A Flak Jacket for Markets

COULD MAPPING MARKET STRUCTURE PREVENT FLASH CRASHES?

By Sherree DeCovny

Since the flash crash on 6 May 2010, several studies have tried to explain what happened, which securities were most affected, and who or what is to blame for the sudden extreme volatility. Research undertaken by BlackRock managing director Ananth Madhavan focused on the relationship between the equity market structure and the risk of an extreme price movement. Several key findings emerged from his research. Securities that experienced greater fragmentation prior to the flash crash were disproportionately affected during the event. Counterintuitively, however, trading for exchange-traded products (ETPs) was more severely distorted even though ETP trading is usually less fragmented than equity trading.

Today, there are more trading venues and technologies than ever before. Madhavan wanted to find a measure that summarized market structure complexity in terms of diversity of the venues, but he also wanted to track it over time. To this end, he measured fragmentation in terms of volume, quotes, and time-series variation.

Madhavan used the Herfindahl index as the basis of his calculation. The index is traditionally used to measure competition: The higher the number, the more concentrated the market. In this case, if all trading volume occurred on a single centralized exchange, then the Herfindahl would be 1. If the volume was spread over hundreds of venues, the Herfindahl would be close to zero.

“One can look at fragmentation not only in terms of where actual trades took place but also in terms of quotation activity,” he says. “Looking at quote fragmentation is perhaps more meaningful.”

Suppose that one venue has the best quotes most of the time but volume is spread over two or three different venues. The Herfindahl for quote fragmentation would show a higher number because all of the best quotes come from one market. Yet the volume may be spread across multiple markets for several reasons, including rebate incentives.

By the end of the sample period in March 2012, the average stock’s Herfindahl was around 0.306. This led Madhavan to conclude that, although fragmentation has been increasing over much of the past decade, the new levels are unprecedented. Also, this increased fragmentation may represent a tipping point in terms of the vulnerability of stock prices to an order flow shock or other impulse. Indeed, equity market fragmentation is now at its highest level ever and dramatically higher than it was 18 years ago.

“Quite a bit of research was done before and after the May 2010 flash crash dealing generally with the impact of market fragmentation on market quality or depth,” says Neville O’Reilly, associate director of the Financial Statistics & Risk Management Program at Rutgers University. “However, this paper is the only one I know of that attempts to demonstrate in a rigorous way that fragmentation contributes to the propagation of liquidity shock in an episode of stress. The relationship established by the research is admittedly statistical and not causal, but it is convincing nonetheless.”

O’Reilly adds that the real root cause of the flash crash is fragility caused by a convex, nonlinear response to stress. As the threshold of stress is exceeded, the amount of “disturbance” increases more than it would in a straight-line relationship, rising exponentially. In the flash crash, aggressive rebalancing and reversing out of positions in the S&P 500 e-mini futures contract by one or more high-frequency traders pushed the system over its stress thresholds and overloaded trading systems that process market data. This situation had dramatic, extreme effects in terms of bad, delayed, and unexpected pricing.

Madhavan suggests that stocks with greater fragmentation are more exposed to impulses that could trigger abrupt price declines. “In a fragmented market, the limit-order books tend to thin out, and therefore, any shock—be it a sell order or a buy order—can quickly blow through the standing orders,” he explains.

Normally, ETP trading tends to be less fragmented than the underlying securities, partially because of information asymmetry. For ETPs whose components are traded contemporaneously, widespread distortion of the prices of an underlying basket of securities can confound the arbitrage pricing mechanism for ETPs, thus delinking price from value. During the flash crash, uncertainty in the quoted prices of component stocks challenged market makers as the normal arbitrage mechanism broke down.

Across all asset types, fragmentation was significantly higher on 6 May than on any of the previous 20 trading days, and all asset types showed a marked increase in volume on that day. But the relative increase in the dollar volume in ETPs was much greater than it was in equities. This finding is consistent with the fact that ETPs typically account for a higher percentage of volume on volatile days.

Of the securities that experienced large price fluctuations during the flash crash, many were exchange-traded funds.
(ETFs). Moreover, 70% of all the trades that were broken by the exchanges were ETFs.

The fact that ETFs were disproportionately affected by the flash crash has led some commentators to link ETFs with systemic risk and pricing failures. But Madhavan believes that line of thinking is misguided, and he is convinced the ETF arbitrage mechanism works well.

