THE RISE OF COMPUTERIZED HIGH FREQUENCY TRADING: USE AND CONTROVERSY

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ABSTRACT

Over the last decade, there has been a dramatic shift in how securities are traded in the capital markets. Utilizing supercomputers and complex algorithms that pick up on breaking news, company/stock/economic information and price and volume movements, many institutions now make trades in a matter of microseconds, through a practice known as high frequency trading. Today, high frequency traders have virtually phased out the "dinosaur" floor-traders and average investors of the past. With the recent attempted robbery of one of these high frequency trading platforms from Goldman Sachs this past summer, this "rise of the machines" has become front page news, generating vast controversy and discourse over this largely secretive and ultra-lucrative practice. Because of this phenomenon, those of us on Main Street are faced with a variety of questions: What exactly is high frequency trading? How does it work? How long has this been going on for? Should it be banned or curtailed? What is the end-game, and how will this shape the future of securities trading and its regulation? This iBrief explores the answers to these questions.

INTRODUCTION

¶1 In today's highly electronic age, virtually everything in society—including communications, music, television, and financial transactions—have gone digital. Today, many trades on the stock markets[2] are carried out

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[2] There are three types of stock markets in the United States. First, the traditional exchanges such as the New York Stock Exchange (NYSE), where most of the action takes place on a trading floor where brokers and dealers meet face to face. Second, markets such as the NASDAQ, where traders are physically dispersed and dealers' offers to buy and sell are displayed and executed on computer screens. Third, the alternative trading systems (ATSs), which are computers that match customer orders to buy and sell without the intermediation of a dealer. *See* CONGRESSIONAL RESEARCH SERVICE, THE TRADE-THROUGH RULE (June 6,

via complex automated computer programs. These programs are constantly evolving, with faster computers and programs being developed every few weeks. Virtually gone are the days when nearly all securities were traded across the vast floors of stock exchanges by men yelling and wearing bright checkered jackets in order to stand out amongst the crowd. Instead, the majority of trades are now dominated by traders utilizing powerful computer algorithms in a practice known as high frequency trading (HFT).[3] Many stock trades now originate with fully automated "high frequency" funds, "a phenomenon that has accelerated during the market turbulence of recent years because of the relative success of the strategy."[4] These supercomputers allow such firms to make trades in a matter of microseconds and to shell out thousands of trades before a normal person could even blink their eyes. While advocates of these trading platforms claim they are adding liquidity[5] into the market or "making [the] financial markets more efficient,"[6] critics believe this practice is unethical and "destroying [America's] capital market structure."[7]

¶2 At its essence, high frequency (HF), or algorithmic trading, is computer determined trading; the algorithm makes important decisions such as timing, price, or in many cases, executing the entire order without human interaction.[8] HF trading is widely used by pension funds, mutual funds, and other investor driven institutional traders to divide large trades into several smaller trades in order to manage market impact and risk. These

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2005), *available at* https://www.policyarchive.org/bitstream/handle/10207/3939/RS21871_20050606.pdf?sequence=1 (describing the differences between the stock exchanges and issues related to trading across them).

[3] Michael Mackenzie, *High Frequency Trading Dominates the Debate*, FIN. TIMES, Oct. 20, 2009, at 3, *available at* http://www.ft.com/cms/s/0/fa347c26-bc41-11de-9426-00144feab49a.html.

[4] Rob Curran & Geoffrey Rogow, *Rise of the (Market) Machines*, WALL ST. J. MARKETBEAT BLOG (June 19, 2009, 12:29PM), http://blogs.wsj.com/marketbeat/2009/06/19/rise-of-the-market-machines/.

[5] Market liquidity is an asset's ability to be sold without causing significant movement in the price and with minimum loss of value. Liquidity is characterized by a high level of trading activity.

[6] Liz Moyer & Emily Lambert, *Wall Street's New Masters*, FORBES, Sept. 21, 2009, at 40–46, *available at* http://www.forbes.com/forbes/2009/0921/revolutionaries-stocks-getco-new-masters-of-wall-street.html.

[7] *See id.* (quoting NASDAQ's Robert Greifeld's call to ban flash trades and regulate high frequency trading).

