AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

S. HRG. 111–922

EXAMINING THE EFFICIENCY, STABILITY, AND INTEGRITY OF THE U.S. CAPITAL MARKETS

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON
SECURITIES, INSURANCE, AND INVESTMENT

OF THE

COMMITTEE ON
BANKING, HOUSING, AND URBAN AFFAIRS
UNITED STATES SENATE

AND THE

PERMANENT SUBCOMMITTEE ON INVESTIGATIONS

OF THE

COMMITTEE ON
HOMELAND SECURITY AND
GOVERNMENTAL AFFAIRS
UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

ON

EXAMINING THE EFFICIENCY, STABILITY, AND INTEGRITY OF THE U.S. CAPITAL MARKETS

DECEMBER 8, 2010

Printed for the use of the Committee on Banking, Housing, and Urban Affairs

Available at: http://www.fdsys.gov/

U.S. GOVERNMENT PRINTING OFFICE

65–272 PDF WASHINGTON : 2011

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS

CHRISTOPHER J. DODD, Connecticut, *Chairman*

TIM JOHNSON, South Dakota
JACK REED, Rhode Island
CHARLES E. SCHUMER, New York
EVAN BAYH, Indiana
ROBERT MENENDEZ, New Jersey
DANIEL K. AKAKA, Hawaii
SHERROD BROWN, Ohio
JON TESTER, Montana
HERB KOHL, Wisconsin
MARK R. WARNER, Virginia
JEFF MERKLEY, Oregon
MICHAEL F. BENNET, Colorado

RICHARD C. SHELBY, Alabama
ROBERT F. BENNETT, Utah
JIM BUNNING, Kentucky
MIKE CRAPO, Idaho
BOB CORKER, Tennessee
JIM DEMINT, South Carolina
DAVID VITTER, Louisiana
MIKE JOHANNS, Nebraska
KAY BAILEY HUTCHISON, Texas
JUDD GREGG, New Hampshire

EDWARD SILVERMAN, *Staff Director*
WILLIAM D. DUHNKE, *Republican Staff Director*

DAWN RATLIFF, *Chief Clerk*
WILLIAM FIELDS, *Hearing Clerk*
SHELVIN SIMMONS, *IT Director*
JIM CROWELL, *Editor*

SUBCOMMITTEE ON SECURITIES, INSURANCE, AND INVESTMENT

JACK REED, Rhode Island, *Chairman*
JIM BUNNING, Kentucky, *Ranking Republican Member*

TIM JOHNSON, South Dakota
CHARLES E. SCHUMER, New York
EVAN BAYH, Indiana
ROBERT MENENDEZ, New Jersey
DANIEL K. AKAKA, Hawaii
SHERROD BROWN, Ohio
MARK R. WARNER, Virginia
MICHAEL F. BENNET, Colorado
CHRISTOPHER J. DODD, Connecticut

JUDD GREGG, New Hampshire
ROBERT F. BENNETT, Utah
MIKE CRAPO, Idaho
BOB CORKER, Tennessee
DAVID VITTER, Louisiana
MIKE JOHANNS, Nebraska

KARA M. STEIN, *Subcommittee Staff Director*
WILLIAM HENDERSON, *Republican Subcommittee Staff Director*

PAUL SAULSKI, *SEC Detailee*
DEAN SHAHINIAN, *Senior Counsel*
LEVON BAGRAMIAN, *Legislative Assistant*

COMMITTEE ON HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS

JOSEPH I. LIEBERMAN, Connecticut, *Chairman*

CARL LEVIN, Michigan
DANIEL K. AKAKA, Hawaii
THOMAS R. CARPER, Delaware
MARK L. PRYOR, Arkansas
MARY L. LANDRIEU, Louisiana
CLAIRE MCCASKILL, Missouri
JON TESTER, Montana
CHRISTOPHER A. COONS, Delaware

SUSAN M. COLLINS, Maine
TOM COBURN, Oklahoma
SCOTT P. BROWN, Massachusetts
JOHN MCCAIN, Arizona
GEORGE V. VOINOVICH, Ohio
JOHN ENSIGN, Nevada
LINDSEY GRAHAM, South Carolina
MARK KIRK, Illinois

MICHAEL L. ALEXANDER, *Staff Director*
BRANDON L. MILHORN, *Minority Staff Director and Chief Counsel*

TRINA DRIESSNACK TYRER, *Chief Clerk*
PATRICIA R. HOGAN, *Publications Clerk and GPO Detailee*

PERMANENT SUBCOMMITTEE ON INVESTIGATIONS

CARL LEVIN, Michigan, *Chairman*

THOMAS R. CARPER, Delaware
MARK L. PRYOR, Arkansas
CLAIRE MCCASKILL, Missouri
JON TESTER, Montana
CHRISTOPHER A. COONS, Delaware

TOM COBURN, Oklahoma
SUSAN M. COLLINS, Maine
JOHN MCCAIN, Arizona
JOHN ENSIGN, Nevada

ELISE J. BEAN, *Staff Director and Chief Counsel*
CHRISTOPHER J. BARKLEY, *Minority Staff Director*

DAVID H. KATZ, *Counsel*
TY GELLASCH, *Office of Senator Carl Levin*
MARY D. ROBERTSON, *Chief Clerk*
ANTHONY COTTO, *Counsel to the Minority*

C O N T E N T S

WEDNESDAY, DECEMBER 8, 2010

	Page
Opening statement of Chairman Reed	1
Opening statement of Chairman Levin	3
Prepared statement	52

WITNESSES

Mary L. Schapiro, Chairman, Securities and Exchange Commission	8
Prepared statement	78
Responses to written questions of:	
Chairman Reed	169
Chairman Levin	171
Senator Coburn	176
Gary Gensler, Chairman, Commodity Futures Trading Commission	10
Prepared statement	84
James J. Angel, Associate Professor of Finance, McDonough School of Business, Georgetown University	24
Prepared statement	87
Responses to written questions of:	
Chairman Reed	179
Thomas Peterffy, Chairman and Chief Executive Officer, Interactive Brokers Group	26
Prepared statement	156
Responses to written questions of:	
Chairman Reed	187
Manoj Narang, Chief Executive Officer, Tradeworx, Inc.	27
Prepared statement	159
Kevin Cronin, Global Head of Equity Trading, Invesco Limited	29
Prepared statement	161
Steve Luparello, Vice Chairman, Financial Industry Regulatory Authority	31
Prepared statement	164

Additional Material Supplied for the Record

Letter Submitted by Timothy B. Henseler, Deputy Director, Securities and Exchange Commission	189

EXAMINING THE EFFICIENCY, STABILITY, AND INTEGRITY OF THE U.S. CAPITAL MARKETS

WEDNESDAY, DECEMBER 8, 2010

U.S. SENATE,
SUBCOMMITTEE ON SECURITIES, INSURANCE, AND INVESTMENT,
COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS,
PERMANENT SUBCOMMITTEE ON INVESTIGATIONS,
OF THE COMMITTEE ON HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS,
Washington, DC.

The Subcommittees met at 3:30 p.m., in room SD–538, Dirksen Senate Office Building, Hon. Jack Reed, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF CHAIRMAN JACK REED

Chairman REED. Let me call the hearing to order, and I want to thank the Members of the Permanent Subcommittee on Investigations, chaired by Senator Levin, for joining us in the joint hearing this afternoon. Both of our Subcommittees are extremely interested in understanding both the causes and implications of the May 6th Flash Crash, and in particular, we want to focus on how we can avoid and mitigate the effects of such events in the future.

I am going to make an opening statement. I have been informed that Senator Bunning may be delayed and asked us to go ahead. Then I will turn it over to Chairman Levin who will recognize Senator Coburn when he arrives.

Also, under the rules of the Committee on Investigations, witnesses are sworn, and I will ask Chairman Levin to do the—after my opening statement, when the witnesses are introduced, to do the official swearing-in according to the rules of his Subcommittee.

I certainly want to thank Chairman Schapiro and Chairman Gensler for being here, and all our other witnesses, and I want to commend both Chairman Schapiro and Chairman Gensler for the effort, the collaboration, the hard work they have done already to implement the Dodd-Frank bill. It was a spirit that has been noticed of cooperation and collaboration, which is a model for all of us. Thank you so much.

I want to also apologize ahead of time for the schedule of the Senate. First we had to delay the hearing, and I thank the witnesses for understanding that. We also understand that a series of four votes will begin some time after 4 p.m. this afternoon. It is our

hope that we can proceed, get the opening statements of at least our first panel, questions. Senator Levin and I have agreed to shuttle back and forth so that we do not necessarily have to recess the hearing. So we will do our best to maintain the continuity of the hearing throughout the afternoon, but I apologize again for these four votes that are pending.

Let me now focus on the substance of our hearing. Although the recently released report on the events of May 6th was quite thorough and thoughtful, the length of time it took to complete is an issue. What tools do our regulators need so that they can understand what is happening in our capital markets when it is happening, or at least very shortly thereafter? That is, I think, one of the first issues. What resources do you need to effectively surveil and oversee capital markets, particularly markets that are evolving at such a tremendous rate given technology?

In the report, the SEC and the CFTC reconstruct the events that took place across a myriad of securities and futures markets on May 6th, and I think that is a very important point. The interrelated aspect of securities markets and of CFTC product markets is such now that something happening in one market cannot be easily isolated. According to the report, a single trade by a mutual fund was the primary cause of the chain of events that led to the volatile swings in the capital markets on May 6th. In effect, a CFTC-regulated product produced significant impacts within SEC-regulated equity markets, and I am sure the opposite could occur, unfortunately, under the right circumstances.

Even before the plunge, the markets were already stressed and showing high volatility due to the mounting concerns of the debt crisis in Europe on that particular day. According to the report, it was against this backdrop and a Dow Jones average that was already down about 2.5 percent that the mutual fund initiated an automated algorithmic trading program to sell $4.1 billion worth of E–Mini futures contracts which track the Standard & Poor's 500 stock index. In essence, the interaction of this one mutual fund's trading algorithm with the trading algorithms of other market participants, particularly high-frequency traders, seemed to have created a vicious feedback loop that increasingly accelerated the rate at which the orders were executed. In the end, this one trade sold in a span of 20 minutes. It was the largest single trade in E–Mini futures since the start of the year. The net effect of this order was to send panic into the marketplace.

How could one order by one trader do this? That is certainly an issue. How do we stop this from happening again? The events of May 6th bring into sharp focus concerns about the efficiency, stability, and integrity of our capital markets and the current structure of these markets. The existing structure of the U.S. equity markets is governed by a series of rules and regulations collectively known as Regulation National Market System, or RegNMS. One of the questions before us today is how does RegNMS need to be updated to modernize and strengthen the national market system for equity securities for the 21st century?

In addition to the January 2010 Concept Release by the SEC—and, again, let me commend you, Chairman Schapiro and Chairman Gensler, for working on these issues proactively—on possible

revisions to the RegNMS, the SEC has responded with specific regulatory actions related to market structure and trading since May 6th, such as the institution of a stock-by-stock circuit breaker pilot program.

We hope that today's hearing will help us understand some of the regulators' recent proposals and answer some of the other important questions as well. These questions are long, but let me suggest a few.

What does the May 6th Flash Crash tell us about the stability and vulnerability of the U.S. capital markets? And to what extent, if any, can the May 6th problems be attributed to the current fragmentation market structure and interconnectedness between the futures, options, bond, and equities markets?

What effect do technology-driven trading practices have on the stability and integrity of U.S. capital markets? What type of information tools and authorities will regulators need for the effective supervision of the capital markets? How can they more actively police across both products and trading venues?

What are effective strategies for minimizing future market dysfunctions like the May 6th event and for minimizing market abuses caused by technology-driven trading practices? What are the effects of the current market structure in trading practices on long-term capital formation in U.S. markets and, as a consequence, the health and vitality of the U.S. economy more generally?

We look forward to hearing your testimony on all these topics, and I think I have just probably listed just a few of the questions that you have been dealing with quite diligently over the several months. Clearly, the cops on the beat—the SEC and the CFTC—need to have the same tools and resources as the traders so that they can police capital markets effectively.

I will close with an old saying by the great New England poet Robert Frost: "Good walls make good neighbors." You are the folks that build the walls and make sure the neighbors behave, and so we hope you can keep doing that.

Now I would like to recognize Chairman Levin.

OPENING STATEMENT OF CHAIRMAN CARL LEVIN

Chairman LEVIN. Today, U.S. capital markets, which traditionally have been the envy of the world, are fractured. They are vulnerable to system failures and trading abuses, and they are operating with oversight blind spots. The very markets that we rely on to jump start our economy and invest in America's future are susceptible to market dysfunctions that jeopardize investor confidence.

I want to begin by thanking Chairman Jack Reed, his Ranking Member Senator Bunning, and all of our colleagues on the Securities, Insurance, and Investment Subcommittee, who have already held hearings on these issues. We thank him for welcoming our Subcommittee, including our newest Member, Senator Coons, to join with them today to shine a light on problems that threaten U.S. market stability and integrity.

The first fact that we need to grapple with is that our markets have changed enormously in the last 5 years. In the past, most U.S.-listed stocks were traded on the New York Stock Exchange or the NASDAQ. Seven years ago, the New York Stock Exchange

alone accounted for about 80 percent of the trades in its listed stocks. But today, less than 25 percent of the New York Stock Exchange-listed stocks are traded there.

What happened?

There is a chart, which we will put up here. Exhibit 1 shows how the U.S. stock market has fractured. Stock trading now takes place, not on one or two, but on 13 stock exchanges, as well as multiple off-exchange trading venues, including three electronic communication networks, 36 so-called dark pools, and over 200 registered broker-dealer internalizers.

Now, those off-exchange trading venues may need some more explanation. Electronic communication networks, or ECNs, are computerized networks that enable their participants to post public quotes to buy or sell stock without going through a formal exchange. Dark pools, by contrast, are electronic networks that are closed to the public and allow pool members to buy and sell stock without fully disclosing to each other either their identities or the details of their prospective trades. A broker-dealer internalizer is a system set up by a regulated broker-dealer to execute trades with or among its own clients without sending those trades outside of the firm. These off-exchange venues are increasing their trading volumes, most use high-speed electronic trading, and they escape much of the regulation that applies to formal exchanges.

These new trading venues did not appear out of thin air. They are largely the result of Regulation NMS which the SEC issued in 2005. Some call the resulting new world of both on-exchange and off-exchange trading a model of competition. Others call it a free-for-all that defies oversight and is ripe for system failures and trading abuses. In reality, both descriptions have some truth. Trading competition has led to lower trading costs and faster trading, but it has also opened the door to new problems.

One of those problems involves system failures, of which the May 6, 2010, Flash Crash is the most famous recent example. On that day, out of the blue, the futures market suddenly collapsed and dragged the Dow Jones Industrial Average down nearly 700 points, wiping out billions of dollars of value in a few minutes for no apparent reason. Both the futures and stock markets recovered in less than 20 minutes, but left investors and traders in shock. After 5 months of study, a joint CFTC–SEC report has concluded that the crash was essentially triggered by one large sell order placed in a volatile futures market using an algorithm that set off a cascade of out-of-control computerized trading in futures, equities, and options. That one futures order, placed at the wrong time, in the wrong way, set off a chain reaction that damaged confidence in U.S. financial markets.

In some ways, the May 6th crash was a high-speed version of the 1987 market crash, where a sudden decline in the futures market led to a corresponding collapse in the broad stock market, which led, in turn, to crashes in individual stocks. And it is not the only type of system failure affecting our financial markets. So-called mini flash crashes in which one stock suddenly plummets in value for no apparent reason have become commonplace.

On June 2, 2010, for example, shares in Diebold Inc., a large Ohio corporation, suddenly dropped from about $28 to $18 per

share. The stock recovered, but the company was left trying to understand and explain what happened. Even after the SEC initiated a pilot circuit breaker program after the May 6th crash, at least 15 other companies have had similar experiences, including Newcor, Intel, and Cisco. A former senior NASDAQ executive told the Subcommittee that the NASDAQ exchange has experienced single-stock flash crashes five times per week. The New York Stock Exchange and FINRA told us these crashes are commonplace and attribute them to various glitches in computerized trading programs.

Single-stock crashes might seem to be a minor problem, but what happens if the security that crashes is a basket of stocks or commodities? On November 29, 2010, three of the top five equities traded by volume were actually baskets of stocks. If a basket of stocks or commodities crashes in value, what happens to the underlying financial instruments? Uncontrolled electronic trading and cascading price declines in multiple trading venues, including in futures, options, and equities markets, could be the result—in other words, another May 6th.

Many investors, by the way, are not waiting around to find out if our regulators have fixed the problem. According to the Investment Company Institute, each month since May, more investors have fled our markets, pulling billions of dollars of U.S. investments.

System failures are not the only problem raised by our fractured markets. Another problem is their increased vulnerability to trading abuses. Traders today buy and sell stock on-exchange and off-exchange, simultaneously trading in multiple venues. Traders have told my Subcommittee that orders in some stock venues are being used to affect prices in other stock venues; and that futures trades in the CFTC-regulated markets are being used to affect prices on SEC-regulated options and stock markets. Some traders are also using high-speed trading programs to execute their strategies, sometimes submitting and then canceling thousands of phony orders to affect prices.

To get a sense of the trading activity that goes on today, take a look at this stack of paper. This stack, nearly 5 inches high, contains the actual message traffic generated in the futures, options, and equities markets with respect to one major U.S. stock over the course of 1 second. One stock, in 1 second, produced over 29,000 orders, order modifications, order executions, and cancellations. This stack shows in black and white how traders are now analyzing orders in all three markets at once, evidencing how the futures, options, and equities markets are interconnected. Imagine the same stack multiplied countless times, filling this entire hearing room and the interconnectedness of the markets as well as the potential for system failures and trading abuses becoming alarmingly clear.

One well-known trader, Karl Denninger, recently made this public comment about U.S. trading activity: "Folks, this crap is totally out of hand," he said, "and it is now a daily game that is being played by the machines, which are the only things that can react with this sort of speed, and they are guaranteed to screw you, the

average investor or trader. Go ahead," he said, "keep thinking you can invest."

While fractured markets and high-speed trading are causing new problems and forms of manipulation, they are also leaving our regulators far behind. Traders are equipped today with the latest, fastest technology. Our regulators are riding the equivalent of mopeds going 20 miles per hour chasing traders whose cars are going 100 miles per hour.

Our regulators are confronting at least four challenges, and before I go through those challenges, I want to join Chairman Reed in congratulating and thanking our witnesses here today. You have led your agencies in important new directions and reforms, and you are doing it with, I think, great professionalism and talent;, and we commend the efforts that you are making. Here are some of the challenges that our regulators are facing.

The first is the fact that each trading venue today has its own infrastructure rules and surveillance practices. Besides the expense and inefficiency involved, no regulatory agency has a complete collection of trade data from all the venues, much less a single integrated data flow allowing regulators to see how orders and trades in one venue may affect prices in another.

Second, even if regulators had an integrated data flow, the current data systems fail to identify key information, including the names of the executing broker and customer making the trades. That means that regulators cannot use the electronic records to, for instance, trace trading by one person or set up alerts to flag trades. Instead, before any trading analysis can start, regulators have to figure out the broker and customer behind each trade. Patterns of manipulation are hidden.

The third problem is that the SEC has no minimum standards for automated market surveillance by self-regulatory organizations, so-called SROs, and the quality of those efforts is apparently all over the map. Recent SEC examinations of certain exchanges have found, for example, that some ineffective surveillance systems were unable to detect basic manipulations or used such restrictive criteria that they failed to flag suspect activity, some exchanges failed to review some surveillance alerts, and some exchanges had only rudimentary or underbudgeted investigative examination and enforcement programs.

The fourth problem is that the SEC and CFTC have not set up procedures to coordinate their screening of market data to see if trades in one agency's markets are affecting prices in the other's markets. Given the strong relationships between the futures, options, and equities markets, joint measures to detect intermarket trading abuses are essential.

The impact of the regulatory and technology barriers is demonstrated by the fact that it took the CFTC and the SEC 5 months of intense work to figure out what happened over a few minutes on May 6th, and I believe that Chairman Reed made this same reference. In addition, over the past 5 years, there have been few meaningful single-day price manipulation cases. One recent case involves a small trading firm, Trillium Trading LLC, which apparently used phony trading orders to influence the price of several stocks. In that case, FINRA found that over a 3-month period in

2006 and 2007, Trillium submitted phony orders in over 46,000 manipulations, netting gains of about $575,000. Apparently, the victims of the price manipulations got annoyed enough to research the manipulative trading and hand over the data to FINRA. Even then, it took FINRA 4 years to reconstruct the order books, prove who was behind the trades, and resolve the matter. Trillium and its executives recently settled the case by agreeing to pay over $2.2 million in fines and disgorgements.

Traders and regulators have told us that Trillium is not the only company that has engaged in or is engaging in price manipulation in U.S. financial markets. In fact, one of the more chilling examples involves suspect trading involving traders located in China. Are overseas traders trying to manipulate U.S. stock prices? Our regulators are currently ill-equipped to find out.

The May 6th Flash Crash and the Trillium case provide powerful warnings that we need to strengthen U.S. oversight of our financial markets to restore investor confidence. Much needs to be done. Recent actions by the SEC to prohibit phony quotes, impose single-issue circuit breakers, and set up a consolidated audit trail are important advances. But there is a long, long way to go, particularly with respect to coordinating market protections and surveillance across market venues, and across the futures, options, and equities markets.

There also needs to be a greater sense of urgency. The SEC's proposed consolidated audit trail is expected to take years to put into place and will not cover all of the relevant products and markets. Requiring executing broker and customer information, an essential component to effective oversight, is in limbo, pending completion of the consolidated audit trail, as is integrating the trade data for multiple trading venues. Integrating trading data and market surveillance of futures, options, and equities markets by the CFTC and SEC is not even on the drawing board.

I hope this hearing will help inject greater urgency into strengthening U.S. oversight of our fractured, high-speed markets to restore investor confidence.

Again, I want to thank you, Chairman Reed, for holding these hearings and for the kind of leadership that you have shown in digging into these kind of issues over the years. Thank you.

Chairman REED. Thank you very much, Mr. Chairman.

Let me introduce our witnesses. Our first witness is the Honorable Mary Schapiro, Chairman of the Securities and Exchange Commission. Prior to becoming the SEC Chairman, she was the CEO of the Financial Industry Regulatory Authority, FINRA, the largest nongovernmental regulator for all securities firms doing business with the United States public. Chairman Schapiro previously served as a Commissioner of the SEC from December 1988 to October 1994, and then as Chairman of the Commodity Futures Trading Commission from 1994 until 1996.

Our second witness is the Honorable Gary Gensler, the Chairman of the Commodity Futures Trading Commission. He previously served at the U.S. Department of Treasury as the Under Secretary of Domestic Finance from 1999 to 2000 and as Assistant Secretary of Financial Markets from 1997 to 1999. Prior to joining the Department of Treasury, Chairman Gensler worked for 18

years at Goldman Sachs, most recently as a partner and cohead of finance.

Before you begin your testimony, I will turn it over to Chairman Levin to administer the oath pursuant to Rule VI of the Rules of Procedure of the Senate Permanent Subcommittee on Investigations. Would you please stand?

Chairman LEVIN. Thank you very much, Chairman Reed.

As he said, pursuant to the rules of our Subcommittee, all witnesses need to be sworn. If you would raise your hands.

Do you solemnly swear——that the testimony that you will give before these Subcommittees will be the truth, the whole truth, and nothing but the truth, so help you God?

Ms. SCHAPIRO. I do.

Mr. GENSLER. I do.

Chairman REED. Chairman Schapiro, you may begin.

STATEMENT OF MARY L. SCHAPIRO, CHAIRMAN, SECURITIES AND EXCHANGE COMMISSION

Ms. SCHAPIRO. Thank you very much, Chairman Reed and Chairman Levin. Thank you for the opportunity to testify on behalf of the Securities and Exchange Commission concerning the U.S. equity market structure.

When we discuss market structure, we are talking about everything from the organization of a market to the number and types of venues that trade a financial product, and we are talking about the rules by which those markets operate. Although these issues can be complex and the rules arcane, a stable, fair, and efficient structure is the backbone of the equity markets and an important engine of our economy. Keeping that backbone strong means responding to the ongoing dramatic changes that are reshaping our financial markets.

A decade ago, most of the volume in stocks was executed manually. Now nearly all orders are executed by fully automated systems, often in less than a thousandth of a second. And as you have mentioned, just 5 years ago, the New York Stock Exchange executed about 80 percent of the volume in the U.S. equities it listed. Today it executes about a quarter of that volume. The remainder is split among 13 public exchanges, more than 30 dark pools, 3 ECNs, and more than 200 internalizing broker-dealers; and about 30 percent is executed in venues that do not display their liquidity or make it generally available to the public.

At the SEC, we know that we must keep pace with the changing landscape of our securities markets. That is why more than a year ago we initiated a thorough review of equity market structure. As part of that review, we have received hundreds of public comments, some emphasizing the benefit of today's structure and others raising concerns.

We have heard how our current market structure fosters competition among trading venues and liquidity providers, lowering spreads and brokers' commissions. We have heard about the benefits of highly interconnected markets and have been cautioned about regulatory changes that might have unintended consequences. But on the other hand, we have also heard deep concerns about the quality of price discovery and whether the current

market structure offers a level playing field on which all investors can participate meaningfully and fairly.

As we consider regulatory responses, the Commission will evaluate these issues with a particular focus on obtaining the appropriate data and analysis to support our next steps. We will ask whether the changes we consider will aid capital formation and investor protection, enhance competition and price discovery, and improve inspection, surveillance, and enforcement.

In this context, the prism through which I will view the role of market professionals, whether they are exchanges or ATSs, broker-dealers or high-frequency traders, is whether they compete in ways that ultimately benefit investors and are companies seeking to raise capital.

As you know, our market structure review is not a theoretical exercise. Indeed, the events of May 6th, which profoundly impacted investors and listed companies, crystallized the importance of this effort. May 6th highlighted the need for regulators to be able to reconstruct the events of a given day across millions of trades, billions of shares, and multiple markets.

Today each exchange has its own unique and often incomplete data collection system, complicating efforts to reconstruct trading activity that can involve millions of records across dozens of exchanges.

In response, the Commission has proposed large-trade reporting requirements and a consolidated audit trail. This would for the first time allow regulators to track trade data across multiple markets, products, and participants simultaneously. We would also be able to rapidly reconstruct trading and quickly analyze unusual market events.

Since May 6th, we have taken a series of measures to reduce the chances of such an event recurring. For instance, we approved a circuit breaker program that limits excessive price volatility in individual stocks. We approved rules designed to bring order and transparency to the process of breaking clearly erroneous trades. We adopted a new rule to require brokers and dealers to have risk controls in place before providing their customers with access to the market—a rule that effectively bans naked access. And we approved rules to enhance the quotation standards for market makers, including eliminating stub quotes, which represented a significant proportion of the trades that were broken after May 6th.

In addition to regulatory responses, we are aligning our examination and enforcement efforts with the current realities of market fragmentation and high-frequency trading. We are making fundamental structural changes in the way we approach and conduct examinations of self-regulatory organizations, including focusing on how SROs surveil for potentially abusive high-frequency, high-quote, or other algorithmic trading strategies.

At the same time, our Enforcement Division is investigating whether various market participants have sought to unlawfully exploit the fragmentation of the markets, manipulate the price and volume of securities, or contribute to the market's volatility at the expense of investors. Additionally, we created a specialized market abuse unit to conduct investigations and develop expertise in particular high-risk program areas.

We cannot turn the clock back to the days of trading crowds on exchange floors, but we must continue to carefully analyze market structure issues to ensure our rules keep pace with the new trading realities and to identify ways to improve our markets, provide additional transparency, and increase investor protection. As we move ahead, we look forward to working closely with the Congress, and I look forward to answering your questions. Thank you.

Chairman REED. Thank you very much.

Chairman Gensler.

STATEMENT OF GARY GENSLER, CHAIRMAN, COMMODITY FUTURES TRADING COMMISSION

Mr. GENSLER. Good afternoon, Chairman Reed, Chairman Levin, Members of the two Subcommittees. I thank you for inviting me here today. I am also pleased to be testifying along with Chairman Schapiro. I think this is our seventh time testifying together, and at least our third time since on May 6.

The CFTC-regulated markets have rapidly transitioned from face-to-face. Electronic trading now represents 88 percent of our markets. As a father of three daughters, I have learned much about the new world of Twitter, social networking, and certainly texting. Well, just as we cannot turn back that clock—as a father, sometimes I might wish to—we cannot turn back the clock which now we have of automated execution, algorithmic market making, and high-frequency trading.

The May 6 events highlighted the cross-market linkages that you spoke about between prices and volatility in the securities markets, the futures markets, and other derivatives markets, and it is all enabled by technology. Price discovery, which may first occur in any one of these markets, futures or securities, can then move rapidly over into correlated products in other markets. Where small disparities in prices arise, even just for milliseconds, market participants try to profit in what economists call arbitrage between these markets.

The CFTC's surveillance program works to promote market integrity and protect against fraud, manipulation, and other abuses. The CFTC is coordinating closely with the SEC on policy levels, specifically trying to coordinate with rulemaking implementation of Dodd-Frank, but importantly, we also work very closely on surveillance and data sharing.

After May 6, as one example, our staffs promptly shared with the SEC position data and transaction data with regard to that day's events, and the exchanges and the self-regulatory organizations, importantly, conduct front-line market surveillance and also coordinate very closely, not just on May 6, but on many other days, as well, and have regular interactions.

In terms of data, the CFTC does currently receive futures data on a daily basis. This is most important for us. We get it the very next morning, the open interest and the transaction data. We do not regularly get the order book because we do not have the resources, really, to get that. May 6, we asked for it. It was 14 million orders. I have just calculated. It would 476 times more than that stack right there for that 1 day in one contract in 1 month,

and that was part of why it took a while to analyze that data, but we did get it and shared it with the SEC where they wanted it.

We do in our marketplaces, in the futures marketplaces, have what we would call pretrade risk management functionality. Let us call them safeguards. These safeguards protect against extreme movements. They could be price bands, maximum order side, protection against market stop loss orders, and importantly, market pauses, sort of time-outs, back to the children's theme, but a little time-out in the market. Exchanges are required to have these, and executing brokers also have to have some pretrade risk parameters for uses of the clearinghouses for the transactions. Last week, the Commission actually put out a proposal that mandates that markets have pretrade risk safeguards such as these but asked the public for their views.

The events of May 6 and the Dodd-Frank Act present new challenges, however, and those new challenges, I just want to highlight a couple very quickly. Our new authorities also give us from Congress authorities to work with regard to disruptive trading practices. The Act prohibits three specific things, but we are also asking the public and working on other acts, and we put out an Advance Notice of Proposed Rulemaking.

The second thing I would mention is resources, if I might. The CFTC's current funding is less than what we would need to really do the surveillance, not only for the events of May 6, but, of course, the new Dodd-Frank Act. We currently have about 680 full-time staff. We estimate that we will probably need about 400 more staff. To put these in dollar terms, our current funding from last year was $169 million. The President's request for 2011 is $261 million. We anticipate we will have 300 to 400 new applicants that will arrive on our doorstep next summer. These are swap dealers and swap execution facilities and so forth. We have no intention of robo-signing these applications. I mean, we are going to thoughtfully look at them as we are supposed to. We will need the resources to do that.

Thank you.

Chairman REED. Well, thank you both very much.

Chairman Gensler, let me thank you, but also, I think you have raised a troubling concern, which Chairman Schapiro has also suggested in her testimony. Chairman Schapiro, in your testimony, you state, budget permitting—your words—the SEC hopes our enforcement staff with expertise in algorithmic trading strategy, market abuse, quantitative analysis, and many other skills you need.

According to the numbers in the SEC's fiscal year 2011 budget request, between fiscal years 2005 and 2007, the SEC experienced 3 years of flat or declining budgets, which in effect with even small inflation means declines. The net result was that the SEC lost 10 percent of its workforce and was severely hampered in key areas, such as enforcement and examination. By 2008, I think this became readily apparent to every American with the dysfunction in our marketplace.

Even in the fiscal year 2010 budget levels, if you stay at that, your workforce is still below the 2005 level, as I understand it. And at the same time, as Chairman Gensler and you both point out,

with the Dodd-Frank legislation, there is significantly expanded responsibilities which we expect you to carry out.

So, really, for both of you, to what extent are staff levels hampering your ability to improve and strengthen oversight of current high-tech trading, implement the new provisions of the Dodd-Frank Act, and then do what you both alluded to, try to keep up with the most dynamically and rapidly changing marketplace that we have ever had, from 80 percent of trades on the exchanges to a fraction of that today? So let me ask both of you to comment, and you can begin, Chairman Schapiro.

Ms. SCHAPIRO. Thank you very much, Chairman Reed. Well, obviously, resources are a significant concern for the agency. As you rightly point out, we have had a very volatile history of funding at the Securities and Exchange Commission, and while Congress has been very generous in the last couple of years and we have been able to begin to staff up, we are really just now reaching our 2005 levels of staffing and technology spending.

We have been enormously fortunate in the last year to be able to attract tremendous help to the agency to supplement our already very talented staff, but we are trying to bring in new skill sets, people with expertise in algorithmic trading, people from credit rating agencies and trading desks and hedge funds, to try to help us have the capability to do the job we have always been charged with doing, but also to take on the new responsibilities, as you point out, that we have been given under Dodd-Frank. It is absolutely essential that we be able to continue to bring that kind of skill set into the agency.

One of the most important initiatives for us going forward really is the consolidated audit trail, and I would love to respond at the appropriate time to Chairman Levin's comments about how long it is going to take because we think there is good news on that front. But in order to make use of the data that we would receive from a consolidated audit trail, even understanding that the exchanges will be the primary users of that data, we need people with capacity in data management, quantitative analysis, and the servers and system capability to receive something on the order of 20 terabytes of data in a month.

So our needs for both Dodd-Frank and for stepping up and doing what I think the American public has a right to believe we are doing with respect to the oversight of our highly fragmented marketplace, we need significant resources.

Chairman REED. Chairman Gensler, go ahead, please.

Mr. GENSLER. I thank you for that. I do think that our agency, on a little bit smaller base, we are going to be asked to take on the swaps market, which is approximately $280 trillion, notional amount, nearly 20 times the size of our economy, just arithmetically. We currently oversee a market that is about $40 trillion in notional, the futures marketplace. So it is about seven times the size. We think we need about 70 percent more people, so we are trying to be efficient.

Part of the efficiency comes from technology. We have asked for $18 million more in this coming year, and that is part of the President's request for $261 million. That is to deal with data. A lot of data will be in data repositories, but we will need to be able to, in

essence, put a pipeline into that data and to search it, to analyze it, and to have automated surveillance. In later testimony, I noted that FINRA currently has surveillance tools and alerts on 300 different algorithms. I can assure you, we at the CFTC have a fraction of that right now. We only started the program of building our own algorithms in the last 2 years in a serious way.

Chairman REED. Let me ask you both, and perhaps this might be a point if you wanted to comment on the consolidated audit trail, but essentially, we are asking two agencies who—and I again commend you for your collaboration, both informally and formally—to surveil these markets, to have sort of ongoing insights into what is going on. How are you doing that in informal and formal ways? How are you coordinating? I presume, Chairman Gensler, you have something comparable to the consolidated audit trail that you are trying to roll out. So let me begin with Chairman Schapiro, and talk about some of the collaboration as you go forward. You might even want to talk about the time tables that you have.

Ms. SCHAPIRO. Sure. The collaboration really has been superb between the two agencies, and I think May 6 is a great demonstration of how the two staffs work together, understand each other's data, and the interconnections between the marketplace.

The consolidated audit trail would be designed in the first instance to give us a single consolidated set of data with really all the information one could want with respect to the equities markets and the options markets, but it would be our view that, over time, it should absolutely include all related financial products so that we should include municipal securities, Government securities, and futures that are on equities or equity products so that we have a truly comprehensive view of the trading of instruments in our economic substitutes for each other. Otherwise, it will not be a very effective system.

The initial estimates of the SEC staff when we proposed the consolidated audit trail were quite extraordinary in terms of the dollar cost and the timeframe, about $4 billion all in and as long as three to 4 years to implement. We would ask that the SROs actually develop the plan for the consolidated audit trail. The SEC would set out the criteria, what has to be real-time reporting and what all the data elements are, and are many in order to have the information that we need.

But as a result of the comment process and our meeting with a number of technology firms, we believe that we can dramatically reduce the cost and the timetables of implementation because a large portion of those costs, well over half, were thought to be necessary to allow broker-dealers to build the reporting systems to get the information into the repository. We do not think that that is likely to be necessary and that there are, in fact, technologies that already exist that can be utilized in this space. So we are hopeful that when we come to approving a final rule, the costs and the implementation period will be down significantly, which to my mind would mean we could more quickly bring in all the related products that we think are necessary for this to truly be a consolidated audit trail.

Chairman REED. And in that regard, Chairman Gensler, you both essentially regulate economic equivalence of each other in some cases, and you, I presume, have a complementary sort of vision about how you can build something like the consolidated audit trail. Could you comment on that?

Mr. GENSLER. We are fortunate. We have a less fragmented market now. I think in the swaps world, it would become fragmented with these execution facilities. By the morning of May 7, but every morning, we have the full transaction file from the day before in the futures world already in our system and our analysts are able to analyze it. Actually, on the evening of May 6, we already knew of the single large trader, the 75,000 contract, and we told the SEC that evening and some of the other regulators that evening and interviewed the executing broker the morning of the 7th. So we ere fortunate in that way.

Our challenges are we do not currently have what is called account ownership and control information. We put out a rule this summer and we very much need to do that. We have the data, but we do not always have the ownership.

The second challenge is we do not have the resources to analyze the order book every day. We only did that for May 6. But it is 14 million orders on one contract. Imagine on the whole market. It is probably measured in the billions of orders.

And the third challenge is with the swaps market coming in, how we aggregate the data across the swaps and futures market, and, of course, aggregate.

I do believe that we have work to do to institutionalize our cooperative nature. It has been a great working relationship, but we will not be there forever and our staffs will change and so I think we do have work to do to institutionalize some of this.

Chairman REED. My last comment. You are collectively working on an institutionalization both in terms of technology systems and communication systems as well as people. That is going to go on.

Mr. GENSLER. Yes, in the midst of a lot of rulemaking.

Chairman REED. Right. Right. Let me recognize the Chairman.

Chairman LEVIN. Chairman Schapiro, since we are talking about your consolidated audit trail and the good news you brought us, give us an estimate. Will it be less than half the cost and half the time? Is that fair, or is that too optimistic?

Ms. SCHAPIRO. Almost certainly, any estimate I give you will be wrong, but I will tell you that we think that between 50 and 80 percent of the current cost estimate is associated with the requirement for the broker-dealers to build the reporting systems, and to the extent there are existing technologies that would facilitate that, it should make a very significant change in the cost level and——

Chairman LEVIN. Would that be up to half, do you estimate? Could it be as much as half?

Ms. SCHAPIRO. I would hope so. I honestly do not know. I also think it is important to point out that while it is a very large number, $4 billion, these are markets that trade $220 billion worth of securities every day. So it is a big number, but there is a lot at stake in getting this market structure right.

Chairman LEVIN. Absolutely. That is why we are pressing it. Do you think it could be done in perhaps less than half the previously estimated time?

Ms. SCHAPIRO. Again, I do not know and I do not want to be misleading in any way because I truly do not know, but it would very much be my hope. I think this is perhaps for me one of the most important things I can try to get accomplished at the SEC.

Chairman LEVIN. OK. Thank you. In your opening statements, you both acknowledged that the market prices in each venue are nearly simultaneously affecting each other and that the futures and stock prices in America—regulated by each of your Commissions—also affect each other. In my judgment, since these markets are so connected, it would seem to me that there is nothing preventing somebody from using one market to manipulate another market.

So let us take a look at Exhibit 2, a chart. I do not know if you can see that or not. Turn that around, if you would, so they can see it, unless it is in front of them. Let us assume that Joe Trader was entering orders that he never intended to have executed in one market so that it would move prices to his benefit in another related market. After moving the market price and taking advantage of the price movement that he caused, he then cancels his original orders, allowing the markets to return to normal. Now, that seems to me to be a variation of what Trillium traders did, but this time using two markets.

My question to you is, might that type of trading strategy be a manipulation? I am not asking you whether it is. You obviously cannot know. But might that kind of strategy I just outlined be manipulative?

Ms. SCHAPIRO. I think it is entirely possible that it could be.

Chairman LEVIN. OK.

Mr. GENSLER. Because our statutory framework relates to intent, it would depend on the party's intent. But it could be if the intent was there to manipulate a market.

Chairman LEVIN. Now, I think you have testified already that since people trade in multiple markets, that our regulators need to be able to compare the trading data from more than one market to see if trading in multiple markets is being improperly used. Can your agencies coordinate your automated surveillance efforts to spot this type of cross-market price manipulation or anything else that might be appropriate? Is that a possibility?

Ms. SCHAPIRO. I think it is a possibility. With the consolidated audit trail—and now again, we have two different agencies with different jurisdictions. We would have to ultimately agree to require that the exchanges and the market participants under two separate agencies' jurisdictions agreed to contribute data to the same consolidator and to the same audit trail. But I do not know of any reason why, if there is a will to do it and there is the technical capacity to do it, why we would not do it, frankly.

Chairman LEVIN. All right. Mr. Gensler.

Mr. GENSLER. We already do it. I would say it is more on an *ad hoc* basis or an event-driven basis and an enforcement case-driven basis, and we have had some very good collaboration. I think to do it and institutionalize it might take some rule changes on both

sides to have exchanges and self-regulatory organizations on a regular basis from the two jurisdictions sharing information and that would be worthwhile to consider.

Chairman LEVIN. OK. If you would consider that, it would be helpful.

Chairman Schapiro, do you currently have an automated surveillance to detect cross-market manipulations? Do you have that in place now?

Ms. SCHAPIRO. No. We have some tools in place that allow us to, upon request from the—we request the exchanges to provide us with information and so we can see activity in options markets and equity markets, but we do not have routine capability to see across to other derivative markets, over-the-counter markets, and we do not really have the tools to efficiently utilize the data that we do get.

Chairman LEVIN. Now, is that what you hope the consolidated audit trail will help obtain?

Ms. SCHAPIRO. That, as well as the large trader reporting system, which we believe could be in place even much sooner, that will at least give us the capacity to see what larger traders are doing in our market.

Chairman LEVIN. OK. And when do you think that is possible, that large trader reporting system?

Ms. SCHAPIRO. It was proposed earlier this year and it would be my hope that we would be able to finalize the rules for both that and the consolidated audit trail early in the new year, and then I do not know off the top of my head what the implementation timeframes are for large trader. They are measured in months, not in years.

Chairman LEVIN. Now, FINRA has an Order Audit Trail System, as I understand it O–A–T–S. Are you familiar with it?

Ms. SCHAPIRO. That is right, yes. Yes.

Chairman LEVIN. Is that something which you could use as an interim step?

Ms. SCHAPIRO. I think it is a great question and there are—FINRA has the OATS system. The New York Stock Exchange has the Order Tracking System. And the options exchanges have an audit trail that they use, as well. And I think it is kind of a philosophical question almost. The OATS system gathers data and it covers a significant portion of the marketplace. So we could look at whether to spend resources and time trying to make it a little bit better and a little more robust and broader or we could take those resources and time and create a genuinely consolidated audit trail system that is very scalable and very capable of capturing all the economic substitutes for equities.

And so I think what we have said in the consolidated audit trail proposal is we expect exchanges and FINRA to come to us with a plan for how they are going to implement a consolidated audit trail that gives us all of the data that we need as regulators and that we expect them to use as market surveilors and leave the choice of the technology to them.

Chairman LEVIN. And to kind of summarize your previous point: at the moment, at least, you are relying on someone to identify a problem for you first and then you can look across markets——

Ms. SCHAPIRO. I think that——

Chairman LEVIN. At the moment. At the moment.

Ms. SCHAPIRO. I think that is generally true, either someone identifying a problem or our own staff obviously sees market activity and may be concerned about a big spike in volume, for example, ahead of a corporate announcement, and then we would utilize a tool called the Electronic Blue Sheets to investigate whether the people who traded ahead of that corporate announcement might have had access to material nonpublic information and violated the Federal securities laws. So it is a combination.

Chairman LEVIN. Let me just raise a question before I have to run off. We are talking about trading abuses here and I want to talk about a trading abuse that involves credit default swaps. Now, they were not subject, those swaps, to regulation before Dodd-Frank came along and that includes credit default swaps that bet against mortgage-backed securities, which are the bets that made a major contribution to the financial crisis.

Now we have got Dodd-Frank, which requires your agency to monitor those types of swaps for a variety of uses, and I want to give you a description of something that my Subcommittee uncovered during our investigation of the financial crisis. I think you or your staff has seen some of these documents, which we were able to get to you yesterday, which we uncovered during our investigation of the financial crisis. I want to get your thoughts as to how either of your agencies could monitor swaps electronically to detect a type of market squeeze.

From late 2006 to early spring of 2007, major financial investors had begun betting against subprime-related CDOs by purchasing credit default swaps, or CDSs. Soon, the price rose and no one in the market was willing to offer any more CDS protection against a fall in the value of subprime-related CDOs. Goldman Sachs wanted to continue to buy CDSs, but none were available at a reasonable price, so it changed the situation. Goldman's asset-backed securities desk, their ABS desk, decided it would offer CDS protection at a lower and lower price in order to drive down the market price and induce current CDS holders to sell off their holdings. And when the sell-off was large enough and the price got low enough, Goldman planned to move in and purchase the CDSs for itself at artificially low prices.

Now, that short-squeeze strategy was described in a number of exhibits, including Exhibit 3A, which I will start with. It is a self-evaluation which was done by one of the Goldman traders on the ABS desk who participated in that activity, and we will include that in the hearing record at this time, a self-evaluation report by a Mr. Salem, S-a-l-e-m.

On page 15 of that Exhibit 3A, at the bottom of the first paragraph, this is what he wrote. "In May, while we remained as negative as ever on the fundamentals and subprime, the market was trading very short," in caps, "and susceptible to a squeeze. We began to encourage this squeeze with plans of getting very short again and after the short squeeze caused capitulation of these shorts. This strategy seemed doable and brilliant, but once the negative fundamental news kept coming in at a tremendous rate, we

stopped waiting for the shorts to capitulate and instead just reinitiated shorts ourselves immediately."

Now, in an interview with us, the trader who wrote this self-evaluation denied that the ABS desk ever intended to squeeze the market. He claimed that he had wrongly worded his own evaluation report, and that his account is consistent with other Goldman documents.

In May 2007, for example, Michael Swenson, the manager of the ABS desk who oversaw the traders' efforts, wrote e-mails in which he encouraged the attempt to squeeze the market, and we will include these e-mails, Exhibits 3B and 3C, in the record at this time.

In the first e-mail, dated May 25, Mr. Swenson wrote, "We should be offering a single-name protection down on the offer side to the street on tier one stuff to cause maximum pain." And then on May 29, he followed up with another e-mail. "We should start killing the single-name shorts in the street. Let's pick some high-quality stuff that guys are hoping is wider today and offer protection tight. This will have people totally demoralized."

Now, when interviewed, Mr. Swenson also denied there was an effort by Goldman to squeeze the shorts. He said the purpose behind Goldman's effort was to restore balance to a market that had gone too far to one side, leading to an artificially high cost for CDS protection, but he could not explain why he used the terms he did, "cause maximum pain" and "this will have people totally demoralized" to describe an effort to restore balance to the market.

Other e-mails suggest that the attempted short squeeze by Goldman negatively impacted its own clients. For several weeks, as Goldman tried to drive down the price of CDS protection, it required some of its clients to make collateral payments to Goldman on CDS protection that they had bought at a higher price. In some e-mails, clients asked Goldman how they could owe more collateral to Goldman when the clients had shorted the mortgage market, which was declining in value.

In the end, short sellers did not offer to sell their shorts at the lower price. Instead, most went even shorter and Goldman abandoned its efforts to squeeze the market. Even after Goldman abandoned the effort, some investors were harmed by the lower prices.

Now, this is my question. Chairman Gensler first. You are familiar with short squeezes in the commodities markets. Would this type of attempted short squeeze in the mortgage-backed securities market trouble you, number one, either as a conflict of interest or as manipulation on the part of Goldman. Mr. Gensler.

Mr. GENSLER. Are you sure you did not want Chairman Schapiro to go first?

[Laughter.]

Mr. GENSLER. No, in more seriousness, I am not familiar enough with the facts, and the first time I have seen the document is, of course, now. But in our markets, in the futures markets, manipulation relates to intent and to distort a price. There is a four-factor test about price manipulation. The Dodd-Frank bill actually, fortunately, I think, broadens that, and we have a proposed rule out on fraud-based manipulation, and also Congress has given us additional authorities on disruptive trading practices, all that we will

be publishing rules on and get public comment on that are very helpful.

In the current statutory framework on what is called price manipulation, you need to have an intent to, in essence, distort a price, and the price has to have been distorted, and those would be sort of the factors that would have to be applied to this situation or other situations.

Chairman LEVIN. Alright, Chairman Schapiro, let me ask you a question. Does the SEC have the capacity to monitor MBS markets for this type of activity? Is the capacity there to monitor?

Ms. SCHAPIRO. It is not there now.

Chairman LEVIN. Would it be helpful for you to have it?

Ms. SCHAPIRO. I think so, and I do think that we will have better capacity generally with respect to the asset-backed securities markets going forward based on rule proposals we did last spring, but also authorities under Dodd-Frank. But it would be, obviously, helpful. That is troubling language that you read to us.

Chairman LEVIN. Thank you both very, very much, and I am going to run and vote.

Chairman REED. Well, we again apologize for the tag-team actions caused by the votes, but one point I want to raise, and it goes to sort of the conceptual issue. The presumption, I think, from most people—not perhaps the most sophisticated traders in the world, but people who own a few stocks—is that the value of stocks, the liquidity associated with the stocks is directly a function of their economic value. The same thing with debt instruments, the same thing with derivatives, that there is a real economic value here. And one of the issues that we have to deal with is with the proliferation of these algorithmic high-frequency trades. Some of these algorithms do not take into account the fundamentals of the instrument, the economic value, the dividends, or the status of the municipality issuing them. They are simply saying if enough of these are sold, then we start selling. And then if we start selling, another algorithm kicks in.

To the extent we get further away from the economic values here, does that not only cause concern but is that—you know, is that something that is good for the economy? It may be a naive question, but I will pose it.

Ms. SCHAPIRO. I do not think it is a naive question at all. I actually think it is sort of the fundamental question that we are really grappling with: What is the role of traders versus investors? And what kind of trading really provides liquidity to the marketplace that enables investors to get in and out of positions successfully?

When we meet with public companies—and I always ask this question of them, and I always ask this question of retail broker-dealers: How are the markets working for you, for what you need to do, as a public company, in raising capital; what your customers, as a retail broker-dealer, are looking for in the marketplace? And there is a lot of concern about whether the price discovery mechanism is efficient or whether we have the development of two-tiered markets that is hindering effective price discovery, whether the playing field is level so that long-term investors are going to be buyers and holders of securities, have an equal opportunity to get the best price in the marketplace, as traders do, whether issues

like speed and colocation and access to proprietary data feeds, skews the ability of others to effectively participate in the marketplace. And I do not know the answers to all those questions, but they are very much questions that are on the minds of the retail public and on the minds of public companies—for whom these capital markets are their lifeblood. Their capacity and their capability is in these markets to expand and grow and create jobs.

So I think these are exactly the kinds of questions that we are trying to explore through our Concept Release. When we ask about what is the quality of the marketplace and what is the quality of our market structure and what are the best metrics to measure that in addition to looking at detailed questions about the role of algorithms and high-frequency traders and as well as dark pools of liquidity.

Chairman REED. Before I turn to Chairman Gensler, one of our roles is to amplify these questions in the broader context and in the public debate and also to see if we can drive effective answers, and they might change over time. So I appreciate what you are doing, I know what you are doing, but your efforts—and please, ask us how we can be helpful—to find real answers to this that are questions that are to be posed, as you point out very adroitly, not only by the investor on the street but large institutional investors, large corporations, *et cetera,* go really to the nature of a functioning market versus a highly lucrative trading venue. And they can be two different things.

Ms. SCHAPIRO. I think you made an excellent point. In the comment process that followed the Concept Release and a roundtable that we also held back in June to look at market structure issues, one commenter supplied a survey that they had done of a number of investors across a range, and not just investors but also trading firms and others, and even large institutional investors in that survey, only about half of them said they felt like the market structure was fundamentally working for institutional investors' interests at this point.

Chairman REED. Thank you.

Chairman Gensler, your comments from your perspective?

Mr. GENSLER. I think that markets have to have the confidence of the public, not just the investing public but as Chair Schapiro said, the capital formation and the markets, we oversee those that hedge, whether it is a farmer or a rancher in our core groups or a modern financial company hedging a risk.

I think that markets for decades have included hedgers, investors, and speculators, and have even included the interdealer trader. In the old days, it was somebody in the pits of a Chicago futures exchange or on the floor of the New York Stock Exchange. Today in the modern Twitter and high-frequency world, it is somebody with a computer who is maybe collocated and so forth.

I think the core that we have to make sure is that these markets—that everybody has sort of an equal access to these markets, that they are very transparent. That is at the core of the new Dodd-Frank bill for the swaps market, but that they are transparent and somebody does not have some information advantages, and that we do effectively police them against fraud manipulation. Whether what Chairman Levin laid out is manipulation I could not

speak to, but we have to police against those manipulations and have the tools to do that.

Chairman REED. I think I have asked this question in different words, but succinctly, so much of this is cross-market activity, and you alluded to it, Chairman Gensler, and you, Chairman Schapiro, in your comments. The obvious thing is that arbitrage is something that is attractive because if you can catch two markets in a quick match, that is usually a profitable exchange.

Again, anything that you want to add with respect to the steps you are taking to ensure that cross-market activities, someone who is trading a future to affect the price of an equity so that they can either short or go long on the equity, what are you doing? And then, Chairman Schapiro, what are you doing, or what do you both think you are doing?

Mr. GENSLER. Well, candidly, most of what we are doing is within the jurisdiction that we are in, and so there is cross-market arbitrages within the futures market, the options on futures, and then most recently the swaps markets. So we are going to try to work to make sure that we really do have the data set within these markets and can aggregate and do surveillance across those markets, because they can even be in one futures contract between the months—that is called a basis trade or a spread trade. I do think we need to do more to institutionalize across the markets as well. But it is within our jurisdiction and then across our jurisdiction.

Chairman REED. Chairman Schapiro.

Ms. SCHAPIRO. Yes, I would really agree with that. I think our problem is we have so many markets and we have so many venues where trades are executed that just getting it to a point where we have consolidated data about the equity markets would be an enormous step forward. But it would be my hope that we would ultimately have a consolidated audit trail and the capability to surveil across related instruments.

Chairman REED. In your Concept Release in January of 2010, Chairman Schapiro, you said, "Regulation has not kept pace with the rapid evolution of the securities markets." I would assume you would both agree with that. I certainly agree with it.

But there is another, I think, again, perhaps naive but I think a profound question. There is a window to catch up, and if you cannot catch up, are we always going to—is this something that will get beyond our capacity to regulate, frankly? And I think it goes back to the issues we have talked about in terms of resources, in terms of personnel, in terms of technology systems, *et cetera.* But, you know, this is not your father's market or your grandfather's market where it moves at something close to the pace—I hesitate to use the Congress as a model, but at a pace much slower than what is happening now. And I must say that one of my fears is that this is a critical moment to not only get up to speed and so that we are regulating on a near real-time basis or an effective basis, but if we miss this moment, the gap will widen so significantly that regulation will be simply—it will not be effective. It will be there, but it will not be effective. And the second part of this is just this proliferation of markets where you do not even have a perspective into it. Comment on those two major points, and then I will conclude.

Ms. SCHAPIRO. Sure. There are two things that I think are critical. One is the need for regulators to be, as you said, up to speed for the purposes of policing the market, to understand the activity that is happening, where there are abusive practices going on. Our enforcement program is looking into about 12 different kinds of trading strategies that we think have the potential to be problematic. So we have to have the capacity to do all that with the audit trail and with the human and technical resources at the SROs as well as at the SEC.

