

Box 2

Gauging contagion in euro area stock markets with implied volatility measures

Stock market uncertainty in the euro area, as measured by the implied volatility extracted from options on the Dow Jones EURO STOXX 50 index, settled down after mid-March 2003. All in all, the ten-day moving average of implied volatility dropped by almost 18 percentage points between mid-March and 9 July. In tandem with this, stock prices, as measured by the broad Dow Jones EURO STOXX index, increased by 19% over the same period.

The implied stock market volatility extracted from options prices is an important measure for gauging the degree of uncertainty prevailing among market participants. However, it is not always clear whether changes in implied volatility are caused by the aggregation of uncertainties relating to specific firms or sectors or whether they are caused by general uncertainties in the market. By examining the implied volatility of individual stocks as a complement to the analysis of the implied volatility of market indices, it is possible to make inferences about these issues. This box discusses an indicator which is designed to distinguish between volatility episodes that are prompted by sector-specific, or even firm-specific, concerns and those that are prompted by more general or systemic concerns.

When monitoring the implied volatility of a given stock market index, it is important to recognise that it measures the expected volatility of a well-diversified portfolio of stocks. A basic tenet of finance theory is that, in a well-diversified portfolio, the ups and downs of individual stock prices will, to a large extent, counterbalance one another. Everything else being equal, the more risky the portfolio, the higher the return required by an investor to hold that portfolio. The riskiness of a portfolio of stocks is determined by several components. One is the variance of the price of each of the individual stocks in the portfolio. When a portfolio only contains a few stocks, the volatility of each individual stock price will play an important role in driving the volatility of the portfolio. A second component relates to the extent to which individual stock prices move together, usually measured by correlation. All other things being equal, the more stock prices move together, the higher the volatility of the portfolio will be. Hence, the implied volatility extracted from options prices on a stock market index should reflect both expectations about future volatility of the individual stocks within the index and expectations about the future correlation between these stocks. Simply examining patterns in the implied volatility of the index will not reveal which of these two sources is playing the most important role in driving overall stock market index volatility.

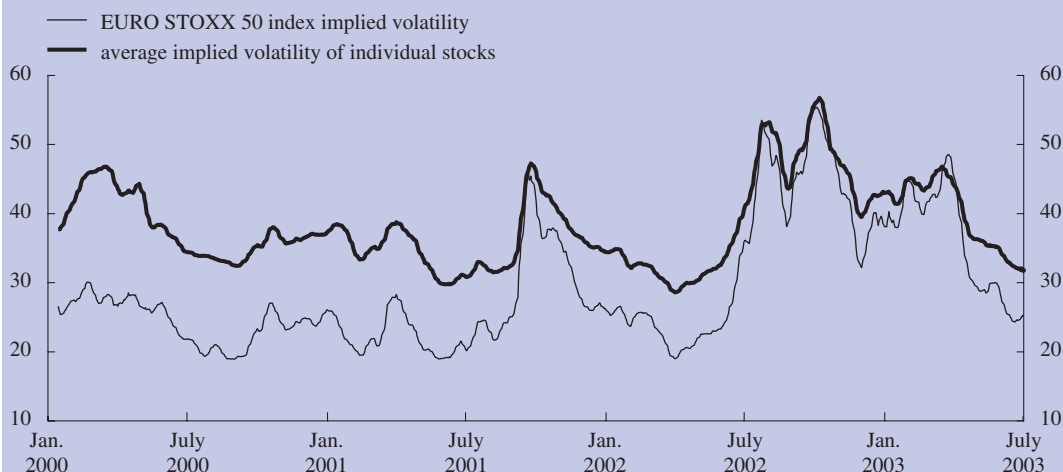
In order to determine the extent to which the implied volatility of a stock market index is driven by expectations of volatility in the individual stocks that make up the index, the implied volatility of each of the individual stocks can be examined. By taking an appropriately weighted average of the implied volatility of each of these stocks, it is possible to reveal the extent to which the implied volatility of the EURO STOXX 50 index is due to the expected volatility in the individual stocks. At the same time, by comparing this average with the implied volatility of the EURO STOXX 50 index, some inferences can be made about the extent to which volatility in the stock market reflects expectations about correlations between these stocks.

The chart plots developments in both the weighted average and the index implied volatility series for the EURO STOXX 50 index over the past three years. This average is based on 44¹ of the 50 stocks in the EURO STOXX 50 index. As such, it should provide a good, albeit imperfect, proxy for the average volatility of all stocks in this index. While the patterns in the implied volatility of the EURO STOXX 50 index and the average volatility of its constituents were broadly similar over this period, there were also some diverging tendencies. First, the average volatility among the constituent stocks in the EURO STOXX 50 index has generally exceeded the index implied volatility. Over the past three years, the average index implied volatility

¹ Owing to data availability, the calculations are based on 44 companies which represent 85% of the stock market capitalisation of the EURO STOXX 50 index.

Average implied volatility for 44 stocks within the EURO STOXX 50 index and the EURO STOXX 50 index implied volatility

(percentage per annum; ten-day moving average of daily data)



Source: Bloomberg.

has been around 30%, while the mean of the average idiosyncratic implied volatilities of each of the stocks in the portfolio has been almost 40%. A positive spread of the average volatility of the individual stocks over the market index implied volatility is a typical feature of all stock markets. The reason for this is that when the correlation between individual stocks is less than perfect, a portfolio of these stocks will carry less risk than any individual stock. This is simply a reflection of the benefits of diversification.

On several occasions over the past three years, however, the benefits of portfolio diversification have been minimal, as revealed by episodes where the two measures of volatility have converged. Convergence of the two measures can occur when the correlation between stocks rises because of general market concerns, or contagion, rather than reflecting heightened uncertainties about individual firms or sectors. For instance, such convergence occurred in September 2001, and again for several months after June 2002. The first episode can be linked to the widespread uncertainties caused by the terrorist attacks in the United States in that month, which prompted sharp drops in stock prices. The convergence after June 2002 may be linked to the uncertainties prompted by the discovery of accounting irregularities at WorldCom, when market participants' confidence in the information disclosed by corporations was severely impaired. Again, in early 2003, general or systemic uncertainties took hold in stock markets against the background of concerns about the possibility of a war in Iraq.

An examination of the implied volatility of individual stocks can provide a useful complement to the analysis of the implied volatility of market indices in better understanding stock market developments. In particular, it can shed light on whether market participants' uncertainties are general or specific. Lately, it would appear that, as war-related uncertainties faded away, investors became more discerning about risks among individual firms, implying a greater decoupling of the two measures of implied volatility.