

Comments to the
SEC Equity Market Structure Advisory Committee
regarding the
Market Quality Sub-Committee Recommendations for Rulemaking on Issues of Market Quality

James J. Angel, Ph.D., CFA

Georgetown University

August 2, 2016

Summary

Limit-Up Limit-Down (LULD):

- LULD does a good job of preventing runaway stock prices, but the reopening process is messy.
- LULD can be improved with gradually widening bands instead of a trading halt.
- LULD bands should be harmonized with the Clearly Erroneous Execution (CEE) rules.

Market-wide circuit breakers:

- Widening the market-wide circuit breakers to 10% BASED ON THE OPEN is a good idea.
- Market-wide circuit breakers need to be coordinated with derivative markets.
- The re-opening process needs to be carefully reconsidered.
- The market should (almost) always be re-opened later long enough to produce valid closing prices.
- Each market-wide event is different, so human judgment is required.
- 16 Separate SRO filings demonstrate the problems with our regulatory structure.

Small-cap liquidity:

- The problems in the small-cap sector represents a serious threat to the economic growth and wellbeing of the United States. Don't give up.
- Improvements need to be made in compliance costs, litigation risks, and market structure.
- Experimentation in market structure, such as issuer-paid liquidity providers, should be encouraged. There is no "one-size-fits-all" perfect market structure.

Introduction

My name is James J. Angel and I am an Associate Professor of Finance at the McDonough School of Business at Georgetown University. I have an engineering as well as finance background and am a co-inventor on 12 financial technology patents. I was a Visiting Academic Fellow at the NASD where, among other things, I participated in the design of the opening and closing auctions at Nasdaq. I have visited over 70 stock and derivative exchanges around the world.¹

As a finance professor with an engineering background, I have long been concerned about the fragility of our modern electronic markets. Indeed, I warned the SEC in writing five times before the Flash Crash about this fragility.²

As the discussion today is primarily about the application of trading restrictions and halts to prevent excess volatility, it is useful to begin with some general comments about when it is appropriate to halt a market:

1. Information dissemination. When there is a major information event such as a merger or earnings announcement, fairness dictates that market participants have sufficient time to receive and process the information. For this reason, most corporate earnings announcements are made outside of regular trading hours, and procedures are in place to halt trading during the day for news dissemination.
2. Temporary liquidity imbalances. When there are temporary liquidity imbalances, a market pause or slowdown of some type can prevent clearly erroneous trades from occurring in a fast moving automated market. Furthermore, a trading halt provides time to seek out liquidity. A switch to a single price reopening auction theoretically concentrates all of the liquidity in one time and one place and thus theoretically results in good price discovery.
3. System malfunction. Clearly if there is a fire, power failure, computer or other major malfunction, prudence dictates closing the market until the malfunction is resolved. What is more problematic is what to do when there is only a partial malfunction in part of the market network. The operational question concerns how bad the malfunction needs to be in order shut down the entire market.
4. Other disruptions in the economy. During serious crises, the market may be shut down for political reasons. The NYSE was closed for four months at the outbreak of World War I due to

¹ My vita is attached as an appendix.

² Details are in my testimony before the U.S. Senate Sub-Committee on Securities, Insurance, and Investment and the Senate Permanent Sub-Committee on Investigations, December 8, 2010, "Examining the Efficiency, Stability, and Integrity of the U.S. Capital Markets", available at http://www.banking.senate.gov/public/_cache/files/a4f49d29-fe78-4ed9-a839-3a6c09917298/33A699FF535D59925B69836A6E068FD0.angeltestimony1282010.pdf

U.S. government concerns that foreign selling of securities to finance the European conflict would lead to a gold drain from the U.S. and thus disrupt U.S. exchange rates. More recent closures occurred in Egypt and Greece.³

5. Lack of trading interest. There is only so much trading interest in a given instrument, and it doesn't make sense to keep a market open when no one wants to trade. Despite our computerized markets, the computers are overseen by people, and people like to go home and sleep at night. Regular trading hours stop at 4:00 pm ET each day and extended hours at 8:00 pm ET. Despite the availability of extended and pre-open trading hours, liquidity is generally low at those times.
6. Memorials for important people. The U.S. equity markets have traditionally closed for a day for presidential funerals to honor dead presidents. Moments of silence have also been observed at other times such as to honor the victims of the terrorist attacks of September 11, 2001.

Call auctions are not a panacea.

Call auctions, however, are not a panacea for the market's ills. Theoretical arguments for call auctions often naively ignore the many real-world problems that complicate the design of call auctions. Call auctions are vulnerable to gaming and manipulation. This is especially true when a market has been closed and there has been no price information generated by trading.

Designing an auction is a tricky process. There are numerous design decisions regarding allowable order types are allowed and when, what information should be disclosed and to whom, how the price is determined, how shares are allocated, whether the execution or cutoff time is randomized, what kind of cancellations are allowed and when, and so forth. Due to this complexity, our exchanges are still constantly experimenting with changes to their opening auctions despite two centuries of operation.

Some market liquidity is conditional upon the counterparties knowing something about the counterparty (e.g. retail v. institutional). Such liquidity would not be expressed in a reopening call auction.

Call auctions impose execution risk on market participants. In a continuous market, participants can receive executions in a few microseconds at a known price. In a discontinuous call market, the participant is locked in to an unknown execution price, which creates risk that deters traders from participating in the auction. Thus, some investors prefer to wait and see what happens in an opening auction before trading.

³ The Athens Stock Exchange was closed on June 26, 2015 and reopened on August 3, 2015. For information on the Greek shutdown, see "Athens stock market tumbles on reopening," *Financial Times*, August 3, 2015 Kerin Hope in Athens and John Aglionby and Michael Hunter in London <http://www.ft.com/cms/s/0/c61d1b12-39b0-11e5-bbd1-b37bc06f590c.html>. The Egypt Stock Exchange was closed due to the Arab Spring uprising on January 27, 2011 and reopened on March 23, 2011. See "Egypt stock market halts trading minutes after reopening," <http://www.bbc.com/news/business-12828413>, accessed October 10, 2015.

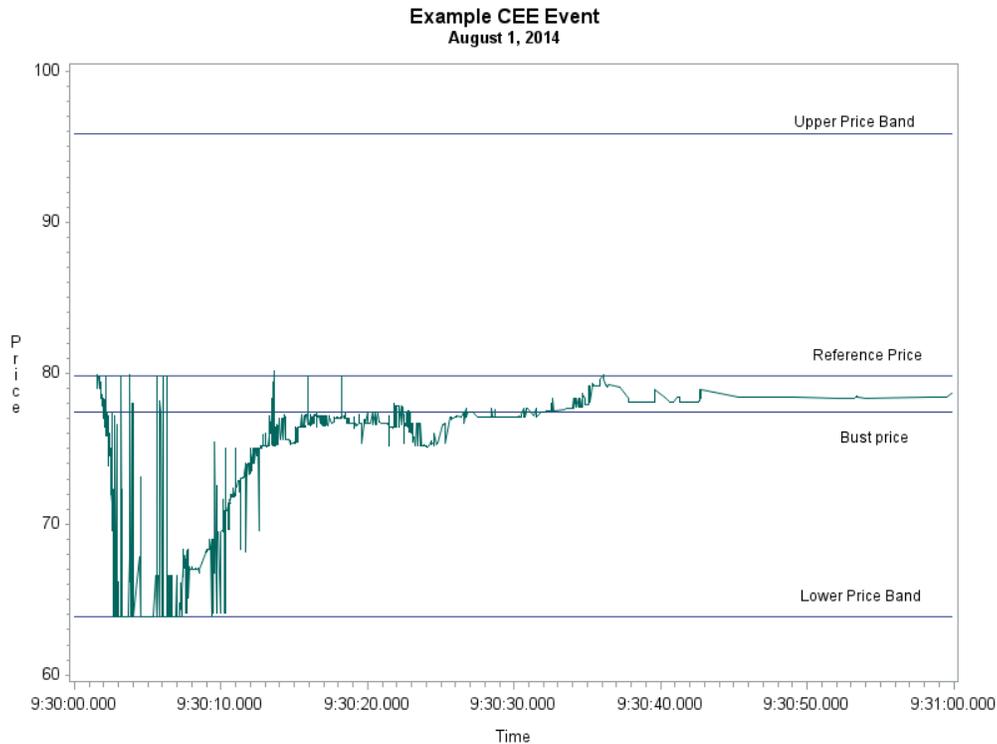
Call auctions themselves are also themselves vulnerable to liquidity imbalances. Furthermore, as has been the experience in LULD reopening auctions, all orders are not necessarily routed to the primary listing market's reopening auction, sometimes resulting in less than stellar reopening results.