But I think we also have to look at whether there are regulatory changes that are necessary in our marketplace in order to create a stronger infrastructure. We have talked about the things that we have done already with respect to—relatively simple things like single-stock circuit breakers, eliminating stub quotes, prohibiting naked access to the markets. But we also have a menu of ideas—and at this point they are really just ideas—for other steps that we might be able to take at the SEC that would strengthen that backbone of the market structure, including requiring broker-dealers to have procedures that prevent algorithms from behaving destructively in the marketplace, something we saw, obviously, on May 6th. Whether there should be obligations on market makers to either support the markets or at least not to trade in ways that detracts from the quality of the marketplace, looking again at the quality of exchange data feeds and whether the public data feed is sufficiently robust in comparison to the one they sell for a lot more money in their proprietary context, we need to assess the fee structures within the exchanges, the maker-taker fee and so forth. And we are talking now very actively about migrating the single-stock circuit breaker to a limit up/limit down model which would much more closely actually mimic the futures model.

So I think there are lots of things for us to do that will be incrementally important but important to try to solidify this market structure in addition to trying to do a better job with surveillance and viewing across all markets the activity that we see.

Chairman REED. Chairman Gensler.

Mr. GENSLER. I was going to say that maybe—the glass is half-full. I am an optimist, and we have certain tools. We leverage off of the exchanges. We leverage off of the self-regulatory organizations and also the big market participants, the dealers mostly, what we call futures commission merchants in our world. And we leverage by certain tools. We publish rules. We hopefully update them. They are never quite up-to-date, but, you know, we update them on a regular basis. We use enforcement actions as well. Sometimes there is signaling to the markets when there is a particularly bad actor or manipulation and so forth. I think these pretrade risk safeguards are absolutely critical. That is why we last week published a rule that included that the exchanges themselves—they have had them in a voluntary way, and the futures market has been very fortunate to have very robust pretrade risk management, but now we require some of this pretrade risk management. So I think we have to always leverage off the market participants and the self-regulatory organizations, use rules, enforcement mechanisms, and as I say, risk safeguards.

The last thing we use is transparency. I am a big believer that transparency helps economic activity, but it also helps in a sense the regulators, because, frankly, you get more people bringing information to you, too.

Chairman REED. Well, thank you very much for your testimony and for your great effort at both the Securities and Exchange Commission and the CFTC. Thank you very much, and I am sure we will meet again. Thank you.

Mr. GENSLER. Thank you.

Chairman REED. The second panel can come forward.

Let me introduce now the second panel, and then I am awaiting Senator Levin's return. The second vote has been called. He will vote, return, then I will depart. But in the meantime, I can introduce the panel. He is not here. I will also swear the panel in, and then we can begin the testimony.

Our first witness is Dr. James Angel, Associate Professor of Finance at Georgetown University's McDonough School of Business. Professor Angel specializes in the structure and regulation of financial markets around the world. His current research focuses on short selling and regulation. Dr. Angel currently serves on the Board of Directors of the Direct Edge Stock Exchange.

Our next witness is Thomas Peterffy. Mr. Peterffy is Chairman and CEO of the Interactive Brokers Group, a global market-making and brokerage firm with nearly $5 billion in equity capital. Its trading subsidiary is a registered broker-dealer and futures commission merchant that provides high-speed, technology-driven trade to individual clients, hedge funds, institutional investors, and others. Another subsidiary was one of the world's first electronic market-making firms and is a registered market maker and liquidity provider in all major U.S. futures and securities markets.

Our third witness is Manoj Narang, the CEO of Tradeworx. During the 1990s, he held a variety of technology research and trading positions at several major Wall Street firms, gaining experience in a multitude of markets, including equities, foreign exchange futures, and fixed income. In 1999, he left Wall Street to found Tradeworx Inc. with the mission of democratizing the role of advanced technology in the financial markets.

Our fourth witness is Mr. Kevin Cronin, global head of equity trading at Invesco Ltd. He is responsible for Invesco's trading desk in Atlanta, Hong Kong, Houston, London, Melbourne, Taipei, Tokyo, and Toronto. Mr. Cronin joined Invesco in 1997 as the head of listed equity trading for Invesco AIM and later became director of equity trading. Mr. Cronin is currently the chairman of the Investment Company Institute's Equity Markets Advisory Committee, a recently appointed member of the NASDAQ Quality of Markets Committee, and a member of the National Association of Investment Professionals and the Securities Traders Association. Thank you, Mr. Cronin.

Our final witness is Steve Luparello, vice chairman of the Financial Industry Regulatory Authority, or FINRA, the largest nongovernmental regulator for all securities firms doing business with the United States public. In this capacity, Mr. Luparello oversees FINRA's regulatory operations, including enforcement, market regulation, member regulation, and business solutions.

And now pursuant to Rule VI of the Rules of Procedure of the Senate Permanent Subcommittee on Investigations, would you gentlemen please stand and raise your right hands? Do you swear that the testimony you will give before this Subcommittee will be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. ANGEL. I do.

Mr. PETERFFY. I do.

Mr. NARANG. I do.

Mr. CRONIN. I do.

Mr. LUPARELLO. I do.

Chairman REED. Thank you very much, gentlemen.

Dr. Angel, your testimony, please.

STATEMENT OF JAMES J. ANGEL, ASSOCIATE PROFESSOR OF FINANCE, MCDONOUGH SCHOOL OF BUSINESS, GEORGETOWN UNIVERSITY

Mr. ANGEL. Thank you. It is an honor to be here. I would like to thank you for the invitation. As you mentioned in the introduction, I study the nuts-and-bolts details of how financial markets operate around the world. And I am also the guy who warned the SEC in writing five times in the year before the Flash Crash that our markets are vulnerable to these kind of events, and I would like to say that the Flash Crash can happen again, and here is why.

First, our market is a very complex network. It consists not only of equity exchanges and futures exchanges and options exchanges, but of all the broker-dealers, fixed commission merchants, IT vendors, analytics providers, media entities, and investors. It is a very rich and complex ecosystem, and a disruption anywhere in that network can feed throughout the network.

Now, most of the time, this market network works pretty well—except when it does not—but, by most measurable dimensions in market quality, our market works far better, faster, and cheaper than it did 5, 10, 20 years ago. However, like any finite system, like any human system, our market has finite capacity. It can only handle so much trading activity before it chokes. And from time to time, our market is overwhelmed by massive quantities of trading activity that cause the market to choke.

Now, this is not a new phenomenon. If you look in the history of financial markets, you will see that going back in time this has happened over and over again. In 1906, the *New York Times* had a headline that blared—let me get the words right here—"Stocks Break and then Recover." We saw it in 1929, we saw it in 1962, we saw it in 1987. We see these waves of activity that overwhelm the market mechanism. So what we need are safeguards for this market network that are integrated across the entire market network. And what we need is we need somebody to be able to call a timeout when the market network is going crazy, and we do not really have that right now.

Now, some people grumble about market fragmentation. I think we need to worry less about the fragmentation of the market than we do about the fragmentation of regulation. We have literally hundreds of different financial regulators at the Federal and State levels, and, you know, they do not always play nicely with each

other. A lot of stuff has fallen through the cracks, as we saw in the meltdown of 2008, and there is also a lot of duplication. And most of these regulators have a pretty narrow mandate. And, here in Washington, we have the SEC in one granite fortress on F Street, the CFTC in another granite fortress a couple miles away in Lafayette Center. Both of them are hundreds of miles away from the financial markets they try to regulate. That lack of physical proximity makes it really hard to actually regulate the markets because it makes it much harder to figure out what is going on.

How long it took the regulators to figure out what was going on in the Flash Crash is a direct result of the fragmentation of regulation and having regulators hundreds of miles away from the markets they are trying to regulate. So our regulators need better market intelligence, and they need better funding as well.

We have spent approximately $18 billion on the SEC since its founding in 1934. That is less than half of what investors lost from Bernie Madoff alone. So I think we have been really penny-wise and pound-foolish in the way we have funded our regulators.

Now, what can we do about this? First of all, I understand that there are political forces that make it really hard to consolidate agencies. But one thing we can do is we can deal with this fragmentation of regulation by putting all the financial regulatory agencies in one building. Instead of having them miles apart, which makes any kind of interaction difficult, stick them in the same building.

Second of all, let us stick this building in the heart of our financial district in New York. That will make it much easier for our regulators to find out what is going on, and it will make it easier for them to attract the kind of people with market experience they need to understand what is going on in the markets.

Finally, as we pay attention to market structure, we need to think about how the markets are working for all companies, large as well as small. And I think we need to pay attention to the fact that the number of public U.S. companies has fallen by almost 50 percent in the last 15 years. The number of public companies is shrinking steadily, and if we run out of public companies, we run out of jobs. In 1997, before the dot-com bubble got out of hand, there were 8,200 U.S. public companies listed on our exchanges; at the end of 2009, approximately 4,400.

Now, if you figure half of the missing 4,000 companies were dot-coms that should not be there or companies that were merged, well, that leaves 2,000 missing public companies. If each of them were responsible for 1,000 jobs, that is 2 million jobs lost to our public markets. That would make a big dent in our unemployment rate of 15 million.

There are a lot of reasons for that, and I just want to say I think you should hold further hearings on the reasons why we are losing our public capital markets.

Thank you.

Chairman REED. Thank you very much, Dr. Angel.

Just for everyone's understanding, your statements will be made part of the record, so if you want to summarize, feel free to do that. Thank you, Professor.

Now Mr. Peterffy, please.

STATEMENT OF THOMAS PETERFFY, CHAIRMAN AND CHIEF EXECUTIVE OFFICER, INTERACTIVE BROKERS GROUP

Mr. PETERFFY. Thank you for inviting me. I am Chairman of Interactive Brokers Group, a brokerage and market-making firm that is headquartered in Connecticut. Our customers have about $21 billion of assets with us, so we are very focused on the health of the U.S. markets.

Here is my worst nightmare. Imagine a high-frequency trading firm, or HFT, with a few computers, some programmers, and $30 to $50 million in capital. These operations exist all over the world trading with sponsored access, where an often undercapitalized U.S. broker allows the HFT to send orders directly to the exchange using the broker's membership ID. These orders are never seen by the broker before they are executed.

One day, at 3:45 p.m., the HFT starts sending waves of orders to sell large cap stocks and ETFs. As the close nears, more sellers jump in and stop orders are triggered. The market closes down 30 percent. The next morning, terrified investors and brokers holding undermargined accounts run for the exits and sell into cascading circuit breakers. Brokers fall like dominoes, but the HFT that started it all makes a huge profit, covering its short at fire-sale prices and moving its gains offshore before the regulators know who did it.

In the alternate scenario, the market realizes that it was duped. No news is seen causing the prior day's drop, and the market moves up 40 percent the next morning. The HFT's short sales are big losers, and the sponsoring broker and clearing broker go bust, possibly starting a chain reaction. Under either scenario, innocent investors will be caught by the huge down move or up move, and confidence in our markets will suffer further.

This is not far-fetched. We have nothing in place to prevent this from happening. It could happen on any day. It could be a manipulator seeking profits or a disgruntled employee at the hedge fund or HFT or a brokerage firm. It could be a terrorist act or a simple computer bug.

What can be done? I have four recommendations to review briefly that are explained in detail in my written testimony. These recommendations apply to the securities and futures markets because these markets are inextricably linked, and it is critical for the rules and surveillance tools of the two markets to be coordinated with close coordination between regulators.

First, sponsored access. Rather than in July of next year, the SEC's new rules banning sponsored access should apply right away by emergency order of the Commission. Seven months is much too long to continue at risk. We screen or pat down over a million people every day to prevent a plane crash, yet we do not screen electronic orders to prevent the market crash. The ability to send orders to the exchanges should be restricted to brokers that are members of the clearinghouse. Brokers with no financial stake in the clearinghouse should not be sending unfiltered orders directly to exchanges any more than the HFT should.

Second, surveillance tools. Regulators need real-time surveillance, especially the identity of the person behind each trade. The SEC should approve its proposed audit trail rules, but shorten the

2-year implementation deadline. And until then, the Commission should order that clearing brokers record the identity of the person associated with each trade, starting now. The CFTC should approve similar rules at the two agencies as they must work together.

Third, improving liquidity of the exchanges. We must improve liquidity by banning or restricting off-exchange trading of exchange-listed securities. It is bizarre that under Dodd-Frank over-the-counter equity derivatives must trade on exchanges, yet exchange-listed securities can still trade over the counter. When exchange-listed products are traded on OTC, market makers leave and liquidity on the exchanges dries up, allowing crashes like May 6th to happen. We must address this by bringing trading in listed securities back to the exchanges.

Fourth, and last, circuit breakers. The current circuit breakers are in effect only from 9:45 a.m. to 3:35 p.m., but they should be in effect at all times when the market is open. Also, the circuit breakers should kick in fixed price intervals instead of being moving targets so that everyone can precalculate what prices are allowed and not allowed. This would eliminate the single-stock mini crashes that seem to occur almost every week and that you were referring to some time ago.

There should also be a marketwide circuit breaker that would not allow transactions to take place outside a certain limit for the day, but would allow continued trading inside those limits.

Finally, the circuit breaker level must be coordinated among the stock and related derivative markets so as not to cause price misalignments that could result in temporary insolvencies.

Thank you.

Chairman LEVIN. Thank you very much.

Mr. Narang, is that how you say your name?

Mr. NARANG. That works.

Chairman LEVIN. Thank you very much.

Mr. Narang.

STATEMENT OF MANOJ NARANG, CHIEF EXECUTIVE OFFICER, TRADEWORX, INC.

Mr. NARANG. My name is Manoj Narang and I am the CEO of Tradeworx, Inc. We are a financial technology firm that provides high-performance trading infrastructure to investors and trading firms. In addition to supporting outside clients with our technology, we operate a proprietary trading practice which utilizes the same technology to engage in high-frequency trading strategies. Our proprietary trading business consists of highly complex and data-intensive algorithms based on correlations between securities that span multiple markets, including stocks, options, and futures.

Before I begin, I would like to express my gratitude for the opportunity to share my perspectives and insights in today's hearing and to recognize that smaller firms such as Tradeworx are not often afforded such a privilege.

My prepared remarks are on the topic of restoring investor confidence to our markets. It is self-evidence that markets depend on confidence in order to function smoothly, and there is no denying that the confidence of investors was severely shaken on May 6. It is this loss of confidence that transformed the Flash Crash from

just the most recent chapter of the ongoing credit crisis into the referendum on market structure that it has become.

Ever since May 6, investors have been plagued by the nagging suspicion that the regulatory agencies are powerless to understand the inner workings of the market or to meaningfully assess the practices of its most active participants. For the past 2 years, the public has been treated to endless debate about market structure issues. Are the prices posted by market makers fair or are they subject to widespread manipulation? What impact do rebates or elevated cancellation rates have on liquidity? Why is speed important to strategies which provide liquidity? How do the equities, options, and futures markets influence and interact with each other?

The public should not be forced to accept anecdotal or speculative answers to such questions when definitive answers can be found by analyzing data. Firms like Tradeworx have the infrastructure to easily calculate objective answers to these kinds of questions, and while we happily share our insights with the SEC, what is needed to boost markets' confidence is for the markets' chief regulator to have these capabilities on its own.

Another key issue related to investor confidence is that the market has become too complicated for ordinary investors to understand. That is one of the things that leads to speculation and unsubstantiated hypotheses. Our stock market sports the most complex and fragmented structure known to mankind. The cornerstone of this system, Regulation NMS, was 10 years in the making and it spans over 520 pages. For perspective, consider that in competitive games like chess, extraordinary complexity arises from just a handful of rules. It should surprise nobody that an undertaking of this magnitude might backfire, nor should it surprise anyone that such unnecessary complexity might fuel the perception among investors that the system is somehow rigged against them.

Regulation NMS does many things, but at its core, its objective is to keep prices at the different exchanges synchronized. In most markets, this is accomplished via arbitrage, which tends to be incredibly efficient in this role. For example, consider the relationship between the stock SPY and the IVV S&P futures contract, both of which track the S&P 500 index. Because they are completely different securities that trade on different markets, their prices are not protected by Regulation NMS. But if you sample their prices at subsecond intervals, you will find that they have a 99.9 percent correlation to each other. I have diagramed that correlation in the exhibit. You can see on the exhibit just how stable this relationship is, despite the existence of any regulation to cause that correlation to be that high.

But apparently a 99 percent correlation was not good enough to dissuade policy makers from the incredibly daunting task of crafting rules to keep prices in sync. Unfortunately, the price for complex rules that solve imaginary problems is rather high. Rather than minimizing fragmentation, which was the stated goal, Regulation NMS has directly exacerbated it by guaranteeing that new exchanges will have orders routed to them. Rather than limiting the role of arbitrage, the regulation has diverted its focus from productive uses to the exploitation of the regulation itself. And to top it off, the rule has managed to ignite a massive technology arms race

by making the speed of information transmission a more critical issue than it ever was before.

Now that a heightened appetite for more rulemaking clearly exists, I feel that we are doomed to repeat our past mistakes. Once again, proposals abound to solve nonexistent problems. It is easy to conjure up gimmicks such as speed limits on order cancellations, but it is also trivially easy to demonstrate how they would backfire and harm long-term investors. When lawyers with minimal trading expertise devise such rules, they should recognize that world-class engineers with profit motive will be there to exploit them. History makes abundantly clear who tends to win this battle of wits.

Many market professionals have strong opinions on how to fix market structure, but to win back the confidence of investors, the SEC should engage in rulemaking that is supported by empirical evidence and analysis rather than by opinions and speculation. Furthermore, adding ambitious or superfluous regulations to a system which is already hopelessly complex is guaranteed to backfire by inviting unintended consequences. Such rulemaking will not restore investor confidence in our markets. Fixing the very real flaws in our existing regulations will.

I hope to have the opportunity to elaborate on these topics at today's hearing and I ask that the entirety of my written remarks be included in the record.

Chairman LEVIN. They will be. Thank you very much, Mr. Narang.

Mr. Cronin.

STATEMENT OF KEVIN CRONIN, GLOBAL HEAD OF EQUITY TRADING, INVESCO LIMITED

Mr. CRONIN. Thank you, Chairmen Reed and Levin, Ranking Members Bunning and Coburn, and Members of the Subcommittees for the opportunity to speak here today. I am pleased to participate on behalf of Invesco at this hearing examining efficiency, stability, and integrity of the U.S. capital markets. Invesco is a leading independent global asset management firm with operations in 20 countries and assets under management of approximately $620 billion.

In the interest of time, I will keep my comments brief, but I have submitted for the record a more detailed statement.

An efficient and effective capital formation process is essential to the growth and vitality of the U.S. economy. The most important aspect of the capital formation process is that it attracts long-term investors' capital. To accomplish that, it is critically important that the primary and secondary capital markets which facilitate the capital formation process are transparent, effective, and fair. To that end, it is essential that sensible, consistent rules and regulations are in place to govern the markets and that regulators have the tools necessary to ensure the stability and integrity of those markets. Long-term investor confidence is the key to robust securities markets.

To be clear, investors both retail and institutional are better off now than they were just a few years ago. Competition in today's market, which was virtually absent 5 years ago, has spurred innovation and enhanced investor access. Trading costs, certainly in the

most liquid securities, has been reduced and investors have more choice and control in how they execute their orders.

With that said, over the past several years, long-term investor confidence has been challenged by a series of scandals, financial crises, economic tumult, including most recently the Flash Crash of May 6. In order to recover long-term investor confidence, regulators must ensure that securities markets are highly competitive and efficient as well as transparent, and above all else, fair.

While we laud the gains made in the last years, today's market structure is far from perfect. The events of May 6 brought to the forefront several inefficiencies in the current market structure and highlighted the interdependencies of equity, options, and futures markets. Perhaps most significantly, the events of May 6 underscored the absence of an effective mechanism to dampen volatility at the single stock level. The lack of consistency and synchronization of rules which govern trading at the various exchanges, the outsize impact trading algorithms and small market orders can have on the prices of securities in times of duress, and perhaps not surprisingly, the fact that market-making mechanisms in place today provide virtually no liquidity to investors in times of market stress.

Ruling all instability and volatility from the equity markets is neither possible nor appropriate. However, establishing mechanisms to address extreme price moves in the markets and volatility related to inefficient market structure will be critical in promoting investor confidence in markets going forward. Many of these issues have been addressed or are in the process of being addressed by the regulators. That said, the potential for another May 6 will not entirely be removed from these actions alone. The SEC, CFTC, and SROs must be coordinated, diligent, and measured in their efforts to create sensible regulation designed to minimize the inefficiencies in market structure and advance surveillance and enforcement capabilities to thwart nefarious behavior.

There are today at least 13 for-profit exchanges. Competition between exchanges is fierce, resulting in new innovations and different ways for investors to seek and provide liquidity. This is a welcome development from our perspective, provided that the rules and regulations which govern the various exchanges are consistent and not incongruent with the goals of fairness and equal access for investors.

One potential concern we have about exchange competition is that it has ignited an electronic arms race where speed appears to be the singular objective. While Invesco believes that speed is an important variable to consider in execution of trades, we believe price is the most important variable. Buying stocks at the right price, which is determined through a robust price discovery process, is what long-term investing is all about. There is a point where speed and robust price discovery diverge, a concept that must be understood by exchanges as they race to trade in increments of one-billionth of a second.

There are today also 40 different trading venues, including dark pools, and over 200 broker-dealers who internalize customer orders. This vast network of exchanges and venues has resulted in a very

complicated web of conflicted order routing and execution practices by broker-dealer and execution venues.

We believe that investors need improved information about order routing and execution processes to make better informed decisions. Today, as much as 50 to 60 percent of the trading activity in the U.S. equity markets is attributed to high-frequency traders, HFT. Given the recent ascendence of HFT, there is not a lot known about their practices and very little regulatory oversight.

Invesco believes that there are many beneficial high-frequency trading strategies and participants which provide valuable liquidity and efficiencies to the market. On the other hand, we are concerned that some strategies could be considered as improper or manipulative activity. Some of these strategies, such as the so-called "order anticipation" or "momentum ignition" strategies, provide no real liquidity to the markets or utility in any way. Rather, they prey on institutional retail orders, creating an unnecessary tax to investors. While there has been a recent case brought by regulators against this kind of improper activity, we are concerned that the ability of regulators to monitor and detect nefarious behavior by these participants is not where it needs to be.

Additionally, regulators must address the increasing number of order cancellations in the securities markets. It has been theorized that as many as 95 percent of all orders entered by high-frequency traders are subsequently canceled. Order cancellations relating to making markets is one thing, but orders sent to the market with no intention of being traded is quite another—before they are canceled is quite another. These orders tax the markets' technological infrastructure and under the right circumstances could overwhelm the systems' capacities to process orders, causing massive system failures and trading disruption.

Invesco believes that efficient trading markets require many different types of investors and participants to thrive. That said, it is noteworthy that where the interests of long-term investors and short-term trading professionals diverge, the SEC has repeatedly emphasized its duty to uphold the interest of long-term investors. We need to ensure that there are no abusive practices within high-frequency trading or, for that matter, any other participant in the marketplace which contravene the interest of long-term investors.

I thank you for the opportunity to speak here today and I look forward to answering your questions.

Chairman REED. Thank you very much, Mr. Cronin.

Mr. Luparello, please.

STATEMENT OF STEVE LUPARELLO, VICE CHAIRMAN, FINANCIAL INDUSTRY REGULATORY AUTHORITY

Mr. LUPARELLO. Chairman Reed, Chairman Levin, thank you for the opportunity to testify today. My name is Steve Luparello and I serve as Vice Chairman of the Financial Industry Regulatory Authority. Also known as FINRA, we are the primary independent regulator for securities brokerage firms doing business in the United States. In addition to our work overseeing firms and brokers, FINRA performs market regulation under contract for a number of market centers in the United States. Through this work, FINRA is responsible for aggregating and regulating approximately

80 percent of U.S. equity trading. FINRA's activities are overseen by the SEC, which approves all FINRA rules and has oversight authority over FINRA operations.

Over the last several years, how and where trading occurs has evolved rapidly, as has execution speed, particularly with equity trading. High-frequency trading, dark pools, and direct access are now commonplace and have contributed to the fragmented markets that exist today. Fragmentation and increased competition have resulted in narrow quotation spreads and a high level of liquidity when markets are operating smoothly. However, it can also result in the fast electronic removal of liquidity when markets are stressed, as we all observed on May 6.

The events of that day identified several areas where regulators could take steps to reduce the impact of extreme market volatility and provide increased transparency and predictability in restoring order to the markets following such events. FINRA has participated in these discussions with the U.S. exchanges, under the leadership and direction of the SEC, to establish and implement a number of important changes, as described in my written statement.

While the disruption on May 6 focused attention on high-frequency and algorithmic trading, FINRA had already been scrutinizing trading activity to find attempts to use these technologies to implement manipulative strategies. In September, we fined a New York brokerage firm, Trillium Brokerage Services, and suspended and fined several individuals at the firm for the use of illicit high-frequency trading strategy. Trillium entered numerous layered, non-*bona fide* market moving orders to generate selling and buying interest in specific stocks. By creating a false appearance of buy or sell-side pressure, this strategy induced other market participants to enter orders to execute against Trillium limit orders. As a result of this improper strategy, Trillium's traders obtained advantageous prices that otherwise would not have been available to them.

FINRA is able to pursue instances of this and other illegal trading strategies in the markets we regulate. However, due to the limitation of current audit trails, the risk of missing instances of manipulation, wash sales, abusive short selling, and other improper gaming strategies is still unacceptably large.

With the drop in exchange barriers to entry along with increased competition and connectivity among exchanges and other execution venues, it is clear that market quality can no longer be ensured by a single exchange acting in a siloed fashion. As the SEC correctly recognized in its recent proposal, this evolution of equity markets has created an environment where a consolidated audit trail is now essential to ensuring proper surveillance of and investor confidence in these markets.

FINRA strongly supports the establishment of a consolidated audit trail as a critical step to enhance regulators' ability to conduct surveillance of trading activity across multiple markets. In fact, it is very plausible that certain market participants, knowing the extent of current regulatory fragmentation, now consciously spread their trading activity across several markets in an effort to exploit this fragmentation and avoid detection.

Based on our experience developing and operating the Order Audit Trail System, or OATS, FINRA believes the key aspects necessary to ensuring an effective, comprehensive, and efficient consolidated audit trail are uniform data, reliable data, and timely access to that data by the SROs and the SEC. We also believe that the most effective, efficient, and timely way to achieve the goals of the consolidated audit trail is to expand existing systems, such as OATS, and to consolidate exchange data with discrete new data, such as large trader information, into a central repository. Building off existing systems would significantly reduce both the cost and time required for implementation of a fully consolidated audit trail and integration of that audit trail into surveillance systems.

Significant changes in the financial markets in recent years have necessitated adaptation by regulators across a wide spectrum of issues. Both technological and policy developments have made the practice of regulating the markets a more complex task.

The SEC has correctly identified one of the most pressing challenges for regulators conducting market surveillance. We are all hampered by the lack of a comprehensive, sufficiently granular, and robust consolidated audit trail across the equities markets. FINRA stands ready to work with Congress, the Commission, and our fellow SROs to help bring about a consolidated and enhanced audit trail that will facilitate more effective surveillance for the protection of investors and for market integrity.

Again, thank you for the opportunity to share our views. I would be happy to answer any questions that you have.

Chairman REED. Thank you very much, gentlemen, for your testimony.

I just want to recognize Senator Coons has joined us. As soon as I conclude and Senator Levin concludes, we will recognize him for questions.

I have questions for all the panelists, but let me first focus on the market participants, Mr. Peterffy, Narang, and Cronin. My presumption is that you would feel that the regulators do not have all the information they need at this time. From your perspective, what forms of information, market intelligence, *et cetera,* should they have? And you have listened to both Chairman Schapiro and Chairman Gensler about what they are doing in terms of a consolidated audit trail. Your comments on whether that is adequate, sufficient, or additions. Mr. Peterffy.

Mr. PETERFFY. I agree that they do not have all the surveillance tools that they need. However, I do not think that we should wait for the two or three or 4 years to get this consolidated audit trail for $4 billion. I think that as of tomorrow, they could order U.S. registered brokers to keep an audit trail of their own orders, and most of all, to record the name of the beneficial interest associated with each order. Then if anything happens in the market, they would just go ask the broker, via the exchange, who did this trade? Please send order details tomorrow. It does not cost anything to do that. It can be done today.

Chairman REED. Thank you.

Mr. PETERFFY. Thank you.

Chairman REED. Mr. Narang, your comments?

Mr. NARANG. So in terms of what data, I think, the regulatory bodies could benefit from, I think, absolutely, I support the acquisition of data that helps the regulators engaged in forensic analysis of various types, such as the audit trail, such as the large trader reporting requirement, and I say that as somebody who would certainly be affected by at least one of those.

So that said, I think that there are some lesser known items that could be rather useful, as well. Many people have pointed to the analogy that I think one of you, in fact, said earlier, that the regulators are akin to a moped on a highway dominated by hundred mile-an-hour race cars. The way I would rephrase that in terms of data requirements is that the regulators very much need to be able to see the markets in the same way that its most active participants see it.

So what that means is that they need not just direct data from the exchanges rather than the consolidated view that they see right now via the so-called SIP, or the Standard Information Processor. Those are consolidated feeds. The regulators need the direct data from the exchanges, but they need better than that. They need to be able to synchronize that data in the same way that a high-frequency trader, for instance, would. And that means that they cannot just rely on the time stamps that the exchanges put on their data in order to synchronize them. They need to collect that data over high-speed telecommunications networks themselves and self-time stamp it.

Then, furthermore, both Ms. Schapiro and Mr. Gensler noted the fact that they do not have the ability to efficiently build order books from that quotation data. I think that that is something that is a prerequisite if you are going to have the capability to police modern traders. You know, technologies are out there—firms like ours possess them, for instance—that allow you to very, very efficiently construct order books from quotation data.

Now, the data itself is just the starting point. One of the things that makes me nervous is that the SEC barley has the ability, as far as I can understand, to analyze the data that it already possesses. So adding a hundred to a thousand times more information to that mix is not going to really help matters if their analytical capabilities are not augmented at the same time. And the main thing that the analytical capabilities are missing, as was rightfully alluded to earlier, is the ability to analyze securities based on their correlation.

A tremendous amount—I would say the majority—of the volume that occurs in today's markets is premised upon the fact that securities, both within the same markets and across markets, have semi-stable correlations to each other, so that when price discovery happens in one instrument, it must propagate to other instruments that are correlated to it, and regulators currently have no clue how that works and have no tools to analyze those effects. Those effects are now structural issues and I think that the regulators need to have analytical tools that endow them with those capabilities.

Chairman REED. Thank you.

Mr. Cronin, your comments, please, and then I will recognize Chairman Levin.

Mr. CRONIN. Yes, sir. I would quickly add that I agree that having the information from a regulatory standpoint is helpful. I do tend to agree that being able to analyze the data is fundamental. The other point that is important is that the regulators have to be able to coordinate the information. It seems to me that having the data, even having the ability to analyze, in the absence of pulling all the pieces together is not going to get us where we need to be. This will be an effective deterrent to the extent that it is in place, but as Mr. Peterffy says, I do not agree that we have the kind of time that it sounds like it is going to take. I am not sure we have the financial appetite, either, but this is something that needs to happen.

Chairman REED. Thank you. There will be a second round. Let me recognize Chairman Levin.

Chairman LEVIN. Thank you, Senator Reed.

Mr. Peterffy, you described your worst nightmare, and I think every member of the panel heard that description of your nightmare. I am wondering whether or not the other members believe, as you do, that the nightmare is plausible.

Mr. ANGEL. It definitely could happen, that our market is very complex and there are all kinds of things which can go wrong and Murphy's Law will strike. There will come a time when on a day of heavy trading volume, whether because of some malevolent action, some benign action, or some programming error, something is going to go haywire. This is the nature of complex electronic systems. And just like sometimes our computers crash, our computerized stock network will, as well, and we need to have good safeguards in place to protect us the next time it happens.

Chairman LEVIN. This was not so much a crash based on some glitch; this was an intentional effort on the part of somebody who had as little as $30 to $50 million and a few computers and a couple programmers. In any event, you would agree that that nightmare scenario is plausible?

Mr. ANGEL. Yes.

Chairman LEVIN. Mr. Narang, would you say that you believe it is plausible?

Mr. NARANG. No. I believe it is extraordinarily implausible, and I will explain why. I think there is no doubt that a larger trader could impact the market, but the attribution of that nightmare scenario to a high-frequency trader that controls only $30 to $50 million in capital is utterly preposterous on its face. You can do the math.

You can statistically estimate, as we have done, and we have shared our findings with the SEC that, for instance, the trade by Waddell and Reed on May 6, the $4.1 billion trade, very likely had a price impact of around 2.7 to 2.9 percent, OK, with a reasonable degree of confidence. If you extrapolate from that what a $30 million to $50 million capitalized firm could have done on that same day at that same time, you come up with about three basis points, or three-hundredths of a percent of impact. So it is entirely implausible. A firm like that would exhaust its entire capital base before the market would even notice the movement.

Chairman LEVIN. OK. Mr. Cronin, do you believe a scenario like that is plausible?

Mr. CRONIN. Plausible, yes. Three hundred shares took it from $52 to $100,000.

Chairman LEVIN. OK. Mr. Luparello.

Mr. LUPARELLO. I will fall somewhere between my fellow panelists. I would say it is implausible, but it is not impossible. I think there are structures in place around risk controls in terms of the firms that provide access to the marketplace. It is not a comforting thing just to rely on risk controls of broker-dealers. I think the steps that the SEC has taken in the adoption of its rule around controlling access will go a great way to making that scenario even more implausible and nearly impossible.

Chairman LEVIN. OK. Now, Mr. Peterffy, do you want to comment on Mr. Narang's comment?

Mr. PETERFFY. Yes. You see, with naked access, you do not need to have any capital to send in orders. You send in the orders. The orders are not even seen by the broker. You only need the money the next day, when the clearing broker gets these trades and he says, where is the money? Well, in this scenario, there is a lot of money there because there are imbedded profits as the trader sells them down. But even if there is no money there, it is too late the next day to discover that all this should not have happened. That is why naked access is a problem and that is why these trades should be screened. Now——

Chairman LEVIN. Let me go through your remedies.

Mr. PETERFFY. Yes.

Chairman LEVIN. I am over my time——

Senator COONS. You are fine.

Chairman LEVIN. Well, this may take a few minutes, so I am happy to come back to it.

I would like to go through the remedies, because whether it is plausible, implausible but possible, or at least that much, there are a number of remedies for this that Mr. Peterffy has suggested. One of them is that the ability to submit orders to exchanges should be restricted to brokers that are clearing members. That is one of the suggestions that you make. I am wondering if anybody wants to comment on that, and also on the other suggestion that relates to this, that brokers who are not members of the clearinghouse are allowed to send orders directly to an exchange with the permission or the arrangement of a clearing member broker. They give their permission. All these 5,000 brokers that are not members of the clearinghouse can send orders directly, and you would prohibit that.

Mr. PETERFFY. Yes.

Chairman LEVIN. OK. So there are two suggestions there. Now, let me start with you, Professor Angel. What do you think of those ideas?

Mr. ANGEL. There are a lot of subtleties involved with the proposal to ban anyone but clearing members from putting orders directly into the exchange. Given the economies of scale in clearing, there has been quite a consolidation in the business, so what that would do would be limit direct access only to the very largest Wall Street firms. Do we really want to encourage that kind of consolidation in the industry? So that is one thing to think about.

Also, I could see a clearing member actually providing naked access, and I support the SEC's proposals to get rid of so-called naked access, where a broker is providing a direct pipe without screening the orders first. I think that is the most important thing here, that we have to have the right risk controls in place so that the people who are responsible for the trades know what they are sending into the markets.

Chairman LEVIN. Even if they are doing it through a clearing broker, not being a clearing broker themselves?

Mr. ANGEL. Right. There has to be—you need to have the risk controls in place.

Chairman LEVIN. OK. So, Mr. Narang, your comment on that suggestion.

Mr. NARANG. Yes. I would like to comment on that suggestion and I would also like to comment on Mr. Peterffy's refutation of my refutation. So——

Chairman LEVIN. You know what that is going to produce, though.

Mr. NARANG. What is that?

Chairman LEVIN. You know what the next production will be of that: a refutation of your refutation.

Mr. NARANG. Correct.

Chairman LEVIN. Happily, my time will be up perhaps before that happens.

[Laughter.]

Mr. NARANG. So first of all, I fail to see the need for additional remedies. I think that Mr. Peterffy's scenario, by his own admission, was based on a situation where naked access or sponsored access are in place. We are already at the stage where a ban on sponsored access has been posted to the Federal Register and is due to go into effect within 7 months.

Chairman LEVIN. Would you make that effective immediately?

Mr. NARANG. No, I cannot say that I fully——

Chairman LEVIN. Based on an emergency argument that Mr. Peterffy suggested?

Mr. NARANG. I cannot say that I fully endorse the ban on sponsored access. I can see some of the rationale behind it, but I think that there are some little-known issues that are peripheral to that that are anticompetitive but I think are perhaps above the scope of this hearing.

As for the refutation——

Chairman LEVIN. Nothing is above the scope of this hearing.

[Laughter.]

Mr. NARANG. If you want to keep us for a few hours longer, I am happy to comment on it.

As far as the comment about the capital not needing to be there and risk checks not being applied, that is a little bit misleading because all that naked access means is that risk checks are not done on a pretrade basis. They are still absolutely done on a posttrade basis and there is not much latency between the time a trade occurs and the time——

Chairman LEVIN. That was the "next morning" comment.

Mr. NARANG. No, it is not—no. By posttrade, it does not mean next morning. Posttrade means as soon as the trade happens, your buying power is reduced, OK.

Chairman LEVIN. Do you agree with that?

Mr. NARANG. Brokerage firms monitor your day trade buying power.

Mr. PETERFFY. No, I do not. The fact is that there are many little brokers who provide naked access. There is nobody policing whether they do any screening of orders or not. So some of them, I assume, do posttrade screening. Many of them probably do not.

Chairman LEVIN. OK. I interrupted you, Mr. Narang.

Mr. NARANG. I do not know of any who do not. I think that is a rather hypothetical statement. The point is that posttrade risk checks are nearly universal and adequately prevent people from exceeding their buying power.

Chairman LEVIN. OK. Very quickly, Mr. Cronin, because I am way over my time.

Mr. CRONIN. I am just amused, listening to the whole thing. Like all long-term investors, we get hung up in listening to some of this discussion and kind of scratch our heads and say, you know what, guys? When we are talking about naked access and that kind of thing, we are kind of losing sight of what the goal of the structure and the integrity of markets is. There have to be rules in place to prevent nefarious activity. If we think there is a chance that shutting the door today can contain that, I think we should shut the door today and move on. There are more important things for the world to worry about than the naked and unfiltered access.

Chairman LEVIN. Thank you. Mr. Luparello.

Mr. LUPARELLO. I would have to say Mr. Peterffy's scenario is based on an assumption that a clearing firm is not managing intraday risk. So the idea that only clearing firms should be allowed to trade in that context would be, I think, an odd solution. I do not want to say that every clearing firm is perfect at managing intraday risk, but their economic livelihood is staked on it. Again, I would go back to the recent rulemaking by the Commission which puts some real teeth in what that monitoring means, but as a general matter, clearing firms monitor intraday risk because it is what keeps them open day after day.

Chairman LEVIN. And would you make that rule immediately effective?

Mr. LUPARELLO. I would not. I would assume that there is a fair amount of disruption that would go with that, and in the rare scenario that a clearing firm was mismanaging its intraday risk, to have that much dislocation in that short a period of time, I would worry that the costs would outweigh the benefits.

Chairman LEVIN. Thank you.

Chairman REED. Thank you, Chairman Levin.

We have been joined by Senator Coons, who is the worthy successor to Senator Ted Kaufman, who was one of the, I think, great—I think the right word would be "and persistent" analysts of the whole issue of high-frequency trading's impact on markets, and thank you, Senator Coons, for joining us.

Chairman LEVIN. And made a major contribution——

Chairman REED. A major contribution.

Chairman LEVIN. ——to the bill. I know Senator Kaufman was right in the middle of that famous outbreak, also for the Permanent Subcommittee, an extraordinary contributor to our efforts. And we know that you are right in that capability, as well.

Senator COONS. Well, thank you, Senator Reed, and, Chairman Levin, I hope to be Senator Kaufman's successor in interest both in subject matter interest and interest in terms of representing both the people of Delaware and our country. Senator Kaufman did a great deal of work, I think, to ensure the stability, the transparency, the fairness, and liquidity of our markets following one of the greatest market dislocations we have known. I will report back to him that I had the opportunity to hear one of the first cases of refutation arbitrage that I think I have ever seen in testimony. And I just wanted to focus on a sort of simple question, I think.

Markets' fundamental role in our economy, in my view, is capital formation and serving and protecting long-term investors, and that is sort of part of the purpose of the transparency, fairness, and stability. So my question first to you, Mr. Cronin, if I might, to what degree are you concerned that the markets are no longer serving those functions and that high-frequency trading is detracting from price discovery in a way that undermines those core goals of our markets?

Mr. CRONIN. As I said, Senator, the overall function of the market is much better for investors today than it was, say, 5 years ago. Competition has been enhanced. Our ability to have more control over our orders has clearly been enhanced. And we have seen a reduction in transaction costs.

Now, I will say that that has not been a universal experience. Transaction cost reduction clearly in the top 200 names, I think, given the ubiquitous liquidity that is available now is clear. When we move down the market cap curve, it is not as clear that this market structure is serving the smaller companies in the formation process as well as it could otherwise. So I am confident that the market structure is better today. It can always be better. It will always probably be the case that it could be better.

To the extent that high-frequency trading has entered the market, frankly, we are fairly agnostic. To the extent that the activity has liquidity and does not cause undue dislocation on a given day or week, we are OK. But the problem is that we do not believe that the regulators have the appropriate tools to really understand all the things that go on. We are pretty smart, and we understand a lot that goes on, and I am sure that there are areas that we cannot possibly understand today. So what does concern me is I think there are nefarious activities and participants who are out there who today are taking advantage of investors. That is wrong. If you bring nothing to the party in terms of liquidity or, you know, efficiencies, you shouldn't tax investors. There is no purpose for that.

So we have some concerns about high frequency, but we would have concerns about any participant who is trying to manipulate the market. So we would not single them out necessarily.

Senator COONS. So then just two follow-up questions, and I might ask the members of the panel in my time left to comment on both of these. Some propose there is an IPO crisis that in part is a consequence or an outcome of these short-term strategies.

What linkage do you see between all the dynamics of market fragmentation and the difficulties identified here, particularly in the market sectors that maybe you do not participate in but others? And what is the impact of that on innovation and capital formation for IPOs?

Then just the follow-on question, should high-frequency traders who act like market makers be subject to additional regulations that would help solve that specific problem? If you would, please, Professor.

Mr. ANGEL. Thank you, Senator. I am very glad you are cognizant of the IPO crisis because I think it has serious implications for the long-term growth and stability of our economy. I do not think that high-frequency trading as such is at the root of it. There are many other things in our economy ranging from Sarbanes-Oxley 404, the litigation environment, and other market structure changes that we can talk about if you have a few more hours.

The thing about high-frequency trading is that there is both good and bad computerized trading. All investors these days are using computers basically to do what they used to do manually. And a lot of this is good for the market. For example, a lot of so-called high-frequency traders follow the old strategy of buy on the dip, sell on the rebound. That helps to stabilize prices. And one of the things that happened on May 6th was when the data feeds got scrambled and those people said we cannot trust our data feeds, those people who were stabilizing the market stepped aside and other traders kept on going, causing the market mechanism to fail.

So some high-frequency traders are really good. Others help keep prices in line with each other. If Coke gets out of line with Pepsi, they step in to make sure that those prices stay in sort of the same correlated path. So a lot of what they do is good. I will not say everything they do is good. But we cannot just say, "Ew, high-frequency trading is bad." You know, there are some strategies that may be harmful to the market, but the bulk of them are actually doing things that help the market.

However, I do think we need to pay attention to the smaller cap side of the market because what we have done is we have collapsed transaction costs. We have a one-size-fits-all market mentality at the SEC, and I am convinced that smaller companies actually need a different market mechanism and that having a market mechanism with a very small bid-ask spread for those companies is not necessarily the best market mechanism. And I think we really need to pay a lot of attention to how small companies come to market and how hospitable the market is to them, because that is where our future growth lies and that is where we have a serious crisis on our hands.

Senator COONS. Thank you. I am over time, so if any other members of the panel who want to comment could keep it just on that one question, I would appreciate it.

Chairman REED. Yes, but take your time, Senator.

Mr. PETERFFY. High-frequency traders are not by themselves good or bad. When they provide liquidity, they are good; when they take liquidity, they are not so good. I think this would be very simple to regulate; namely, when a high-frequency trader provides liquidity, it puts in a bid or an offer that does not take up any other

bid or offer. Then that is a useful activity and, therefore, they should be encouraged to do so. They could even be incentivized to become market makers because that is what market makers do. And when they are taking liquidity, which is basically a way of probably front-running statistical relationships that will come back in line, then they should—their order should be slowed by—I suggested a tenth of a second.

Mr. NARANG. I would like to comment on your question earlier about the capital formation process and more generally about the social utility of high-frequency trading, because many people have raised that issue.

I would like to point out that when an investor buys shares of a company in the open market, the proceeds of that purchase go to the seller. They do not go to the company that the stock is written on. No capital is raised for the firm in question when an investor purchases share of that security. In other words, no capital formation happens in the secondary market. The capital formation is the job of the primary market.

The role of the secondary market is exclusively to encourage investors to participate in the primary market by providing them with liquidity. So when you are planning the desirable attributes for a secondary market to have, I firmly believe that there are few, if any, attributes that can trump liquidity. That is the overriding social purpose of a secondary market. It is to support the capital-raising function that occurs in the primary market.

So to the extent that you believe that high-frequency trading is a fixture of our markets in terms of liquidity provision, then you would have to argue that it serves just as much, if not more of a social value than investing in company shares than the secondary market does.

Second of all, on the notion of obligations, my major concern there is that obligations really put us on a slippery slope toward the two-tier market that we had in the 1990s. I think our goal or your goal as policy makers ought to be to keep the good features of the market that have occurred as the markets have evolved and, you know, address or ameliorate the bad ones. In terms of the bad features, we are talking about mostly unbridled fragmentation.

In terms of the good features, I do not think that anyone disputes the fact that markets have gotten more liquid and that spreads have gotten tighter and transaction costs have gone down, and virtually no one disputes the notion that that has happened because the market-making function has been opened up to competition. The two-tiered system that we had was dismantled. Going back to that system would be counterproductive.

Furthermore, I cannot think of any empirical evidence that market maker obligations actually matter in practice. Take the example of May 6th. On May 6th, there was a corner of our industry known as the wholesaling industry which executes the bulk of all retail order flow. Virtually every firm in that industry shut down for business during the Flash Crash and dumped its shares onto the market. That is the one corner of our industry that does have obligations. So it shows you how effective obligations are.

And in 1987, during the great crash in October, Black Monday, market makers took a lot of heat for many, many months in the

press after that event for, quote-unquote, putting their hands down and refusing to take orders.

So the point is that even if you are obligated 99.9 percent of the time to provide liquidity, the 0.1 percent of the time where you will choose not to is precisely at those moments where the market needs it most. So obligations, there is no empirical evidence that such a thing will work. There is empirical evidence that people who request obligations will also request certain privileges that go along with them.

Senator COONS. Well put. Thank you.

Mr. CRONIN. Well, that is a question with a lot of different dimensions. I think that I will try to condense my thoughts to this:

There is always confusion of volume and liquidity in the market. There is without a doubt much more liquidity in the top 200 names than there has been certainly historically. But I am not sure that another 100 million shares trading in Citigroup qualifies as real liquidity in the marketplace. In fact, I do not think it qualifies at all.

So I do think, again, if we were to look at the market in terms of all of the different components of the market, there is clearly the top part which has been functioning and served us very well by the current structure. It is very much less clear in terms of transaction costs—and believe me, we have done the analysis—that the market structure currently is serving the other parts of the market very well.

So I think if there were value in market making—and I think historically market making has been an important part of the efficient market structure—then it is certainly worthy of consideration. I get that nobody wants to catch falling knives. No question about it. We have seen it time and again. However, we are putting in place circuit breakers; we are putting in place some other things that I think could be helpful in those calamitous events that make the provision of liquidity, albeit probably on the small end, at least at some level more orderly and fair than it has been historically, and maybe there is some value in that going forward.

Senator COONS. Thank you.

Mr. Luparello.

Mr. LUPARELLO. It was multipart and there have been multipart responses, so I will just ally myself with the last bit that Mr. Cronin said. I do think there is a place for mandatory liquidity in the marketplace. I think Mr. Narang is right that that mandatory liquidity has not stepped in the way of moving trains, but Kevin is also correct that those trains with certain circuit breakers can only move so far.

So as policy makers continue to analyze the place of high-frequency traders in the marketplace and analyze that tradeoff of in theory liquidity and volatility, I think one of the aspects that has to be looked at in there is: How productive is that liquidity? And how can you put some mandatory obligations back on certain participants in the marketplace?

Senator COONS. Great. Thank you. Thank you very much to the panel.

Thank you, Mr. Chairman.

Chairman REED. Thank you, Senator.

Let me just start the second round briefly, and then I will turn it over to Chairman Levin to conclude the hearing.

It strikes me that one of the, I think, consistent themes of all the panel has been that high-frequency trading has provided some efficiencies in the marketplace, has utility to the marketplace, *et cetera*. But there are high-frequency trading strategies that are dangerous and disruptive and harmful to investors.

And the other point, I think, that emerges is that at this juncture the regulators do not have the ability to understand, even with all the data, these different strategies, and that their focus should be on, let us say, the unfortunate strategies or the perverse strategies, whatever the terminology. Mr. Narang and Mr. Cronin, quickly, is that a fair summary of where you think we are?

Mr. NARANG. First of all, let me say that I certainly agree that there exist high-frequency strategies that perhaps have less social utility than others. I do not now of any high-frequency strategies that are in use or that could even be hypothetically conceived of that are destabilizing to the market system in some way. And the reason I say that is simply a recognition of the fact that virtually every high-frequency trading firm that is out there controls very, very little capital. The largest high-frequency trading firms in the world would not even be medium-sized hedge funds in terms of the capital they control.

So the point is it takes capital to move markets. Markets move because of buying pressure or selling pressure. The buying pressure or selling pressure in any fixed unit of time that is sufficiently long is roughly equal for a high-frequency trading firm. That is what makes them have high frequency. The high frequency refers to their holding period. So if your holding period is only 1 minute, what that means is that in a minute on average you buy and sell the same number of shares. You cannot have a protracted or permanent effect on a stock's price when you do that.

So that virtually rules out the possibility of destabilization, barring some hitherto unknown accidental bug that occurs. But I think your question focused more on intentionality, so from an intentionality perspective, I would say that, yes, high-frequency strategies, like any other strategies, run the gamut in terms of what value they provide. But I do not know that markets should be policed based on some sort of subjective assessment about how much value a participant is adding to the market. I think that all that should happen is that rules should be obeyed, that, you know, make sure there is a level playing field, and that the markets are fair.

What I will tell you is that even though I am a high-frequency trader, there are definitely unfair aspects of the market structure today that favor certain participants over others.

Chairman REED. Well, thank you. First of all, I think you have illustrated there are at least two issues at play here: stability of the markets and fairness of the markets.

Mr. NARANG. Yes.

Chairman REED. The markets could be very stable but very unfair to participants, some participants, and grossly overcompensating on this, but I think it is an important point.

But, Mr. Cronin and Mr. Peterffy, just your quick comments, and then I want to——

Mr. CRONIN. So I would submit there is one other dimension other than buy and sell, and that is quote.

Chairman REED. Right.

Mr. CRONIN. Why are there participants allegedly quoting one stock 4,000 times in a second? What is the intention there? So I do believe that there is activity that goes on that is trying to get institutional or retail orders to react without, in fact, taking the risk of taking an offering or hitting a bid. I think that is out there, and it certainly needs to be looked at.

Chairman REED. Mr. Peterffy, please. Quickly.

Mr. PETERFFY. The risk of systemic disaster caused by disruptive trades is very real. There is no justification for continuing naked access. We should stop it now. It costs nothing to stop it. Only irresponsible, undercapitalized brokers support naked access, and there is no justification for continuing it.

Chairman REED. Thank you.

Mr. PETERFFY. If I may just say, I have never heard of Mr. Narang before, and as far as I know, his reputation is impeccable.

[Laughter.]

Chairman REED. Well, thank you very much.

Mr. NARANG. I second that thought.

Chairman REED. One of the interesting things about this hearing is it has raised more questions than it has answered, and that is a good hearing in my book, because this is a very extraordinarily complicated topic, and you have all shed so much light on it.

There is one other issue here, and that is, Mr. Narang made the point that, you know, primary markets form capital. Professor Angel made the point that the primary market, the IPOs, seem to be diminishing, the public companies are diminishing, *et cetera.* So is there a contradiction between this very successful, if you will, secondary market, highly liquid, *et cetera,* but the fact that it is not generating the kind of capital formation that puts people to work, *i.e.,* the classic, which always—I did not understand and I probably still do not, the real economy versus the financial economy? And we talk about high-frequency trading and naked access, you know, that is the financial. The real economy is: Do I have a job? Do I have capital to expand my business, *et cetera*?

So if you can just comment briefly on that, Professor Angel.

Mr. ANGEL. Sure. We have—I call it the best of times and the worst of times, just like in Charles Dickens. For the most liquid stocks, the big stocks, it really is the best of times. By almost any measurable dimension of market quality, the market for Microsoft, IBM, and Citigroup is very liquid, very cheap, very fast. It works really well. But when you get into the smaller stocks, you have liquidity drying up. I mean, it is better than it was 10 years ago, but still a lot of smaller companies just say, hey, it is not worth it to access the capital markets, whether because it is the high cost of being a public company with all the compliance requirements or the fact that the capital market is not recognizing the value of these enterprises.

Now, we need good secondary markets to provide exits for the people who buy in the primary market. But we also need the IPO

market to provide exits for the entrepreneurs who build the companies, and we really need to pay a lot of attention to what is going wrong here. There is no one magic bullet here. But it is a serious crisis.

Chairman REED. Well, Mr. Narang, very quickly.

Mr. NARANG. I appreciate it. I think that the Committee would be well served to solicit the testimony of venture capitalists on this topic, and I am confident that what they would tell you is that the main reason why companies are not seeking to go the IPO route is because the stock market has been roughly flat for the past 10 years, and a better exit for companies is to sell their firm to Google or some other big public company than to list themselves. So, in other words, economic conditions clearly have a lot more to do with the state of affairs when it comes to listing companies than, you know, the health of the secondary market.

The second thing I would say is that it has also been shown, I believe, that other exchanges across the world are perhaps more competitive than the United States because of regulations such as Sarbanes-Oxley and other regulations that you have to comply with if you are listed in the United States. So that is another thing that I think ought to be studied.

Chairman REED. Thank you all very much for excellent testimony and participation.

Chairman Levin, thank you.

Chairman LEVIN. OK. Thank you again, Senator Reed, for all you have done in this area and for today's hearing, too. Doing this jointly with you and your staff has been very, very useful to us, and I hope also to the Senate, in its considerations.

I have some additional questions which I am going to be asking of you, so let me start with Mr. Luparello and then go down the line. I think most of you, if not all of you, have said that the trading across multiple market venues has made it necessary for the regulators to have information from those same venues in order to effectively regulate or police potentially manipulative trading. They just cannot look at activity on their own trading platform.

First of all, do you agree with that?

Mr. LUPARELLO. A hundred percent.

Chairman LEVIN. Does anyone disagree with that?

[Witnesses shaking heads.]

Chairman LEVIN. OK. So I will shorten that.

Now, when it comes to the manipulative trading that exists in the view of some, I think many, between platforms, including phony bids and layering strategies or other strategies, let me start now with you, Mr. Cronin. Have you observed what appears to be manipulative, same-day trading between platforms?

Mr. CRONIN. I have not directly. Anecdotally, certainly I have heard about different things, but not really so much across platforms. For example, if you are talking about the futures exchange relative to the underlying, I have not.

Chairman LEVIN. OK. But you have heard anecdotally about such——

Mr. CRONIN. Yes.

Chairman LEVIN. OK. Mr. Narang.