[8] *See Algorithmic Trading*, AUTOMATED TRADER, *http://www.automatedtrader.net/glossary/algorithmic+trading* (last visited Mar. 26, 2010) (broadly defining algorithmic trading, its uses and objectives and the key players utilizing these trades).

supercomputers and algorithms look for signals – such as the movement of interest rates, miniscule economic fluctuations, news and other subtleties – to take advantage of these indications before anyone else in the market is even aware of them. The computer systems being used in the markets today can break down large orders into extremely small slices and "execute them across different trading venues at close to the speed of light."[9]

¶3 The main objective of high frequency trading "involves minimizing risk and posting small deal sizes that enable [HF traders] to move in and out of trades extremely quickly, arbitraging between spreads available on different exchanges and platforms, and even between the speed of trading available on them."[10] There are many forms of HFT. Some HF traders are known as market makers and trade on signals to make markets by providing securities on each side of a buy and sell order.[11] Other HF traders utilize algorithms to try to speculate where the markets are going to move in the short-term.[12] Regardless of the strategy these high frequency traders utilize, they all attempt to do the same thing: Make vast profits by being smarter and faster than everyone else.

¶4 In the last five years, there has been a major surge in the amount of trading carried out by high frequency traders. According to Boston-based consulting firm Aite Group LLC, it has been estimated that a third of all European and US stock trades in 2006 were driven by automatic programs.[13] Today, high frequency firms, "which represent approximately 2% of the 20,000 or so trading firms operating in the U.S. markets . . ., account for 73% of all U.S. equity trading volume."[14] According to Matthew Rothman, an analyst from Barclays Capital, "five years ago, less than one-quarter of U.S. stock-trading volume was generated by 'high-frequency' traders, and few considered the funds more than a niche strategy. [However,] the niche's role now overshadows that of mainstream brokers, mutual funds and hedge funds."[15] The dramatic increase in HFT is most likely due to its profitability. Despite the economic recession, high-frequency trading has been considered by many to be the biggest "cash

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[9] *See* Mackenzie, *supra* note 3.
[10] *Id.*
[11] Scott Patterson & Geoffrey Rogow, *What's Behind High-Frequency Trading*, WALL ST. J., Aug. 1, 2009, http://online.wsj.com/article/SB124908601669298293.html.
[12] *See, e.g.*, *id.*
[13] Rob Iati, *The Real Story of Software Trading Espionage,* ADVANCED TRADING, July 10, 2009, *available at* http://advancedtrading.com/algorithms/showArticle.jhtml?articleID=218401501.
[14] *Id.*
[15] *See* Curran & Rogow, *supra* note 4.

cow" on Wall Street and it is estimated that it generates approximately $15-$25 billion in revenue.[16]

¶5 Part I of this iBrief explores the history and development of high frequency trading to its current stance of prominence in today's markets. More specifically, it describes how trading orders on the various exchanges and markets began becoming computerized and how the different regulations that were put into place set the stage for the algorithmic trading revolution. Part II then delves into the current uses of high frequency trading by various institutional investors and HFT firms. This section provides an in-depth description and analysis of the market components that allow HFT to function, as well as a brief overview of the types of HFT strategies in use. Lastly, Part III gives an analysis of the controversy and legality of the various HFT strategies, their proposed regulation, and the benefits and harms of HFT on the marketplace and America's capital structure.

I. HISTORY AND DEVELOPMENT OF HIGH FREQUENCY TRADING

¶6 While computerized trading has only recently gained widespread notoriety, it is not new. Computerization of the order flow in financial markets began in the mid 1970's with the introduction of the New York Stock Exchange's "designated order turnaround" system (DOT) in 1976, and later Super-DOT in 1984.[17] DOT and later Super-DOT allowed the transmission of orders to buy and sell securities to the proper trading post electronically. These orders appeared on a special electronic workstation called the "display book," which permitted each specialist firm to execute orders for the market.[18]

¶7 Before this, "financial information was disseminated slowly, usually by ticker tape, and telephonic communication was expensive."[19] In the previous era of floor-based trading, buyers and sellers stood literally next to one another, "allowing for the expeditious identification of

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[16] *See* Tyler Durden, *Goldman's $4 Billion High Frequency Trading Wildcard*, ZEROHEDGE, http://zerohedge.blogspot.com/2009/07/goldmans-4-billion-high-frequency.html (Jul. 17, 2009, 2:16AM) (discussing estimates by the FIX Protocol, an organization that maintains a messaging standard for the real-time electronic exchange of securities transactions).