LULD prevents runaway prices but the reopening is messy.

Currently, the Limit Up Limit Down (LULD) system, in oversimplified terms, works as follows to prevent runaway stock prices: A stock is not permitted to trade outside moving price band is determined (generally the average of the last five minutes of trading prices) for each stock. A "limit state" occurs if a stock's quote hits the boundary of the bands. If a stock is stuck in a limit state for 15 seconds, a trading halt (euphemistically called a "pause") ensues. The stock then reopens in approximately five minutes.

Here is an example of LULD in action:

On August 1, 2014, Magellan Midstream Partners opened at 9:30:01.467. The opening print and first reference price was \$79.86. The band size was 20%, and thus the lower and upper band prices were \$63.89 and \$95.83 respectively. However, the guideline for cancelling clearly erroneous executions (CEE) for a stock in this price range is only 3%. Almost immediately after the open, the stock price plunged. The offer hit the lower band of \$63.89, triggering a limit state that lasted 4.132 seconds. During that state, 340 trades took place at the lower band of \$63.89. The price quickly rebounded to near the opening price within seconds.



All trades at \$77.46 or below were busted, resulting in 3,080 cancellations across 11 SROs.

LULD did its job and created an effective boundary that prevented even more trades from printing at even lower prices. This prevented the possibility of executing trades at prices such as \$.01 as occurred during the Flash Crash. However, it did not prevent clearly erroneous executions that needed to be cancelled.

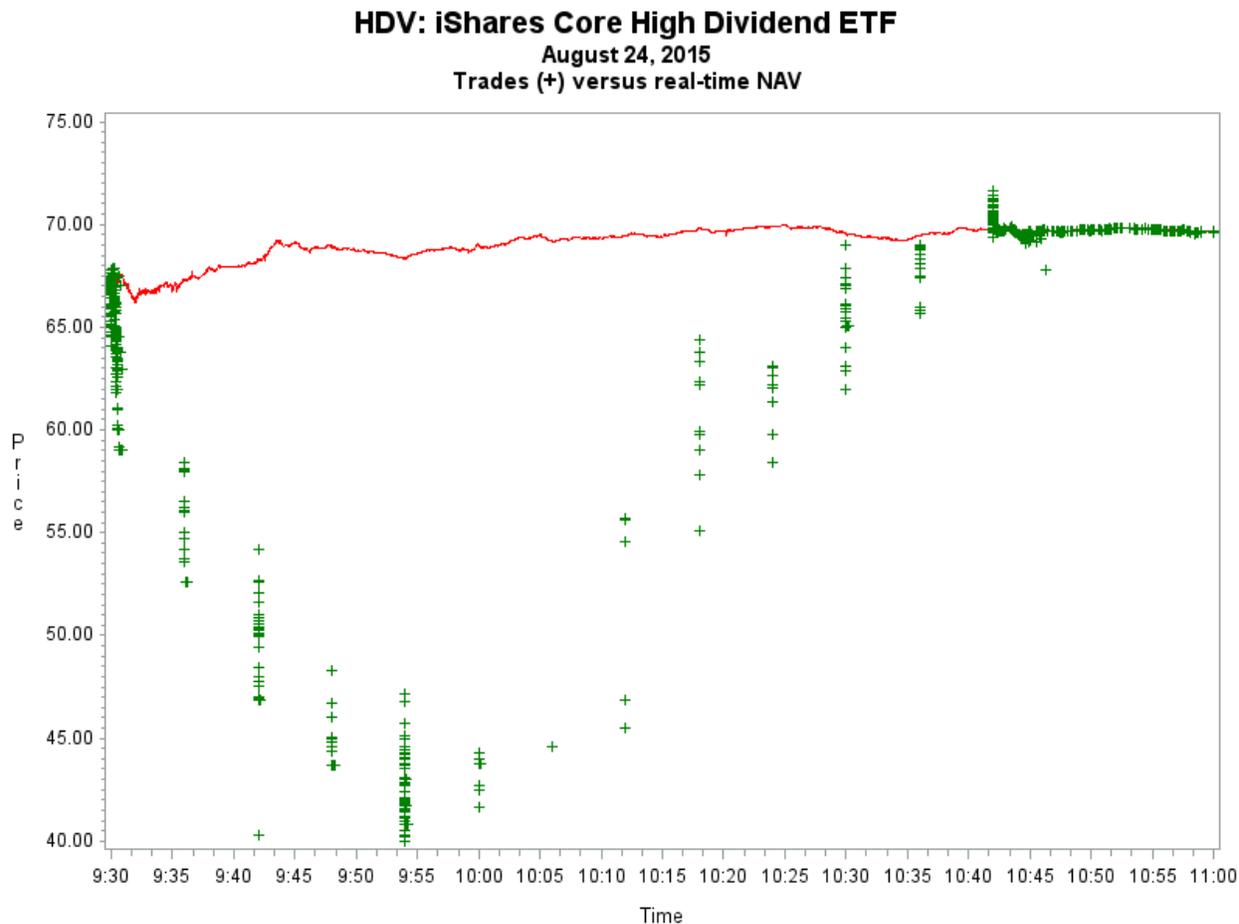
CEE should be harmonized with LULD.

Traders may hesitate to step in to offset liquidity imbalances if they fear that their trades will later be cancelled. For example, a trader may observe that a stock price has fallen and step in to buy, and thus help to halt the decline in the price. Later, the stock price recovers and the trader sells the position, earning a profit for stepping in when the market needed it. However, if the purchase trade is later cancelled, the trader is left with a naked short position and likely trading losses. Faced with such a prospect, few intelligent traders will step in.

I concur with the Sub-Committee’s recommendation that the LULD bands should be harmonized with the Clearly Erroneous Execution (CEE) rules to prevent any trades that should later be cancelled. This will create certainty of execution that will make it more likely for traders to step in and provide liquidity when needed.

Re-openings can be improved.

As discussed above, there are a number of problems with the design and operation of call auctions. The volatility of August 24, 2015 demonstrated the problems with the reopening process after LULD pauses. Domestic Exchange Traded Funds (ETFs) were particularly hard hit that day. The following chart displays what happened to the iShares Core High Dividend ETF (HDV).



The solid red line indicates the true Net Asset Value (NAV) of the fund calculated from the actual trading prices in consolidated trading of its constituents each minute.⁴ The green plus signs (+) are the actual

⁴ This ETF consists of actively traded large-cap U.S. equities. Even though many of the constituents stocks had not yet formally opened on their primary listing exchange, they were actively traded on other exchanges under Unlisted Trading Privileges (UTP).

trade prices of the ETF. Note that the price of the ETF was at times more than \$20 below the actual value of the underlying portfolio, a sign of how under stress the market was that day.

There were 12 LULD pauses in HDV that day. However, most of the re-opening auctions did not result in prices anywhere near the true underlying value of the ETF's portfolio. One of the reasons for this is that the auction process that was used at the time had a price limit on how far the re-opening price could move, one of the many design decisions in auction design.

Stocks should re-open using the normal morning pre-open procedures.

The Sub-Committee recommends that the length of the maximum limit state be extended from 15 seconds to two minutes, and the trading halt would be reduced to a halt-like "pre-open" state of two minutes.

The recommended use of a pre-open state is an excellent idea. This can be improved even further by using the pre-open procedures currently in use in the U.S. equity market, one that allows trade matching for some customers.

Currently, pre-open trading starts in the pre-dawn darkness when some exchanges switch on their computers as early as 4:00 am. During this time the trades of the more adventurous traders discover the price. Meanwhile, retail and patient institutional orders queue up for the 9:30 auction. However, this auction does not generally discover the price – the price has already been discovered in the pre-open trading. Thus, the retail and patient institutional orders get the "right" price in a fair and orderly opening process. Such a process permits traders who are willing to take step and provide liquidity in a market under stress to trade, thus discovering the price that the rest of the market benefits from.

It works every morning to produce a fair and orderly opening price for thousands of stocks. There is no reason we should not use this well-oiled process for reopening halted stocks and IPOs.

Better yet, gradually widen the LULD bands rather than halt trading altogether.

Another approach worthy of consideration is to gradually widen the LULD bands until trading naturally resumes. Rather than having a trading halt of some arbitrary length, the LULD bands could gradually be widened until trading resumes. For example, if a stock is stuck at a 5% band for two minutes, the band could widen to 10% for the next five minutes. If it is still stuck, the band could widen to 15% for the next five minutes and so forth. This will allow enough time for humans to react. This time interval is important so that market participants can re-examine orders or determine whether there are system problems, and regulators can examine the situation to see if there is a news pending situation.

