Testimony of

Hal S. Scott

Nomura Professor and Director of the Program on International Financial Systems,

Harvard Law School;

Director of the Committee on Capital Markets Regulation

Before the

Subcommittee on Securities, Insurance, and Investment

Committee on Banking, Housing, and Urban Affairs

United States Senate

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Thank you, Chairman Warner, Ranking Member Johanns, and members of the Subcommittee for permitting me to testify before you today on the impact of high frequency trading on investor confidence and capital formation in U.S. equity markets. I am testifying in my own capacity and do not purport to represent the views of any organizations with which I am affiliated, although some of my testimony is based on the work of the Committee on Capital Markets Regulation (CCMR). On the whole, high frequency-trading increases liquidity in our equity capital markets. The increased liquidity leads to decreased costs of stock issuance, thus improving capital formation. And of course, improved capital formation for our businesses leads to higher growth in the real economy.

The Committee was formed in 2005 to address the issue of competitiveness in our primary public equity capital markets and issued a report in 2006 detailing the threats to our primary markets and suggestions for improvement.[1] Just as regulatory changes can lead to competitiveness concerns in our primary markets, the same is true of our secondary markets. Therefore, any changes in our secondary market trading must be assessed for their competitive implications, particularly given the current relative competitive strength of our secondary markets vis-à-vis those abroad.

The CCMR tracks, on a quarterly basis, thirteen measures of the competitiveness of the U.S. public equity market.[2] We have found that while the competitiveness of our primary markets has suffered over the past six years, our secondary markets remain strong with roughly 50% of global exchange trading occurring on U.S. exchanges.[3] The CCMR is currently undertaking a review of market structure issues with a focus on dark pools, internalization, decimalization, exchange backup systems, and the subject of today's hearings, high frequency trading.

"High frequency trading" or "HFT" is a topic that has generated significant attention in recent years and increasingly in the last few months. The widespread public interest in this topic was intensified following the 2010 "flash crash" and more recently, with the publication of Michael Lewis' book "Flash Boys," which has ignited a general attack on HFT's place in the U.S. capital markets. But policy cannot be made on the basis of a journalistic tale that makes for a best seller—rather it must be informed by

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[1] Comm. On Capital Mkts. Reg., Interim Report Of The Committee On Capital Markets Regulation (Nov. 30, 2006), http://www.capmktsreg.org/pdfs/11.30Committee_Interim_ReportREV2.pdf.
[2] Comm. on Capital Mkts. Reg., Competitiveness Measures, http://www.capmktsreg.org/education-research/competitiveness-measures/
[3] *Id.*

verifiable facts. This is largely why we are here today and my intention is to provide a thoughtful response to a debate that has been at times fraught with frenzied emotion.

Let me be clear at the outset, that I believe the net effect of HFT activity in our equity markets has been positive. Transaction costs are at historic lows, liquidity is at historic highs, and volatility has stabilized. These features of today's market not only benefit both retail and institutional investors, but also positively affect capital formation, and by extension, promote job creation. The fact that HFT is the subject of a best-selling book and has generated vocal opposition both within the financial industry and across the American public more broadly, does not, in itself, justify drastic regulatory change. There is nothing new about the advantages of speed to traders. You may recall that the Rothschilds used carrier pigeons to bring them news of the outcome of battles in the Napoleonic wars.[4] While the speed with which they obtained this information gave the Rothschilds an advantage, the markets generally benefitted from the speed by which the new information got into the market, even if those who actually traded with the Rothschilds were at a disadvantage.

My primary concern is that the recent frenzy over HFTs draws attention away from other important market structure issues. For example, as a member of the Equity Capital Formation Task Force, along with my fellow panelist Mr. Solomon, I have been highly supportive of a tick-size pilot program for small cap stocks and have been encouraged by the SEC's recent commitment to conduct such a program.[5] That being said, to the extent that public concern over HFTs reduces investor confidence, our capital

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[4] Mary Blume, "The hallowed history of the carrier pigeon," New York Times, Jan. 30, 2004.