Mr. NARANG. Look, there is little doubt that that stuff happens. You know, I was a treasury market maker in the mid-1990s making markets on long bonds for a primary dealer, and it was very common in those days for traders to "paint the screens"; in other words, to show buying interest on the screens when, in fact, they were sellers. That is not a new practice, and it really has nothing to do with computers or automation. In fact, I would hasten to add that those sorts of strategies really are the domain of human beings because they cannot be modeled, they cannot be simulated. You cannot model the effect of what would happen if you show a large quote. And that is why, you know, everyone—I was a little bit disturbed when the Trillium example which everyone points to occurred, and it was immediately blamed on high-frequency traders. Trillium was a firm, as far as I understand, that consisted of human day traders, and the fact that they held their positions on an intraday basis should not immediately paint everybody who does that with a bad brush. The point is that these sorts of strategies are psychological in nature, and humans have no—computers have no capacity to run those sorts of things. That is on a theoretical level.

On a practical level, one of the benefits to the market of computerized trading that is not discussed very much is the fact that it leaves a very, very concrete paper trail. So the forensic analysis is readily doable when algorithmic traders are participating in the market. So because of that, you know, computerized algorithms have a very concrete recipe that is written down. It is discoverable; it can be subpoenaed. So it would be remarkably foolish for somebody who is intending to engage in manipulative activity to do that with an algorithm. That is something that is best done by human beings, and for all practical purposes, I know of no example that has been discovered thus far of manipulative activity being done by a computer.

Chairman LEVIN. Putting aside how it was done—that was not part of my question.

Mr. NARANG. Sure.

Chairman LEVIN. My question was whether or not——

Mr. NARANG. I have no doubt that it is done, but I do not know of any concrete examples.

Chairman LEVIN. OK. So you have not observed manipulative same-day trading between platforms?

Mr. NARANG. No, but I would virtually guarantee that it occurs.

Chairman LEVIN. OK. Mr. Peterffy.

Mr. PETERFFY. We see that happening all the time, but I do not believe that that should be such a great concern. It is bad, but we have much, much worse situations to deal with at this time. But I am suggesting here that each broker keep on record the identity of a person associated with each order so if there are any orders that are questionable, they can be easily identified by the regulators across the different exchanges.

Chairman LEVIN. Let me call on Professor Angel before I go back to that point. Do you have a comment on my last question about whether or not you believe that manipulative same-day trading between platforms exists?

Mr. ANGEL. Well, there are two types of manipulation. There is the old-fashioned manipulation like order ignition where you dump a big sell order in the market trying to push the price down to scare other people and trigger all the stop orders. That does not really depend on the platform. And, indeed, a lot of traders do not pay any attention to the platform. They just send an order to someone like Mr. Peterffy, and his very good smart router figures out where to get best execution for that order.

There is a lot of trading, a lot of good trading, and a lot of manipulative trading that does not really pay attention to the platforms.

Now, is somebody actually trying to say, OK, I am going to put this order into this exchange versus that exchange because nobody will notice?

Chairman LEVIN. The regulators do not have such automatic access.

Mr. ANGEL. Well, actually the Intermarket Surveillance Group feed actually does consolidate the data. So if somebody is trading, the folks over at FINRA can very quickly through an electronic blue sheet figure out who did what. They just cannot put together the order books to figure out the strategies, and that is why they need better data.

Chairman LEVIN. And that is why it takes an awful lot of time to put together these studies and these analyses?

Mr. LUPARELLO. That is certainly one of the reasons. But another reason is that the quality of data we get for the purposes of running surveillance is fragmented and incomplete, and that prevents us from looking at activity across markets.

Chairman LEVIN. And that is what I want to ask you about next. That fragmented and incomplete information, what is not included in the information, is the beneficial owner or the person putting the order in. Is that correct?

Mr. LUPARELLO. It is a variety of things. At this point, you still have the equities markets being regulated somewhat in siloed fashion. We are in the process of aggregating our current regulation of the over-the-counter market and NASDAQ and adding in the New York Stock Exchange regulated markets, which will give us a much closer to complete picture of the equities trading. But options markets are still done in a siloed fashion, and options and equities obviously are still done in that way. So a consolidated audit trail I think is the necessary step to getting to an ability to look at these things happening across markets on a real-time basis.

Chairman LEVIN. And are broker-dealers required to report the executing broker or the customer information?

Mr. LUPARELLO. At this point executing broker, but not customer information.

Chairman LEVIN. At this point.

Mr. LUPARELLO. At this point.

Chairman LEVIN. Is that useful?

Mr. LUPARELLO. Customer information is certainly useful, I think especially if you are looking at it not from maybe necessarily every customer but certainly at the large trader thresholds that the SEC has proposed. It is certainly a very useful bit of information for everybody.

Chairman LEVIN. And is that in the works?

Mr. LUPARELLO. Well, I think Chairman Schapiro alluded to developments in the consolidated audit trail that I cannot speak to but one would hope that anything that came out of consolidated audit trail was not just the merger of the data at the executing level, but the inclusion of some level of more granular customer data.

Chairman LEVIN. And what about the stock exchanges? You do not look at them, right?

Mr. LUPARELLO. No, we do.

Chairman LEVIN. Do you get that same information from them?

Mr. LUPARELLO. Yes. The way it currently works and the way it would work in a consolidated audit trail is the merger of the data not just at the executing levels but also the exchange order books, and that is absolutely essential.

Chairman LEVIN. And that is where the name of the customer would be useful as well?

Mr. LUPARELLO. Yes, absolutely.

Chairman LEVIN. OK. Does anyone want to comment on that?

Mr. CRONIN. Can I just add on the customer information?

Chairman LEVIN. Yes.

Mr. CRONIN. While we completely support the idea of having the information in the regulators' hands, obviously that is very sensitive and privileged information that if there was any leakage of could have very bad consequence to our clients and shareholders, so we would just make sure, while this data is being collected and for the right purposes, that it is secure and that we do not read about WikiLeaks or anything else with our positions because that would be catastrophic to our clients.

Chairman LEVIN. OK. But subject to that, you would agree with Mr. Luparello that——

Mr. CRONIN. Yes.

Chairman LEVIN. ——the regulators have got to have access to that information?

Mr. CRONIN. Yes.

Chairman LEVIN. OK. Mr. Luparello, is FINRA currently investigating activities involving foreign-owned accounts that are held at U.S. broker-dealers located in other countries?

Mr. LUPARELLO. Our jurisdictional limitations make that difficult and it is an area that we are quite concerned about. Broker-dealers obviously have customers, some based in the U.S., some based abroad. In addition, sometimes those customers are just a holding entity that sits above a network of other customers. Since our jurisdiction only goes to the broker-dealer and our ability to compel that first level of information, investigations that we have get stopped at that level, and if there is an ongoing concern of illegal conduct, that will result in a referral to the SEC.

Chairman LEVIN. All right. But you basically have difficulty investigating foreign accounts that you suspect of trading abuses—for the reasons you give, and also because you cannot get clients' names.

Mr. LUPARELLO. Yes. Well, we can get clients' names in the course of an investigation. So if we are doing an investigation, we will ask the firm for client names. They will provide that to us. Our

ability to compel either financial information or testimony from customers is what limits us, and that is true whether they are domestic customers or international customers. Obviously, the ability of the SEC, then, to reach those international customers creates yet another layer of complexity.

Chairman LEVIN. On the same point about foreign banks, Mr. Luparello, is it true that foreign banks that open accounts with U.S. broker-dealers are not required to disclose the names of their customers to U.S. broker-dealers?

Mr. LUPARELLO. U.S. broker-dealers have an obligation to know their customer and that comes out in a variety of different other requirements including, importantly, antimoney laundering. What exact requirements those U.S. broker-dealers have to know not just the customer but the customer of a customer is an area that has been somewhat vague over the years.

I think, again, I would point to what the Commission has put forward in terms of its rulemaking, it is mostly around sponsor and naked access, but could potentially be used to add some greater teeth to those "know your customer" requirements because there is that concern that actually the customer of the broker-dealer is just a holding entity for the real customer sitting behind that. That construct actually exists in the U.S., too, and in some master/subaccount scenarios that we try to look through to have the customer of the customer be treated as a customer of the broker-dealer. I think there is both further interpretive rulemaking and enforcement that needs to be done in that area.

Chairman LEVIN. Mr. Narang, you made reference to certain unfair aspects that exist to some participants. Can you expand on what those unfair aspects are?

Mr. NARANG. Yes. They are a little bit esoteric, but I will do my best. Basically, in the United States equity markets, the vast majority of exchanges observe what is known as price/time priority. That means that orders that arrive at the exchange at a particular price get first priority to execute against inbound orders based on their arrival time. If your order arrives before mine, then somebody who wants to trade at that price actively will give you a fill before they give me a fill.

Now, because of some technicalities associated with Regulation NMS, particularly in Rule 611, the so-called Order Protection Rule, the long-term investors who are attempting to trade and form a new price in the process very often lose their priority to certain proprietary trading firms that have the ability to utilize a specialized kind of order known as intermarket sweep orders. And so what happens is that price/time priority gets violated.

Now, you can empirically calculate what price/time priority is worth. It is worth a lot of money. So there is a massive transfer of wealth underway from long-term investors who are executing the VWAP algorithms or just old-fashioned techniques into the pockets of certain high-frequency traders who actively utilize that capability.

I do not think that those high-frequency trading firms should be faulted for utilizing that capability because there is no intentionality behind that. What happens is that when a long-term investor goes to take an offer and post a bid at the new price, the

exchange will hold up that bid until the price is formed by somebody who is using an ISO order. So the user of the ISO order does not need to know why it is happening. They just need to know that there is a two-cent spread now and they want to tighten the spread.

So the high-frequency trader who is doing that is acting in the interests of the market as well as his own interests, but that is not a fair proposition. That is one of the few unfair aspects of market structure that I know about. The other is the tiering of rebates. The exchanges tend to give much higher liquidity rebates—not all of them, the BATS Exchange is a notable exception—but many other exchanges give higher rebates, liquidity rebates, to their most active traders than they do to smaller traders, and I think that is an anticompetitive practice and ought to be seriously examined.

By and large, I do not want to give the impression that the equities market is unfair. I think that this is one of the fairest markets in the world and one of the most well functioning. That does not mean it is perfect.

The glitch in Rule 611 that I mentioned to you is the very same glitch that is responsible for all the market fragmentation that we have seen. This very same rule is what causes exchanges to route orders to other exchanges rather than posting them if they appear to walk the exchange's notion of the national best bidder offer. That creates an economic incentive for new exchanges to spring up that never existed before Regulation NMS went into effect because they have the ability to virtually be guaranteed to get order flow from other exchanges. That is why the market centers have proliferated to the extent that they have since Regulation NMS went into effect in 2007.

Chairman LEVIN. Thank you. Just one last question of Mr. Luparello. Our first panel was asked a question by me about—and I believe you were here during that question—about what appeared to be an attempted short squeeze by Goldman traders using credit default swaps that bet against mortgage-backed securities. You were here during that?

Mr. LUPARELLO. I was.

Chairman LEVIN. If a FINRA member were to attempt a short squeeze, was unsuccessful in it—this, to me, is an intended manipulation—would FINRA typically investigate this activity to determine whether it violated FINRA rules, such as the FINRA rule about, quote, "high standards of commercial honor and just and equitable principles of trade"?

Mr. LUPARELLO. Absolutely. That scenario, and I was not privy to the facts before this, and I think there is probably a question about whether those were securities at the time, but that fact pattern in the current environment—trading practices that had a specific manipulative intent behind them, irrespective of the success or failure of that, would be something that would be investigated and we would think could, with the right facts, run afoul of our rules.

Chairman LEVIN. Does anybody want to add anything before we bring our hearing to a close?

Mr. ANGEL. I would just like to thank the Chairman for investigating these very important issues. I was very impressed by the

eloquence and basically high quality of your opening speech and I just want to urge you to keep up the good work.

Chairman LEVIN. Well, I am glad we gave you that opportunity to say that.

[Laughter.]

Chairman LEVIN. Does anybody else want to—no, I had better stop while I am ahead.

[Laughter.]

Chairman LEVIN. Thank you all. We have a good number of letters from two exchanges, which we will make part of the record.

There may be some questions that we would like to ask each of you for the record that may come to you. You are not obligated to answer them, but we sure would appreciate your answers.

We will stand adjourned, again, with our thanks to each of you, not just for your testimony and your direct answers, but also for very graciously being allowed to be moved about to satisfy a very crazy Senate schedule. I will not say it is unusual. Crazy is usual. But thank you.

[Whereupon, at 6:20 p.m., the hearing was adjourned.]

[Prepared statements, responses to written questions, and additional material supplied for the record follow:]

PREPARED STATEMENT OF CHAIRMAN CARL LEVIN

Today, U.S. capital markets, which traditionally have been the envy of the world, are fractured, vulnerable to system failures and trading abuses, and are operating with oversight blindspots. The very markets we rely on to jump start our economy and invest in America's future are susceptible to market dysfunctions that jeopardize investor confidence.

I would like to thank Chairman Jack Reed, his ranking Member Senator Bunning, and all our colleagues from the Securities, Insurance, and Investment Subcommittee who have already held hearings on these issues and welcomed our Subcommittee to join with them today to shine a light on problems that threaten U.S. market stability and integrity.

Fractured Markets. The first fact we need to grapple with is that our markets have changed enormously in the last 5 years. In the past, most U.S. listed stocks were traded on the New York Stock Exchange or the Nasdaq. Seven years ago, the New York Stock Exchange alone accounted for about 80 percent of the trades in its listed stocks. But today, less than 25 percent of the New York Stock Exchange listed stocks are traded there. What happened? Stock trading now takes place, not on one or two, but 13 stock exchanges.

This chart, Exhibit 1, shows how the U.S. stock market has fractured. Stock trading now takes place on 13 exchanges as well as multiple off-exchange trading venues, including 3 Electronic Communication Networks, 36 so-called "dark pools," and over 200 registered "broker-dealer internalizers."

Electronic Communication Networks or ECNs are computerized networks that enable their participants to post public quotes to buy or sell stock without going through a formal exchange. Dark pools, by contrast, are electronic networks that are closed to the public and allow pool members to buy and sell stock without fully disclosing to each other either their identities or the details of their prospective trades. A broker-dealer internalizer is a system set up by a regulated broker-dealer to execute trades with or among its own clients without sending those trades outside of the firm. These off-exchange venues are increasing their trading volumes, most use high speed electronic trading, and they escape much of the regulation that applies to formal stock exchanges.

These new trading venues didn't appear out of thin air. They are largely the result of Regulation NMS which the SEC issued in 2005. Some call the resulting new world of on and off exchange trading a model of competition. Others call it a free-for-all that defies oversight and is ripe for system failures and trading abuses. In reality, both descriptions have some truth. Trading competition has led to lower trading costs and faster trading, but it has also opened the door to new problems.

System Failures. One of those problems involves system failures, of which the May 6 flash crash is the most famous recent example. On that day, out of the blue, the futures market suddenly collapsed and dragged the Dow Jones Industrial Average down nearly 700 points, wiping out billions of dollars of value in a few minutes for no apparent reason. Both the futures and stock markets recovered in about 20 minutes, but left investors and traders in shock. After 5 months of study, a joint CFTC–SEC report has concluded that the crash was essentially triggered by one large sell order placed in a volatile futures market using an algorithm that set off a cascade of out-of-control computerized trading in futures, equities, and options. That one futures order, placed at the wrong time, in the wrong way set off a chain reaction that damaged confidence in U.S. financial markets.

In some ways, the May 6 crash was a high-speed version of the 1987 market crash, where a sudden decline in the futures market led to a corresponding collapse in the broad stock market which led, in turn, to crashes in individual stocks. And it is not the only type of system failure affecting our financial markets. So-called "mini flash crashes," in which one stock suddenly plummets in value for no apparent reason have become commonplace. On June 2, 2010, for example, shares in Diebold Inc., a large Ohio corporation, suddenly dropped from about $28 to $18 per share. The stock recovered, but the company was left trying to understand and explain what happened. Even after the SEC initiated a pilot circuit breaker program after the May 6 crash, at least 15 other companies have had similar experiences, including Nucor, Intel, and Cisco. A former senior Nasdaq executive told the Subcommittee that the Nasdaq exchange has experienced single-stock flash crashes 5–6 times per week. The New York Stock Exchange and FINRA told us these crashes are commonplace and attribute them to various glitches in computerized trading programs.

Single-stock crashes might seem to be a minor problem, but what happens if the security that crashes is a basket of stocks or commodities? On November 29, 2010, 3 of the top 5 equities traded by volume were actually baskets of stocks. If a basket

of stocks or commodities crashes in value, what happens to the underlying financial instruments? Uncontrolled electronic trading and cascading price declines in multiple trading venues, including in futures, options, and equities markets, could be the result—another May 6th.

Many investors, by the way, are not waiting around to find out if our regulators have fixed the problem. According to the Investment Company Institute, each month since May, more investors have fled our markets, pulling billions of dollars of U.S. investments.

Trading Abuses. System failures are not the only problem raised by our fractured markets. Another problem is their increased vulnerability to trading abuses. Traders today buy and sell stock on and off exchange, simultaneously trading in multiple venues. Traders have told my Subcommittee that orders in some stock venues are being used to affect prices in other stock venues; and that futures trades on CFTC-regulated markets are being used to affect prices on SEC-regulated options and stock markets. Some traders are also using high speed trading programs to execute their strategies, sometimes submitting and then cancelling thousands of phony orders to affect prices.

To get a sense of the trading activity today, take a look at this stack of paper. This stack, nearly 5 inches high, contains the actual message traffic generated in the futures, options, and equity markets with respect to one major U.S. stock over the course of one second of time. One stock, in one second, produced over 29,000 orders, order modifications, order executions, and cancellations in all three markets. This stack shows in black and white how traders are now analyzing trades in all three markets at once, evidencing how the futures, options, and equity markets are interconnected. Imagine the same stack multiplied countless times, filling this entire hearing room, and the interconnectedness of the markets as well as the potential for system failures and trading abuses becomes alarmingly clear.

One well known trader, Karl Denninger, recently made this public comment about U.S. trading activity:

> Folks, this crap is totally out of hand. And it's now a daily game that's being played by the machines, which are the only things that can react with this sort of speed, and they're guaranteed to screw you, the average investor or trader. Go ahead, keep thinking you can invest. (Emphasis omitted.)

Regulatory Barriers. While fractured markets and high speed trading are causing new problems and forms of manipulation, they are also leaving our regulators far behind. Traders are equipped today with the latest, fastest technology. Our regulators are riding the equivalent of mopeds going 20 mph chasing traders whose cars are going 100 mph.

Our regulators are confronting at least four challenges. The first is the fact that each trading venue today has its own infrastructure, rules, and surveillance practices. Besides the expense and inefficiency involved, no regulatory agency has a complete collection of trade data from all the venues, much less a single integrated data flow allowing regulators to see how orders and trades in one venue may affect prices in another.

Second, even if regulators had an integrated data flow, the current data systems fail to identify key information, including the names of the executing broker and customer making the trades. That means regulators can't use the electronic records to, for example, trace trading by one person or set up alerts to flag trades. Instead, before any trading analysis can start, regulators have to figure out the broker and customer behind each trade. Patterns of manipulation are hidden.

The third problem is that the SEC has no minimum standards for automated market surveillance by Self-Regulatory Organizations (SROs), and the quality of those efforts is apparently all over the map. Recent SEC examinations of certain exchanges have found, for example, some ineffective surveillance systems that were unable to detect basic manipulations or used such restrictive criteria that they failed to flag suspect activity, exchanges that failed to review some surveillance alerts, and exchanges with only rudimentary or under-budgeted investigative, examination, and enforcement programs.

The fourth problem is that the SEC and CFTC have not set up procedures to coordinate their screening of market data to see if trades in one agency's markets are affecting prices in the other's markets. Given the strong relationships between the futures, options, and equities markets, joint measures to detect intermarket trading abuses are essential.

The impact of the regulatory and technology barriers is demonstrated by the fact that it took the CFTC and SEC 5 months of intense work to figure out what happened over a few minutes on May 6. In addition, over the past 5 years, there have been few meaningful single day price manipulation cases. One recent case involves

a small trading firm, Trillium Trading LLC, which apparently used phony trading orders to bid up the price of several stocks. In that case, FINRA found that, over a 3-month period in 2006 and early 2007, Trillium submitted phony orders in over 46,000 manipulations, netting gains of about $575,000. Apparently, the victims of the price manipulation got annoyed enough to research the manipulative trading and hand over the data to FINRA. Even then it took FINRA 4 years to reconstruct the order books, prove who was behind the trades, and resolve the matter. Trillium and its executives recently settled the case by agreeing to pay over $2.2 million in fines and disgorgements.

Traders and regulators have told my Subcommittee that Trillium is not the only company that has engaged or is engaging in price manipulation in U.S. financial markets. In fact, one of the more chilling examples involves suspect trading involving traders located in China. Are overseas traders trying to manipulate U.S. stocks? Our regulators are currently unequipped to find out.

Solutions. The May 6 flash crash and the Trillium case provide powerful warnings that we need to strengthen U.S. oversight of our financial markets to restore investor confidence. Much needs to be done. Recent actions by the SEC to prohibit phony quotes, impose single issue circuit breakers, and set up a consolidated audit trail are important advances. But there is a long, long way to go, particularly with respect to coordinating market protections and surveillance across market venues, and across the futures, options, and equities markets.

There also needs to be a greater sense of urgency. The SEC's proposed consolidated audit trail is expected to take years to put into place and won't cover all the relevant products and markets. Requiring executing broker and customer information—an essential component to effective oversight—is in limbo pending completion of the consolidated audit trail, as is integrating the trade data from multiple trading venues. Integrating trading data and market surveillance of the futures, options, and equities markets by the CFTC and SEC isn't even on the drawing board.

I hope this hearing will help inject greater urgency into strengthening U.S. oversight of our fractured, high speed markets to restore investor confidence.

Exhibits 1–5 Submitted by Chairman Carl Levin

EXHIBITS

JOINT HEARING

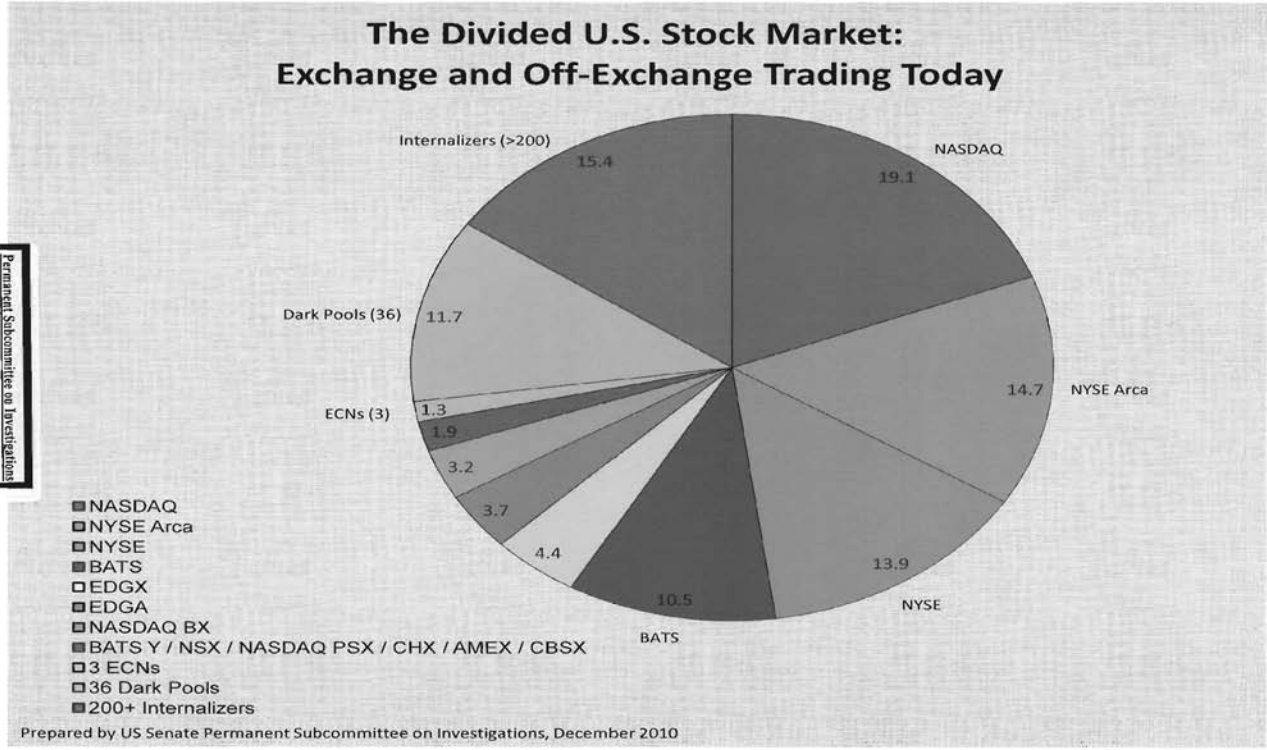
SUBCOMMITTEE ON SECURITIES, INSURANCE, AND INVESTMENT
Committee on Banking, Housing, and Urban Affairs
and
PERMANENT SUBCOMMITTEE ON INVESTIGATIONS
Committee on Homeland Security and Governmental Affairs

EXAMINING THE EFFICIENCY, STABILITY, AND INTEGRITY OF THE U.S. CAPITAL MARKETS

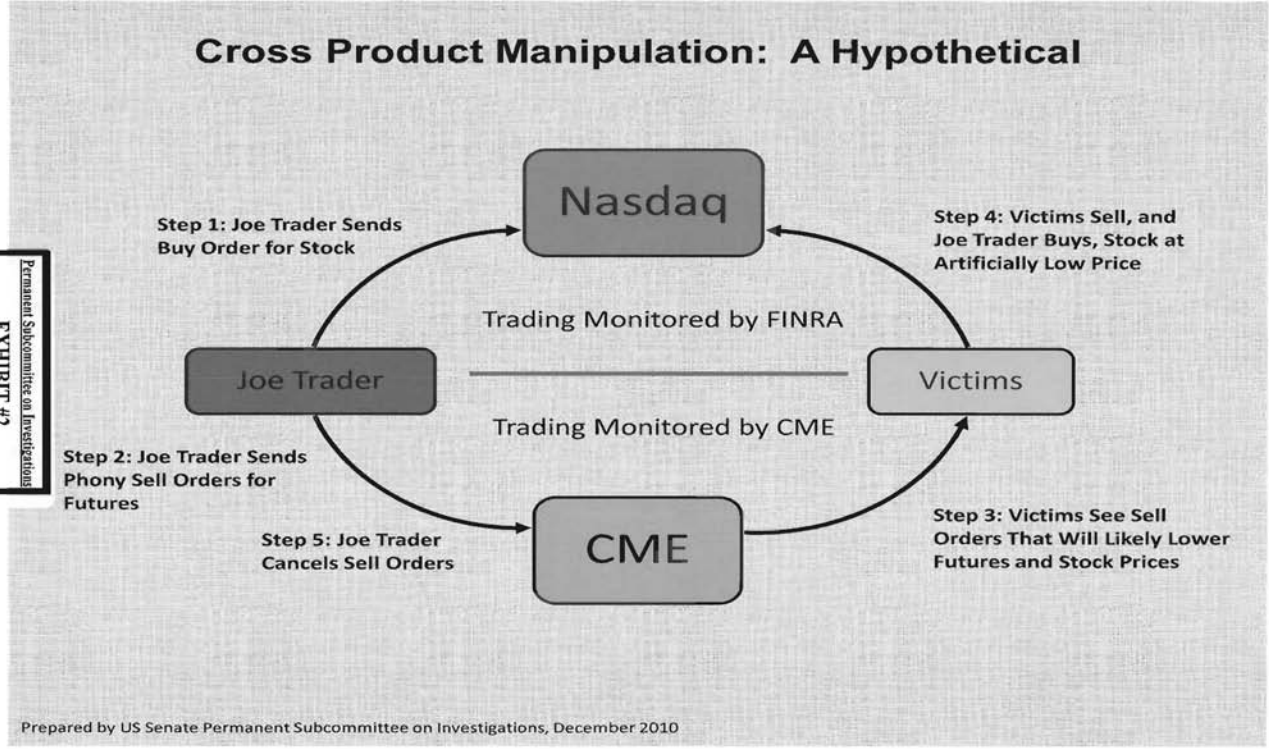
☆ ☆ ☆

Wednesday, December 8, 2010
538 Dirksen Senate Office Building

Permanent Subcommittee on Investigations
EXHIBIT #1



Permanent Subcommittee on Investigations
EXHIBIT #2



Redacted by the
Permanent Subcommittee on Investigations

FIXED INCOME, CURRENCY AND COMMODITIES INDIVIDUAL REVIEW BOOK

Reviewee : Salem, Deeb A

Permanent Subcommittee on Investigations
EXHIBIT #3a

Title : VP
Review Criteria : FICC-Vice President
Business Unit : Mortgages
Department : SPG Trading
Region : Americas
Date of Hire : 16-JUL-01
Primary Manager : Swenson, Michael J
Co - Manager 1 : Lehman, David A
Co - Manager 2 : Birnbaum, Josh S
Co - Manager 3 :
Co - Manager 4 :
Mentor :

THE PURPOSE OF THIS REVIEW MATERIAL IS FOR PERSONAL DEVELOPMENT. IT IS NOT INTENDED FOR DISCLOSURE OUTSIDE THE FIRM.

Title Description: VP=Vice President/Executive Director; AS=Associate; AN=Analyst; EX=Exempt; NX=Non-Exempt

As you review feedback information, you should be alert to instances in which an individual has received an unusually negative comment or low score on the "Compliance" or "Diversity and Equitable Treatment" questions. Please consider whether the response requires follow-up, including consultation with a more senior manager, a Compliance professional, Employee Relations representative or other individuals.

VI. Self Evaluation (Continued)

Self Evaluation

Review Criteria	Comments
Overall Performance	1. General Trading Acumen: Redacted by the Permanent Subcommittee on Investigations In May, while we were remained as negative as ever on the fundamentals in sub-prime, the market was trading VERY SHORT, and was susceptible to a squeeze. We began to encourage this squeeze, with plans of getting very short again, after the short squeezed caused capitulation of these shorts. The strategy seemed do-able and brilliant, but once the negative fundamental news kept coming in at a tremendous rate, we stopped waiting for the shorts to capitulate, and instead just nihilated shorts ourselves immediately. I also respect liquidity tremendously. When the desk needs to add or reduce a position, I focus more on optimizing the likelihood of getting desired size of the trade and less on optimizing the price of each individual trade. Redacted by the Permanent Subcommittee on Investigations 2. My attitude: Redacted by the Permanent Subcommittee on Investigations 3. Obviously the most important aspect of my 2007 and my contribution to the firm has been the desk's P&L. Redacted by the Permanent Subcommittee on Investigations

From: Swenson, Michael
Sent: Friday, May 25, 2007 12:08 PM
To: Chin, Edwin; Salem, Deeb
Subject: Re:

We should be offering sn protection down on the offer side to the street on tier one stuff to cause maximum pain

----- Original Message -----
From: Chin, Edwin
To: Bhavsar, Avanish R
Cc: Swenson, Michael; Salem, Deeb
Sent: Fri May 25 11:41:59 2007
Subject: RE:

We can offer protection on the following mezz CDO names @ 795 as a package. Levels good up to 10MM each.

Deal Name	Tranche	Rating	Issuer	Ref Ob	Px Date
BFCGE 2006-1A	A3L	A	BFC Genesee CDO Ltd	BFCGE 2006-1A A3L	Feb-06
BWIC 2006-1A	C	A	Broadwick Funding Ltd	BWIC 2006-1A C	Apr-06
CAMBR 6A	D	A	Camber	CAMBR 6A D	May-06
CRNMZ 2006-1A	5	A	Cairn CRNMZ 2006-1A 5		Aug-06
CRNMZ 2006-2A	C	A	Cairn CRNMZ 2006-2A C		Oct-06
DUKEF 2006-10A	A3	A	Duke Funding Ltd	DUKEF 2006-10A A3	Apr-06
ETRD 2006-5A	A3	A	E*Trade CDO I	ETRD 2006-5A A3	Aug-06
GLCR 2006-4A	C	A	Glacier Funding CDO Ltd	GLCR 2006-4A C	Mar-06
HGCDO 2006-1A	C	A	Hamilton Gardens CDO Ltd	HGCDO 2006-1A C	Sep-06
HLCDO 2006-1A	C	A	Halcyon	HLCDO 2006-1A C	Sep-06
IXCBO 2006-2A	C	A	IXIS ABS CDO 1 Ltd	IXCBO 2006-2A C	May-06
LRDG 2006-1A	C	A	Longridge ABS CDO Ltd	LRDG 2006-1A C	Sep-06
PINEM 2006-AA	C	A	Pine Mountain	PINEM 2006-AA C	Oct-06
TOPG 2006-2A	B	A	Topanga CDO Ltd	TOPG 2006-2A B	Nov-06
TOURM 2006-2A	D	A	Tourmaline CDO	TOURM 2006-2A D	Mar-06

-----Original Message-----
From: Bhavsar, Avanish R
Sent: Friday, May 25, 2007 11:19 AM
To: Chin, Edwin
Subject: RE:

whats eta?

-----Original Message-----
From: Chin, Edwin
Sent: Friday, May 25, 2007 10:38 AM
To: Bhavsar, Avanish R; Salem, Deeb
Cc: Swenson, Michael
Subject: RE:

Let's start with these RMBS offers. 10MM each.

ABFC 2006-OPT2 M8	355
CWL 2006-15 M9	315
FHLT 2006-E M8	345
FMIC 2006-3 M8	415
GSAMP 2006-FM2 M8	465
GSAMP 2006-HE8 M8	375

Confidential Treatment Requested by Goldr

Permanent Subcommittee on Investigations
EXHIBIT #3b

GS MBS-E-012443115

JPMAC 2006-FRE2 M8	525
JPMAC 2006-NC2 M8	295
SAST 2006-3 B3	450
SVHE 2006-EQ2 M8	375

From: Bhavsar, Avanish R
Sent: Friday, May 25, 2007 9:36 AM
To: Salem, Deeb; Chin, Edwin
Cc: Swenson, Michael
Subject:

We have a new equity acct [redacted] they are interested in seeing offerings on the following

1) CDS on CDOs late 06, early 07 mezz deals, BBB thru AA

2) Single names RMBS 2nd half '06, BBB- or BBB

They are axed to buy protection.

Avanish R. Bhavsar
Managing Director
Capital Structure Sales
Securities Divison

Goldman, Sachs & Co.
1 New York Plaza 50th Floor | New York, NY 10004
Tel: 212 [redacted] Cell: 917 [redacted]
e-mail: avanish.bhavsar@gs.com

[redacted] = Redacted by the Permanent Subcommittee on Investigations

© Copyright 2007 The Goldman Sachs Group, Inc. All rights reserved. See http://www.gs.com/disclaimer/email-salesandtrading.html for important risk disclosure, conflicts of interest and other terms and conditions relating to this e-mail and your reliance on information contained in it. This message may contain confidential or privileged information. If you are not the intended recipient, please advise us immediately and delete this message. See http://www.gs.com/disclaimer/email/ for further information on confidentiality and the risks of non-secure electronic communication. If you cannot access these links, please notify us by reply message and we will send the contents to you.

Confidential Treatment Requested by Goldman Sachs

From: Swenson, Michael
Sent: Tuesday, May 29, 2007 11:06 AM
To: Salem, Doob
Subject: Re: they want to think about doing this again...

We should start killing the sn shorts in the street - let's pick some high quality stuff that guys are hoping is wider today and offer protection tight - this will have people totally demoralized

----- Original Message -----
From: Salem, Deeb
To: Swenson, Michael
Sent: Tue May 29 10:41:55 2007
Subject: RE: they want to think about doing this again...

the index wont close where it is this morning in my opinion...

-----Original Message-----
From: Swenson, Michael
Sent: Tuesday, May 29, 2007 10:21 AM
To: Salem, Deeb
Subject: Re: they want to think about doing this again...

Then you need to be prepared to widen their marks we also need credit approval

----- Original Message -----
From: Salem, Deeb
To: Bhavsar, Avanish R; Swenson, Michael
Cc: Chin, Edwin; Birnbaum, Josh
Sent: Tue May 29 10:05:52 2007
Subject: RE: they want to think about doing this again...

indices ~125bps wider since trades 1 week ago

Ref Ob	CUSIP	Offer
ACE 2006-CW1 M9	00441QAP4	500
BSABS 2006-HE3 M8	07387UH27	650
CARR 2006-NC2 M9	14453FAN9	650
GSAMP 2006-NC2 M8	36246JAN1	715
IXIS 2006-HE3 B2	46602UAM0	725
JPMAC 2006-ACC1 M9	46628RAP0	625
JPMAC 2006-FRE1 M8	46626LFV7	595
JPMAC 2006-NC2 M9	46629FAN0	525
LBMLT 2006-8 M8	54251UAN6	875
LBMLT 2006-WL1 M9	542514RE6	595
MSAC 2005-HE5 B3	61744CVA1	600
RAMP 2006-NC3 M9	76112B4X5	700
SVHE 2006-OPT3 M8	83611MPS1	575
WMABS 2006-HE2 M9	93934JAN4	650

-----Original Message-----
From: Bhavsar, Avanish R
Sent: Tuesday, May 29, 2007 9:20 AM
To: Salem, Deeb; Swenson, Michael
Cc: Chin, Edwin
Subject: they want to think about doing this again...

last trade with [redacted]..

Protection Buyer: [redacted]

[redacted] = Redacted by the Permanent Subcommittee on Investigations

Permanent Subcommittee on Investigations
EXHIBIT #3c

Confidential Treatment Requested by Goldman

Protection Seller: Goldman Sachs
Size: $105mm total ($7.5mm x 14 reference obs)

ACE 2006-CW1 M9	00441QAP4	415bps
BSABS 2006-HE3 M8	07387UH27	575bps
CARR 2006-NC2 M9	14453FAN9	490bps
GSAMP 2006-NC2 M8	362463AN1	625bps
IXIS 2006-HE3 B2	46602UAM0	550bps
JPMAC 2006-ACC1 M9	46628RAP0	515bps
JPMAC 2006-FRE1 M8	46626LFV7	500bps
JPMAC 2006-NC2 M9	46629FAN0	415bps
LBMLT 2006-8 M8	54251UAN6	800bps
LBMLT 2006-WL1 M9	542514RE6	465bps
MSAC 2005-HE5 B3	61744CVA1	490bps
RAMP 2006-NC3 M9	76112B4X5	590bps
SVHE 2006-OPT3 M8	83611MPS1	490bps
WMABS 2006-HE2 M9	93934JAN4	540bps

CME Group

December 8, 2010

The Honorable Carl Levin
Chairman
Senate Permanent Subcommittee on Investigations
340 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Levin:

As you requested, in connection with your joint hearing today on "Examining the Efficiency, Stability, and Integrity of the U.S. Capital Markets," we are pleased to provide our July 30, 2010 comment letter that we submitted to the SEC and Joint SEC-CFTC Advisory Committee on Emerging Regulatory Issues (attached) relating to the SEC's single stock circuit breaker pilot program, which they recently extended.

Since the events of May 6, 2010, CME Group has had the opportunity to review the current market-wide circuit breaker regime and the related market microstructure mechanisms that were in place at the time, as well as the recent single-stock circuit breaker pilot program instituted by the SEC. As noted in detail in our attached comment letter, CME Group believes that it is essential that these circuit breaker and related market microstructure rules address critical inter-market linkages or they will have the potential to result in significant disruptions to trading across related markets.

As you conduct your examination of the U.S. Capital Markets, CME Group encourages you to consider our recommendations as set forth in the attached comment letter, and we look forward to working with you on these issues.

Sincerely,

Terrence A. Duffy
Executive Chairman, CME Group

Craig Donohue
Chief Executive Officer, CME Group

Cc: The Honorable Jack Reed
Chairman, Senate Subcommittee on Securities, Insurance, and Investment

20 South Wacker Drive Chicago, Illinois 60606

Permanent Subcommittee on Investigations
EXHIBIT #4

CME Group

Craig S. Donohue
Chief Executive Officer

July 30, 2010

Via Electronic Mail: rule-comments@sec.gov

Ms. Elizabeth M. Murphy
Secretary
U.S. Securities and Exchange Commission
100 F Street, N.E.
Washington, D.C. 20549

Re: Comments Regarding SR-NYSEArca-2010-61,SR-NYSE-2010-49, SR-NASDAQ-2010-079, SR-CBOE-2010-065, SR-BATS-2010-18, SR-CHX-2010-14, SR-EDGA-2010-05, SR-EDGX-2010-05, SR-ISE-2010-66, SR-BX-2010-044, SR-NSX-2010-08, also File No. 265-26, Joint CFTC-SEC Advisory Committee on Emerging Regulatory Issues

Dear Ms. Murphy:

CME Group Inc. ("CME Group") appreciates the opportunity to comment on the above-captioned stock exchange rule filings (the "Rule Filings"), as well as the opportunity to submit comments to the Joint Commodity Futures Trading Commission ("CFTC")-Securities and Exchange Commission ("SEC") Advisory Committee on Emerging Regulatory Issues ("Committee"), which will be making recommendations to the SEC relating to proposals to address the events of May 6. The Rule Filings relate to a proposed industry-wide expansion of the recently adopted single stock circuit breaker pilot program ("Pilot Program").

Since the market events of May 6, 2010, CME Group has had the opportunity to review the current market-wide circuit breaker regime, as well as the related market microstructure mechanisms that were in place at the stock exchanges and at CME Group. We have also had the opportunity to review recent efforts of the SEC, the stock exchanges and the Financial Industry Regulatory Authority, Inc. ("FINRA") to be responsive to the events of May 6, including the June 10, 2010 single stock circuit breaker pilot program applicable to stocks in the S&P 500 Index and the above-referenced Rule Filings, as well as the proposed implementation of new rules clarifying the circumstances under which erroneous trades will be cancelled. While we commend these efforts, we believe that certain of these actions may result in unintended consequences. We therefore believe that prompt additional action is necessary to ensure the integrity of the equity and equity derivatives markets and promote confidence among market users.

Markets can employ various tools to address the problem of sharp, destabilizing price swings. For example, markets can employ various types of automated functionality to mitigate the likelihood of erroneous trades or momentary liquidity gaps negatively impacting the market in a particular instrument. These techniques generally allow the price discovery process to continue seamlessly without any

significant disruption. Markets can also employ price limits, which are typically applicable at a product level and which are less disruptive than circuit breakers, because the market can continue to trade within the defined limits. Finally, market-wide circuit breakers that completely halt trading across all equity and equity derivatives markets when triggered can serve as an effective, albeit last line of defense. The initial introduction of market-wide circuit breakers came out of the recommendations of the 1988 Report of the President's Working Group on Financial Markets ("PWG"). The PWG was established in response to events in the financial markets on October 19, 1987, and was charged with recommending legislative and private sector policies to bolster investor confidence and enhance the integrity, efficiency, orderliness and competitiveness of U.S. financial markets. As the PWG observed, sharp declines in prices and spikes in volume can threaten the market infrastructure and lead to uncoordinated and ad hoc market closings, which, in turn, can have the effect of further destabilizing the market. The PWG was concerned about the potential for macro-market price destabilization to overwhelm the market infrastructure of trading, clearing and credit systems. In recommending circuit breakers, the PWG intended to substitute planned and coordinated trading halts for unplanned and uncoordinated halts, reducing uncertainty without necessarily increasing the frequency of such disruptions. Importantly, it was not contemplated that circuit breakers could or should alter fundamental equity prices.

As illustrated in the diagram below, each of these mechanisms serve different purposes, but should act as an integrated and escalating approach to managing market disruptions.

Automated risk management and volatility mitigation mechanisms should form the first line of defense in maintaining orderly markets and limiting opportunities for erroneous trades or liquidity gaps. Product specific price limits constitute a second line of defense and serve as a cooling mechanism, facilitating trading activity at or above pre-established price limits for a specified period of time. Market-wide circuit breakers serve as the last line of defense and generally involve market halts for a specified period of time that give market users the opportunity to assimilate market conditions and to reassess investment and trading strategies prior to the resumption of trading.

I. Background

CME Group presently employs a range of mechanisms in its equity index futures and options markets, including a variety of automated risk and volatility mitigation mechanisms, price limit rules for specific products, and market-wide circuit breakers for domestic equity index products that are fully coordinated with the cash equity and options markets.

A. Risk and Volatility Mitigation Functionality

In order to maintain fair and orderly markets, CME Group employs a variety of automated risk and volatility mitigation mechanisms on its CME Globex system which help to prevent most error trades and mitigate the impact of momentary liquidity gaps. Among the primary tools employed are the following:

- Price Banding and Maximum Order Sizes: CME Globex subjects all orders to price verification using a process called price banding. Price banding prevents the entry of erroneous orders such as a limit order to buy at a price substantially above the market or a limit order to sell at a price substantially below the market. The platform utilizes separate mechanisms for futures price banding and options price banding. Similarly, maximum order size restrictions automatically reject orders which exceed certain pre-determined quantity thresholds. These mechanisms enhance a market's price integrity, as well as confidence in trade certainty, by substantially reducing the occurrence of error trades and the collateral damage caused by having to cancel such trades.

- Stop Logic: Stop Logic functionality helps to mitigate artificial market spikes that can occur because of the continuous triggering, election and trading of cascading orders. On CME Globex, if elected stop orders would result in execution prices that exceed pre-defined thresholds, the market automatically enters a very brief reserved state. During this period, which lasts for 5-20 seconds depending on the product and time of day, new orders are accepted but trades do not occur until the reserve state expires, thereby providing an opportunity for liquidity to be replenished and for the market to regain its equilibrium.

- Protection Points: Market and Stop Order protection points permit orders to be filled only within a pre-defined range of prices without the user having to define a limit price. Any unfilled quantity for a Market Protected or Stop Protected Order becomes a Limit Order at the limit price calculated by

the trading engine. This type of functionality precludes orders from being executed at unreasonable levels when there is a temporary absence of liquidity in the market and also mitigates the likelihood of error trades by preventing the execution of trades at prices substantially away from the market.

B. Price Limits

CME Group also employs price limits in each of its equity index products. Price limits allow trading to continue at or above the limit price (in the case of a downside limit), thereby allowing investors time to evaluate market conditions and mobilize liquidity, generally without halting the market as in the case of circuit breakers. The price limits established by CME Group for its domestic equity futures products follow the same 10%, 20% and 30% triggers of the market-wide circuit breakers, as well as their time of day applicability parameters; however, the price limits are based upon declines in the lead month of the specific futures contract rather than being tied to a decline in the DJIA. If the market remains limit offer after 10 minutes, a 2 minute trading halt is triggered, after which trading resumes with the 20% limit in effect. If the market is no longer limit offered after ten minutes, there is no halt and trading continues with a 20% limit in effect. CME Group also employs a single-threshold price limit of 5% on both the upside and downside for each domestic equity index product outside of regular trading hours.[1]

C. Circuit Breakers

Presently, CME Group trading halts are coordinated with trading halt policies in the primary securities markets. NYSE Rule 80B provides for trading halts based upon 10%, 20% and 30% declines in the Dow Jones Industrial Average (DJIA) relative to the prior day's settlement. NYSE Rule 80B operates as follows:

- If the DJIA declines by 10% prior to 2:00 p.m. Eastern Time (ET), a one-hour trading halt ensues.
- If the DJIA declines by 10% at or after 2:00 p.m. but before 2:30 p.m. (ET), a half-hour trading halt ensues. The 10% circuit breaker becomes inapplicable at or after 2:30 ET.
- If the DJIA declines by 20% before 1:00 p.m. ET, a two-hour halt ensues. At or after 1:00 but before 2:00 p.m. ET, a one-hour halt ensues. If the DJIA declines by 20% at or after 2:00 p.m., the market is closed for the remainder of the trading session.

[1] This 5% upside and downside price limit policy is in effect during overnight electronic trading hours (between 3:30 p.m. and 8:30 a.m. Central Time ("CT")) which allows participants to trade continuously within the bands of the designated price limits; further, if an equity index futures contract is locked limit at 8:15 a.m. CT and remains so at 8:25 a.m. CT in the lead month futures contract, a trading halt is implemented until 8:30 a.m., the commencement of regular trading hours (floor and electronic trading). During the trading halt, the Exchange provides an Indicative Opening Price of the re-opening of trading on CME Globex, if applicable. If the lead month futures contract is no longer locked limit at 8:25 a.m. CT, trading will continue with the 5% limit in effect. At 8:30 a.m. CT, the 5% limit is replaced by the broader limits applicable to regular trading hours.

- There is an absolute daily limit of 30% such that if the DJIA should decline by 30%, trading is halted for the remainder of the day.

Trading in CME Group domestic stock index products is halted whenever a NYSE Rule 80B halt is in effect.

II. Recent SEC, Stock Exchange and FINRA Actions

The Securities and Exchange Commission ("SEC"), the stock exchanges and the Financial Industry Regulatory Authority, Inc. ("FINRA") have recently taken actions that are designed to prevent the recurrence of the events of May 6. On June 10, the SEC approved stock exchange and FINRA rule changes that implemented single stock circuit breakers on a pilot basis extending through December 10, 2010 (the "Pilot Program"). The Pilot Program established rules that call for a pause in the trading of any component stock of the S&P 500 Index when the price of any such stock moves 10% or more over a rolling five minute period. Upon the occurrence of a triggering price move, the stock's primary listing market is required to disseminate a special indicator over the consolidated tape to prompt the halting of trading in the stock on all venues for a minimum of five minutes. If the primary listing market does not reopen the stock within 10 minutes, other markets are allowed to resume trading. On June 30, 2010, the stock exchanges and FINRA filed additional rule change proposals (the "Rule Filings") to expand the Pilot Program to include stocks in the Russell 1000 Index and 344 enumerated Exchange Traded Products ("ETPs").[2] The enumerated ETPs include a number of Exchange Traded Funds ("ETFs") that are based on broad-based equity indexes.[3]

III. CME Has Specific Concerns Regarding the Recent Actions

CME Group believes that the proposed Rule Filings fail to address critical inter-market linkages and could result in potentially significant disruptions to trading across related markets. Certain ETFs included in the proposed expansion are based on the same indexes underlying the most active cash index options, index futures and options on ETFs. If the Rule Filings are adopted, there would be different and uncoordinated halting mechanisms in place for ETFs related to a particular index and the index options, index futures and options on ETFs based on the same index. As has been frequently noted, all of these markets are very closely linked and the absence of effective coordination across comparable markets was one factor cited by many (including the staff of the SEC) as having contributed to certain of the market issues experienced on May 6. Clearly, inconsistent treatment of the same underlying beta exposure would add

---

[2] The registered national securities exchanges and FINRA filed similar rule changes to expand the Pilot Program with the exception of the New York Stock Exchange ("NYSE"). The NYSE proposal was limited to expanding its individual stock circuit breaker program to include stocks in the Russell 1000.

[3] An ETF is an open-ended registered investment company under the investment Company Act of 1940 that has received exemptive relief from the SEC to allow secondary market trading in the ETF shares. ETFs are generally index-based products, in that each ETF holds a portfolio of securities that is intended to provide investment results that, before fees and expenses, generally correspond to the price and yield performance of the underlying benchmark index.

further stress to the market during periods of turbulence, impeding liquidity and exacerbating risk management challenges.

Additionally, should the proposed Rule Filings be adopted, the trading halts that would apply to ETFs on broad-based indexes would not be coordinated with the market-wide circuit breakers or with the price limits that currently apply to related index futures and options.

Under the Pilot Program, multiple constituent stocks in an index could be halted without a market-wide circuit breaker being triggered. In a macro-market event, individual stocks would likely be halted and opened on staggered timelines, creating complexity and confusion in understanding the index calculation. Market participants would be required to determine for themselves the relevance of the index values that are disseminated and the value impact of index-component stocks that have been halted.[4] The halting of high capitalization, highly liquid index components would be disruptive for the following reasons:

- The number of halted issues may impact whether the index triggers a market-wide circuit breaker;
- The intra-day index values published and used for risk management purposes may not be reflective of the true value of the underlying market; and
- The risk management capabilities of large liquidity providers in index futures and ETFs who use these products to hedge market-making activity would be adversely affected and this may cause traders to withdraw from the market, further hampering liquidity.

Further, the single stock circuit breakers are calculated in a manner that creates information asymmetries across customer segments with respect to the trigger levels. Because of the trigger methodology, the point at which a circuit breaker will be triggered is not readily observable to retail market participants. In contrast, sophisticated market participants who possess real time access to consolidated security prices and computation processing capabilities will likely employ tools that allow them to determine when a particular instrument is approaching a halt-triggering price, better enabling them to modify their investment and trading decisions.

---

[4] Notwithstanding CME Group's objection to the single-stock circuit breakers, to the extent such circuit breakers are employed, it is imperative that uniform policies and procedures be adopted to address circumstances when the computation of the market-wide circuit breaker index value is impacted because of the triggering of stock specific circuit breakers in its component securities. We would urge that the index publisher of the index upon which the market-wide circuit breaker is based be required to monitor and report to the market the percentage, both in index weight and number of securities, of index components that are halted due to the triggering of stock specific circuit breakers.

IV. CME Recommendations

A. Replace Security Specific Circuit Breakers with Less Disruptive Automated Risk and Volatility Mitigation Mechanisms

Instead of continuing or expanding the Pilot Program, CME Group recommends that automated risk and volatility mitigation mechanisms be implemented in place of trading halts in individual securities. Trading halts are intended to protect against the possibility of a broader market breakdown and should not be used to compensate for weaknesses in trading processes. Proven market mechanisms are available that mitigate volatility caused by transitory liquidity gaps and that minimize the risk of clearly erroneous trades - without the need for disruptive market halts and without the disruption associated with error trades and their cancellation. Although CME Group is supportive of the goals of the Pilot Program, we believe its objectives can be more effectively achieved by adopting the mechanisms described below.

First, CME Group recommends that all trading venues adopt automated means, similar in function to the CME Group's stop logic functionality, to briefly pause the market in the event that cascading sell orders precipitate a material market decline because of a transitory dearth of liquidity. The momentary pause afforded by stop logic functionality allows an opportunity for liquidity to be replenished and, in a highly automated market, the pause can reasonably be calibrated in seconds without substantive impacts on the broader market. The benefit of this type of functionality was clearly evident on May 6 as stop logic functionality on CME Globex triggered a five second pause in E-mini S&P futures market, during which time buy side liquidity came into the market, leading the reversal of the broader market decline.

Second, CME Group recommends that all markets employ functionality similar to the protection point functionality employed by CME Globex to automatically apply limit prices to all orders, including market and stop orders. This type of automated functionality precludes such orders from being executed at unreasonable levels when there is a temporary absence of liquidity in the market and allows new liquidity to enter the market and fill the orders at reasonable levels. This functionality also substantially mitigates the likelihood of clearly erroneous trades by preventing the execution of trades at prices substantially away from the market's fair value. We also believe that the prompt elimination of stub quoting practices will be useful in mitigating such trades.

Third, CME Group recommends that all markets employ automated price banding functionality and maximum order size restrictions, which substantially reduce the occurrence of "fat-finger" error trades by automatically rejecting orders that are entered at aberrant prices or for aberrant quantities.

Under the Pilot Program as currently constructed, a single errant trade can have the effect of causing a halt in the trading of a security.[5] Clearly, isolated errors caused by human error or system malfunction

---

[5] In each of the three implementations of the new single security circuit breakers to date, the cause of the halt was an errant trade and trades were subsequently cancelled. For example, on June 29, 2010, 8,820 shares of Citigroup Inc. were reported as an off exchange transaction at $3.3174, or 13% below the previous price, triggering the circuit breaker. The trade that triggered the halt was subsequently cancelled. Thus, in a stock that trades approximately

are not the types of events that justify the disruption of a trading halt. In addition, allowing isolated errors to disrupt all trading in a security introduces the possibility of a single market actor intentionally halting markets for manipulative purposes. As noted, we believe there should be a focus on ensuring that markets have adopted transparent controls to prevent erroneous transactions from occurring.

Implementing these recommendations will more effectively address the types of issues that the single-security circuit breakers are intended to address without the negative consequences of halting trading in a particular security across all venues. However, for as long as single stock circuit breakers continue to be employed, we recommend that regulators and markets establish uniform policies and procedures for circumstances when the computation of the market-wide circuit breaker index value is negatively impacted due to the triggering of stock specific circuit breakers on its component securities. Further, we would urge the index service provider upon which the market-wide circuit breaker is based to monitor and report to the market the percentage, both in index weight and number of securities, of index components that are halted due to the triggering of stock specific circuit breakers.