[17] Jerry W. Markham & Daniel J. Harty, *For Whom the Bell Tolls: The Demise of Exchange Trading Floors and the Growth of ECNs,* 33 IOWA J. CORP. L. 865, 897 (2008).

[18] *Id.*

[19] Chris Brummer, *Stock Exchanges and the New Markets for Securities Laws,* 75 U. CHI. L. REV. 1435, 1458 (2008).

counterparties."[20] However, once exchanges started implementing computerized communication, buy and sell orders could be executed much faster; traders could be connected to a trading platform rather than being physically present on trading floors.

¶8 Additionally, in 1971, NASDAQ became the world's first electronic stock market and allowed dealers to compete in the provision of quotes for securities. NASDAQ did not employ a specialist auction system and instead employed competing market makers in an electronic quotation system.[21] "By 1992, NASDAQ volume was accounting for some 42% total share volume on all U.S. markets."[22]

¶9 The era of floor-based trading drew to a close in the 1980s with the advent of fully electronic financial markets and a trading strategy called program trading. Still in use today, program trading is loosely defined by the NYSE as the placing of orders to buy or sell 15 or more stocks valued at over $1 million total.[23] This practice became widely used in the 80s in trading between the S&P 500 equity and futures markets. With the aid of computers, program traders could buy or sell stock index futures contracts, such as the S&P 500 futures, and sell or buy a portfolio of up to 500 stocks at the New York Stock Exchange (NYSE) matched against the futures trade. This program trade could be pre-programmed into a computer to enter the order automatically into the NYSE's electronic order routing system at a time when the futures price and the stock index were far enough apart to make a profit.[24] This practice, known as stock index arbitrage, was later blamed by some as leading to the 1987 stock market crash.[25]

¶10 While computerized trading in the 70's and 80's was dominated by trading on the NASDAQ and NYSE, the game changed in the late 1990's with the emergence of other electronic trading venues known as electronic communications networks (ECNs). An electronic communication network is a type of computer system that facilitates trading of financial products, such as stock and currencies, outside of the traditional stock exchanges.[26]

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[20] *Id.*
[21] Markham & Harty, *supra* note 17, at 899.
[22] *Id.*
[23] Dean Furbush, *Program Trading*, CONCISE ENCYCLOPEDIA OF ECONOMICS, http://www.econlib.org/library/Enc1/ProgramTrading.html (last visited Mar. 26, 2010) (providing a detailed overview of the types of program trading and the history of its use).
[24] *See id.* (detailing the practice of stock index arbitrage and why it is considered to be one of the most controversial forms of program trading).
[25] *See* Moyer & Lambert, *supra* note 6.
[26] *See* LAUREN LIEBENBERG, THE ELECTRONIC FINANCIAL MARKETS OF THE FUTURE, AND SURVIVAL STRATEGIES OF THE BROKER-DEALERS, 73–75 (2002) (providing an introduction to ECNs and how they work).

ECNs became very popular in the late 90's after the U.S. Securities and Exchange Commission (SEC) authorized their existence with its Regulation Alternative Trading Systems (Reg. ATS).[27] Reg. ATS was pushed through in 1998 by then SEC Chairman Arthur Levitt, who was dissatisfied with the duopoly the NYSE and NASDAQ enjoyed.[28] After Reg. ATS, the emergence of these alternative trading systems made it possible for individual investors to trade after-hours outside of the exchanges, and eventually more computer systems began developing that facilitated the entry and execution of orders electronically by algorithms.[29]

¶11 Individual investors subscribing to ECNs can enter orders electronically into the network via a custom computer terminal, and the ECN will then automatically match and execute contra-side orders.[30] If no match is identified, then an ECN order can be posted externally on NASDAQ as soon as it becomes the best price. This arrangement allows ECNs to "function as a hybrid between a broker for counterparties, a broker-dealer or market-maker, and an exchange, and their gain has been at the expense of NASDAQ."[31] The early ECNs provided many benefits over past trading venues—including the reduction in costs and trading errors, enhancement of operational efficiencies, and other benefits associated with risk management. Eventually, day-trading firms who originally sought greater market access to NASDAQ, as well as brokerage firms, began hustling to set up ECNs; and the growth rate of ECNs has skyrocketed since 1997.[32] The growth of these ECNs in the late 1990's led to the wider use of algorithmic trading and eventually the rise of independent high frequency trading firms.

