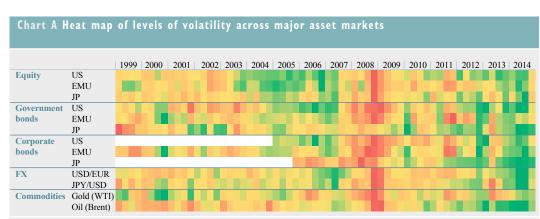
Box 3

FINANCIAL MARKET VOLATILITY AND BANKING SECTOR LEVERAGE

Global asset market volatility remained persistently at historical lows across financial asset classes and economic regions from the third quarter of 2013 up until early October 2014. Low financial market volatility may in many ways reflect fundamentals, including low uncertainty regarding policies, limited surprises in economic releases and the stabilising influence of more

¹ In October 2014, a deterioration of the economic outlook in major advanced and emerging economies, including the United States and China, triggered an episode of market volatility in several asset markets.



Sources: Thomson Reuters Datastream and ECB calculations.

Notes: Volatility estimates are derived from non-overlapping quarterly samples of daily price data. The colour code is based on the ranking of these quarterly estimates in the respective asset market. A red, yellow and green colour code indicates, respectively, a high, medium and low volatility estimate compared with other periods. Equity markets are represented by the respective MSCI price index at the country or region level. Bond markets are represented by the respective PPMorgan government bond index at the country or region level (local currency/all maturities). The last observation is for 30 September 2014. White indicates non-availability of data.

stringent post-crisis regulation of the financial sector. At the same time, financial stability risks may arise from investor complacency especially during periods of weak returns on financial assets when investors hunt for yield. Such periods have the potential to embed systemic risk, if they lead to an excessive build-up in leverage or maturity extension.

The broad-based nature of this current period of record low volatility is particularly noteworthy. Option-implied stock market volatility (as measured, for instance, by the VIX) and derived measures of uncertainty and risk aversion have approached record low levels.² At the same time, realised market volatility has remained at extremely low levels for the past five consecutive quarters (up until the end of the third quarter of 2014) in thirteen major asset markets (G3 equity, government bond, corporate bond and FX markets, as well as two major commodity markets; see Chart A). Indeed, the average annualised daily market volatility of these markets has fallen to a range of 6.3% to 9.5% – even lower than daily volatility of 7.9%-12.8% for global bond and equity markets on the eve of the global financial crisis. Moreover, volatility is touching record lows across a much broader range of asset categories than it did during the pre-crisis era and is proving more persistent (see Chart A). The former may reflect the growing correlation of global asset markets in the post-2008 period.

According to the *volatility paradox* hypothesis³, an environment of low yields and volatility could invite excessive risk-taking by financial investors. First, risk aversion tends to decline during prolonged periods of low volatility as suggested by estimates of the volatility risk premium (see Section 2.2). A lower premium amounts to investors demanding less compensation for holding risky assets. Such a fall 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. Second, low volatility mechanically compresses backward-looking risk measures, such as the value at risk (VaR), which shape investors' risk management decisions. In fact, the unit VaR – calculated as the VaR per unit of assets – of a sample of large euro area banks lags a measure

² For further details, see Financial Stability Review, ECB, May 2014, pp. 55-56 and BIS Quarterly Review, September 2014, pp.10-11.

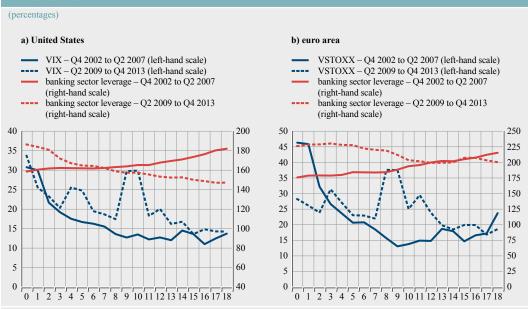
³ Adrian, T. and Shin, H., "Procyclical Leverage and Value-at-Risk", *NBER Working Paper Series*, No 18943, 2013; Adrian, T. and Boyarchenko, N., "Intermediary Leverage Cycles and Financial Stability", Federal Reserve Bank of New York Staff Report No 567, 2013; and Brunnermeier, M. and Sannikov, Y., "A Macroeconomic Model with a Financial Sector", *American Economic Review*, Vol. 104(2), pp. 379-421, 2014.

of stock market volatility in the euro area by about a year. This pro-cyclical behaviour of the VaR allows investors to increase their exposure to assets which are prone to bursts of volatility for a given risk threshold. Finally, cheap funding and subdued risk measures allow investors to increase their leverage, thereby reinforcing the vulnerability of the financial sector at large.

The period of low volatility leading up to the global financial crisis commencing in 2007 is illustrative of such risks via *leverage*. In that episode, the build-up of banking sector leverage was certainly a side-effect of low market volatility. From 2002 to 2007 banking sector leverage in the United States and the euro area rose considerably (see Chart B). During this period, financial market volatility as measured by the VIX, which is often also interpreted as a yardstick of global risk aversion, was at very low levels. By contrast, the decline in market volatility since mid-2009 has so far not been associated with a renewed increase in banking sector leverage (see Chart B).

There are a number of reasons why the mechanical link between market volatility, risk appetite and banking sector leverage observed ahead of the last crisis does not hold for current developments. Between 2002 and 2007 the pro-cyclical nature of the leverage cycle appeared to follow an empirical regularity whereby in periods of low volatility and low measured market risk, lower risk weights for banks to meet capital adequacy requirements enabled them to build up leverage. Since mid-2009, this mechanism has not yet started to operate for two reasons. First, capital and liquidity requirements for regulated banks have been tightened in the context of more stringent regulatory requirements. Second, the legacy of the crisis has led to a prolonged period of low economic growth. As a result, low credit growth has partly been driven by subdued demand for loans. Finally, the reasons for low market volatility during the leverage cycle between 2002 and 2007 might have been different from those in recent years.

Chart B Banking sector leverage and financial market volatility in the United States and the euro area



Sources: Bloomberg, ECB and ECB calculations.

Notes: Data on banking sector leverage (debt/equity) in the United States and the euro area are based on partly consolidated data for comparability purposes. Banking sector debt includes total loans given to banks by non-banks, money deposited by non-banks, total debt securities issued and money market fund shares.

Nevertheless, the current period of low volatility may be contributing to rising leverage outside the regulated banking sector (see Section 2.2).

Ultimately, the elusive and time-varying nature of many of these explanatory factors implies a need for monitoring persistently low financial market volatility for financial stability risks. Indeed, given the profound impact of the global financial crisis on both the financial system and the economy, the nature of systemic risks may too be evolving – requiring a broad-based monitoring of low volatility with various measures of leverage including leverage *outside* the regulated banking sector (for example, embedded in financial market transactions of certain market segments such as derivatives, securities financing or repo markets) as well as any prospect of broad-based liquidity or maturity mismatch that could cause system-wide stress.