B. Adopt Uniform Price Limits for Certain Broad-Based Index Products

As noted above, under the securities exchanges' and FINRA's proposed expansion of the Pilot Program, the circuit breaker trigger methodology for all affected ETFs, including those based upon benchmark indexes, would employ a different calculation than that employed by the market-wide circuit breaker. The Rule Filings propose that when the price of the ETF rises or falls at least 10 % in five minutes, trading in such shares would be halted for a minimum of five minutes. By contrast, the trigger levels for a market-wide trading halt are set quarterly at 10%, 20% and 30% of the DJIA, calculated at the beginning of each calendar quarter, using the average closing value of the DJIA for the prior month. The difference in methodology means that ETFs based on the same index as the market-wide circuit breaker could be halted without the market-wide circuit breaker being triggered and without other products offering similar beta exposure being halted. Therefore, the proposal creates protocols that are not coordinated across markets – precisely the situation that contributed to disruptive and fragmented trading on May 6.

In contrast to trading halts, CME Group recommends adoption of uniform price limits across all broad-based index products based upon the S&P 500, the DJIA, and the NASDAQ 100. This uniformity should be manifested in price limit methodologies and levels that can be consistently applied across all exchange traded and OTC products related to a particular instrument (e.g., index futures, index options, ETFs, options on ETFs, and swaps related to the indexes above). Consistent with our proposed revisions to the market-wide circuit breakers, the individual price limits for each index-linked product would be established at 5%, 10% and 20%. Each price limit threshold would be implemented for 10 minute intervals, during which time market participants would be precluded from trading below the enumerated limit but would be able to trade at or above such limit. At the end of any particular 10 minute period, trading would continue with the next applicable limit in effect. Should a market-wide circuit breaker be triggered while an

---

800 million shares a day, a single off-exchange error processed by a broker halted all market trading in a highly liquid security.

individual index price limit were in effect, the timing and trigger levels of the market-wide circuit breaker would supersede the timing and trigger levels of the individual price limit.

We recognize that ETF sponsors desire, on behalf of the retail community, to prevent a repeat of the situation on May 6 in which a large proportion of cancelled trades involved ETFs, and that the sponsors have therefore embraced single security circuit breakers for these products to remediate that issue. However, ETF activity in general is highly concentrated in a small number of domestic large cap index products, specifically products based upon the S&P 500, the DJIA and the NASDAQ 100. Table 1 below provides the average daily notional volume traded in the SPDR S&P 500 ETF (SPY), the PowerShares QQQ (QQQQ), and the SPDR Dow Jones Industrial Average (DIA) as well as the same information regarding the Top 10 ETFs busted on May 6.

Table 1.

	Name	YTD Notional ADV (As of 7/15/2010)
Most Actively Traded ETFs	SPDR S&P 500 ETF	$26,307,196,044.78
	Powershares QQQ	$ 4,642,413,768.66
	SPDR Dow Jones Industrial Average	$ 1,267,709,247.76
May 6 Top 10 ETFs Busted Based Upon $ADV	ProShares UltraShort QQQ	$ 348,739,108.21
	iShares Russell 1000 Growth Index Fund	$ 155,254,023.58
	iShares Russell 2000 Value Index Fund	$ 144,838,708.58
	iShares Russell 1000 Value Index Fund	$ 132,164,184.48
	Vanguard Total Stock Market ETF	$ 123,201,429.10
	ProShares Ultra Real Estate	$ 120,257,955.22
	iShares Russell 1000 Index Fund	$ 119,246,743.58
	iShares Russell Midcap Index Fund	$ 78,286,270.60
	iShares S&P MidCap 400 Index Fund	$ 78,212,962.01
	iShares Russell Midcap Value Index Fund	$ 64,138,745.67

As the data reflects, the trades cancelled on May 6 were not in the equity index ETFs that are based upon unleveraged U.S. domestic, large cap, index products; rather, the ETFs whose trades were busted were in less liquid, style or sector or inverse leveraged products. Therefore, our recommendation that liquid broad-based index ETFs be subject to price limits that are coordinated with other products offering similar beta exposure simply reflects the differentiated liquidity profile and important inter-market linkages of these instruments relative to the broader universe of ETFs. The objectives of preserving price integrity and addressing the high incidence of error trades in the less liquid ETFs on May 6 are more effectively addressed by our recommendations in Section A above.

C. Current Market-wide Circuit Breaker Parameters Should Be Amended

The most impactful step the industry can take to promote investor confidence and address the issues that occurred on May 6 is to amend the parameters of the market-wide circuit breakers. Despite widespread concerns about the speed and scope of the market decline on May 6, the current market-wide circuit breakers were not triggered. CME Group recommends lowering the current circuit breaker percentage thresholds. Today, the circuit breaker rules are triggered based upon 10%, 20% and 30% declines in the DJIA; and, as noted, none of these levels were breached on May 6. We believe that the triggering of market-wide circuit breakers should be prudently imposed at levels that protect the market system and promote investor confidence, but are infrequent in occurrence; therefore, while recognizing the need for broader industry input and review, we recommend implementing market-wide circuit breakers based upon lower thresholds of 5%, 10% and 20%. Although it is possible to contemplate other trigger methodologies, e.g., a percentage move over a specified time horizon, we believe that pre-established and observable limits better facilitate market participants' understanding of the circuit breakers and allow for more effective coordination across venues.

In addition to lowering the circuit breaker thresholds, we recommend shorter halts and simplification of the time of day application of the different thresholds. Given today's highly automated market structure and sophisticated information processing technology, less lengthy halts are necessary to allow the market to assimilate information, assess risk and attract liquidity. Specifically, we believe that there should be a 10 minute halt in the event of a 5% move, a 30 minute halt in the event of a 10% move and a closing of the market for the remainder to the trading day in the event of a 20% move.

We further recommend that the 5% circuit breaker level become inapplicable (with the 10% limit in effect) beginning at 3:30 p.m. Eastern Time ("ET"); if the 10% limit were hit at 3:30 p.m. ET or afterwards, the market would be halted for the remainder of the trading day. In the event the 5% limit were hit prior to 3:30 p.m. ET, and the 10% limit were hit after 3:30 p.m. ET, the market would similarly be halted for the remainder of the trading day.

In light of the lower percentage thresholds, we also recommend that the timeframe for calculating the baseline price for establishing these triggers be shortened. Currently, this baseline is reset on a quarterly basis; we believe the reset should occur on a monthly basis and be calculated based upon the average closing price of the relevant index for the immediately preceding month. This would ensure that the baseline price would be established based upon a value that was updated more frequently to be reflective of underlying market conditions.

V. Conclusion

CME Group welcomes the efforts of the SEC, the stock exchanges and FINRA to act quickly to respond to the circumstances giving rise to the market events of May 6. We do believe, however, that the Pilot Program and the Rule Filings may have unintended consequences that lead to disruption of the markets.

As set forth in the recommendations above, we believe that an inter-market approach involving a coordinated blend of available tools is the best approach to addressing the problems that occurred on May 6. We look forward to working closely with the regulators, exchanges and the industry to provide thoughts and recommendations to ensure the integrity of the markets and to promote market confidence among market users.

Sincerely,

Craig Donohue
Chief Executive Officer

cc: The Honorable Mary L. Schapiro, Chairman, SEC
The Honorable Kathleen L. Casey, Commissioner, SEC
The Honorable Elisse B. Walter, Commissioner, SEC
The Honorable Luis A. Aguilar, Commissioner, SEC
The Honorable Troy A. Paredes, Commissioner, SEC
Mr. Robert Cook, Director, Division of Trading & Markets, SEC

The Honorable Gary Gensler, Chairman, CFTC
The Honorable Michael Dunn, Commissioner, CFTC
The Honorable Bart Chilton, Commissioner, CFTC
The Honorable Jill Sommers, Commissioner, CFTC
The Honorable Scott O'Malia, Commissioner, CFTC

Janet L. McGinness
Senior Vice President - Legal & Corporate Secretary
Legal & Government Affairs

NYSE Euronext

20 Broad Street
New York, New York 10005
t 212.656.2039 | f 212.656.8101
jmcginness@nyx.com

December 8, 2010

Senator Carl Levin
Chairman
Permanent Subcommittee on Investigations
Russell Senate Office Building, SR-269
Washington, DC 20515

Dear Senator Levin:

NYSE Euronext appreciates your efforts to hold a joint hearing December 8, 2010 entitled "Examining the Efficiency, Stability, and Integrity of the U.S. Capital Markets". Per your request, we wanted to provide you with our previously articulated views regarding two important issues currently resting with the Securities and Exchange Commission (SEC). Specifically, we want to express our support for both a consolidated audit trail as well as market wide circuit breakers, or similar methodology, designed to prevent erroneous trades that have become commonplace in the market.

In May of 2010, the SEC proposed rules that, if adopted, would provide regulators with the necessary data needed to reconstruct a trading event like occurred on May 6th. As we expressed in our August 9, 2010 comment letter[1] to the rule, NYSE Euronext believes that if regulators are to surveil effectively for illicit trading activity, there must be an ability to uniformly obtain a complete view of all trading activity across markets. While we believe the cost and length of time to implement real-time data reporting as proposed in the SEC's release may outweigh the benefits, we believe significant progress could be made in a relatively short period of time if the SEC took a first step of gathering uniform data on an end-of-day basis from every market into one reporting system. As referenced in our Concept Release comment letter, we also believe similar benefits could be achieved by establishing a consolidated regulator for the marketplace[2].

We also believe that circuit breakers, potentially augmented by limit up/ limit down methodologies, are a good way to inject rationality into times of marketplace uncertainty and stress. In a world where we are measuring execution speeds in millionths of a second, allowing markets to pause for liquidity to reaggregate and judgment to weigh-in is essential to any healthy marketplace. NYSE Euronext has applied this logic to our market structure through the use of Liquidity Replenishment Points or LRPs. LRPs temporarily and

[1] http://www.sec.gov/comments/s7-11-10/s71110-46.pdf

[2] http://www.sec.gov/comments/s7-02-10/s70210-154.pdf

Permanent Subcommittee on Investigations
EXHIBIT #5

automatically pause trading in stocks when significant price movement occurs. On a typical day, LRPs are triggered a few hundred times, lasting generally for a few seconds at most. When LRPs are in effect, our quote is visible to other market participants and new orders are accepted. However, LRPs are not utilized market-wide, and we believe the marketplace would benefit from similar market-wide mechanisms[3].

Again, we appreciate your efforts to review these and other important issues facing our markets.

Sincerely,

Janet McGinness

[3] http://www.sec.gov/comments/265-26/265-26-26.pdf

PREPARED STATEMENT OF MARY L. SCHAPIRO

CHAIRMAN, SECURITIES AND EXCHANGE COMMISSION

DECEMBER 8, 2010

Chairmen Reed and Levin, Ranking Members Bunning and Coburn, and Members of the Subcommittees: Thank you for the opportunity to testify on behalf of the Securities and Exchange Commission concerning the U.S. equity market structure.

Market structure encompasses all aspects of the organization of a market, including the number and types of venues that trade a financial product and the rules by which they operate. Although these issues can be complex and the rules technical, a stable, fair, and efficient market structure is the backbone of the equity markets and an important engine of our economy.

My testimony today will note some important recent market structure developments and discuss the Commission's ongoing review of our market structure. In particular, we have undertaken a broad-based appraisal of both the strengths and weaknesses of our current equity market structure. This review includes an evaluation of recent market structure performance and an assessment of whether market structure rules have kept pace with recent significant changes in trading technology and practices. The goal of this evaluation is to effectively address any market structure weaknesses while preserving its strengths.

As will be described below, the Commission has recently moved to enhance regulators' capacity to monitor trading across all trading venues and to enforce the securities laws and regulations and self-regulatory organization (SRO) rules. These initiatives include publishing for public comment one proposal that would mandate the development and implementation of a consolidated audit trail system and another that would require large trader reporting.

In addition, the SEC published a concept release on equity market structure in January 2010 (the "Concept Release"). The Concept Release described the current market structure and then broadly requested comment from the public on three categories of issues: (1) the quality of performance of the current market structure, (2) high frequency trading, and (3) undisplayed liquidity in all its forms.

The Commission has received more than 200 comments on the Concept Release. A number of commenters identified benefits of the current market structure, in particular noting that it has fostered competition among trading venues and liquidity providers that has lowered spreads and brokerage commissions. These investors cautioned against regulatory changes that might lead to unintended consequences. Other commenters, however, raised concerns about the quality of price discovery and questioned whether the current market structure continues to offer a level playing field to investors in which all can participate meaningfully and fairly. These commenters suggested a variety of initiatives to address their concerns.

Following up on the written comments, the Commission hosted a public roundtable on market structure in June. The roundtable participants, who included listed companies, investors, exchanges, market makers, high frequency traders, broker-dealers, agency-only brokers, and economists, offered a wide range of perspectives and recommendations. The debate at the roundtable was spirited and extremely helpful to the Commission in its efforts to obtain a deep understanding of complex policy issues.

The Commission's job in the coming months will be to evaluate these issues in a responsible, timely, and comprehensive fashion, with particular focus on obtaining the appropriate data and analysis to support our decisions to proceed with or to table any particular initiative. A few basic principles will guide our actions.

I. Guiding Principles

A. Capital Formation and Investor Protection

At its most basic level, market structure must achieve two critical objectives: serving the interests of companies in efficient capital formation and the interests of investors in attaining their financial goals. Efficient capital formation and strong investor protection in our equity markets will promote economic growth and jobs, as well as the ability of individual Americans to realize economic security and invest for things such as retirement and college.

Equity markets support these objectives by helping to turn the savings of investors into capital for business, enabling a flow of funds from investors to entrepreneurs and back again through dividends and capital gains. Those who purchase stock in an initial public offering, for example, can have confidence that they will be able to sell that stock at a fair and efficient price in the secondary market when they need or want to do so. The values assigned to stocks in the secondary market,

moreover, play an important role in the ability of companies to raise additional funding.

Healthy equity markets allocate capital efficiently and help ensure that investors and companies are able to reap the rewards of their efforts. If, however, the equity market structure breaks down—if it fails to provide the necessary fairness, stability, and efficiency—investors and companies may pull back, raising costs and reducing growth.

In sum, the interests of companies and investors lie at the heart of market structure. All of the securities industry professionals and entities that act as intermediaries between companies and investors play vitally important roles in our equity market structure, but their roles ultimately must serve the ends of capital formation and investor protection.

B. Competition and Price Discovery

To achieve efficient capital formation and strong investor protection, a market structure must secure the dual benefits of competition and effective price discovery. Competition among multiple markets and market making firms can benefit investors through specialized trading services, lower fees, and narrow spreads. When many markets and firms compete for order flow in the same stock, however, any structural inefficiencies can lead to order flow fragmentation and concerns about the quality of price discovery. If price discovery were to be impaired, it could cause the price of a company's stock to deviate from true consensus values and lead to excessive volatility that is harmful to both investors and companies.

Section 11A of the Exchange Act directs the Commission to facilitate a national market system that achieves multiple objectives, including: competition among markets and broker-dealers, efficient execution of securities transactions, price transparency, best execution of investor orders, and an opportunity, consistent with other objectives, for investor orders to meet directly.

The Commission's market structure task is further complicated by the continual change that characterizes modern financial markets. Even if an optimally balanced market structure were achieved at any particular time, the dynamic forces of technology and competition are sure to generate new market conditions that will effectively—and sometimes rapidly—alter the balance. As a result, the Commission must regularly review its rules to assess whether they have kept pace with changing market conditions.

Our ongoing market structure review is focused on current, and potential future, market conditions, not those that existed in the past, and on whether the current rules continue to foster an appropriately balanced market structure that achieves all of the Exchange Act's objectives.

C. Surveillance, Inspection, and Enforcement

A final guiding principle for the Commission's market structure program is a recognition that the right rules are meaningless if they are not followed and enforced. All industry participants must know that the regulators are closely monitoring compliance and will take enforcement action against those who violate the rules. Consequently, the Commission is focused on obtaining the tools and resources necessary to better surveil trading, inspect regulated entities, and enforce the rules in today's highly automated, high speed and high volume markets.

II. Recent Market Structure Developments

A. Technology

The U.S. equity market structure has changed dramatically in recent years. A decade ago, most of the volume in stocks was executed manually, whether on the floor of an exchange or over the telephone between traders. Now nearly all orders are executed by fully automated systems at great speed. The fastest exchanges and trading venues are now able to accept, execute, and send a response to orders in less than one thousandth of a second.

Speed is not the only thing that has changed. As little as 5 years ago, the great majority of U.S. equities capitalization was traded on a listing market—the New York Stock Exchange (NYSE)—that executed nearly 80 percent or more of volume in those stocks. Today, the NYSE executes approximately 26 percent of the volume in its listed stocks. The remaining volume is split among 13 public exchanges, more than 30 dark pools, 3 electronic communication networks (ECNs), and more than 200 internalizing broker-dealers. Currently, approximately 30 percent of volume in U.S.-listed equities is executed in venues that do not display their liquidity or make it generally available to the public, reflecting an increase over the last year.

The evolution of trading technologies has dramatically increased the speed, capacity, and sophistication of the trading functions that are available to market partici-

pants. The new electronic market structure has opened the door for entirely new types of professional market participants. Today, proprietary trading firms play a dominant role by providing liquidity through the use of highly sophisticated trading systems capable of submitting many thousands of orders in a single second. These high frequency trading firms can generate more than a million trades in a single day and now account for more than 50 percent of equity market volume.

B. May 6 Trading Disruption

On May 6, 2010, two weeks after the end of the 90-day comment period for the Concept Release, the U.S. equity markets experienced one of the most significant price declines and reversals since 1929. While the decline in prices in broad market indexes on May 6 was not as steep and as persistent as the decline in October 1987—when trading was slower and less reliant on technology—the broad market indexes, including the Dow Jones Industrial Average and S&P 500, dropped more than 5 percent in 5 minutes, only to almost entirely reverse the decline in a subsequent few minutes. Approximately 15 percent of stocks suffered even more severe declines and reversals of 10 percent or worse. These include two of the 10 largest capitalization stocks, which declined 36.7 percent and 19.5 percent, during the half-hour disruption, only to recover nearly their full value.

At the worst end of the spectrum, 326 securities suffered declines of more than 60 percent from their 2:40 p.m. prices, leading the exchanges to "break" or cancel more than 20,000 trades. Many of these broken trades were executed at absurd prices of one penny or less per share. Nearly 70 percent of these broken trades were in exchange-traded funds (ETFs), whose pricing integrity depends in significant part on the price integrity of individual stocks and the activities of professional liquidity providing firms.

In September, the staffs of the SEC and the Commodity Futures Trading Commission (CFTC) published their second joint report on their inquiry into the day's events. Producing the report required an extraordinary amount of staff resources. On the securities side in particular, much of the time and effort was devoted to collecting and then painstakingly sifting through the data necessary to reconstruct trading. These efforts highlighted the pressing need for enhanced data functionalities in the securities markets.

The joint report lays out the multiple factors that in our view significantly contributed to the liquidity failure and disruptive trading on that day, outlining the complex interplay of multiple factors across the securities and futures markets. This interplay is significant because it demonstrates the need for a multifaceted regulatory response that addresses the full scope of the risks in a comprehensive and responsible way.

C. Investor Views About Market Structure

Since the events of May 6, some investors are questioning the integrity and fairness of the U.S. market structure. Many individual investors, for example, have submitted comments to the Commission that are highly critical of the current market structure. Retail broker-dealers have told us that their customers—individual investors—have pulled back from participating in the equity markets since May 6. Some institutional investors also have submitted comments outlining their market structure concerns after May 6. These concerns included the transitory nature of a large percentage of liquidity, an uneven playing field created by data latency and colocation, and trading tactics employed to detect the presence of large blocks and trade ahead of them.

On the other hand, many institutional investors (such as mutual funds and pension funds who often represent the interests of many individuals investing indirectly in equities) who commented on the Concept Release believed that their trading costs had declined in recent years, that technology had fostered competition among trading venues and liquidity providers, improved the efficiency of trading, narrowed spreads, and that their brokerage commissions have never been lower. These investors highlighted important benefits in the current market structure that should be preserved.

III. Responding to Developments in Market Structure Under Existing Authority

A principal lesson of the financial crisis is that, because today's financial markets and their participants are dynamic, fast-moving, and innovative, the regulators who oversee them must continuously improve their knowledge and skills to regulate effectively. In response to the ever-changing nature of our financial system, the SEC's Office of Compliance, Investigations and Examinations (OCIE) and our Division of Enforcement have adopted new approaches to promote fair, orderly and efficient operation of the markets.

A vigorous examination program not only reduces the opportunities for wrongdoing and fraud, but also provides early warning about emerging trends and potential weaknesses in compliance programs. As described in more detail below, over the past year, we have begun reforming OCIE in response to developing Wall Street practices and lessons learned from recent fraud investigations.

Enforcement is another critical element to fair and effective markets. Swift and vigorous prosecution of emerging schemes designed to circumvent the law is at the heart of the agency's efforts to promote investor confidence in the integrity of the marketplace.

A. Market Surveillance and Inspections

In response to the dramatic changes that recently have developed in our markets, the Commission is employing an interdisciplinary approach designed to bring together subject matter experts from across the agency to identify, analyze and address issues that arise.

Recognizing the sweeping industry and market changes that have occurred in the past few years, OCIE, under new leadership, recently completed a critical self-assessment of its national examination program, not only of SROs, but also of broker-dealers and other regulated entities. As a result of that self-assessment, OCIE determined that it needed to develop a more risk-focused strategic plan to address SRO oversight of individual market centers.

OCIE is in the process of implementing its new SRO examination program this year. In addition to its ongoing examination responsibilities, OCIE staff currently is conducting risk assessment evaluations of each of the 13 registered exchanges and the options and equities markets that they operate. This assessment has been informed by recent market events, including the events of May 6, and will include an overview of key risk areas including conflicts of interest, corporate governance, regulatory structure, and market oversight and surveillance.

OCIE expects to use the findings of these examinations to create a comprehensive risk matrix for each of the exchanges and use that risk-based approach to inform future examinations. In addition, the exam findings will provide the SEC with the ability to address cross-market issues more holistically, by, for example, articulating common risk factors and better practices that can be adopted by all markets.

B. Enforcement Response

While market structure is primarily a regulatory challenge, an enforcement response is available and appropriate where market participants violate the law. The SEC's Division of Enforcement is devoting significant investigative resources to determine whether various market participants have engaged in conduct that unlawfully exploited the fragmentation of the markets, intentionally contributed to market volatility or manipulated the price and volume of securities at the expense of innocent investors.

The Enforcement Division's Market Abuse Unit is one of five specialized units established earlier this year to conduct specialized investigations and develop expertise in particularly high risk program areas. The Market Abuse Unit is helping to coordinate the Commission's enforcement response to complex abusive trading practices and market participants seeking unlawfully to exploit current market structure. The Unit is planning an Analysis and Detection Center, to be staffed, budget permitting, with specialists having expertise in algorithmic trading strategies, trading abuse, quantitative analysis, market structure and data architecture. By concentrating expertise in these areas, the Division of Enforcement can more efficiently and effectively identify potentially abusive trading practices that pose the greatest risk of harm to investors.

Investigating manipulation cases is often difficult, particularly given the speed and volume with which trading is occurring in today's markets. The Enforcement Division is committed to discovering manipulation schemes at their incipient stages. The SEC has had recent success, for example, through close coordination with criminal authorities, who are able to use law enforcement techniques that are proactive, and may yield stronger evidence of scienter—or manipulative intent.

That said, while traditional law enforcement approaches to investigating manipulation schemes are often effective, they alone are insufficient to police today's markets for potentially manipulative practices involving high frequency, algorithmic and large volume trading. The Commission needs significant upgrades to our systems and analytical resources to be able to effectively identify manipulations as they occur in today's markets. For example, we need the tools that will enable us to keep up with market participants who are placing thousands of orders per second.

Similarly, the fragmentation of trading at different market centers means trading data often has format, compatibility and clock-synchronization differences, making

it difficult to quickly identify a complete picture of a single trader's market activities on a timely basis. The prevalence of high-volume trading through direct market access providers requires that investigative staff trace the trading back through multiple layers of intermediaries to identify the original trader. Because the staff must manually evaluate each layer of data before it can request the next, the lack of advanced data analysis tools can both delay our investigations and make it more difficult to identify the trader whose conduct is of ultimate interest. Enforcement staff is currently focusing on whether certain trading practices occur that potentially give rise to Federal securities law violations. Such practices include layering or spoofing, improper order cancellation activities or "quote stuffing," the use of order anticipation and momentum ignition strategies undertaken for a manipulative purpose, passive market making practices that incentivize possible manipulative quoting activity, abusive colocation and data latency arbitrage activity in potential violation of Regulation NMS, use of Direct Market Access arrangements to conceal manipulative trading activity and conduit entity market manipulation.

We must stress that our investigative efforts in these areas at this stage are fact finding in nature and the pendency of an investigation does not mean that the Commission or its staff has determined that abuses have occurred. It is premature to predict whether enforcement actions will result from these matters, but the sustained specialized knowledge and insights we gain will inform the agency's regulation and lead to greater efficiency and effectiveness in our investigations.

IV. Steps to Strengthen the Equity Market Structure

It is vital that the rules that govern market structure and market participant behavior support equity markets that warrant the full confidence of investors and listed companies. The Commission recently has adopted a number of important initiatives to further this goal:

- Less than 2 weeks after May 6, the Commission posted for comment proposed exchange rules that would halt trading for certain individual stocks if their price moved 10 percent in a 5 minute period. Barely more than 6 weeks after the event, exchanges began putting in place a pilot uniform circuit breaker program for S&P 500 stocks. In September, the program was extended to stocks in the Russell 1000 Index and specified exchange-traded products. The aim of this program is to halt trading under disorderly market conditions, which in turn should help restore investor confidence by ensuring that markets operate only when they can effectively carry out their critical price-discovery functions.
- In September, the Commission approved pilot exchange rules designed to bring order and transparency to the process of breaking "clearly erroneous" trades. On May 6, nearly 20,000 trades were invalidated for stocks that traded 60 percent or more away from their price at 2:40 PM. That 60 percent benchmark, however, was set after the fact. We now have consistent rules in place governing clearly erroneous trades that will apply to any future disruption.
- In November, the Commission approved exchange rules to enhance the quotation standards for market makers. In particular, the new rules eliminate "stub quotes"—a bid to buy or an offer to sell a stock at a price so far away from the prevailing market that it is not intended to be executed, such as a bid to buy at a penny or an offer to sell at $100,000. Executions against stub quotes represented a significant proportion of the trades that were executed at extreme prices on May 6 and were subsequently broken.
- Also in November, the Commission took an important step to promote market stability by adopting a new market access rule. Broker-dealers that access the markets themselves or offer market access to customers will be required to put in place appropriate pretrade risk management controls and supervisory procedures. The rule effectively prohibits broker-dealers from providing customers with "unfiltered" access to an exchange or alternative trading system. By helping ensure that broker-dealers appropriately control the risks of market access, the rule should prevent broker-dealers from engaging in practices that threaten the financial condition of other market participants and clearing organizations, as well as the integrity of trading on the securities markets.

In addition to these adopted rules, the Commission has proposed large trader reporting requirements and a consolidated audit trail system to improve our ability to regulate the equity markets. These proposals would tremendously enhance regulators' ability to identify significant market participants, collect information on their activity, and analyze their trading behavior. Both of these initiatives seek to address significant shortcomings in the agency's present ability to collect and monitor data

in an efficient and scalable manner and to address discrete market structure problems.

Today, there is not any standardized, automated system to collect data across the various trading venues, products and market participants. Each market has its own individual and often incomplete data collection system, and as a result, regulators tracking suspicious activity or reconstructing an unusual event must obtain and merge a sometimes immense volume of disparate data from a number of different markets. And even then, the data does not always reveal who traded which security, and when. To obtain individual trader information the SEC must make a series of manual requests that can take days or even weeks to fulfill. In brief, the Commission's tools for collecting data and surveilling our markets do not incorporate the technology currently used by those we regulate.

The proposed consolidated audit trail rule would require the exchanges and FINRA to jointly develop a national market system (NMS) plan to create, implement, and maintain a consolidated audit trail in the form of a newly created central repository. The information would capture each step in the life of the order, from receipt or origination of an order, through the modification, cancellation, routing and execution of an order. Notably, this information would include information identifying the "ultimate customer" who generated the order. And, it would require members to "tag" each order with a unique order identifier that would stay with that order throughout its life.

If implemented, the consolidated audit trail would, for the first time, allow SROs and the Commission to track trade data across multiple markets, products and participants simultaneously. It would allow us to rapidly reconstruct trading activity and to more quickly analyze both suspicious trading behavior and unusual market events. It is important to recognize, however, that the consolidated audit trail is a major change in the technology infrastructure for our equity markets, and thus will require some time to fully implement. In addition, in order to fully use this new infrastructure, the Commission's own technology and human resources will need to be expanded well beyond their current levels.

We also are examining the circuit breaker mechanisms that directly limit price volatility. These include the recently adopted circuit breakers for individual stocks, as well as the longstanding broad market circuit breakers that apply across the securities and futures markets. While they have worked well, the individual stock circuit breakers adopted since May 6 may need to be further enhanced. They were important first steps that could be implemented quickly to address the worst aspects of excessive volatility, and as such were approved on a pilot basis. Now that we have some experience with them, however, we better understand some of their limitations and shortcomings.

For example, we are working with the exchanges to consider a limit up/limit down procedure that would directly prohibit trades outside specified parameters, while allowing trading to continue within those parameters. Such a procedure could prevent many anomalous trades from ever occurring, as well as limiting the disruptive effect of those that do occur.

In addition to these new circuit breakers for individual securities, the futures and securities markets long have had circuit breakers for the broad market that, when triggered, pause trading in futures, stocks, and options. None were triggered, however, during the severe market disruption on May 6. We are assessing whether various aspects of the broad market circuit breakers need to be modified or updated in light of today's market structure.

We also are examining a wide range of other market structure issues. These include the Commission's proposals with respect to flash orders and undisplayed liquidity, issues arising out of May 6 (such as large order execution algorithms that can operate in unexpected ways and the role of registered market makers), and the broad policy issues raised in the Concept Release.

One of these is the issue of competition and fragmentation. As previously noted, trading volume in U.S.-listed stocks is split among many different venues. These include exchanges that display quotations that are made widely available to the public and nonpublic markets that do not display quotations at all. These venues offer a wide range of choices that many investors value highly to meet their diverse needs.

The emergence of multiple trading venues that offer investors the benefits of greater competition also has made our market structure more complex. Market participants use a multitude of information sources and routing strategies in their efforts to obtain best execution of orders across all the different venues. The venues, in turn, compete vigorously to attract this order flow by, among other things, distributing proprietary market data feeds that are separate from the consolidated data feeds that are made widely available to the public. We are assessing initiatives

to improve transparency of order handling and execution practices that were supported by many commenters on the Concept Release.

In addition, orders executed in nonpublic trading venues such as dark pools and internalizing broker-dealers now account for nearly 30 percent of volume, up from approximately 25 percent 1 year ago. We are considering the effect of these venues on public price discovery and market stability. Many institutional investors value the opportunity to trade in dark venues because of a fear that trading in the public markets in large sizes will cause prices to run away from them. We will explore all aspects of this issue to reach a balanced conclusion. At the end of the day, investors of all types must have confidence that our market structure provides high-quality price discovery and the tools they need to meet their investment objectives in a fair and efficient manner.

In sum, we must look comprehensively at the issues, identify if and where the current market structure is not fulfilling its guiding principles, and take appropriate steps in a balanced way that also preserves the strengths of the current market structure. As noted above, the Commission's guiding principle must be to encourage a market structure that promotes capital formation and protects investors. We must also be mindful of the need for strong empirical analysis to support our actions, and of the potentially significant risk of harm to the markets that might arise from unintended consequences. In addition, we must continue to support and staff these and other market structure initiatives with appropriate levels of expertise.

V. Conclusion

The structure of today's markets offers many advantages to investors. We should not attempt to turn the clock back to the days of trading crowds on exchange floors. But we must continue to carefully analyze the issues raised by our Concept Release and by the events of May 6 to determine whether our market structure rules have kept pace with the new trading realities and to identify whether there are ways to improve our markets, provide additional transparency and increase investor protections.

As we move ahead, we look forward to working closely with Congress to continue addressing these critical market structure issues.

Thank you for inviting me here to discuss the developments in market structure. I look forward to answering your questions.

PREPARED STATEMENT OF GARY GENSLER

CHAIRMAN, COMMODITY FUTURES TRADING COMMISSION

DECEMBER 8, 2010

Good afternoon Chairman Reed, Chairman Levin, Ranking Member Bunning, Ranking Member Coburn, and Members of the Subcommittee on Securities, Insurance, and Investment and the Permanent Subcommittee on Investigations. I thank you for inviting me to today's hearing. I am pleased to testify alongside Securities and Exchange Commission (SEC) Chairman Mary Schapiro. This is our seventh time testifying together, and our third on issues related to the May 6 market events.

Since we last testified before the Subcommittee, staff from the Commodity Futures Trading Commission (CFTC) and SEC released a supplemental report on October 1 on the unusual market events of May 6, 2010. As outlined in the joint staff report, there were three chapters of the May 6 market events:

- very fragile and uncertain markets due in part to the unsettling news concerning the European debt crisis;
- a liquidity crisis in the E-Mini S&P 500 futures contracts (E-Mini) and related index securities; and
- a liquidity crisis in individual securities.

The events of that day highlighted many aspects of our markets, but two that I want to specifically focus on. One is how interconnected our markets are and the second is the role of technology in our markets. Before I talk about the overall nature of our markets today, though we have put this in previous reports, I want to mention some of the events during that critical half hour on May 6.

At around 2:30 p.m. that day, in markets that were already frail and volatile, a large fundamental trader came into the E-Mini market to hedge about $4.1 billion of equity market exposure by selling 75,000 futures contracts, using an executing broker to execute the transaction. The trader chose to put the entire order into an automated execution algorithm. The trader chose to use an algorithm without establishing a price limit or a minimum time for execution of the order; instead, the order

was executed based upon an aggregate target of 9 percent of the trading volume calculated over the execution period. Once the order was entered into the algorithm, it stayed on auto-pilot to be executed in its entirety even if the market fell rapidly.

This particular half hour highlighted cross-market linkages between securities, futures, and other derivatives marketplaces that are enabled by technology. Traders can employ automated trading systems to detect and take advantage of differences in prices of related markets. Cross-market trading strategies are about buying in one market and selling in another market products that are highly correlated. For instance, it may be something traded in the futures market that is indexed to the stock market and separately trading in the stock market itself. Where small disparities in the prices arise—even for just milliseconds—market participants try to profit from those differences in what economists and financial experts call arbitrage.

During the critical 13-minute period on May 6, cross-market arbitrageurs transferred the price declines in the E-mini futures market produced in part by the large fundamental seller to the equities markets by opportunistically buying the E-Mini and simultaneously selling the S&P 500 SPDR exchange traded fund (SPY) and baskets of underlying stocks in the S&P 500 Index. Subsequently, prices in the SPY and individual securities rapidly fell. After a critical 5-second pause in trading of the E-mini in the futures market, the prices of the E-mini began to rise. During that period, as the price of the E-mini rose, the cross-market linkages resulted in a rise in the price of the SPY.

Though the markets for the E-mini and the broad market SPY began to rise, there was a liquidity crisis in individual securities as well.

Technology

CFTC-regulated markets have rapidly transitioned from face-to-face to electronic trading, where 88 percent of trades are executed electronically. The move from trading on the floor of an exchange to electronic trading introduced significant changes in trading methods, spawning dramatic increases in automated execution, algorithmic market making and high frequency trading.

Automated Execution

Executing firms that have direct access to an exchange's electronic trading platform provide investors with automated execution of large orders. These programs often are used to divide a large trade into many small trades with the goal of achieving the best average price. Automated execution is widely used by large investors, such as pension funds and asset managers, to acquire or hedge their exposures in different markets, including cash, futures, or options.

Algorithmic Market Making

Algorithmic market making broadly consists of placing limit orders, either as offers to sell above the current market price or bids to buy below the current market price. The goal of this strategy is to earn the bid-offer spread on lots of transactions. Algorithmic market makers generally do not access the markets in the same way that investors using algorithmic execution do. They tend to design their own algorithms to quickly, often in a manner of microseconds, get their orders into the trading platforms.

High Frequency Trading

High frequency trading typically refers to trading activity that employs extremely fast automated programs for generating, routing, canceling, and executing orders in electronic markets. They often act as algorithmic market makers, but they do other things as well, such as cross-market arbitrage, for example. Another high frequency trading strategy is referred to as "sniping." This strategy submits and quickly cancels orders, looking for hidden pockets of liquidity.

Surveillance and Safeguards

The CFTC's surveillance program works to promote market integrity and protect against fraud, manipulation, and other abuses. In the ever changing market environment, it is important that regulators have access to data, coordinate across agencies, trading platforms and self-regulatory organizations and have effective market mechanisms and pretrade safeguards.

Data

By the morning of May 7, the CFTC had all of the transaction and open position data for trading on May 6. We are fortunate to receive futures data every day. Because of the events of May 6, we also asked for full order book data, which we do not normally do. We do not have the resources to collect or examine order books on a daily basis, but, given the events of May 6, we reviewed that day's order books.

This was a tremendous effort to collect and analyze an enormous data file that included more than 14 million messages just for 1 day in the lead month of the E-Mini.

Though we do get daily futures data, it is currently missing an important bit of information: We receive traders' account numbers, but we do not get the identity of the owner or controller of that account. Over time, CFTC staff has manually identified traders associated with a significant number of the more active trading accounts. The Commission published a proposed rule in July of this year that will, if finalized, require automated identification of account ownership and control.

Though our interviews with traders did not suggest that on May 6 the swaps marketplace played a significant role, it may have on other days and may in the future. That is why I think it is very important that Congress has given regulators the authority to require swap dealers to provide swaps data to trade repositories that must make the data available to regulators. The CFTC has a rule out for public comment that would allow us to see all the data in the swaps markets that we see in the futures markets. Additionally, the CFTC will need to establish data linkages between swaps and futures data to conduct financial risk surveillance, market surveillance, economic analysis, and enforcement investigations across markets.

Coordination With Regulators, Exchanges, and Self-Regulatory Organizations

The CFTC is coordinating closely with the SEC on a policy level. We coordinated in providing recommendations to Congress on harmonizing our regulations. We also are closely coordinating on rulemakings to implement the Dodd-Frank Wall Street Reform and Consumer Protection Act.

Importantly, we are working together on surveillance and data sharing. For instance, after the events of May 6, CFTC staff promptly shared position and transaction information directly with the SEC.

Though coordination between the regulators is important, it is every bit as important that there be coordination between the exchanges and self-regulatory organizations, who conduct front-line market surveillance. The securities, options and futures exchanges have an intermarket working group to address surveillance concerns.

Futures exchanges utilize computer surveillance systems that enable their investigators to conduct focused reviews of exception reports and create customized, *ad hoc* queries of trade data to identify instances of possible trade practice rule violations. The largest exchange also uses specific computerized pattern detection algorithms to identify trading patterns associated with several major types of violations. The exchanges monitor the basis relationship between cash and futures for both broad based index and single stock futures and look for anomalies.

The CFTC also has been developing automated surveillance programs to detect prohibited trading activity and identify large price changes and large position changes. We have only just begun this process. We have significant more work to do to adequately automate surveillance in the futures market—not to mention the swaps market. The Commission will require additional resources to complete this project.

Pretrade Safeguards

Both CME Globex and the ICE trading systems have automatic safety features—termed "pretrade risk management functionality"—to protect against errors in the entry of orders and extreme price swings. These features help ensure fair and orderly markets. These pretrade risk management safeguards include: (1) price bands; (2) maximum order size; (3) protections against market stop loss orders; and (4) stop logic functionality, or market pauses that prevent cascading stop orders. This is what was triggered on May 6 and coincided with the bottom of the E-mini. Exchanges also require executing brokers to have pretrade credit limitations to ensure that traders have the financial resources to complete transactions.

One rulemaking that the Commission proposed on December 1 requires futures exchanges to have effective risk controls to reduce the potential for market disruptions and ensure orderly market conditions. To prevent market disruptions due to sudden volatile price movements, the proposed rule requires futures exchanges to have effective risk controls in place. This includes pauses or halts to trading in the event of extraordinary price movements that may result in distorted prices or trigger market disruptions.

Implementing Enhancements to the CFTC's Regulatory Program

Though the Commission draws on more than 70 years of experience regulating futures, the events of May 6 and the Dodd-Frank Act present new challenges, responsibilities, and authorities.

Joint Advisory Committee

The CFTC and SEC—with Congressional authorization—established the CFTC–SEC Joint Advisory Committee on Emerging Regulatory Issues. The first task of this Advisory Committee is to evaluate the events of May 6 and make recommendations to both agencies to improve market structures and regulations. The Advisory Committee has met four times thus far, and we are targeting to reconvene in late January. Amongst the areas we have asked them to address are the design of existing broad market circuit-breakers and pretrade risk management safeguards.

CFTC staff is working with SEC staff to review and recommend potential revisions to the design of broad market circuit-breakers in light of today's interconnected markets and changes in technology.

Disruptive Trading Practice

The Dodd-Frank Act gives the CFTC specific authority to restrict disruptive trading practices. The Act specifically prohibits three trading practices: (1) violating bids or offers; (2) intentional or reckless disregard for the orderly execution of transactions during the closing period; and (3) spoofing (bidding or offering with the intent to cancel the bid or offer before execution). In addition, Congress gave the Commission the authority to write rules and regulations that are reasonably necessary to prohibit trading practices that are disruptive of fair and orderly markets.

On October 26, 2010, the CFTC published an advanced notice of proposed rulemaking seeking public comments on disruptive trading practices and the appropriate exercise of our rulemaking authority in this area. Specifically, the Commission solicited public input on the intersection of algorithmic and high frequency trading with possible market abuses and asked whether—outside of the closing period—there should be an obligation on executing brokers.

Resources

Before I close, I will address the resource needs of the CFTC. The futures marketplace that the CFTC oversees is currently a $33 trillion industry in notional amount. The swaps market that the Dodd-Frank Act tasks the CFTC with regulating has a far larger notional amount as well as more complexity. Based upon figures compiled by the Office of the Comptroller of the Currency, the largest 25 bank holding companies currently have $277 trillion notional amount of swaps.

The CFTC's current funding is far less than what is required to properly fulfill our significantly expanded role. The CFTC requires additional resources to enhance its surveillance program, prevent market disruptions similar to those experienced on May 6 and implement the Dodd-Frank Act.

The President requested $261 million for the CFTC in his fiscal year 2011 budget. This included $216 million and 745 full-time employees for pre-Dodd-Frank authorities and $45 million to provide half of the staff estimated at that time needed to implement Dodd-Frank. The House Appropriations Subcommittee with jurisdiction over the CFTC matched the President's request. The Senate Appropriations Subcommittee with jurisdiction over the CFTC boosted that amount to $286 million. We are currently operating under a continuing resolution that provides funding at an annualized level of $169 million. To fully implement the Dodd-Frank reforms, the Commission will require approximately 400 additional staff over the level needed to fulfill our pre-Dodd-Frank mission.

I again thank you for inviting me to testify today. I look forward to your questions.

PREPARED STATEMENT OF JAMES J. ANGEL

ASSOCIATE PROFESSOR OF FINANCE, MCDONOUGH SCHOOL OF BUSINESS, GEORGETOWN UNIVERSITY

DECEMBER 8, 2010

I wish to thank the Subcommittee for investigating these important questions in market structure. My name is James J. Angel and I study the nuts and bolts details of financial markets at Georgetown University. I have visited over 50 financial exchanges around the world. I am also the former Chair of the Nasdaq Economic Advisory Board and I am currently a public member of the board of directors of the Direct Edge Stock Exchanges.[1] I am a coinventor of two patents relating to trading

[1] These remarks are my own and do not necessarily represent those of Georgetown University or the Direct Edge stock exchanges.

technology. I am also the guy who warned the SEC in writing five times before the "Flash Crash" that our markets are vulnerable to such big glitches.[2]

Another Flash Crash can happen again, and we need to take steps to fix our fragmented regulatory system to prevent another one from further damaging our capital markets. Here's why:

The market is a complex network

Our financial market is not a single exchange with a wooden trading floor, but a complex network linking numerous participants trading many different types of linked products including exchange-traded equities, options, and futures as well as over-the-counter instruments. This network includes not only numerous trading platforms but a vast infrastructure of supporting services. Participants include:

- Equity exchanges
- Option exchanges
- Futures exchanges
- Automated trading systems operated by broker-dealers
- Proprietary trading systems operated by broker-dealers
- Proprietary trading systems operated by other investors
- Algorithm providers
- Data vendors
- Telecommunications providers
- Data centers
- Analytics providers
- Settlement organizations such as DTCC
- Stock transfer agencies
- Banks
- Proxy service firms
- Professional traders
- Money managers
- Hedge funds
- Retail investors
- Media

Problems anywhere in the network can disrupt the entire market

A problem anywhere in the network can lead to a disruption. For example, on Monday, September 8, 2008, the South Florida Sun Sentinel erroneously published an old story that United Airlines had filed for bankruptcy—an event that had occurred in 2002.[3] Some investors thought that United Airlines was filing for bankruptcy again, and the stock of the new United Airlines temporarily plummeted more than 75 percent before recovering. Power outages and telecom problems can also disrupt the market.

Most of the time our market network has enough redundancy to prevent a failure in one location from disrupting the whole network. Minor problems at one exchange or other part of the system are routine occurrences. Equity exchanges routinely declare "self help" when there are problems with other exchanges. Under normal conditions, market participants just trade around the problem and it never makes the news. On May 6, 2010, the market buckled under the flow of data and seemingly minor problems in data feeds cascaded into a chaotic partial failure of the entire network.

Our market network performs really well—most of the time

By most measurable standards, our market network is working better than ever before. Our automated markets provide fast, low cost executions. Total trading volume and displayed liquidity have jumped dramatically in recent years. This can be seen in the attached study I performed with Larry Harris of USC and Chester Spatt of Carnegie-Mellon, both former chief economists at the SEC. However, in that

[2] See the Appendix for details.

[3] *See, http://www.upi.com/Business_News/2008/09/08/United-Airlines-hit-by-5-year-old-news/UPI-66501220903137/.*

study, which was submitted to the SEC, we also warned of the danger of misfiring algorithms that could cause a meltdown—or a melt up of the market.[4]

Our market network has finite capacity

Just like any human system, our market network can only handle so much activity before it has problems with traffic jams. When the flow of data through a computer network overflows its capacity, strange things begin to happen. As the market is quite complex, bottlenecks can occur in unexpected places. Dealing with the capacity limitations of the network is not as simple as making sure that the equity exchanges have lots of spare computer capacity—the SEC does a pretty good job of that. As the network involves many unregulated entities, such as data vendors and IT providers as well as investors themselves, it is virtually impossible for the SEC or any regulator to force every network participant to maintain ludicrously high levels of excess capacity. This is especially true since network participants will rationally resist sizing their systems for once-a-decade data tsunamis. Instead, we need to have well thought out safeguards for dealing with these extreme events, which occur regularly in our financial markets.

The Flash Crash was exacerbated by bad market data

If traders don't have good price data, they can't trade. Many of the most important participants in our markets are known as "liquidity providers" who buy on the dips and sell on the rebound. They perform an important stabilizing role in markets. In the old days, they were known as specialists and hung out on those old wooden trading floors. Now they do their job with computers that hang out in stock exchange data centers in what is known as "colocation." This kind of "high frequency" trading is a thin margin business with a lot of competition. These traders typically earn a small fraction of a penny per share, but they make money by trading in high volumes. These liquidity providers depend upon accurate data. If they detect that there is a malfunction in their data feeds, they do the rational thing and stop trading until they can figure out what is going wrong. As the SEC and CFTC noted in their report on the Flash Crash:

> As such, data integrity was cited by the firms we interviewed as their number one concern. To protect against trading on erroneous data, firms implement automated stops that are triggered when the data received appears questionable.[5]

This is what happened on May 6:

- Heavy trading activity led to traffic jams in market data. In the words of the Wall Street Journal's Scott Patterson, "The market infrastructure was fried."[6]
- Important market participants detected problems in the accuracy of their market data, and stopped trading. This led to a decrease in liquidity.
- Other market participants that did not detect the data problems kept trading. There were few buyers in the market when their sell orders arrived, causing prices to plummet temporarily.

Flash Crashes are not new

Financial market history contains many events in which the market was overwhelmed by the flow of data and the market mechanism broke down. Many of these events happened long before computers. On May 3, 1906, the *New York Times* headline blared "Stocks Break and Recover. On August 9, 1919, the *New York Times* reported a "sharp break" in prices. As in the Flash Crash, there were problems in getting prices out to the public: "In the break, prices quoted on the ticker tape were once again far behind the market . . . " Soon there was an upturn and prices recovered.

System problems in times of stress are not new

Market history contains numerous examples of system problems that occurred during times of market stress. These problems were both a result of the level of market activity and a cause of additional confusion in the market. In the crash of 1929, the ticker tape ran several hours late, adding to the confusion and panic. Investors did not know whether their orders had been executed or at what price. In

---

[4] Indeed, some stocks on May 6 did melt up. A trade in Sotheby's was printed at $100,000 per share. The study can be seen at *http://www.sec.gov/comments/s7-02-10/s70210-54.pdf.*

[5] Findings Regarding the Market Events of May 6, 2010: Report of the Staffs of the CFTC and SEC to the Joint Advisory Committee on Emerging Regulatory Issues, *http://www.sec.gov/news/studies/2010/marketevents-report.pdf,* p. 35.

[6] Oral remarks at the Dow Jones Expert Series, Nasdaq Market Site, October 27, 2010.

the crash of 1987, there were, in the SEC's words, "large scale breakdowns in automated trading systems."[7] Among other problems, the printers on the NYSE jammed, so that order tickets could not be printed.

Market tsunamis are regular events, so we need to be prepared for the next one

On May 6, the market network was so overwhelmed with the flood of data that it broke down and started spewing out bad prices. This is not the first time, nor will it be the last time. Market history teaches us that these extreme but infrequent events happen regularly. We need to be prepared for the next market tsunami. It is impractical to mandate an extreme amount of overcapacity throughout the extended market network. Instead, we should put safeguards in place so that when the next one hits, our market deals with the overflow of activity in a fail-safe manner.

We need safeguards for individual stocks as well as for the whole market network

Crude "circuit breakers" were put in place after the crash of 1987.[8] If the Flash Crash of 2010 had occurred just a few minutes earlier and been a little steeper, a 1 hour trading halt would have occurred. Thank God that didn't happen! Imagine the public panic that would have occurred when the news got out that the market crashed and then shut down. The public may well have thought that the fall in prices was a fundamental result of bad news stemming from the situation in Greece, and there may have been even more panic selling when the market reopened. Our close brush with doom on May 6, 2010, shows us how poorly the post-1987 circuit-breakers were designed. We need to seriously rethink the marketwide as well as stock specific safeguards.

We also have mini-disruptions in individuals stocks with distressing regularity. The crude stock-by-stock circuit breakers that were imposed after the Flash Crash are an important first step, but there is much more refinement that needs to take place. The safeguards need to cover all stocks, and they need to be in effect during the open and the close. We need to fix the erroneous trade problem that has led to many false alarms after the circuit breakers were implemented.

The current circuit breaker designs are based on price, which is good, but we should also have circuit breakers that are based on data integrity. When the data feeds can't keep up with the market, we need to slow down the market so we can catch up. This will nip the problems in the bud before prices go crazy.

The safeguards need to be integrated across the entire market network

Currently, our fragmented regulatory system treats each exchange as an independent Self Regulatory Organization. There is no real time supervision of the entire market network. There is no entity that can call a timeout when there is some network problem that may not have been anticipated in the circuit breaker design. Somebody needs to be monitoring the system in real time and that somebody needs to have the authority to call a timeout when things go crazy. I think that FINRA is the obvious candidate to be that somebody.

We need to worry less about a fragmented market than about fragmented regulation

Some market participants grumble about the complexity and "fragmentation" of today's markets. Yes, today's market is far more complex than the days of old, but it works much better. Most of our technology today, from the automobile to the word processor, contains far more complicated technology than before, and most of the time works far better.

One can think of the stock market of a few years ago as being similar to a manual typewriter. We upgraded it to an electric typewriter, and then to a word processor. On May 6, 2010, that word processor went into short spasm that highlighted many of the flaws I previously warned the SEC about. However, that does not mean that we should throw out the word processor and go back to a manual typewriter. It means we need to put safeguards in place to make sure that it doesn't happen again.

Even though the technology of our markets has improved dramatically in recent years, our regulatory system is still stuck in the manual typewriter days of the early twentieth century. There are literally hundreds of financial regulatory agencies at the State and Federal levels. None of them have the big picture in their in-baskets. Each of them has a fairly narrow mandate.

In the 1975 "National Market System" amendments to the Securities Exchange Act, Congress mandated a competitive market structure. The SEC has dutifully im-

---

[7] *http://www.sec.gov/news/studies/tradrep.htm*

[8] *See, http://www.nyse.com/press/circuit_breakers.html* for the current circuit breaker levels.

plemented this. However, Congress has not thought through how to regulate our interconnected financial markets. The Dodd-Frank bill did not meaningfully address the dysfunctional fragmentation in our regulatory system.

We need regulators who understand the entire market

Although the SEC has many dedicated and intelligent public servants, as an organization it does not really understand the entire market network. The Commission is a specialist agency with a narrow mandate that focuses on "securities." Other related financial products (futures, insurance, and loan products) are left to other State and Federal agencies, which leads to gaps as well as overlaps in the regulation. If we think of our market network as a body, the SEC is perhaps, a cardiologist who might very well ignore the patient's lung cancer as it assumes that other doctors treat it.[9] And since the cardiologist and the oncologist and in different granite towers, the cancer is ignored.

The regulators need better market intelligence

One of the frightening aspects of the Flash Crash was how long it took the regulators to piece together what happened, and how their reports still displayed a lack of a deep understanding of the significance of the facts they uncovered. We need regulators who really understand the market network and have access to the data and resources they need to properly nurture and supervise our markets.

The regulators need good funding

We have been penny wise and pound foolish with respect to funding the SEC. The SEC's total cumulative budget since its founding has been, in today's dollars, about $18 billion. That is less than half of investor losses in the Madoff scandal. We need good cops on the beat to keep the crooks out. We need to hire enough good people to do the job right, and make sure they have the right tools to do the job. We also need to be able to pay them enough to attract and keep good people. The pay level of SEC officials is very far below their private sector counterparts. SEC salaries should be benchmarked close enough to the private sector so that they can get the right people.

One solution: De facto *integration in our financial capitals*

The SEC is sequestered in a granite tower on F Street in Washington, hundreds of miles away from the heart of the markets that it attempts to regulate. The CFTC is in a different granite tower two miles away from the SEC in Lafayette Centre. The banking regulators are spread all over. Congress seemed unwilling to address the dysfunctional structure of our fragmented regulatory morass in the recent Dodd-Frank bill.

However, there is an administrative solution to the fragmentation of our regulatory system that would not require massive legislation: If you want the regulators to work together, house them in close physical proximity. House all of the Federal financial regulators in one building with common shared facilities for security, food service, information technology, and so forth. In this way, it will become easy for regulators in the different agencies to literally work closely with each other. It will also make it easier for agencies to make use of the already existing Intergovernmental Personnel Act (IPA) mobility program to rotate employees through the different agencies. Increasing the rotation of employees through the different regulatory agencies will improve the thinking of regulatory agencies by making the agencies more cognizant of the entire market network rather than the narrow piece that their agency regulates.

Second, locate this facility in the heart of our financial markets in New York City. Even though we live in an electronically linked world, physical proximity still matters. Being in the heart of the financial system makes it easier for the regulators to actually interact with the people in the markets. I know from my own experience that it is hard to understand markets from my ivory tower office. I learn about markets by taking every opportunity I can to make on-site visits to market practitioners. It is very important for the regulators to get out of their granite towers and interact with the financial markets, and it will be much easier if they are located closer to the markets they are regulating. It will also be easier for them to invite market practitioners in to visit them as well.