Market-wide circuit breakers need fixing

Market-wide circuit breakers were imposed in the U.S. after the Crash of 1987. From October 13, 1987 through October 19, 1987, the Dow Jones Industrial Average lost nearly 1/3 of its value, including a drop

of 22% on October 19 alone.⁵ During the crash of October 19, severe systems failures plagued the market. The level of order flow overwhelmed the capacity of the market to handle the orders, leading to long delays in the execution of orders. For example, the printers that printed the order tickets on the NYSE could not handle the volume. Stale prices affected the prices of indices such as the S&P500, resulting in apparently large deviations between the stocks and the futures.

Subsequent to the crash, market-wide circuit breakers were imposed that call for various trading halts. This seemed to make sense, as it would give the humans in the market time to catch up with the flow of volume and reassess the situation. If the market, as measured by the Dow Jones Industrial Average, dropped by approximately 10% or more before 2:30 pm, trading would be halted for one hour. If the market dropped by 20%, there would be another halt, and 30% would halt the market for the rest of the day.

In the May 6, 2010 “Flash Crash”, the market was again overwhelmed by a tsunami of order activity. A large sell order in the e-mini S&P 500 futures contract led to a rapid decline in the futures price, which was quickly transmitted to the equities markets. The high volume of message traffic caused substantial delays in some data feeds. Many liquidity providers pulled out of the market, citing “data integrity” concerns. The lack of liquidity resulted in many trades occurring at absurd prices, which required the cancellation of over 20,000 clearly erroneous equity trades.

Subsequently, the U.S. markets tweaked the market-wide circuit breakers through a process that involved rule filings from 16 separate SROs.⁶ The first halt is now set at a drop of 7% in the S&P 500, and the halts are shorter.⁷ However, there has been insufficient consideration in how the market would re-open after such a halt.

Our new market-wide circuit breakers are badly designed and we are extremely lucky that they have never been triggered. As the recent turmoil in China in 2015 demonstrated, badly designed market-wide circuit breakers can do more harm than good. The uncertainty as to when or if the market will close can cause further panic as investors try to get out before the market is closed. The lack of information during a closure may cause other investors to join the panic and try to get out as soon as the market reopens.

Trading should be prematurely halted only when the market mechanism is not working.

⁵ See *Report Of The Presidential Task Force On Market Mechanisms*, Superintendent of Documents, U.S. Government Printing Office, Washington, DC. 20402 , 1988

⁶ File Nos. SR-BATS-2011-038; SR-BYX-2011-025; SR-BX-2011-068; SR-CBOE-2011-087; SR-C2-2011-024; SR-CHX-2011-30; SR-EDGA-2011-31; SR-EDGX- 2011-30; SR-FINRA-2011-054; SR-ISE-2011-61; SR-NASDAQ-2011-131; SR-NSX-2011-11; SR-NYSE-2011-48; SR-NYSEAmex-2011-73; SR-NYSEArca-2011-68; SR-Phlx-2011-129

⁷ See <https://www.sec.gov/rules/sro/bats/2012/34-67090.pdf>

The primary job of an exchange is to match buyer and seller and discover the price. Price discovery occurs through the interaction of the buy and sell orders placed by investors. Investors depend upon a rich information infrastructure to disseminate the information needed to make informed trading decisions. The exchanges disseminate quote information regarding available liquidity as well as trade information regarding recent trades. Data vendors carry this information to investors. News media convey both company specific information as well as general information regarding the state of the economy. Analysts and other commentators digest this information into forms that others can assimilate.

There are large costs to halting trading, and it should only be done in extreme circumstances when the market mechanism is not working properly. A sudden and unanticipated halt, especially a lengthy one, can leave many market participants with excessive and costly risk exposures and unhedged positions. Indeed, depending on the circumstances surrounding the halt, the halt itself may cause fear and more panic. For example, if the Flash Crash had triggered a lengthy halt, the news media could potentially have attributed the crash to fundamentally bad news, triggering more panic selling when the market re-opened.

There are two primary types of situations in which the market mechanism can fail. The first is when an information event occurs and investors have not had time to receive the information. For this reason our markets routinely and rightly halt trading when news is pending.

The second is when there is a technical problem with the market mechanism. As our markets depend on high quality information, any disruptions in the flow of information threaten to wreak chaos in the market. Market-wide circuit breakers seemed like a natural response to the Crash of 1987 because the manual stock market of that era could not keep up with the crush of volume. One of the exacerbating factors to the Flash Crash cited in the various postmortems was that liquidity providers stopped trading due to concerns about “data integrity” – the equity markets could not keep up with the flow of data.

A sudden large fluctuation in aggregate stock prices is a sign that the market mechanism may not be working properly, and it may be appropriate to pause the market to locate and fix the problem. The question is, how large should such a fluctuation be in order for an automatic circuit breaker to stop trading?

7% is too small for a market-wide trigger

There was no real economic analysis or sound economic reasoning in the rule filings that reduced the trigger percentage for the first halt from 10% to 7%. If this 7% rule had been in effect in recent years, we would have had trading halts on the following days:

May 6, 2010 (The Flash Crash)
December 1, 2008
November 20, 2008
October 22, 2008
October 15, 2008

October 10, 2008
October 6, 2008
September 29, 2008
September 17, 2001 (the re-opening post 9/11)

With the benefit of 20/20 hindsight, would we have wanted to halt trading in the markets on those days? No. We would have had market-wide halts several times during the financial storm in 2008 if the trigger price were 7% from the prior close. The market volatility was reflecting the great uncertainty over the financial crisis then erupting. Although investors were unhappy about the prices, there was general agreement that the equity market structure worked reasonably well during that time period, especially compared with the complete freeze-up in the mortgage backed securities markets. I don't recall any serious discussion stating that we should have had trading halts at that time. For example, the SEC's Concept Release on Equity Market Structure issued in January 2010 raised several issues about equity market structure, but did not even mention trading halts or pauses.⁸

A trigger level of 7% is clearly too small as it would have triggered many clearly erroneous halts. A return to the 10% level seems quite reasonable. Exchanges should also be encouraged to have plans in place to deal with capacity shortages regardless of the movement in prices, either through a trading pause or some kind of fair and orderly load shedding.

The market should NOT be halted by the opening auction. A market-wide circuit breaker should be based on the opening price, not the prior close.

Our market opening procedures provide a fair and orderly auction that does a good job of digesting the information that has accumulated since the previous close. The small amount of professional trading that occurs in the pre-opening period provides battle-tested prices, assisting the market in finding the right price in the opening auction. Sometimes major events occur that lead to a significant drop on the opening. It would not make sense to shut down the market to hold a call auction immediately after holding the opening call auction after the overnight shutdown in such a case.

Consider, for example, the re-opening of the market after the September 11, 2001 terrorist attacks. The DJIA opened on September 17, 2001 down 7.13% from the previous close on September 10.⁹ Should we have shut the market down immediately after the open on September 17, 2001? No! It makes no sense to shut the market down for an auction immediately after reopening it. For this reason, the reference price used should be based on the morning open, not the previous close.

There should be a procedure to determine fair and orderly closing prices.

⁸ <http://www.sec.gov/rules/concept/2010/34-61358.pdf>

⁹ Yahoo! Finance reports the previous day's close for the opening price for the S&P500 for that time period, so I am using the DJIA for which data on the open was available.

Even in an extreme event, it is not clear that the market is served by closing for the rest of the day. Indeed, such a close could be extremely harmful and do much unnecessary damage. For example, suppose that a news report comes out that illegal alien zombies from outer space have landed. The market drops 30% and is halted for the day. It turns out, however, that the news is fake. Nevertheless, traders' positions are all marked to market at the unnaturally low prices prevailing when the market was closed for the day, leading to margin calls and overnight funding problems. Mutual fund transactions are executed at clearly erroneous prices. Unless there is some reason to believe that the market mechanism is broken, there should be a normal closing process so that mutual fund prices are properly determined.

If a halt occurs before the close, then extend the time of the close.

If there is a disruption large enough to require a trading pause near the close, the market should be re-opened in order to permit an orderly closing process. This would permit market participants to clean up their positions before the overnight period. It would also discover fair prices that mutual funds use to price their shares, and brokerage firms use to calculate margin positions. If there is no orderly close, mutual funds will be mispriced and brokerage firm margin calculation will be inaccurate. Such an extended close needs to be tested very carefully, however, to make sure that all of the systems at the various exchanges brokerage firms, and data vendors can handle it. Many computers may be programmed Y2K like to always treat 4PM as the end of day.

Retain flexibility to let humans call a halt.

