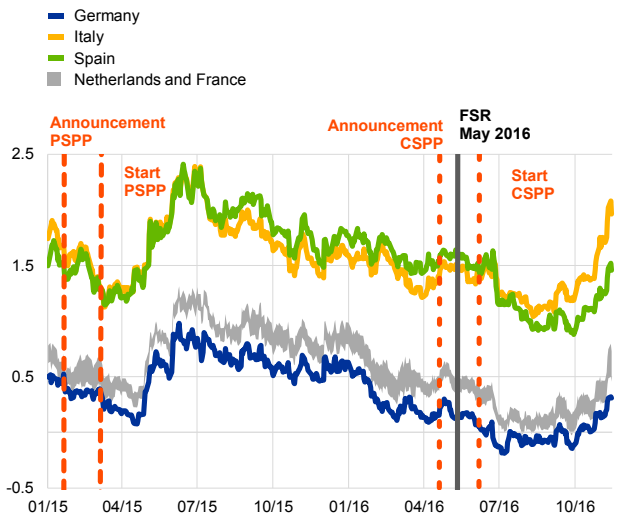
broad-based decline in euro area yields, with the largest declines observed at longer maturities. In October and the first half of November, however, euro area bond yields increased somewhat owing to improved global growth prospects. Taking a longer perspective, apart from the sharp sell-off in spring 2015, euro area government bond yields have trended down in a measured manner in recent years, supported by the measures taken by the ECB to combat the low-inflation environment. The bulk of the decline in euro area government bond yields since the peak in June 2015 has been related to lower term premia demanded by investors (see **Chart 2.12**). The low levels of term premia demanded on euro area bonds do, however, require close monitoring and investors should maintain sufficient buffers to withstand any prospective reversal of premia over the medium term.

Chart 2.11

Euro area government bond markets are responding to ECB measures…

Euro area ten-year government bond yields

(1 Jan. 2015 – 15 Nov. 2016, percentage per annum)



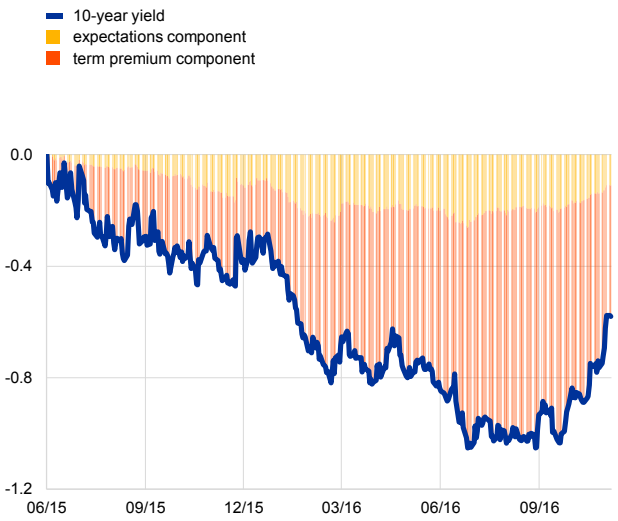
Sources: Bloomberg and ECB calculations.
Notes: The public sector purchase programme (PSPP) was announced on 22 January 2015 and started on 9 March 2015. The corporate sector purchase programme (CSPP) was announced on 21 April 2016 and started on 8 June 2016.

Chart 2.12

…as is evident in a compression of term premia in euro area ten-year government bond yields

Cumulative changes in the expectations component and term premium component of euro area ten-year government bond yields since the June 2015 peak

(10 June 2015 – 15 Nov. 2016, daily data, cumulative change in percentage points)



Sources: Bloomberg, New York Federal Reserve and ECB calculations.
Notes: The JSZ term premium for the euro area is derived from a Gaussian dynamic term structure model (for more details, see Joslin, S., Singleton, K. and Zhu, H., "A New Perspective on Gaussian Dynamic Term Structure Models", *Review of Financial Studies*, Vol. 24, No 3, 2011). The term premium is modelled on euro area ten-year overnight index swap (OIS) rates.

