the Availability Digest

www.availabilitydigest.com

Knight Capital Crippled by Software Bug

August 2012

On Wednesday morning, August 1, 2012, Knight Capital, the number one market maker for the NYSE and NASDAQ stock exchanges, was virtually wiped out in just a few minutes by a software bug. The story of how that happened rings a wakeup bell for the modern techniques of high-frequency trading, which lets brokerage firms place and delete quotes and make trades in microseconds.

Knight Capital

The Knight Capital Group (NYSE: KCG) is an American global brokerage firm engaging in market making, trading, and institutional financial services. Established in 1995 and headquartered in Jersey City, N.J., Knight was the number one market maker for the NYSE (New York Stock Exchange) and for the NASD (National Association of Securities Dealers, which runs the NASDAQ – NASD Automated Quotations – trading system). It is the responsibility of a market maker to provide liquidity to equity markets by stepping in to buy or to sell stocks using its own capital to ensure orderly activity. Without market makers, investors may not be able to find another side for their trades.

Employing almost 1,500 people, Knight's largest business was market-making in U.S. securities. Knight was the market maker for 690 securities listed on the NYSE, and it traded in over 19,000 U.S. securities. In the second quarter of 2012, Knight traded over 350 million shares per day at an average value of $21 billion. Using its high-frequency trading algorithms, Knight represented about 17% of all trading activity on both the NYSE and NASD stock exchanges.

High-Frequency Trading

High-frequency trading (HFT) is the use of sophisticated computer algorithms to trade securities. HFT systems typically hold a position for only a short period of time – perhaps seconds – and liquidate their positions at the end of the trading day. Bid and offer quotes to buy or to sell securities are made in microseconds, and trades typically just yield a gain or loss of fractions of a penny per share. But the pennies add up to massive profits at the end of the day.

In the United States, high-frequency trading firms represent 2% of the approximately 20,000 firms operating today, but account for 73% of all equity orders.

Wednesday Morning, August 1, 2012

The warning signs were clear before the NYSE opened for trading on August 1. Traders noted that there was a huge volume of orders queued up to trade when the opening bell went off at 9:30 AM. Back offices were called to see what was going on. The Knight traders on the floor were told by their back office in Jersey City that it wasn't Knight that was generating the orders.

When the markets opened, sure enough they were flooded with an immense volume of orders. By 9:40 AM, the NYSE identified Knight as the source of the orders. It took Knight another 20 minutes to locate the cause of the problem and to shut off the order flow. The backlog of queued orders continued to be executed for another fifteen minutes.

Stock prices in 148 companies went wild. Wizzard Software soared 400%, from $3.50 to $14. Abercrombie & Fitch jumped 9%. Harley-Davidson fell 12%. Later in the day, the NYSE canceled trades of six smaller stocks that had wide swings, including Wizzard.

In 45 minutes, Knight executed billions of dollars in errant trades. It had executed orders that amounted to a $440 million loss for the firm. Knight Capital was on its knees.

The Aftermath

Goldman Sachs immediately offered to buy Knight's unwanted positions at a discount over their current market value. The NYSE moved Knight's market-making operations, including employees, to its major competitor, GETCO, a leading global market maker.

Knight's stock price crashed from a recent high of $10.33 to a low of $2.27. Knight Capital had lost 78% of its value!

Knight Capital Group Stock Performance
(Yahoo! Finance, August 11, 2012)

Thomas Joyce, CEO of Knight, said that the problem was not with the company's HFT algorithms. Rather, it was in a software upgrade installed Tuesday night, July 31st, to work with a new system of the NYSE. This system is known as the Retail Liquidity Program, designed to improve markets for small investors.

As Joyce wryly commented, “You cannot keep people from doing stupid things. That is what happens when you have a culture of risk.” He said that Knight’s clients were not negatively affected

Over the weekend, unlike the big banks’ inaction during the break of the housing bubble, a consortium of financial services firms negotiated a takeover deal with Knight. The consortium included GETCO, Blackstone Group, TD Ameritrade, Stifel Nicolaus, Jeffries Group, and Stephens. For $400 million, they received warrants at $1.50 a share, which, when executed will give them ownership of 70% of Knight.