[5] *See* Letter from Hal S. Scott to Joseph Dear, Chairman, Inv. Adv. Comm., U.S. Sec. and Exch. Comm. (Jan. 23, 2014), *available at* http://www.equitycapitalformationtaskforce.com/files/H%20Scott%20IAC%20letter%202014%2001%2023.pdf

markets will suffer. But in my opinion, any reduction in confidence would not be based on the facts. Given the recent volumes in trading, there is little evidence that people have lost confidence in our markets.

Critics of HFT point to the $261 billion that retail investors have pulled from equity mutual funds since the 2010 "flash crash" as evidence that investors have lost confidence in our equity markets.[6] However, retail investors have simply moved their investments to exchange traded products, which of course trade in U.S. equity markets. The net effect is investor inflows of almost $500 billion since the 2010 flash crash.[7] In 2012 alone, there were net inflows of $57 billion in securities trading in U.S. equity markets.[8] If investors were indeed overly concerned by HFT then they wouldn't have added such substantial amounts to their capital at risk in our equity markets.

Another common misconception regarding HFT and our current equity market structure is that HFTs have somehow caused an increase in transaction costs for individual retail investors. In fact, transaction costs for retail investors are at historic lows, as evidenced by current bid-ask spreads and retail brokerage commissions. Since 2006, the average effective bid-ask spread on NYSE-listed stocks has dropped in half, from over 3 cents to roughly 1.5.[9] Retail brokerage commissions are also at all-time lows; the average commission charged by the three major retail brokers is approximately $10 per trade.[10] Given the reduction in spreads and commissions, the net cost of a given trade has dropped dramatically for retail investors. According to the Tabb Group, seven

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[6] Justin Schack, "HFT is not driving investors from the stock market," Fin. Times, May 10, 2013.
[7] *Id.*
[8] *Id.*
[9] *See* James J. Angel, Lawrence E. Harris, and Chester S. Spatt, *Equity Trading in the 21st Century: An Update*, June 21, 2013.
[10] *Id.*

years ago retail investors' effective payments on executed trades were roughly 130% of the NBBO spread (the difference between the national best bid and offer). Since then they have dropped to less than 100%, so the average retail investor receives a better price on a trade than the best price available on an exchange.[11] In short, it is a great time to be a retail investor.

However, bear in mind that retail investors only directly account for approximately 15-20% of daily stock market volume. [12] Since many retail investors access the equity markets indirectly through institutional funds or advisors (such as mutual funds, pension funds, or private wealth advisors), institutional cost reduction is highly relevant to retail investors as well. In 1950, over 90% of U.S. equities were held directly by households.[13] That number has dropped to less than 40% in 2013[14] and this is primarily high-net worth individuals. Household ownership of mutual funds has risen from 5.7% in 1980 to 46.3% in 2013 constituting 90% of mutual fund assets.[15] Collectively mutual funds own 30% of the U.S. stock market capitalization.[16] Clearly, what is good for institutional investors is also beneficial for the small investor.

The institutional investors that primarily trade on behalf of the small investor constitute roughly 25-35% of average daily stock trading volume in the U.S.[17] And today institutional trading costs are historically low. Based on institutional trade data compiled

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11 *See* The Citadel Conversation, Q1 2013, *available at* https://www.citadelsecurities.com/_files/uploads/sites/2/2013/06/The-Citadel-Conversation-with-Larry-Tabb-and-Jamil-Nazarali.pdf

12 Rosenblatt Securities estimate.

13 B. Friedman, "Economic Implications of Changing Share Ownership," Journal of Portfolio Management 22 (Spring 1996).

14 Board of Governors of the Federal Reserve System, Flow-of-Funds Accounts (2013).

15 Investment Company Institute, 2013 Factbook.

16 *Id.*

17 Rosenblatt Securities estimate.

by leading finance academics, the average transaction cost for an institutional order of 1 million shares for a $30 stock is at a historic low of 40 basis points.[18] This includes additional costs associated with price movement from information leakage. The costs of trading these large orders can exceed bid/ask spreads if there is information leakage that a large order is being placed and the price of the trade subsequently moves against the buyer. To prevent this, institutional traders split large orders into small orders for execution to avoid tipping off other market participants that a large order has entered the market. Neither retail nor institutional investors appear to have suffered from the increase in HFT trading activity. If anything, market participants are experiencing the best trading conditions ever seen.