It is not possible to determine all of the reasons in advance why it would be appropriate to halt the market. For this reason, there should be flexibility for human judgment to call a trading halt in an emergency situation or when otherwise necessary to maintain a fair and orderly market. For example, suppose that the President has a heart attack, as happened to President Eisenhower. It might be appropriate to halt the market in order for the market to digest the information. Or there might be a partial network outage affecting so many market participants that it might be appropriate to pause the market.

For this reason, the SRO rules should also permit a trading pause at the request of the SEC, FINRA, the Fed, or the Treasury Department. Likewise, the SROs themselves should be able to call a halt if they feel in their collective judgment that a trading pause is necessary to maintain a fair and orderly market.

Likewise, humans should be allowed to overrule the "close for the day" part of the market-wide circuit breakers and plan for an orderly re-opening if needed to create fair and orderly closing prices.

Any trading halt and re-open needs to be closely coordinated with derivative markets.

The equity and derivative markets are closely interconnected. However, there is very little work on how to coordinate the halting and re-opening of such markets in a market-wide event. Planning now will prevent a bleepstorm later.

The reopening process needs to be carefully rethought.

The recent changes to the market-wide circuit breakers gave no apparent thought to how to reopen the market in the event of disruption serious enough to call a halt. If the market is slammed shut in a time of turmoil, reopening the market could be extremely messy, with large and violent price fluctuations as the market attempts to adjust.

On a normal day, futures contracts provide a good signal of the overall value of the market, and pre-open trading provides battle hardened prices for most actively traded stocks, leading to a fair and orderly market opening. Following a market-wide trading halt, the market should reopen in a similar gentle manner. First derivatives, then pre-open trading in the largest stocks, then pre-open trading in all stocks, and finally a normal open. Without careful thinking and planning, a messy re-open in a time of market dislocation could make the dislocation even worse.

And finally,

This should be done with one SEC rule, not sixteen separate SRO rule filings!

The process used to institute market-wide circuit breakers exemplifies how bleeped up our regulatory system is. Having sixteen separate rule filings is absurd. It is an extreme waste of scarce taxpayer resources to have such waste and duplication, not to mention a useless compliance tax on all of the SROs that have to file all this paperwork. Market-wide rules should be instituted through a single SEC rule filing. The individual SRO rules should merely say something like “Trading is halted when a trading halt is declared under SEC Rule HALT.”

Section 3(f) of the Securities and Exchange Act of 1934 explicitly requires:

Whenever pursuant to this title the Commission is engaged in rulemaking, or in the review of a rule of a self-regulatory organization, and is required to consider or determine whether an action is necessary or appropriate in the public interest, the Commission shall also consider, in addition to the protection of investors, whether the action will promote efficiency, competition, and capital formation.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

This method of forcing sixteen SROs to file sixteen piles of paperwork to institute a single unified market-wide rule, requiring sixteen of everything is clearly inefficient.

The SEC appears to be bypassing the Administrative Procedures Act by forcing all SROs to have basically the same rule. This leaves market-wide rules like this open to legal challenges later on the grounds that they are not really SRO rules, but really SEC rules that were not properly adopted. The SEC should resist the temptation to do future market-wide rules in this manner and do proper rulemaking at the SEC, not the SRO, level.

Don't give up on small cap liquidity.

I noticed with sadness that the Sub-Committee has suspended further discussion of small cap liquidity issues. This is a mistake, as the problems in the small cap sector signal serious problems for capital formation. There is no easy answer to the small cap liquidity problem, as the causes include:

- Compliance burdens
- Market structure issues
- Litigation risks

Just because there is no easy silver bullet to solve the problem does not mean we should not address the many contributors to the problem. Some market structure reforms are simple. For example, **we should permit European style liquidity providers to be paid for by issuers.** This works without serious problem in several countries and should be permitted here. Others issues require longer and deeper dialogues, such as the proper role of a dealer market in the small cap sector. But we will never get there unless we start.

If you have any questions, feel free to email me at angelj@georgetown.edu or call me at (202) 687-3765.

Respectfully submitted,

James J. Angel, Ph.D, CFA
Georgetown University
McDonough School of Business
Washington DC 20057
(202) 687-3765



Comments

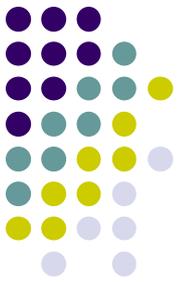
Prof. James J. Angel, Ph.D., CFA
Georgetown University
Presentation to SEC EMSAC
August 2, 2016



About @GuFinProf

- Studies financial markets and regulation
 - Warned SEC in writing 5 times before the F... that our markets were vulnerable
 - Visited over 70 exchanges around the world
 - Former Chair of Nasdaq Economic Advisory Board
 - Board of Directors, DirectEdge Stock Exchange
 - Holds 12 patents on financial technology
 - Visiting Economist, Shanghai Stock Exchange 2004
- B.S. Caltech, MBA Harvard, Ph.D. Berkeley
- At Georgetown +/- since 1991



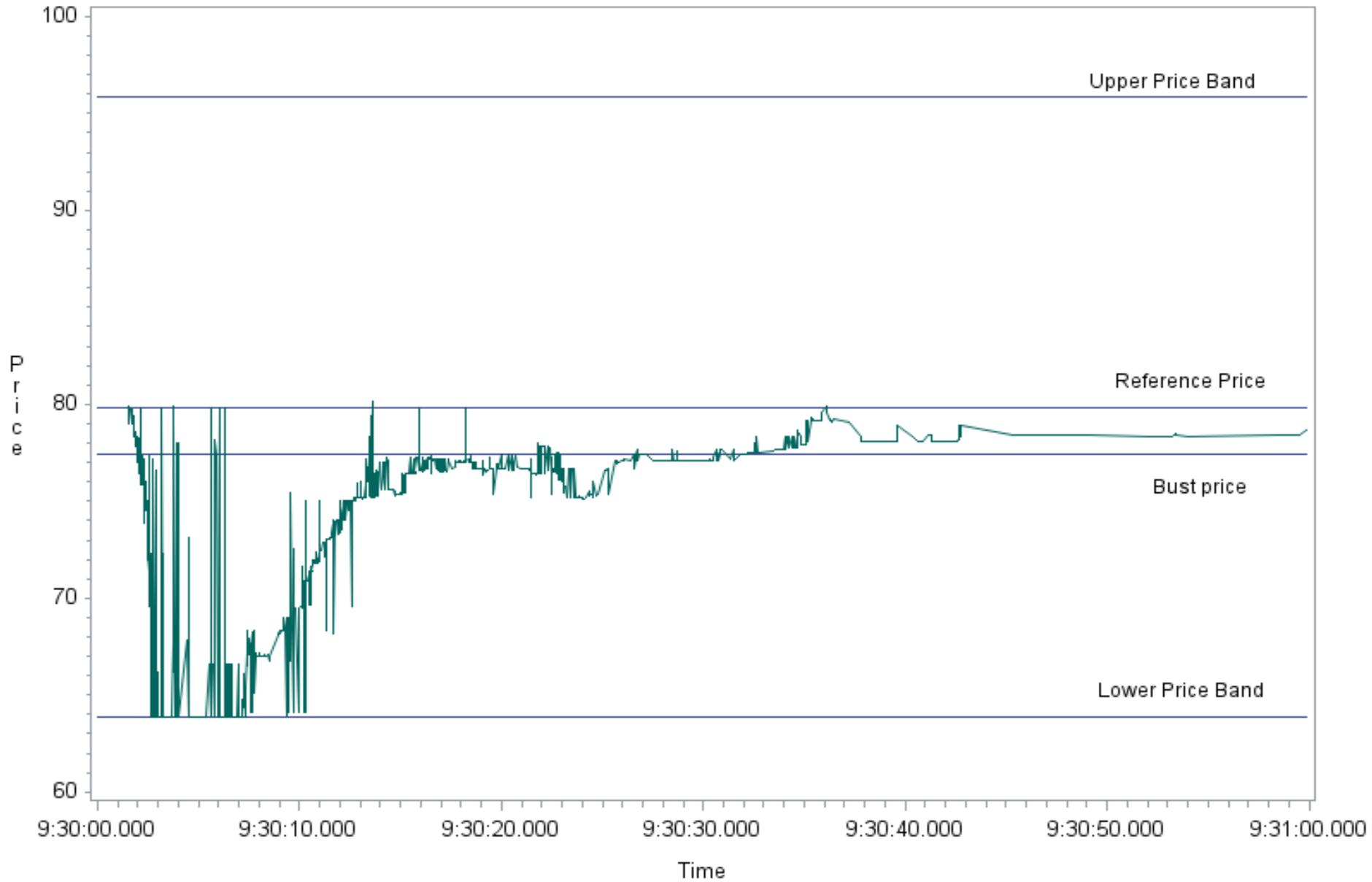


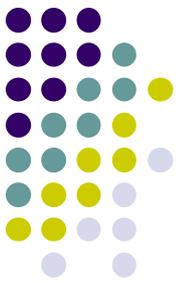
Major Points

- I. LULD prevents runaway prices
 - But can be improved.
- II. Our market-wide circuit breakers are defective and can do more harm than good.
 - Need to fix BEFORE the next tsunami.
- III. The crisis in the small cap sector is a big problem for U.S. capital formation and economic growth.
 - Don't give up!