¶12 Another milestone came in 2001, two years after Reg. ATS, when stock exchanges started quoting stock prices in decimals instead of fractions. This "decimalization" of the exchanges changed the minimum stock tick size from 1/16th of a dollar to $0.01 per share and further encouraged algorithmic trading by ECNs. What this meant was that "overnight the minimum spread a market-maker stood to pocket between a bid and offer was compressed from 6.25 cents…down to a penny."[33] This move decreased a market-maker's trading advantage and led to increased

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[27] 17 C.F.R. § 242.300 (1999).
[28] Moyer & Lambert, *supra* note 6.
[29] *See* Markham & Harty, *supra* note 17, at 902.
[30] *See* LIEBENBERG, *supra* note 26, at 75.
[31] *Id* (emphasis in original).
[32] *See id.* at 78-79 (listing the competitive advantages and economic benefits of ECN's and how they have gained on NASDAQ's market share since their inauguration in 1997).
[33] Moyer & Lambert, *supra* note 6.

liquidity,[34] which in turn eventually led to the current boom in algorithmic trading. In this more liquid market, institutional traders began splitting up orders according to their algorithms to execute trade orders faster and at a better average price.

¶13 The final important development in the history of HFT occurred in 2005, when the SEC pushed through Regulation National Market System (Reg. NMS)[35] Reg. NMS is a series of initiatives promulgated by the SEC which were designed to modernize and strengthen the national equity markets. Through Reg. NMS, the SEC has promoted a national market system, which includes rules such as the Trade Through Rule (Rule 611), the Access Rule (Rule 610), the Sub-Penny Rule (Rule 612) and the Market Data Rules.[36] Before Reg. NMS, brokerages had plenty of wiggle room to match buy and sell orders internally and pocket the spread, or to "send them to exchanges that paid kickbacks for order flow."[37] However, under Reg. NMS, and particularly the updated Trade-Through Rule, it is now decreed "that market orders be posted electronically and immediately executed at the best price nationally."[38] Reg. NMS was the final structural move that set the stage for the current electronic trading revolution.[39] Today, high frequency trading firms such as GETCO and certain hedge funds take advantage of the structural changes implemented by Reg. NMS by "posting continuous two-sided quotes on hundreds of stocks" and even scooping up the price differences that result from momentary lags between exchanges.[40]

II. THE PRACTICE OF HIGH FREQUENCY TRADING TODAY

¶14 Today, equity trading volumes in the US and also in Europe are dominated by high-frequency traders. Most HF trading firms use a variety

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[34] Liquidity is the degree to which an asset or security can be bought or sold in the market without affecting the asset's price. Assets that can easily be bought or sold are known as liquid assets. .

[35] *See* Regulation NMS, Exchange Act Release No. 34-51808, 70 Fed. Reg. 37,496, 37,532 n.300 (2005).

[36] *See, e.g.*, *id.*

[37] Moyer & Lambert, *supra* note 6.

[38] *Id.*; *accord* CRS Report for Congress, *supra* note 2, at 2-4 (stating that the Trade-Through Rule mandates that when a stock is traded in more than one market, transactions may not occur in one market if a better price is offered on another market).

[39] Reg. NMS applies equally to all markets and eliminates the distinction between securities associations, such as NASDAQ, and the exchanges (like NYSE). The new rules mandated an improved system of inter-market linkages be developed, so that all traders have access to all automated quotations across markets, and can avoid trade throughs. *See, e.g.*, CRS Report for Congress, *supra* note 2, at 2–5.

[40] Moyer & Lambert, *supra* note 6.

of practices and strategies to consistently stay ahead of the market and execute trades before anyone else even realizes it. Many of the profit-making devices HF traders employ depend upon important major components which underlie all HF strategies. In this section, a variety of the unique characteristics of HFT and the trading strategies HF traders employ will be analyzed, along with several examples of how these strategies are utilized for profit by today's independent HF firms and institutional investors.