In addition to transaction costs, market volatility and more importantly severe market dislocations are also a primary concern for all investors. Critics of HFT contend that HFT strategies have led to a significant increase in stock market volatility caused merely by HFT trading activity, rather than changes to the fundamentals of stocks. However, respected market structure experts continue to believe that volatility is largely driven by macro-economic concerns and not HFT activity. Stock market volatility, as proxied by the CBOE Volatility Index ("VIX"), understandably rose during the heart of the financial crisis, but has since fallen to its lowest levels in seven years. Intraday volatility of individual stocks also remains low. Professor Larry Harris has found that there is no clear pattern that stock market volatility or the intraday volatility of individual stocks has accompanied the rise of HFT.[19] And while the extreme volatility experienced during the flash crash in 2010 was a significant market disruption that should not be

[18] *See* James J. Angel, Lawrence E. Harris, and Chester S. Spatt, *Equity Trading in the 21st Century: An Update*, June 21, 2013.
[19] *Id.*

repeated, the SEC has largely addressed this concern by implementing single-stock circuit breakers and revising market-wide circuit breakers that will temporarily halt trading if price movements become too volatile.

Thus, it is hard to argue that the U.S. equity market is "broken" as a result of the emergence of HFT activity. Nonetheless, there is always room for targeted improvement of the current regulatory structure, including with respect to certain practices of HFT traders. But we should proceed cautiously and thoughtfully so as not to chill legitimate market functions. There are risks to implementing any changes which must be assessed – for example, bid/offer spreads could widen or exchange volumes (and with it liquidity) could drop.

As a first step, we must precisely identify what practices warrant further regulatory scrutiny. Defining high frequency trading is far from straightforward. For example, many institutional traders place relatively small trades with high frequency, but whether this is a unique and potentially abusive investment strategy or whether this is simply an optimal trading strategy that has evolved with automated trading (for e.g. to execute a large block trade without exposing the size of the order), is a baseline question. Technological advances mean that modern trading is done electronically with orders no longer being given to a broker on an exchange floor. And trading is getting faster every year. We can't put the genie back in the bottle; Mary Jo White recently acknowledged that "the SEC should not roll back the technology clock."[20]

At the same time, there are certainly many general risks that come with automated and faster trading. We need to make sure our rules keep up with industry technology.

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[20] Mary Jo White, Chair, U.S. Sec. and Exch. Comm., *Enhancing Our Equity Market Structure,* Speech at Sandler O'Neill & Partners, L.P. Global Exchange and Brokerage Conference (Jun. 5, 2014).

Regulation has not kept pace with technological advances. As Mary Jo White acknowledged, "many market structure rules and industry practices were developed with manual markets in mind."[21] We have seen other significant changes in response to modern technology before – for example, following the October '87 crash, when the NYSE implemented market-wide circuit breakers in response to the recommendations of a presidential task force.[22]

Market instability is something everyone agrees we need to avoid, to the extent possible. In our fast-paced world, our markets are particularly susceptible both to fat finger mistakes and errors, as well as intentional, manipulative behavior by certain market participants. The incredible speed at which we now trade can exacerbate errors, and quickly.

We need to ensure the safety and soundness of our markets. Fortunately, as I have previously mentioned, the SEC and securities industry have already taken a number of steps to address this topic. For example, in addition to circuit breakers, the SEC has issued requirements for market participants to address technology risks through the Market Access Rule and proposed Regulation SCI. The Consolidated Audit Trail is expected to be operational in 2016 and will provide the SEC comprehensive data regarding the routing and execution of orders, allowing regulators to better prevent, identify and respond to any firms engaged in harmful practices.

