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WRITTEN TESTIMONY

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HEARING ON

"Equity Market Structure: A Review of SEC Regulation NMS"

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Chairman Garrett, Ranking Member Maloney, and members of the Subcommittee, thank you for the opportunity to testify before you today at this important hearing. While much regulatory attention has been focused on the derivatives markets, it is, in fact, the equities markets that are the foundation of our financial markets. By reviewing and questioning the assumptions behind the regulatory policies that govern these markets, regulators can develop rules that will advance the national goal of making the markets as fair, efficient, deep and stable as is possible.

My name is Steven Lofchie, I am a Partner, and Co-Chair of the Financial Services Group, at the international law firm Cadwalader, Wickersham & Taft LLP. I am here in my personal capacity and not to represent the views of Cadwalader or any of the firm's clients. Below I have provided background on both the firm and myself.

Background on Cadwalader and Steven Lofchie

Cadwalader, Wickersham & Taft LLP, founded in 1792, is proud of more than 200 years of service to many of the world's most prestigious institutions. Our rich history and participation in many significant social, economic, and legal issues in the United States enabled us to become one of the world's most prominent law firms, advising clients of all types. We represent major corporations, financial institutions, both buy- and sell-side, as well as governmental entities, including the U.S. government, which we represented in the restructuring of Chrysler LLC and General Motors Corporation. The International Financial Law Review named Cadwalader one of the best Financial Regulatory Practices in the United States for the last two years (2013 and 2014), which reflects the depth and breadth of our regulatory practice.

I am the head of the Financial Services Group at Cadwalader and lead our financial regulatory practice. I am the author of *Lofchie's Guide to Broker-Dealer Regulation*, which is regarded as the standard treatise on the subject. In addition, as the head of the regulatory practice, I am responsible for the publication and editing of a daily regulatory newsletter that goes out to over 10,000 recipients, including many here in Washington. I am also responsible for a legal website, the Cadwalader Cabinet, designed for use by financial service and compliance professionals, that has been endorsed as an information resource by two former Chairpersons of the SEC, two former Chairpersons of the CFTC, and numerous others involved in financial regulation.

Overall Theme: Questioning Assumptions

My fellow panelists include two economists who have extensive experience in the quantitative analysis of trading. All of my co-panelists have tremendous regulatory experience. My goal is to contribute a different perspective. It is to set forth questions, based on my experience advising market participants, that should be addressed by economists and regulators as they undertake to re-examine the rules.

If the assumptions underlying the rules that govern the National Market System ("NMS") are not correct—and I think that they are, if not wrong, at least unproven—then the NMS Rules themselves may be wrong, which is to say, damaging to the interests of investors, both retail and institutional.

I want to be clear. All of these assumptions that underlie NMS are well-intentioned. They share a common tendency: they sound true. The very fact that they sound true, however, can make it seem unnecessary to test whether the underlying assumptions are, in fact, true.[1]

Same Old, Same Old (Not)

To start, I question whether we should interpret Section 11A of the Securities Exchange Act, which provides the statutory basis for the adoption of the rules governing the National Market System, in the same manner as it was interpreted by the original adopting Congress. Put differently, should we respect "original intent"?

Section 11A is written so as to express goals that sound timeless—fair competition among firms, the practicability of executing orders in the best market, the opportunity for orders to be executed without the intervention of a dealer. Hearing that very elegant language, it is easy to think that the drafters of the 1975 language anticipated our current circumstances with such foresight that we have only to follow in their footsteps. Notwithstanding that the language of Section 11A may ring of eternal truths, we should be mindful that the markets that Congress and the SEC oversaw in 1975, at the time of the adoption of Section 11A, bear little resemblance to our current markets.

In 1975, the New York Stock Exchange had a practical monopoly on the trading of stocks in the United States. Trade speed was measured in minutes, not in milliseconds. Every trade was at risk of being picked off by the specialist. Spreads were in eighths, at a minimum, so a round trip purchase and sale cost a quarter. The NYSE formed something of a private club that served to regulate its members, but was largely closed to outside forces. Section 11A was adopted to deal with the problems faced by the market at that time: a monopoly on trading held by one exchange, slow manual executions, specialist profiteering based on knowledge of limit orders, spreads that were extremely high taking into account inflation and the dollar spread in today's terms between a bid and offer, and limited access by non-NYSE members to the bids and offers available on the exchange floor.

The problems of 1975 have in large part been successfully addressed, but only to be replaced by new ones. Today's problems are not those of a monopoly, they are of fragmentation; they are not of sloth, they are of speed; they are not of specialist profiteering, they are of the lack of strong incentives for firms to become market makers; they are not of over-reliance on the individuals who are specialists on the floor, they are of technology breakdowns; they are not of a private club of exchange members, they are of regulating competition between exchanges and their former members.

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[1] As Chair White has said, there are many assumptions about market structure that seem almost "accidental" and can be a result of "long-standing market practices"—and I would add: regulatory habits. I further agree with Commissioner White that in order to get it right, we must "identify and test [these] assumptions [regarding] market structure [and its effects on investors]. *See* Chair Mary Jo White, Speech at the Security Traders Association 80th Annual Market Structure Conference Washington, D.C., *Focusing on Fundamentals: The Path to Address Equity Market Structure* (October 2, 2013), http://www.sec.gov/News/Speech/Detail/Speech/1370539857459.

If we go into the rewrite of the NMS Rules thinking that we are just solving the same problems, we will exacerbate the very different problems that we now face. That is, a rule adopted in 1975 may have quite a different effect in 2014. Let me provide one example of this.

The requirement that firms have an absolute obligation to trade with the best order on an exchange's book has one result in a market structure where (i) there is, for all intents and purposes, only one exchange and (ii) competition between orders leads to the best price being displayed on that one exchange. On the other hand, the same rule may have quite a different effect where (i) there is no limit on the number of exchanges, and (ii) competition to be at the top of an exchange's book results in an order being moved to a different exchange so as to be the best priced order on that other exchange. Consequently, in 1975, the rule may have created competition between orders; in 2014, the same rule today may exacerbate market fragmentation.[2]

Exchange Competition and Trade-Throughs (Why So Bad?)

At some level, the most fundamental decision that any securities regulator must make with respect to market structure is whether there should be one securities exchange, with the maximum possible depth and liquidity, or multiple exchanges competing with respect to the services that they provide market participants. There is something to be said for both structures, and the choice between them would be a very difficult one for the SEC to make—if there were in fact, a choice. But there is not. The government, and in particular the SEC, cannot and ought not order any "excess" exchanges to discontinue their business. We are stuck with the benefits and the problems of having multiple exchanges.