Closeness to the markets is one of the reasons why trading firms still congregate in the New York City area. Notice that NASDAQ, which operates an all electronic market, moved its headquarters to New York when it realized that its key employ-

[9] In a discussion once with an SEC staffer a few years ago, I raised a concern about systemic risk. I was immediately and emphatically told that systemic risk was not in the SEC's mandate and that it was the Fed's job to worry about it.

ees were spending so much time shuttling between Washington and New York. Pipeline Trading, which was founded by scientists from Los Alamos, New Mexico, set up shop in New York because that is the heart of the financial markets.

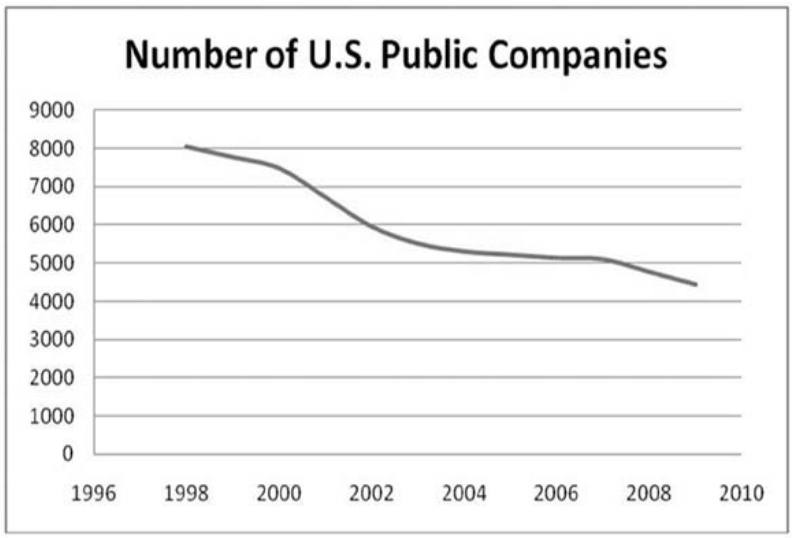
Locating the bulk of our regulators in New York means that the regulatory agencies will draw from a labor pool that understands financial markets and has good market experience. I understand that it is hard right now for the regulators to attract good people to move to DC. The agencies thus draw from a labor pool of Government regulators who are well meaning but don't have the background or experience needed for the job.

The falling number of public companies is a major problem!

Although not a focus of this hearing, there is another market-structure related problem that cries out for serious attention: The number of listed U.S. companies has fallen sharply over the last decade. At the end of 1997, before the dot-com bubble went crazy, there were 8,201 operating domestic companies listed on the NYSE, NASDAQ, and AMEX exchanges. At the end of 2009, only 4,439. [10]

By the end of October, 2010, there were only 3,964 companies in the Wilshire 5000 index, an index which include all domestic companies listed on our exchanges. [11]

While private equity firms have picked up some of the slack, they are not a substitute for vibrant capital markets. Indeed, private equity investors need the public markets in order to be able to exit their investments. Without an exit strategy, investors won't invest in the first place.



Fewer public companies = fewer jobs

In rough numbers, if we assume that half of the roughly 4,000 missing companies are now private or part of larger public companies, that still leaves about 2,000 missing U.S. companies. If each of those missing companies employed 1,000 workers, that is two million fewer jobs. Two million more jobs would slash over 1 percent off of our unemployment rate.

We have made it too expensive to be a public company

There are several causes for the declining number of public companies: For one thing, it has become very expensive to be a public company compared with a private company. The compliance burdens on public companies, such as Sarbanes Oxley

[10] This data comes from the Center for Research in Securities Prices (CRSP) database for common stocks of U.S. companies listed on U.S. exchanges.

[11] *http://www.wilshire.com/Indexes/Broad/Wilshire5000/Characteristics.html,* accessed December 5, 2010.

§404 compliance is one problem. The Dodd-Frank law exempted tiny companies from this §404 burden, but the burden remains for the majority of exchange listed companies. The cost and risk of litigation exposure is another—the cost of directors and officers insurance for a public company is several times higher than the premium for a similar sized private company.

Our market structure is not welcoming to small companies

Market structure issues are also involved. Our markets provide great service to large companies, but it is not clear that the best market structure for big companies is also best for smaller companies. However, SEC policy over the last two decades has been to make the trading of smaller stocks the same as for larger stocks. There is no such thing as a "one size fits all" market, but the SEC does not seem to understand this. Small companies are lost and ignored by the market as an unintended consequence of many of the market structure changes of the last 20 years. We should encourage experimentation with different market models for smaller stocks. [12]

Considerable attention needs to be applied to this problem. Smaller companies are the engine of innovation and economic growth. Without good capital markets nurture these companies of tomorrow, we will condemn our Nation to economic stagnation.

APPENDIX: WRITTEN SUBMISSIONS TO THE SEC REGARDING MARKET GLITCHES PRIOR TO MAY 6, 2010

Warning Number 1

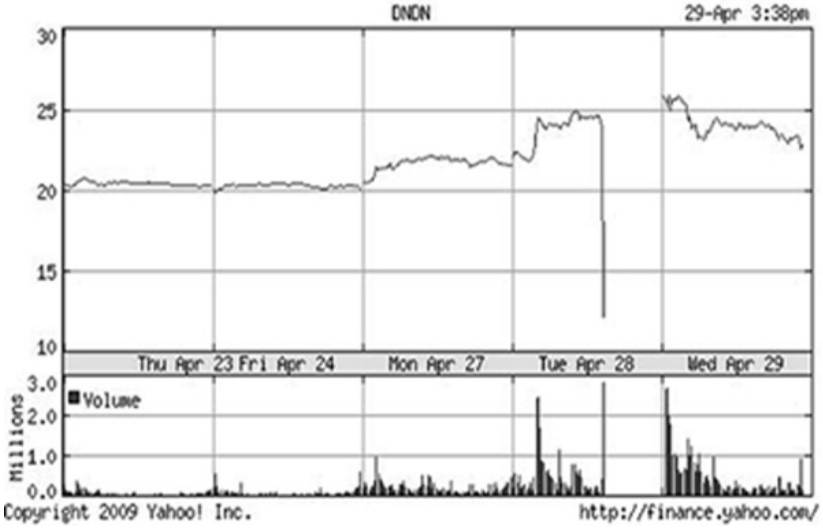
In my May 5, 2009, comments presented at the SEC Roundtable on short selling (*http://www.sec.gov/comments/4-581/4581-2.pdf*), I warned on page 3 that we would have more high speed meltdowns like the one that affected Dendreon in April 2009:

> *We need a shock absorber to prevent another Dendreon.*
>
> Those calling for a return of some type of uptick rule are expressing a legitimate concern. They intuitively grasp that there is something wrong with short-term price formation in our markets today. The recent incident with Dendreon (DNDN) on April 28, 2009, demonstrates the need for a shock absorber. The company was about to make an announcement regarding the effectiveness of its prostate drug Provenge. The stock plunged 69 percent in less than 2 minutes. [13] After the news was revealed, the stock quickly returned to its previous levels. Investors who had placed stop loss orders to protect themselves found that their orders were executed at very unfavorable prices. Why did the stock plunge? It is too early to tell. Was it a "fat fingers" mistake in which an investor hit the wrong button? Did an algorithm misfire? Was it a chaotic interaction between dueling algorithms? Did a long seller panic and dump too many shares too fast? Was there a deliberate "bear raid" manipulation going on from informed traders hoping to push the price down so they could trigger stop loss orders and scoop up shares cheaply? Or was it just the case that the market was very thin just before the news announcement and a few large sell orders exhausted the available liquidity, triggering the selloff? Regardless of the reason, the incident demonstrates the need for a shock absorber to deal with extreme situations.

---

[12] For the record, I strongly disagree with the allegations in the Litan and Bradley study that blame the proliferation of index products such as ETFs for the decline in public companies. "Choking the Recovery: Why New Growth Companies Aren't Going Public and Unrecognized Risks of Future Market Disruptions"; *http://www.kauffman.org/uploadedFiles/etf_study_11-8-10.pdf.* Although I do not agree with all of its recommendations, the Grant Thornton report is also worth noting: *A Wake Up Call for America* by David Weild and Edward Kim; *http://www.grantthornton.com/staticfiles/GTCom/Public%20companies%20and%20capital%20markets/gt_wakeup_call_.pdf*

[13] Ortega, Edward, Nasdaq Will Let Stand Dendreon Trades Under Review *http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a314cxKBoGHI*



The era in which humans traded with humans is long gone. Now computers trade with other computers in the blink of an electron. Most other developed equity markets around the world have some kind of procedure for dealing with extreme situations. Whether it is a price limit, a trading halt, or a special quote mechanism, the United States needs to install a shock absorber to deal with excessive volatility. One of the main purposes of the stock market is to provide good price discovery. If the price discovery mechanism appears to be broken, it will reduce investor confidence in the market.

Unfortunately, merely reimposing the old useless uptick rule or forcing a preborrow for shorted shares will not solve the problem of excessive intraday volatility. What is needed is to think outside the box of "lets get the short sellers" to the more useful question of "what kind of shock absorber works best in our modern markets?"

It is certainly not obvious what form such a shock absorber should take. One thing that is clear is that the 1939 uptick rule will not achieve the objective of reducing excess volatility. Installing a broken shock absorber from a 1939 Chevrolet Coupe into our 2009 Corvette market will not do the job. What would make sense is a dampener similar to the exchanges' proposal. The beauty of the exchange's circuit-breaker with restriction idea is that it does not interfere with normal market operations under normal conditions. It only kicks in when needed, at times when the market is under stress. Perhaps a more gradual shock absorber would make more sense. For example, one approach would be:

- At prices at or above 5 percent below the previous close: No restrictions
- At prices below 5 percent below the previous close: Hard preborrow for short sales
- At prices 10 percent below the previous close: price test for short sales
- If the price hits 20 percent below the previous close: Automatic 10 minute trading halt. The stock would reopen with the usual opening auction after market surveillance has determined that there are no pending news announcements.

I urge the Commission to begin consultation with the industry to develop one that fits the unique and competitive nature of our markets. If nothing is done, there will be more Dendreons.

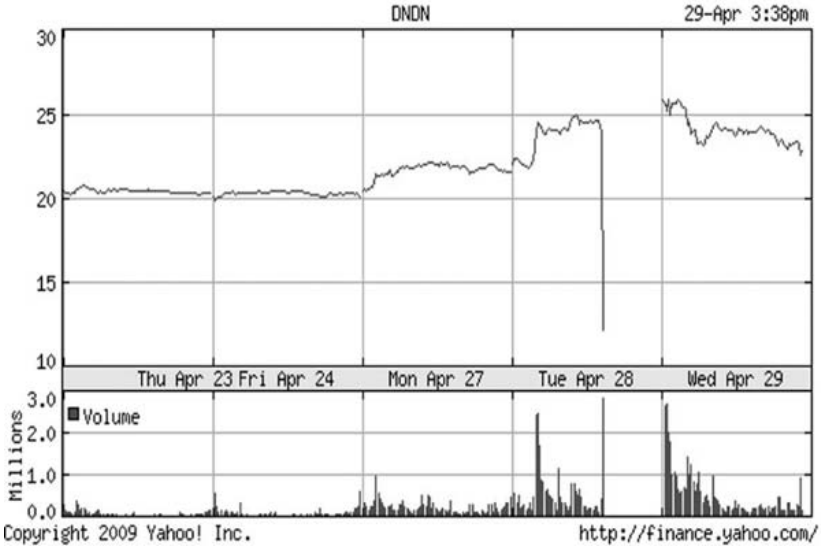
Warning Number 2

In my comment letter of June 19, 2009 (*http://www.sec.gov/comments/s7-08-09/s70809-3758.pdf*), I stated on page 2:

Our electronic markets lack a shock absorber.

Most electronic exchanges around the world have automated systems in place to deal with extreme events. We don't. High speed algorithmic trading has brought amazing liquidity and low transactions costs to the markets, but it also brings the risk of market disruption at warp speed.

Our markets are vulnerable to short-term fluctuations that can result in prices that do not reflect the market's consensus of the value of the stock. The disruption in the trading of Dendreon (DND) on April 28, 2009, that I referred to in my remarks at the Roundtable is a smoking gun. (My remarks are repeated at the end of this comment letter for you convenience as well.)



The stock plunged for no apparent reason, and by the time the humans halted trading the damage was done. Many investors who had placed stop-loss orders discovered that their orders had been filled at very low prices. Furthermore, incidents like these bring up suspicions of foul play, and these suspicions hurt our capital markets. When investors think that market manipulation is unpunished, they will withdraw from our capital markets, reducing their usefulness to our society.

Short selling is not the only cause of short term market disruptions.

A burst of short selling can cause a "Dendreon moment", but so can long selling. Markets can also be disrupted on the up side as well. In considering what to do about situations like this, the Commission should consider the broader needs of the market for a shock absorber to deal with excessive short-term volatility.

The Commission should actively consider shock absorbers that deal with ALL price disruptions, not just ones triggered by short sales. One time-tested model to consider is the "volatility interruption" used by Deutsche Börse.[14] When the stock moves outside of a reference range, trading is halted for a period of time and trading then restarts with a call auction.

We need not follow the Deutsche Börse model exactly. Short orders at prices below the previous opening or closing price could be excluded from the restarting auction (with appropriate exemptions for market makers and arbitrageurs). After trading restarts, restrictions should be placed on short sales at prices 5 percent or more below the previous opening or closing price

[14] *http://deutsche-boerse.com/dbag/dispatch/en/binary/gdb_content_pool/imported_files/public_files/10_downloads/31_trading_member/10_Products_and_Functionalities/20_Stocks/50_Xetra_Market_Model/marktmodell_aktien.pdf*

to maintain fair and orderly trading. These could include (1) preborrowing requirements or a bid test.

Any changes should be carefully studied with a transparent pilot experiment.

Before the Commission institutes any such changes, it should experiment carefully as it did with the original Regulation SHO pilot. In this way, the Commission could adopt the best of the different proposals after carefully examining their impact.

Warning Number 3

In my September 21, 2009 comment letter to the SEC on short selling (*http://www.sec.gov/comments/s7-08-09/s70809-4658.pdf*), I stated on page 1:

The big picture is that today's warp speed computerized markets contain the potential for another financial catastrophe at warp speed. If an algorithm at a large financial institution misfires, whether because of an honest malfunction or sabotage, it could create an enormous critical chain reaction that would cause a tsunami of economic destruction within milliseconds. Yet we currently rely on slow humans at our exchanges to make decisions. We need automated circuit breakers that function on a stock by stock basis that will kick in instantly when something goes haywire. To date, the SEC has taken the same approach to such warnings as FEMA took to warnings that New Orleans was vulnerable to a Category 5 hurricane. Do we need a Category 5 meltdown in the equity market before the SEC moves to take action to prevent such a preventable calamity? The individual exchanges cannot act on their own because of the competitive fragmented nature of our modern markets. If a single exchange halts trading, it stands at a competitive disadvantage to its competitors. Dealing with this threat requires intelligent coordinated action by the SEC.

Warning Number 4

In my joint study with former SEC chief economists Lawrence Harris and Chester Spatt (*http://www.sec.gov/comments/s7-02-10/s70210-54.pdf*), we stated on page 47:

8.3 Misfiring algorithms

In a related area, we are also concerned that, even without naked access, the risk control procedures at a brokerage firm may fail to react in a timely manner when a trading system malfunctions. In the worst case scenario, a computerized trading system at a large brokerage firm sends a large number of erroneous sell orders in a large number of stocks, creating a positive feedback loop through the triggering of stop orders, option replication strategies, and margin liquidations. In the minutes it takes humans at the exchanges to react to the situation, billions of dollars of damage may be done.

Currently our exchanges have no automatic systems that would halt trading in a particular stock or for the entire market during extraordinary events. It is our understanding that the circuit breakers instituted after the Crash of 1987 would be manually implemented, which could take several minutes. These circuit breakers are triggered only by changes in the Dow Jones Industrial average, so severe damage could be done to other groups of stocks, and the circuit breakers would not kick in. Also, a misfiring algorithm could also create a "melt-up" as well. We recommend that the exchanges and clearinghouses examine the risk and take appropriate actions. Perhaps the issue most simply could be addressed by requiring that all computer systems that submit orders pass their orders through an independent box that quickly counts them and their sizes to ensure that they do not collectively violate preset activity parameters.

Warning Number 5

In my comment letter of April 30, 2010 (*http://www.sec.gov/comments/s7-02-10/s70210-172.pdf*), I stated on page 5 (Italic text is in the original):

High frequency technology requires high frequency circuit breakers.

There is one risk that HFT imposes on the market that must be addressed by the Commission. With so much activity driven by automated computer systems, there is a risk that something will go extremely wrong at high speed. For example, a runaway algo at a large firm could trigger a large

series of sell orders across multiple assets, triggering other sell orders and causing major disruptions with losses in the billions. With the global linkage of cash and derivative markets around the world, it would be extremely difficult to go back after the fact and bust the appropriate trades, leading to years of litigation. The uncertainty and confusion would cause serious damage. Even more troubling is the prospect that such a glitch could be caused intentionally, either by a disgruntled employee or a terrorist.

All market participants have the right incentives to prevent this from happening. The brokerage firms and exchanges have filters in place designed to catch "fat fingers" and other mistakes. However, the never ending quest for higher speed also creates incentives for them to cut corners and eliminate time consuming safeguards that might slow their response time. In today's competitive market place, no one market center can take all the needed actions alone. There needs to be coordinated guidance from the Commission on this issue.

No human system is perfect. Despite all of the correct incentives and precautions, airplanes sometimes crash. *Eventually there will be some big glitch.* We need a marketwide circuit breaker that is activated automatically in real time. It is my understanding that the crude marketwide circuit breakers imposed after the crash of 1987 are currently operated manually. In the minute or so it takes for humans to respond to a machine meltdown, billions of dollars of damages could occur.[15] The April 28, 2009, incident involving Dendreon is an example of what can go wrong. The stock lost over half its value for no apparent reason in less than 2 minutes before the humans could stop trading. When trading resumed, the stock returned to its previous value. Many investors who had placed stop orders experienced severe losses from trades that were not busted. Almost exactly 1 year later, on April 27, 2010, a botched basket trade resulted in the need to bust clearly erroneous trades in over 80 different stocks. It is extremely messy to attempt to bust erroneous trades after the fact, especially if multiple instruments in multiple asset classes traded on multiple exchanges in multiple countries are involved. For example, an investor may sell stock that was purchased during the malfunction only to find that the purchase was busted but not the later sale, leading to an inadvertent naked short position. We need a real time circuit breaker that can stop the market before extreme damage occurs.

The Commission should consider imposing an automated marketwide trading halt in any instrument that falls 10 percent in a short period of time. The stock would then reopen using the opening auction after humans have examined the situation to make sure that the stock can be reopened in a fair and orderly manner.

If this Commission fails to act on this risk after asking so many questions about HFT in this Release, this Commission and its staff will be blamed for ignoring this risk when the inevitable big glitch occurs.

---

[15] *See,* Bernard S. Donefer, "Algos Gone Wild: Risk in the World of Automated Trading Strategies", *Journal of Trading* 5(2), Spring 2010 pp. 31–34 *http://www.iijournals.com/doi/abs/10.3905/JOT.2010.5.2.031*

FT.com FINANCIAL TIMES

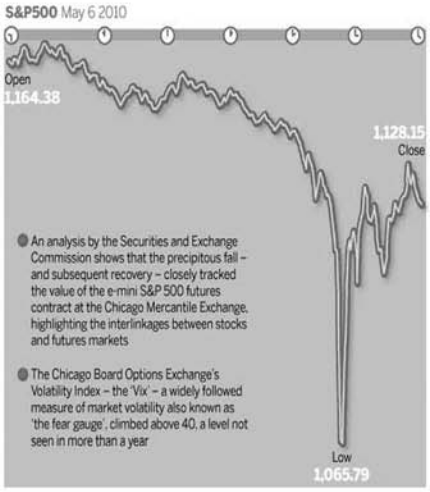
COMMENT
ANALYSIS

Close

Stock markets: That sinking feeling

Print

By Aline van Duyn, Michael Mackenzie and Jeremy Grant
Published: June 1 2010 20:52 | Last updated: June 1 2010 20:52



When James Angel **wrote** to the Securities and Exchange Commission just over a month ago, he made a prescient point. "With so much activity driven by automated computer systems, there is a risk that something will go extremely wrong at high speed," the associate professor of finance at Georgetown University warned the US equity market's main regulator in a letter sent on April 30.

It took only six days for the prediction to come true.

On May 6, a Thursday, the mood on Wall Street was already negative: concerns about the Greek sovereign debt crisis and its impact on the euro meant US stocks were already down by about 5 per cent. But within seconds, **just after 2.40pm, those falls had doubled or more**. Shares in Procter & Gamble, the household products giant, fell 35 per cent; those of Accenture, the consulting group, slid precipitately from $40 per share to trade at the incredible price of just one cent.

Traders were stunned. "We thought a big European bank was about to go under, that this was it," says a dealer who was on one of the big trading floors at the time. "Everyone got on the phone. Then, traders quickly realised that the falls were due to lots of automated sell orders. At that point we all just wanted to reach for the emergency button and press stop."

While there have been times in equity markets where some stocks have moved wildly, the afternoon that has become known as the "flash crash" was the first time that the entire US equity market was convulsed by such turmoil.

But 20 minutes later prices had bounced back. Trades that took place during that dramatic slice of the hour where the movement was more than 60 per cent were cancelled. Yet the impact of the flash crash will be felt for a long time to come, not least because it showed that the equity markets do not have such an emergency button, or any way to halt trading when something goes haywire.

"The decline and rebound of prices in major market indices and individual securities on May 6 was unprecedented in its speed and scope," said the SEC

Stop lights on the way

"Circuit-breakers" intended to prevent the kind of rout seen briefly in the May 6 "flash crash" will be introduced next week for stocks in the Standard & Poor's 500 index. If prices move by 10 per cent or more – up or down – compared with those recorded in the preceding five minutes, trading will be temporarily halted. Significantly, the curbs will apply to all exchanges and platforms on which S&P 500 shares are traded. While similar measures are already in place on the floor of the New York Stock Exchange, for

in a report on the saga. "The whipsawing prices resulted in investors selling at losses during the decline and undermined confidence in the markets."

On Wednesday, the regulator is hosting a day-long Washington debate on the topic, involving many leading industry participants. "All market reform will be looked at through the prism of what happened on May 6," says William O'Brien, chief executive of DirectEdge, one of the four main public exchanges for US shares.

The gathering comes as the issue of how markets function also rises up the agenda in Europe, where the German cabinet on Thursday meets to discuss proposals to ban so-called "naked" short-selling in German stocks – offering securities that one neither owns nor has agreed to borrow – as well as a ban on speculative derivatives on the 16-nation euro currency. In Brussels, the European Commission, the European Union's executive arm, is preparing a review of the liberalisation it introduced in share trading three years ago.

Yet amid all this activity, it is still unknown exactly what sparked the breakdown in US share trading on that otherwise unremarkable Thursday. The search to answer this mystery is in full swing, with regulators ploughing through thousands of spreadsheets and tracking more than 19bn trades in equity and derivatives markets in the search for clues.

One thing has been established: the SEC says it has found no evidence yet that the crash was the result either of "fat finger" errors, when a trader presses the wrong key or magnifies an order by misplacing a decimal point, or of computer hacking or terrorism.

"The real shocker is that it was nothing nefarious that caused the crash," says David Weild, senior adviser to Grant Thornton and former vice-chairman at Nasdaq. "It was acceptable investor behaviour – people trying to put on hedge transactions," he believes. "The market had a mini-meltdown in an instance when it appears no one was intentionally trying to manipulate the market. It's disturbing that it does not take a lot to cause these markets to cascade."

The ongoing autopsy of the US flash crash has implications way beyond Wall Street. Markets across the globe – particularly those that trade privately instead of through exchanges – are under intense scrutiny.

Opacity in privately traded markets, such as in derivatives and complex securitised bonds, is widely seen as having contributed to the meltdown of the financial system in 2008 and the ensuing global economic crisis. Laws are being passed across the globe to force over-the-counter derivatives and other markets into the public eye.

In many cases, stock markets have been hailed as the standard to live up to, for the ease with which investors can check stock prices and trade shares even when markets are volatile. "Our current equity markets are characterised by efficient and effective linkages and healthy competition among markets and market participants," said the Securities Industry Financial Markets Association, which represents many large banks and brokers, in a letter to the SEC, also penned on April 30.

During the 2008 financial crisis, trading in the equity markets "continued without a significant hitch", Sifma points out. "This is in contrast to the liquidity freezes and instability that were evident in other markets (ie, the credit markets) during that time."

But the flash crash confirmed the suspicions of those investors and regulators who had long worried that complicated trading systems, fragmented trading across some 40 different venues, and the enthusiastic embrace of super-fast trading with computers spitting out thousands of buy and sell orders in microseconds, could threaten disaster.

Indeed, the flash crash taps into a debate that has been simmering for years between those who see benefits created by the rapid advance of technology – by lowering barriers to entry for new participants and boosting liquidity for investors who wish to trade – and those who fear it has introduced unknown risks into the system.

The events of May 6 revealed that while getting rid of old-style "specialist" market makers has reduced the cost of trading by narrowing bid-ask spreads, the benefit has come at a cost. Now, no one has an obligation to provide prices for all shares all the time during a trading day, as trading has fragmented across an array of electronic trading venues and traders. The moment the markets grow too risky, many new electronic market makers appear only too willing to head for the exit.

Stitching venues together is a dazzling new way of trading that has become the engine for profits for many of the biggest exchanges and trading houses,

example, they have not so far applied to the whole market.

REGULATORY TECHNOLOGY

The fax is not dead: why collecting data is still an everyday struggle

Collecting data by fax may seem hopelessly 20th-century in an age when trading is conducted hundreds of times faster than the blink of an eye, *writes Jeremy Grant.*

But that is how Scott O'Malia, a commissioner at the US Commodity Futures Trading Commission, recently said his agency was still gathering certain kinds of information from traders. When futures brokers open accounts on behalf of clients, they fax required details to the CFTC. The same applies when so-called "large trader" data are sent in by other kinds of market participants.

For Mr O'Malia, it shows how the regulator has been in a "perpetual game of technological catch-up" when it comes to monitoring the derivatives markets. That same game is being played out across the globe as market regulators scramble to close the gap that has opened up between them and the markets they oversee.

As Mary Schapiro, chairman of the US Securities and Exchange Commission, puts it: "The technology for collecting data and surveilling our markets is often as much as two decades behind the technology currently used by those we regulate. As a result, there is an intense need for regulators to have efficient access to a far more robust

powered by rapid-fire computer programs. Trades can be executed as fast as 250 microseconds – hundreds of times faster than the blink of a human eye.

Trading volumes have soared as a new species, the high-frequency trader, has emerged – their computers spitting out thousands of prices and trading constantly during the day before retiring at the closing bell without, more often than not, holding any stocks.

This shift is not unique to the equities business. Technology has changed many other big markets around the world and also tied them more closely together. High-frequency trading is an increasing feature in the currency, bond and commodity markets. Hedge funds and other investors shift both within these markets and between them. Trading strategies can adapt with ease.

Such changes have created winners and losers. Traditional brokerages have been forced to upgrade their technology and mourn the loss of bigger trading margins from buying and selling shares. Both the New York Stock Exchange and Nasdaq have ceded market share and influence to Bats Exchange and DirectEdge, the new upstart exchanges that have captured about 20 per cent of trading volumes.

Against this backdrop, the SEC in January launched a broad review of the structure of US equity markets. The aim was to assess whether the ability of some types of traders with short-term horizons to deploy sophisticated technology might put longer-term investors at a disadvantage; whether the dispersal of liquidity across multiple trading venues meant there was any longer a "unified national market system"; and whether more rules and regulations were needed.

The debate is not unique to equity markets, nor to the US. In Europe, concern over how market structures function is just as intense – and opinions just as polarised. Fragmentation between multiple trading venues – a feature of the US landscape for a decade – did not arrive in Europe until 2007, when rules enacted by the European Commission broke the monopolies of established exchanges such as the London Stock Exchange and Deutsche Börse.

The Markets in Financial Instruments Directive unleashed a wave of competition from new trading platforms. That has led to a confusing picture for investors, made worse by the lack of a US-style national price quoting system – known as a "consolidated tape".

Brussels is about to launch its first review of Mifid, with preparatory work being done by the Committee of European Securities Regulators – just as the US is in the midst of its review. This week, the Paris-based CESR will start studying dozens of comments sent in by market participants.

But the scope of CESR's work – and therefore the eventual Mifid review – has expanded far beyond a routine taking of the temperature, as Europe has had to cope with the consequences of the same technology revolution that swept the US. CESR now says it needs to assess issues such as high-frequency trading "in greater depth due to their potential effects on overall equity market structure".

It is doing so amid concern that a flash crash – and perhaps one without so rapid a rebound as was seen on Wall Street last month – may come to be not solely an American phenomenon. Christian Katz, chief executive of the Swiss stock exchange, says bluntly: "This flash crash could be possible in Europe." What is more, he points to gaps in co-ordination that might exacerbate that sort of seizure were it to happen. "We cannot guarantee that when we halt trading [in extreme conditions on the Swiss exchange], the same happens on other venues. We should adopt some minimum level of safety systems."

and effective cross-market order and execution tracking system."

On May 6, the day of the "flash crash", more than 19bn shares were traded across multiple markets, each with its own data collection approach. The task for regulators is to form a single view over all that activity by knitting together the information coming into a building where teams of people analyse the data.

Last month, the SEC proposed a rule that would set up a consolidated audit trail system, including a "central repository" to capture every share trade conducted across the multiple platforms that operate in the US.

Mr O'Malia says plenty of data come into the CFTC but the difficulty is knowing how everything fits together. "It's not seamless yet. There is too much manual entering and cross-checking of data," he says, adding: "What we don't have internally is the ability to see who the beneficial owners of an account is or who the individual traders of an account is. We lack the ability to link all the various packages of information."

Nils-Robert Persson, chairman of Cinnober, a Swedish technology company, says: "If you want to have surveillance of several markets at the same time, you have to develop new systems based on new technology, and regulators are starting to understand."

In Britain, the Financial Services Authority receives 6m -8m "transaction reports" from trading platforms daily. If staff spot unusual share prices movements, they investigate these for potential abuse. But the FSA will soon have a system in place that will automatically alert staff to potential abuse in "real time". Alexander Justham, the FSA's director of markets, says the use of such "complex event processing" technology will give the FSA "a more proactive, machine-on-machine approach" to surveillance.

As the debate intensifies, there is growing anxiety that the interests of the big banks and the exchanges are not the same as the interests of investors – a theme that runs through regulators' efforts to reform derivatives and other markets too.

After the flash crash, exchange heads met SEC officials and efforts are afoot to restore trust. Circuit breakers, aimed at stopping dealings if the algorithms that drive high-frequency trading spiral out of control, are due to kick in next week.

But Edward Kaufman, a Democratic senator who has repeatedly warned about the dangers of high-frequency trading, says the industry has so far co-operated only "in finding Band-Aid solutions". He argues: "We may need further action, probably against the interests of those who benefit from the current market design," adding that "regulators are dependent almost exclusively for the information and evidence they receive about market problems on the very market participants they are supposed to be confronting about needed changes."

A survey by Tabb Group, a consultancy, taken ahead of Wednesday's SEC meeting, highlights the divergence of views. It found that 62 per cent of survey respondents on the "buy side" – those with money to invest – were negative towards high-frequency trading after the flash crash. Banks on the "sell side" and exchanges remained positive in their views, the survey discovered.

Adam Sussman, Tabb's director of research, finds that worrying. "This is particularly demoralising, given that the buy side are guardians over much of the equity investments in the US," Mr Sussman says.

Whatever the outcome of the debate, the experiences of May 6 confirm that machines are too fast for humans to keep up with – meaning that safety catches need to be automated too. As Mr Angel from Georgetown wrote to the SEC: "In the minute or so it takes for humans to respond to machine meltdown, billions of dollars of damages could occur."

Copyright The Financial Times Limited 2010. Print a single copy of this article for personal use. Contact us if you wish to print more to distribute to others.

"FT" and "Financial Times" are trademarks of the Financial Times. Privacy policy | Terms
© Copyright The Financial Times Ltd 2010.

Equity Trading in the 21st Century

February 23, 2010

James J. Angel
Associate Professor
McDonough School of Business
Georgetown University

Lawrence E. Harris
Fred V. Keenan Chair in Finance
Professor of Finance and Business Economics
Marshall School of Business
University of Southern California

Chester S. Spatt
Pamela R. and Kenneth B. Dunn Professor of Finance
Director, Center for Financial Markets
Tepper School of Business
Carnegie Mellon University

Carnegie Mellon Tepper SCHOOL OF BUSINESS

GEORGETOWN McDONOUGH School of Business UNIVERSITY

USC MARSHALL SCHOOL OF BUSINESS

1. Introduction[1]

Trading in financial markets changed substantially with the growth of new information processing and communications technologies over the last 25 years. Electronic technologies profoundly altered how exchanges, brokers, and dealers arrange most trades. In some cases, innovative trading systems are so different from traditional ones that many political leaders and regulators do not fully appreciate how they work and the many benefits that they offer to investors and to the economy as a whole.

In the face of incomplete knowledge about this evolving environment, some policymakers now question whether these innovations are in the public interest. Technical jargon such as "dark liquidity pools," "hidden orders," "flickering quotes," and "flash orders" appear ominous to those not familiar with the objects being described. While professional traders measure system performance in milliseconds, others wonder what possible difference seconds—much less milliseconds—could have on capital formation within our economy. The ubiquitous role of computers in trading systems makes many people nervous, and especially those who remember the 1987 Stock Market Crash and how the failure of exchange trading systems exacerbated problems caused by traders following computer-generated trading strategies. Strikingly, the mechanics of the equity markets functioned very well during the financial crisis, despite the widespread use of computerized trading. Indeed, much of the focus of computerized trading during the financial crisis has been on offering liquidity ("market-making") and shifting liquidity ("arbitrage") rather than as in 1987 in consuming the market's liquidity ("portfolio insurance").

This paper discusses recent innovations in trading systems and their effects on the markets. Using non-technical language, we show that investor demands for better solutions to the trading problems that they have traditionally faced —and will always face—largely drove the innovations. The introduction of computerized trading systems and high-speed communications networks allowed exchanges, brokers, and dealers to better serve and attract clients. With these innovations, transaction costs dropped substantially over the years, and the market structure changed dramatically.

The winners first and foremost have been the investors who now obtain better service at a lower cost from financial intermediaries than previously. Secondary winners have been the exchanges, brokers, and dealers who embraced electronic trading technologies and whose skills allowed them to profitably implement them. The big losers have been those intermediaries who did not innovate as successfully, and, as a consequence, became less competitive, and ultimately less relevant.

Not all developments in financial market trading have been in the public interest. We identify several problems that regulators should consider addressing to ensure that our markets continue to serve well both investors and the corporations that use them for raising capital. For example, systemic risks can arise because poorly capitalized broker-dealers allow electronic traders to

---

[1] *To better inform parties interested in understanding innovations in market structures, Knight Capital Group, Inc. commissioned the authors to write a paper describing new market structures and the resulting effects on the markets. This article presents our analyses and opinions only and does not necessarily represent the opinions of the sponsor of this project. The authors retained full editorial control over the content and conclusions of this report.*

access the market in their name with insufficient real-time risk management controls on their trading. While exchanges and clearinghouses can alleviate this problem by better regulating their members, we support the recent SEC rule proposal on this issue. Front-running across markets also concerns us. To some extent, well-informed traders or their agents can control this problem through careful transaction cost analyses, but the SEC and CFTC should write and enforce new regulations that prevent agents from front-running client orders in correlated instruments. Finally, transparency and fairness problems arise when trading systems employing make-or-take pricing schemes compete against exchanges that charge traditional transaction fees and against dealers who cannot charge access fees. The SEC could solve this problem with a simple modification to Regulation NMS.

While the markets could potentially benefit from some specific regulatory changes, regulators must be sensitive to the "unintended consequences" of poorly considered responses to concerns now being raised about recent changes in the trading environment, many of which are not universally understood. Technological innovations have led to the emergence of electronic liquidity suppliers who have outcompeted— and thus supplanted—most traditional dealers by lowering the costs of trading to investors. If poorly conceived regulations were to handicap electronic liquidity providers, a significant degradation in market quality would be the likely unintended consequence.

An executive summary of our report appears in the next section. The following section provides empirical evidence of how markets have changed in recent years, and in particular, how they have become more liquid over time. We then discuss the main trading problems that traders must solve and how traders traditionally solved those problems. We next discuss several of the innovative systems that exchanges, brokers, and dealers have created to help investors address these problems, and we explain how they benefit the economy. We then offer brief comments about the market's performance during the financial crisis and contrast the equity markets with other market structures. We conclude by discussing concerns about specific aspects of electronic trading.

2. Executive Summary

The U.S. equity market changed dramatically in recent years. Automation gradually transformed the market from a human-intermediated market to a computer-intermediated market with little human interaction or real-time oversight. Regulation also changed. The 1997 order-handling rules and the 2001 decimalization led to dramatic reduction in transactions costs. Regulation NMS cleared regulatory impediments to electronic trading and thereby led to increased competition between market centers. Dozens of new trading platforms emerged, including some with very different models from the old exchanges. This study examines the impact of these changes on market quality. Our major findings follow.

2.1 Trading problems remain unchanged

- Traders still face the same challenges as before: Minimize total trading costs including commissions, bid/ask spreads, and market impact.
- Large traders remain very careful about exposing their trading interest.
- New technologies allow traders to implement traditional strategies more effectively.

Traders today face the same challenges they have always faced. All traders seek to minimize their transactions costs, which include commissions, bid-ask spreads, and market impact. Buyers and sellers must find each other and agree upon a price. They must avoid trading with better-informed traders to avoid losses from being on the wrong side of a transaction.

Large institutional traders cannot widely publicize their interest in trading large blocks. Indiscriminant dissemination of such information increases the costs of their trades by scaring away counterparties, by attracting front-runners and other traders who can trade to profit from this information at the expense of the large traders.

Traders used to solve these problems on exchange floors. New communications and computing technologies now allow them to solve these problems in electronic trading systems at substantially lower cost.

For example, large traders once used floor brokers to hide the full sizes of their orders. The brokers displayed size only to traders that they trusted would not unfairly exploit the information. Now large traders use the hidden order facilities of electronic exchanges and dark pools to control the exposure of their orders. These facilities generally are more reliable than floor brokers and much less costly to use. The traditional NYSE floor was the forerunner of today's electronic "dark pools" that only disseminate information to trusted traders.

2.2 The market changed

- Liquidity increased as volumes grew substantially.
- Average trade size fall as electronic systems allowed traders to easily divide orders to obtain better executions.
- Quote traffic increased substantially.
- Competition among exchanges intensified.

We document many changes that have occurred in recent years. U.S. average daily reported trading volume increased dramatically in recent years, from about 3 billion shares per day in 2003 to nearly 10 billion shares per day in 2009. Over this period, the share of trading reported by traditional exchanges fell substantially. The market share of the NYSE in its listed stocks fell from 80% of all volume in January 2003 to 25.8% in December 2009.

The nature of trading changed as "high frequency" and "algorithmic" trading grew to dominate trading volumes. Average trade size fell substantially as computers made slicing large blocks into small pieces a cost effective means of limiting adverse costs of trading large positions. Automated traders began providing liquidity, supplementing and displacing traditional liquidity suppliers. The number of quote updates per trade, as well as the number of orders cancelled per executed trade, increased dramatically as traders employed new electronic strategies for offering and searching for liquidity.

2.3 Market quality improved dramatically

- Execution speeds fell.
- Bid-ask spreads fell and remain low.
- Commissions fell.
- Market depth increased.
- Volatility continues to fluctuate.

These changes substantially improved market quality. Virtually every dimension of U.S. equity market quality is now better than ever. Execution speeds have fallen, which greatly facilitates monitoring execution quality by retail investors. Retail commissions have fallen substantially and continue to fall. Bid-ask spreads have fallen substantially and remain low, although they spiked upward during the financial crisis as volatility increased. Market depth has marched steadily upward. Studies of institutional transactions costs continue to find U.S. costs among the lowest in the world.

Volatility spiked in 2008 during the financial crisis. However, unlike during the Crash of 1987, the U.S. equity market mechanism handled the increase in trading volume and volatility without disruption. However, the selling ban increased trading costs by frustrating the implementation of liquidity providing and shifting strategies by active traders who often must sell short to offer liquidity or manage the risks of their trading.

The quality of the U.S. equity market is especially notable in comparison to markets in other instruments and countries. For example, U.S. retail customers pay much higher transactions costs when trading U.S. Treasuries in comparison to fixed income ETFs that contain the same Treasuries.

We document many changes that have occurred in recent years. U.S. average daily reported trading volume increased dramatically in recent years, from about 3 billion shares per day in 2003 to nearly 10 billion shares per day in 2009. Over this period, the share of trading reported by traditional exchanges fell substantially. The market share of the NYSE in its listed stocks fell from 80% of all volume in January 2003 to 25.8% in December 2009.

The nature of trading changed as "high frequency" and "algorithmic" trading grew to dominate trading volumes. Average trade size fell substantially as computers made slicing large blocks into small pieces a cost effective means of limiting adverse costs of trading large positions. Automated traders began providing liquidity, supplementing and displacing traditional liquidity suppliers. The number of quote updates per trade, as well as the number of orders cancelled per executed trade, increased dramatically as traders employed new electronic strategies for offering and searching for liquidity.

2.3 Market quality improved dramatically

- Execution speeds fell.
- Bid-ask spreads fell and remain low.
- Commissions fell.
- Market depth increased.
- Volatility continues to fluctuate.

These changes substantially improved market quality. Virtually every dimension of U.S. equity market quality is now better than ever. Execution speeds have fallen, which greatly facilitates monitoring execution quality by retail investors. Retail commissions have fallen substantially and continue to fall. Bid-ask spreads have fallen substantially and remain low, although they spiked upward during the financial crisis as volatility increased. Market depth has marched steadily upward. Studies of institutional transactions costs continue to find U.S. costs among the lowest in the world.

Volatility spiked in 2008 during the financial crisis. However, unlike during the Crash of 1987, the U.S. equity market mechanism handled the increase in trading volume and volatility without disruption. However, the selling ban increased trading costs by frustrating the implementation of liquidity providing and shifting strategies by active traders who often must sell short to offer liquidity or manage the risks of their trading.

The quality of the U.S. equity market is especially notable in comparison to markets in other instruments and countries. For example, U.S. retail customers pay much higher transactions costs when trading U.S. Treasuries in comparison to fixed income ETFs that contain the same Treasuries.

2.4 Some improvements can be made

- "Make or take" pricing causes problems.
- Direct access requires appropriate risk management supervision.
- Front running orders in correlated securities should be banned.

Electronic trading raises some concerns that should be addressed. In particular, the "make or take" model for pricing exchange services has led to perverse outcomes. In the make or take model, trading platforms charge access fees to traders who "take" liquidity with marketable orders and pay rebates to limit order traders that "make" liquidity by placing standing limit orders. Current best execution standards require brokers to take the "best" price without regard to the access fees. We recommend that the SEC require that all brokers pass through the fees and liquidity rebates to their clients. The SEC also should indicate clearly that the principles of best execution apply to net prices and not to quoted prices. Alternatively, the SEC simply could ban access fees.

Concerns over the risk management practices of brokerage firms that provide "naked access" are legitimate. We support the proposed SEC rules that would require such firms to have appropriate risk management policies in place to prevent a catastrophic trading meltdown. At the same time, however, we note that no market-wide risk management systems are in place that would deal with a computer-generated meltdown in real-time. Regulators should give careful consideration to the question of what real-time controls could prevent a major computer malfunction from instantly throwing the market into chaos.

Although front-running a customer's order in the same instrument is illegal, we are concerned about front running in correlated instruments. For example, buying S&P 500 futures contracts while holding a large open customer buy order in an S&P 500 ETF (to profit from the expected price impact of the customer order) should be illegal since arbitrageurs will quickly shift the price impact of the broker's order in the futures market to the ETF market where it will increase the cost of filling the customer's order.

3. An Empirical Profile of Recent Changes in Markets

Innovations in electronic trading have produced new trading platforms and order types. Market participants now use better and faster tools, and the markets changed as a result. This section characterizes how various measures of market activity and liquidity changed in recent years.

3.1 Trading volumes increased

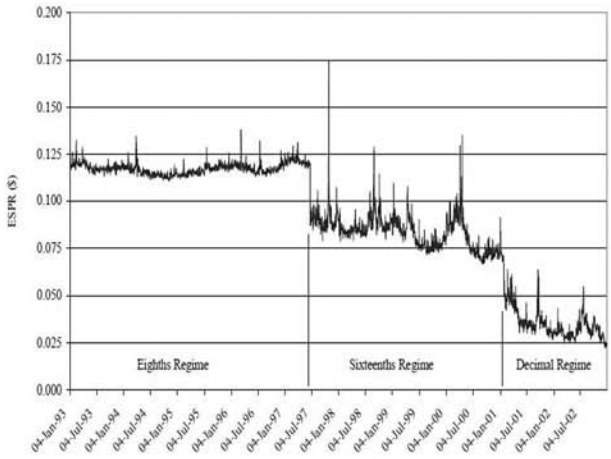
Source: Barclays Capital Equity Research

Reported equity trading volumes tripled in the last nine years. Several factors produced this outcome. The direct costs of trading fell substantially, making it economically feasible to implement strategies that would have been uneconomic at higher costs. The increase in derivative products also increased the amount of trading as arbitrage activity keeps derivatives prices linked with prices in the underlying cash markets. The growth in the number of exchange-traded funds (ETFs) also contributed to the increase in trading volume.

3.2 Bid-ask spreads fell and remain small

3.2.1 NYSE bid-ask spreads since 1993

Figure 2. Value-Weighted Daily Average Effective Spread, NYSE, 1993-2002



Source: Chordia, Tarun, Richard Roll and Avanidhar Subrahmanyam, 2008, Liquidity and Market Efficiency, Journal of Financial Economics 87:2, 256, as published.

This chart tracks the fall in quoted bid-ask spreads on the NYSE following the reduction of the minimum price variation (tick size) from one-eighth to one-sixteenth and then to one cent.

3.2.2 NASDAQ bid-ask spreads since 1993

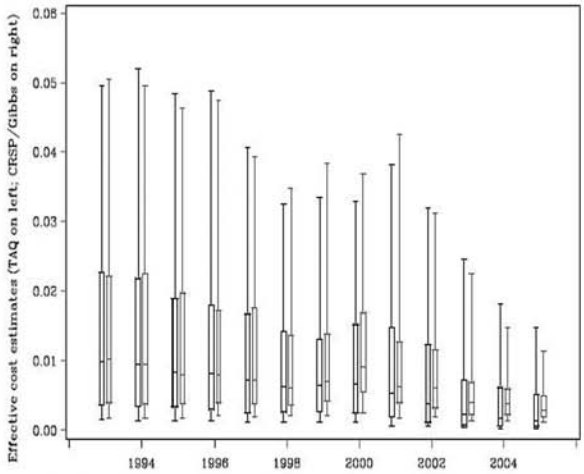
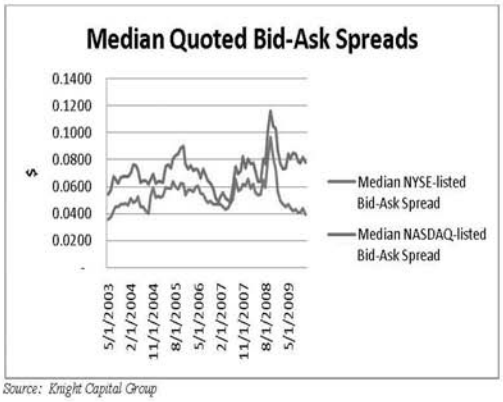


Figure 2. TAQ and CRSP/Gibbs estimates of effective cost in the comparison sample. The comparison sample consists of approximately 150 NASDAQ firms and 150 NYSE/Amex firms selected in a capitalization-stratified random draw in each of the years 1993 to 2005. For each firm in each year, the effective cost is estimated from TAQ data and from CRSP daily data using the Gibbs procedure. The figure depicts the cross-sectional distributions for these estimates year-by-year, with TAQ estimates on the left and Gibbs estimates on the right. The upper and lower ranges of the box-and-whisker figures demarcate the 5th and 95th percentiles; the upper and lower edges of the boxes correspond to the 25th and 75th percentiles; the line drawn across the box indicates the median.

Source: Hasbrouck, Joel, 2009, Trading Costs and Returns for U.S. Equities: Estimating Effective Costs from Daily Data, Journal of Finance 64:3, 1457, as published

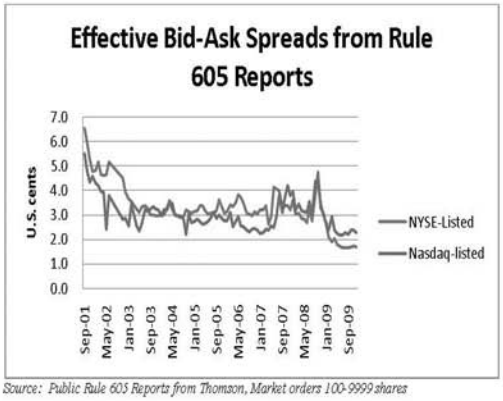
Decimalization, along with the SEC's order handling rules, led to a large decline in bid-ask spreads on NASDAQ as well as the NYSE.

3.2.3 Quoted and effective NYSE and NASDAQ bid-ask spreads since 2003



Source: Knight Capital Group

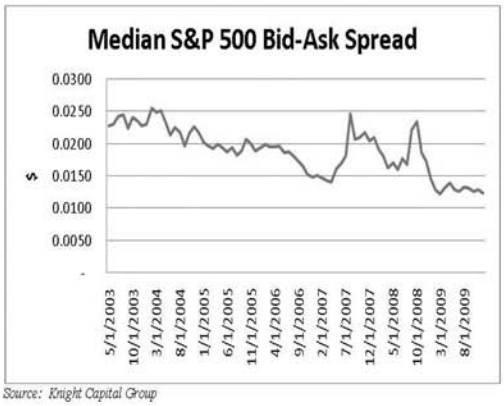
This chart displays the median quoted bid-ask spreads for NYSE- and NASDAQ-listed stocks.



Source: Public Rule 605 Reports from Thomson, Market orders 100-9999 shares

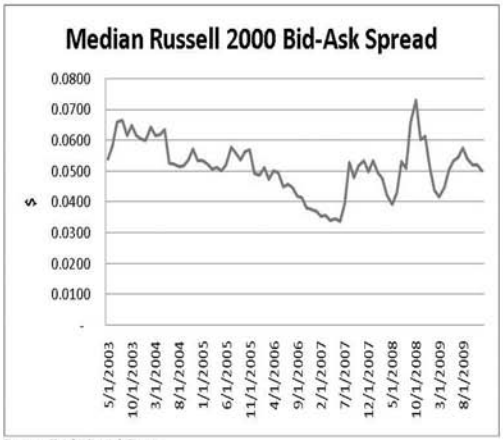
This chart displays the average effective bid-ask spreads obtained from the Rule 605 reports for eligible market orders. The effective bid-ask spread estimates spreads that investors actually pay. It is twice the difference between the actual trade price and the midpoint of the quoted NBBO at the time of order receipt. Once again, we see that the general trend on spreads has been downward, interrupted by an upward spike during the recent turbulence.

3.2.4 Quoted bid-ask spreads for index stocks since 2003



Source: Knight Capital Group

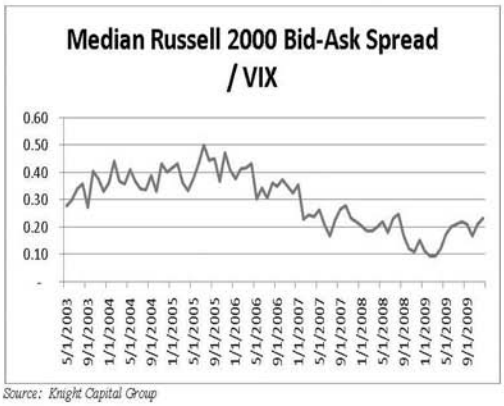
This chart presents the median bid-ask spread for S&P 500 stocks. The spread on many high volume stocks is now often only a penny or two.



Source: Knight Capital Group

This chart shows the median quoted bid-ask spreads for the Russell 2000 Index. The downward trend in spreads, which is so visible for the larger stocks, has not been as uniform for smaller stocks.

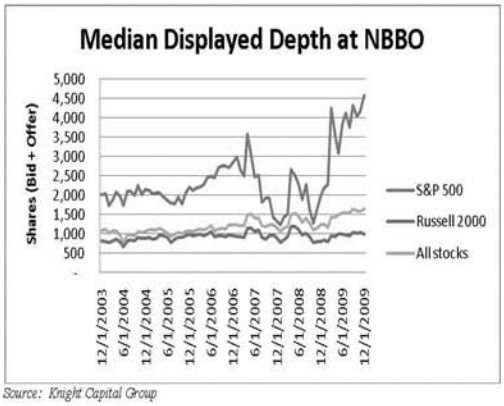
3.2.5 Quoted Russell 2000 bid-ask spreads relative to VIX since 2003



Source: Knight Capital Group

Most spreads spiked up during the financial crisis because high volatility increases risks for market makers. Dividing the reported spread by the VIX index of volatility shows that liquidity adjusted for volatility has been dropping. VIX measures the implied volatility of S&P500 options traded on the CBOE.

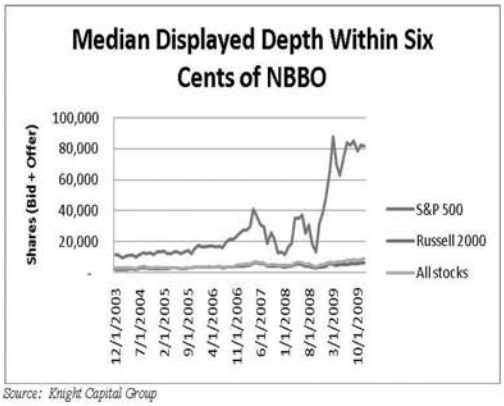
3.3 Market depth increased since 2003



Source: Knight Capital Group

Market depth is an indicator of liquidity. This chart shows the median number of shares (both bid and offer) displayed at the NBBO in the exchanges and ECNs. We see a steady upward trend over the last several years, an indicator of increased liquidity. Deeper markets imply lower price impacts for investors.

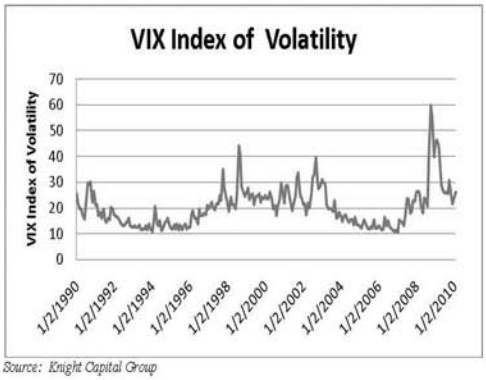
3.3.1 Displayed depth behind the NBBO since 2003



Source: Knight Capital Group

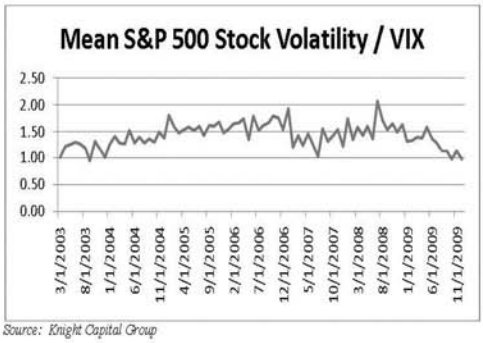
Depth increased substantially not just at the NBBO but also behind it. This chart shows the depth of book for various groups of stocks such as the S&P 500 and the Russell 2000 at the NBBO as well as within six cents of the NBBO.

3.4 Market volatility fluctuated



Source: Knight Capital Group

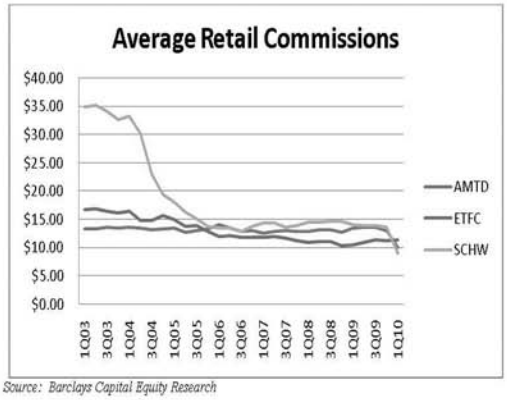
Volatility has always fluctuated in the U.S. equity markets, reflecting the changing levels of uncertainty in the overall economy. The 1930s and the early 1970s were periods of high volatility. Volatility also increased during the recent financial crisis. The VIX index, which is based on the implied volatility of S&P 500 options, was unusually low in 2006 but rose to record levels in the fall of 2008. It has since fallen to more normal levels. Volatility for the market as a whole is a poor measure for characterizing the impact of changes in market technology on the trading of individual stocks. We thus need to correct for overall market volatility.



