# Abstract

A market crisis event is one in which prices become extremely volatile, causing investors to lose confidence, further exacerbating volatility in a positive feedback loop. However, the day-to-day movements of prices in stock markets are not generally indicative of market behavior during crisis events. From both a scientific and a regulatory perspective, an early warning signal for crisis events would be tremendously valuable.

Using NASDAQ order book data at the one-minute resolution and NASDAQ trade data at tick resolution, we look for statistical indicators which differentiate between a known crisis event, the 2008 Financial Crisis, and non-identified crisis events.

It has long been known that volume correlates with price volatility. However, more recently it has been shown that volume cannot imply price volatility in and of itself (cite farmer). In this analysis, we first present an overview of the stylized facts for both order book and price data. Next, we measure liquidity in the order book data using price dispersion methods developed by Yeo et al., and look at how these measures change before, during, and after the 2008 crisis. Last, we perform a rescaled range (R/S) analysis on five-minute-resolution and one-hour-resolution price data, and calculate a Hurst exponent, an indicator of long-term memory in price returns.

As expected, we find that kurtosis correlates very highly with returns in the last quarter of 2008, after the Lehman brothers declared bankruptcy. We also find that both volume and order book dispersion measures correlate with returns, and that order book dispersion is a mild but early indicator of volatility. The results of the R/S analysis lend evidence towards the idea of long-term memory, but a conclusion on this topic is outside the scope of this study.