Of course, once we have more than one exchange, there is no right number. So long as exchanges can satisfy the demands of market participants by providing an attractive place to trade, may they live long and prosper.

The difficulty with multiple exchanges arises when they survive, not necessarily because they provide a place for the competing bids and offers of market participants to meet and interact, but because they provide a way to generate fees, directed by the government, that result from those bids and offers. This appears to be the case today: exchanges thrive—and what is more worrisome from a market standpoint, multiply--because the business of collecting and selling market data at SEC-regulated rates is thriving. Consequently, the exchanges are responding not so much to the demands of market participants, as to the incentives built into the system by the regulators.

So how do we let market participants demonstrate that they do not find real value in a given exchange. Fundamentally, it means that we have to let market participants elect not to trade on an exchange, even though it happens to display the best price. One way to let market

[2] To better explain this, suppose the best bid on an exchange is 10. In 1975, a second bid at ten would have been executed behind the first bid. In order to get into first place, the second bidder would have to increase his bid to eleven. In today's market, with fifteen or so exchanges, the second bidder could move into the leading position, or at least a tie for the lead, not by increasing his bid but by moving his bid to a different exchange. So competition between bids has been replaced by dispersion of bids between exchanges, a condition also known as fragmentation.

participants demonstrate that they don't find value in an exchange, the simplest way in fact, is that we let them "trade-through" that exchange.

A "trade-through" sounds like a bad thing, like a slight, a measure of disrespect. It is impossible to read the Reg NMS Proposing Release and the NMS Adopting Release[3], and not to be struck by the strength of the opprobrium to trade-throughs. It's like hearing a Red Sox fan discuss the Yankees: they are simply bad, there is simply nothing good to be said about them.

The hostility to trade-throughs makes perfect sense in the context of a monopoly exchange (circa 1975, or even pre-NMS) where there would be little reason to trade around the best quote on the NYSE. It is harder to defend that regulatory hostility, other than as a habit of regulatory perspective, in a market structure that consists of thirteen exchanges, whose number is very possibly still growing. If we want to match the number of exchanges to the number that actually serves market participants, than we have to let market participants decide that they can avoid exchanges that do not serve them—that is, we have to allow exchanges the possibility of failure.

Consider our current direction: the costs of running an exchange are merely those of paying FINRA to surveil it and of running a computer server. Once an exchange is up and running, SEC rules demand that market participants honor the best bid on that exchange, even though the exchange does not provide any real market where there is an expectation that buyers and sellers come to that exchange for the purpose of doing business there. If FINRA surveillance costs are low enough, and if market-data fees are high enough, we can have a market structure with an infinite number of exchanges, one exchange for every bid or offer.

The alternative to a world of a separate exchange for every quote is a world in which exchanges may be allowed to fail. Allowing trade-throughs, at least for proprietary orders, would be a start in that direction.

Transparency vs. Dark Pools (What If We Called It Naked Bazaars vs. Protective Coves?)

A second regulatory assumption, or habit of mind, that transparency is always good, so good that it must be forced upon the market to the greatest extent possible, likewise deserves some scrutiny. Just as the regulatory assumption seems to be that market participants should be forced to defer to the requirements of every exchange, regardless of how little actual liquidity the exchange may provide, there seems likewise to be a regulatory assumption that so-called dark pools markets are bad, and ought to be shrunk down in size by force. But why that disparity in the treatment of businesses, exchanges and dark pools, providing similar services?

Given a choice between (i) the transparent display of quotes on the lit (exchange) markets or (ii) the execution of trades in a dark pool, it seems that the only acceptable choice is the oft-repeated mantra that transparent display of quotes on an exchange is preferable, and that we

[3] For citations of the materials used in this testimony, please refer to Appendix A.

should "seek to promote transparency to the maximum extent possible. . . ." [4] After all, we want transparent government and transparent regulation: shouldn't stock market quotes be the same way? The alternative "dark pools"—sounds just awful: a bit like underground caverns where blind prehistoric fish swim.

But I want to shift the perspective a little so that the terms we use to describe markets reflect appropriate assumptions and do not predispose us to conclusions that are not supported. What if we called exchanges, instead of lit markets, "naked bazaars?" What if we called alternative trading systems, instead of dark pools, "protective coves?" This change of terminology may cause us to question our assumptions. If you are a long-term institutional investor who takes large positions based on in-depth fundamental corporate analysis, where would you send your quote: (i) to be hung out in a naked bazaar exposed to the glare of high-frequency algorithmic momentum traders equipped with laser-speed co-located flickering quote transponders or (ii) sheltered in a protective cove? A "protective cove" sounds pretty nice and safe as compared to a naked bazaar.[5]

Implicitly or explicitly, we all recognize that transparency is not an unqualified good. If mutual funds and pension plans should be fully transparent, why not require mutual funds to broadcast their trading intent for the day in the morning, before the market even opens? If a little transparency is good: shouldn't more transparency be better? The answer to that question is of course no: we don't force mutual funds and the pension plans to be fully transparent because it would injure them. Other traders, knowing of the mutual funds' and pension plans' intent, would jump in the market ahead of them, to the detriment of these long-term institutional investors.

But if it is obvious that we ought not to force the mutual funds and pension plans to reveal their intent in the hours before they trade, why is it obvious that we ought to force them to reveal their intent thirty minutes before they trade, or one minute, or five seconds, or one second? In fact, might it not instead follow that the mutual fund could be better served by sheltering its quote in a protective cove until the very instant of execution?

As we re-examine the NMS Rules, rather than assuming that transparency is an unmitigated good, we should recognize it for what is: the forced transfer of knowledge from someone who has valuable information to someone who wants that valuable information. It can

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[4] *See* Opening Statement of Ranking Democratic Member Paul E. Kanjorski, *Hearing on Reviewing U.S. Capital Market Structure: Promoting Competition in a Changing Trading Environment* at 3 (October 30, 2003), http://archives.financialservices.house.gov/media/pdf/103003ka.pdf.

[5] While I thought that this was a very clever idea to rename dark pools, I learned to my chagrin that a very similar suggestion about the negative connotation of this terminology had been previously made by the ICI in its letter in regard to the Forced Transparency Release. In that letter, the ICI said:

> "We believe it is unfortunate that such a pejorative term [dark pool] has now become ingrained in the terminology used by the securities markets and policymakers to describe a type of trading venue that has brought certain benefits to all kinds of market participants, including funds and their shareholders. We therefore are reluctant to use the term when discussing issues surrounding this part of our market structure and urge that an alternative term be established to describe such venues." *See* ICI Comment Letter at footnote 6.

be in the public interest, at times, to force the broad dissemination of an institutional investor's information, but we should not assume it without question as a universal truth. Rather, when regulators assume that the greater good is advanced by ignoring the desires of the individual, regulators must bear the burden of proof and not satisfy themselves with stating what feels to them to be obvious.

