

Box 6

RECENT TRENDS IN IMPLIED BOND MARKET VOLATILITY

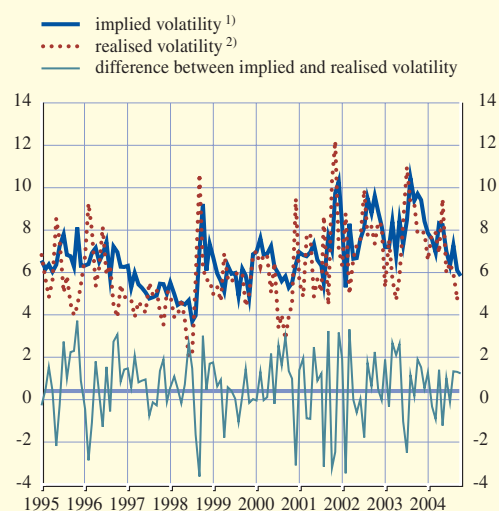
Over the last few quarters there has been a marked decline in options-based implied volatility across a wide range of financial asset classes, such as equities, government bonds and exchange rates. Some concerns have been raised that these declines in implied volatility might have gone too far, implying higher risks of a later upward correction. In the previous issue of the Monthly Bulletin, this topic was analysed for stock markets, using the US market as an example.¹ This box follows up on this issue with an investigation of developments in implied volatility of US long-term government bonds.

Chart A shows the implied volatility, which measures market participants' near-term expectations of future bond market volatility extracted from option prices, on US ten-year Treasury note futures contracts with 22 trading days to maturity since January 1990, together with the realised bond market volatility over the subsequent 22 trading days. A comparison of the two series therefore provides information on whether and to what extent market participants' expected volatility deviated from the realised outcome in each month.

Several inferences can be drawn from the chart. First, neither implied nor realised volatility are currently at levels which are unusually low from a historical perspective. Second, implied and realised volatility show a fairly high degree of co-movement.

Chart A Implied and realised volatility in the US long-term bond market

(percentages per annum; monthly data; January 1995 to October 2004)



Sources: Bloomberg and ECB calculations.
Note: The straight line shows the average spread in the difference between implied and realised volatility.
1) Each month the implied volatility is extracted from options on ten-year Treasury note futures contracts with 22 days to maturity.
2) Calculated as the standard deviation of the daily changes in the logarithm of the futures price over the 22 days to maturity.

¹ See the box entitled "Recent trends in implied stock market volatility" in the November 2004 issue of the Monthly Bulletin.

Particularly in periods when implied volatility is high, realised volatility also tends to be high, and vice versa.² Third, implied volatility has declined steadily for more than a year, and so has realised volatility.

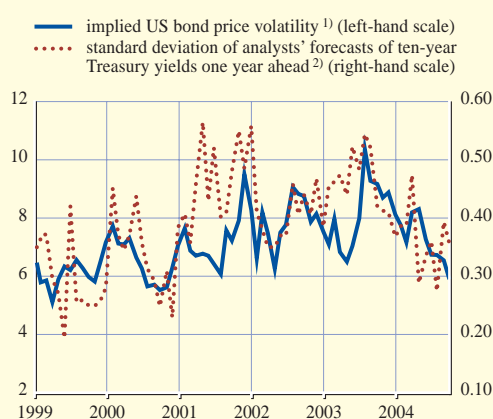
The difference between implied and realised volatility for the US long-term bond market is also shown in Chart A. Any systematic pattern in this difference, for example a relatively long series of expectation errors of the same sign, could indicate a potential mispricing. As is evident from this time series, there are no indications that implied volatility in recent years has systematically under or overpredicted realised volatility, as should happen if implied volatility were to be driven by factors other than market participants' expected volatility. Instead it appears that implied volatility has declined because market participants have expected lower realised volatility, and they have, at least so far, been correct.

The recent decline in implied bond market volatility goes hand in hand with a survey-based measure of bond market uncertainty, namely the standard deviation of a number of analysts' forecasts of ten-year US Treasury yields one year ahead. This index measures the level of disagreement among market participants rather than aggregated uncertainty.³ Chart B nonetheless shows a quite remarkable co-movement of this indicator with the developments in implied bond market volatility, particularly since mid-2003.

Summing up, the empirical evidence presented here on the basis of the predictive content of implied volatility does not suggest any major mispricing of options on long-term US bonds. Instead, it suggests that the recent decline in implied bond market volatility is due to the fact that market participants have correctly anticipated lower future realised bond market volatility. This, in turn, is consistent with a normalisation process following a period of above-average implied and realised bond market volatility.

Chart B Measures of uncertainty in the US long-term bond market

(percentages per annum; monthly data; January 1999 to October 2004)



Sources: Bloomberg, Consensus Economics and ECB calculations.

- 1) Extracted from options on ten-year Treasury note futures contracts on the 15th of each month.
- 2) The dates of the survey do not necessarily coincide exactly with the dates of the implied volatility.

2 The implied volatility series tends, on average, to be slightly higher than realised volatility, probably reflecting several measurement biases in the two series. For a discussion of these biases, see B. J. Christensen and N. R. Prabhala (1998), "The relation between implied and realized volatility", *Journal of Financial Economics*, 50, pp. 125-50.

3 For a discussion of disagreement versus uncertainty, see Lahiri, Teigland and Zaporowski, 1988, "Interest Rates and the Subjective Probability Distributions and Inflation Forecasts", *Journal of Money, Credit and Banking*, 20, pp. 233-48.