**Box 5**

## DISTINGUISHING RISK AVERSION FROM UNCERTAINTY

The financial crisis has seen an unprecedented increase in financial market volatility and in risk premia for a wide range of assets. Such increases can be driven both by changes in the level of uncertainty (or risk) in the system and by changes in the way investors "tolerate" (or dislike) uncertainty (investors' risk aversion). An ability to distinguish between these two underlying drivers can help considerably in financial stability monitoring, as there are structural links between risk aversion and uncertainty on one hand and macro-financial developments on the other hand.[1] However, the distinction between the two in empirical work is often blurred when some common volatility indicators are used as their proxies.

One approach to obtain individual estimates of these two phenomena is to use a decomposition of volatility indices such as VIX and VSTOXX, which are derived from option prices and capture both expected stock market volatility (uncertainty) and risk aversion.[2] Uncertainty can be estimated with established techniques for measuring expected stock market variance. Risk aversion (the so-called variance premium) can then be obtained as the difference between the (squared) VIX/VSTOXX (which captures implied market variance) and the expected stock market variance.

The results of such an approach are in the chart below, which displays the evolution of risk aversion and uncertainty indicators for the United States and the euro area. Three periods of market turbulence are particularly noteworthy: the aftermath of the dot-com bubble, the collapse of Lehman Brothers, and the euro area sovereign debt crisis. Interestingly, despite the potential for region-specific factors, estimated measures of risk aversion and uncertainty for the United States and the euro area appear generally quite closely correlated. The benefit of these measures, however, goes beyond capturing periods of market turbulence. For example, recent research shows that the risk aversion measure is a reliable predictor of stock returns,[3] with low risk aversion providing a signal of "booming" asset prices and compressed risk premia which lied at the root of the global financial crisis. Indeed, between 2005 and mid-2007, risk aversion for both the euro area and the United States touched historical lows.

Although risk aversion and uncertainty tend to co-move, there are some notable periods in which they differ. As could be expected, movements in these measures for the United States were more marked following the collapse of Lehman Brothers, while more volatility was evident for the euro area measures during the sovereign debt crisis. For example, uncertainty increased much more relative to risk aversion at the end of the 2008 financial crisis, in both the United States and in the euro area. Conversely, in the United States, risk aversion increased much more than uncertainty in relation to the Russian crisis in 1998 and to the US sovereign debt rating downgrade in summer 2011, which had much more limited financial stability and macroeconomic implications. Such developments mirror the results of past research[4] which has shown that uncertainty is a better predictor of financial instability and business cycles. Interestingly,

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1  See, e.g., Bloom, N., "The Impact of Uncertainty Shocks", *Econometrica*, Vol. 77 (3), 2009, pp. 623-685, and Bollerslev, T., Tauchen, G. and Zhou, H., "Expected Stock Returns and Variance Risk Premia", *Review of Financial Studies*, Vol. 22 (11), 2009, pp. 4463-4492.
2  See Bekaert, G., Hoerova, M. and Lo Duca, M., "Risk, Uncertainty and Monetary Policy", *Journal of Monetary Economics*, Vol. 60 (7), 2013, pp. 771-788, and Bekaert, G. and Hoerova, M., "The VIX, the Variance Premium and Stock Market Volatility", NBER Working Paper No 18995, National Bureau of Economic Research, 2013.
3  See, e.g., Bollerslev, T., Tauchen, G. and Zhou, H. (2009), cited above.
4  Bekaert, G. and Hoerova, M. (2013), cited above.

in the euro area, risk aversion increased more than uncertainty in late 2011/early 2012, in relation to rising financial tensions in Italy and Spain.

Currently, estimates of both risk aversion and uncertainty are close to historical lows in both the euro area and the United States. This could be related to abundant liquidity in the context of macroeconomic policy accommodation at the global level, and could point to potential underpricing of risks in global financial markets. A sharp adjustment in these measures, in particular the uncertainty measure, could have important financial stability consequences. According to estimates based on a predictive regression of the CISS indicator of systemic stress[5] on risk aversion and uncertainty measures for the United States (1990-2010 sample), a shock of 100 percentage points to uncertainty could increase the CISS indicator by 0.2 variance units after one year (the CISS ranges between 0 and 1), with a concomitant negative impact on euro area financial stability.[6] Well-communicated and predictable monetary policy has an important role to play in attenuating the scope for spikes in risk aversion and uncertainty. In this context, it is worth noting that changing monetary policy expectations in the United States since May 2013 have not affected the end-of-month measures of risk aversion and uncertainty for the euro area or the United States. Likewise, geopolitical tensions in Ukraine and Russia have contrasted with relative stability in estimated uncertainty so far.

In sum, the presented decomposition of stock market volatility into a risk aversion and an uncertainty component appears to provide useful information on financial market conditions relevant for financial stability, with the risk aversion component more relevant for understanding stock price developments, and the uncertainty component more tightly linked to past episodes of financial instability.

## Risk aversion and uncertainty

(Jan. 1990 – Apr. 2014; squared percentage points)

■ uncertainty　▦ risk aversion
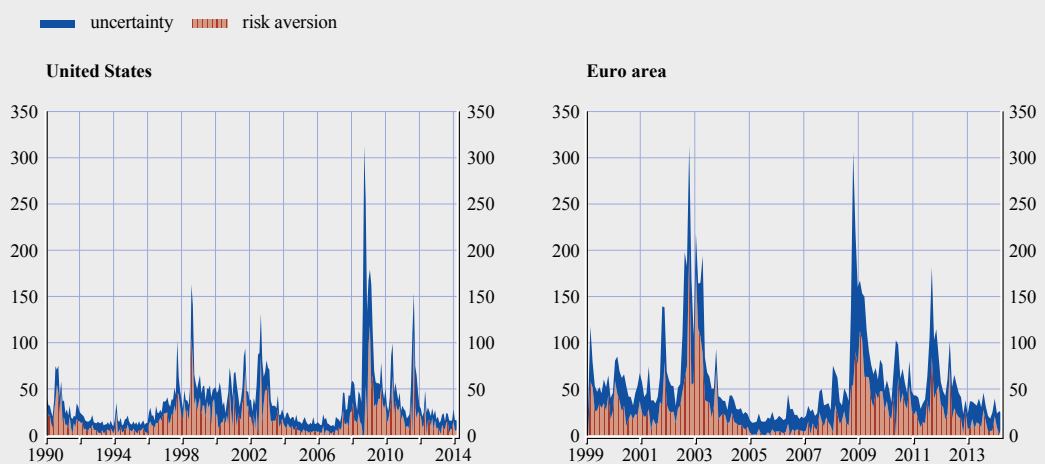


Sources: Thomson Reuters Datastream and ECB calculations.
Notes: Decomposition of the (squared) VIX and VSTOXX indices into risk aversion and uncertainty. Risk aversion and uncertainty are expressed in squared percentages; the sum of risk aversion and uncertainty is equal to the squared VIX/VSTOXX index.

5 Hollo, D., Kremer, M. and Lo Duca, M., "The CISS – A composite indicator of systemic stress in the financial system", *Working Paper Series*, No 1426, ECB, March 2012.
6 Bekaert, G. and Hoerova, M. (2013), cited above.