Limit Orders Have Great Option Value (OK, But How Great Exactly?)

The basis for the assumption that transparency is of great value rests on the equally presumed-true-beyond-doubt assumption that there is great economic value in encouraging, or forcing, the public display of quotations.

The logic for this assumption sounds pretty straightforward: if an investor can look at the market and know that there is substantial buying power or selling pressure at particular price levels, the investor can gauge how strong the market is at those various levels, and thus know whether his trade is likely to move the market materially up or down.

But is this really true? If I put a firm bid on a house, and give you a week to accept or reject the bid, my firm bid has real value. It gives you time to assess the market and make a determination as to whether you can do better with another buyer.

On the other hand, if you see a quote in the securities markets, that quote is good for somewhere between a millisecond and a second. For something of a real-world illustration of this, one can look at the SEC's report on the Flash Crash: when the markets got uncertain, quotes vanished. Whatever is there now can disappear awfully fast. Again, this is not to dismiss the value of public limit-orders, but only to raise a question as to their value rather than assuming it. Quotes provide some indication of the depth of the market at some instant in time, but only for that actual instant (however long one thinks an "instant" is).

Continuing on this theme of valuing limit orders, the NMS Adopting Release in fact describes "limit orders" as options that have value to the market. This is economically true, and an astute manner of characterizing a limit order. That said, the value of an option is not an absolute: it depends on at least three factors: (i) the price at which the option can be exercised, (ii) the size of the option, and (iii) the time to expiration of the option. However, the NMS Adopting Release does not follow up on its own insight as to this economic value of limit orders.

As a starting matter, a limit order may have a very short life: possibly less than a second, so its time value is inherently quite limited—much less than my bid on your house that is good for a week. But what is even more important in light of the NMS Rules' emphasis on prohibiting trade-throughs is the size of the option: a larger limit order may have more economic value than a smaller limit order, even though the smaller limit order may be at a better price. Accordingly, by always favoring smaller, better-priced limit orders over larger limit orders (which is what the NMS Rules do with the trade-through prohibition), the trade-through prohibition may favor the less valuable option over the more valuable option.

Again, none of this is to say that limit orders do not have value and should not be encouraged. It is to say that the assumptions that the SEC makes as to their value both in relative

terms (always favoring price over size) and in absolute terms (ignoring time value entirely) are worth questioning.

Limit Orders Have Great Option Value (But Let's Not Reward Them—or Market Makers)

Let us assume that the SEC properly understood the real value of limit orders to the market. Let us then assume it is good policy to reward that gift of value to the market. How best to do it? There is only one way in which it is possible to reward limit orders and the firms that place them: by driving executions to them.

What follows from that is important if you are writing new rules: if we believe that market makers provide value to the market by being ready to buy and sell at all times, that is by constantly placing limit orders, then it follows that we should encourage that value by giving them first dibs at a trade, even priority over customers. After all, if there is no benefit to being a market maker, if it is better to be a customer, then it is not clear why anyone should want to be a market maker, or put themselves at risk by being in the business of writing options to the market.

The flash crash led many to question the value of technology. A better analysis, in my view, would lead us to ask whether we have under-valued market making, as we had back in the good old days, when the NYSE traded manually and specialists could provide depth-of-market. Back then, specialists were able and willing to do this, because the NYSE specialists of old had an economic interest in making the markets work and everyone benefitted from the smooth operations of those markets. What benefits do today's market makers receive by contrast?

The NYSE had a near-monopoly on the trading of major stocks, and it was able to share the benefit of this monopoly with its member firms, and particularly with the specialists. It was well-understood that the specialists made quite good profits, profits that were perhaps even extraordinary given the level of capital and resources that they committed. But the price of being able to keep earning those profits was a willingness to step up and put a limited amount of capital at risk in the direction of slowing market momentum. There was thus an unwritten deal made: specialists made extraordinary profits but risked the loss of some of those profits to dampen volatility. You can argue one side or the other: whether that was an absolutely fair deal, or whether the markets overpaid the specialists, but leaving aside the price, each side clearly had something to offer: the specialist made larger profits, but the specialist also took risk and acted to dampen volatility.

That deal is not going to happen in today's market structure. No exchange has anywhere near a monopoly on trading or any means of rewarding its specialist or market-maker firms with enough benefit to make the market maker want to stand in front of market momentum.

As we scrutinize our basic assumptions. The question for the regulators to answer should be whether, in the absence of a single exchange monopoly, it is possible to develop a regulatory structure that provides an affirmative reason to make markets. If there is no profit in being a market maker, why do it?[6] If there are not "real" market makers who will stay in the market at

[6] A number of regulators have suggested that high-frequency traders should be required to register as broker-dealers. This misses the point entirely. It imposes a cost (complying with record-keeping, capital

all times and can make a profit at it, what is the long-term effect on spreads? What is the likelihood of more market breaks if no one has any incentive to fight the tape.

Information Is Good (But Not Without Interpretation and Anticipation)

The regulators tell us that they need better information in order to improve the workings of the National Market System. Soon we will have a Consolidated Audit Trail which will have infinite amounts of data. More information is generally a good thing. No one should discourage the acquisition of trading-data. But information is like a race car: it's no good in the garage.

So here are a few questions about information acquisition that should be considered very carefully. Is the SEC using the data it now has to the greatest extent possible? More importantly, is the SEC using that data in an open-minded manner, to really understand the markets, or is it selectively touting data that it believes consistent with its habits of mind. Take this example: if you assume that trade-throughs are bad per se, than any data that shows the existence of a trade-through seems to illustrate a problem. On the other hand, if you do not make that assumption, the discovery of a trade-through just leads us to ask a more significant question: why? What was the motive of the firm trading through? Was it an improper motive, to injure a customer? Was it to take advantage of a trade of larger size? Was it to avoid an exchange that has operational issues? If our only use of data is to confirm our expectations, then why bother collecting it? The value of trade data is only if we use it to understand the motivations of market participants, and if the regulators are open to being challenged in their assumptions, and even surprised.

More important than using information to describe the past - particularly when it comes to trading- is whether data provides insight into motivation and into future conduct; let us call this: anticipation. Trading is an exercise in anticipation, in strategy, in predicting the future, in guessing the behavior of others. When a regulator proposes to adopt rules that govern trading, the regulator must use the data that it has to anticipate the way in which the market participants will react to its proposals: Will the proposals cause markets to coalesce or to fragment? Will the proposals cause spreads to widen or narrow? Will the proposals incentivize market makers to dampen momentum or will they cause volatility to increase?[7]

How well have the regulators done in the past in anticipating how market participants will react to new rules? As to the NMS Rules, the NMS *dissenters* were more on target in their anticipation of the effect of the rules. They predicted (i) decreased quantity discovery, (ii) increased gaming opportunities, (iii) increased market fragmentation and (iv) increased volatility.[8] So obviously they used the data at hand pretty well. That raises the question: is more data required, or is more interpretation and anticipation required?