Joe Gawronski, president and chief operating officer at Rosenblatt Securities, agrees with some of Madhavan's conclusions. ETFs are baskets of securities, and erroneous data on a day like the flash crash has an exacerbated effect on these instruments. This dynamic is probably the main culprit for the overrepresentation of ETFs in broken trades. He also notes that ETFs are typically a higher percentage of trading in volatile markets. No ETFs are listed on the NYSE, which broke no trades that day, so ETFs would likely be overrepresented on that basis as well.

But Gawronski questions whether fragmentation and the changing nature of liquidity provision are the primary causes of the flash crash. “I’d agree that fragmentation contributed to what happened in this case,” says Gawronski. “But that doesn’t explain why there have been other flash crashes, even when trading was largely centralized, such as in 1962, when the Dow fell sharply and then rebounded after 20 minutes. Nor does it explain why we didn’t experience flash crashes in the volatile 2008–09 period when fragmentation as we would measure it had already reached a fever pitch.”

At the time of the flash crash, market makers were required to maintain a two-way market at all times. A market maker that did not want to take a position on one side of the market would enter one side of the quote close to the market and the other side far away from the market. During the flash crash, these “stub quotes” were executed at ridiculous prices. Since then, the rules have changed, and market makers must make two-way quotes within a given range a certain percentage of the time.

Circuit breakers have been put in place to limit the extent to which prices can change within a specified period of time. According to one ETP market participant (who wished to remain anonymous), limits on daily or hourly price moves are only part of a temporary fix for ETF trading and should be replaced or supplemented by something better. An ideal solution would include a mechanism to bring supply and demand for a specific instrument together as efficiently as possible.

“If there was ever a market that cries out for a consolidated limit-order book, the ETF market is it,” he says.

Some argue that eliminating competition could discourage technological innovation. To this end, the regulators must strike a balance between competition and innovation.

Others suggest scrapping the current intraday ETF value calculations for most ETFs. The intraday optimized portfolio value (IOPV) determines what the net asset value of the ETF would be if it were calculated at that moment. The problem is that the IOPV is posted every 15 seconds and is based on the last sale. For example, the SPDR has 500 stocks in it. Some of these stocks trade constantly, and others trade no more than a dozen times a day. Market makers and proprietary traders tend to recalculate the IOPV at various times to determine where they bid or offer for an ETF.

Although exchanges offer several order types, not all are suitable for trading ETFs. Most ETP markets are thin. Because of the link between the ETF’s value and its price, there are usually few customer limit orders on the book. Investors may want to avoid using market orders in ETFs, perhaps with the exception of the SPDR. Instead, immediate or cancel (IOC) orders allow any portion of the order to be filled at the limit attached to the order with an immediate cancellation of the balance.

Intermarket sweep orders scoop as many shares as possible from the order books of several marketplaces. Some researchers have concluded that these orders may have triggered the flash crash by aggressively taking bid-side liquidity.

One lesson from the flash crash is that regulators need to monitor market activity more closely. “We learned a lot about markets by studying the flash crash,” Greg Berman, associate director of the division of the office of analytics and research at the US SEC, said publicly. “We also learned how important it was to be able to accurately collect and analyze complete order book data, which were the lynchpin for any of these types of analyses.”

In January 2013, the SEC rolled out the Market Information Data and Analytics System (MIDAS). The SEC collects about a billion records from the proprietary feeds of 13 national equity exchanges daily. These feeds provide information on every trade, displayed order, order modification, and cancellation on those venues. MIDAS also stores historical records, so the SEC can perform analysis on thousands of stocks over periods of six months or longer. MIDAS is being used for market structure research, forensic analysis of market events, and real-time market monitoring.

Because MIDAS does not include nonpublic data, it provides no information on off-exchange orders or about how orders are routed, rerouted, aggregated, and disaggregated across many broker/dealer systems. Orders are not tagged with the names of the broker/dealers, and trade executions do not come with account numbers or customer identifiers. To this end, the Consolidated Audit Trail (CAT) is being developed to provide a more complete view.

Much analysis has been done since the flash crash, and no doubt there will be more in the future from various perspectives. Madhavan’s research is not the last word, and market participants must hope it will lead to a better understanding of market dynamics and more informed policy decisions by regulators, which would help restore investor confidence.

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