Market perceptions of sovereign risk remained contained. A model-based indicator of sovereign risk embedded in euro area government bond yields edged up slightly during the financial market turmoil recorded around the turn of the year and also ahead of the UK referendum. After the referendum, however, this indicator of sovereign risk declined and remained at low levels in the months thereafter. The resolute action taken by the Bank of England, the ongoing economic recovery in the euro area and favourable sovereign financing conditions in terms of both pricing and duration contributed to this reduction in sovereign risk. The view that systemic stress in euro area sovereign bond markets in 2016 has been contained overall is consistent with the sovereign composite indicator of systemic stress (CISS) (see

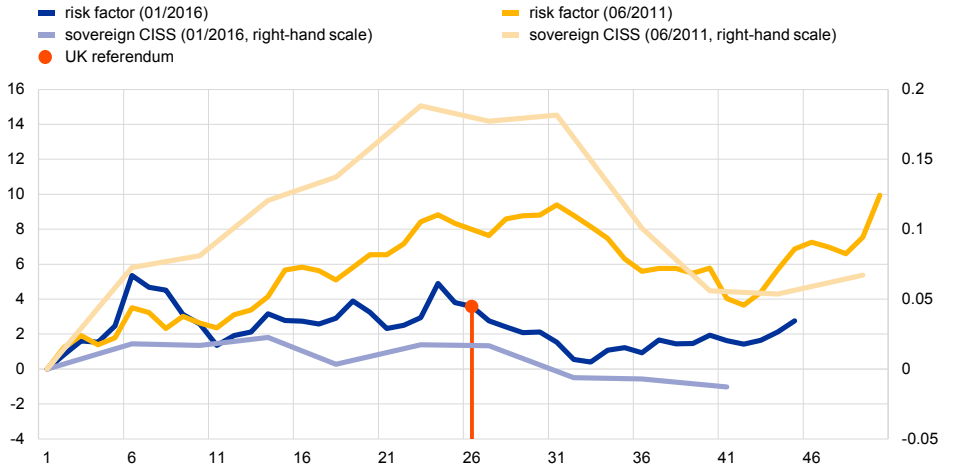
Chart 2.13). Taking a longer perspective, the relatively limited movements in sovereign stress indicators in 2016 are in sharp contrast with the dynamics recorded in 2011 when sovereign tensions escalated.

Chart 2.13

Sovereign risk embedded in euro area government bond yields proved resilient to market tensions during the first half of 2016

The evolution of a factor capturing sovereign risk in bond yields and the sovereign CISS indicator since January 2016 and during the run-up to the peak of sovereign tensions in 2011

(x-axis: weeks since the beginning of specified months; y-axis (left-hand scale): risk factor measured in cumulative standard deviations of weekly changes in bond yields; y-axis (right-hand scale): composite indicator of systemic stress in euro area sovereign bond markets)



Sources: Thomson Reuters Datastream and ECB calculations.
Notes: The period starting in June 2011 was chosen as a reference benchmark to quantify financial stress in sovereign bond markets. The risk factor displayed in the chart is based on a factor model of euro area long-term sovereign bond yields, which decomposes yield co-movements into a component driven by the monetary policy stance and related expectations and a component reflecting sovereign risk (Adam, T. and Lo Duca, M., ECB, mimeo, 2016). The sovereign CISS indicator is based on Holló, D., Kremer, M. and Lo Duca, M., "CISS – A composite indicator of systemic stress in the financial system", *Working Paper Series*, No 1425, ECB, March 2012.