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and other regulations) on certain traders, but does not incentivize them to trade in a way that stabilizes the market. Putting a stick to high-frequency traders is not the same as putting a carrot to market making.

[7] The SEC has likewise previously recognized that market structure is also affected by markets' response to regulatory actions. *See* Concept Release at 74 FR 3594.

[8] *See* The NMS Dissent at 28.

Here is another example of a prediction: the conclusion of the SEC proposal on the Regulation of Non-Public Trading Interest. That proposal would be better titled the "Forced Transparency Proposal," because the gist of the proposal was that the SEC should force greater transparency of quotations.

The "Benefits" section of the Forced Transparency Proposal trumpets two "predictions":

> The Commission preliminarily believes that the proposed amendment [generally to discourage dark pool trading and force investors to display their quotes] would benefit market participants by increasing transparency and reducing the potential for a two-tiered market.
>
> The Commission also preliminarily believes that the proposed amendment would help encourage displayed liquidity in the form of publicly displayed limited orders.[9]

These predictions, I worry, are based on those unscrutinized assumptions. They do not seem to take account of or explain why the market has changed in the way that it has since the adoption of the NMS Rules. That is: why is there more fragmentation? Why are markets so much faster?

What if the Forced Transparency Proposal had instead said:

> The Commission preliminarily believes the proposed amendment [generally to discourage dark pool quoting and force investors to display their quotes] would benefit momentum traders by increasing transparency and so facilitating the ability of these opportunistic market professionals to anticipate the actions of, and front-run, institutional investors, thereby increasing the costs of long-term investments.
>
> The Commission also preliminarily believes that the proposed amendment would help encourage market fragmentation in the form of more dark pools as institutional investors seek to move their quotations from well-established, larger dark pools that would be forced to exhibit quotes under the Commission's proposal to newly created smaller dark pools that would not be required to show their bids in the public market.

Ultimately the difference between the conclusion that the SEC proposes and the one that I worry about will not turn on who has more information. It's about the better interpretation of that information and better anticipation of the effect of changes in the rules on the behavior of market participants.

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[9] *See* Regulation of Non-Public Trading Interest at 74 FR 61226.

Enforcement Is the Solution (to All Problems or Just Some Problems?)

Technology failure, of little significance in 1975, has become a paramount concern in writing new rules to protect the market. Limiting or stopping technology failure is, however, today, a principal goal of these regulators.

Given the serious consequences of technology failure, regulators turn to familiar tools in the tool kit. Greater enforcement is the solution that we know. Unfortunately, enforcement has serious limitations as a means of regulation. This is particularly true for the regulation of complicated structures such as the technology behind the national market system. While it may be unpopular to do so, we should concede that there are going to be malfunctions: they are inevitable in a market that is so dispersed (thirteen exchanges, all of whose prices must be checked, real time, seventy alternative trading systems), moves so quickly (in milliseconds) and is subject to so many complicated and interacting rules.

Technology error, however, is not the moral equivalent of a fraud. Nobody in the market wants to make a technological error. Mistakes can be enormously costly, even put firms out of business. So the discouragement value that sanctions have for fraud or misconduct are much less meaningful for technology failures. Firms are sufficiently frightened of technology failures that they will do whatever they can do to avoid them, without regard to whether an enforcement action will follow.

That means that when there is a technology glitch in the market, the assumption ought not to be that an enforcement action will follow: it's just coals to Newcastle. Rather, the assumption should be that an investigation will follow, and a report of lessons learned from the glitch will be made to the market so that others can benefit from it. While it will always be appropriate to punish intentional misconduct or gross negligence, it is often not appropriate to punish honest error (beyond the very significant dollar consequences that can result from the market punishing honest error).

In an appended memorandum to this testimony, independent research and consulting firm System Logic argues that the current tools of regulatory examination and enforcement action actually weaken the resiliency of the equity market, and suggests a model that looks to the regulation of commercial aviation as a guide to how the SEC might treat technology glitches. In financial regulation as in aviation regulation, we ought to prioritize public safety.

Exchanges Can Regulate Broker-Dealers (But They Shouldn't)

The reason commonly given why exchanges cannot regulate broker-dealers is that the exchanges are now "for profit" organizations. In my view, the real issue driving the debate over regulation of broker-dealers is that the reputational relationship between the exchanges and the firms that trade on them is dissolving.

In 1975, member firms of the NYSE might boast of their regulatory status as such, giving customers who dealt with them a confidence, whether or not well-founded, that NYSE member firms were subject to a tougher set of rules and a tougher regulatory structure. Further, NYSE firms might argue for the benefits of NYSE execution as providing some stamp of best price, whether or not that was actually true.

Today, all of that is changed. All firms are essentially regulated by FINRA; there is no set of tougher NYSE Rules, as the FINRA rules are being merged into the old NASD Rules so that all firms will be subject to a universal, one-size-fits-all FINRA Rule set. Even to the extent that exchanges may have their own rule books, those books are effectively enforced by FINRA. In 1975, broker-dealers might have established their credentials by boasting of membership on, and regulation by, the NYSE. That credential is now irrelevant. Under a single "self-regulator," FINRA, no firm can claim a marketing advantage by being associated with any particular exchange.

This separation of the reputation of the individual exchanges from the reputation of the various broker-dealers who trade on those exchanges means that the relationship between broker-dealers and exchanges is no longer a mutually positive reinforcing co-branding: it's just about economics. Exchanges and the broker-dealers are in a supply chain just like soy-bean farmers and vegetarian restaurants. They both want good tofu, but no one would assume that soy-bean farmers can regulate vegetarian restaurants, or the other way around.

This means that one component of the re-examination of the national market system must be re-examination of the role of the exchanges as regulators. The assumption that one participant in a supply chain of production should regulate another participant is very difficult to sustain. Further, it is bound to have at least one of two bad effects, and very possibly both. First, the regulating participant is subject to the costs of developing and maintaining a regulatory structure, not an insignificant burden on it. Second, the regulating participant uses its superior position in the regulatory hierarchy to bring it some competitive advantage, or at least advantage enough to offset the cost burden under which it labors.

Conclusion

I do want to concede to the difficulty of the task that confronts the SEC. Life at the SEC would be ever so much simpler with a one-exchange market as effectively existed in 1975.