The members of the consortium had many questions. What happened to the chain of command? Why wasn’t trading shut off when the warning bells went off? However, they had no chance to do any due diligence. Rather, they trusted Knight’s reputation; and Thomas Joyce has been a trusted figure on Wall Street for decades.

The Future of High-Frequency Trading

There evidently have been many instances of small market turmoil due to high-frequency trading that do not make the headlines. However, one extreme was the “flash crash” of May 2010. A massive (though legitimate) sale of 75,000 S&P contracts started a sharp market decline on a day when the Dow Jones average was already down 300 points. With the market in a sharp decline, HFT algorithms triggered sales of their positions, leading to massive sales. Willing buyers were soon exhausted, and the market lost 600 points in minutes, sending some stock values into the pennies. The market stabilized a few minutes later, and the massive decline was erased.

Though not fundamentally caused by HFT, the botched Facebook IPO in May 2012 was caused by an excessive volume of orders at the opening of the IPO that overwhelmed the NASDAQ trading system. Customers could not tell if their orders had been executed, and new buy/sell orders were delayed by hours. There is a good chance that a great deal of this excessive volume was caused by HFT systems. The Knight debacle was an ironic embarrassment for CEO Joyce, who had publicly criticized the NASD for the problems with Facebook’s IPO.

One of our subscribers, Paul Green of Stratus Technologies, has recently posted a question on our Continuous Availability Forum[1] that has received quite a bit of comment. He asked:

> ***“****What advice would you give to the NYSE for avoiding problems with high-frequency trading software?****”***

The responses are thoughtful and worth reading. Among them are suggestions for better circuit breakers and a tax on trades. The NYSE instituted circuit breakers to stop trading in affected securities after the flash crash, but perhaps the circuit breakers were not tight enough. It is not clear whether Knight had circuit breakers, but a clear lesson from the Knight disaster is that any firm that is using HFT trading algorithms better have tight and fast circuit breakers in place; and they should modify their trading algorithms to be aware of the circuit breaker thresholds.

The concept of taxing trades is not new. Nobel Laureate James Tobin suggested such a tax in 1972 on currency transactions to curtail short-term speculation in currencies. To control HFT, such a tax would be so small that normal investors would never notice it. However, the tax would be high enough to make trades that resulted in gains of a fraction of a penny per share much less attractive (hopefully, totally unattractive).

One problem that the exchanges face is that HFT systems flood the market with buy/sell orders that never get executed. The intent of these orders is to test the market to see where it is moving. Consequently, there are many more orders than trades. Exchanges make their money on trades; they do not charge for orders that are not executed. However, the mass of orders must be processed; and the exchanges must

[1] http://www.linkedin.com/search-fe/group_search?pplSearchOrigin=GLHD&keywords=continuous+availability+forum

invest in bigger and bigger systems to handle this non-income producing activity. A tax on trades that could be extended to a tax on orders would go a long way towards solving this problem. Alternatively, the exchanges could require that bids and offers be valid for a minute or so rather than the subsecond order lifetimes currently in vogue with HFT. Phishing orders would then be converted to real orders that could be hit, and the order volume would be reduced to a meaningful amount.

Several of the commenters on the Continuous Availability Forum felt that HFT had no redeeming value socially. The only beneficiaries were the brokerage houses that made millions on it. However, the proponents of HFT point out that it increases the liquidity of the marketplace and narrows the bid/offer spread, this making trading more efficient and more economical.

Summary

Caution! High-frequency trading can be hazardous to your health! Knight Capital certainly found this out and hopefully has raised the bar for other firms to ensure that they do not follow in Knight's footsteps.

Will the exchanges take drastic steps to ensure that incidents such as the Knight debacle and the flash crash do not happen again? Probably not, short of tightened circuit breakers. Exchanges compete with each other and do not want to lose business due to tightened rules not adopted by other exchanges. Only the SEC (Securities and Exchange Commission) could force these changes, and then only in the United States.

Besides, the billions of dollars that brokerage firms have invested in HFT systems and the billions of dollars they stand to make are major barriers to any change.

Acknowledgements

Material for this article has been taken from the following sources:

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