Example CEE Event

August 1, 2014





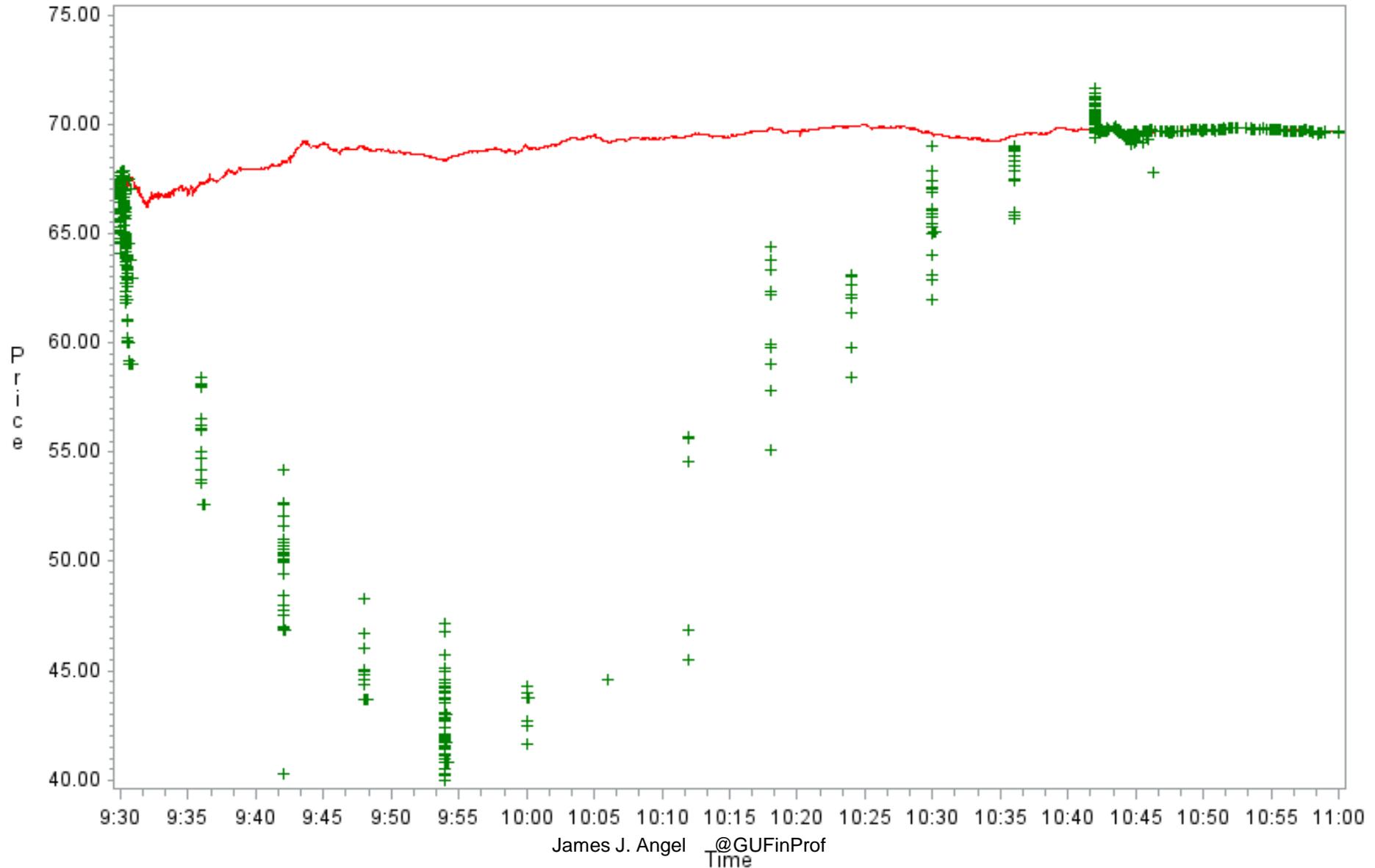
Re-opening is problematic

- Auctions are vulnerable
 - Gaming
 - Manipulation
 - Liquidity Imbalances
- Auctions are complicated to design
 - What kind of orders to allow and when
 - What information to disseminate and to whom
 - When to hold auction
 - How to determine price
 - Whether to constrain price movements
 - How to allocate shares

HDV: iShares Core High Dividend ETF

August 24, 2015

Trades (+) versus real-time NAV





Potential improvements

- Gradually widening bands instead of trading halt.
 - Let market naturally find new price.
- Harmonize Clearly Erroneous Execution (CEE) rules with LULD

II: Market wide circuit breakers are defective.

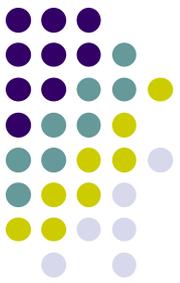


- Halt made sense in manual days.
 - Market could not keep up in 1987.
- Markets under stress do not need the uncertainty of a whether they will close.
 - Experience in China shows can do more harm than good.



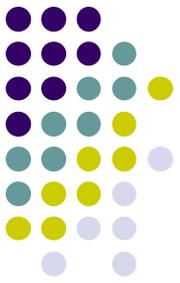
More problems

- Trigger should be based on open price, not close.
 - Market has already been closed all night.
 - Makes no sense to switch to auction immediately after opening auction.
- 7% trigger is too small
 - Would have triggered on 9/11 reopen, too many times in 2008
- No substantive thought has been given to coordination with derivative markets
 - Where is FSOC when you need them???
- Or reopening process.



III. Small cap crisis

- We now have approximately half as many U.S. public companies as 20 years ago.
 - Only 3,556 companies in the Wilshire 5000
- Closing the public markets to small cap companies shuts off a vital source of capital for small and growing companies.
- Less capital = less investment = less growth = fewer jobs

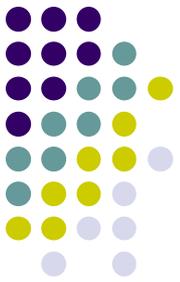


No silver bullet

- Small cap challenges
 - Litigation risk
 - Compliance burdens
 - Market structure
 - We no longer have choice in market structure
 - Old days:
 - High cost Nasdaq dealer market provided research support – but had higher transaction costs
 - Amex/NYSE had lower transaction costs

Don't give up!

- Lack of easy answers does not mean we should not address problem.



CURRICULUM VITAE

James J. Angel, Ph.D., CFA

Associate Professor of Finance
McDonough School of Business
Georgetown University
509 Hariri Building
Washington, D.C. USA 20057
1 (202) 687-3765

angelj@georgetown.edu

Twitter: @GuFinProf

<http://explore.georgetown.edu/people/angelj/?PageTemplateID=109>

Research Focus

My research focuses on financial market structure and financial technology (fintech) and the associated ethical issues. My topics of interest include the microstructure of trading, payments, and the regulation and industrial organization of global financial markets around the world. I have visited over 70 stock and derivative exchanges around the world.

Education

Harvard Business School
Making Corporate Boards More Effective, 2013

University of California at Berkeley
Walter A. Haas School of Business
Ph.D. in Finance, 1991
Dissertation advisor: Alberts S. "Pete" Kyle

Harvard Business School, M.B.A. 1985

California Institute of Technology, B.S. 1981
Double major: Engineering and Applied Science, Economics

Sewickley Academy, Sewickley, PA, 1977

Work Experience

1986-1991	BARRA (later part of Morgan Stanley), Berkeley CA	Consultant
1984-1985	The Analysis Group, Belmont MA and Sausalito, CA	Consultant
1981-1983	Pacific Gas and Electric, San Francisco CA	Rate Engineer I

Academic Appointments

Wharton School, University of Pennsylvania

Visiting Associate Professor, 2012-2014

Shanghai Stock Exchange

Visiting Economist, 2004

National Association of Securities Dealers

Visiting Academic Fellow, 1999-2000

Georgetown University McDonough School of Business

Associate Professor of Finance 1998-

Assistant Professor of Finance 1991-1998

University of California at Berkeley

Graduate Student Instructor

Research Assistant to Professors Pete Kyle and David Modest

Harvard Business School

Research Assistant to Professor Richard Meyer, 1984

Research Assistant to Professor Regina Herzlinger, 1985

California Institute of Technology

Summer Undergraduate Research Fellow, 1979 and 1980

Research Assistant to Professor Charles Plott 1979-1981

Boards

Edga Exchange Inc. (DirectEdge) Board of Directors

Member 2010-2014

Edgx Exchange Inc. (Direct Edge) Board of Directors

Member 2010-2014

Quadrisev Academic Advisory Council

Member 2009 -

Nasdaq Economic Advisory Board

Member – 1998-2001

Chair 2000-2001

Nasdaq OTC Bulletin Board Advisory Committee

Member, 2001 – 2004

National Service

Federal Reserve Faster Payments Task Force

Member, 2015-

Journal Articles

ETF Transaction Costs Are Often Higher Than Investors Realize (joint work with Gary Gastineau and Todd Broms), forthcoming, *Journal of Portfolio Management*, 2016.