Source: Knight Capital Group

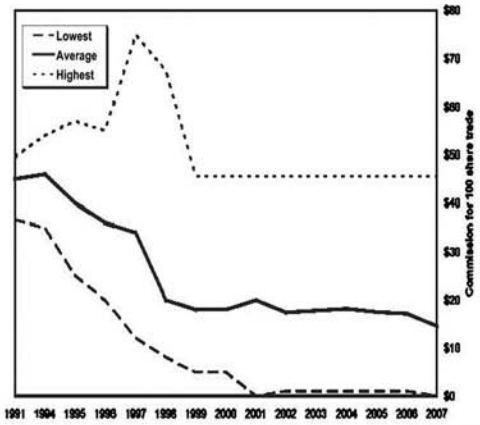
One simple way to correct for overall market volatility is to look that the total volatility of individual stocks relative to the VIX. This chart displays the average actual monthly intraday volatility of various groups of the stocks divided by the VIX. This measure has fluctuated in much the same range in recent years, indicating no overall increase in the volatility in excess of the VIX.

3.5 Retail commissions fell and remain low



Source: Barclays Capital Equity Research

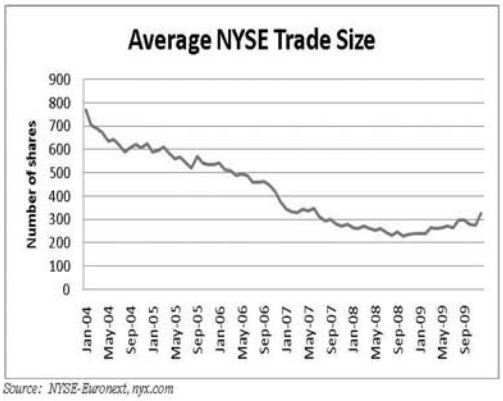
With small bid-ask spreads, commissions remain a significant component of total transactions costs paid by retail investors. This chart shows the average commissions charged by three of the largest online brokerage firms. Price competition intensified recently with prices dropping even further in last few months.



Source: AAII Journal, Discount Broker Guide, February 2007 at http://www.aaii.com/journal/200702/guide.pdf, as published.

This chart from the American Association of Individual Investors documents the steep drop in commissions among all the firms in its sample over the 27 years ending in 2007.

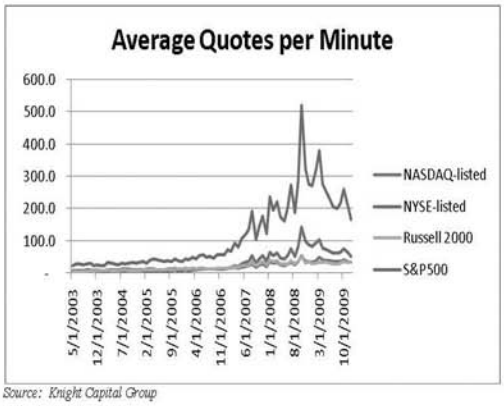
3.6 Average trade size fell



Source: NYSE-Euronext, nyx.com

The average size of reported trades has fallen significantly in the last decade. Average trade size on the NYSE by the end of 2009 was approximately 300 shares, half of what it was five years earlier. Traders have always chopped large orders into smaller ones to minimize market impact. Automation and lower trading costs now allow traders to economically slice orders into even smaller slices through what is known as "algorithmic" trading.

3.7 Quote frequency increased



Source: Knight Capital Group

This chart displays the average number of quote updates per minute for various groups of stocks. The frequency of quote updates increased dramatically in recent years, with a spike during the period of intense volatility and volume associated with the recent financial crisis. The increasing frequency of quote updates is consistent with higher trading volumes and the increased use of algorithmic trading strategies that break large orders into many smaller ones.

3.8 Execution times fell

Source: Rule 605 data from Thomson for all eligible market orders (100-9999 shares)

Increasing automation led to a market wide decrease in the speed of execution for small market orders.

3.9 Order cancellations relative to executions increased

Source: NASDAQ ITCH data provided by Knight Capital Group

The ratio of orders cancelled to orders executed more than tripled in recent years, from under 10 at the beginning of 2002 to over 30 by the end of 2009. This graph presents the ratio of order cancellations per execution from NASDAQ ITCH data. Many trading strategies require the cancellation of an order. For example, an electronic market maker who wants to update a quote will first cancel the previous quote in the system. As trading volume increases and average trade size decreases, one expects many more quote updates.

3.10 Market shares at traditional markets fell

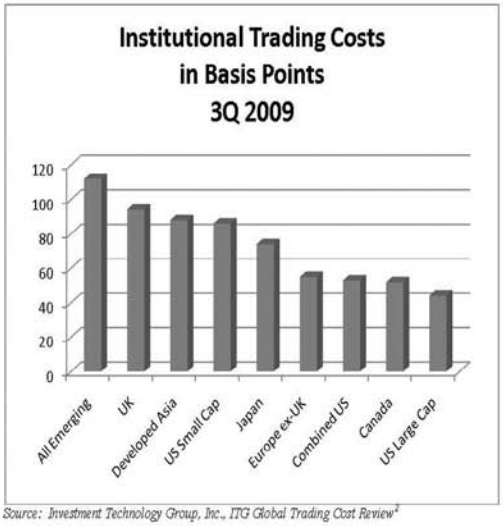
Source: Barclays Capital Equity Research

Regulation NMS (2005) freed electronic trading platforms to compete with the NYSE. Subsequently, new entrants gained significant market share. The NYSE market share of volume in its listed stocks fell from 80% at the beginning of 2003 to 25% by the end of 2009. NASDAQ matched share volume also increased, but it later fell as volume traded through new entrants such as BATS and DirectEdge increased. The "other" category, which includes both internalization by dealers as well as "dark pool" trading systems, also increased.

Source: Barclays Capital Equity Research

NASDAQ market share fell in recent years as other competitors gained ground. The old NASDAQ did not actually match trades, but relied on a dealer network for order execution. NASDAQ later added its own matching engine, SuperMontage, and acquired ECNs such as INET.

3.11 U.S. transactions costs are among the lowest in the world



Source: Investment Technology Group, Inc., ITG Global Trading Cost Review[2]

ITG, Inc. regularly reviews institutional trading costs around the world. The above chart shows that trading costs in the U.S. are among the lowest in the world. Care must be taken in using their data, as ITG does not correct for differences in the sizes of companies in different markets.

[2] http://www.itg.com/news_events/papers/ITG_GlobalTradingCostReview_2009Q3.pdf

4. Classical Trading Problems and Their Traditional Solutions

Three problems complicate trading. First, and most obviously, buyers must find sellers and sellers must find buyers. Second, traders are anxious not to trade with informed traders to avoid the losses typically associated with such trades. Finally, traders seeking to execute large orders must address several problems to ensure that they obtain the best prices for their trades. This section describes these problems and discusses the market structures that traders traditionally used to solve them. The following section discusses how recent advances in electronic communications and information processing technologies have substantially changed trading practices, and in particular, have provided innovative solutions to these problems.

4.1 The search for liquidity

Trades result only when willing buyers and sellers can meet and negotiate terms. Traditionally, traders came to exchanges where they or their brokers could locate one another and arrange trades. By providing a common meeting place and time, exchanges greatly decreased the cost of searching for liquidity.

Arranging trades at exchanges works well when buyers and sellers are both present. However, when securities are infrequently traded, or when traders seek to trade much more size than is typically available at an exchange, trading often moves away from traditional exchanges.

Finding a buyer or a seller in an infrequently traded security is often quite difficult. In such securities, investors will often trade with dealers. Dealers have an advantage in these markets as suppliers of liquidity because they often are more patient searchers than their clients. They also may have an advantage if traders widely recognize that they specialize in trading such securities, so that traders approach them when they want to trade. Since dealers generally are easy to find, they can conduct their businesses away from exchanges.

When traders seek to trade much more size than is typically available at an exchange, finding a willing counterparty often is particularly difficult. If the desired trade size is not too large, a block dealer might facilitate the transaction. But dealers often are not willing or able to arrange very large trades. To arrange such trades, traders seek the services of a block broker.

Block brokers specialize in knowing who would want to trade if presented with a suitable opportunity. Often such traders are not even aware of their interest since many traders who ultimately are willing to trade do not consider whether they would trade until asked. Economists call such traders latent liquidity suppliers. Block brokers identify such traders by keeping track of who owns large blocks of securities that they might sell and of who might be interested in purchasing large blocks of securities. Of course, the information that they collect and communicate rarely appears on exchange floors or in exchange trading systems. Many investment banks run large off-exchange block brokerage operations, as do some firms that have specialized in block brokerage, such as Jones Trading, whose operations were the original "dark pools."

Some information providers such as Autex offer systems that allow traders to post indications of interest (IOI) designed to help other large traders find them. An IOI is a message that effectively

says, "I'm interested in buying XYZ—give me a call." These messages are similar to those that appear on Craigslist in the sense that they help direct people to potential matches. Like those on Craigslist, they also can be potentially dangerous. Many brokers post IOIs with the hope of obtaining clients, many traders call upon IOIs with the hope of identifying trading interest that they can exploit, and many traders can post false IOIs with the hope of influencing the markets. These problems ensure that the flow of IOIs may not be particularly informative.

4.2 Informed trading

All traders would prefer to avoid trading with well-informed traders, who have superior information about future price levels. They buy when they expect prices to rise and sell when they expect prices to decline. Since well-informed traders are correct more often than not, they tend to profit. Those traders who trade against them tend to lose when they buy, or lose the opportunity to profit if they sell. Either way, they often will regret that they had traded. Accordingly, traders try to avoid trading with well-informed traders or on the side opposite from which well-informed traders are trading.

Concerns about informed trading make trading large blocks difficult. Most traders presume that large traders are well informed because well-informed traders tend to trade large orders and because large traders generally can afford the research necessary to become well informed. Indeed, empirical findings show that large trades tend to reflect more information than small trades. The risk of trading with a well-informed trader makes dealers and other traders wary of filling the orders of large traders. Large traders thus must convince other traders that they are not well informed to fill their orders at the best possible prices.

Dealers who know their clients well generally know who are well informed and who trade for other reasons. The dealers tend to provide better prices to those traders whom they believe trade for other reasons and try to avoid trading much, if at all, with well-informed traders.

When dealers do not know whether they are trading with informed traders, for example when they trade with anonymous traders, they widen their spreads to recover from uninformed traders what they lose on average to well-informed traders. Since traders transact anonymously at exchanges, exchange bid-ask spreads depend on the degree to which informed traders participate in the exchange markets.

Brokers who know their clients well also can help them obtain better prices by telling potential counterparties that their clients are trading for reasons other than information. They stake their reputations on the quality of this representation. If other traders suspect that the brokers have been disingenuous, they will avoid trading with them in the future.

Although exchange floor brokers generally cannot tell other traders that their clients are well informed, they can tell them they are not well informed. Those who honestly represent the nature of their clients' motives can obtain better prices for their uninformed clients.
Many dealers specialize in filling retail orders. Since retail traders are not as informed on average as are institutional traders, dealers can offer better prices to them. To capture the benefits associated with largely uninformed order flow, brokers preference (route) their retail orders to correspondent dealers. Best execution standards require that the dealers execute the orders at the National Best Bid or Offer (NBBO) or at better prices, and the brokers demand certain levels of price improvement. Dealers receiving preferenced orders often pay the brokers for the order

flow. Since brokers cannot obtain these payments if they do not have retail orders, competition forces the brokers to return much, if not all, of these payments to their clients in the form of lower commissions or better services, both of which attract retail clients and their orders.

Many broker-dealers internalize their retail orders for the same reasons that brokers may preference the orders to certain dealers. Acting as dealers, these broker-dealers often provide price improvement to their customers. Trading this informed order flow can produce excess dealing profits, especially if the NBBO reflects the costs of dealing to many well-informed traders. However, since internalizing broker-dealers cannot obtain these payments if they do not have retail orders, competition forces them to offer lower commissions or better services to attract retail clients and their largely uninformed orders. In recent years, retail commissions of some electronic brokers became very small.

The ability of dealers to price discriminate based upon their perception of how well informed their clients are allows them to offer better execution to investors who they believe are not well informed. When dealing was strictly face-to-face or phone-to-phone, dealers would quote different prices based on their perception of the risks of trading with each client.

Dealers now trade over electronic systems. Many dealers continue to discriminate by offer better prices and large quantities to those traders who they trust will not cause them losses. In many cases, they do this by sending out actionable indications of interest. Lately, the SEC has become concerned about IOIs because they are not available to all traders.

If regulations required dealers to disclose firm quotes to all traders, uninformed investors would be harmed. Dealers would widen their spreads and withdraw liquidity to take into account the greater access to their quote by informed investors. Although the dealers could still discriminate in favor of their less informed (mostly retail) clients by offering them improved prices, dealers would not be able to attract their order flow by bidding aggressively with IOIs directed only to them (or their brokers). A prohibition on IOIs in this context thus would have the unintended consequence of reducing the relevant quote information available to less informed traders, and thereby reduce price competition for their order flow.

4.3 Problems Associated with Large Traders

Large traders face—and cause—special trading problems. Other traders may front-run their marketable orders or employ quote-matching strategies to extract option values from their standing orders. Both strategies increase their transaction costs. In contrast, large traders try to price discriminate among liquidity suppliers to reduce the costs of filling their orders. This behavior causes liquidity suppliers to withdraw from the market.

Attempts to solve these problems account for much of the innovation in market structure. This section introduces these problems and explains how traders traditionally solved them.

4.3.1 Front-running

Traders generally like to expose their orders to help traders on the other side locate them. However, exposing orders produces undesirable consequences, especially for large traders.

Traders who fill large orders often must move prices substantially to encourage other traders to trade with them. These price concessions are especially large when other traders believe that the

large traders are well informed, but they may still be quite significant even when the large traders are not informed.

Expectations of these price changes make filling large orders problematic. If other traders become aware of a large buy order, some may immediately buy in front of the order in an effort to profit from the expected price change. They likewise may sell in front of large sell orders. Such trades increase the ultimate costs of filling large orders.

Also, traders who have posted limit orders or quotes will try to cancel their orders and quotes if they become aware that they could trade with large traders. They replace their orders and quotes with new orders and quotes placed further from the market so that they do not lose as the large traders put pressure on prices. If these trades can fade from the market, the large traders will pay more to fill their orders.

Both problems—front-running by traders on the same side and fading by traders on the opposite side make large traders very reluctant to disclose the sizes of their orders. Traders traditionally address this problem by giving their orders to floor brokers and upstairs brokers who expose the orders only to traders that the brokers trust will not front-run the large orders. However, information leakage often occurs because brokers cannot effectively conceal their orders, even assuming that they do not favor others.

Many buy-side traders believe that floor brokers are unable or unwilling to effectively conceal the information in the orders entrusted to them. At best, the brokers simply cannot keep a straight face. At worst, the brokers may tip off others to gain other advantages. The clients try to identify these problems by measuring their transaction costs to identify the quality of the service that they obtain from their brokers. However, transaction costs are notoriously difficult to measure, and measurement is not useful if all brokers suffer the same failings. Accordingly, many buy-side traders have enthusiastically supported innovative hidden order and dark pool trading systems that address this problem.

4.3.2 Quote-matching

Large traders who expose their limit orders risk that other traders will employ a strategy called quote-matching against them. The quote-matching strategy increases transaction costs for large traders. An example can help introduce the quote-matching strategy. Suppose that a large trader places a limit order to buy at 30. A clever trader who sees this order could immediately try to buy ahead of it, perhaps by placing an order at 30 at another exchange, or by placing an order at a tick better at the same exchange. If the clever trader's order fills, the clever trader will have a valuable position in the market. If prices subsequently rise, the trader will profit to the extent of the rise. But if values appear to be falling, perhaps because the prices of correlated stocks or indices are falling, the clever trader will try to sell to the large trader at 30. If the clever trader can trade faster than the large trader can revise or cancel his order, and faster than can other traders competing to fill the large trader's order, the clever trader can limit his losses. The clever trader thus profits if prices rise, but loses little otherwise. The large trader has the opposite position: If prices rise, he may fail to trade and wish that he had. If prices fall, he may trade and wish that he had not. The profits that the clever trader makes are lost profit opportunities to the large trader.

The quote-matching strategy is profitable when very fast traders can extract option values from limit orders. Orders have option values because they give other traders rights to trade at fixed prices. For example, a standing limit sell order represents a call option struck at the limit price granted to the market as whole. The first trader who wants to buy at the limit price exercises this option.

Large traders traditionally have avoided quote-matching losses by limiting the exposure of their orders. On floor-based exchanges, large traders trust their orders to floor brokers with the understanding that the brokers will only display the orders to traders whom the brokers expect will fill the orders and who the brokers trust will not front-run the orders. Off-floor brokers likewise carefully manage the exposure of the orders entrusted to them.

Large traders who do not trust their brokers may break their orders into small pieces so that they do not expose the whole order all at once. However, by breaking up their orders, they increase the number of trades taking place on the same side of the market. Dealers and other traders who see such trading patterns often conclude that well-informed traders are in the market, which makes it difficult for the large traders to fill their orders at a low cost.
Concerns about the quote-matching problem have caused many buy-side traders to enthusiastically support innovative trading systems that help them solve this problem.

4.3.3 Price discrimination

Large traders often try to break their large orders into smaller pieces so that can fill the first pieces at the best available prices and then only fill the remaining sizes at inferior prices. Since traders who offer liquidity are aware of this problem, they tend not to post much size at the best quoted prices. Those who do post significant size too often fail to earn the price concessions that large traders typically pay to fill an order.

Large traders may avoid this problem to some extent by using the services of block dealers or brokers. These traders try to determine the full size of their large clients' orders so that they can properly price them. They keep their clients honest by paying close attention to their clients' subsequent trades and by refusing to arrange trades again for clients who prove to be dishonest. Those traders who can credibly convince others that they will not price discriminate often obtain better average prices for their orders than they would if they tried to price discriminate.

5. Innovative Solutions to the Classical Trading Problems

New communications and computing technologies have allowed exchanges, brokers, dealers, and alternative trading systems to create innovative solutions to the traditional trading problems described above.

5.1 Order routing to exchanges

Perhaps most notably, innovations in electronic communications and computing technologies have greatly reduced the costs of searching for liquidity at exchanges and in other trading systems.

The first benefit that new technologies provided was remote access. Traders who were far from an exchange could quickly send their orders to the exchange over telegraphs, then telephones, and now over computer linkages. These communications technologies have allowed investors off the floor of an exchange to easily participate in the search for liquidity and quickly learn about executions of their orders.

The introduction of ticker tapes, and later quotation feeds, allowed remote traders to determine whether brokers and dealers were handling their orders fairly on the floors of the exchanges to which they routed their orders. With this information, traders could send orders to distant exchanges without worrying too much about being cheated.

These advances in telecommunications technologies substantially decreased the number of exchanges as investors increasingly sent their orders to larger markets where the probability of finding contra-side interest was greatest. Transaction costs decreased and trading volumes increased as buyers and sellers could more easily find each other by sending orders to brokers and dealers on exchange floors. Order flows consolidated substantially to the point that exchanges such as the New York Stock Exchange and the American Stock Exchange obtained market shares of 90 percent or more in their listed securities. Regional exchanges merged to form larger exchanges, but never competed very successfully. Many small exchanges failed.

As information technologies continued to improve, consolidated quote feeds mandated by the SEC and sold by various data venders allowed remote traders to know almost instantly the quotes posted by exchange specialists, and later, all order sizes at the best bid and offer. With these feeds, traders could easily determine which markets posted the best current trading opportunities.

At first glance, the availability of these quote feeds should have promoted competition from secondary exchanges because traders could easily route their orders to the best trading opportunities. However, these feeds did not adequately represent all relevant information about trading opportunities at an exchange, and in particular, at the dominant exchanges. Quote information was incomplete in two respects. First, only the best bid and offer were reported whereas traders on the floor of an exchange often could see trading interest behind the best prices. Second, many traders did not post orders that the exchange could disseminate. Instead, for reasons discussed in the previous section, larger traders typically gave their orders to floor brokers who revealed them to other traders on the floor of the exchange on a selective basis. As a result, for most traders searching for liquidity, the primary exchanges remained the destinations

of choice as those exchanges continued to be the most productive places to search for counter-parties.

The SEC designed the ITS order routing systems to connect exchanges in the National Market System (NMS) to each other. In conjunction with a rule prohibiting trading through the quotes of a NMS exchange, the ITS system was supposed to facilitate the search for best price while promoting competition among exchanges. In practice, the system did not meet its objectives because it operated too slowly (operators entered orders manually) and because specialist dealers receiving orders did not have to respond immediately. These problems with the ITS system ensured that most traders continued to route their orders to the primary listing markets.

In the OTC markets where unlisted securities traded, dealers would contact each other over the phone when they wanted to trade with each other. The NASD created NASDAQ as an automated quotation system to help the dealers identify who was offering the best price. Over time this system eventually evolved to become an exchange system that maintained order books and automatically executed trades.

5.2 ECNs

Innovative brokerage systems such as Instinet and Island created alternative trading systems called Electronic Communication Networks ("ECNs") to collect and match their client orders automatically. The ECNs initially did not take much trade from the primary listed markets because too much order information in these floor-based markets remained on the floor. Traders were unwilling to trade in the electronic systems because more trading opportunities were available on the floor. Without traders posting orders in these systems, the systems never became liquid and therefore never posed any significant challenges to the traditional listing exchanges until Regulation NMS became effective.

Best execution standards that prevented brokers from arranging or accepting trades at prices inferior to those quoted in the National Market System also limited the ECN growth in listed securities. These restrictions prevented them from trading through quoted prices at the floor-based exchanges.

As a purely electronic system, NASDAQ was always a fast system, and latency (the amount of time needed to respond to a message) decreased substantially with technological innovations in communications networks and in processing systems. The low latency allowed traders to submit marketable orders and quickly receive confirmation that their orders executed. Low latency also allowed the traders to submit order cancellation instructions and quickly receive confirmation that their orders were cancelled or already had been filled.

The low latency in NASDAQ allowed the ECNs to compete very successfully in NASDAQ-listed stocks. The ECNs solicited order flow for their systems by making the following proposition to their brokerage clients: If you post an order with us, we will post a copy of that order in the NASDAQ quote montage. If the order executes at NASDAQ, you will obtain the execution. While the order is sitting at NASDAQ, if an incoming marketable order arrives in our system, we will hold the marketable order, cancel the standing NASDAQ order, and then fill your order. If we arrange the trade for you, we will charge you less than other NASDAQ dealers.

This proposition ensured that brokers would obtain the benefit of any liquidity offered in the NASDAQ system, while still posting orders in the ECN. The ECN could offer this proposition only because it could cancel and confirm cancelation of its NASDAQ quote very quickly. Without that facility, the ECN could not hold up the execution of the incoming marketable order. With this facility in place, trading in the ECNs grew very substantially in NASDAQ-listed stocks.

Likewise, the low latency of the NASDAQ system allowed ECNs to accept orders that were not marketable in their systems, but which were marketable against other NASDAQ dealer's quotes. They submitted these orders through NASDAQ, received quick confirmations of their executions, and then continued to process any remaining size in their systems if possible. The ECNs thus were able to avoid trading through the NASDAQ quotes, while conducting their operations.

The ECNs could not offer these facilities for listed stocks because they could not quickly obtain confirmed executions and order cancellations from the floor-based exchanges where latency was often greater than 15 seconds. Their slow floor markets of the primary listing exchanges thus protected them from ECN competition. To obey the trade through rules, the ECNs would have had to halt their system while waiting for the NYSE floor to respond to their orders.

5.3 Hidden order size

To help protect order flow information, many exchanges and ECNs created hidden order facilities. These facilities allow traders to submit orders to their execution systems that limit the exposure of their sizes. Depending on the order type, traders may completely hide size (hidden orders), partially reveal size (reserve orders), or reveal size in whole or part at prices away from the market (discretionary orders). Traders use these orders to offer liquidity without revealing information about the full sizes of their orders. They thereby hope to avoid front-running and quote-matching problems.

Traders who seek liquidity discover hidden order sizes at a given price by submitting orders to trade at that price. If hidden size is present, a larger trade will result than displayed quantities would indicate. The price of discovering the hidden size is a binding commitment to trade with it.

Although these systems only reveal hidden size to the extent of the size of the marketable orders, some proprietary traders "ping" the market repeatedly with small orders to discover whether hidden sizes are present. They can only be sure about the size that they discover, but they often infer additional size when their orders repeatedly fill. At some exchanges and dark pools, large traders who want to prevent such discoveries of their orders can place minimum fill quantities restrictions on their orders. The availability of such restrictions obviates regulations that might prevent pinging.

Large traders who seek liquidity generally are as unwilling to display their searches, as are the large traders whose hidden orders they seek. To prevent discovery of the remaining sizes of their orders, large traders submit immediate or cancel orders (IOC) when seeking hidden liquidity.

IOC orders are by far the most commonly submitted orders. Brokers use them to sweep across trading venues at progressively more aggressive prices to discover hidden liquidity. Most do not execute, but those that do provide executions at improved prices and augmented sizes. These tactics are feasible because latency at many exchange trading systems is now under a millisecond.

5.4 Alternative trading systems for large block traders (dark pools)

Brokers and others have developed many alternative trading systems to help large traders arrange trades and enhance liquidity provision, while protecting these traders from front-running and quote-matching problems that arise when information about their orders is widely known. Large traders are anxious to protect the intellectual property and privacy of their trading plans. In a trading floor context, these traders previously used floor brokers who worked their orders based on their experience. Now many large traders use dark pools instead. Space constraints prohibit description of all of these systems, or even all of the most significant of these systems. Here we discuss two of the most innovative systems.

5.4.1 POSIT

Brokers created alternative trading systems specifically designed to solve search problems for large traders. The first such system that enjoyed wide popularity was POSIT. POSIT conducts a call market that appeals to large traders who do not wish to expose their orders to the market. Traders submit orders to POSIT, which does not display the orders to anyone. At the time of the call, POSIT matches the buy orders to the sell orders. Generally, all orders on the side with the smaller total size are filled. The orders on the other side are filled on a pro-rata basis. Once so matched, the trades take place at the midpoint of the bid and ask quotes at the primary listing market for the security.

Since many POSIT orders are extremely large, very large order imbalances are common when one side is present, but the other is not. Since the POSIT order imbalance is not displayed, imbalances in POSIT cannot attract balancing size. Accordingly, most POSIT calls trade only a small fraction of the total order size submitted.

Despite the low fill probability, buy-side traders use POSIT because the prices for the trades that they do obtain are very favorable. When large traders meet on opposite sides in POSIT, they both obtain executions with no price impact that are much better than they would otherwise expect to obtain if they traded in the market. By calling traders to a single point in time, the POSIT market increases the probability that both sides will be present. Moreover, they obtain this service without revealing information about their orders to the market. In particular, their orders are not revealed when they fail to trade.

The POSIT system is not perfect, however. Traders whose orders fill partially can estimate the total size submitted on their side of the market from knowing the total POSIT fill, which is public information, and the portion of their order that filled, which only they and other participants on their side know. Buy-side traders are aware of the leakage of this information and many use other alternative trading systems, at least in part, due to concerns about this issue.

5.4.2 Liquidnet

Liquidnet is another innovative alternative trading system that large buy-side traders use widely. Subscribers allow Liquidnet's computers to see the orders in their order management systems. These are the orders that the portfolio managers give to their buy-side traders to fill. The buy-side traders then try to fill these orders by negotiating with dealers or by submitting orders to block brokers, to exchanges, or to alternative trading systems. When Liquidnet sees that a buyer and a seller are both interested in the same security, it sends a message to the two buy-side traders that indicates that they may be able to arrange a trade. The message does not reveal trader

identities. The traders then negotiate with each other to arrive at a price and size for their trade. The resulting trades are often very large.

To help guard the order information, Liquidnet rates traders by their propensity to conclude deals suggested to them. To avoid front-running and quote-matching problems, traders can indicate that they do not want information about their orders to be shared with traders who have low completion rates. Liquidnet thus ensures that only traders who have a high probability of arranging trades obtain information about future trades.

Liquidnet also allows clients to indicate traders and classes of traders with whom they do not to want to trade. For example, clients generally do not want to trade with traders that they perceive to be better informed than themselves.

5.4.3 Dark pools and retail orders

Many brokers have arranged to pass marketable order flow through dark pools with the hope of obtaining better executions than they would if they were sent to other venues. Institutional traders generally welcome the opportunity to trade with retail order flow because retail traders are largely uninformed. If they trade, the retail traders obtain better executions and the institutional traders obtain more size. Using dark pools benefits both sides, but not informed traders who these pools try to exclude.

5.5 Indications of interest and actionable indications of interest

Dark pools only work when traders are willing to express their interests in trading as orders and then make those orders available to the alternative trading system. If only one side to a potential trade expresses its interest as an order, no trades can be arranged or proposed.

Traders sometimes can attract contra-side interest by showing that a trading opportunity is available. Traders thus have an interest in displaying their orders because such displays may attract other orders. However, as noted above, order display can often lead to front-running and quote-matching problems.

An IOI represents a middle strategy in the search for liquidity between displaying an order and hiding an order. Since IOIs are not firm, traders who might try to exploit the information in them may find that the order is not available to them.

IOIs are most valuable when they are displayed by traders widely recognized to be reliable, and when they are received only by traders who will not engage in exploitive trading strategies. When an IOI truly represents a real opportunity to trade, and when the recipient can be trusted not to exploit the information, both traders have an interest in ensuring that they can act upon the IOI at minimum cost to produce a trade.

To this end, many dark pools have systems for disseminating actionable IOIs to trustworthy entities. These actionable IOIs inform the entity that a trade is possible. For example, a retail broker may receive an IOI from a dark pool. If the broker has an order that would help fill the interest, the broker then could route to the dark pool and obtain a better execution at lower cost for its client.

Without actionable IOIs, the broker would have to use an IOC order to probe the dark pool for liquidity when looking to fill an order. Since such probes usually produce fruitless results and thereby waste time while in flight, brokers may choose not to probe the dark pool when trying to fill their orders. Alternatively, they may only probe the pool late in their sweep sequences so that they can probe first other trading venues that generally produce better results.

The actionable IOI differs from a firm quote because dark pools offer them only to certain market participants based on the degree to which they trust them not to exploit the information that they convey. Firm quotes that are displayed to all traders are much riskier.

Dealers also publish actionable IOIs to brokers for whom they are willing to fill their clients' orders. These brokers typically represent traders whose orders the dealers do not fear, either because the traders are uninformed, or because the dealers are confident that they can layoff their positions before the information in an informed traders order moves the market. The actionable IOI allows the dealer to advise the broker that liquidity is available so that the broker can quickly route to it if it represents the best available trading opportunity.

As noted above, the actionable IOI allows the dealer to offer better prices and more size to certain clients. While this discrimination against well-informed traders might seem to be unfair, allowing it lowers transaction costs for retail clients and many institutional investors. If regulations prevented the use of actionable IOIs, dealers would offer less liquidity as they faced greater losses from being picked off by informed traders. Banning the use of actionable IOIs by dealers would much more likely discourage liquidity provision than dramatically increase their use of firm quotes.

A continuum of investors trade in our marketplace, ranging from well informed to uninformed. The use of a range of order types by those prepared to commit capital to liquidity provision enhances the liquidity process by allowing them to risk their capital when they want to and avoid doing so otherwise.

The use of actionable IOIs reflects the evolving nature of trading technology. They allow dealers to efficiently communicate with potential customers and for the customers to respond. Although other traders do not share the same opportunities, post-trade reporting requirements ensure that all traders share in the information produced in trades arising from actionable IOIs.

5.6 Algorithms

To avoid displaying information about the full sizes of their orders, large traders often break their trades into smaller pieces to fill them over time. This trading strategy also allows markets to recover over time from the effects of order imbalances so that the price impacts of large orders may be reduced. Practitioners call strategies for breaking up orders and for submitting them to markets algorithms.

Algorithms differ according to whether they offer liquidity or take it. Many do both. For example, some algorithms immediately take liquidity upon starting up. They then post limit orders to obtain better fill prices. While posting liquidity, they may often cancel their orders to obfuscate their presence and thereby frustrate traders who would try to exploit information in their orders. As a trader-imposed deadline approaches, the algorithm may then take liquidity, if necessary, to finish filling the order.

Computerized trading systems implement algorithms based on information available to them from trade and quotation feeds. Many algorithmic strategies are based on substantial statistical analyses into how orders execute on average and in specific situations.

Algorithmic trading has substantially reduced workloads for buy-side traders and for the brokers who serve them. Although the costs of developing and maintaining algorithms are high, the cost savings from using them often greatly cheapen the overall costs of trading, especially for routine trades.

5.7 Proprietary trading

By providing very fast and inexpensive systems, today's electronic markets allow nontraditional dealers to offer liquidity using electronic proprietary trading systems. These traders use various high frequency trading strategies to provide liquidity. They could act as dealers who commit capital to connect buyers to sellers who arrive at different times, or they could act as arbitrageurs who connect buyers in one market to sellers in another correlated market.

These electronic proprietary traders have substantial advantages over traditional dealers who cannot see as much information, process as much information, or react as quickly to new information as can computers. As they competed with traditional dealers and with each other, they substantially decreased bid-ask spreads while making prices more informative and more resilient to transitory displacements caused by unexpected demands for liquidity.

5.8 Co-location

When many traders seek to take advantage of the same trading opportunities, the fastest traders are the most successful. Accordingly, algorithmic traders and proprietary traders seek every speed advantage that they can obtain. They try to employ the fastest computers, write the fastest software, and obtain market data before others, often through direct links to exchanges. Communications latencies are due to time lost as messages travel at the speed of light and to delays caused by passing messages through routers. To speed their communications, high frequency traders co-locate their servers as close as possible to the exchange servers that produce market information and collect orders.

Co-location is no different than the traditional practice of locating brokerage firms close to the stock exchange to reduce the time and expense of filling an order. If the practice of co-location were banned, traders would merely seek to locate their servers in the closest piece of real estate to the exchange data centers, with far less oversight than is possible within the exchange data centers.

5.9 Effects on listed exchanges

Combined efficiencies from high frequency proprietary trading and from the operation of the low-cost electronic ECNs substantially decreased the costs of trading NASDAQ stocks. Practitioners and regulators observed similar decreases in transaction costs in Canada, Europe, and Asia, where different regulatory environments allowed electronic exchanges to flourish earlier than in the United States.

In response to these observations, regulators at the SEC adopted Regulation NMS in 2005. That regulation removed the ITS trade-through rule and substituted a rule that prohibited trade-throughs of electronically accessible quotes. As a result, floor-based trading systems lost their

primacy to electronic systems. The listed exchanges (NYSE and AMEX) started to offer electronic trading, but their systems were too slow and too expensive, and they quickly loss market share to faster electronic competitors. At the same time, floor brokerage at the listed exchanges has become less important as buy-side traders increasingly use dark pools to arrange their trades with less information leakage. As illustrated earlier, the New York Stock Exchange now only trades 25% of the volume in its listed stocks.

6. Market Performance during the Panic of 2008

The financial markets experienced a severe financial crisis in 2008. During this period, equity trading systems handled the extreme volatility and volumes without system problems. Their performance stands in sharp contrast to the system problems experienced during the Crash of 1987, which led to serious delays in executing orders. The trading systems then used could not, or would not, handle the trading volume. For example, the printers that generated order tickets on the NYSE floor could not print out the orders fast enough, and NASDAQ market makers would not pick up the phone. These glitches in the trading system added to confusion and uncertainty, as investors could not be certain of the status of their orders or of current market conditions.[3]

Some commentators would like to blame the recent drop in stock prices on short selling or other practices in the equity market such as computerized trading. We believe that stock prices fell for fundamental reasons as investors began to recognize the extent of valuation and risk management problems on various balance sheets. Indeed, the approximately 50% drop in equity prices is comparable to the experience of other recessions such as in 1974 and 2001, at which times no significant concerns were expressed about short selling or computerized trading.
We note that short sellers and computerized traders did not induce lenders to make loans to millions of borrowers who could not pay them back. Short sellers did not package those loans into securities that were then sold to investors, nor did short sellers get the rating agencies to stamp AAA on securities that should not have been rated AAA. Neither did computerized traders force entities such as Fannie Mae, Freddie Mac, or Lehman Brothers to purchase tens of billions of dollars worth of what were later called "toxic" securities.

Concerns over short selling led to various restrictions on the practice in the U.S. and other markets during the panic in 2008. Beber and Pagano, among others, have analyzed these restrictions and found that they were detrimental to market liquidity and failed to support market prices.[4] These findings are reasonable because much, if not the majority, of short selling does not consist of directional bets on the value of a security. Instead, short selling helps markets operate more smoothly in areas such as market making, arbitrage, and statistical arbitrage. Categorical restrictions on short selling do more to reduce such beneficial short selling than to prevent any alleged abusive short selling.

Restrictions on short selling also frustrate the trading of well-informed traders who recognize that companies are overvalued. Overvaluation generally is a more serious problem in public markets than is undervaluation. When securities are overvalued, capital gets wasted as companies sell securities to fund poor projects, and investors lose money when prices fall. When securities are undervalued, companies often find capital from other sources, and long-term investors do not experience losses if they hold until prices regain their true values.

---

[3] *For more information on the Crash of 1987, see Presidential Task Force on Market Mechanisms, 1988, Report of the Presidential Task Force on Market Mechanisms, Nicholas Brady (Chairman), U.S. Government Printing Office.*

[4] *See Beber, Alessandro and Pagano, Marco, Short-Selling Bans Around the World: Evidence from the 2007-09 Crisis (November 2009). CEPR Discussion Paper No. DP7557. Available at SSRN: http://ssrn.com/abstract=1533163. See also Kolasinski, Adam C. Reed, Adam V. and Thornock, Jacob R., Prohibitions versus Constraints: The 2008 Short Sales Regulations (October 5, 2009). AFA 2010 Atlanta Meetings Paper. Available at SSRN: http://ssrn.com/abstract=1365037.*

7. Comparison with Other Markets

No examination of the U.S. equity market would be complete without a comparison with markets in other financial instruments and with other equity markets around the world.

7.1 Other equity markets

The U.S. equity market is characterized by its open architecture, which makes it easy for those with innovative ideas to enter the market. This intense competition has led to a dramatic fall in execution costs. Many other countries are behind the United States; especially those that accepted exchange monopolies. Europe has moved quickly toward a competitive exchange structure, and many of the same trends of declining legacy exchange market share seen in the U.S. are visible there as well. However, trade reporting in Europe generally lags behind the United States, and no equivalent official NBBO exists there. We note once more the ITG results that show U.S. transactions costs are among the lowest in the world.

7.2 Other financial markets: U.S. fixed Income

In the U.S. fixed income world, no definitive source for price information exists that is comparable to the National Best Bid and Offer (NBBO) and last sale for equities. Brokerage firms typically trade as principals against their retail customers, and retail customers often cannot easily determine the quality of their executions.

For example, U.S. Treasury bonds are considered to be among the safest and most liquid securities in the world. Treasury bonds have characteristics that should make their transactions cost among the lowest in the world: huge trading volumes, large supply, and virtually no traders who possess better information than the dealers. Published quotations in the Wall Street Journal's online edition typically show institutional spreads of about 1/32nd of 1%, about 3 basis points. Yet retail investors typically face much wider spreads, on top of which they pay commissions as well. For example, a recent online retail quote for the November 2039 4.375% long bond from one of the largest brokerage firms was 97.30 bid and 98.75 offered, or a bid-ask spread of 145 basis points (1.45%) of the bond's par value. In contrast, the bid-ask spread on a Treasury ETF such as the iShares Barclays 20+ Year Treasury Bond (TLT) is typically only one or two cents on a $92 stock, or around one or two basis points. It is clear that the present U.S. equity markets deliver far lower trading costs to retail investors than do the fixed-income markets.

8. Recommendations for SEC Rulemaking

8.1 Make-or-take pricing

Make-or-take pricing has significantly distorted trading in the National Market System in which best execution standards and mandated order routing determine execution venues and execution prices. The distortions arise because orders are priced on different bases in different markets. The problem is large and growing larger as bid-ask spreads and commissions decrease. It has distorted order routing decisions, aggravated agency problems among brokers and their clients, unleveled the playing field among dealers and exchange trading systems, produced fraudulent trades, and produced quoted spreads that do not represent actual trading costs.

In the make-or-take pricing model, exchanges (and some alternative trading systems) charge an access fee for executing marketable orders that fill against (take) standing orders and provides a liquidity rebate for executed standing orders that make markets. The difference between the access fee and the liquidity rebate is the net fee that the make-or-take exchanges earn for arranging trades. In contrast, exchanges that charge a transaction fee for arranging trades simply charge the buyer, the seller, or the member trader a fee for executed trades. The transaction fee and the net fee earned by make-or-take exchanges are of similar magnitudes so that access fees are generally greater than transaction fees. (On rare occasions, the relationship has been inverted when an exchange runs a promotion.)

At first glance, the make-or-take pricing model appears attractive because it seems to reward makers for good behavior—offering liquidity. To earn the liquidity rebate, makers tend to compete to offer better prices, which reduces bid-ask spreads on average. However, in competitive markets, the access fee offsets the narrower average quoted spreads so that takers are no better or worse off on average. Likewise, the liquidity rebate offsets the narrower quoted spreads so that makers also are no better or worse off on average. The actual economic bid-ask spread at these exchanges is the quoted bid-ask spread plus twice the access fee. (This sum is the total cost of simultaneously buying and selling using marketable orders.) In competitive markets, the actual spread will not depend on how high the access fees and liquidity rebates are, so long as the difference between them is constant. Traders simply adjust their quoted prices so that the net prices that they pay or receive are the same on average. The make-or-take pricing model thus would appear to accomplish nothing besides reducing quoted spreads and thereby obfuscating true economic spreads, which are the net spreads inclusive of the access fees and liquidity rebates.[5] The obfuscation makes it more difficult for traders to recognize the true costs of their trading.

The obfuscation problem may be best understood by considering its analog in retail commerce conducted over the Internet. Some retailers quote low prices for their products so that search engines rank their offers high. They then charge high shipping and handling fees so that their net prices are as high as or higher than their competitors. Variation in shipping and handling fees that is unrelated to actual costs creates substantial price confusion and can lead to poor decisions by

[5] *In some markets, the minimum price variation—the tick size—sets a binding floor on the bid-ask spread. In those markets, makers offer more size at make-or-take exchanges than they would at traditional transaction fee exchanges to increase the probability that an order will be routed to them. The additional size will expose them to greater losses to information traders, and the greater losses offset the liquidity rebates that they obtain.*

uninformed shoppers. Some Internet search engines attempt to solve this problem by ranking offers by net price rather than quoted price.

Unfortunately, make-or-take pricing has effects on order routing decisions that are substantially more significant than simple obfuscation of true spreads. Brokers make most order routing decisions based on the quoted prices that their clients will receive, and not the true net prices of the trades. They typically route customer limit orders that they cannot immediately execute to make-or-take exchanges where the broker will receive a rebate—which usually is not passed on to the customer—for the order execution. They route marketable orders to exchanges, and alternative trading systems if they have the same prices, but do not charge access fees. They also may route marketable orders to internalizing dealers who promise to fill orders at the National Best Bid or Offer (NBBO).

These routing decisions ensure that makers at make-or-take exchanges receive later executions than they otherwise would receive. At a given price, the standing orders of such makers execute only after no size remains at that price at venues that do not charge access fees. Since brokers route marketable retail orders to internalizing dealers to avoid access fees, the traders who pay the access fees at make-or-take exchanges typically are proprietary and institutional traders whose orders internalizing dealers will not accept. These traders tend to be well-informed traders. The retail orders routed to make-or-take exchanges thus always execute when prices move against them, but they may not execute as often as they would otherwise execute when prices move in their favor. The problem results because retail customers usually do not receive the liquidity rebates, and because standards for best representation of limit orders are primitive in comparison to standards for best execution of marketable orders.

Make-or-take pricing also affects the competition between internalizing dealers and exchanges. Best execution principles require that dealers who internalize retail order flow match the National Best Bid or Offer (NBBO) when trading. The artificially decreased quoted bid-ask spreads that result when make-or-take pricing hurt internalizing dealers because they must trade at tighter spreads on average, but they cannot charge access fees to their customers, and they do not receive liquidity rebates when they trade. As a result, this pricing model ensures that internalizing dealers compete at a disadvantage with make-or-take exchanges. The problem is exacerbated by the fact that make-or-take pricing distorts brokerage order routing decisions so that internalizing dealers fill most retail orders.

The make-or-take pricing model forces dealers into organized markets where they can receive liquidity rebates. Unfortunately, they cannot provide better prices on a selective basis to largely uninformed retail traders in such markets as they can and do when filling retail order flows.

Make-or-take pricing also affects the competition between the make-or-take exchanges and the transaction fee exchanges. Regulation NMS trade-through rules require that exchanges must route marketable orders to other exchanges that provide better prices. When the other exchanges are make-or-take exchanges, the routing exchange must pay the destination exchange the access fee. Some exchanges absorb the loss while others pass the access fee along to their customers. Those that accept the loss clearly are hurt. Moreover, they are exposed to customers who strategically route orders through them to avoid the take fee. Those exchanges that pass the fee along to their customers force their customers to pay fees that they generally do not expect and could only avoid by adding immediate-or-cancel instructions to their orders.

To avoid these problems, many exchanges have created flash trading facilities. These facilities help them find traders who are willing to match or improve the prices at the make-or-take exchanges, so that the transaction fee exchange can retain the execution and thereby avoid the access fee. In this sense, flash trading can be viewed as a way to limit the "unintended consequences" of the "make-or-take" pricing framework under the current regulatory system.

The distortions induced by make-or-take pricing perhaps are illustrated best with an explanation of how proprietary traders can exploit — and we understand are exploiting — the current market structure. Suppose a proprietary trader can post orders at a make-or-take exchange and receive a liquidity rebate of 0.3 cents/share when their standing orders execute. Suppose further that they can trade through one of several Internet brokers that allow their customers to trade unlimited size at a commission of $9.99 per trade. To exploit the make-or-take problem, the proprietary trader will post an aggressively priced buy (or sell) order at the make-or-take exchange in a low price stock for which the bid-ask spread is wider than the minimum price variation, and thereby improve the NBBO in that stock. The trader then immediately will submit a marketable sell (or buy) order at the same price to the Internet broker. If the Internet broker routes the order to the make-or-take exchange, the liquidity rebate will be greater than the $9.99 if the trade is for more the 3330 shares. If the order is sufficiently large, the proprietary trader will profit and the broker will lose the take fee. Alternatively, if the Internet broker routes the order to an internalizing dealer, the internalizing dealer will fill the order at the NBBO and then very likely immediately cover his position by taking the order at the make-or-take exchange for his own account. Again, the proprietary trader will profit (if the order is sufficiently large) and the dealer will lose the take fee. Brokers tell us that they believe this abuse is already taking place. Although trading this strategy is potentially illegal, clever traders certainly would be able to accomplish its objective through the coordinated use of seemingly unrelated accounts. Alternatively, Incorporation of a slight modification of this strategy into an otherwise profitable proprietary dealing strategy substantially increases the profits that could be made.

The make-or-take pricing problem is growing larger as bid-ask spreads and commissions decrease. When Regulation NMS limited access fees to 0.3 cents per share, spreads, commission, and dealer trading profits per share were much larger than they are presently. The growth of electronic trading, better order routing systems, and proprietary trading has substantially decreased spreads commissions and per share dealer profits, while substantially increasing trading volumes. The constant access fee consequently has become a relatively larger determinant of routing decisions, and ultimately of transaction costs.

The SEC could solve these make-or-take problems by requiring that all brokers pass through access fees and liquidity rebates to their clients. Presently, some brokers do this voluntarily or upon request by their clients. However, the practice is complex and therefore confusing to most customers. Most retail brokers provide single fee commissions because this single fee pricing appeals most to their customers.

We recommend that the SEC require that all brokers pass through the fees and liquidity rebates to their clients. Doing so would ensure that the customers receive and pay the actual net prices associated with filling their orders. The SEC also should clearly indicate that the principles of best execution apply to net prices and not to quoted prices. These changes would ensure that brokers route all orders to best serve their clients, rather than to enrich themselves. With these

changes, we expect that make-or-take exchanges would quickly change to transaction fee exchanges so that little confusion would actually result.

Alternatively, we recommend that the SEC eliminate access fees. This change would offer a common pricing standard for exchange services and thereby ensure that price quotes are comparable across exchanges.

The elimination of access fees would also cause securities markets to conform to common agency law. Common law generally prevents agents from collecting fees from people seeking to do business with their clients. Such fees are prohibited because they inevitably reduce the value of the business that the clients receive. Oddly, these fees have been accepted in securities markets where exchanges act as agents for the traders that post orders on their books and where brokers act as agents for their clients. Exchanges should not be allowed to require that traders pay them to trade with their clients; neither should brokers be allowed to receive liquidity rebates for routing client limit orders to make-or-take exchanges. In other contexts, these payments would be recognized as illegal kickbacks.

8.2 Naked sponsored access

Proprietary high frequency trading can expose markets to systemic risks if an electronic trader's trading system submits orders that lead to trades that the trader cannot settle. Such settlement failures may arise when a programming error or an unanticipated response to erroneous data causes a trading system to go out of control and issue unintended orders. Settlement failures may also arise when traders who know that they are bankrupt continue to trade with the hope that subsequent events may reverse their fortunes before anyone becomes aware of their financial problems.

The trades that result in either of these events can be very costly to other traders when they fail to settle. The failures may result because the exchange breaks (nullifies) the trades, or because the initiating trader is financially unable to settle the trades. Both processes are disruptive at best, and often quite costly to other traders.

Exchanges generally break trades if the trades obviously were mistakenly ordered. The contra-side traders whose trades occurred at unreasonably high or low prices are disappointed, but they can hardly be surprised when they learn their trades turned out to be too good to be true. The costs of broken orders are incurred by traders who rationally believed that their trades were good and relied upon their confirmations. For example, brokers representing customers to whom they have already reported the trades must either break the trades with their customers or make the trades good on their own accounts. In either event, the brokers lose through degradation in their client relationships or through trading losses that they must place in their error accounts.

Other losses from broken trades arise when traders arrange related trades before learning that the broken trades will be broken. For example, following the sale of one stock, proprietary traders commonly buy a correlated stock to responsibly manage their portfolio risks. When the first trade is broken, they are still left with the second trade, which will become un-hedged. If prices in the second security have changed to their disadvantage, they will lose. Since the second security is correlated with the first security, any reversal in the price of the first security will likely also appear in the second security so that the proprietary trader will far more likely realize a loss rather than a gain in the second position. When exchanges break trades to reverse errors, they make

good on trading losses in related securities. The risk of such events thus is systemic. These considerations make exchanges and other regulators very reluctant to break trades.

Similar problems arise when trader are financially unable to settle their trades. In that case, the trader's broker must settle the trades. Any losses that the broker suffers are due to the broker's failure to adequately monitor and regulate the client's trading. If the broker lacks the capital to settle the trades, the trades must be settled by the clearing member through whom the broker clears trades. Any losses that the clearing member suffers are due to the clearing member's failure to adequately monitor and regulate the introducing broker's business practices and customer's trading. If the cleaning member lacks the capital to settle the trades, the clearinghouse must settle the trade, which imposes a cost upon all other clearing members. Aside from creating substantial disruption, the failure of brokers, clearing members, and potentially clearinghouse may cause many other problems as these entities are all bound together through various contractual relationships that may fail in the event of a bankruptcy.

To avoid these problems, governmental regulators, clearinghouses, clearing members, and brokers impose capital requirements designed to ensure that those responsible for settling trades can do so. They also oversee and regulate the trades of those traders whose trades they guarantee. To this end, most brokers examine and approve customer orders before they permit them to interact with the market.

Proprietary electronic trading is most profitable when traders can route their orders for execution as quickly as possible. To avoid the time spent confirming that a trader's orders are acceptable, some brokers have been allowing their clients to submit orders for which the brokers will guarantee execution without first examining and approving those orders. This arrangement is called "naked sponsored access." For the reasons discussed above, this practice introduces systemic risk into the markets if the broker lacks sufficient capital to make good on the clients trades, should the client be unable to settle those trades.

The SEC recently proposed to prohibit naked access. In principle, the clearinghouse and clearing members introducing trades for brokers who provide sponsored access to their customers should regulate associated risks themselves. However, we believe that the right to interact directly with the markets comes with certain responsibilities, and that these rights and responsibilities should be bound together in a common regulatory framework. According, all traders who seek direct access to the markets should be registered as broker-dealers. We thus support the proposed rule.

In its rule proposal, the SEC expressed concern about the problem of identifying the origins of proprietary order flow directly routed to the markets in naked sponsored access arrangements. These concerns can involve only issues about which real-time decisions must be made since all order flows ultimately are adequately identified in audit trails. The concern arises if a sponsoring broker permits many traders to route orders in its name. If the order flow proves to be problematic, exchanges or regulators may want to shut if off without shutting off all other order flows routed through that broker and without relying upon the sponsoring broker. We believe that the concerns expressed above provide sufficient basis for restricting naked access. Brokers who fail to manage their clients' trades should risk losing the privilege to introduce orders from all sources. We believe that this risk undoubtedly will encourage brokers to be more effective regulators than they would be if they knew that regulators could shut off access only to identified sources of their order flow.

8.3 Misfiring algorithms

In a related area, we are also concerned that, even without naked access, the risk control procedures at a brokerage firm may fail to react in a timely manner when a trading system malfunctions. In the worst case scenario, a computerized trading system at a large brokerage firm sends a large number of erroneous sell orders in a large number of stocks, creating a positive feedback loop through the triggering of stop orders, option replication strategies, and margin liquidations. In the minutes it takes humans at the exchanges to react to the situation, billions of dollars of damage may be done.

Currently our exchanges have no automatic systems that would halt trading in a particular stock or for the entire market during extraordinary events.[6] It is our understanding that the circuit breakers instituted after the Crash of 1987 would be manually implemented, which could take several minutes.[7] These circuit breakers are triggered only by changes in the Dow Jones Industrial average, so severe damage could be done to other groups of stocks, and the circuit breakers would not kick in. Also, a misfiring algorithm could also create a "melt-up" as well. We recommend that the exchanges and clearinghouses examine the risk and take appropriate actions. Perhaps the issue most simply could be addressed by requiring that all computer systems that submit orders pass their orders through an independent box that quickly counts them and their sizes to ensure that they do not collectively violate preset activity parameters.

8.4 Flash Orders

The SEC should ensure the use of flash trading facilities remains voluntary. Whether the flash order instruction is an opt-in instruction or an opt-out instruction is not important. If traders or their brokers regularly measure and act to control their transaction costs, they will determine whether flash orders are in their interest and act accordingly.

With two exceptions, the SEC should make it illegal for flash order participants to take liquidity on the same side at a price equal or better than the price of a flash order that they have seen within one second of seeing that order. Flash participants should be exempt from this restriction if they filled the flash order or when they are trading to fill another flash order.
The SEC should encourage exchanges to conduct a sealed-bid auction among the flash participants during the flash period to allocate the flash order to the participant offering the best price, rather than to the participant who is first to respond. Since the bids will be sealed, they should not be subject to any minimum price variation.

8.5 Front-running orders in correlated markets

Common law, regulation, and basic fiduciary principles prohibit broker-dealers from trading ahead of their clients. In particular, the Manning decision restricts brokers-dealers buying or

---

[6] *The exchanges do have some pre-trade filters designed to catch bad orders based on criteria such as size and frequency of submission. The NYSE has a procedure to slow down trading when Liquidity Replenishment Points (LRP) are hit, but this procedure only applies to the traditional NYSE system. We understand that this LRP mechanism does not apply to NYSEArca or to other exchanges, which would continue with their normal automated trading.*

[7] *The circuit breakers are activated at various levels of decline in the Dow Jones Industrial Average, and vary with the time of day when they are activated. If a 10% drop occurs before 2:00 pm, then trading is halted for one hour, but would have no effect after 2:30pm. A 30% drop at any time would halt trading for the remainder of the day. See http://www.sec.gov/answers/circuit.htm and http://www.nyse.com/press/1254305776282.html for more details on the circuit breakers.*

selling a security when they hold an open order for that security. Broker-dealers cannot buy (or sell) for their house accounts before filling their customer buy (or sell) market orders, and they can only buy (or sell) for their house accounts at prices one penny or higher (or lower) than the prices of their customers' open limit buy (or sell) orders. These restrictions prevent brokers-dealers from profiting by front-running the price effects of their customers' orders, and from taking for themselves liquidity that should go their clients.