Unfortunately, we must also concede that there is very little in today's markets that resembles the markets of 1975. Accordingly, it is incumbent upon the SEC to rethink the application of the goals expressed in the 1975 legislation to the markets of today.

This is not a small task. It will require the SEC to re-examine the role of every participant in the market system: exchanges, market makers, customers firms, proprietary traders, institutional investors and retail customers. It will require the SEC to look at the conduct of entities such as alternative trading systems that did not exist in 1975. It will also require the SEC to focus on every form of competition: not just price competition, but also data information competition and technology competition. Finally, it will require the SEC to look at the regulatory structure itself, at the role that it plays, that FINRA and the exchanges play, and at the tools that are used to regulate, including both the power to sanction and the power to investigate and teach. Fortunately, the SEC has consistently demonstrated since its creation that it is up to the task of dealing with great change, and this challenge should prove no different.

APPENDIX A

The majority of this testimony is derived from the following materials:

Regulation of Non-Public Trading Interest, 74 FR 61208 [SEC Release No. 34-60997] (November 23, 2009), http://www.gpo.gov/fdsys/pkg/FR-2009-11-23/pdf/E9-27951.pdf. (the "Forced Transparency Proposal").

Regulation NMS, 70 FR 37496 [SEC Release No. 34-51808] (June 29, 2005), http://www.gpo.gov/fdsys/pkg/FR-2005-06-29/pdf/05-11802.pdf. (the "NMS Rules," "NMS Adopting Release," "NMS Release").

The Dissent of Commissioners Cynthia A. Glassman and Paul S. Atkins to the Adoption of Regulation NMS, http://www.sec.gov/rules/final/34-51808-dissent.pdf. (the "NMS Dissent").

Report of the CFTC and SEC Staffs to the Joint Advisory Committee on Emerging Regulatory Issues, *Findings Regarding the Market Events of May 6, 2010* (September 30, 2010), http://www.sec.gov/news/studies/2010/marketevents-report.pdf. (Referred to as "SEC's report on the Flash Crash").

Investment Company Institute Comment Letter, *Re: Regulation of Non-Public Trading Interest (file no. S7-27-09)* (February 22, 2010), http://www.ici.org/pdf/24142.pdf. (Referred to as "letter on the Forced Transparency Proposal," "ICI Comment Letter").

SEC Staff of the Division of Trading and Markets, *Equity Market Structure and Literature Review, Part 1: Market Fragmentation* (October 7, 2013), https://www.sec.gov/marketstructure/research/fragmentation-lit-review-100713.pdf. (the "Market Fragmentation Report," "Paper on Market Fragmentation").

Regulation NMS Proposed Rules and Amendments to Joint Industry Plans, 69 FR 11126 (March 9, 2004), http://www.gpo.gov/fdsys/pkg/FR-2004-03-09/pdf/04-4712.pdf.

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System Logic

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To: Members, House of Representatives Committee on Financial Services
Subcommittee on Capital Markets and Government-Sponsored Enterprises

Re: Using Regulation to Create a Reliable National Market System

Dear Chairman Garrett, Ranking Member Maloney, and Members of the Subcommittee:

Thank you for the opportunity for us to submit this exhibit to the House of Representatives Committee on Financial Services Subcommittee on Capital Markets and Government Sponsored Enterprises. We applaud the Committee for holding this hearing called "Equity Market Structure: A Review of SEC Regulation NMS" and are honored that Steven Lofchie, Partner and Co-Chair of the Financial Regulatory Group at the international law firm Cadwalader, Wickersham & Taft LLP, thought that the views of System Logic would be a valuable addendum to his testimony. We hope that this memorandum will aid the work of this Committee in considering how to create the right regulatory environment for a reliable and fair national securities market.

About System Logic

System Logic is an independent research and consulting firm that helps organizations manage complexity. System Logic works with both private- and public-sector clients and specializes in combining academic research with practical practices to help firms improve risk management and reduce their exposure to catastrophic failures, even as operations become more complex. More information about System Logic can be found at www.system-logic.com.

By drawing on experience in diverse industries and leading academic research, System Logic uses a sophisticated systems-level paradigm to help uncover and understand the risks that arise from the unexpected interactions present in complex systems, of which the current national market system is an example. It is through this lens that we turn our attention to the role of regulation in creating a reliable equities market.

Executive Summary

Mr. Lofchie requested that we address how complex systems, such as high-speed electronic trading, cause errors and why the tools of regulatory examinations and enforcement actions fail to prevent such errors. Additionally, he asked that we discuss how different regulatory approaches—for example, those used in the regulation of commercial aviation—might help inform the structure of securities regulation

and reduce the vulnerability of the equity market to catastrophic failure.

Complex systems can cause and magnify errors due to unexpected interactions that are difficult to understand and stop in real time. For electronic trading, these errors can be extremely costly and detrimental to the smooth and orderly functioning of the market. Unfortunately, the tools of regulatory examination and enforcement actions on which securities regulators rely do not reliably mitigate errors that arise from complexity. Rather, enforcement and examinations inadvertently create an environment that exacerbates the likelihood and severity of such errors, leading to a less robust and stable national market system. Instead, securities regulators should consider the tools that increase systemic reliability in commercial aviation, such as anonymous self-reporting, industry-led reliability monitoring, and no-fault investigatory practices, especially for severe errors. This memorandum discusses each of these issues in turn.

How the National Market System Causes and Magnifies Errors

The U.S. stock trading industry today is fundamentally different than it was at the turn of the millennium. One reason for the change is the increasing role of technology in securities trading. As it has with almost every aspect of modern life, technology fundamentally changed the way that market participants created models, processed data, and sent trades to the markets. The growth of the internet and rapidly increasing computing power yielded faster and cheaper communications and computation infrastructure, lowering barriers to entry and facilitating innovation in electronic trading.

A second, more direct reason for this change was the development of a modernized National Market System through the enactment of SEC Regulation NMS ("Reg NMS"). By implementing a rule requiring that quotes had to be honored on a national level, thus breaking the long-held monopoly of New York Stock Exchange ("NYSE") specialists, Reg NMS led to the interconnection of exchanges and shifted the vast majority of securities trades to anonymous, electronic interactions, facilitating a technology-driven approach to trading. While some effects of Reg NMS were immediately visible, the increased complexity of the resulting market system and its propensity for errors have been more difficult to recognize, even as the structure of the national market system itself creates profound challenges.