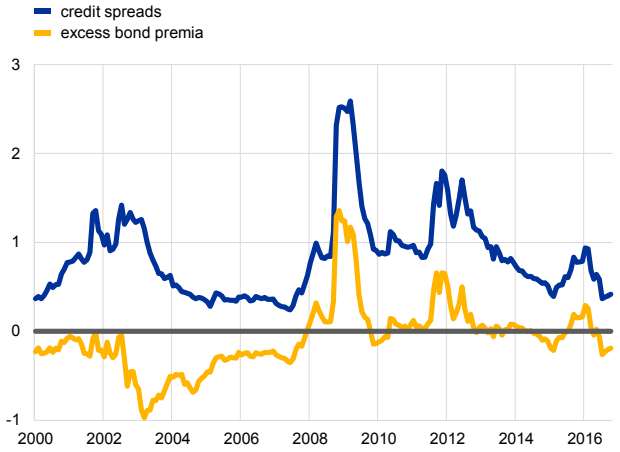
The yields on euro area corporate bonds across the credit spectrum have remained low, partly supported by the Eurosystem's corporate sector purchase programme. The Eurosystem's asset purchases are aimed at strengthening the transmission of monetary policy to financing conditions of the real economy and, in conjunction with the other non-standard monetary policy measures in place, they provide further monetary policy accommodation. Against this background, examining the evolution of credit risk valuations up until October suggests an edging-up in both the high-yield and investment-grade segments of the non-financial corporate bond market (see **Chart 2.14** and **Chart 2.15**). Corporate bond spreads in the high-yield segment are below their long-term averages in spite of weak fundamental data (e.g. slow earnings growth). According to model-based evidence, however, at present levels, high-yield bonds still appear to be valued broadly in line with fundamentals, following a brief period of undervaluation in early 2016. For investment-grade bonds, values below those implied by historical regularities at the start of the year suggest a modest degree of overvaluation, similar to episodes witnessed in early 2010 and early 2015.

Chart 2.14

Euro area investment-grade bond spreads are lower, pushing credit risk valuations higher…

Investment-grade bond spreads and excess bond premia for euro area non-financial corporations

(Jan. 2000 – Oct. 2016, monthly data, percentage per annum)



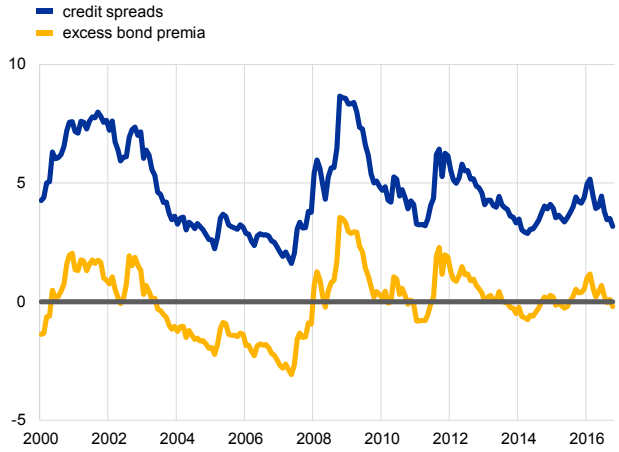
Source: De Santis, R., "Credit spreads, economic activity and fragmentation", *Working Paper Series*, No 1930, ECB, 2016.
Notes: The excess bond premium is the deviation of the corporate credit spreads from the measured default risk of the issuer. It is obtained by estimating the asset swap spreads of the individual bonds on the basis of credit risk measures (i.e. individual credit ratings and sectoral expected default frequency), the outstanding amount, the coupon and the maturity, and on the basis of industry and country dummies using panel methodology. The data include investment-grade and high-yield bonds. The reported aggregate measures are compiled as the mean of the individual deviations. The latest observation is for 26 August 2016. The euro area countries covered are Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands and Spain.

Chart 2.15

…and spreads on riskier high-yield bonds are also lower

High-yield bond spreads and excess bond premia for euro area non-financial corporations

(Jan. 2000 – Oct. 2016, monthly data, percentage per annum)



Source: De Santis, R., "Credit spreads, economic activity and fragmentation", *Working Paper Series*, No 1930, ECB, 2016.
Note: See notes to Chart 2.14.