The Ethics of Payments: Paper, Plastic, or Bitcoin (joint work with Douglas M. McCabe), *Journal of Business Ethics* (A **Financial Times** list publication for ranking business schools) 132:3, 2015, 603-611.

Equity Trading in the 21st Century: An Update (joint work with Chester Spatt and Larry Harris), *Quarterly Journal of Finance* 5:1, 2015

When Finance Meets Physics: The Impact of the Speed of Light on Financial Markets and Their Regulation, *The Financial Review* 49, 2014, 271–281.

Ethical Standards for Stockbrokers: Fiduciary or Suitability? (joint work with Douglas M. McCabe), *Journal of Business Ethics* (A **Financial Times** list publication for ranking business schools) 115, 2013, 183-193.

Fairness in Financial Markets: The Case of High Frequency Trading, (joint work with Douglas M. McCabe), *Journal of Business Ethics* (A **Financial Times** list publication for ranking business schools) 112(4), 2013, 585-595.

Equity Trading in the 21st Century (joint work with Chester Spatt and Larry Harris), lead article in the first issue of the *Quarterly Journal of Finance* 1, 2011, 1-53.

The Ethics of Speculation, (joint work with Douglas M. McCabe), *Journal of Business Ethics* (A **Financial Times** list publication for ranking business schools) 90(3,) 2010 (Winner of

the Primeaux Prize for the Best Paper at the Fifteenth Annual International Conference Promoting Business Ethics, New York, 2008)

In Praise of Mark to Management: The Need for Three-Dimensional Accounting, *Journal of Law, Economics, and Policy* 6, 2010 153

Short-Selling and the Weekend Effect in NASDAQ Stock Returns, (joint work with Stephen E. Christophe and Michael G. Ferri, *Financial Review*, 2009, 44 1, 31-57. (Selected as one of the two outstanding publications in *Financial Review* in 2009.)

The Business Ethics of Short Selling and Naked Short Selling, (joint work with Douglas M. McCabe), *Journal of Business Ethics* (**A *Financial Times* list publication for ranking business schools**) 85(1) 2009

The Ethics of Managerial Compensation: The Case of Executive Stock Options (joint work with Douglas M. McCabe), *Journal of Business Ethics* (**A *Financial Times* list publication for ranking business schools**) 78(1-2), 2007, 225-235.

Should Owners of NASDAQ Stocks Fear Short-Selling? (joint work with Stephen E. Christophe and Michael G. Ferri) Christophe, (2007) *Journal of Portfolio Management*, Winter 2007.

Short Selling Prior to Earnings Announcements (joint work with Stephen E. Christophe, and Michael G. Ferri), *Journal of Finance* (**A *Financial Times* list publication for ranking business schools**) 59 (4), August 2004.

When-Issued Shares, Small Trades, and the Variance of Returns Around Stock Splits (joint work with Raymond M. Brooks and Prem G. Mathew), *Journal of Financial Research* 27(3), Fall 2004.

A Close Look at Short Selling on the Nasdaq Market, (joint work with Stephen E. Christophe, and Michael G. Ferri), *Financial Analysts Journal* 59 (6) November/December, 2003.

Discussion of “Stock Exchange Governance and Market Quality” *Journal of Banking and Finance* 27, 1879- 1881, 2003.

Market-Adjusted Options for Executive Compensation, (joint work with Douglas McCabe) *Global Business and Economic Review* 4 (1), 1-23, 2002.

The Rise and Fall of the AMEX Emerging Companies Marketplace (joint work with Reena Aggarwal), *Journal of Financial Economics* (**A *Financial Times* list publication for ranking business schools**) 52(2), 257-289, 1999.

Nonstandard Settlement Transactions, *Financial Management* 27(1), 31-46, Spring 1998.

Tick Size, Share Prices, and Stock Splits, *Journal of Finance* (A **Financial Times** list publication for ranking business schools) 52, 655-681, June 1997. (Abstracted in *Contemporary Finance Digest* 2 (1), 67-68, Spring 1998.)

Picking Your Tick: Toward a New Theory of Stock Splits, *Journal of Applied Corporate Finance* 10(3), 59 - 68, Fall 1997.

Does Ethical Investing Impose a Cost upon the Firm? A Theoretical Perspective (joint work with Pietra Rivoli), *Journal of Investing* 6 (4), 57-61, Winter 1997.

A New Trade Implementation and Portfolio Management Tool for Institutional Investors: Exchange-Traded Stock Options, *Derivatives Quarterly* 4(2), 26-35, Winter 1997. (Excerpted in *CFA Digest*, 36-37, Summer 1998.)

Reducing the Market Impact of Large Stock Trades (joint work with Gary L. Gastineau and Clifford J. Weber), *Journal of Portfolio Management* 24 (1), 69-76, Fall 1997.

Using Exchange-Traded Equity FLEX Put Options in Corporate Stock Repurchase Programs (joint work with Gary L. Gastineau and Clifford J. Weber), *Journal of Applied Corporate Finance* 10 (1), 109-114, Spring 1997.

The Value of the Stock Voting Right: Evidence from the Swiss Equity Market (joint work with Roger Kunz), *Financial Management* 25(3), 7-20, Autumn 1996. (Lead article)

Comparison of Two Low-Cost S&P 500 Index Funds, *Derivatives Quarterly* 2 (3), 32-38, (joint work with Don M. Chance, Jack Clark Francis, and Gary L. Gastineau) Spring 1996.

The Broker Game, *Financial Practice and Education* 4 (1), 61-66, Spring/Summer 1994.

Implications of Chaos Theory for Portfolio Management, *Journal of Investing* 3 (2), 30-35, Summer 1994.

The Municipal Bond Insurance Riddle, *Financier* 1 (1), 48-63 February 1994.

Patents

Methods and systems for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 8,775,298, issued July 8, 2014

Methods and systems for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 8,266,045, issued September 11, 2012

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 8,041,628, issued October 18, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 8,040,138, issued August 30, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,917,425, issued March 29, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,908,206, issued March 15, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,908,205, issued March 15, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,877,318 issued January 25, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,865,425 issued January 4, 2011

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,814,000, issued October 12, 2010

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,428,506, issued September 23, 2008

Method for directing and executing certified trading interests, (co-invented with Henri Waelbroeck, Fred J. Federspiel), U.S. Patent Number 7,356,500, issued April 8, 2008

Book Chapters

How We Got Here, *Current Perspectives on Modern Equity Markets: A Collection of Essays by Financial Industry Experts*, published by Knight Capital Group, 2010.

Does Ethical Investing Impose a Cost upon the Firm? A Theoretical Perspective (joint work with Pietra Rivoli), *The Investment Research Guide to Socially Responsible Investing*, Brian R. Bruce Editor, Published by The Colloquium on Socially Responsible Investing, 1998. Distributed through Investment Research Forums, Plano TX.

Flexible Friends (joint work with Gary L. Gastineau and Clifford J. Weber). *Breaking Down the Barriers*, Risk Publications.

Selected Other Publications

Where Bitcoin boosters are getting it wrong. CNET News, January 23, 2014, http://news.cnet.com/8301-11386_3-57617636-76/where-bitcoin-boosters-are-getting-it-wrong/

Don't get bitten by Bitcoins, CNN.com, April 12, 2013, <http://www.cnn.com/2013/04/11/opinion/angel-bitcoin-currency/>

Walk, don't run, to money market reform, *Washington Times*, August 23, 2012.

Impact of special relativity on securities regulation, United Kingdom Foresight Project: The future of computer trading in financial markets, 2011

Flexible Friends (joint work with Gary L. Gastineau and Clifford J. Weber), *Risk*, October 1997, Volume 10 (10).