A. Components of high-frequency trading and nature of the markets

¶15 In its simplest form, high frequency trading involves the collection of tiny gains (sometimes measured in fractions of a penny) on short-term market fluctuations. High frequency trading firms hunt for temporary inefficiencies in the market and trade as quickly as possible to make money before the brief distortions go away. Because of this, high frequency trading is characterized by a high turnover in capital and is dependent on a variety of market components that enable traders to turn a profit. The distinguishing characteristics of high frequency trading strategies include a dependence on ultra-low latency, the limited shelf-life of trading algorithms and the reliance on multiple asset classes and exchanges.[41]

¶16 The speed factor in trading is known as "latency", and is an important component of all high-frequency trading strategies. Trading strategies that optimize the value of high frequency algorithmic trading are highly dependent on "ultra-low" latency. Ultra-low latency refers to trading at speeds of less than 1 microsecond. In order to turn a profit, HF traders have to flow information into their algorithms microseconds faster than their competitors. Therefore, to remain competitive, HF traders must constantly upgrade their computer systems to stay ahead of the pack.[42] "To realize any real benefit from implementing [HFT] strategies, a trading firm must have a real-time, collocated, high-frequency trading platform—one where data is collected, and orders are created and routed to execution venues in sub-millisecond times."[43] Many of these trade profits, however, are measured in pennies or even fractions of a penny. To remain sufficiently profitable, HF traders utilize ultra-low latency to execute hundreds of thousands of trades before the average investor even knows what is going on. Because of HFT's reliance on ultra-low latency, the practice has become

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[41] *See* Iati, *supra* note 13 (explaining the various components of high-frequency trading strategies and how high-frequency firms rely on these components to make a profit).
[42] MacKenzie, *supra* note 3.
[43] Iati, *supra* note 13.

a "technological arms race."[44] In the HF trading world, speed and the most innovative technology separate the winners from the losers. The current trend in employee recruiting is to hire traders with degrees in math and computer science from the top schools, many traders even with PhD's, in order to stay competitive.[45] Many of today's high frequency traders are "practical, problem-solving people with an engineering background."[46]

¶17 Taking advantage of ultra-low latency is not an easy task, and the competitive advantage of a high frequency trading algorithm normally dilutes over time. Algorithmic codes tend to have a limited shelf life and must be constantly upgraded to stay ahead of the competition, sometimes every few days.[47] While frequent upgrading was extremely expensive in the past, technological innovation has made this much easier today. Some programs, such as the Apama Algorithmic Trading Platform,[48] "[make] it possible for day traders to build complicated trading algorithms almost as easily as they draw icons across a digital desktop."[49]

¶18 At the micro-level, high-frequency trading strategies are constantly altered for two important reasons.[50] "Firstly, because high frequency trading depends on ridiculously precise interaction of markets and mathematical correlations between securities, traders need to regularly adjust code . . . to reflect the subtle changes in the dynamic market."[51] Today's capital markets are extremely volatile and constantly changing, which means the relationships that form the core of algorithmic trading strategies sometimes change within minutes.

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[44] *See* Charles Duhigg, *Stock Traders Find Speed Pays, in Milliseconds*, N.Y. TIMES, July 24, 2009, at A1, *available at* http://www.nytimes.com/2009/07/24/business/24trading.html (describing the competition for newer and faster technology in the markets that allow traders to execute trades faster than their rivals).

[45] *See* Phil Wahba & Emily Chasan, *Geeks Trump Alpha-males as Algos Dominate Wall St*, REUTERS (Dec. 2, 2009), http://www.reuters.com/article/idUSTRE5B114220091202 (detailing the changing social and technological nature of securities trading on Wall St).

[46] *Id.*

[47] *See* Duhigg, *supra* note 44.

[48] *See, e.g.*, Progress Software, Algorithmic Trading Accelerator, http://web.progress.com/en/apama/algorithmic-trading.html (last visited Jan. 6, 2010) (detailing how this platform functions and allows traders to build their own algorithms).

[49] Charles Duhigg, *Artificial intelligence applied heavily to picking stocks – Business – International Herald Tribune,* N.Y. TIMES, Nov. 23, 2006, http://www.nytimes.com/2006/11/23/business/worldbusiness/23iht-trading.3647885.html [hereinafter *Artificial Intelligence*].

