

How Do Clearing Organizations Control the Risks of High Speed Trading?

Carol Clark and John McPartland

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Background

Over the past decade, a confluence of market, regulatory and technological events has radically changed the microstructure of many exchange traded markets. The decimalization of U.S. equity and equity options markets has resulted in smaller tick sizes, increased trading volumes, and an explosion of market data information, which has challenged the data assimilation capabilities of human traders. At the same time, market liquidity has been fragmented among various equity trading venues.¹ These changes, combined with mathematical breakthroughs and technological advances in communications and digital computing, have expedited the migration from floor-based to screen-based (point-and-click) trading to high speed trading (HST) where computers programmed by humans make trading decisions. HST has migrated to various asset classes including equities, futures, FX, and options. So called black boxes² are capable of reacting to market data, transmitting thousands of order messages per second, cancelling and replacing orders based on changing market conditions, and capturing price discrepancies with little or no human intervention.

In a floor based trading environment, customers of broker dealers (B-D) and Futures Commission Merchants (FCMs) convey their orders to the B-D/FCM via telephone or other electronic means and B-D/FCMs execute these orders on an exchange trading floor. Customers of B-D/FCMs include companies, like airlines that may want to lock in a future price for oil or hedge other business exposures, private equity firms, pension funds, mutual funds, retail customers, etc. As the migration from floor trading to point-and-click trading developed, some B-D/FCMs began to offer their trading platforms, which were either developed in house (proprietary) or purchased from a vendor, to their customers. Doing so provided customers with more direct access to markets and quicker execution capabilities, which may increase the likelihood of obtaining the desired price in the market.

Over time, some customers found that legacy point-and-click trading systems provided by B-D/FCMs were not keeping pace with some of the current technological advances and began to seek alternative solutions. In response, some trading venues and B-D/FCMs began to allow certain customers to access their markets directly (send their orders directly to the trading venue without using the B-D/FCM's trading system) using proprietary trading platforms the customer developed and/or vendor provided trading platforms the B-D/FCMs approved.

B-D/FCMs and their customers found other ways to decrease latency (the time it takes to send an order to a trading venue and for a trading venue to acknowledge the order) in order to increase their chances of getting their orders executed first. One way customers reduce latency is by placing (co-locate) their servers as near as possible to the trading venue's matching engine(s).

Over the past several years, reports have circulated that some B-D/FCMs may not have been properly controlling the risks associated with their customers' accessing the markets directly. In particular, concerns were raised that some B-D/FCMs were allowing their customers to send

their trades to a trading venue³ without establishing appropriate pre trade limits on their trading platforms thereby exposing the B-D/FCMs to financial risk.

To ensure that B-D/FCMs are appropriately managing the risks of their customers that access the markets directly, the SEC implemented Rule 15c3-5 in July 2011, which among other things, requires B-Ds to maintain a system of controls and supervisory procedures reasonably designed to limit the financial exposures arising from customers that access the markets directly. The CFTC also issued a notice of proposed rulemaking in August 2011 to bolster risk management at the FCM level.

Broadly speaking, regulatory and industry attention on high frequency trading has produced recommendations and best practices related to how pre and post trade risk controls⁴ at one or more levels of the trade life cycle – from trade execution to trade settlement - may be improved for firms that access the markets directly. Staff from the Federal Reserve Bank of Chicago's Financial Markets Group used these recommendations⁵ as a baseline to elicit information on the controls that are currently in place at each level of the trade life cycle to manage the risks of HST. We define HST as high frequency, automated, and algorithmic trading, since firms engaging in these styles of trading can potentially send thousands of orders to a trading venue within a second(s). It is also important to note that it is difficult to quantify the precise number of orders that would designate a firm as being engaged in HST. As an obvious example, an algorithmic trader could execute 100 trades over the course of a day, which would not be considered HST.

Over thirty interviews were conducted with primarily U.S. domiciled technology vendors, proprietary trading firms, broker dealers and futures commission merchants, and clearing organizations. Non-U.S. entities interviewed include one exchange, one clearing organization and one foreign broker-dealer. This article summarizes what was learned during conversations with four clearing organizations. The interviews focused on risk controls and other topics of interest or concern to these firms.