Looking Back At Our Debt Defaults, *Chicago Tribune*, February 1, 1996

An Investor's Guide to Placing Stock Orders, *American Association of Individual Investors Journal*, April 1993

Center for Nutritional Research, Harvard Business School Case 0-185-145 with Joyce Lallman, 1985

Comment Letters on Regulator Filings

Date	Topic	URL
3/28/2016	Use of derivatives by investment companies	https://www.sec.gov/comments/s7-24-15/s72415-170.pdf https://www.sec.gov/comments/sr-nysearca-2015-104/nysearca2015102.pdf
12/5/2015	Trade reports for ETPs	2.pdf
12/5/2015	Short interest reporting by large institutions	https://www.sec.gov/comments/4-689/4689-2.pdf
12/5/2015	IEX Exchange application	https://www.sec.gov/comments/10-222/10222-35.pdf
8/17/2015	Concept Release on ETPs	https://www.sec.gov/comments/s7-11-15/s71115-29.pdf
12/22/2014	Tick size pilot	https://www.sec.gov/comments/4-657/4657-86.pdf
7/1/2014	Crowdfunding	https://www.sec.gov/comments/s7-09-13/s70913-323.pdf
6/20/2014	JOBS Act	http://www.sec.gov/comments/jobs-title-v/jobstitlev-16.pdf
5/7/2014	W2007 Grace	https://www.sec.gov/comments/81-939/81939-41.pdf
2/5/2014	Crowdfunding	https://www.sec.gov/comments/s7-09-13/s70913-268.pdf
1/13/2014	Impact of speed of light on securities regulation	https://www.sec.gov/comments/s7-02-10/s70210-410.pdf
11/22/2013	Pay ratio disclosure	https://www.sec.gov/comments/s7-07-13/s70713-347.pdf
11/5/2013	Comments on OFR Study on Asset Management Industry	https://www.sec.gov/comments/am-1/am1-27.pdf
9/17/2013	Money market fund reform	http://www.sec.gov/comments/s7-03-13/s70313-228.pdf
9/3/2013	W2007 Grace	https://www.sec.gov/comments/81-939/81939-38.pdf
9/3/2013	Lessons learned from Nasdaq glitch	https://www.sec.gov/comments/s7-01-13/s70113-64.pdf
9/3/2013	W2007 Grace	https://www.sec.gov/comments/81-939/81939-38.pdf
7/22/2013	W2007 Grace	https://www.sec.gov/comments/81-939/81939-36.pdf
6/3/2013	Regulation SCI	http://www.sec.gov/comments/s7-01-13/s70113-24.pdf
6/3/2013	W2007 Grace	http://www.sec.gov/comments/81-939/81939-26.pdf
5/14/2013	NYSE Rule 104	https://www.sec.gov/comments/sr-nyse-2013-21/nyse201321-2.pdf
3/22/2013	Political spending	https://www.sec.gov/comments/4-637/4637-1589.pdf
2/6/2013	Money market fund reform	https://www.sec.gov/comments/mms-response/mmsresponse-27.pdf
9/5/2012	Market technology and stability	https://www.sec.gov/comments/4-652/4652-5.pdf
8/23/2012	Limitations on SRO Liability	https://www.sec.gov/comments/sr-nasdaq-2012-090/nasdaq2012090-1.pdf https://www.sec.gov/comments/jobs-title-i/tick-size-study/tick-size-study-1.pdf
8/19/2012	JOBS Act tick size	1.pdf

8/16/2012	Nasdaq benchmark orders	https://www.sec.gov/comments/sr-nasdaq-2012-059/nasdaq2012059-1
6/8/2012	Scaling disclosure for smaller companies	https://www.sec.gov/news/otherwebcasts/2012/angel_060812.pdf
3/5/2012	NYSE trading floor rules	http://www.sec.gov/comments/sr-nyse-2011-56/nyse201156-5.pdf
11/28/2011	NYSE Dark Pool proposal	https://www.sec.gov/comments/sr-nyse-2011-55/nyse201155-13.pdf
8/26/2011	Broker-dealer reports	https://www.sec.gov/comments/s7-23-11/s72311-17.pdf
8/25/2011	Market-wide circuit breakers	https://www.sec.gov/comments/sr-bats-2011-038/bats2011038-2.pdf
6/24/2011	Limit-up Limit-Down Fairness in Financial Markets	https://www.sec.gov/comments/4-631/4631-14.pdf
1/16/2011		https://www.sec.gov/comments/s7-02-10/s70210-316.pdf
1/14/2011	BX Venture Exchange	https://www.sec.gov/comments/sr-bx-2010-059/bx2010059-5.pdf
10/20/2010	Proxy voting	https://www.sec.gov/comments/s7-14-10/s71410-210.pdf
9/21/2010	Crowdfunding	https://www.sec.gov/comments/4-605/4605-33.pdf
8/24/2010	Comments on Proxy Voting Concept Release	https://www.sec.gov/comments/s7-14-10/s71410-228.pdf
8/24/2010	Ethical obligations of broker-dealers	https://www.sec.gov/comments/4-606/4606-2822.pdf
8/9/2010	Consolidated Audit Trail (CAT)	https://www.sec.gov/comments/s7-11-10/s71110-51.pdf
6/19/2010	Circuit breakers imposed after Flash Crash	https://www.sec.gov/comments/sr-bats-2010-018/bats2010018-13.pdf
5/11/2010	Flash Crash Warnings	https://www.sec.gov/comments/s7-02-10/s70210-181.pdf
4/30/2010	Equity Market Concept Release	https://www.sec.gov/comments/s7-02-10/s70210-172.pdf
12/18/2009	OTC Quote Proposal from FINRA	https://www.sec.gov/comments/sr-finra-2009-077/finra2009077-5.pdf
9/21/2009	Regulation SHO short sale restriction	https://www.sec.gov/comments/s7-08-09/s70809-4658.pdf
9/20/2009	Securities Lending Round Table	https://www.sec.gov/comments/4-590/4590-37.pdf
5/5/2009	Roundtable on Short Selling	https://www.sec.gov/comments/4-581/4581-2.pdf
12/17/2008	Reg 204T and settlement failures	http://www.sec.gov/comments/s7-30-08/s73008-54.pdf
8/11/2008	Reg SHO, market maker exemption	http://www.sec.gov/comments/s7-19-07/s71907-1306.pdf
8/4/2008	XBRL	https://www.sec.gov/comments/s7-11-08/s71108-87.pdf
7/1/2008	Financial responsibilities of broker dealers	https://www.sec.gov/comments/s7-08-07/s70807-29.pdf
5/17/2008	Naked short selling	http://www.sec.gov/comments/s7-08-08/s70808-401.pdf

5/16/2008	ETF Issuance rules Privacy of consumer	http://www.sec.gov/comments/s7-07-08/s70708-6.pdf
5/15/2008	financial information	https://www.sec.gov/comments/s7-06-08/s70608-94.pdf
2/13/2008	Ticker symbols Regulation SHO market	https://www.sec.gov/comments/4-534/4534-50.pdf
9/10/2007	maker exception Stock exchange ticker	https://www.sec.gov/comments/s7-19-07/s71907-117.pdf
8/16/2007	symbol allocation plan reporting requirements for smaller reporting	https://www.sec.gov/comments/4-533/4533-42.pdf
7/15/2007	companies	https://www.sec.gov/comments/s7-15-07/s71507-11.pdf
5/24/2007	Nasdaq Portal Proposal Rule changes for securities futures	https://www.sec.gov/comments/sr-nasdaq-2006-065/nasdaq2006065-1
4/29/2007	exchanges Internal controls over	https://www.sec.gov/comments/s7-06-07/s70607-2.pdf
2/26/2007	financial reporting	https://www.sec.gov/comments/s7-24-06/s72406-188.pdf
2/14/2007	Rule 105 short sales Regulation SHO on	https://www.sec.gov/comments/s7-20-06/s72006-7.pdf
2/14/2007	short sales	https://www.sec.gov/comments/s7-21-06/s72106-35.pdf
7/18/2006	Regulation SHO	https://www.sec.gov/comments/s7-12-06/s71206-266.pdf
12/5/2005	Late filers	https://www.sec.gov/rules/sro/nyse/nyse200575/jjangel4858.pdf
12/5/2005	Regulation NMS	https://www.sec.gov/rules/proposed/s71004/jjangel012505.pdf
7/5/2005	Proxy voting fees Companies that do not	https://www.sec.gov/comments/sr-nyse-2013-07/nyse201307-43.pdf
1/25/2005	file in a timely manner	https://www.sec.gov/rules/sro/nyse/nyse200449/jjangel012605.pdf
8/16/2004	W2007 Grace Securities transactions	https://www.sec.gov/comments/81-939/81939-43.pdf
8/9/2004	settlement	http://www.sec.gov/rules/concept/s71304/jjangel04092004.pdf
6/30/2004	Regulation NMS	https://www.sec.gov/rules/proposed/s71004/jangel063004.pdf
5/19/2004	Regulation NMS	https://www.sec.gov/rules/proposed/s71004/jjangel051904.pdf
1/3/2004	Regulation SHO Concept release on	https://www.sec.gov/rules/proposed/s72303/jjangel011004.htm
10/2/1997	regulation of exchanges	http://www.sec.gov/rules/concept/s71697/angel1.txt