Critics of HFT contend that HFT firms have access to proprietary data feeds from the exchanges that provide them with information before other traders, allowing them to "front run" the market. However, it is important to be clear that trading on information

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[21] *Id.*

[22] *See* NYSE Circuit Breakers, *available at* https://usequities.nyx.com/markets/nyse-equities/circuit-breakers.

that is publicly available is different than a broker trading ahead of a customer, which is patently illegal. Michael Lewis points out examples in which he claims that HFT traders obtain an advantage in the market when brokers trade only a small portion of a larger customer order with the HFT to gain a rebate on that small portion. The HFT then uses the information from the small order to trade ahead of the remainder of the customer's order, thus resulting in the broker's customer receiving an inferior price for the remainder of the order. However, the flaw in these examples is that brokers actually route customer orders in a manner that ensures that their customers' orders arrive at various trading platforms at the exact same time, so customers receive the best price for their full order. Such routing practices are consistent with brokers' legal requirement to seek the best execution reasonably available for their customers' orders. Specific examples are described in the appendix.

Additionally, there is growing public interest in a practice called "co-location," which refers to traders locating their data servers in the same physical space as exchanges to facilitate faster trading and profits, which along with proprietary data feeds gave rise to latency arbitrage. In general, latency arbitrage entails the ability of HFTs to synthesize quotes from all exchanges faster than other market participants, thus enabling HFTs to trade on those quotes at a profit. One could argue that this activity closes the gap between divergent prices in similar ways as other forms of arbitrage. While critics question the "fairness" of allowing certain traders to benefit from their physical proximity to an exchange or access to proprietary data feeds, proponents of the practice point out that the SEC does not allow exchanges to discriminate in offering these services. If an exchange offers proprietary data feeds or co-location to any traders, it is required to offer access to

all other market participants, both HFT firms and non-HFT firms, at the same cost. Under this system, every market participant has an opportunity to co-locate. If the exchanges no longer offered this access to anyone, either by choice or prohibition, a race would ensue to acquire the real estate adjacent to the exchange, which could actually limit access to many market participants. One might even view co-location as the modern incarnation of market makers vying for position on an exchange floor. Furthermore, 90% of all trades are now executed by co-located traders with access to proprietary data feeds, which includes institutional investors acting on behalf of retail investors.[23]

Another issue to consider is the increasing technology "arms race" occurring among HFTs. To beat out competitors, HFTs invest more heavily in powerful and expensive technology to gain an edge over the competition. But increased competition among HFTs may further reduce costs for the rest of the market as HFT margins decline. The TABB Group estimates that HFT revenues in the U.S. have dropped from $7.2 billion in 2009 to $1.3 billion in 2014.[24]

Much discussion recently has also revolved around the "maker-taker" pricing system that developed roughly 17 years ago, well before the rise of HFTs.[25] On a trading platform with "maker-taker" pricing, the liquidity taker pays a fee and the liquidity provider receives a rebate. The first venue to introduce maker-taker pricing was Island ECN in 1997.[26] While some have introduced various criticisms of maker-taker pricing, this is neither a system nor a problem created by HFTs. The maker-taker pricing system can exist in low frequency trading environments and HFT environments alike.

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[23] Rosenblatt Securities estimate.

[24] TABB Forum, "No, Michael Lewis, the US Equities Market is Not Rigged," http://tabforum.com/opinions/no-michael-lewis-the-us-equities-market-is-not-rigged.

[25] *See* Larry Harris, *Maker-Taker Pricing Effects on Market Quotations*, Aug. 30, 2013.