Firm Profiles

The four clearing organizations interviewed clear equities or derivatives (futures and options) products. The equity and options clearing organizations interviewed have horizontal clearing structures where each clearing organization accepts matched trades from multiple trading venues. The futures clearing organizations interviewed have vertical clearing structures where the clearing organization generally clears trades for a single trading venue.

Margin Process

Margin deposits provide an ex ante safeguard against unfavorable price moves and allow clearing organizations to guarantee contract performance. Clearing organizations require margin

deposits to protect against exposures that could arise if a clearing member⁶ were unable to fulfill its financial obligations due to losses in trading or other activities. Depending on the clearing organization, clearing members must post initial/premium margin for their open positions on the same day of the trading activity or on the following morning. Futures clearing organizations also require once or twice daily variation (mark-to-market) margin payments from their clearing members. Options clearing organizations require option premium pass through payments from clearing members and may require additional margin from clearing members whose short options positions increase in value.⁷ Equities clearing organizations settle matched trades on T+3 and collect margin on T+1. During exigent market conditions, clearing organizations typically reserve the right to calculate margin with greater frequency. Clearing organizations' rules also give them the ability to liquidate a clearing member's initial/premium margin and close out its positions if the member is unable to fulfill its obligations.

Clearing organizations calculate initial/premium margin requirements based on clearing members' open positions. But, the process clearing organizations use to determine open positions differ based upon three factors. First, whether the clearing organization primarily clears for a single exchange or for multiple exchanges (vertical or horizontal clearing). Second, whether the clearing organization has a gross or net margining system.⁸ Third, whether or not the clearing organization receives an open/close indicator with each and every matched trade that identifies whether a trade opens a new position or closes an existing position.

A net margining clearing organization can generally determine a clearing member's open positions without obtaining any additional position information from other sources. In order for a gross margining clearing organization to determine the open positions of a clearing member, it would need to either 1) receive open position information from clearing members (open position information can only be processed with the same cycle frequency with which clearing members provide this information to the clearing organization) or 2) receive an open/close indicator with each and every matched trade. For those clearing organizations that do rely upon receiving open position information from clearing members, such information is received at least once per day and at times, twice per day.

Vertical clearing organizations may have an operating advantage over horizontal clearing organizations in that clearing member exposures can be calculated in near real time. Horizontal clearing organizations' ability to calculate clearing member exposures is reliant upon the periodicity with which they receive matched trade information from multiple trading venues. Depending on the clearing organization, positions may be calculated intraday, at the end of the trading day, or, in the case of clearing organizations that offer deferred settlement, on T+1. Some clearing organizations provide clearing members with the ability to assign or "give up" cleared trades.⁹

Each of the derivatives clearing organizations interviewed has implemented a margin surcharge for concentrated positions and for less liquid products. Margin surcharges are meant to protect

the clearing organization(s) from potential losses arising from the extended period of time it would take to liquidate a large concentrated position(s) or a position(s) in thinly traded products. One of the vertical clearing organizations interviewed has the capability to calculate open positions at the customer account level, even if the customer clears through multiple clearing members, and to implement margin surcharges based on this calculation. The average number of firms that are subject to a margin surcharge range from a few at one clearing organization to up to two dozen at another. The equity clearing organization interviewed is seeking approval from its regulator to implement a margin surcharge program.

Guarantee Fund

Clearing organizations have adopted a number of self insurance devices in order to guarantee performance and to protect against situations where trading losses exceed margin deposits. For example, most clearing organizations have guarantee funds which are collected from clearing members and used to cover the potential liquidation losses associated with an insolvent clearing member(s). Guarantee fund deposits are largely driven by margin requirements. Margin requirements may include margin surcharges, so firms that carry concentrated or illiquid positions would need to make higher concomitant contributions to the guarantee fund.