First, the changes due to the implementation of Reg NMS were overlaid on a legacy system which caused existing components to take on new roles for which they were not originally designed. For example, rather than christen new exchanges or redesign the trade matching process, Reg NMS required existing exchanges to connect in new and different ways. Although new technology was developed to implement Reg NMS on the exchange and market participant level, and there are quasi-standards like the Financial Information Exchange ("FIX") protocol,[1] the connected national market system relies on a

[1] Though FIX allows for a standard communications protocol between market participants, it often is implemented in idiosyncratic ways.

variety of distinct technology choices and rule implementations that vary between exchanges. These result in exchanges that are similar enough to provide little diversification from market-wide failures yet are different enough that their idiosyncratic features can create substantial problems.

Second, Reg NMS increased complexity and reduced tolerance to errors by significantly increasing the coupling (i.e., connectedness) among different participants of the national market system. Embedded in the operation of the individual exchanges of the national market system is a vast array of distinct functions that all need to be working properly. These include connectivity to broker-dealer participants and other exchanges; the conduct of automated opening auctions; the continuous matching of securities trades; and the real-time reporting of quotes, trade, and volume data both to subscribers of data from individual exchanges and the consolidated national reporting "tape." Many of these functions are *tightly coupled*, meaning that the failure of one quickly exerts a significant effect on the operation of the market system as a whole. As a result, broad swaths of the national market system may be crippled by a bug in a single ancillary component.

Third, given the raw number of software components and organizations involved, and the fact that the national market system was not primarily designed to maximize error-tolerance and robustness, it is now difficult to build effective redundancies into this system. Even when backup systems do exist, they are often vulnerable to the same failure against which they were designed to protect. Thus, what appear to be redundant features of the system might provide little redundancy in practice.

The failure of NASDAQ's Securities Information Processor ("SIP")[2] in August 2013 illustrates many of these points. The SIP consolidates and disseminates trade data nationally for NASDAQ-listed securities. A connectivity problem from another exchange overwhelmed the SIP's software which ran on the out-of-date Windows 2003 operating system.[3] Ultimately, the SIP's backup instance failed as well. As a result, the trading of all NASDAQ-listed securities which include Microsoft, Google, Facebook, and other tech giants, was halted nationwide for over three hours. Given the complexity of the national market system, such failures often are exceedingly difficult to identify, diagnose, and fix in real time.[4] But rather than rely on sharp troubleshooting skills and heroic real-time efforts to bring critical software components back online, the national market system should systematically be designed to reduce vulnerabilities and the impact of errors.

Indeed, similar problems affect the professional market participants (i.e., broker-dealers) as well. The competition that drives markets creates correlated risks that can lead to failures of the national market system as firms pursue similar strategies which rely on similar or identical sources of information. Again,

[2] The SIP, operated by NASDAQ, is for the reporting of trades in NASDAQ-listed securities.

[3] See Hope, Bradley. U.S. Exchanges Near Deal for Infrastructure Upgrade. *The Wall Street Journal*. Dec. 15, 2013.

[4] Indeed, attempting a fix in real time can cause additional problems, as seen in NASDAQ's handling of the Facebook IPO.

this leads to implementations that are similar enough to be vulnerable to the same sources of errors yet different enough to create a diversity of exposure to bugs and even potentially catastrophic failures. For example, market participants depend on the reliable and timely delivery of market data, yet bugs can occur in the firm-specific software implementations that integrate market data into trading systems, as occurred recently at a Merrill Lynch trading unit.[5] Moreover, technological features that are added onto legacy systems create complex vulnerabilities for market participants and have potentially powerful systemic consequences. For example, the SEC's recent detailed release on the failure of Knight Capital reveals[6] multiple layers of legacy software components that interacted in unexpected ways to nearly bankrupt the firm. In particular, code from a software component that had been discontinued nine years earlier accidently was reused. Because of the fast and tightly-coupled nature of electronic trading, this error was hard to identify, diagnose, and fix in real time. As a result, Knight suffered a loss of over $460 million in a span of 45 minutes—more than $10 million dollars per minute. During this time, Knight's automated order router inadvertently sent millions of orders into the market, causing market-wide disruptions and movements in the prices of 140 NYSE-listed stocks.

Finally, it should not escape notice that the current structure of the national market system and its potential intolerance to the failure of even relatively minor components leads to unnecessary geographic vulnerabilities. Finance is a key part of the national infrastructure. As a result of the events of September 11, 2001, organizations like the Depository Trust & Clearing Corporation which clears and settles the majority of U.S. equity trades, have developed geographically diverse backup and business continuity capabilities to maintain their ability to clear and process trades even if a protracted disruption were to affect the broader New York City region. And though financial services are concentrated in the New York City region, there are exchanges in locations such as Chicago, Philadelphia, and Kansas City. However, it is likely that the expected backup capability provided by this diversity is, to a large degree, *illusory*. In the event of a protracted disruption to New York City's power or telecommunications infrastructure, it is likely than an unexpectedly critical software component (such as a SIP system) will fail, preventing trading and thus grinding the national markets to a halt. This will persist until exchanges and market participants make *ad hoc* compromises, implement technical fixes, and obtain regulatory approvals to operate without an entirely functioning marketplace.

The Current Role of Regulators

Regulators have been struggling to deal with the tremendous shifts in the securities industry even as they have facilitated those shifts through the enactment of Reg NMS. By removing the barriers that limited competition, Reg NMS fostered the development of a complex national market with tightly coupled components and unexpected interactions between them. While there are tremendous benefits to the development of this competition-driven system, regulators have been slow to realize the limitations of their traditional tools in regulating such a market.

[5] See FINRA's Letter of Acceptance, Waiver and Consent No. 20080145847-01 against Merrill Lynch.
[6] See SEC Release No. 70694, Knight Capital Americas LLC.

Bad Actors

Securities regulators are used to dealing with bad actors, not with complex systems. Regulators discover bad actors, like fraudsters, those with prior criminal convictions, or those misrepresenting information or misleading customers, through a variety of mechanisms, including an examination of books and records, requirements for background checks, or by collecting and acting on customer complaints. These are linear processes that lend themselves to investigation by teams of people armed with rulebooks (such as rules about how firms must store their books and records, for example). When violations are found, remedial actions are negotiated, mitigations are implemented, and firms are punished. Some cases are deemed worthy of enforcement and larger, usually civil, actions are brought against the offending parties.

This process does not mitigate or prevent errors that arise from complexity. While advances in real-time trading data collection and analysis will provide a more detailed and comprehensive picture of trading and might allow regulators to identify bad actors more effectively, it will not increase the stability of the markets. Even if regulators have access to copious amounts of data, the nature of systemwide failures in the national market system generally will be indirect and elude real-time analysis.

