TWO TSS SIGMA

October 24, 2012

Via Electronic Submission

Ms. Elizabeth M. Murphy
Secretary
Securities and Exchange Commission
100 F Street, N.E.
Washington, DC 20549–1090

Re: Technology and Trading Roundtable (File No. 4-652)

Dear Ms. Murphy:

Two Sigma Securities, LLC ("TSS") appreciates the opportunity to offer the Securities and Exchange Commission ("Commission") our recommendations on certain ways to enhance the stability of trading infrastructure of the U.S. securities markets.[1] The recently held roundtable helped start a process of systematically analyzing the safe use of technology to improve the U.S. equity markets.

Competition, innovation, and technological advances have created substantial economic benefits to equity market participants, but we share the Commission's belief that externalities associated with trading errors need to be controlled. Trading errors, which can be the result of poorly written or improperly deployed software, "fat finger" entries or other mistakes, reduce confidence in the market. We believe the Commission has the opportunity to mitigate the risks of undisciplined trading *irrespective of the source of the error*. Success in this endeavor will be greatly enhanced through robust dialogue with market participants in an effort to develop best practices prior to engaging in the rulemaking process. Doing so would support the functioning of fair and efficient markets.

At its core, TSS is a technology company with a rather simple philosophy. We believe that computing technologies, applied with rigor, focus and within predefined risk parameters, are critical to achieve our business objectives. Our commitment to this philosophy is evident, for instance, in our investment in knowledge management tools to track and approve software changes, in our creation of sophisticated simulation environments for our researchers to carefully study the effects of their software before deployment, and in our systematic, process-driven approach to synthesizing large amounts of data for enhanced decision making. This philosophy defines our infrastructure and guides our efforts to act as an efficient and disciplined market maker for our clients.

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[1] Established in 2009, TSS is a market maker in over 7,000 securities and a member of the Financial Industry Regulatory Authority, Inc. and 11 U.S. exchanges. TSS is an affiliate of Two Sigma Investments, LLC ("TSI"), which commenced operations as an investment adviser in 2001 and has been registered with the Commission since 2009. The views expressed herein represent only the opinions of TSS and not necessarily the views of TSI or any of TSS's other affiliates.

As a market maker built with modern technology and scientific research, we believe we can contribute to the ongoing partnership between regulators and broker-dealers to disseminate best practices for change management and software development. Without being codified into rigid requirements, best practices can permit broker-dealers to learn from one another to improve their policies and procedures. In the same vein, we urge the Commission to continue an open dialogue with diverse stakeholders before engaging in the formal rulemaking process.[2]

In considering what additional measures are warranted for the industry, we are guided by four key principles:

I. ***The Business is Technology***—The complexity and volume of data of the modern market demands that all participants rely heavily on technology. The business model of many financial firms where sales, trading and research are the "front office" and operations, accounting and technology comprise the "back office" is outdated and dangerous. TSS believes the separation of technology priorities from business priorities is a false distinction. Research, technology and rigorous scientific methodology are in our corporate DNA. We believe that a properly engineered software development environment with modern version control, code review, and deployment along with defined testing and QA processes can be more efficient as well as safer. We also view simulation environments that replay market data and test trading models as fundamental; their development is as critical a priority as the development of production code.

II. ***Risk Control is Fundamental***—Risk controls should be built into the core infrastructure used by trading systems to reflect both the potential for loss at individual firms as well as the potential for errors to affect other market participants. Trading systems should be built with real-time monitoring software that generates automated alerts and has the potential to stop trading when predefined risk limits are violated. This software should have knowledge of all orders, executions, and positions. Broker-dealers should not say they are managing risk if they cannot identify their current exposure.

III. ***Fundamental Fairness***—Regulation should support a level playing field without bias towards specific parties or groups. We urge the Commission to take care that new rules designed to provide market stability do not have the effect of artificially enhancing the profitability of one organization or one type of organization, and to recognize that ensuring market integrity is an obligation that must be shared among all involved parties.

IV. ***Own your mistakes***—Regulation should ensure that the costs of errors are borne by the firm(s) responsible for the errors, rather than spreading the costs among participants, regardless of the type of firm or error. Insulating execution venues and broker-dealers from the full risks of system malfunctions creates a moral hazard, which can, in turn, lead to systemic risk. Diligent firms should not be forced to insure careless ones.

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[2] In this regard, we strongly support Commissioner Gallagher's suggestion that the Commission "focus on working with the industry to better understand market structure issues and find ways to encourage the development of best practices." *See* Daniel M. Gallagher, Market 2012: Time for A Fresh Look at Equity Market Structure and Self-Regulation, Oct. 4, 2012, *available at* http://www.sec.gov/news/speech/2012/spch100412dmg.htm.