Some clearing organizations' formulae for determining clearing members' contributions to the guarantee fund may be based, in part, on executed and cleared volumes. Including executed and cleared volumes in guarantee fund contribution calculations is one way some of the clearing organizations interviewed manage exposures unique to HST firms.

Intraday Monitoring

Clearing organizations calculate and monitor intraday exposures of clearing members using different methodologies and frequencies, but in general, using the most up to date information they have received from trading venues. Some trading venues send information to clearing organizations in real time and others once daily. Real time intraday risk monitoring has the advantage of continually capturing the activities of all clearing members, including those clearing members that engage in HST and access the markets directly and those clearing members that clear for HST firms.

Clearing organizations monitor out of the ordinary exposures to clearing members by comparing exposures to defined tolerance levels. These tolerance levels may be based upon concentration of trades, the liquidity of the underlying product(s), or excess net capital. Each clearing organization monitors these exposures at the clearing member level. Two can also monitor exposures at the customer account level. When tolerance levels are breached, clearing organization staff responds on a case by case basis, and/or alerts senior management and contacts

the relevant clearing member. Some clearing organizations may issue intraday margin calls on a case by case basis based upon clearing member exposures that are outside of historic norms.

Risk Management Practices

All clearing organizations have processes for on-boarding new clearing members. These processes may include a review of one or more of the following:

- Credit
- Operational preparedness (including vendor/proprietary systems)
- Settlement banking relationships
- Internal controls
- Compliance and risk management
- Nature of proprietary and client business
- Experience of staff

Most of the clearing organizations interviewed do not incorporate risk management practices that are unique to HST firms that access the markets directly or to clearing members that clear trades for HST firms. Rather, all clearing members are treated equitably. However, one clearing organization conducts weekly risk meetings with a cross functional team to review trading patterns of HST firms

Post Trade Information Provided

Clearing organizations provide various types of post trade information to clearing members to assist them in monitoring their exposures. Some clearing organizations charge clearing members for this information and some do not. The types of post trade information offered to clearing members may include one or more of the following;

- Open positions – this is most critical for horizontal clearing structures where a purchase on one trading venue would liquidate a sale executed on another trading venue.
- Information on average price processing
- Near real time cleared trade information - One clearing organization mentioned during the interview that some clearing members' systems may not be able to process near real time cleared trade information. This would be cause for concern where settlement occurs on T+0 or T+1 and less of a concern where final settlement occurs on T+3.
- Information on performance collateral and performance collateral substitutions. This information may be available from twice daily to near real time, depending on the clearing organization. One clearing organization offers real time performance collateral requirements at the product level.
- Information on “give up” trades. Some clearing organizations provide this information in near real time.

- Two clearing organizations interviewed also provide some type of post trade information to non clearing members, if they are authorized by the clearing member to do so. This may include real time cleared trade information or performance collateral requirements at the product level.
- One of the interviewees also provides clearing members with the capability to view margin information in near real time.

Some clearing organizations are cooperating with an industry-led group to standardize post trade data transmissions utilizing the XML variant of the FIX protocol, and in particular the XML Schema for version 4.4 of the Protocol.

Clearly Erroneous Trade Policies

Clearly erroneous trades can be caused by any number of factors and may arise from trades that are not generated by algorithms as well as from trades that are. Sometimes, algorithms deployed by high speed trading firms that access the markets directly may go awry due to corrupt data, programming errors, hardware failures, network issues, or any number of other unforeseen circumstances. Some out-of-control algorithms and/or erroneous orders may be detected and stopped by a trading firm's risk controls. If the trading firm's risk controls are inadequate, the next line of defense for stopping the order(s) is the B-D/FCM's risk controls. Should the out-of-control algorithm and/or erroneous trade bypass the trading firm and B-D/FCM's risk controls, risk controls at the trading venue level act as a last line of defense to stop orders before they reach the matching engine.

Nevertheless, risk controls at trading venues vary and the parameters may be set so wide as to be ineffective in stopping the order(s). In such circumstances, trading venues may have publicly available policies for busting clearly erroneous trades, but these policies vary by trading venue and by product. Some trading venues require trading firms to report clearly erroneous trades within minutes and others permit trades to be busted weeks after their occurrence. Clearing organizations typically receive instructions related to which trades should be busted from the trading venue(s).