Examination and Enforcement

Examination and enforcement inadvertently create an environment that exacerbates the likelihood and severity of errors caused by complexity. When it comes to the complexity of electronic trading systems, examinations can only scratch the surface. Because software development is complex, and because most firms have unique trading systems, examiners scarcely are able to understand the detailed workings that might stem from the unexpected interactions of complex systems (consider, as examples, the failure of Knight Capital and NASDAQ's handling of the Facebook IPO). Furthermore, although regulations such as Rule 15c3-5 require broker-dealers to implement "reasonable" risk controls, reasonableness is not well-defined and there is not a universally accepted software development and testing process that implies reasonableness. As a result, examinations are most likely to discover errors that are self-reported (e.g., short-sale mismarkings[7]) and necessarily minor (otherwise, they likely would have been discovered due to their consequences, not during an examination). Thus, the regulatory examination of electronic trading systems likely is to be ineffective: It serves to highlight issues that already are understood and might discourage deeper self-examinations by broker-dealers for fear that regulators will harp on issues that are being self-corrected.

Enforcement actions (and the fear of enforcement actions) have a similar chilling effect on the systemic stability of the national market system. While it is important that errors are understood, and such understanding is widely disseminated to encourage learning across the industry, enforcement is a poor mechanism to pursue this, and SEC Orders are not the ideal means of dissemination. First, an

[7] While these may be important, the fact that they are self-reported is *prima facie* evidence that a firm is surveilling for, documenting, and, most likely, handling these errors in a thoughtful way.

enforcement action likely is to reduce the level of cooperation to the minimum required to be regarded as not obstructing an investigation. Second, enforcement increases the likelihood of certain types of errors. For example, market maker rules, enacted after the 2010 Flash Crash, require broker-dealers to continuously quote two-sided markets in securities in which they make markets; this restricts market makers' ability to stop trading in the face of a known or suspected systems malfunction. This increases the risk of a catastrophic failure, but firms are loathe to stop trading in the absence of a change in the rules or a no-action letter by regulators. Finally, through enforcement actions, regulators make inadvertent, and sometimes conflicting, *ad hoc* policies that usurp more carefully considered rulemaking and interpretation processes. For example, while the SEC's enforcement action against Knight Capital[8] admonished Knight for not identifying and fixing its coding issue before the start of the trading day through a quick *ad hoc* solution, the Order disciplining NASDAQ for its mishandling of the Facebook IPO criticized NASDAQ for implementing such a real-time *ad hoc* fix to try to salvage their ongoing technical problems.[9]

Furthermore, it is not lost on the industry that these Orders are in the form of enforcement actions, sending the message that, if you make a mistake, a disciplinary action will follow. This incentivizes broker-dealers to focus on the minutiae of a particular order and take corresponding corrective actions, rather than take a step back and assess what steps could increase the safety and reliability of their systems. This, in turn, reduces the resilience of the industry and makes failures such as those that occurred with Knight and NASDAQ more probable and potentially more severe.

Reducing Systemic Errors through Regulation

Managing and Preventing Crises

To reduce the potential for errors that arise from complex systems, regulators should temper their use of examinations and enforcement. Instead, they should increase the development of rules—such as limits and circuit breakers that pause trading—that can slow down the market during times of crisis and give participants time to identify, diagnose, and fix problems (including "fixing" a problem by stopping trading).

In addition to slowing the market down during times of crisis, regulators should foster an industrywide cultural emphasis on safety. Cultural change must start with the regulators themselves. If a firm needs to stop trading because they fear a technical glitch, regulators need to defer such decisions to firms themselves and encourage that they make such safety-oriented decisions without fear of regulatory consequences. Regulators either should amend marketing rules or adopt a no-action letter that enshrines a no-fault policy to the cessation of firms' market-making requirement when a technical problem is suspected and trading is halted.

[8] SEC Release No. 70694, Knight Capital Americas LLC, p. 7.
[9] SEC Release No. 69655, The NASDAQ Stock Market, LLC, p. 6.

Moreover, regulators need to establish a clear public commitment to the integrity of the markets, even during times of crisis. Market-wide movements such as the Flash Crash were exacerbated as liquidity providers that may have been willing to purchase securities at low prices stopped trading because of uncertainty as to whether or not trades would stand or be busted. Notably, during Knight's crisis, Chairman Mary Shapiro was very clear that the trades that occurred because the trading glitch would stand as appropriate. This dampened the price swings caused by Knight's glitch. Regulators firmly should commit to and enshrine such a practice, even at the expense of helping potentially significant and politically important firms "do over" an electronic trading error that might cost billions of dollars.

Looking for Trouble

In the world of complex, tightly coupled systems that are the new normal in electronic trading, regulators proactively should "look for trouble," seeking out problem areas, such as bugs and potential adverse interactions among systems. This is in contrast to the standard approach of waiting for problems to occur and using infrequent examination—and enforcement-based regulatory activities to uncover them.

To look for trouble proactively, regulators should consider leveraging the experience and expertise of those already involved in electronic trading by partnering with broker-dealers to improve the stability of the marketplace. By creating a regulatory framework that focused on a partnership and maximized the reduction of systemic risk, regulators could leverage the direct operational experiences of broker-dealers in a structured way. Such a framework could create a reliable and effective paradigm to identify, mitigate, and even predict risks, communicate findings across the industry, and simultaneously retain the power of regulators to enforce as a last resort.

While this proposal may sound radical in the securities context, such a partnership characterizes the effective and safety-driven regulatory scheme present in modern commercial aviation.

Preventing Crashes: Lessons from Commercial Aviation

The complex system of commercial aviation provides an example of the successful regulation of another national asset whose safety and reliable operation is critical to national interest. Although an in-depth comparison between the system of commercial aviation and the national market system is outside the scope of this memorandum, sufficient similarities exist, and securities regulators might consider the tools used within aviation to increase systemic reliability.

Anonymous Self-Reporting

Aviation uses anonymous reporting to collect and share data on near misses and regulatory violations across the industry. Individuals, from maintenance technicians and dispatchers to flight crews and air traffic controllers, can self-report errors. As an incentive for such reports, proof of a report submitted will result in waived sanctions from a regulatory violation, assuming it is in the absence of intent or gross negligence. Note that these are not "whistleblower" reports but, rather, individuals incentivized, through a waiver of sanctions, to contribute to the overall safety of the industry. This system leads to

industrywide benefits because operating entities (such as commercial airlines) can obtain information relevant to the safety of their operations that they would never have otherwise obtained and are able to act on that information to mitigate vulnerabilities due to similar circumstances. Additionally, airlines and aircraft manufacturers themselves can self-report issues to regulators. These reports include corrective actions taken, if any, and are not used as the basis for regulatory enforcement; further, the timely provision of a self-report (before the FAA begins an enforcement action) revealing the company's violation and its corrective action will avert the enforcement, under this program.

