

Box 6

TRACKING BOND AND STOCK MARKET UNCERTAINTY USING OPTION PRICES

Financial option prices – through the estimation of risk-neutral densities (RNDs)¹ – offer the possibility to gauge the uncertainty attached by market participants to future asset prices and to track its changes over time. This box discusses the uncertainty surrounding the short-term (three-month) outlook for the ten-year German government bond (“Bund”) price – gauged using the prices of options on Bund futures – and relates it to that for the Dow Jones EURO STOXX 50 index during the financial turbulence of the last few years.

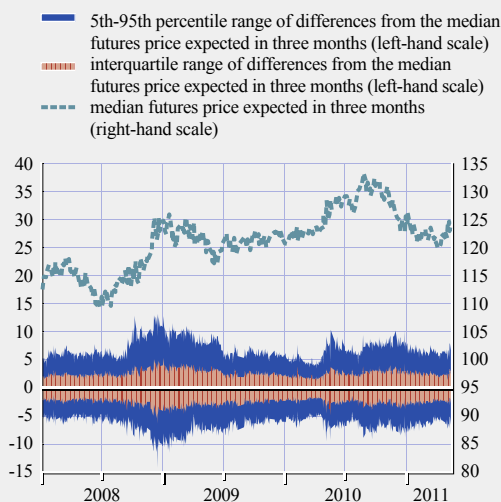
Chart A shows the median Bund futures price expected in the next three months, as derived from option-based RNDs that reflect the probabilities attached by market participants to the distribution of future Bund prices. Bond prices and yields are inversely related and thus lower bond (and Bund futures) prices imply higher yields. Chart A also shows the dispersion of expected Bund futures prices around the median expected price.

The larger the range of expected Bund futures prices, the higher the uncertainty about future Bond prices. Measured this way, uncertainty as well as the magnitude of potential “tail” (i.e. extreme) outcomes clearly peaked in late 2008 after the bankruptcy of Lehman Brothers. It was also high during the euro area sovereign debt crisis episodes in May and November 2010 and remained elevated throughout the first half of 2011.

In order to compare the impact of distress across different markets throughout the financial crisis, Chart B depicts changes in the uncertainty about future asset prices in both German government bond and euro area equity markets and uses the standard deviation of RNDs extracted from three-month option prices to measure the uncertainty with respect to future asset prices.² Although uncertainty in both markets co-moved strongly, reflecting the severity and pervasiveness

Chart A Dispersion of ten-year German government bond futures prices expected in three months

(Jan. 2008 – May 2011)



Sources: Bloomberg and ECB calculations.
Note: The distribution of expected Bund futures prices was estimated using RNDs extracted from the prices of three-month options on Bund futures traded on Eurex.

1 For a description of the RND estimation methodology employed in this box, see R. de Vincent-Humphreys and J. M. Puigvert Gutiérrez, “A quantitative mirror on the EURIBOR market using implied probability density functions”, *ECB Working Paper Series*, No 1281, December 2010.

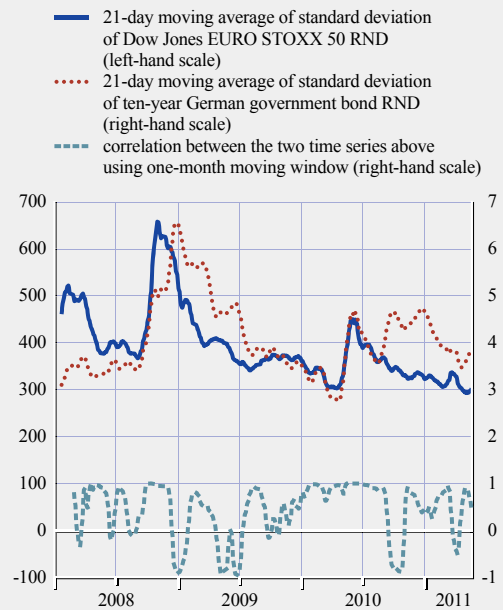
2 For a detailed description of changes in euro area stock market uncertainty during the financial crisis and some of its specific episodes, see ECB, “The information content of option prices during the financial crisis”, *Monthly Bulletin*, February 2011.

of the financial crisis, the intensity of that co-movement varied over time, as indicated by the moving correlation coefficient presented in the bottom part of Chart B. For example, in late 2008 and in the first half of 2009 uncertainty in euro area equity markets appeared to lead that in the Bund market, possibly on account of the safe-haven status of German government bonds. In addition, the increase in Bund market uncertainty in the spring of 2010 proved to be much longer-lasting, as changes in uncertainty in the two markets started to diverge in September 2010, although the co-movement strengthened again in 2011.

To sum up, the distribution of expected asset prices estimated using option-based RNDs can be useful in gauging uncertainty about future asset prices, as well as the likelihood and magnitude of expected extreme outcomes. Furthermore, various measures of uncertainty may help to interpret better specific episodes of market distress both within and across various financial markets.

Chart B Standard deviations of ten-year German government bond and euro area stock prices expected in three months and correlation between them

(Jan. 2008 – May 2011)



Sources: Bloomberg and ECB calculations.
Note: RNDs were extracted from three-month option prices.