How do clearing organizations envision HST evolving over the next few years?

Only two of the four clearing organizations interviewed had an opinion on how HST might evolve in upcoming years. One observed that HST, including flash crashes, is getting more media attention and public interest. In recent years, this clearing organization has observed that the sum of its overall margin requirements has increased; however, staff was unable to determine whether this rise was the result of increased open interest or was the result of higher overall performance collateral requirements due to market volatility, or both. Staff at another clearing

organization is in the process of designing functionality to revalue the portfolios of clearing members with greater frequency throughout the day. Such a capability could capture volume spikes and performance collateral utilization by clearing members that might result in intraday calls for additional performance collateral. Another risk tool being contemplated would compare historic data on intraday positions with data on current open positions to detect trades that appear outside the norm. However, staff at this clearing organization pointed out that functionality to stop trades that exceed historic norms by some measure could only be implemented at the exchange (trading venue)¹⁰ level.

Do clearing organizations think the market reached a saturation point for marginal returns for HST?

Staff at two clearing organizations said the markets seem to have reached a saturation point for marginal returns for HST due to the commoditization of algorithms. As a result, trading firms now rely on new trading strategies as well as speed.

What keeps clearing organization staff awake at night?

Clearing organization staff outlined a number of issues that keep them awake at night, including:

- Worrying about unknown unknowns
- Keeping up with markets that are more volatile, global and increasingly fast
- Worrying about how markets are controlling risks. Pre trade risk controls are needed, but they increase latency.
- Keeping abreast of changes in products

What would clearing organizations do if they had the power and ability to change *anything* for the betterment of the markets?

Clearing organization staff expressed a variety of opinions when asked what they would do if they had the power and ability to change anything for the betterment of the markets, including:

- Coordinate regulations globally (including CPSS-IOSCO, Dodd-Frank, Basel III, MiFID, and EMIR)
- Harmonize bank and exchange holidays to ensure that settlement banks are open when the markets are open. Until and unless this harmonization occurs, prevent the release of economic reports on bank holidays.
- Require advanced risk protections that calculate various margin components such as:
 - Total margin
 - Expected cash flows
 - Next day margin, including additional margin
 - Current liquidation margin (initial/premium margin and variation margin)

What are clearing organizations' concerns from a regulatory perspective?

Clearing organization staff also raised a variety of regulatory concerns, including:

- Avoiding competition among regulators
- Maintaining interoperability with other clearing organizations under MiFID can be challenging
- Identifying which OTC products will be cleared on exchanges and how trading firms' legacy systems will handle trading on swaps execution facilities (SEFs) may be challenging
- A regulatory approach akin to “throwing spaghetti on the wall” to see what sticks, will have unintended and adverse consequences

Conclusion

Clearing organizations use margin deposits as an ex ante safeguard against unfavorable price moves and as protection against potential liquidation losses that could arise if a clearing member were unable to fulfill its financial obligations. All but one of the clearing organizations interviewed also assesses margin surcharges on concentrated positions and on positions in less liquid products to protect against the potential losses that could arise if it were to take an extended period of time to liquidate such positions. Such a capability should be considered a best practice. Additional best practices for clearing organizations with a vertical clearing structure would be to monitor open positions at the customer account level, even if the customer clears through multiple clearing members, and to implement margin surcharges based on this calculation. Margin surcharges would apply to all clearing members where that customer had open positions.

Guarantee funds also serve as a financial safeguard to protect the clearing organization when potential liquidation losses might exceed the margin deposits of the defaulter. Clearing organizations may want to consider including executed and cleared volumes in their calculations for determining guarantee fund contributions to better manage exposures to their clearing members, including HST firms, which may have high volume levels but low margin requirements.

The periodicity with which clearing organizations are able to calculate and monitor intraday exposures is based in part on the frequency with which they receive up to date matched trade information from trading venues. Clearing organizations that are able to conduct real time risk monitoring are able to continually capture the activities of all their clearing members, including those that engage in HST or clear for HST firms. Using historic data on clearing firms' intraday positions and comparing that information to current open positions could also help detect patterns outside the norm.