Market liquidity conditions in euro area bond markets appear mixed. Market liquidity conditions remain difficult to interpret in the context of central bank purchases and the mixed signals coming from various sources. As for survey-based evidence, the "Survey on credit terms and conditions in euro-denominated securities financing and over-the-counter derivatives markets" (SESFOD) suggests that, although the liquidity and functioning of some euro area sovereign and corporate bond markets deteriorated over the last one and a half years, there was little change reported in the third quarter of 2016.[16] However, quantitative indicator-based evidence is not fully consistent with this assessment. One measure of a liquid market is where the execution of regular-sized transactions will have a limited price impact.[17] Such a "liquidity score" index for the euro area government bond markets, estimated on a bond-by-bond basis as the ratio of deal sizes to the unexpected price impact, suggests that liquidity conditions have remained sound across euro area countries in recent quarters. The liquidity score in Germany suggests fairly stable liquidity conditions in 2015-16 and the score for Italy points to an improvement in the

16 The September 2016 SESFOD survey results are available here.

17 Market liquidity is usually defined as ample when: (i) the cost of turning around a position over a short period of time is low; (ii) the size of an order flow innovation required to change prices by a given amount is low; and (iii) the speed with which prices recover from a random, uninformative shock is low. These three concepts are often labelled as tightness, depth and resilience. The liquidity score presented here mainly captures the notion of resilience. See also *Financial Stability Review*, ECB, May 2016, p. 52.

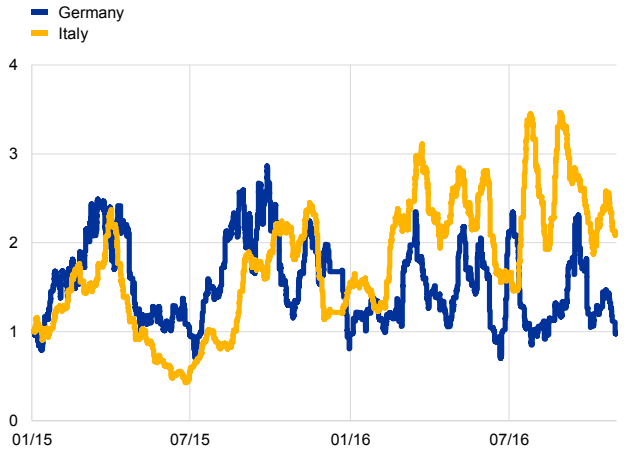
Italian markets (see **Chart 2.16**). As regards the euro area corporate bond markets, standard indicators such as bid-ask spreads have remained fairly compressed over the past six months (see **Chart 2.17**). At the same time, other indicators do suggest some liquidity constraints. In particular, the number of trades has increased sharply in recent years, whereas the overall volume has remained broadly stable. This could suggest some difficulties in executing large transactions.

Chart 2.16

Liquidity conditions in the euro area government bond markets are relatively favourable

Liquidity scores for the German and Italian government bond markets

(1 Jan. 2015 – 15 Nov. 2016, ten-day moving average)



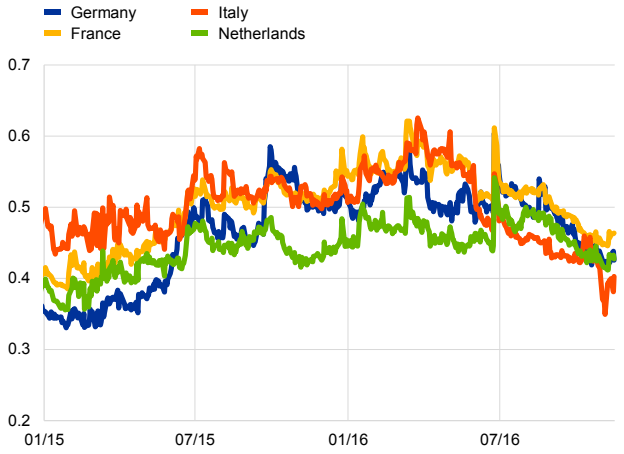
Sources: Bloomberg, Reuters, MTS and ECB calculations.
Notes: The chart shows the ten-day moving average of the liquidity score for Italy and Germany. The deal size is defined as the traded volume over the number of trades for each bond. The price impact measure is a proxy for the unexpected (absolute) change defined as the difference between the absolute price change in the respective bond and the corresponding absolute price change in the overnight index swap rate. A higher value of the liquidity score thus indicates improved liquidity conditions. Due to the normalisation, it is not possible to make an absolute comparison between the liquidity scores of the two depicted countries, i.e. the fact that the liquidity score for Italy is above the German score does not imply that the liquidity situation in the Italian market is better (in absolute terms) than that in the German market.

