

Anatomy of a Meltdown:

The Risk Neutral Density for the S&P 500 in the Fall of 2008

ABSTRACT

We examine the intraday behavior of the risk neutral probability density (RND) for the Standard and Poor's 500 Index extracted from a continuous real-time data feed of bid and ask quotes for index options. This allows an exceptionally detailed view of how investors' expectations about returns and attitudes towards risk fluctuated during the financial crisis in the fall of 2008. The increase in risk measures was extraordinary, such as a fivefold increase in minute-to-minute volatility from October 2006 to October 2008. In contrast to moderate positive autocorrelation in the S&P index, the analysis reveals unusually large negative autocorrelation in the mean and standard deviation of the RND. Using quantile regressions, we find a strong pattern in how much different portions of the RND move when the level of the stock index changes, with the middle portion of the RND amplifying the change in the index by a factor of as much as 1.5 or more in some cases. This phenomenon increased in size during the crisis and, surprisingly, was stronger for up moves than for down moves in the market.

Keywords: risk neutral density; implied probabilities; stock index options; 2008 financial crisis

JEL Classification: G13, G14, D84