[26] *Id.*

Finally, I note that certain critics of HFTs are also highly critical of the "dark pools" where these traders, along with other institutional investors, increasingly trade. It is estimated that 15% of stocks are now executed in dark pools, where information about orders is not publicly displayed.[27] Critics suggest that dark trading inhibits the pricing function of secondary markets, and also question their opacity more generally. It is important to note, however, that neither dark pools nor market fragmentation more generally are "problems" that arose because of HFT. The automation of equity trading following the SEC's adoption of Regulation National Market System ("Reg NMS") in 2005 led to a fragmentation of execution venues, including SEC registered exchanges as well as alternative trading venues like dark pools. Thus dark pools and fragmentation were partly the result of regulation. In addition though, there were general market forces at work. Buy-side traders who questioned whether their trades were being front-run on traditional exchanges turned to dark pools because of the protection that dark trading brings from potential front-running. One key benefit to dark pools is that orders are not displayed, thus it is difficult to front-run them or to know when large blocks are being bid and offered. Furthermore, it is important to remember that a Reg NMS stock can only be traded in the dark if it is executed at a price that is equal to or better than the best publicly available price on an exchange. In addition, dark pools are required to offer post-trade transparency, as executed stocks are publicly reported in real time. While proposals to further reform dark pools, for example, by requiring disclosure of trading practices or fee structures or imposing anti-discrimination rules, may warrant further attention, such reforms are unrelated to HFT and outside the scope of my testimony today.

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[27] James J. Angel, Lawrence E. Harris, and Chester S. Spatt, *Equity Trading in the 21st Century: An Update*, June 21, 2013.

I would now like to present a few specific proposals that I believe could be helpful in ensuring the safety and security of our automated world.

First, regulators should consider mandating and harmonizing exchange-level kill switches. A kill switch is a mechanism that would halt a firm's trading activity when a pre-established exposure threshold has been breached, thus stopping erroneous orders and preventing any further uncontrolled accumulation of positions. For example, if a trading firm typically only holds $1,000,000 in shares of NASDAQ-traded stock during any point in the trading day, it could be required to implement a kill switch at 5 times that exposure-level, or $5,000,000 in shares of NASDAQ-traded stocks. If the threshold is breached, further trading would be prevented and the firm's open orders on NASDAQ would be halted. It is important that such kill switches be mandatory at the exchange level. This would serve to further mitigate volatility related to errant algorithms or "fat finger" errors.

Second, we might consider addressing the volume of order message traffic, which can create market instability, by establishing order-to-trade ratios. Electronic order instructions are used to direct the placement, cancellation and correction of orders. Since 2005, order flow has increased by 1,000% while trade volume has increased by only 20%.[28] As was experienced during the 2010 flash crash, a spike in orders and cancellations can exacerbate market volatility and overwhelm the exchanges' infrastructure. The current market structure only places costs on trade executions, thereby allowing market participants to generate excessive order-message traffic without internalizing the costs of the negative externalities just described. Regulators should

[28] *See* Gary Cohn, Op-Ed, "The Responsible Way to Rein in Super-Fast Trading," Wall Street Journal, Mar. 20, 2014; and James J. Angel, Lawrence E. Harris, and Chester S. Spatt, *Equity Trading in the 21st Century: An Update*, June 21, 2013,

assess why order volumes have increased and consider charging fees for extreme message traffic, keeping in mind that any order-to-trade ratios should depend on the liquidity of the stock.

Third, regulators should consider abolishing immunity that exchanges have from liabilities for losses from market disruptions based on their SRO status. For example, NASDAQ received immunity from liability for half a billion dollars of losses incurred by brokers from the Facebook trading glitch because it claimed it was acting in its SRO, and not its for-profit, capacity. If immunity does not apply to activities related to smart routing and other technology offerings, this might better align the exchanges' incentives to limit potentially risky trading activity that could pose widespread operational risk.

In addition to the proposals discussed above, I wanted to address two recent suggestions by Mary Jo White. First, the SEC staff is working to develop a recommendation for an anti-disruptive trading rule.[29] In theory, such a rule has potential as a targeted solution aimed at aggressive short-term traders. However, "the devil is in the details." While such a rule would be aimed at active proprietary traders during specific, short time periods when the markets are most vulnerable, basic questions will need to be addressed, such as which traders should be restricted, during which time periods, and for which activities. There may be some clear-cut cases, where for instance it would be easy to craft a rule that says: "don't short further during a period where stock's value has declined by x." But it is perhaps not as clear-cut as to whether we should impose an affirmative market-making obligation during periods of stress. None of this is to say an

[29] *See* Mary Jo White, Chair, U.S. Sec. and Exch. Comm., *Enhancing Our Equity Market Structure,* Speech at Sandler O'Neill & Partners, L.P. Global Exchange and Brokerage Conference (Jun. 5, 2014).

anti-disruptive trading rule is undesirable; however, it would need to be formulated carefully.