We are concerned that with the growth in proprietary high frequency trading by brokers and dealers who also have access to information about open client orders, some brokers-dealers may engage in a proprietary trading strategy that uses information in customer orders to profit by trading securities and contracts whose prices are correlated with the prices of the securities and contracts for which their customers have submitted orders. In particular, we believe that broker-dealers could profit from the following strategy at the expense of their customers:

1. Based on information in the client order flows that the broker-dealer sees, extract predictions for future price changes.
2. Trade on these predictions in securities for which you are not presently holding open client orders.

We are not aware of any broker-dealers who presently are engaged in such trading, but we know that the expertise, infrastructure, and data necessary to profitably conduct such proprietary trading are widely available. Indeed, given the very small bid-ask spreads that characterize most markets, dealing is only profitable to the extent that dealers can anticipate future price changes. We know that electronic proprietary traders employ models that predict future price changes from publicly available information. Imagining that broker-dealers might try to predict future prices using information about their customers' orders is not farfetched.

Although broker-dealers conducting such trades would not trade in the same securities in which they hold orders, the effect of their trading could hurt their clients. For example suppose that a broker-dealer holds a large order to buy the homebuilder Pulte Homes that will certainly require that the stock price rise to completely fill the order. The broker-dealer could profit by buying other homebuilders such as D R Horton or Lennar since the prices of their stocks are highly correlated with the price of Pulte's stock. When the execution of the Pulte purchase causes the Pulte stock price to rise, the price of other homebuilder will rise as arbitrageurs buy the other homebuilders and sell Pulte, and as dealers and other traders in the other homebuilders adjust their quotes and orders to reflect the information that they may infer from the Pulte price rise. The harm to the broker-dealer's client come from the reverse effect: As the broker-dealer buys other homebuilders and pushes up their stock price up, or simply lifts liquidity so that traders become aware that their prices are more likely to rise than fall in the near future, the price of Pulte stock will also rise, which will harm the client. We are not aware of specific rules that prohibit these activities.

FINRA released a rule proposal in December 2008 on a related topic.[8] FINRA proposes to prohibit brokers from front-running a client block order in a security, security future on that

---

[8] *FINRA Release 08-83 at http://www.finra.org/web/groups/industry/@ip/@reg/@notice/documents/notices/p117629.pdf. The comment period ended Feb 27, 2009 with only three comments submitted. No action appears to have been taken.*

security, or option on that security in any of the other two instruments ("all related financial instruments"). The proposed rule is limited to block orders and clearly limited to "related financial instruments," where the relation is legal/contractual and not based on correlation. The fact that FINRA is considering this rule indicates to us that the correlated security front-running issue is an open legal issue. However, in the request for comment FINRA notes, "… FINRA believes that this type of trading would generally violate existing FINRA rules, such as FINRA Rule 2010 (Standards of Commercial Honor and Principles of Trade) ..." It appears to us that FINRA believes the rule is necessary because it cannot effectively enforce Rule 2010 without the proposed rule.

We are concerned about the potential abuses that would result if broker-dealers could employ the front-running strategy we outline. Those broker-dealers that use this strategy would have a significant advantage over those who do not: Competition among broker-dealers who exploit their order flow this way would tighten spreads and lower commissions as they compete to fill their orders and compete to obtain the order flows necessary to make their inferences. Moreover, since the value of exploiting order flow information increases with the total order flow processed, permitting broker-dealers to pursue such proprietary trading would be anticompetitive because greatest advantage would go to the largest firms, which then would grow larger.

We recommend that the SEC specifically prohibit the use of information gleaned from open client orders in proprietary trading strategies. Definitive evidence of any rule violations would be found by examining computer codes.

8.6 Sub-penny pricing

The minimum price variation was a full eighth of a dollar at the start of the 1990s. It decreased to a sixteenth and finally to a penny when markets completed decimalization in 2001. With each of these decreases, bid-ask spreads dropped, but so too did displayed order sizes.
The decrease in spreads was due to competition among traders to provide better prices, much of which had been frustrated by the binding constraint that a formerly large minimum price variation placed on bid-ask spreads. These smaller spreads benefit retail traders who submit small marketable orders that typically execute without price impact.

The decrease in displayed order sizes occurred because traders will not quote for significant size when they are exposed to trading losses that they incur when trading with informed traders or with large uninformed traders whose orders move prices significantly. Displayed sizes also decreased because smaller tick sizes reduced the incentives to place orders early and because small tick sizes facilitate parasitic quote-matching trading strategies designed to extract option values from standing orders.

Bid-ask spreads for many actively traded stocks are now often just one cent for the reasons described above and also due to the recent drop in stock prices of many actively traded stocks. For stocks trading above one dollar, Regulation NMS's prohibition on sub-penny quotes sets a binding lower bound of one cent on their spreads. However, trades can be—and often are—executed on smaller increments.

Some market participants recently have called for a further decrease in the minimum price variation, perhaps to a mil. This decrease would further lower bid-ask spreads for stocks where spreads are commonly one penny, and it would further lower displayed sizes in those stocks.

A decrease in tick size would have the beneficial effect of reducing the minimum price variation to the same order of magnitude as the access fees and liquidity rebates that make-or-take trading systems charge and pay their customers. Regulation NMS currently caps access fees at three mils per share. With a one-mil price increment, the SEC could easily require that quoted prices reflect access fees.[9] We believe that this change would quickly eliminate the make-or-take pricing model and the problems associated with it.

Despite these benefits, we do not recommend that the minimum price variation be decreased further. We are particularly concerned about the effect of a small minimum price variation on order display and on transaction costs of large traders, most of whom represent pensions, endowments, and mutual funds. Dark pools and hidden order exist because large traders are reluctant to reveal their orders. Their reluctance in large part is due the losses they suffer from traders who step in front of their orders to extract their option values—the so-called "pennying strategy" that we identified above as quote-matching. The decrease in tick sizes over the last two decades is responsible for much of the growth in dark venues.

As discussed above, the SEC can solve make-or-take problem by simply requiring that access fees and liquidity rebates be passed along to clients. Alternatively, the SEC could establish a single pricing standard for exchange fee pricing by further reducing the maximum permitted access fee.

Sub-penny pricing also would be burdensome to the market information systems that deliver information to trader's screens. The primary burden would not be transmission capacity, but rather screen real estate. An additional digit would further clutter screen displays. The data vendors would have to substantially modify their systems to present sub-penny prices, and users would see more data but less information.

Sub-penny pricing also would further exacerbate the Manning penny problem that dealers face. When dealers hold a client buy order at priced at 20.00, if they buy from another client at any price below 20.01, they must give the fill to their customer at 20.00. The dealers lose the difference while providing price improvement to their clients—an untenable proposition in the long run. A change in the tick size thus would require some change in the Manning rule. However, that rule sensibly protects clients from strategies that dealer might deliberately take to disadvantage their clients without their knowledge. The rule probably should be modified to exempt trades that dealers make when compelled to by reasonable business models.

Finally, we note that issuers concerned about the one cent binding constraint upon bid-ask spreads in their low priced stocks can reverse split their stocks. Companies do not like to engage in such transactions because they are costly and disruptive, and because they draw attention to their poor financial performance. The SEC might remove some of the stigma by suggesting that all companies interested in conducting reverse splits do their splits on the same day.

8.7 Rules 605 and 606 and consumer disclosures of broker quality

SEC Rule 605 requires market centers to reveal information about the quality of their executions. Rule 606 requires brokerage firms to disclose information about order routing and payment for

[9] *Quantity discounts in access fees would complicate such a rule.*

order flow practices. The intent of these rules was to focus attention on execution quality. The rules should be updated with the intent of providing information usable to consumers about the execution quality delivered by the brokerage firms. For example, a brokerage firm could provide statistics giving execution times along with the percentages of orders filled at the quote, better than the quote, and worse than the quote, for different size buckets including odd lots.

9. Conclusion

Equity markets have evolved quickly over the last decade. The U.S. equity market is now an open architecture market in which entrants with innovative technology can compete effectively. This freedom has led to a decline in market shares for previously dominant exchanges. The character of trading has also changed. We have moved from a market in which humans manually traded to one in which computers execute the bulk of trades without human intermediation. Volume is higher. Trade size has become smaller as it is now cheaper for institutions to divide orders up into smaller slices to reduce their market impact.

Many innovations in market structure help investors do what they have always done, only in more advanced ways. For example, so-called dark pools permit investors to trade while limiting the dissemination of their trading information. Traders have always limited the display of their orders by using the upstairs block market or through instructions given to floor brokers on NYSE and AMEX trading floors.

Transactions costs have fallen to very low levels, and trading volumes have increased, as basic economics predicts. The increased liquidity reduces corporate costs of capital because investors will pay more for investments that are not costly to enter and exit.

Lower transactions costs also allow computerized investors to provide cost effective market improving services. For example, arbitrageurs ensure that the prices of related instruments, such as a stock and its derivatives, are in the proper alignment. Thus, when retail investors purchase S&P500 ETFs, they depend on the arbitrageurs ensure that the ETF price reflects the prices of the constituent stocks in the ETF.

The ability to trade at low cost allows high-speed traders to provide great liquidity to the markets. Their willingness to devote capital to buy when others desire to sell and vice versa smoothes out the price effects of order imbalances and further reduces transactions costs for end investors.

Although U.S. equity market structures are operating very efficiently, some changes can produce further improvement. The requirement that brokers ignore exchange access fees when seeking "best execution" defies economic rationalization and leads to market distortions. Front running orders through trades in correlated instruments can harm brokerage customers and should be banned. Markets and clearinghouses also should consider how to best protect our high-speed markets from a high-speed meltdown caused by programming mistakes.

Electronic traders now provide most liquidity in U.S. equity markets. Their greater efficiencies allowed them to largely displace traditional dealers. Although the resulting markets are more liquid than they have ever been, the unintended consequences of new regulations could easily damage them. For example, even a small transactions tax on trading would seriously reduce liquidity because the margins on which electronic traders operate are so small. Accordingly, regulators must carefully consider all implications of proposed regulations lest they accidently harm our markets and thereby retard or reverse the economic recovery we presently are experiencing.

Author Biographies

JAMES J. ANGEL
Associate Professor, McDonough School of Business, Georgetown University

Professor Angel specializes in the structure and regulation of financial markets around the world, and he has visited over 50 financial exchanges around the world. His current research focuses on short selling and regulation. He teaches undergraduate, MBA, and executive courses, including Financial Crises: Past Present and Future. Other courses include World Equity Markets and Regulation in Financial Markets. Professor Angel began his professional career as a rate engineer at Pacific Gas and Electric, and then BARRA (now part of Morgan Stanley) where he developed equity risk models. He has also served as a Visiting Academic Fellow in residence at the National Association of Securities Dealers (NASD – now FINRA) and also as a visiting economist at the Shanghai Stock Exchange. He has also been chairman of the Nasdaq Economic Advisory Board and a member of the OTC Bulletin Board Advisory Committee.

LAWRENCE E. HARRIS
Professor of Finance, Marshall School of Business, University of Southern California

Professor Harris's research, teaching, and consulting address regulatory and practitioner issues in trading and investment management. Chairman Harvey Pitt appointed Dr. Harris to serve as Chief Economist of the U.S. Securities and Exchange Commission in July 2002 where he continued to serve under Chairman William Donaldson through June 2004. As Chief Economist, Harris was the primary advisor to the Commission on all economic issues. He contributed extensively to the development of regulations implementing Sarbanes-Oxley, the resolution of the mutual fund timing crisis, the specification of Regulation NMS (National Market System), the promotion of bond price transparency, and numerous legal cases. Professor Harris currently serves on the boards of Interactive Brokers, Inc., the Clipper Fund, Inc., and CFALA, the Los Angeles Society of Financial Analysts. Other professional service has included year-long assignments to the U.S. Securities and Exchange Commission and to the New York Stock Exchange immediately following the Stock Market Crash of 1987. Dr. Harris received his Ph.D. in Economics from the University of Chicago in 1982.

CHESTER S. SPATT
Professor of Finance, Tepper School of Business, Carnegie Mellon University

Professor Spatt is a well-known scholar studying financial economics with broad interests in financial markets. He has extensively analyzed market structure, pricing and valuation, and the impact of information in the marketplace. His co-authored 2004 paper in the Journal of Finance on asset location won TIAA-CREF's Paul Samuelson Award for the Best Publication on Lifelong Financial Security. In the past, he served as Chief Economist of the U.S. Securities and Exchange Commission and Director of its Office of Economic Analysis from July 2004 through July 2007. Additionally, he has served as Executive Editor and one of the founding editors of the Review of Financial Studies, President and a member of the Founding Committee of the Society for Financial Studies, President of the Western Finance Association, and is currently an Associate Editor of several finance journals. He earned his Ph.D. in economics from the University of Pennsylvania and received his undergraduate degree from Princeton University.

PREPARED STATEMENT OF THOMAS PETERFFY

CHAIRMAN AND CHIEF EXECUTIVE OFFICER, INTERACTIVE BROKERS GROUP

DECEMBER 8, 2010

A. Introduction

Chairman Reed, Chairman Levin, Ranking Member Bunning, Ranking Member Coburn, and Senators, thank you for inviting me here to discuss some of the issues facing the Nation's securities and futures markets and what we might do to address these issues.

I am the Chairman and CEO of the Interactive Brokers Group. Interactive Brokers is a technology-focused brokerage firm that provides sophisticated investors and institutions with access to securities and futures trading in the U.S. and across the world. Interactive Brokers also has a large market making business, in which we provide liquidity on stock, options and futures exchanges. We are an $8 billion company by market capitalization and our customers hold about $21 billion dollars with us, and so you might say we have a lot of "skin in the game" in terms of our interest in the health of the U.S. markets. We have some serious concerns that I would like to share with you.

B. The Interconnected Securities and Futures Markets of the U.S. Continue To Be Vulnerable to Major Disruption

To begin, I would like to tell you about my worst nightmare:

Consider a high frequency trading—or "HFT"—operation with as little as $30 to $50 million dollars. This HFT firm consists of a few computers, a couple of programmers, and maybe a 3-month track record of high volume, computerized trading with modest gains or losses.

Many such high frequency trading operations exist today scattered around the world. They gain direct, unfiltered access to U.S. exchanges via what is called *Sponsored Access,* wherein the sponsoring, often undercapitalized, U.S. broker will essentially lend out its exchange membership for a fee and under that broker's membership, the high-frequency trading operation is able to do an unlimited number of transactions without any prescreening by the sponsoring broker (*i.e.,* the sponsoring broker does not see the orders before the HFT firm executes them).

One day, at 3:45 p.m., the HFT firm's computers start sending orders to sell large capitalization stocks and Exchange-Traded Funds (ETFs). The circuit breakers are not in effect after 3:35 p.m., but even if they were, perhaps our HFT firm would try to mediate its orders to avoid triggering the circuit breakers. As the HFT firm's selling continues, the market decline accelerates and spreads to the futures and options markets. As the close of trading approaches, many other sellers jump in, including day traders trying to go home flat, traders with stop orders in the system, and securities and futures brokers liquidating undermargined customer accounts.[1] With the right pressure applied, the market might easily close down 30 percent for the day.

The next morning, scared investors and brokers holding undermargined accounts all have to run for the exits and sell into the cascading circuit breakers. Undercapitalized brokers fail. Other HFTs and hedge funds that were long going into the decline, fail, and their clearing brokers fail. Clearinghouses may be threatened, as more and more positions must be liquidated for margin reasons. There will be a great many losers, but the HFT firm that started it all will garner huge profits when it covers its short positions during the fire sale. Its gains will be moved quickly to offshore accounts before the regulators figure out who did it.

In the other, almost-as-bad scenario, when the market opens the next day it realizes it was duped. No external event or news is seen justifying the prior day's break, and the source of the orders has been isolated. In this scenario, the market rallies sharply, climbing 40 percent the next morning. The HFT firm's sell orders that caused the original decline become massive losers, losses that the broker sponsoring the access (and its clearing broker) cannot cover. Bankruptcies follow.

Under either scenario, many innocent, ordinary investors will be caught by the huge downdraft or updraft and confidence in the stability and integrity of our markets will suffer further.

---

[1] There is a new short sale restriction scheduled to become effective in March 2011, which restricts short sales from hitting the bid if a certain downward threshold has been reached. In the case of a sponsored account, one wonders how this rule would be enforced. If the high frequency trading firm does not label short sales as such, the market damage will be done and the violation only detected, if at all, some time after the event.

Unfortunately, what I have just described is very plausible. It could be an attempted manipulation by an HFT firm with a goal of simple profit. It could be an intentional act by a terrorist or anarchist, or by a dissatisfied employee of a hedge fund or broker or HFT firm. Or it could be caused by a simple computer bug.

So the question becomes, what can we do to prevent these and other, less dramatic abuses?

C. Recommendations

I. The SEC's New Rules Banning Certain Forms of Sponsored Access and Requiring Risk Management Procedures Should Be Strengthened and Should Be Made Effective Immediately, by Emergency Order if Necessary. The CFTC Should Also Adopt Similar Rules.

The SEC recently approved new rules banning certain forms of sponsored access and requiring brokers to implement new risk management procedures, but the rules do not go into practical effect until mid-July 2011, seven months from now. A great deal could happen between now and then.

In addition, the regulations are somewhat vague and seem to leave enough discretion to brokers that some might allow orders to be sent to market that are beyond the financial wherewithal of the customer.

Finally, although the new rules prevent customers from sending orders directly to an exchange using sponsored access, about 5,000 brokers that are not members of the clearing house are still allowed to send orders directly to an exchange, with no prefiltering or credit review by the clearing member broker that is ultimately financially responsible.

These gaps need to be closed. First, the SEC should make the new rules (or at least the important, operational portions of them) effective very shortly, by emergency order if necessary and hopefully by the end of the year.

Second, the regulations should be clarified to require that the clearing broker that is financially responsible for a particular customer's orders must set a specific credit limit for that customer. This credit limit must not exceed the smaller of: (1) the customer's stated capital (as reasonably relied upon by the broker); or (2) the assets on deposit with the broker plus 10 percent of the broker's capital.

The broker should calculate the margin requirements on the customer's existing positions in real time and reject any order that, if executed, would cause the customer's margin requirements to exceed the prescribed credit limit. This is an elementary risk management tool that most reputable brokers already use, and all reputable brokers should use.

Finally, the ability to submit orders to exchanges should be restricted to brokers that are clearing members. Thinly capitalized firms or firms with poor risk management systems may register as broker-dealers, become exchange members, and send orders directly to the exchange, for which another broker—the clearing broker—ultimately will be responsible. And yet that clearing broker whose capital is at risk is not required to see or to credit check these orders before execution. This is a huge risk management gap that must be closed.

II. The SEC Should Approve and Accelerate Its Proposed Audit Trail Rules. The CFTC Should Adopt Coordinated Rules and Use the Same Unique Beneficial Owner Codes so That the Agencies Can Effectively Share Surveillance Information. As a Stopgap Until These Systems Are Fully Developed, the Commissions Should Require Clearing Brokers To Create Basic Audit Trails, Including Beneficial Owner Information.

Manipulation and insider trading are frequent and appear to be on the upswing, and the SEC and the CFTC need real-time consolidated audit trail information, including most importantly the identity of the underlying beneficial owner behind each trade.

The SEC has proposed comprehensive rules providing for the creation of a single, consolidated audit trail, but these rules have not yet been approved and will not become fully effective for at least 2 years, and probably more like three or four including the extensions of time that the industry undoubtedly will request.

The SEC should approve its proposed audit trail rules and shorten the timeframe for implementation substantially. But as a stopgap, the SEC should issue a very basic order, effective in no greater than 90 days, requiring that clearing brokers maintain a basic audit trail, including the identity of the underlying beneficial owner behind each order for which the clearing broker is responsible. The information would have to be provided to the Commission and relevant SROs on demand, perhaps using existing systems.

Having immediate access to the identity of the underlying traders behind each order by a simple request to the clearing broker will be a marked improvement over

the current system until the full-blown, cross-market consolidated audit trail comes on line in 2 or 3 or 4 years.[2]

When the consolidated audit trail system does come on line, the SEC and CFTC should have similar or identical systems. Most importantly, the unique large trader and beneficial owner codes that would be issued by the central audit trail processor should be the same across the securities and futures markets so that cross market activity can be monitored effectively.

III. To Improve Liquidity and Transparency and Help Prevent Future Crashes, Off-Exchange Trading of Exchange-Listed Products Should Be Limited or Prohibited.

An observer from another planet, here to study our financial regulation, would have some difficulty understanding the following proposition: In the wake of Dodd-Frank, equity-based "Over-the-Counter" derivatives must trade on exchanges, so long as similar products are listed there. Yet "Exchange-Listed Securities" remain free to trade over-the-counter. This is bureaucracy at its best, or perhaps at its worst.

In the current U.S. equity markets, brokers "internalize" stock trades by trading against their customers' orders directly or selling them to another firm to do so (thus avoiding the exchanges). The trades are then printed to the tape and put up at the clearinghouse. Brokers are supposed to provide best execution even when they internalize or sell their order flow, but best execution is vaguely defined and essentially unenforced.[3] Brokers in the U.S. must post reports showing where they route their customers' orders, but it is clear that most brokers do not care what is reflected in those reports.

It should be shocking that according to the Rule 606 reports mandated by the SEC, no major online broker, with the exception of our company Interactive Brokers, sends more than 5 percent of its orders to organized exchanges. More than 95 percent of their orders go to internalizers!

The fact is that when exchange-listed products are traded off of the exchanges, liquidity on the exchanges dries up. As fewer orders are sent to exchanges, fewer market makers compete for those orders or quote in size because they get nothing out of it. Exchanges become illiquid and are unable to withstand supply and demand imbalances. This causes confidence-draining mini-crashes in single stocks from time to time, but becomes disastrous on days where a major market event occurs. On such days, the internalizers suddenly dump their orders on the exchanges because the internalizers are afraid to take on large positions, but there is no liquidity on the exchanges to deal with the orders sent there.

Congress or the SEC should prohibit off-exchange trading of exchange-listed securities or limit it to large institutions trading very large size. This is essential to restore liquidity and confidence in our markets.

IV. The Existing Circuit Breakers Must Be Modified and Must Be Effective at All Times While Markets Are Open.

First, the current circuit breakers in the equity markets are only in effect from 9:45 a.m. until 3:45 p.m., leaving the volatile opening and closing periods of trading uncovered. The circuit breakers should be in effect at all times that the market is open.

Second, the circuit breakers do not kick in until a price moves 10 percent in a 5-minute period. This allows prices to move 2 percent per minute indefinitely without ever triggering the circuit breakers (allowing the market to move, for example, nearly 80 percent in 40 minutes). This needs to be changed.

Circuit breakers should first take effect at a price 10 percent up or down from the prior day's close. When a circuit breaker is triggered, trading would not be halted, but no trades would be allowed for 5 minutes at any price further than 10 per-

---

[2] The ultimate goal of the proposed consolidated audit trail is to allow regulators to view order and trade information in time-sequence in order to be able to replay actual market events. Due to calibration difficulties and inherent latencies in communications, it will be impossible to precisely recreate market events. In any event, we usually know what happened but do not know who did it. The presence of quickly accessible data identifying rule violators would serve as a deterrent.

[3] The internalizers are supposedly matching the best prices prevailing at the exchanges, so that they can argue that their customers get best execution. This is subject to serious doubt, however. Transaction Auditing Group, Inc., a third-party provider of transaction analysis, has consistently determined that Interactive Brokers' U.S. stock and options executions are significantly better than the industry (on average 28 cents better per 100 shares in the most recent 6-month period studied). Rather than internalize its customers' orders, Interactive Brokers simply routes each order, or parts of an order, to the exchange or market with the best price for that order, and quickly reroutes if another market becomes more favorable.

cent from the prior close. In a falling market, for example, trades at prices above 10 percent down would still be allowed during the 5-minute circuit breaker period, thus allowing the stock to bounce but preventing it from falling any further for 5 minutes.[4]

After 5 minutes, the stock would be able to trade freely again, except that another circuit breaker would take effect at 20 percent down from the prior day's close, for another 5 minutes. The process would be repeated at 30 percent down from the prior close, 40 percent, and so on.

In addition to these individual circuit breakers, there would be a marketwide circuit breaker that would take effect if at any time more than 10 percent of National Market System stocks had tripped the 20 percent price band. If this overall circuit breaker were triggered in a down market, then the 10 percent of NMS stocks already trading outside the 20 percent price band would not be allowed to trade at any price lower than their day's low to that point. Stocks that had not yet traded below 20 percent down from the prior close would be allowed to trade at any price down to 20 percent but no further. The price limits would last for the rest of the trading day.

The current circuit breakers in the futures markets should be augmented with the same marketwide circuit breaker. Thus, when 10 percent of NMS stocks traded outside the 20 percent band, futures markets would limit the move in related index contracts by calculating the maximum allowed price move of each index component (including some index components that would be allowed to trade down 20 percent and some that might already have broken that band and thus would be allowed to trade down to their day's low) and than applying these individual component limits to the fair value of the lead futures contract.

Likewise, functionally equivalent restrictions would have to be applied to other equity-based derivatives markets (such as exchange-traded options).

PREPARED STATEMENT OF MANOJ NARANG

CHIEF EXECUTIVE OFFICER, TRADEWORX INC.

DECEMBER 8, 2010

My name is Manoj Narang, and I'm the CEO of Tradeworx Inc., a financial technology firm that provides hardware and software solutions to investors interested in ultra-high-performance trading. In addition to supporting outside clients with our technology, we operate a proprietary trading practice which utilizes the same technology to engage in high-frequency trading strategies. We also manage money in lower-turnover quantitative strategies for outside investors. All of our strategies involve technology-driven trading based on statistical arbitrage.

I'd like to begin by expressing my gratitude for the opportunity to share my insights and perspectives in today's hearing, and by recognizing that small firms like Tradeworx are not often accorded such an opportunity.

Restoring Investor Confidence in the Markets

My prepared remarks focus on the topic of restoring investor confidence in our markets. It is self-evident that markets depend on confidence in order to function smoothly, and there is no denying that the confidence of investors was severely shaken on May 6. It is this loss of confidence that transformed the Flash Crash from just another chapter of the ongoing credit crisis into the far-reaching referendum on market structure that it has become. Ever since May 6, investors have been plagued by the nagging suspicion that the regulatory authorities are unable to understand the inner workings of the market, or to meaningfully assess the practices of its most active participants.

For the past 2 years, the public has been treated to endless debate about market structure issues. Are prices posted by market-makers fair, or are they subject to widespread manipulation? What impact do rebates or elevated cancellation rates

---

[4] "Mini-crashes" continue to occur even with the recently enacted circuit breakers in the equity markets. This is because the primary listing market for each equity security has to calculate throughout the day whether the circuit breaker has been tripped for that security and then notify the secondary markets if the circuit breaker has been tripped. But between the time that such electronic notification is made by the primary market and the time that the secondary markets can react to it, the security can continue to trade on the secondary markets at prices well outside the circuit breaker. If the circuit breakers instead were set at 10 percent, 20 percent, 30 percent, *etc.,* away from the prior day's close, the secondary markets would not need to wait for notice from the primary market that a circuit breaker was triggered (because they could calculate the circuit breaker triggers themselves by comparing trade prices throughout the day with the prior day's close).

have on liquidity? Why is speed important to the business of market-making? How do the equities, options, and futures markets influence and interact with each other?

The public should not be forced to accept anecdotal or speculative answers to such questions when definitive answers can be had by analyzing data. Firms such as Tradeworx have the ability to produce objective and factual answers to questions of this sort with only minutes of effort. While we have shared our insights with the SEC, there is no substitute for the regulators having these sorts of capabilities on their own.

Regulation NMS

Another key obstacle to restoring the confidence of investors is that the markets have become too complicated for ordinary investors to understand. The U.S. Equity Market sports the most complex and fragmented market structure known to mankind. The regulators deserve their share of the blame: their magnum opus—Regulation NMS—was 10 years in the making and spans over 520 pages. For perspective, consider that in competitive games like chess, extraordinary complexity arises from just a handful of rules. It should surprise nobody that an undertaking of this magnitude would overreach and backfire. Nor should it surprise anyone that the Byzantine structure it foisted upon the market would generate paranoia among investors, fueling the perception that the system is somehow "rigged" against them.

Remarkably, the most complex and problematic part of the regulation adds almost no value to the market in practice. I'm referring to Rule 611, which is designed to keep prices at the different exchanges synchronized with each other. Consider that the stocks SPY and IVV, both of which track the S&P 500 index, have a 99.9 percent correlation with each other when their prices are sampled at subsecond intervals, despite the fact that there is no regulation to keep their prices in sync. This is compelling evidence that arbitrage alone is more than sufficient to keep prices in line with each other.

Unfortunately, 99.9 percent was not good enough for policy makers. With Reg NMS, the SEC decided to keep prices in line by decree, rather than by the traditional mechanism, arbitrage. Never mind that the underlying idea violates the laws of physics—exchanges can never perfectly incorporate each other's information, because information takes time to transmit.

The market continues to pay a steep price for this overreach. Rather than minimizing fragmentation, which was its stated objective, the regulation has directly encouraged it, giving upstart exchanges an economic incentive they never before enjoyed by virtually guaranteeing that they will get orders routed to them by other exchanges. Rather than limiting the role of arbitrage, the regulation has diverted its focus from keeping prices in check to exploiting the shortcomings of the regulation itself, often to the detriment of long-term investors. To top it off, the rule has managed to ignite a massive technology arms race, by making the speed of information transmission a more critical issue than it ever was previously.

Now that the regulators clearly have the mandate to create even more rules, I fear we are doomed to repeat our past mistakes. Once again, superfluous proposals which solve nonexistent problems abound. It is easy to conjure up gimmicks such as "speed limits" on order cancellations, but it is also trivially easy to demonstrate how they will backfire and harm long-term investors. When lawyers with minimal trading expertise devise such rules, they should recognize that world-class engineers with a profit motive will be there to exploit them. Who do you think will wind up with the upper hand?

Adding ever-more expansive regulations to a system which is already hopelessly complex is guaranteed to backfire by inviting unintended consequences. This will not restore investor confidence in our markets. Fixing flaws in the existing regulations will.

There is plenty of low-hanging fruit to be picked here, starting with the provision of Rule 611 which prohibits exchanges from posting orders which lock the quotes of other exchanges. Of all the provisions of Reg NMS, this is the most utterly useless, the most exploitable, and the most flagrantly damaging.

Were this one superfluous provision to be relaxed, trading venues would cease their unabated proliferation, and fragmentation would likely begin a steady reversal. Volumes would start migrating back from dark pools to the lit exchanges. Message traffic and excessive order cancellations would decline. Proprietary traders would cease to have the ability to jump in front of investor orders. The wind would be taken out of the sails of the high-tech arms race. All of this could be accomplished while leaving the vast majority of Reg NMS intact and without altering the framework of the national market system in a meaningful way. I hope to have the opportunity to elaborate on these topics at today's hearing, and I ask that the entirety of my written remarks be included in the record.

PREPARED STATEMENT OF KEVIN CRONIN

GLOBAL HEAD OF EQUITY TRADING, INVESCO LTD.

DECEMBER 8, 2010

Thank you, Chairman Reed, Ranking Member Bunning, Chairman Levin, Ranking Member Coburn, and Members of the Senate Subcommittee on Securities, Insurance, and Investment and the Senate Permanent Subcommittee on Investigations for the opportunity to speak here today, I am pleased to participate on behalf of Invesco at this hearing examining the efficiency, stability and integrity of the U.S. capital markets, Invesco is a leading independent global asset management firm with operations in 20 countries and assets under management of approximately $620 billion.

An efficient and effective capital formation process is essential to the growth and vitality of the U.S. economy. The most important aspect of the capital formation process is that it attracts long-term investors' capital. To accomplish this, it is critically important that the primary and secondary capital markets which facilitate the capital formation process are transparent and working in the best interests of investors. To that end, it is essential that sensible, consistent rules and regulations are in place governing the markets and that regulators have the tools to ensure fairness and integrity in the markets. Such a foundation fosters the confidence of long-term investors to provide the capital necessary for companies to create new and innovative services, products and technologies which in turn create additional jobs and advance our standards of living. We therefore commend the Subcommittees for holding this hearing to examine these critical issues.

Unfortunately, over the past several years long-term investor confidence has been undermined by a series of scandals, financial crises and economic tumult, including most recently the "flash crash" of May 6th. In order to recover long-term investor confidence, it is incumbent upon regulators to ensure that the securities markets are highly competitive and efficient as well as transparent and fair. The regulatory structure that governs the securities markets must encourage, rather than impede, liquidity, transparency, and price discovery. Consistent with these goals, Invesco strongly supports regulatory efforts to address issues that may impact the fair and orderly operation of the securities markets and investor confidence in those markets.

To be clear, investors, both retail and institutional, are better off now than they were just a few years ago. Competition in today's markets, which was virtually absent 5 years ago, has spurred trading innovation and enhanced investor access. Trading costs, certainly in the most liquid of securities, have been reduced and investors have more choice and control in how they execute their trades. Advances in technology have increased the overall efficiency of trading. These gains, however, haven't come without accompanying challenges. Some of these challenges were highlighted by the market events of May 6 and others are broader market structure issues that were raised in the SEC's concept release on market structure.

The Market Events of May 6th

The events of May 6 brought to the forefront several inefficiencies in the current market structure and highlighted the interdependency of the equity, options and futures markets, particularly the connection between price discovery for the broader stock market and activity in the futures markets. Perhaps most significantly, the events of May 6 underscored the absence of an effective mechanism to dampen volatility at the single-stock level; the lack of consistency and synchronization of rules which govern trading at the various exchanges; the lack of clearly defined rules on the handling of clearly erroneous trades; the outsized impact trading algorithms and small market orders can have in the prices of securities in times of duress; and the fact that the market making mechanisms in place today provide virtually no liquidity to investors in times of market stress.

Several of these issues have already been addressed by regulators, including the need to establish mechanisms in single stocks to address extreme price moves and better procedures for resolving clearly erroneous trades. In addition, discussions are ongoing among regulators and market participants regarding the inconsistent practices of exchanges when dealing with major price movements. Invesco is a diversified investment manager and as such we participate in trading in many types of securities on many different exchanges and market venues. We believe it would serve our investors' interests as well as other long-term investors' interests to have better coordination, both at the regulator and exchange levels, between the options, futures, equities, and credit markets.

Establishing Mechanisms To Address Extreme Price Moves

Removing all instability and volatility from the equity markets is neither possible nor appropriate. However, establishing mechanisms to address extreme price moves in the markets and volatility related to inefficient market structure will be critical in preventing a repeat of the May 6 market event.

Circuit Breaker Rules and Clearly Erroneous Rules

Invesco supported the single stock circuit breaker proposals as a means to immediately mitigate the impact of sudden market volatility by implementing a trading pause for individual securities in times of market stress. As the circuit breakers are set to expire soon we would strongly encourage replacing them with a so-called "limit up/limit down" regime. Circuit breakers require a trading halt when the threshold price is reached which can be confusing and inefficient for investors. As we have seen over the past few months, the single stock circuit breakers have been triggered a number of times due to system errors or gaps in liquidity that cause an unnecessary disruption of trading. We believe a limit up/limit down regime would be a more effective means of accomplishing the same goal of having a more orderly process in place in times of duress.

One thing is clear, whether the answer is circuit breakers or limit up/down, there absolutely must be coordination among futures, options and equity exchanges to ensure a consistent approach to extreme market movements.

The integrity of trading data is critical given the speed and volume of trading in the markets. Invesco therefore has strongly supported amendments to the rules relating to clearly erroneous executions to clarify the process for breaking erroneous trades and to provide uniform treatment across the exchanges for clearly erroneous execution reviews. We believe, however, the whole notion of taking trades off the tape is generally detrimental to investor confidence. We would propose that the exchanges instead clearly define and articulate the parameters that constitute erroneous trades and then program their systems to detect and reject trades outside of those parameters. We believe uncertainty surrounding the clearly erroneous rules and the risks associated with entering orders during the drop in stock prices likely contributed to the rapid and dramatic price declines on May 6. Ensuring that only good trades are reported to the tape will provide investors and liquidity providers an increased level of confidence regarding the trading data they need to participate in good and bad markets.

Use of Market Orders

As was clearly illustrated by the events of May 6, when there is a vacuum of liquidity, smaller market orders can have an outsized impact on the prices of securities. As an institution, we have long understood the significant risk of using market orders particularly as the market has become more fragmented. We abandoned their use many years ago in favor of marketable limit and limit orders. In light of the events of May 6 and the continuing issues small market orders have had in the market (*i.e.,* electing newly imposed single-stock circuit breakers on WPO, CSCO, C, APC, and others), Invesco strongly supports the examination of the current practices surrounding the use of market orders, particularly the use of "stop loss" orders. There can be nothing more erosive to the confidence of investors in the efficient workings of the market than to watch a small market order take a stock from $50 to $100,000.

Trading Algorithms

The Joint CFTC–SEC Advisoty Committee report on the market events on May 6th clearly shed negative light on the use of trading algorithms, particularly in times of market duress. While we agree that using a price agnostic algorithm in any environment incurs significant risk, we believe trading algorithms, when appropriately employed, can be highly effective tools in our best execution process. Algorithms allow us to approach our trades from a number of different pursuits giving us the speed, anonymity and access to liquidity that we need to be effective for our clients. That said if regulators feel compelled to act with respect to algorithms, we would encourage them to focus their efforts on broker dealer and venue order routing practices and any potential manipulative practices being employed by market participants through the use of algorithms.

Responsibilities of Market Makers

The role of traditional liquidity providers such as market makers has taken on more significance since the events of May 6, as the sudden absence of liquidity in the markets played a critical role in the severe decline in stock prices. We recognize that the obligations market makers have in times of market duress likely succumb to innate self-preservation instincts—after all catching falling knives is generally

not a good idea. Several ideas have been put forth to improve the operation of market makers that are worthy of further examination, including increasing obligations surrounding best price, depth of markets, and the maximum quoted spread obligation. Similarly, there should be an examination of the incentives that market makers currently have to make reasonable two-sided markets. Given the introduction of single stock circuit breakers and more clarity around the handling of clearly erroneous trades, it would appear that some of the risk of making markets in volatile times has been reduced. In any event, the goal of our capital markets has to be the provision of fair and orderly markets in good times and bad. We believe that market makers who have appropriate incentive and obligations are an important aspect of that.

Ensuring May 6th Doesn't Happen Again

While many of the steps being taken by the various regulators and exchanges will greatly reduce the potential for another May 6th—the risk will not be entirely removed from these actions alone. The SEC, CFTC, and SROs must be coordinated, diligent and measured in their efforts to create sensible regulation designed to minimize inefficiencies in market structure and advance surveillance and enforcement capabilities to thwart nefarious behavior.

One idea which deserves further consideration in that regard is the consolidated audit trail (CAT) or a similar solution to provide regulators the data they need to surveil markets on a timely basis. The proposed CAT would provide regulators with timely access to order and execution information for all securities within the National Market System (NMS). This would give regulators the ability to perform timely, detailed analysis of single stock or general market activity which would greatly enhance existing oversight and enforcement capability. Our expectation is that all information collected within the CAT or equivalent system will be absolutely secure with no possibility for leakage or manipulation and that the costs to create and maintain the CAT (or equivalent) will be much more reasonable than some of the published estimates.

Beyond May 6th

While the events of May 6th highlighted some of the challenges of the current market structure they did not reveal all of them. Regulators should not lose sight of the broader market structure issues raised by the SEC's concept release examining the structure of the U.S. equity markets, including the adequacy of information provided to investors about their orders, the impact of high frequency trading, and nondisplayed liquidity. These issues are equally critical to investors' ability to trade efficiently under the current market structure.

Fragmentation

There are today at least 13 for-profit exchanges. Competition between exchanges is fierce resulting in new innovations and different ways for investors to seek and provide liquidity. This is a welcome development from our perspective provided that the rules and regulations which govern the various exchanges are consistent and not incongruent with the goals of fairness and equal access for investors. We believe that the notion of exchanges having their own SROs is outdated and potentially disruptive to the efficient operation of securities markets. Therefore Invesco would support a move to a single SRO for all exchanges. It is interesting to note that exchange competition has also spurred an electronic arms race where the race to microseconds will soon cede to nanoseconds. It has also dramatically changed the revenue models of exchanges to a point where so called "maker-taker" models thrive and fees for cancelled trades are routinely waived for the most active participants.

While Invesco believes that speed is an important variable to consider in the execution of trades, it is clearly not the only one which long-term investors should consider as they seek best execution. Some of our fundamental fund managers may take months to research a particular company before they are ready to buy its stock; buying those shares in one-millionth of a second isn't exactly the manager's top priority. Buying the shares at the "right" price which is understood through a robust price discovery process wherein there is real understanding about the underlying supply and demand in the shares is much more appealing. If this happens in seconds or days is at best a secondary consideration. Invesco believes that there is a point where speed and robust price discovery diverge—a concept that must be understood by exchanges as they race to trading in one-billionth of a second.

There are also 40 different trading venues/dark pools and over 200 broker dealers who internalize customer order flow in the market today. The nondisplayed liquidity traded in dark pools and with internalizing broker-dealers is estimated to be as much as 30 percent of the shares traded in the U.S. This fragmentation has the potential to seriously undermine the price discovery process essential to efficient mar-

ket structure. As an institutional investor with larger-sized orders, Invesco utilizes dark pools and institutional crossing networks as essential elements of our best execution process. While our use of these venues may contribute to the fragmentation of the markets, until we create a more efficient market structure for the execution of institutional sized orders, these venues allow institutional investors to avoid transacting with market participants who seek to profit from the impact of the public display of large orders to the detriment of funds and their shareholders.

This vast network of exchanges and venues has resulted in a very complicated web of conflicted order routing and execution practices by broker dealers and execution venues. Institutions like Invesco are in a position to get the routing data from broker-dealers and trading venues to perform an analysis of the effectiveness of trading in the various venues. However we are concerned that many investors do not have this level of transparency. We believe that improved information about order routing and execution practices would allow investors to make better informed investment decisions.

High Frequency Trading

Today as much as 50–60 percent of trading activity in U.S. equity markets is attributed to High Frequency Traders (HFT). Given the recent ascendance of HFT there is not a lot known about their practices and very little regulatory oversight. It can certainly be argued that some high frequency trading activity provides real liquidity to the markets. In fact, Invesco believes there are many beneficial high frequency trading strategies and participants which provide valuable liquidity and efficiencies to the markets. For example strategies such as statistical arbitrage help maintain pricing efficiencies in the markets. On the other hand, we are concerned that some strategies could be considered as improper or manipulative activity. Some of these strategies, such as the so-called order anticipation or momentum ignition strategies provide no real liquidity or utility to the markets, rather they prey on institutional and retail orders creating an unnecessary tax on investors.

While there has been a recent case brought by regulators against this kind of improper activity, we are concerned that the ability of regulators to monitor and detect nefarious behavior by these market participants is lacking. We therefore believe there is an immediate need for more information about high frequency traders and the practices of high frequency trading firms.

Additionally, regulators must address the increasing number of order cancellations in the securities markets. It has been theorized that as many as 95 percent of all orders entered by high frequency traders are subsequently cancelled. Order cancellations related to making markets is one thing, but orders sent to the market with no intention of being executed before they are cancelled is quite another. These orders tax the market's technological infrastructure and under the right circumstances could overwhelm the systems capability to process orders causing massive system failures and trading disruptions.

Efficient trading markets require many different types of investors and participants to thrive. It is important to note that where the interests of long-term investors and short-term professional traders diverge, the SEC has repeatedly emphasized that its duty is to uphold the interests of long-term investors. We need to ensure that there are no abusive practices within high frequency trading which contravene the interests of long-term investing.

Conclusion

We believe investors, both retail and institutional, are better off now than they were just a few years ago. That said long-term investor confidence is critical to the efficient operation of the capital formation process in the U.S. To restore potentially damaged investor confidence, regulators must ensure that the securities markets are highly competitive, transparent and efficient and that the regulatory structure that governs the securities markets is consistent, congruent and encourages, rather than impedes, liquidity, transparency, and price discovery.

PREPARED STATEMENT OF STEVE LUPARELLO

VICE CHAIRMAN, FINANCIAL INDUSTRY REGULATORY AUTHORITY

DECEMBER 8, 2010

Chairman Reed, Chairman Levin, Ranking Member Bunning, Ranking Member Coburn, and Members of the Subcommittees: I am Steve Luparello, Vice Chairman of the Financial Industry Regulatory Authority, or FINRA. On behalf of FINRA, I would like to thank you for the opportunity to testify today on the important issues

of how markets and trading have evolved, and how we can enhance the information regulators receive to ensure market integrity and the protection of investors.

I'd like to commend Chairmen Schapiro and Gensler for their leadership in spearheading the coordinated review of market activity after the events of May 6. We appreciated the opportunity to collaborate with the SEC and other SROs to identify measures that could be taken quickly to significantly reduce the chances of a recurrence of the market disruption that occurred that day. FINRA's Chairman, Rick Ketchum, serves on the CFTC–SEC Joint Advisory Committee on Emerging Regulatory Issues that is continuing its work to identify additional steps regulators may take to respond to the lessons of May 6.

FINRA

The Financial Industry Regulatory Authority (FINRA) is the largest independent regulator for all securities firms doing business in the United States. FINRA provides the first line of oversight for broker-dealers, and, through its comprehensive regulatory oversight programs, regulates both the firms and professionals that sell securities in the United States and the U.S. securities markets. FINRA oversees approximately 4,600 brokerage firms, 166,000 branch offices and 636,000 registered securities representatives. FINRA touches virtually every aspect of the securities business—from registering and educating industry participants to examining securities firms; writing rules and enforcing those rules and the Federal securities laws; informing and educating the investing public; providing trade reporting and other industry utilities and administering the largest dispute resolution forum for investors and registered firms.

In addition, FINRA conducts surveillance of over-the-counter (OTC) trading in equities and debt, and provides market surveillance, investigatory and related regulatory services for equities and options traded on U.S. exchanges, including the New York Stock Exchange, NYSE Arca, NYSE Amex, NASDAQ, NASDAQ Options Market, NASDAQ OMX Philadelphia, NASDAQ OMX BX, BATS Equities and Options, and The International Securities Exchange. Through this work, FINRA is responsible for aggregating and providing market surveillance for approximately 80 percent of U.S. equity trading.

FINRA's activities are overseen by the Securities and Exchange Commission (SEC), which approves all FINRA rules and has oversight authority over FINRA operations.

Response to May 6

During the last several years, how and where trading occurs has evolved rapidly, as has execution speed, particularly with respect to equity trading. High-frequency trading, dark pools and direct access are now commonplace—and have contributed to the more fragmented markets that exist today. While the market fragmentation that has occurred has lowered barriers to entry and created fierce competition resulting in narrow quotation spreads and a high level of liquidity in good times, it can also result in the fast electronic removal of liquidity when markets are stressed, as we observed on May 6.

The events of May 6 identified several areas in which regulators could be more proactive in preventing or reducing the impact of extreme market volatility, as well as provide additional transparency and predictability in restoring order to the markets following such events. FINRA has been pleased to participate in these discussions with the U.S. equities and options exchanges, under the leadership and direction of the SEC, to establish and implement a number of important changes.

First, in June 2010, as a result of this coordinated effort, a framework for marketwide, stock-by-stock circuit-breaker rules and protocols was established and implemented on a pilot basis. Under these pilot rules, a single-stock circuit breaker is triggered if the price of a security changes by 10 percent within a rolling 5-minute period. If triggered, all markets pause trading in the security for at least 5 minutes, and then the primary listing market employs its standard auction process to determine the opening print after the 5-minute pause period.

The pilot commenced with securities included in the S&P 500 Index and then was expanded in September 2010 to the Russell 1000 Index and certain exchange traded products. Where there is extreme volatility in a stock, this solution provides for a pause in trading that will allow market participants to better evaluate the trading that has occurred, correct any erroneous "fat finger" orders and provide for a more transparent, organized opportunity to offset the order imbalances that may have caused the volatility. FINRA and the exchanges, with the SEC, have been monitoring continuously the application and effectiveness of the pilot to determine whether expansion to additional securities is appropriate and whether adopting or incorporating other mechanisms, such as a limit up/limit down procedure that would

directly prevent trades outside of specified parameters, would be a more efficient and effective permanent approach.

Similarly, new rules were established to improve the consistency and transparency surrounding the process for breaking erroneous trades, particularly with respect to events like those that occurred May 6, which impacted multiple stocks within a very short time frame. In September, FINRA and the exchanges, in coordination with SEC staff, adopted on a pilot basis new rules to establish standards for breaking trades following multistock events. For events involving between 5 and 20 stocks, FINRA and the exchanges will break trades at least 10 percent away from the reference price (typically the consolidated last sale), and for events involving 20 or more stocks, at least 30 percent away from the reference price. These rules provide more certainty to market participants as to when and at what prices trades will be broken by FINRA and the exchanges, facilitating a more transparent and orderly resolution of multistock events.

Most recently, in November 2010, the SEC approved FINRA and exchange rules to strengthen the minimum quotation standards for market makers and effectively prohibit what have been called "stub quotes" in the U.S. equity markets—quotes to buy or sell stocks at prices so far away from the prevailing market that they are not intended to be executed. Executions against stub quotes represented a significant proportion of the trades that were executed at extreme prices on May 6, and subsequently broken. The new rules require market makers to maintain continuous two-sided quotations throughout the trading day within a certain percentage of the NBBO, thereby prohibiting the use of extreme stub quotes.

Through the CFTC–SEC Joint Advisory Committee, deliberations continue about potential additional measures regulators may institute in the wake of May 6. FINRA is committed to working with our fellow regulators, through the Committee and in other ways, to continue this analysis.

Lastly, it is worth noting that the SEC also recently adopted rules preventing unfiltered market access, as well as requiring brokers with market access to have risk management controls and supervisory procedures to help prevent erroneous orders, ensure compliance with regulatory requirements and enforce credit or capital thresholds. FINRA has consistently taken the approach that brokers sponsoring market access have a responsibility to ensure that proper screens are in place before providing access to firms, including those who may use high-frequency or algorithmic trading strategies. FINRA has questioned brokers providing access to determine whether they have fulfilled their obligations to understand the ownership of firms to whom they are providing access and what is being done with algorithms used through those agreements. FINRA will continue to examine the firms it regulates for compliance in this area, analyze whether enhancements to our supervision rules are warranted and enforce the new SEC requirements vigorously.

High-Frequency Trading and the Trillium Case

While the disruption on May 6 focused significant attention on high-frequency traders and algorithmic trading in today's highly automated marketplace, FINRA had already been scrutinizing trading activity closely in order to detect attempts to use these technologies to implement manipulative trading strategies. In today's fragmented trading environment, it is very plausible that market participants will spread their activity across multiple markets and accounts in an attempt to avoid detection of trading abuses such as wash sales, frontrunning, insider trading, marking the close and open, and manipulative trading strategies like layering. FINRA is aggressively pursuing these types of illegal trading practices that inappropriately undermine legitimate market trading.

In September, FINRA fined a New York brokerage firm—Trillium Brokerage Services—over $1 million and suspended several traders at the firm for using an illicit high-frequency trading strategy. Trillium, through nine proprietary traders, entered numerous layered, non-*bona fide* market moving orders to generate selling or buying interest in specific stocks. By entering the non-*bona fide* orders, often in substantial size relative to a stock's overall legitimate pending order volume, Trillium traders created a false appearance of buy- or sell-side pressure.

This trading strategy induced other market participants to enter orders to execute against limit orders previously entered by the Trillium traders. Once their orders were filled, the Trillium traders would then immediately cancel orders that had only been designed to create the false appearance of market activity. As a result of this improper high-frequency trading strategy, Trillium's traders obtained advantageous prices that otherwise would not have been available to them. Trillium's traders bought and sold NASDAQ securities in over 46,000 instances, reaping nearly $575,000 in improper profits. Other market participants were unaware that they were acting on the illegitimate, layered orders entered by Trillium traders.

In addition to the nine traders, FINRA also took action against Trillium's Director of Trading and its Chief Compliance Officer. The 11 individuals were suspended from the securities industry or as principals for periods ranging from 6 months to 2 years. FINRA levied a total of $802,500 in fines against the individuals, ranging from $12,500 to $220,000, and required the traders to pay out disgorgements totaling roughly $292,000.

While FINRA is able to pursue instances of these illegal trading strategies on markets we regulate as well as through the cooperative information-sharing efforts of market surveillance staffs, the risk of missing instances of manipulation, wash sales, abusive short selling and other improper "gaming strategies" is still unacceptably large. While FINRA's ability to aggregate an increasing share of regulatory data for surveillance purposes is a strong step in the right direction, establishing a consolidated audit trail is the key to enhancing regulators' abilities to detect these activities. This would allow FINRA and the exchanges to more efficiently detect violations and adapt surveillance programs to new scenarios.

FINRA Market Regulation

In addition to performing its own regulatory obligations to conduct surveillance of over-the-counter (OTC) trading in equities and debt, FINRA increasingly is providing surveillance and related regulatory services for equities and options traded on U.S. exchanges. FINRA is responsible for insider-trading surveillance for all exchange-listed equity securities across all U.S. exchanges, regardless of the market on which a trade is executed. FINRA is responsible for surveillance of NASDAQ OMX, originally as a sister subsidiary when NASDAQ was part of NASD and now under contract, and subsequently NASDAQ OMX BX (formerly the Boston Stock Exchange) and NASDAQ OMX PHLX (formerly the Philadelphia Stock Exchange) (collectively NASDAQ). In June 2010, FINRA became responsible for surveillance of the NYSE Euronext's three U.S. exchanges, the New York Stock Exchange (NYSE), NYSE ARCA and NYSE AMEX (collectively the NYSE). FINRA also provides regulatory services to the International Securities Exchange, the Boston Options Exchange, the BATS Y and Z Exchanges and the EDGA and EDGX Exchanges.

As a result, FINRA presently is responsible for conducting posttrade market surveillance of approximately 80 percent of the equity share volume and 30-35 percent of the option contract volume traded on U.S. exchanges. With the recent addition of the NYSE, FINRA has started an integration process that will combine for the first time detailed trading data from FINRA, NASDAQ and the NYSE in one data center. With this aggregated data, FINRA will be able to conduct comprehensive, cross-market surveillance of 80 percent of the equity market.

FINRA uses a variety of sophisticated online and offline surveillance techniques and programs to detect potential violations and reconstruct market activity using trade, quote and order information that is captured daily. Specifically, FINRA's Market Regulation Department is comprised of approximately 440 employees that are organized into roughly 70 specialized teams of subject matter experts for certain rules and trading activity. These teams conduct investigations based on alerts generated by over 300 surveillance patterns that are designed to detect particular threat scenarios by canvassing some or all of the one billion or more market events that are captured by FINRA each day. FINRA also provides interpretive guidance on a variety of trading issues and rules, investigates market-related complaints from investors, broker-dealers and other parties, and conducts market and trading-related preventive compliance activities.

Consolidated Audit Trail

With the growth in the number of registered exchanges and alternative trading systems, increased competition among trading venues and market structure policy compelling connectivity among exchanges and between exchanges and other execution venues, it is clear that market quality can no longer be ensured by a single exchange acting in a siloed fashion. In fact, as noted earlier, it is plausible that certain market participants, knowing the extent of current regulatory fragmentation, now consciously spread their trading activity across several markets in an effort to exploit this fragmentation and avoid detection. As the SEC recognized with its recent rule proposal, that evolution of the U.S. equity markets and the technological advances in trading systems have created an environment where a consolidated audit trail is now essential to ensuring the proper surveillance of the securities markets and the confidence of investors in those markets.

In its proposal to adopt a consolidated audit trail, the SEC correctly identified the challenges that exist in conducting market surveillance with today's regulatory audit trails. FINRA agrees with the SEC on those issues and strongly supports the

establishment of a consolidated audit trail as a critical step to enhance regulators' ability to conduct surveillance of trading activity across multiple markets.