By analogy, securities regulators, traders, and a firm's compliance might work together to review self-reports of incidents, and agree on corrective actions, outside of the context of enforcement actions. This would help firms identify whether, for example, errors have occurred in the deployment of critical software (even if those errors did not have direct consequences), understand the root causes of the incorrect deployments through an analysis of self-reports, and subsequently develop software to surveil for incorrectly deployed software or create new procedures to mitigate the issue.

Industry-Led Reliability Monitoring

Following the crash of ValuJet 592 in 1996,[10] the FAA began to recognize that the systemic complexity of modern airline operations exceeded their ability to directly regulate. While the FAA still has responsibility as a regulator, it began to facilitate industry-lead safety and reliability monitoring, ultimately through an operator-implemented Safety Management System ("SMS") framework.

The FAA recognized that commercial operators, through their day-to-day "on the ground" (and in the air) experiences, have insights into safe operations that regulators do not. To take advantage of these insights, an SMS typically involves four major steps: obtaining information, analyzing the resulting data to identify and classify risks, changing operational procedures to mitigate the identified risks, and auditing to ensure the changes were effective. With information about routine and non-routine events as the bedrock of the SMS process, typical data sources comprise voluntary reporting systems, large volumes of recorded information about routine operations, directed investigations of non-routine events, and proactive auditing and probing of daily operations. The goals of an SMS are to encourage the development of safety management capability, increase confidence in risk controls, and increase the reliability and effectiveness of risk mitigations. To facilitate regulatory participation, the SMS process depends on an interface to promote knowledge sharing between regulator and commercial operators. Ideally, such a system also would support safety and systemic reliability between operators by allowing the sharing of data and safety insights.

[10] Mislabeled and mispacked hazardous cargo, packed by a maintenance contractor, was improperly loaded onto the flight. The resulting fire brought down the aircraft and killed all 110 souls on board. Post-accident, the regulator identified that the airline's oversight of its subcontractor was inadequate and that its own regulatory surveillance of airlines was not capable of reliably identifying and correcting systemic flaws such as these.

While the success of an SMS depends on industry and regulator working hand-in-hand, the FAA still has enforcement tools to identify bad actors and maintain oversight. The FAA, however, recognizes that some of the key incentives of commercial airlines (analogous to broker-dealers) and regulators are aligned: to avoid catastrophic failures that result in loss of life (for broker-dealers, massive loss of profits) and the consequences that follow.

In the context of finance, an analogous system would specify rules that broker-dealers were required to follow to collect data on systems problems and analyze the resulting data to identify and classify risks (e.g., coding errors, connectivity problems, incorrectly set limits, etc). The data and analysis would be for the broker-dealer itself. Each broker-dealer would be responsible for specifying an appropriate form for the data, methods of collection, and techniques for analysis, rather than being required to shoehorn results into a one-size-fits-all data model specified by the regulator. Any changes in operations or procedures to mitigate identified risks would be followed up with internal spot-checks and audits to ensure that the changes were effective. A well-structured system of this kind would be more effective than the current trend toward unspecified compliance involvement in the highly technical process of controlling electronic trading risk. Finally, such a system would allow regulators to examine the results of each firm's risk management process which would give regulators insight into important operational concerns, rather than the more distant view generally afforded by regulatory exams.

No-Fault Investigations

In addition to anonymous self-reporting and industry self-monitoring, commercial aviation benefits from the independent contribution and expertise of the National Transportation Safety Board ("NTSB") which has the primary authority to identify the causes of aircraft accidents in the United States. The NTSB's chief mission is to promote safety.

Through its role as a non-regulatory investigator that does not bring enforcement actions, the NTSB investigates accidents and serious incidents. The products of its investigations are recommendations to prevent the recurrence of similar events. While these recommendations are not binding on the regulator, the NTSB achieves substantial compliance with its recommendations from both the regulator and operators. By being sensitive to failures that underlie rare, major events with highly negative outcomes (e.g., fatal airline accidents), the NTSB can detect issues that affect systemic safety and mitigate risks that apply broadly to worldwide aviation operations. Indeed, the NTSB's explicit focus on safety, rather than enforcement, even allows it to consider and reveal the role that regulatory failures might play in causing errors. Overall, the agency's focus on highly consequential events complements the above-described safety management systems which focus primarily on safety issues arising from routine events and minor incidents. In sum, the NTSB acts as a *blocker*, a technically oriented and informed third party that is not held captive to the compromises of the rulemaking process.

We suggest that a similar approach would greatly enhance the stability and robustness of electronic trading. For example, the SEC's Orders following the Knight failure and NASDAQ's mishandling of the Facebook IPO were valuable to the entire electronic trading industry precisely because they provided details about the errors in Knight's and NASDAQ's electronic-trading systems that other participants

could learn from and avoid. Moreover, these Orders illuminated how human judgment might interact with highly technical systems during such crisis events, potentially allowing others to make more effective decisions in the face of unfolding failures. However, because these Orders were enforcement actions, they shifted the focus of firms from increasing reliability to implementing *ad hoc* suggestions to avoid punitive action. Furthermore, because such investigations are conducted by the regulator itself, their results typically shed little light on the role of rules, regulations, and regulators in shaping the environment that contributed to failure. Creating an independent and non-regulatory party with the power to investigate major incidents would strengthen the resilience of the finance industry and improve the reliability of the national market system.

Conclusion

Securities regulators have a daunting task in increasing the reliability of the national market system. As technology has evolved, and as Reg NMS has facilitated competition and interconnectedness, the complexity of the national market system has increased significantly. To date, regulatory tools have reflected traditional priorities in catching bad actors. But unlike with other regulatory concerns, such as insider trading, the management of electronic trading systems should have few bad actors—as firms already are incentivized to prevent the catastrophic failure of their trading systems—and so regulatory examinations and enforcement actions actually decrease the reliability of the national securities market.

Instead, securities regulators should consider adopting lessons from commercial aviation which, analogous to the securities industry, operates in a high-risk environment demanding high reliability: anonymous self-reporting, industry-led monitoring, and no-fault investigations. By defining risk management and mitigation as corporate responsibilities for the airlines, and by changing the focus of its surveillance and oversight to ensure the reliable and effective function of these corporate activities, the regulatory functions of the FAA have the opportunity to be much more effective. Also, by explicitly separating FAA enforcement and the NTSB's accident investigation practice, and by endowing the NTSB with an independent mission of promoting safety, commercial aviation regulations have successfully empowered a technically sophisticated group with the tools to increase aviation safety.

Securities regulators might consider adopting such methods, lest our national market infrastructure becomes overwhelmed by a series of increasingly frequent and violent errors that shake the confidence of the investing public and the world. Too much of the nation's economic well-being and competitiveness is at stake to be bound by an ineffective *status quo*.

Respectfully submitted,

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