With these key principles in mind, TSS participated in the development of recommendations detailed in an industry-wide comment letter submitted to the Commission last month.[3] While we are supportive of the initial recommendation for a "kill switch", we would note that it is not a panacea. The exchange-based "kill switch" may contain some errors that would otherwise have a much larger impact, though it will not prevent significant errors from occurring in the first place. A "kill switch" may even, at times, limit the ability of firms to reduce risk, particularly when firms are routing more orders than normal to a venue because of the failure of another market center. As a result, we believe that the Commission should encourage the adoption of best practices in the development, testing and deployment of trading software in order to improve the integrity of the market as a whole.

1. **Offer more specific guidance on Rule 15c3-5 by clarifying minimum requirements**

Two of the main tenets of Rule 15c3-5 require a broker-dealer to implement policies and procedures that are reasonably designed to (1) systematically limit the financial exposure of a broker-dealer providing market access, and (2) ensure compliance with all applicable regulatory requirements. We believe there is a need for further guidance on recommended practices to prevent departures from the spirit of Rule 15c3-5. Our industry should not be at the mercy of firms that are either unable or unwilling to invest appropriately in resources and technology to develop meaningful controls.

In particular, TSS believes that meaningful risk controls must include an independent mechanism for real-time monitoring of all trading systems. Independence should be designed to ensure no single software bug can simultaneously affect both the trading strategy and the monitoring software. This monitoring software should generally measure the exposure being created by a trading system as well as comparing a trading system's behavior to pre-established baselines per trading account to flag aberrant behavior. The software should have the ability to alert risk managers when thresholds are exceeded and to either reduce risk or disable trading.

2. **Ensure firms have the ability to monitor and reduce trading risk in real time by using monitoring software, human intervention, or both**

In considering best practices for Rule 15c3-5 compliance, thought should be given to issues such as the volume of orders sent and fills received over defined time periods; the total size across all outstanding orders; whether the trading tactic or activity in use is entirely independent from the monitoring software; and the mechanism or decision-making process by which abnormal trading activity is disabled, or customers experiencing technical difficulties are suspended.

TSS believes that independent monitoring software should be designed to identify abnormal trading behavior and have the ability to automatically trigger different trading modalities based on pre-determined risk characteristics. Different types of businesses can implement monitoring software that interacts with the trading system in various ways. As an

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[3] *See* Letter from the Industry Working Group to Elizabeth M. Murphy, Secretary, SEC (Sept. 28, 2012), *available at* http://sec.gov/comments/4-652/4652-17.pdf.

example, the wholesale market making unit at TSS currently has five different modalities that are controlled by monitoring software and the trading desk's user interface:

- *Normal operation*: The monitoring software has not flagged any issues;
- *Alert Mode*: The monitoring software sends alerts to the risk manager(s) and technologists, who can then take appropriate action;
- *Risk-Reducing Mode*: Only allows trades that reduce positions;
- *Riskless Mode*: Only allows riskless transactions, which have no net position change;
- *Disabled Mode*: The monitoring software turns off the trading system entirely.

In addition to the automated modalities described above, TSS has dedicated individuals that monitor the health of the trading system. For each modality change, appropriate TSS personnel are alerted to the system status and have the ability both to mitigate any problematic behavior in real time and to escalate issues internally and with the counterparties potentially impacted. The automation of these modalities is designed to mitigate the impact of a technology error on the firm, its counterparties, and on the entire market.

TSS believes that a well-defined human component to the monitoring process is critical to the success of these automated trading controls. It is important that trading businesses have a fully accountable risk manager (or other supervisory personnel), who receives alerts or monitors the system in real time. Whether a risk threshold is breached by software malfunction or mistakes made by a human trader, the system should alert these individuals so that pre-determined escalation procedures may be followed. The lack of such a clear command and control process could allow errors to compound and, ultimately, threaten the integrity of the market as a whole.

3. **To foster checking of internal risk systems, ensure that all market centers deliver drop copies in a standardized format on a timely basis**

The Commission can also facilitate enhancements to risk control platforms by working with exchanges and other market centers to set standards for timely delivery of drop copies in a FIX protocol format. Drop copies would provide broker-dealers with an independent check on their internal risk systems. Although a number of market centers make consolidated drop copies available, many alternative trading systems and exchanges do not. For venues that do provide drop copies, the data is delivered in varying formats and degrees of latency. Ideally, for a reasonable cost, all exchanges and alternative trading venues would employ a FIX format and provide a consolidated view across all of a client's sessions to help identify a rogue process from trading on a port that is not otherwise monitored.