[50] *Id.*

[51] *Id.*

¶19 The second reason that firms must constantly alter their trading strategies is because of reverse engineering by rival firms.[52] "Competitive intelligence is so good across all rival trading firms that each is exposed to the increasing susceptibility of their strategies being reverse engineered, turning their most profitable ideas into their most risky."[53] In order to stay ahead of the competition, firms must constantly alter their algorithms. The best algorithms are worth a fortune; and traders in the HFT business must be aware of attempted theft and reverse engineering. The paradigm case occurred last summer with the attempted theft of a variety of trading strategies from Goldman Sachs. This attempted theft[54] illuminated the possibility that millions of dollars could have been lost if the perpetrators succeeded.

¶20 The last major characteristic of high-frequency trading is its reliance on multiple asset classes and exchanges. "Since many of these strategies require transacting in more than one asset class and across multiple exchanges often located hundreds of miles apart, i.e., NY to Chicago, that infrastructure will often require roundtrip long haul connectivity between data centers."[55] Through a practice called "co-location," some HFT firms deal with this issue by purchasing real estate as close to securities exchanges as possible. "This 'co-location' means a high frequency trading system can access prices a fraction faster than if it were located down the street, let alone another city."[56] Because of the vast benefits of co-location, there has been a recent rush for real estate proximate to the exchanges. Office space in such areas sometimes costs an astronomical amount, but firms are willing to pay for it. For instance, in Chicago, 6 square feet of space in the data center where the exchanges also house their computers can go for $2,000 or more a month.[57] Despite these high prices, the number of firms that co-locate at exchanges such as the NASDAQ has doubled over the last year.[58] Their proximity to the exchanges enables such firms to gain information on orders and market movements more quickly than the market as a whole, which allows them to effectively implement their strategies to make very large profits.

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[52] *Id.*
[53] *Id.*
[54] More detail on this attempted theft is discussed in section III.
[55] Posting by Tyler Durden, *supra* note 16.
[56] Mackenzie, *supra* note 3.
[57] *See* Moyer & Lambert, *supra* note 6 (stating that some trading firms even spend 100 times that much to house their servers).
[58] Sal L. Arnuk & Joseph Saluzzi, *Toxic Equity Trading Order Flow on Wall Street: The Real Force Behind the Explosion in Volume and Volatility,* THEMIS TRADING LLC WHITE PAPER, *available at* http://www.themistrading.com/article_files/0000/0348/Toxic_Equity_Trading_on_Wall_Street_12-17-08.pdf.

¶21 One such HFT firm, Global Electronic Trading Co. (GETCO), is located directly in the same building as the Chicago Mercantile Exchange (CME). Until recently, GETCO was a relatively unknown company and its Web site contained little more than a reading list of investment books.[59] However, according to Moyer & Lambert, GETCO buys and sells 15% of all the stocks traded in the U.S. and was reportedly valued at $1 billion as recently as two years ago.[60] GETCO earns these vast profits by buying and selling securities up to thousands of times a second; its vast profits and proximity to the CME have come under increasing scrutiny in the last 8 months.

B. Different Types of HF Trading Strategies Employed

¶22 HFT firms such as GETCO have developed a variety of complex algorithms that enable them to employ multiple trading strategies with minimal human interaction. Some of the most popular HFT strategies include automated market making, low latency arbitrage, and liquidity rebate trading. Additionally, the practice of issuing "flash orders" to high-frequency traders and the use of certain Alternative Trading Systems (ATSs) by those competing with HF traders have come under increasing scrutiny in recent months. These computerized "neural networks" and "genetic algorithms" permit computers to create new rules and automatically change underlying assumptions about the markets. They then evolve by letting different rules compete, and combining the most successful outcomes.

¶23 Through market making, high-frequency firms try to make money on the difference between the amounts that various investors are willing to buy and sell a stock for. This price differential is known as the "bid-ask spread." To make money off of the spread, market makers will buy and sell securities on both sides of the trade by placing a limit order to sell (or offer) above the current market price or a buy limit order (or bid) below the current price in order to benefit from the bid-ask spread.[61] HF traders do this automatically, by inputting the order limits into their algorithms and letting the computers do the work. Some high-frequency firms also utilize such algorithms to automatically "ping"[62] stocks to identify large reserve book