The events of May 6 also have demonstrated the need for SROs and the SEC to have direct and more timely access to consolidated audit trail data. As the Commission noted in its proposal, the SEC's and SROs' inability to timely and efficiently access the patchwork of audit trail data that currently exists creates delays in identifying potential market abuses and creating market reconstructions. Thus, FINRA believes the key aspects necessary for ensuring an effective, comprehensive and efficient consolidated audit trail are: uniform data (both data format and data content across markets); reliable data; and timely access to the data by SROs and the SEC.

In terms of implementation, FINRA believes the most effective, efficient and timely way to achieve the goals of a consolidated audit trail is to expand existing systems, such as FINRA's Order Audit Trail System (OATS), and consolidate this information with exchange data and discrete new data, such as large trader information, into a central repository. Building off existing systems would significantly reduce both the cost (to the industry, and ultimately, investors) and the time for implementation of a fully consolidated audit trail and integration of that audit trail into surveillance systems.

Because market participants already have systems in place to comply with OATS requirements, programming changes needed for an entirely new system are substantially greater than expanding existing protocols. In addition, FINRA recently received SEC approval to expand OATS beyond NASDAQ-listed issues to include all exchange-listed issues, further enhancing the benefits of leveraging OATS for a consolidated audit trail.

FINRA also believes that the practicality, costs and benefits associated with incorporating a broad array of real-time data into the consolidated audit trail should be considered carefully. In many cases, information may be extremely difficult to provide accurately on a real-time basis. In addition, there are many types of information that have limited real-time regulatory benefit, due to the time needed to validate and analyze data to detect complex, violative trading activity. It has also been FINRA's experience that the quality of real-time data can degrade during significant market events due to capacity and other issues.

In terms of the content of any consolidated audit trail, FINRA's experience has shown that there are certain critical elements necessary to conduct effective surveillance across multiple markets. As an initial matter, it is essential that each market participant be required to report the same data elements in a uniform way. Moreover, consolidated data is only useful if each reporting entity uses the same timekeeping system. FINRA also believes that each broker-dealer must have a unique identifier that remains the same regardless of the market on which the participant is trading, and that those identifiers should be more granular than at the firm level. Similarly, FINRA agrees with the SEC that each customer of a firm should have a unique identifier that is constant across all firms through which the customer trades.

Based on our experience developing and operating OATS, FINRA has a unique perspective on many of the specific issues and questions raised in the SEC's proposal. We have provided detailed comments to the Commission and are committed to working with them as consideration of the proposal moves forward.

Conclusion

Changes in financial markets in recent years have necessitated adaptation by regulators across a wide spectrum of issues. Both technological and policy developments have driven changes in the markets that make the practice of regulating them a more complex task.

FINRA continually reviews its programs and technology to ensure that our approach reflects the realities of today's markets. May 6 clearly demonstrated areas where regulators should alter rules going forward to avoid a repeat of the events of that day. As noted above, several coordinated rulemakings have been implemented and consideration of additional steps continues.

The SEC has correctly identified one of the most pressing issues that faces regulators conducting market surveillance—that we are all hampered by the lack of a comprehensive, sufficiently granular and robust consolidated audit trail across the equity markets. It is vital that we consolidate audit trail data in one place so that abusive trading practices can be more readily identified. FINRA stands ready to work with Congress, the Commission and other SROs to help bring about a consolidated and enhanced audit trail that will facilitate more effective surveillance for the protection of investors and market integrity.

Again, I appreciate the opportunity to share our views. I would be happy to answer any questions you may have.

RESPONSES TO WRITTEN QUESTIONS OF CHAIRMAN REED FROM MARY L. SCHAPIRO

Q.1. Will the consolidated audit trail and large trader reporting requirements proposed by the SEC be coordinated with the CFTC so that "unique tags" and customer identification information you described in your testimony would be the same across the securities and futures markets? Why or why not?

A.1. The scope of the consolidated audit trail (CAT) and large trader reporting proposals currently under consideration by the Commission is limited to certain securities products, specifically NMS securities. I believe these proposals are a critical first step towards enabling the Commission to better carry out its oversight of the securities markets and to perform market analysis in a more timely fashion, whether on one market or across markets. I anticipate that over time the scope of the CAT will be expanded to include other types of securities, including debt and OTC equities. I also hope the CAT ultimately will include information on related futures products, and we will work with the CFTC toward this end. Due to the enormity of this project even when just focusing on equities, however, we felt it was more feasible—and made more sense—to utilize a phased approach that started with equities and built out from there.

Further, I note that the newly created Office of Financial Research (OFR) is considering implementing a rule pursuant to which all legal entities in the financial industry would be assigned unique identifiers. Such a system could be of significant benefit to regulators worldwide, as each market participant could readily be identified using a single reference code regardless of the jurisdiction or product market in which the market participant was engaging. Such a system also could be of significant benefit to the private sector, as market participants would have a common identification system for all counterparties and reference entities, and would no longer have to use multiple identification systems.

The CAT rule as proposed is written to ensure that market participants have sufficient flexibility to use the unique identifier assigned under such a rule to comply with the proposed CAT requirements. Thus, the Commission and the CFTC could use the common set of identifiers if such identifiers are mandated by the OFR.

Q.2. In regard to the proposed consolidated audit trail, what is the benefit of establishing a new audit trail system as opposed to building on an existing system such at FINRA's Order Audit Trail System?

A.2. Although FINRA's Order Audit Trail System is one of several existing technologies that could be used to expedite the CAT implementation process, other technologies are currently available that can leverage the resources, speed, and accuracy of existing business practices and normalize and consolidate different data sets in real time. Each available technology has benefits and drawbacks that require careful analysis and balancing before selection.

We are also considering some interim steps to improve the current audit trail systems, and our large trader reporting rule will be a useful first step. That said, we feel it is critical to remain focused on creating an audit trail that directly addresses today's problems,

can be expanded to include all types of financial products, and will remain useful as we tackle tomorrow's problems.

Q.3. Should there be serious consideration of removing the SRO function out of the individual exchanges and placing it into a single SRO? Should this consideration be extended to include a single SRO responsible for the equities as well as the futures markets? Could that possibly be a way to reduce the regulatory fragmentation that Professor Angel discussed in his testimony?

A.3. Because the structure of our securities markets and their regulation is complex, there invariably can be room for improvement. The establishment of a single SRO to supervise all securities markets, however, would not necessarily be a simple solution to regulatory fragmentation. Congressional action likely would be required to change our system of self-regulation to create a new "super SRO." Moreover, there could be collateral consequences to removing the SRO function from each exchange and placing it into a single SRO. For example, exchanges have varying market structures and do not necessarily trade the same types of securities, and personnel at each exchange have experience with that exchange's particular structure, rules, systems, and listed products. As an SRO, each exchange is required to submit its proposed rule changes with the Commission, among other obligations under the Exchange Act. If there were a single SRO, the personnel at that SRO would have to acquire the expertise to oversee all exchanges and the single SRO also would have to submit proposed rule changes to the Commission for each exchange.

In a number of ways, the exchanges and FINRA already have been working together to create a more efficient regulatory system that is consistent with the Exchange Act. For example, NYSE Euronext and its three subsidiary exchanges, NYSE, NYSE Amex and NYSE Arca, recently entered into a regulatory services agreement in which FINRA now conducts a substantial portion of regulation on behalf of these three exchanges, with each exchange retaining full regulatory responsibility in the event that FINRA fails to perform appropriately. Other exchanges also have entered into regulatory services agreements with FINRA with respect to aspects of their regulatory programs. Further, the exchanges and FINRA have entered into Commission-approved delegation plans in which a number of SROs delegate to a single SRO full regulatory responsibility for particular matters, *i.e.,* oversight of one or more common rules. SROs are members of the Intermarket Surveillance Group and, as such, their respective staff and Commission staff meet regularly on matters that reach across SROs. Also, the Commission recently proposed a consolidated audit trail that would provide the SROs and the Commission with data allowing them to conduct cross-market surveillance when regulatory issues arise.

The current system of self-regulation is based on the notion that each securities market is in the best position to monitor and understand the activity in its market and to respond to rapidly changing conditions and business practices. We will continue, however, to work with the SROs to reduce regulatory fragmentation wherever possible, while maintaining the benefits of regulatory expertise and focus in each market.

RESPONSES TO WRITTEN QUESTIONS OF CHAIRMAN LEVIN FROM MARY L. SCHAPIRO

Q.1. My Subcommittee staff has reviewed a number of the examination reports produced by the Securities and Exchange Commission staff to evaluate the market surveillance programs at some exchanges. The reports show wide variations and some serious deficiencies in the ability of some exchanges to conduct basic surveillance.

For example, one report, which took 3 years to complete, from January 2007 to April 2010, found the exchange's trading surveillance program was generally ineffective for monitoring trading on its system and had problems reviewing trades to detect even the most basic manipulations such as wash sales. It found that the exchange was also operating without a dedicated regulatory budget. A second examination report found that another exchange had failed to develop effective automated surveillance programs to monitor trading activity on its market, and was only in the early stages of developing investigative, examination, and enforcement programs. Other reports were equally troubling.

These report findings were issued during the same years trading volume was exploding on the new exchanges, and market participants were developing software to trade across markets in fractions of a second.

(a) Do you find these examination findings troubling, and does the SEC have any plans to develop minimum standards for market surveillance efforts at the exchanges?

(b) You testified that you envision the consolidated audit trail being used by exchanges and other SROs to help monitor the markets. Given the deficiencies your examination staff has identified, do you have confidence in the capability of the SROs and exchanges to make use of the new data or will new capabilities need to be developed?

(c) Please describe any efforts undertaken by the SEC to improve and coordinate trading surveillance and enforcement efforts by its exchanges and SROs, in particular with respect to trades that may influence prices on more than one market.

A.1. Both the examination staff responsible for these reports and I do find these results troubling.

As a general matter, Commission staff devotes significant examination resources both to identifying deficiencies at SROs, as well as to ensure that the SROs take adequate remedial actions to address those deficiencies. Without speaking to any specific matter, I can tell you that referrals to our Enforcement Division have in fact been made in connection with certain past SRO examinations. In addition, and again without speaking to any specific matters, what is contained in an examination report may not reflect the full universe of steps that the Commission or its staff have taken in connection with its oversight function. For example, the staff supplements its examination efforts with regular meetings with the SROs, surprise on-site reviews, staff compliance letters to all SROs on specific risk topics, and reviews of SRO surveillance plans for certain rule proposals.

The staff uses these efforts to help establish and communicate general standards for SRO market surveillance, as well as tailored

guidance to specific SROs when appropriate. As noted below, we have revised our SRO examination program to better address evolving market risks, and will continue to evaluate the standards for market surveillance—and the methods of communicating those standards—in light of the evolving risks.

We recognized that our SRO and exchange exam program needed to change to adapt to new market realities, and it in fact is changing. Recently, we consolidated the SRO inspection function into one group singularly responsible for SRO inspections, the Office of Market Oversight (Market Oversight). Market Oversight is headed by a new Associate Director with significant SRO, policy, and enforcement experience.

We also recognized that market developments, such as high frequency trading and increased market fragmentation, required us to adjust our examination program to address newly emerging areas of risk. As a result, we have made fundamental structural changes in the way we approach and conduct SRO examinations, including looking at how SROs surveil for potentially abusive high frequency, high quote or other algorithmic trading strategies. In November 2010, the heads of our Division of Trading and Markets and Office of Compliance, Inspections and Examinations (OCIE) sent a letter to all the SROs specifically requesting that they conduct a thorough review of its data feeds as well as its regulation and surveillance of its members' order and trading practices to ensure compliance with the securities laws.

In addition, Market Oversight has developed an examination plan for Fiscal Year 2011 that includes assessments of each of the 15 registered exchanges and 22 options and equities markets that they operate. The assessments have been informed by recent market events, including the events of May 6, and will include an overview of key risk areas, including market oversight and surveillance. OCIE expects to take the findings of these assessments to create a comprehensive risk matrix for each of the exchanges and use that risk-based approach to inform future inspections of each of the SRO "complexes."

At the same time, though I am recused from FINRA issues, I was informed in preparation for this hearing that OCIE will be conducting an in-depth examination of FINRA, including all of the items articulated in Dodd-Frank Section 964. As part of the FINRA review, I was informed that staff will be building on an examination of FINRA's surveillance programs that it started last year. Specifically, staff will be using the information garnered in its initial examination to focus on FINRA surveillances related to high frequency trading strategies, high quote traffic strategies, and other algorithmic trading such as spoofing and layering.

In terms of the timing of our SRO examinations, SRO examinations have historically been resource intensive reviews that, while appropriate in some cases, occasionally resulted in unnecessary delays. OCIE intends to focus future inspections on high risk areas that can be completed within 180 days after conducting the onsite portion of our examinations. In addition, OCIE and our Trading and Markets Division are leveraging their resources and using other methods of overseeing the SROs, such as sending compliance letters to all SROs on cross-market issues.

We previously worked with the SROs to better regulate certain cross-market issues, and we expect to continue that process as appropriate in the future. For example, pursuant to a staff recommendation in an examination sweep, the SROs have worked together to better manage market fragmentation and allocate regulatory responsibility for insider trading surveillance. The SROs also continue to work together through the Intermarket Surveillance Group, which was formed in 1983 to improve the detection of intermarket securities fraud and share regulatory concerns.

Finally, if approved, I believe that a consolidated audit trail will dramatically improve market regulation. The new data will allow for the development of new regulatory capabilities, including improved risk assessment and more precise, effective, and comprehensive surveillance, examination, and enforcement efforts. The SROs and the Commission will need to work collaboratively to take full advantage of the proposed audit trail, and I am committed to making sure that happens.

Q.2. FINRA recently announced a settlement regarding same-day manipulations by Trillium Trading LLC. According to the settlement, during a 3 month period about 4 years ago, Trillium traders manipulated the market by combining legitimate and phony orders to bid up the prices of some stocks. Trillium's traders used this manipulation strategy more than 46,000 times, netting profits of more than $575,000. After several years and thousands of hours of investigation, FINRA settled the case, and both Trillium and its executives paid $2.2 million in fines and disgorgement.

(a) How many trading manipulation actions have been brought or settled by the SEC in the last 5 years?

(b) How many of these involved same-day manipulations?

(c) What factors inhibit the SEC's ability to investigate and pursue these cases, including any legal standards?

(d) Please provide the same information for actions brought or settled by your exchanges or SROs.

A.2. The Commission's Enforcement Division is devoting significant resources to investigating whether various market participants have engaged in conduct that unlawfully exploits the fragmentation of the markets, intentionally contributes to market volatility or uses high-frequency trading strategies to manipulate the price and volume of securities at the expense of innocent investors. The Division's new Market Abuse Unit is helping to coordinate the Commission's enforcement response to complex abusive trading practices. Practices that are the focus of our Enforcement staff include layering or spoofing, improper order cancellation activities or "quote stuffing," the use of order anticipation and momentum ignition strategies undertaken for a manipulative purpose, passive market making practices that incentivize possible manipulative quoting activity, abusive colocation and data latency arbitrage activity in potential violation of Regulation NMS, use of Direct Market Access arrangements to conceal manipulative trading activity and conduit entity market manipulation.

In the last 5 years, the Commission has filed approximately 200 enforcement actions where the staff classified the primary type of misconduct as market manipulation. The Commission does not

track manipulation cases according to whether the conduct occurred intraday or over a period of time. The enforcement actions the Commission filed that involved manipulative conduct included misconduct such as account intrusions, wash trades, matched orders, kickback manipulations, and "pump-and-dump" schemes. For the most part, the filed actions allege misconduct over a period of time, though certain of the misconduct occurred both intraday and over a lengthier period, particularly in cases involving matched orders and wash trades. In addition, in certain cases that were coordinated with the criminal authorities, the Commission has filed enforcement actions that halted intraday manipulation schemes in their incipient stages as the result of undercover operations undertaken by criminal authorities.

During the last 5 years, registered exchanges and self-regulatory organizations brought 47 proceedings involving trading manipulations, 32 of which they characterized as same-day manipulations. This includes information from NYSE AMEX, NYSE ARCA, BATS, Boston Options Exchange, C2 Options Exchange, CBOE, CBSX, Chicago Stock Exchange (CHX), Direct Edge, FINRA, the International Securities Exchange, NASDAQ OMX, NASDAQ BX OMX, NASDAQ PHLX OMX, the National Stock Exchange (NSX), and NYSE.

There are a number of factors that make these cases challenging to investigate, particularly given current technology-driven trading practices.

First, the volume of data creates extraordinary resource challenges. The Commission needs similar technological and human analytical resources as those possessed by the firms that are placing thousands of orders per second. For example, the Enforcement Division's Market Abuse Unit currently has vacancies for specialists with current industry knowledge that the unit has not been able to fill due to current budget constraints. The unit's planned Analysis and Detection Center, if able to be staffed by these specialists, would coordinate trading abuse investigations with the Division's investigative staff and would generate specialized insight into other abusive high frequency and algorithmic trading practices. To perform these functions, the specialists will need advanced data analysis applications, better hardware and access to greater third party databases and information warehouses.

Second, the fragmentation of trading at different market centers, including exchanges, dark pools, broker-dealer internalizers, and direct market access providers requires data collection—often with format and compatibility differences—from a variety of market centers.

Third, because of the prevalence of high-volume trading through direct market access providers, our investigators often must trace the conduct back through multiple layers of broker-dealers to identify the original trader. This can both delay our investigation and also serve to obscure the true identity of the trader at interest.

Fourth, the use of algorithmic code to direct trading decisions presents multiple challenges. We must ensure that historical versions of algorithmic code are maintained so that we preserve the ability to study high-frequency trading instructions, which could contain important and unique evidence of scienter. In addition, it

requires resources to analyze computer code in the course of our investigations.

The consolidated audit trail and large-trader reporting initiatives, if adopted, will help address some of these challenges. Ultimately, only when we have: (1) comprehensive and accessible data sources; (2) adequate technology resources; and (3) additional personnel with the appropriate backgrounds and skills will it become easier to detect and stop technology-driven market abuse.

Q.3. On May 6, much like the crash of 1987, a fall in the price for a broad futures product triggered severe price drops in the equities markets, including in individual stocks.

(a) Given the connection between the futures and stock markets, would it make sense for the SEC and CFTC to coordinate and ensure that circuit breakers or other stabilization measures, such as a limit up/limit down function, apply consistently across all markets in similar financial instruments (futures, options, and equities)?

(b) If so, are there any efforts underway to do that now?

A.3. It does make sense to seek to coordinate such efforts between the Commission and the CFTC, and we have been doing so. SEC and CFTC staffs worked closely together on both the preliminary and final joint staff reports that set forth their findings regarding the events of May 6, and presented those reports to the agencies' Joint Advisory Committee comprised of prominent experts that was created to advise both agencies on emerging regulatory issues.

Some of the initial regulatory actions taken by the Commission after May 6—for example, the pilot programs with respect to single stock circuit breakers and the enhanced procedures for breaking clearly erroneous trades, as well as the approval of SRO rules banning of stub quotes—were designed to quickly address regulatory concerns unique to the securities markets. As noted in the staff reports, on May 6 the futures markets already had mechanisms in place such as limits and trading pauses applicable to futures contracts, and some restrictions on how far from the midmarket a participant can quote.

As the Commission moves forward with a more comprehensive and permanent set of regulatory responses to the events of May 6, such as a possible limit up/limit down mechanism applicable to individual securities, we will consult regularly with CFTC staff. And in some areas, such as the modernization of the cross-market circuit breakers put in place after the 1987 market crash, SEC and CFTC staffs have been working closely together—and will continue to do so—to help assure a consistent mechanism is applied across the futures and securities markets.

Q.4. Exchanges, traders, and SROs have told us that the equities markets have been experiencing mini-crashes in single stocks regularly for years. Since the pilot circuit breaker took effect in June, there have been at least 18 instances of the triggers going off. In some instances, trades were still reported at prices outside of the circuit breaker's range.

(a) Why hasn't the pilot program prevented these mini-crashes?

(b) How does the SEC plan to improve the functioning of the stabilization measures to prevent trades from occurring outside of their bands?

A.4. While the individual stock circuit breakers have helped limit the extent of price moves in the securities to which they apply, I believe our experience with the pilot program shows that improvements to that mechanism are warranted.

For the actively traded stocks included in the circuit breaker pilot, to date we have observed 20 instances of stocks experiencing a sudden price move that triggered an individual circuit-breaker halt. In a few cases, these price moves were attributable to significant news concerning the company. In many others, they were attributable to mistakes in order submission or trade reporting. To trigger the circuit breaker, the price of the security, as reflected in an executed trade, must move 10 percent or more over a 5-minute period. As such, there must be an executed trade outside of the circuit breaker parameters in order to trigger the circuit breaker for that stock, which explains, at least in part, why trades are still being reported outside of the circuit breaker parameters.

One way to improve the individual stock circuit breakers may be to replace or enhance them with a "limit up/limit down" mechanism. One of the advantages of this approach is that it could prevent trades from occurring outside of a designated price band that is tied to the current market price, and thus prevent "mini-crashes" outside of that range. At the same time, it could be less restrictive than a circuit breaker because it would not halt trading within the applicable price band. Recourse to a trading pause could be maintained to accommodate more fundamental price moves. At present, Commission staff is actively working with the exchanges on a proposal for a limit up/limit down mechanism, and I would expect a proposal to be published for comment in the near future.

RESPONSES TO WRITTEN QUESTIONS OF SENATOR COBURN FROM MARY L. SCHAPIRO

Q.1. How much money will the SEC spend in the next year to comply with Dodd-Frank?

How many employees at the SEC are working on the new Dodd-Frank requirements?

A.1. So far, the SEC has proceeded with the first stages of implementation of the Dodd-Frank Act without additional funding. This has largely involved performing studies, analysis, and the writing of rules. These tasks have taken staff time from other responsibilities, and have been done almost entirely with existing staff. To accomplish minimal Dodd-Frank Act implementation (hiring six people and initial IT expenditures) in FY2011 would require an estimated $14.6 million.

To fully carry out its new responsibilities for oversight of over-the-counter derivatives, private fund advisers, credit rating agencies, and other areas of the financial industry, the SEC will indeed require additional resources. In FY2012, we estimate a requirement for 468 new staff, of which many would need to be expert in derivatives, hedge funds, data analytics, credit ratings, or other new or expanded responsibility areas. We also will need to invest

in IT systems to facilitate the registration of additional entities and capture and analyze data on these new markets. The agency's overall cost estimate for Dodd-Frank in FY2012 is approximately $123 million.

Q.2. Your proposal for a Consolidated Audit Trail reflects an enormous cost—$4 billion, with an ongoing cost of nearly $2.1 billion per year. That is $15 billion over the next 5 years. However, during our hearing, you stated your belief that the SEC could "dramatically reduce the cost and the timetables of implementation."

(a) When do you expect to issue a revised proposal with the new cost and timetables for implementation?

(b) How and when would you plan to use the data available in this new database?

(c) What, if any of this information, do you currently have access to?

(d) How would you balance the need for transparency with the need for businesses to maintain some privacy?

(e) Your proposal emphasizes real-time data, instead of data that arrives at the end of the day. Can you give an example for when the SEC would use real-time data differently than end-of-day data?

A.2. On May 26, 2010, the Commission proposed Rule 613 to establish a Consolidated Audit Trail (CAT). The Commission received many thoughtful comments on the proposal that addressed a wide range of issues, including the way in which audit trail data would be provided to the central repository, the scope of the required data elements, and suggestions on how to reduce implementation costs. Commission staff has been actively considering the comments it received in response to the proposal, following up with a range of market participants and technology providers, and preparing a recommendation for the Commission for the adoption of the rule. I currently expect the Commission will consider the staff's recommendation for adoption of the rule, including the implementation timetable and revised cost estimates, in the first half of this year.

Though the full realization of the benefits of a CAT would not come until a proposal is fully implemented, upon implementation I expect we would begin to realize the benefits of the data almost immediately. For example:

- surveillances of the markets should be significantly enhanced by being more focused, less manually intensive, and better able to detect cross-market issues;
- examinations should be informed by better risk assessments, and more exam work could be done without burdening registrants with time-consuming document requests; and
- enforcement investigations should be more efficient and less reliant on the production of information by respondents.

In short, the CAT data would be tremendously useful both to the SEC as well as the national securities exchanges and national securities associations ("self-regulatory organizations" or "SROs").

Currently, there is no single database of comprehensive and readily accessible securities order and execution data available to the Commission. Instead, the Commission must obtain and merge

together a very large volume of disparate data from numerous different market participants, a process which takes a significant amount of time and effort.

The Commission staff itself does not have immediate access to the individual SRO's audit trail information, and instead must specifically request that an SRO produce the audit trail information that it has. Though the SRO audit trails vary, generally they collect information covering order receipt and origination, order terms, order transmissions, and order modifications, cancellations and execution. The audit trail information is collected through submissions from SRO members by the end of each business day or, in certain cases, upon request by the regulating entity. Significantly, the SRO audit trails do not collect beneficial owner information (as the CAT proposes to do), a critical limitation that makes the process of identifying the ultimate customer responsible for the transaction at issue both extremely labor intensive and time consuming.

Moreover, information provided to the Commission from the individual audit trails of the various SROs does not provide a view of trading activity occurring across multiple markets. An SRO's audit trail information effectively ends when an order is routed to another exchange. As a result, key pieces of information about the life of an order may not be captured—or easily tracked—if an order is routed from one exchange to another, or from one broker-dealer to an exchange. As a result, regulators cannot readily piece together activity related to the same order or customer occurring across several markets to determine whether violative conduct has occurred.

Commission staff currently obtains information about orders or trades directly from broker-dealers through the Electronic Bluesheet System (EBS) under Rule 17a-25, and from equity cleared reports. However, the information provided through these systems is limited in detail and scope. For example, EBS data does not include the time of execution, and often does not include the identity of the beneficial owner. Commission staff often must make multiple requests to broker-dealers to obtain sufficient order information—such as information identifying the customer submitting an order, the person with investment discretion for the order, or the beneficial owner—to be able to adequately analyze trading. Again, collecting, interpreting and analyzing diverse data sources such as these are labor intensive and time consuming.

I believe that implementation of a consolidated audit trail would significantly improve the comprehensiveness and timeliness of the data the Commission needs in order to efficiently and effectively regulate today's markets.

Transparency and privacy are both important considerations as we consider the CAT proposal. To meet the need for transparency, the proposal would require that specified order information for all equities and options be collected from the SROs and their members and reported to a central repository. At the same time, the proposal would include provisions designed to address the legitimate privacy concerns of market participants. Access to audit trail information would be strictly limited to regulators, and the proposed rule provides that the SROs may access and use the consolidated audit trail data only for regulatory—and not commercial—purposes. The proposed rule also requires that the SROs maintain policies and

procedures to assure the confidentiality of all information submitted to, and maintained by, the central repository.

Regarding your question about real time data, end-of-day reporting, coupled with the current laborious process of identifying the ultimate customer responsible for a particular securities transaction that may take weeks or even months, can impact effective oversight by hindering the ability of SRO regulatory staff to identify manipulative activity close in time to when it is occurring, and respond quickly to instances of potential manipulation. As a fundamental matter, our markets work in real time, and I therefore think regulators overseeing the markets should seek, when feasible, to work in real time as well. That is already happening today as the exchanges use real time data to monitor and control order flow and to run certain surveillances. I believe that these current efforts would benefit from the detailed and cross-market data in a real time CAT. I also believe new monitoring and surveillance efforts will be developed to take advantage of the consolidated data, as the CAT proposal requires the SROs to develop and implement enhanced surveillances to make use of the CAT data. For example, cross-market order flow could be monitored in real-time for potential problems, which could then be expeditiously addressed, potentially preventing further damage and future problems.

RESPONSES TO WRITTEN QUESTIONS OF CHAIRMAN REED FROM JAMES J. ANGEL

Q.1. Does the increased reliance in the market on dark pools and other types of "undisplayed liquidity" have the potential for negatively affecting public price discovery? If so, does this have the potential of making our markets less efficient? Does it make the markets more prone to bouts of episodic volatility as we saw on May 6?

A.1. Price discovery is one of the most important features of our public markets. It is important that investors be able to find counterparties to their trades and reach agreement on an appropriate price. There is a concern that if too much trading occurs "in the dark," then market quality may deteriorate.

How much trading can occur in the dark before price discovery deteriorates? Statisticians point out that one does not need to measure every member of a population in order to measure it. We only need a statistically valid sample, which can be a rather small fraction of the total population. For example, public opinion polls typically only use a few thousand people to get a sense of the opinion of the whole U.S. population.

There can also be too little trading in dark pools as well as too much. Dark pools allow market participants to provide some conditional liquidity that they may not want to provide unconditionally. For example, a firm may want to act as a market maker by providing liquidity to retail investors, but wants to avoid trading against sophisticated high-speed traders. If the firm were to post quotes in the public markets, it may get picked off by the high-speed sharpshooters. The firm may gladly add liquidity to a dark pool that caters to retail investors, giving them better executions than they would get in the public markets.

I don't know precisely how much is too much or too little dark pool participation rates. This is a question that calls for careful empirical research done. I suspect that we are far from the point of having too much activity in dark pools. In general, by most measurable standards, the quality of the U.S equity market has increased in recent years at the same time as activity in dark pools has increased. [1]

By the way, there is really no such thing in the U.S. as a completely "dark pool" because the moment a trade takes place, a flashbulb goes off and the price and volume of the trade are instantly public information. Investors thus know almost immediately the prices at which trades are taking place in the market, which certainly helps in price discovery. Dark pools are only dark before trades, not afterward.

With respect to increasing the risk of disruptions such as May 6, I do not believe that they present any more risk than other market participants. There is always the risk that a computer glitch may occur that destabilizes the market network. This can occur anywhere in the market network. However, additional trading platforms such as dark pools may provide additional liquidity and additional trading capacity that may ameliorate market disruptions.

Q.2. In your testimony you argued that both marketwide and stock-by-stock circuit breakers should be redesigned and that these circuit breakers should be based on "data integrity" as well as those based on price. Can you elaborate on this? What would such circuit breakers look like, what data would they monitor, and how would the system effectively determine the integrity of that data? Why wouldn't these circuit breakers be just as prone to errors as those based on price?

A.2. One of the key lessons of May 6 is the importance of data integrity. The SEC/CFTC report clearly stated that the reason given by many firms for pulling out on May 6 was that they were experiencing data integrity problems. The report also indicated that computerized trading firms perform a variety of tests on market data and pause trading when they detect the possibility of problems with the price feeds, either because of extreme movements in price or when different data feeds disagree. It makes sense to design data integrity pauses based on what the industry is already doing. It would make sense to pause the market under the same conditions that cause the important liquidity providers to pause. Not doing so runs the risk that the market will experience another May 6th event in which technical issues push the liquidity providers to the side, but other orders are still allowed to execute at bad prices.

A quick look at trade data shows the kind of problems that were experienced on May 6. The following table shows 25 seconds of normal trading in Accenture on May 6 just before the crash:

[1] For details on how U.S. market quality has improved over the last decade, see my study (joint with Larry Harris and Chester Spatt) Equity Trading in the 21st Century, available at *http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1584026.*

Time	Venue	Size	Price
2:30:01 PM	NASDAQ	100	41.52
2:30:03 PM	NYSE	200	41.51
2:30:06 PM	ADF	200	41.5115
2:30:12 PM	NYSE	100	41.52
2:30:12 PM	NYSE	100	41.52
2:30:12 PM	NYSE	100	41.52
2:30:15 PM	NYSE	100	41.52
2:30:19 PM	NASDAQ BX	200	41.52
2:30:19 PM	NASDAQ BX	100	41.52
2:30:19 PM	ADF	100	41.52
2:30:19 PM	ADF	100	41.52
2:30:20 PM	NYSEARCA	100	41.52
2:30:20 PM	NYSE	100	41.52
2:30:20 PM	ISE	100	41.52
2:30:20 PM	NATIONAL	100	41.52
2:30:20 PM	ADF	100	41.52
2:30:22 PM	ADF	500	41.5201
2:30:25 PM	ADF	4700	41.53
2:30:25 PM	ADF	300	41.53

Note that the prices are usually the same on each market, and when they change the amount of the change is usually less than one cent.

Market quality began to deteriorate. Here are 5 seconds in Accenture showing that reported trades on different exchanges are getting farther and farther apart in price. Note that there are large jumps in price between trades during the same second:

Time	Venue	Size	Price
2:46:51 PM	NASDAQ	400	38.13
2:46:51 PM	NASDAQ	100	39.01
2:46:51 PM	NYSE	200	39.12
2:46:51 PM	NYSE	100	39.12
2:46:51 PM	NYSEARCA	100	39.02
2:46:51 PM	NYSE	200	39.55
2:46:51 PM	ISE	100	39.02
2:46:51 PM	NYSE	100	39.56
2:46:51 PM	NYSE	100	39.62
2:46:51 PM	ISE	100	39.02
2:46:51 PM	NYSE	200	39.61
2:46:51 PM	NYSE	300	39.61
2:46:51 PM	NYSE	100	39.53
2:46:52 PM	NYSE	100	39.36
2:46:52 PM	NYSE	100	39.36
2:46:52 PM	NYSE	200	39.16
2:46:53 PM	NASDAQ	300	39.11
2:46:53 PM	ISE	100	39.04
2:46:54 PM	NASDAQ	500	38.00
2:46:55 PM	NYSEARCA	100	38.13
2:46:55 PM	NYSEARCA	100	38.13
2:46:55 PM	NYSEARCA	100	38.13
2:46:55 PM	NYSEARCA	609	38.00

The markets continued to disintegrate. Here are 2 seconds showing the disconnection of the market centers:

Time	Venue	Size	Price
2:47:47 PM	NASDAQ	100	34.61
2:47:47 PM	NYSEARCA	151	32.62
2:47:47 PM	NYSEARCA	3780	32.62
2:47:47 PM	NASDAQ	100	32.40
2:47:47 PM	NASDAQ	100	33.69
2:47:47 PM	NASDAQ	100	33.69
2:47:47 PM	NASDAQ	100	33.69
2:47:47 PM	NASDAQ	100	32.40
2:47:47 PM	NASDAQ	200	31.91
2:47:47 PM	CBOE	100	31.80
2:47:47 PM	NASDAQ	150	31.79
2:47:47 PM	NYSEARCA	100	39.10
2:47:48 PM	NASDAQ	155	31.26
2:47:48 PM	NASDAQ	145	31.26
2:47:48 PM	NASDAQ	100	30.79
2:47:48 PM	CBOE	100	31.60
2:47:48 PM	NASDAQ BX	300	33.34
2:47:48 PM	NASDAQ BX	170	31.72
2:47:48 PM	ADF	100	32.125
2:47:48 PM	NASDAQ	100	29.34
2:47:48 PM	CBOE	100	30.92
2:47:48 PM	NASDAQ	186	28.12

A few seconds later we hit the well-known Armageddon:

Time	Venue	Size	Price
2:47:54 PM	NASDAQ	100	1.84
2:47:54 PM	NASDAQ	100	0.01
2:47:54 PM	CBOE	100	0.01
2:47:54 PM	NASDAQ	100	1.74
2:47:54 PM	CBOE	100	0.01
2:47:54 PM	NASDAQ	100	1.54
2:47:54 PM	NASDAQ	100	1.44
2:47:54 PM	NASDAQ	100	1.34
2:47:54 PM	NASDAQ	100	1.24
2:47:54 PM	CBOE	100	0.01
2:47:54 PM	NASDAQ	100	1.14

Later more normal conditions returned:

Time	Venue	Size	Price
2:59:35 PM	BATS	100	40.68
2:59:35 PM	NYSE	200	40.68
2:59:37 PM	NYSE	100	40.69
2:59:37 PM	ISE	100	40.68
2:59:37 PM	NYSE	100	40.69
2:59:40 PM	ADF	100	40.69
2:59:44 PM	ADF	100	40.70
2:59:45 PM	BATS	100	40.69
2:59:45 PM	BATS	200	40.69
2:59:45 PM	BATS	100	40.69
2:59:45 PM	NYSE	100	40.69
2:59:45 PM	BATS	100	40.69
2:59:46 PM	NYSEARCA	100	40.68
2:59:46 PM	BATS	100	40.68
2:59:46 PM	NYSE	100	40.68
2:59:49 PM	BATS	100	40.68

Time	Venue	Size	Price
2:59:49 PM	NYSE	100	40.68

A data integrity pause could be one in which the market supervisor monitors the quality of the data feed and calls a 5 minute halt when any one of a number of anomalous situations occur. These situations could include:

- Price gap between exchanges greater than 5 cents.
- Price jump of +/- 10 percent in 5 minutes or less (current circuit breaker)
- Price discrepancy between data feeds, such as the direct feed from an exchange and the consolidated quote.
- Crossed or locked market quotes
- Bid-ask spread larger than some amount

These pauses should be done on a stock by stock basis, as the exchanges often run different stocks on different computers. For example, symbols AAAA through CZZZ may be on one server, DAAA through FZZZ on another, and so forth. By pausing only those stocks that are experiencing problems, overall disruptions to the market are minimized.

There are two types of errors in circuit breakers: One type of error is to not halt trading when it is clear that the market mechanism is misfiring. The other type of error is to halt trading when the market should not be halted. We have seen both types of errors in the last year.

Clearly, data integrity pauses would be subject to both Type I and Type II errors. However, it is my belief that including such pauses would prevent more serious breaches of the type we saw on May 6.

Careful consideration needs to be paid to the design of these systems, especially since they will be called upon at times when the market is under great stress and when the need for good price discovery is most important. The basic goal of circuit breakers is to maintain fair and orderly markets by stopping the market when the market mechanism is likely to be producing incorrect prices. This maintains the integrity of the market and prevents trades that have to be busted later.

The marketwide circuit breakers instituted after the Crash of 1987 were based on the notion that stopping the entire market after a large drop in prices would provide time for investors to assess what was happening in the market, to assimilate any new information that had arrived, and to bring additional liquidity to the market. In the Crash of 1987, the market mechanism could not keep up with the flood of trading, much as the market mechanism could not keep up with the flow of activity in the Flash Crash of 2010.

We learned on May 6 that a disruption can occur for technical reasons. Imagine what would have happened on May 6 if the drop had been just a little more severe and a few minutes earlier. It would have triggered the 1 hour trading halt, causing headlines around the world: “Stock market crashes. Trading Halted!” Many

investors may have interpreted the event as signaling fundamental news, and additional panic selling may have occurred in other markets still open, such as the bond and currency markets. Furthermore, the closed market may have led to more panic selling when the market reopened.

The stock-by-stock circuit breakers imposed in some stocks after May 6 were a step forward, but they need to be refined. Such protection needs to be applied to all stocks, not just the ones in the current pilot. Also, methods need to be found to prevent erroneous trades from occurring and triggering the circuit breakers when they should not be triggered.

Q.3. What is your view on limit up/limit down price banding idea referred to in Chairman Schapiro's testimony?

A.3. I think that the limit up/limit down idea is conceptually appealing because it looks like a method for preventing erroneous trades: Just don't let any trades take place outside of a given band. However, it has a fatal flaw that will result in many complaints to the regulators. In a limit up/limit down system, there is a price band within which trades are allowed to occur. For example, if the reference price is $10 and the band is 10 percent, then trades could occur anywhere between $9 and $11. The system automatically rejects any trades outside the band.

Clearly, there are times when the price should move outside the band because new information has arrived. All limit up/limit down mechanisms allow for an eventual reset in the trading band. At some exchanges, the trading band is set for the entire day and resets the next day. Some of the proposals currently circulating call for a faster reset of the band, perhaps after several minutes.

Alas, a limit up/limit down system does not stop trading and thus allows unsophisticated retail investors to trade at what is demonstrably not the fair price of the asset. This will cause an enormous number of complaints from retail investors to the regulators and to legislators. Here is an example:

The current band is from $9 to $11. News comes out that a takeover offer has been made at $20 per share. Buyers immediately start buying and quickly push the price up to the limit. The stock is stuck at the limit with orders to buy at $11 but no sellers at that price. At some point, the band will be reset so the stock can trade at its new fair and higher price. However, an unsophisticated retail investor who submits a market sell order during this time will be executed at $11. Shortly thereafter, the band resets and the price jumps. The investor feels that he or she has been taken advantage of and complains to the regulators as well as to their congressional representatives.

If any such system is put in place, it should be tested in a carefully controlled pilot experiment that investigates different sized bands and different reset periods.

Q.4. Many claim that one of the benefits of high-frequency traders is that they supply needed liquidity to the market. Yet the events of May 6 seem to show that this liquidity is fleeting and disappears when it is needed most. As such, do the events of May 6 demonstrate that this liquidity is only illusionary? If so, what, if any-

thing, should be done to ensure that the liquidity high-frequency traders claim to offer is there in bad times as well as the good?

A.4. The SEC/CFTC report investigated why these firms stopped trading.[2] The report stated on page 35 "As such, data integrity was cited by the firms we interviewed as their number one concern. To protect against trading on erroneous data, firms implement automated stops that are triggered when the data received appears questionable." And on page 36: "Whenever data integrity was questioned for any reason, firms temporarily paused trading in either the offending security, or in a group of securities."

Indeed, it is quite reasonable for these firms to stop trading when they detect the possibility of machine malfunctions. They cannot know where the malfunctions are occurring, and if they trade based on bad data they could lose enormous amounts of money in a short time and cause havoc in the rest of the market.

The implication is simple: If we want these firms to keep providing liquidity when the market is under stress, we need to make sure that the market has data integrity when the market is under stress. This is another reason to have data integrity pauses as discussed above.

I am not a fan of rules that try to force market makers to trade when they don't want to trade. Imposing such costs will result in fewer firms willing to make markets. Even if there are such rules, firms will try to get around them when the market is under stress. This was especially apparent in the Crash of 1987 when there were widespread accusations that NASDAQ market makers and NYSE specialists were not living up to their market maker obligations at that time.

Markets that have affirmative obligations for market makers generally also give market makers special privileges in their systems, such as special access to the market unavailable to others. This gave them an edge that offset the cost of their affirmative obligations. For example, the old NASDAQ system did not allow customer limit orders to compete directly with dealer quotes. Market structure changes over the last decade have eliminated these advantages, which has led to a decline in the number of traditional market makers. Any proposal to impose obligations should also be very clear as to what special privileges will be given to market makers in compensation.

One way to improve the liquidity provided by market makers is to permit the issuers to contract directly with and pay market makers for providing liquidity. This would allow the firm to compensate market makers for the expected losses they would experience by providing liquidity at times when they would otherwise choose not to do so. This system, which is used in Europe, is not currently permitted under current FINRA rules. Our rules should be changed to permit experimentation with this approach.

Q.5. What are the economic tradeoffs that need to be considered in placing curbs on the use of high-frequency trading in the markets? What might such curbs look like?

---

[2] *http://www.sec.gov/news/studies/2010/marketevents-report.pdf*

A.5. Traders use fast computers for a number of applications, many of which are beneficial to the market such as market making and arbitrage.[3] Any curbs on high-frequency trading run the risk of curbing such beneficial trading more than any harmful trading. I personally do not see a need for curbs on all high-frequency trading as such, and would want to see good empirical data demonstrating harm before imposing any curbs.

There are numerous potential curbs on high-frequency trading. Abusive strategies such as spoofing should be curbed by an enforcement regime good enough that any spoofers are quickly caught and sanctioned.

Excessive cancellations impose bandwidth costs on other market participants who must process all the data generated. One simple curb would be a speed limit on the number of quote updates in a given security in a given time. If a market participant cancels more than 200 orders per second in a given stock in a given exchange, then that exchange would reject all orders in that stock from that participant for the next 5 seconds.

Another approach is economic rather than regulatory. Surveillance costs increase with the amount of message traffic. As we consider the design and funding of the new consolidated audit trail system, part of the cost allocation could be based on the amount of message traffic generated by a given participant.

I am not in favor of requiring orders to have a minimum time in force for the following reason. There are times when it is appropriate for a long-term investor to cancel a legitimate order, even if it was just placed a nanosecond ago. For example, a patient mutual fund may be trying to accumulate shares by placing buy orders at the current bid. It uses a computer algorithm that places orders at the bid. When the algorithm senses that the price is going down (perhaps by seeing the bid fall on another exchange), it cancels the order at the bid and replaces it with a new order at the new lower bid. If this mutual fund was unable to cancel the order when the market moves, it will be picked off by sharp-shooting high-frequency traders. The result is that the mutual fund will experience higher transactions costs when filling its orders.

Q.6. Should there be serious consideration of removing the SRO function out of the individual exchanges and placing it into a single SRO? Should this consideration be extended to include a single SRO responsible for the equities as well as the futures markets? Could that possible be a way to reduce the regulatory fragmentation that many of the witnesses, including you, mentioned in their testimony?

A.6. Yes, we should consider separating the operation of a trading platform from that of enforcing our securities laws. The business of running a trading platform is very different from the business of enforcing Federal securities laws. Our financial markets have changed dramatically since the SRO model was adopted in the Securities Exchange Act of 1934. In 1934, the deputizing of the NYSE made sense as the NYSE was by far the dominant force in the U.S.

[3] For more details on the beneficial as well as harmful uses of high-frequency trading, see my joint work with Douglas McCabe available at *http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1737887.*

equity market. This no longer makes sense in our more modern and competitive markets.

Exchanges currently have two types of regulatory responsibilities under section 6(b)1 of the Securities Exchange Act of 1934: They must be able to enforce compliance with their own rules as well as national securities laws. Clearly exchanges have a clear commercial interest to enforce their own rules. Calling on them to enforce national securities laws is more problematic. How should the duties be divided among the exchanges? Traditionally, the listing exchange bore the bulk of the responsibility. However, this does not work well in a competitive environment. It is not fair to have one exchange do all the regulation and then charge the other exchanges. It is almost impossible to allocate the costs in such a way as to avoid either over or under charging the other exchanges.

Different regulatory functions naturally reside in different places. The exchanges naturally have an incentive to enforce their own rules. However, a manipulative trading strategy may involve numerous different instruments traded in numerous venues. It makes sense for a marketwide regulator such as FINRA to surveil for trading abuses, paid for fairly with a charge on transactions similar to the SEC fee.

The idea of a single SRO for all financial products (including securities, commodities, and insurance) is very appealing and should be seriously explored.

RESPONSES TO WRITTEN QUESTIONS OF CHAIRMAN REED FROM THOMAS PETERFFY

Q.1. Many claim that one of the benefits of high-frequency traders is that they supply needed liquidity to the market. Yet the events of May 6 seem to show that this liquidity is fleeting and disappears when it is needed most. As such, do the events of May 6 demonstrate that this liquidity is only illusionary? If so, what, if anything, should be done to ensure that the liquidity high-frequency traders claim to offer is there in bad times as well as the good?

A.1. There are hundreds of high frequency trading (HFT) operations that exist today and more will come into being in the future. They employ different strategies and practices that change often. Some provide liquidity most of the time while others take liquidity. Some trade continuously throughout the day, while some wait for opportunities to arise in the markets.

I would suggest two alternatives that would increase liquidity and reduce abusive trading on the part of HFTs.

A. A simpler but less beneficial solution would be to delay all orders, regardless of their origin, to the exchanges' matching engines by a tenth of a second when those orders take liquidity (*i.e.,* buy orders priced at the best offer or above and sell orders priced at the best bid or below). This would decrease the ability of HFTs to take liquidity and in turn increase liquidity providers' willingness to provide liquidity.

B. A more encompassing alternative would be to delay the transmission of ALL orders to the exchanges' matching engines, with the sole exception of quotes transmitted by market mak-

ers for products in which they are registered and have undertaken the obligation of providing quotes of minimum size and width, depending on market conditions, on a continuous basis. This measure would incentivize HFTs to become regulated market makers, and reaffirm the obligations and incentives of currently registered market makers to continue in their function.

Either alternative that is chosen should apply to all stock, option and futures markets.

Q.2. What are the economic tradeoffs that need to be considered in placing curbs on the use of high-frequency trading in the markets? What might such curbs look like?

A.2. With the growing participation of HFTs, the interaction in the market place between: (a) market makers and customers, and (b) customers with each other, have diminished (*i.e.,* HFTs are stepping in the middle of these trades). Anecdotal evidence points to HFT annual revenues of $2 to $5 billion. Some of this comes from traditional market makers who have lost some of their business to HFTs but the bulk comes from institutional and retail customers. Accordingly, reduced HFT participation would benefit customers. HFTs are large customers of certain brokers and of the exchanges and pay substantial exchange fees. Any reduction of HFT activity would have a negative impact on exchange revenues. It would also reduce the income of their brokers that tend to be small, undercapitalized firms.

Proposed curbs on HFT activity that are often mentioned in the press include the prohibition of canceling orders for a certain period of time, limiting the number of submitted orders to some multiple of orders actually executed, or financial penalties for frequent order submission. However, all these measures would act to reduce liquidity. Either of the proposals outlined in (A) and (B) above would be a much more constructive approach to channeling HFT activity into a more productive use while still allowing HFTs to participate actively in markets.

Q.3. Should there be serious consideration of removing the SRO function out of the individual exchanges and placing it into a single SRO? Should this consideration be extended to include a single SRO responsible for the equities as well as the futures markets? Could that possibly be a way to reduce the regulatory fragmentation that several of the witnesses mentioned in their testimony?

A.3. YES, DEFINITELY!

ADDITIONAL MATERIAL SUPPLIED FOR THE RECORD

Letter Submitted by Timothy B. Henseler, Deputy Director, Securities and Exchange Commission

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

OFFICE OF
LEGISLATIVE AND
INTERGOVERNMENTAL
AFFAIRS

February 1, 2011

The Honorable Carl Levin
Chairman
Permanent Subcommittee on Investigations
199 Russell Senate Office Building
United States Senate
Washington, D.C. 20510

Re: Follow-up to QFRs from the December 8, 2010 Joint Subcommittee on Securities, Insurance, and Investment and Permanent Subcommittee on Investigations Hearing

Dear Chairman Levin:

On January 7, 2011, Chairman Schapiro provided replies to questions for the record in connection with the December 8, 2010 Joint Subcommittee on Securities, Insurance, and Investment and Permanent Subcommittee on Investigations (PSI) Hearing "Examining the Efficiency, Stability, and Integrity of the U.S. Capital Markets."

PSI staff asked that Commission staff provide supplemental information in connection with question 2, specifically, our best estimate of the number of "intraday" manipulation cases the Commission has brought or settled in the past five years. Based on discussions we have had with your staff, we understand "intraday" manipulation cases to mean system-based or platform-driven trading abuses involving, for example, layering or spoofing, algorithmic, high-frequency or other large volume trading having a manipulative impact on the markets. Using that definition, the Commission has brought or settled the following case in the past five years:

- SEC v. Edgar E. Chapman, Jr., Lit. Rel. No. 20616, 08 civ 77 (M.D. Ga. June 11, 2008) (charging defendant with repeatedly engaging in spoofing and wash trading; defendant consented to be permanently enjoined from future violations of Section 10(b) of the Securities Exchange Act of 1934 and Rule 10b-5 thereunder).

In addition, in May, 2007, the SEC charged Morgan Stanley (In the Matter of Morgan Stanley & Co. Incorporated, AP File No. 3-12631 (May 9, 2007)) with violating the broker-dealer antifraud provisions of the Securities Exchange Act of 1934 for programming its computers to take undisclosed mark-ups and mark-downs on certain retail over-the-counter (OTC) orders processed by its automated market-making system and delaying the execution of other retail OTC orders. While the Morgan Stanley case involved violations of the firm's duty of best execution and was not technically an intraday market manipulation as we have defined it, it did involve platform and system-driven trading violations in which a firm programmed its computers unlawfully to

capture price spreads between the customer's execution price and the National Best Bid or Offer (NBBO) and otherwise denied customers the best prices for their trades. In that case, among other things, the SEC ordered Morgan Stanley to pay disgorgement and prejudgment interest in the amount of $6,457,200 and ordered a civil money penalty of $1.5 million.[1]

The Commission also has brought the following "intraday" manipulation cases (as defined above) outside of the five-year window identified in the question:

- In the Matter of Robert J. Monski, Lit Rel. No. 16986, 01 civ. 00943 (D.D.C. May 3, 2001) (charging defendant with repeatedly engaging in spoofing over a two-month period; defendant consented to the entry of an order requiring him to cease and desist from violating the antifraud provisions of the Securities Act of 1933 and the Securities Exchange Act of 1934 and paid $15,000 in disgorgement and a $10,000 civil penalty).

- In the Matter of Joseph R. Blackwell, Bradford D. Blackwell and Timothy R. Blackwell, Lit. Rel. No. 17221, AP File No. 3-10632, (Nov. 5, 2001); SEC v. Alexander M. Pomper, Lit. Rel. No. 17221, 01 civ 7391 (E.D.N.Y. Nov. 5, 2001); SEC v. Leonid Shpilsky, Alexander Shushkovsky and Grigory Kagan, Lit. Rel. No. 17221 (D.D. C. Nov. 5, 2001) In the Matter of Israel M. Shenker, Lit. Rel. No. 17221, AP File No. 3-10631 (Nov. 5, 2001) (filing four related cases charging eight individuals with engaging in fraudulent spoofing; six of the individuals consented to be permanently enjoined from violating the antifraud provisions of the Securities Act of 1933 and the Securities Exchange Act of 1934 and all together paid $32,319 in disgorgement plus prejudgment interest and $35,000 in penalties; the remaining two relief defendants disgorged a total of $13,430).

- SEC v. Leonard T. Sheehan, Lit. Rel. No. 18040, 03 civ 00694 (D.D.C. Mar. 18, 2003) and SEC v. Jason T. Frazee, Lit. Rel. No. 18040, 03 civ 00695 (Mar. 18, 2003) (charging two individuals with repeatedly engaging in spoofing; both defendants consented to be permanently enjoined from violating the antifraud provisions of the Securities Act of 1933 and the Securities Exchange Act of 1934 and paid a total of $32,569 in disgorgement plus prejudgment interest and $20,000 in civil penalties).

- In the Matter of Cary R. Kahn, AP File No. 3-11468 (Apr. 29, 2004) (charging individual with spoofing; individual was ordered to cease and desist from violating the antifraud provisions of the Securities Act of 1933 and the Securities Exchange Act of 1934 and pay $13,403 in disgorgement plus prejudgment interest).

- SEC v. Stanley Awdisho, Michael Kundrat and Kristopher Smolinski, Lit. Rel. No. 18926, 04 civ 6125 (N.D. Ill. Sept. 21, 2004) (charging three individuals with repeatedly

[1] Although not an intraday manipulation case, the Commission's action In the Matter of ICAP Securities USA LLC et al., AP File No. 3-13726 (Dec. 18, 2009), involved trading abuses whereby ICAP Securities, a U.S. subsidiary of the world's largest inter-dealer broker, displayed thousands of fictitious flash trades on ICAP's trading screens seen by its customers, who consist of primary dealers and other large financial institutions. ICAP, among other relief, consented to pay disgorgement and a penalty of $25 million, while six active ICAP employees paid penalties of $100,000 and an ex-employee paid $50,000.

manipulating the price of stock options by engaging in a spoofing or small lot baiting; defendants consented to be permanently enjoined from future violations of Sections 9(a)(2) and 10(b) of the Securities Exchange Act of 1934 and Rule 10b-5 thereunder and to pay a total of $40,000 in civil penalties.).

As mentioned in Chairman Schapiro's testimony, the Commission's Division of Enforcement is devoting significant investigative resources to determine whether various market participants have engaged in conduct that unlawfully exploited the fragmentation of the markets, intentionally contributed to market volatility or manipulated the price and volume of securities at the expense of innocent investors. In particular, Enforcement staff is investigating practices such as layering or spoofing, improper order cancellation activities or "quote stuffing," the use of order anticipation and momentum ignition strategies undertaken for a manipulative purpose, passive market making practices that incentivize possible manipulative quoting activity, abusive co-location and data latency arbitrage activity in potential violation of Regulation NMS, use of Direct Market Access arrangements to conceal manipulative trading activity and conduit entity market manipulation. While these investigative efforts are fact finding in nature and do not necessarily mean that abuse has occurred or that an enforcement action will result, the sustained specialized knowledge and insights we gain will inform the agency's regulation and lead to greater efficiency and effectiveness in our investigations.

Please call me at (202) 551-2015 if you have any further questions regarding this matter, and thank you.

Very truly yours,

Timothy B. Henseler
Deputy Director