White has also asked her staff to propose a recommendation that would subject unregistered active proprietary traders to the SEC's rule as dealers.[30] Again, such a rule could potentially be an effective tool in monitoring and regulating the behavior of harmful trading practices. But it may be difficult to identify which "unregistered active proprietary traders" should be subject to broker-dealer requirements. We have seen similar difficulties in the new practice of designating "swap dealers" under Dodd Frank. Furthermore, a number of these entities may be subject to oversight already. The SEC should ensure that any registration requirements are streamlined and coordinated.

Finally, I'd like to address the topic of decimalization. As I mentioned up front, I eagerly await the specifics of the SEC's pilot program on tick sizes. I would hope that the SEC pays particular attention when applying different metrics to different types of securities covered by the program, so as not to introduce additional operational risk through increasingly complex trading rules for these stocks. For example, I understand the SEC is considering dividing the pilot into three groups of stocks, which trade at different increments and may or may not be subject to the "trade at" rule.[31] I encourage the SEC to keep in mind the safety and soundness of our equity markets when finalizing the design for this pilot.

Thank you and I look forward to your questions.

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[30] *Id.*

[31] A trade-at rule requires brokers and dark pools to route trades to public exchanges, unless they can execute the trades at a meaningfully better price than available in a public market. It is unclear how the SEC would define a meaningfully better price.

APPENDIX

The following are specific examples of allegedly predatory trading behavior by HFTs from *Flash Boys.* I follow with a response to the perceived problem posed by the example.

Example 1: *On pages 74-75, the example has a customer wishing to purchase 100,000 shares of XYZ Company at $25 per share. In this example, 100 shares are offered on BATS for $25 and 10,000 shares are offered by other sellers on each of ten more exchanges. Lewis suggests that the broker's router will send the buy order to BATS first to receive a rebate offered by BATS, even though BATS is only offering 100 shares. However, the problem then arises that once the BATS trade is executed, the other 100,000 shares available may disappear before they can be purchased.*

This example fails to recognize how brokers actually route customer trades in order to satisfy their "best execution" requirement, which precedes Reg NMS. In practice, brokers will send orders to acquire the 100 shares on BATS and 10,000 shares on the ten other exchanges **at the same time**. In fact, brokers have flexibility to actually send the order for 100,000 shares of XYZ Company to the other exchanges slightly before they send the 100 share order to BATS, if the broker reasonably believes this will achieve a lower fill price for the customer's complete order for XYZ Company.

Example 2: *On pages 137-138, the example has a customer wishing to purchase shares of IBM through a broker (Goldman Sachs in this example). In this example, the broker is required to purchase 100 shares on BATS for $19.99 before purchasing 500 shares on the NYSE for $20.00 due to Reg NMS. As a result, the same problem then arises that once the BATS trade is executed, the other 500 shares available may disappear before they can be purchased.*

Again, the broker would route the 600 IBM share order to both exchanges simultaneously. The broker even has the flexibility to route the 500 share order to the NYSE before the 100 share order to BATS, if the broker reasonably believes this would achieve a lower fill price for the customer's order for IBM.

Example 3: *On page 222-223, the example has a customer wishing to purchase 100,000 shares of P&G through a broker (Bank of America in this example). The customer is willing to pay up to $82.97. The broker first pings IEX looking to buy 100 shares, but then fails to send a larger order subsequently. In this example, Lewis suggests that a seller of 100,000 shares at $82.96 could have existed at IEX, which the broker missed. Instead the broker pings IEX with multiple 100 share orders, thus "goos[ing] up the price."*

The flaw with this example is that the broker does not know that there is really a "seller waiting on it" for 100,000 shares. Furthermore, if the entire 100,000 share order had been sent, and only 1,000 was executed (since the example states that there are only

1,000 shares listed), the broker would have revealed the entire size of the order, thus dramatically "goosing" up the stock much more than the 100 share pings.