Regulators and policy makers may want to consider the following:

- Assessing the methodology clearing organizations use to monitor out of the ordinary exposures to clearing members.
- Providing guidelines to trading venues to establish the frequency with which matched trade information should be sent to clearing organizations and with which clearing organizations should include this information in their risk monitoring activities.
- Providing guidance to clearing organizations regarding which post trade data is critical to clearing members' ability to monitor positions and should be provided free of charge.
- Promoting the adoption of standard formats for post trade information.
- Standardizing the time frames in which clearly erroneous trades must be reported to trading venues and the time frames within which, trading venues should have to bust trades.
- Coordinating regulations globally
- Harmonizing bank and exchange holidays and the release of economic indicators.

¹ Trading venues include exchanges and alternative trading systems (ATS) like Electronic Communication Networks (ECNs) and dark pools.

² Black box trading strategies are 100 percent automated, pre-programmed, and traders cannot interact or modify the algorithms.

³ Trading venues include exchanges and alternative trading systems (ATS) like Electronic Communication Networks (ECNs) and dark pools.

⁴ Risk controls include the processes, procedures and systems a firm needs to prudently manage all the risks resulting from its trading activities to ensure they are within the firms' risk appetite. Risk checks scrutinize orders against a particular limit(s) and are carried out as part of the broader risk control process.

⁵ See: FIA Asia (2007), "Profile of exchange and fcm risk management practices for direct access customers," December 3; OICU-IOSCO (2008), "An overview of the work of the IOSCO technical committee," July; OICU-IOSCO (2007), "Multi-jurisdictional information sharing for market oversight," April; FIA (2009), Letter from John Damgard to Greg Tanzer, IOSCO, May 26; FSA (2008), *Market Watch*, November, Issue no. 30, pp.10-13; FIA-FOA (2009), Clearing Risk Study; OICU-IOSCO (2009), "Policies on direct electronic access," February; FIA (2010), "Market access risk management recommendations," April; OICU-IOSCO (2010), "Principles for direct electronic access to markets," August; FIA (2010), "Recommendations for risk controls for trading firms," November; SEC (2010), "Risk management controls for brokers and dealers with market access," Release No. 34-63241; File No. S7-03-10, November; CFTC (2011), "Recommended practices for trading firms, B-D/FCMs and exchanges involved in direct market access," Pre-Trade Functionality Subcommittee of the CFTC Technology Advisory Committee, March. See also "Software Development and Change Management Recommendations" Futures Industry Association, Principal Traders Group and European Principal Traders Association, March, 2012.

⁶ For a definition of clearing member, see Clark, Carol 2010, "Controlling Risk in a Lightning Speed Trading Environment, Federal Reserve Bank of Chicago *FedLetter*, March at http://www.chicagofed.org/webpages/publications/chicago_fed_letter/2010/march_272.cfm

⁷ A holder of a short options position wants the value of that option to decrease in value rather than increase in value. If the value of the option sold increases in value, its replacement cost increases and, thus the appropriate risk margin to maintain that short option position would also increase proportionately.

⁸ Net margining systems determine initial/premium margin based on the difference between a clearing members' long and short open positions for the same contract/month. Gross margining systems generally calculate initial/premium margin based on the total number of open contracts held by the clearing member. Some

derivatives clearing organizations may net margin the house (proprietary) accounts of clearing members while gross margining their customer accounts.

⁹ A “Give up” trade typically involves an executing broker and a carrying broker. Depending on the clearing organization, the executing broker assigns the trade to the carrying broker and under most circumstances the carrying broker must affirmatively accept the position. Interviewees said most high speed trading firms do not typically utilize give up trades.

¹⁰ Trading venues provide matched trades to clearing organization(s). In order to prevent a trade (outside the norm) from being executed, it would have to be stopped from being matched at the trading venue, well before it is transmitted to by the trading venue to the clearing organization.