Chart 2.17

Broadly stable bid-ask spreads for corporate bonds in 2016

Bid-ask spread of euro-denominated non-financial corporate bonds issued by euro area issuers

(1 Jan. 2015 – 15 Nov. 2016, as a percentage of the mid-price)



Sources: iBoxx and ECB calculations.
Note: The mid-price is the average of the bid and ask prices of each bond; the weight applied to each bond when compiling the indicator corresponds to its respective weight in the iBoxx € Corporates index.

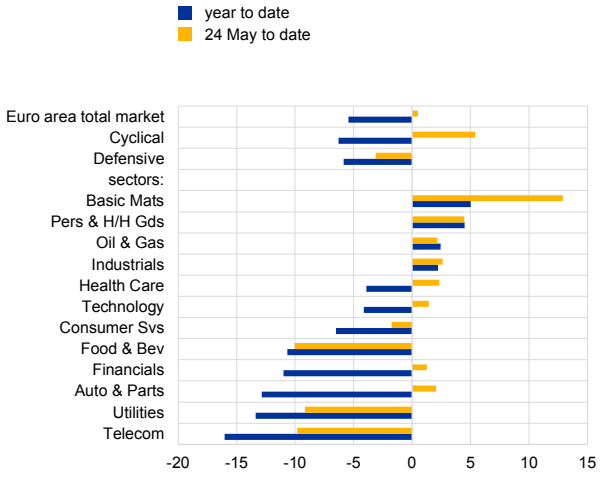
Euro area equity markets have continued to be characterised by regular short-lived shocks, with a particularly pronounced sectoral impact for banks. The outcome of the UK referendum led to a particularly pronounced bout of heightened risk aversion. Looking at the different sectors, the financial sector – and banks in particular – have underperformed year to date (see **Chart 2.18**). A decomposition of euro area stock prices using a dividend discount model shows that most of the fall in stock prices during the associated turmoil in June was related to lower earnings expectations as well as a higher equity risk premium required by investors (see **Chart 2.19**). The correction was short-lived, however, not least given the resolute policy action of the Bank of England.

Chart 2.18

Strong dispersion of euro area stock prices in 2016

Sectoral stock price performance in the euro area

(1 Jan. 2016 – 15 Nov. 2016, percentage per annum)



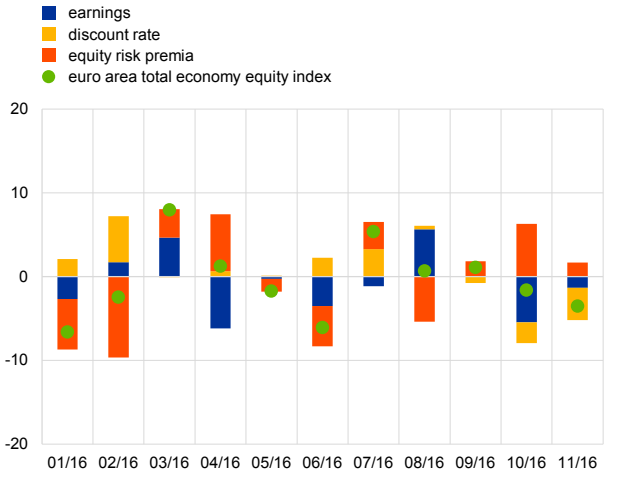
Source: Thomson Reuters Datastream.
Notes: The cyclical sectors are financials, basic materials, and automobiles and parts. The defensive sectors are utilities, personal and household goods, food and beverages, and health care.