4. **Look to the technology industry for best practices**

Broker-dealers should draw upon the best practices of technology and engineering firms since the aforementioned measures taken alone are insufficient to ensure that hastily deployed software does not malfunction. Too many firms ignore the dominant role of technology in our markets and relegate technologists to the "back office" within their firms with significant limitations on their decision-making authority. As a result, many firms build systems piecemeal

without designing operational risk mitigation into the fabric of their systems and processes. Since technology errors can threaten the integrity of the market as a whole, firms must consider technology risks as part of their core business jointly with input from compliance professionals, risk officers and other control types.

Successful technology firms depend on environments with modern version and change controls, source code repositories, peer code review, and defined QA scripts that exercise as many aspects of the system as possible. They view simulation environments as essential to the reliability of production code. They also understand that such an approach actually increases speed to market while ensuring quality. Because technology and systematic research are integral to the development of modern trading systems, TSS believes that a sophisticated simulation environment capable of replaying actual or simulated order flow based on days, weeks or months of actual market data is needed to ensure robust and effective system design and reliability.

At TSS we are also cognizant of the limits to simulation and control procedures. Even best practices are not perfect. With rapidly changing technology in an increasingly complex trading universe, we view continuous and incremental improvements as central to our culture. We believe no firm can afford to be complacent in this area. This is why we are reticent to propose precise standards and requirements. Our concern is that precise guidelines will establish a ceiling instead of a floor for the development of best practices and risk controls.

5. **Encourage simulation, stress testing, practice with the exchanges, and phased deployment**

The software development process in any industry is never perfect, and steps must be taken to detect errors or to mitigate their impact. While QA programs need to be tailored to the objectives and business lines of a firm, we believe there are certain processes that are generally applicable. For example, as it relates to system capacity issues, firms should try to stress test their systems in order to gain an understanding of where critical break points exist. Part of the QA process could also involve controlled failures of various components in order to test robustness.

Once tested in simulation environments and against replayed market data, major software changes should be deployed in phases and rolled out piecemeal in a controlled production environment. For example, in the case where a new venue is being certified, we will typically try out the venue with test symbols before starting production trades. Next, we will test a small subset of securities in order to certify all systems—from trading through regulatory reporting and clearing. For minor changes, however, we often simply monitor their effect on some symbols or with individual venues before rolling out the change more broadly. Regardless of the granularity of the deployment plan, every phase should have a well-defined monitoring process with a clearly accountable person reviewing the change and a predetermined rollback plan.

While we are not suggesting that all changes use test symbols, in order to make the certification process more uniform, TSS would encourage regulation that requires all exchanges and alternative trading systems to have full support for test symbols during market hours.

6. **Avoid the misguided sense of security from technology "ratings agencies"**

Some have suggested that third-party audits of a firm's risk controls are essential. While we acknowledge that independent consultants can provide high-level guidance, effective risk management requires intimate knowledge of system architecture and functionality, strategy goals, and past failure points. Independent auditors would face too steep a learning curve and would be counterproductive in two important ways. First, an independent audit would be necessarily lengthy and divert the attention of employees who perform key control and quality assurance functions. Second, a meaningful audit would require detailed disclosure of a firm's sensitive, intellectual property. This would have a slew of unintended consequences including hindering innovation, reducing competition, and decreasing efficiency.

7. **Provide strong incentives for market participants to preserve market integrity**

Regulators should ensure that market participants bear the full costs and risks of their errors to provide the appropriate incentives to invest in proper safeguards and risk management.

It is important to recognize that there is a wide disparity of capabilities among participants in modern markets. Firms that do not have the expertise, working capital, or time to deploy trading systems with appropriate safeguards threaten the stability and efficient functioning of the market. The regulatory framework should be enhanced to effectively prevent these firms from disrupting the market, whether these firms use their own systems or are provided market access by another broker-dealer.

We recognize the complexity of these issues and understand the natural tendency to ask how to "control technology risk." Nevertheless, we believe that this is fundamentally the wrong question because it is too narrow. Instead, we should ask how to reduce the risk and errors associated with *all* sources of undisciplined trading. When the question is framed this way, it becomes more apparent that technology can and should be part of the solution to reduce the frequency and effect of trading errors on the overall market.

We would welcome the opportunity to discuss this letter and engage in further dialogue with the Commission on these topics. Please feel free to contact me at 646-292-6425 with any questions.

Respectfully submitted,

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