Working Papers

See Social Science Research Network,
http://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=35974

Dissertation

Order Placement Strategy of Informed Investors: Limit Orders and Market Impact, Winner of the 1991 FMA/AAII Completed Dissertation Grant Award

Selected Recent Presentations

“Recent Developments in Market Structure,” Wharton School of Business, Philadelphia PA, April 12, 2016

“Regulation and Research,” Moderator for session with SEC Commissioner Michael Piwowar and CFTC Commissioner Christopher Giancarlo, Eastern Finance Association, Baltimore MD, April 7, 2016

“Recent Developments in Market Structure,” Harvard Law School, Cambridge MA, April 6, 2016

“ETF Transactions Costs are Higher than You Think,” Investment Revolution Conference, Georgetown University, Washington DC, April 5, 2016.

“Disruptive Financial Technology,” Defense Advanced Research Projects Agency (DARPA), Arlington VA, March 14, 2016

“Capital Markets: Access and Volatility”, 2015 Harvard China Symposium on Building the Financial System of the Twenty-First Century: An Agenda for China and the United States Armonk, NY, September 19, 2015

Discussion of “Shades of Darkness” at Financial Intermediation Research Society (FIRS), Reykjavik, Iceland, May 25, 2015

“The U.S. Crisis in Capital Formation,” presented at Examining the Role of Capital Markets in the Economy, Brookings Institution, Washington DC, April 29, 2015,

“Market Fragility and Market Microstructure: The U.S. Experience” Cambridge INET Microstructure Theory and Application Workshop, University of Cambridge, Cambridge, United Kingdom, March 12, 2015

Congressional Testimony

1997, United States Congress, House Commerce Committee Subcommittee on Finance and Hazardous Materials, April 16, 1997, testimony on HR 1053, The Common Cents Stock Pricing Act of 1997.

2008, United States Congress, Senate Committee on Homeland Security and Governmental Affairs, June 24, 2008, Ending Excessive Speculation in Commodity Markets: Legislative Options, testimony

2010, United States Congress, Senate Subcommittee on Securities, Insurance, and Investment and the Senate Permanent Subcommittee on Investigations, December 8, 2010, “Examining the Efficiency, Stability, and Integrity of the U.S. Capital Markets”

2011, United States Congress, House Financial Services Committee, Oversight and Investigations Subcommittee, March 30, 2011, “The Costs of Implementing the Dodd-Frank Act: Budgetary and Economic”

2013, United States Congress, House Committee on Small Business, April 11, 2013, “JOBS Act Implementation”

2014, United States Congress, U.S. Senate Committee on Banking, Housing, and Urban Affairs, July 8, 2014, The Role of Regulation in Shaping Equity Market Structure and Electronic Trading.

Other Sworn Testimony and Expert Witness Experience

2002, Goel v. Goel, sworn testimony in divorce case on value of insurance residuals

2004, United States v. Jeffrey R. Anderson, District Court for Eastern Virginia, Criminal No. 1:03-CR-444, expert report.

2004, Yorkville Advisors Management, LLC v. The Charter Oak Fire Insurance Company, expert report and deposition.

2005, NASD Arbitration No. 02-04697, Louis Barinaga, testimony.

2010, FINRA Arbitration No. 08-03711, Hendricks Automotive Group, testimony

2011, Keife et al. v. Metropolitan Life Insurance Company, expert report. Case No 3:10-cv00546-LRH-VPC

2012, Board of Trustees for the AFTRA Pension Fund et al. v. JP Morgan Chase NA, Civil Action Number 09-00686, rebuttal report in class certification

2012, Diebold et. al. v. Northern Trust, Case No. 09-cv-1934 (N.D. Ill.), rebuttal report in class certification and deposition.

2012, Comcast Corporation and Subsidiaries v. Commissioner of the Internal Revenue, Dockets 1660-11 and 2204-11. Expert and rebuttal reports.

2015, Owens v. Metropolitan Life Insurance Company, Case No . 2:14-CV-0074-RWS, expert report and deposition.

2015, Louisiana Firefighters' Retirement System et al. v. Northern Trust Investments, N.A., et al. Case No. 09-7203, expert and rebuttal reports in class certification and deposition.

Honors and Awards

Columbia University

Fellow, Law and Economics of Capital Markets Program, 2008-

Fifteenth Annual International Conference Promoting Business Ethics

Primeaux Prize for the Best Paper a(joint with Douglas McCabe), New York, 2008

The Nasdaq Stock Market, Inc.

Chair, Economic Advisory Board, 2000-2001

Association of Investment Management and Research

Chartered Financial Analyst, 2001

National Association of Securities Dealers

Visiting Academic Fellow 1999-2000

Georgetown University

Beta Gamma Sigma, Honorary Faculty Initiate, 1997

School of Business Summer Research Grants 1992, 1993, 1994, 1995, 1996, 1997

Executive Education Teaching Award, 2000

U.C. Berkeley

FMA/AIIE Completed Dissertation Grant Award

Outstanding Graduate Student Instructor, 1988

Dean Witter Fellowship

University Fellowship

Harvard Business School:

Second Year Honors

Caltech

Graduation with Honors

National Merit Scholar

Don Shepherd Award
Varsity Football Letterman
Sophomore Class President

Marquis Who's Who in America

Courses Taught at Wharton

Capital Markets

Courses Taught at Georgetown University

Undergraduate

Business Financial Management
Advanced Financial Management
Principles of Investments
Great Books in Finance

MBA

Financial Management
Finance I
Finance II
Regulation in Financial Markets
Financial Crises: Past, Present, and Future
Financial Markets
Corporate Finance

MS Finance

Investments and Fixed Income Securities

Global Executive MBA

Complex Financial Instruments and Derivatives
World Equity Markets
International Finance
New York Residency

Other Executive Programs

International Financial Environment
International Risk Management
Fixed Income

Custom Executive Programs

World Bank
GXS

Gucci
ISMA
ICBC

Ph.D. Committees

Chul Park, *Three Essays in Empirical Financial Economics*, Georgetown University, 1999

Bernard McSherry, *A Private Sector Response to Rising Systematic Risk: The Formation of the New York Stock Exchange Clearing House in 1892*, Pace University, 2012

Julie Schoening, *Empirical Evidence of Knightian Uncertainty in Equity Markets*, Georgetown University, 2016

University Service

Main Campus Core Curriculum Committee
MSB Appeals Board 2006-2012, 2014-
Chair, Faculty Library Advisory Committee, 2007-2012
MSB Graduate Curriculum Committee 2003- 2006
Georgetown University Library Committee 2003 - 2012
Georgetown University Honor Council Investigating Officer 2001 – 2003, 2014-
Georgetown University Faculty Senate 1998 - 1999
Georgetown University Academic Excellence Task Force on Financial Management
1998
Georgetown University Executive Faculty Steering Committee, 1997 - 1999
Coordinator of Summer Research in Progress Seminar Series, 1992-1998
Chair, Faculty Computer Advisory Committee, 1996-1997
Benefits Advisory Committee, 1995-2004
Faculty Advisor, Georgetown University Student Investment Fund, 1995-
Faculty Advisor, Financial Management Association 1993-1996
MSB Undergraduate Finance Field Advisor 1993-1999
MSB Technology and Enhancements to Classroom Committee 1993-1994
MSB Freshman Admissions Committee 1993-1994
MSB Faculty Computer Advisory Committee, 1992-1993, 1994-5
Student member of the U.C. Berkeley Economics Department External Review
Committee, 1988
Student member of U.C. Berkeley Faculty Graduate Council, 1988-1990
Graduate Assembly Representative, 1987-1990

Professional Service

Financial Management Association Electronic Publishing Committee Chair, 1998-
2001

Memberships

American Economic Association
American Finance Association
Eastern Finance Association
Financial Management Association
National Association of the Deaf
Society for Financial Studies
Western Finance Association

Referee Activities

Economic Inquiry
Financial Management
Financial Practice and Education
Financial Services Review
Journal of Banking and Finance
Journal of Economics and Business
Journal of Finance
Journal of Financial Markets
Journal of Financial Services Research
Journal of International Money and Finance
Management Science
Review of Financial Studies