Chart 2.19

Higher equity risk premia and downward revisions to earnings during the June turmoil

Contributions to changes in euro area stock prices

(Jan. 2016 – Nov. 2016, monthly data, percentage)



Sources: Thomson Reuters Datastream and ECB calculations.
Note: Contributions to monthly changes in stock prices, estimated using a dividend discount model applied to financial sector equities.

The scope for investor diversification in equity markets tends to decline during periods of higher stress. From a financial stability viewpoint, computations of a large number of pairwise correlations of individual stock returns can serve as a gauge of systemic risk. A time-varying indicator of systemic stress in equity markets accurately captures such episodes since the 1970s (see **Chart 2.20**) by measuring the share of idiosyncratic risk[18] that cannot be diversified by holding a broad (market) portfolio of equities.[19] More recent developments suggest that benefits from portfolio diversification deteriorated markedly during the stock market turmoil in January/February and after the UK referendum. Both in the euro area and in the United States, diversification opportunities by mid-November were broadly in line with their long-term averages.

[18] The indicator ranges from zero (full diversification of idiosyncratic risk possible by holding a broad equity portfolio) to one (no diversification possible).

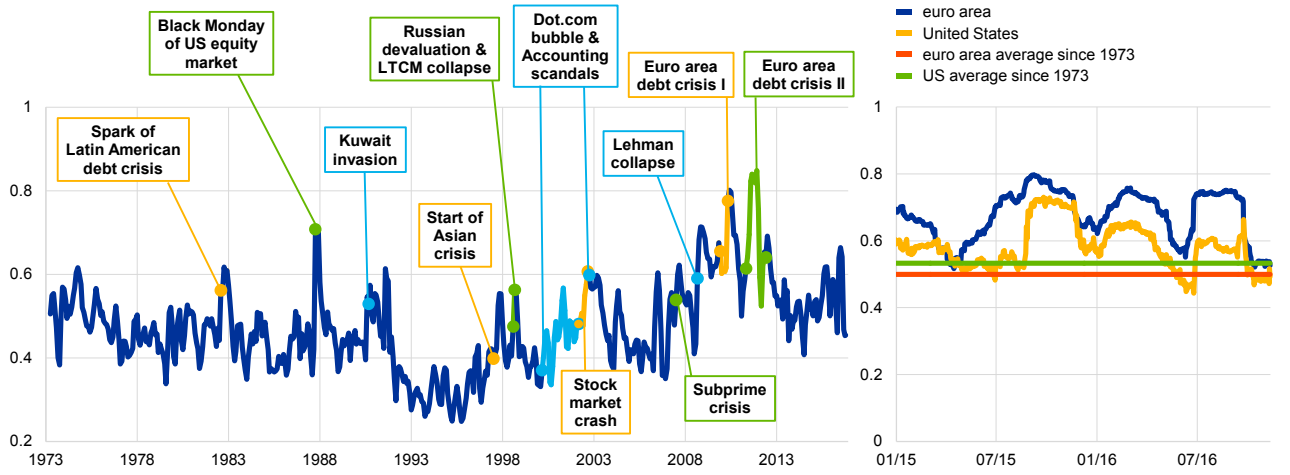
[19] For a similar indicator applied to euro area bank stocks, see the box entitled "A decomposition of euro area bank stock volatility", *Financial Stability Review*, ECB, December 2005.

Chart 2.20

Less diversification in global stock markets during periods of financial stress

Index of diversification of global equity markets (United States and euro area). Higher index values denote lower diversification opportunities in equity markets

(Jan. 1973 – Nov. 2016; left panel: combined index for the United States and the euro area, monthly data, normalised index between 0 and 1)



Sources: Thomson Reuters Datastream and ECB calculations.
Notes: Left panel: end-of-month data; right panel: daily data. All euro area equity prices and corresponding capitalisations are expressed in US dollars.