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[59] Moyer & Lambert, *supra* note 6.
[60] *See id* (describing the mystery that surrounds GETCO and the vast profits that this company makes off of high-frequency trading).
[61] *See* Algorithmic Trading, *supra* note 8.
[62] In "pinging," an automated market maker issues an order ultra fast; and if nothing happens, it cancels the order. If something does happen, then the market maker learns hidden information that it can use to its advantage.

orders by issuing an order very quickly and then withdrawing it.[63] Through this practice, traders obtain information on a large buyer's limit and then they use this to buy shares elsewhere and on-sell them to the institution.[64] Taking advantage of ultra-low latency and co-location, these high-frequency market makers can execute hundreds of thousands of orders in seconds to shave money off of the bid-ask spread. By co-locating their servers in the NASDAQ or the NYSE building next to the exchanges' servers, automated market makers can react much faster than other investors. These automated market makers account for a significant percentage of the volume of trading that takes place on the NASDAQ and NYSE.[65] While some believe market makers keep buy and sell prices close together to the benefit of investors, others scrutinize the practice for its lack of regulation and for the inherent unfairness that can result from co-location.

¶24 Another similar type of trading strategy is called market arbitrage and involves "taking advantage of different rates, prices or conditions between different markets or maturities" and then trying to make money off of the price spreads and inconsistencies in these different markets.[66] For instance, an arbitrager might take advantage of price differentials between markets by buying a stock for a lower price in one market and selling it for the higher price in the other. While these price differentials may only exist for a matter of seconds, high-frequency traders can execute trades on multiple securities and capture the spread before they diminish. The new neural networks that many HFT firms use today can consider thousands of scenarios at once and arbitrage the spreads before anyone else can.[67]

¶25 While arbitraging as a strategy has been around for a while, it has gained much more popularity recently with the use of complex automated algorithms. Stock index arbitrage was utilized heavily in the 1980's by program traders to make money off of the inconsistencies in the NYSE between futures prices and the S&P stock index; it was blamed by some as contributing to the crash in 1987.[68] Today, latency arbitragers use

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[63] Mark Hutchinson, *High Frequency Trading: Wall Street's New Rent-Seeking Trick,* MONEY MORNING, Aug. 14, 2009, http://www.moneymorning.com/2009/08/14/high-frequency-trading/.
[64] *Id.*
[65] *See* Artificial Intelligence, *supra* note 49 (describing that just one such market maker, Automated Trading Desk, a division of Citigroup, alone accounts for about 6% of the total volume on the NASDAQ and NYSE).
[66] *Arbitrage,* FINANCIAL DICTIONARY, *The Language of Money,* http://www.anz.com/edna/dictionary.asp?action=content&content=arbitrage (last visited Jan. 13, 2010).
[67] Hutchinson, *supra* note 63.
[68] *See* Moyer & Lambert, *supra* note 6.

algorithms to create models of great complexity that can involve hundreds of securities in many different markets. This practice is highly lucrative. For instance, the financial markets research and advisory firm TABB Group has estimated that annual aggregate profits of low-latency arbitrage strategies exceed $21 billion, an amount which is spread out among the few hundred firms that deploy them.[69]

¶26 Another strategy called liquidity rebate trading involves taking advantage of the certain "rebates" that some exchanges offer trading firms that are willing to step up and provide shares when needed. Market centers such as the stock exchanges and the ECNs offer these rebates in order to attract trading volume.[70] Such rebates can range from one quarter to a third of a penny.[71] Liquidity rebate traders make a profit by looking for large order flows and then filling a part of a large order, then re-offering the shares at the same price and collecting the exchange fees for providing liquidity to the market.[72] "If the order is filled, the market center pays the broker dealer a rebate and charges a larger amount to the broker dealer who took liquidity away from the market. This has led to trading strategies solely designed to obtain the liquidity rebate."[73] Liquidity rebate trading has been scrutinized because it allows rebate traders to basically trade for free by having their commission costs and exchange fees covered by the exchanges and ECNs.

¶27 Another concept tied to liquidity trading is known as flash trading or issuing flash orders. A flash order is a trade based on access to information for a matter of milliseconds that is not yet public. Flash orders developed due to the competition that exchanges face over the volume of shares posted on their platforms. In order to further encourage trading on their platform, some exchanges, such as the NASDAQ (up until September, 2009), allow firms to get a 30 millisecond peak at orders before they get sent to other markets.[74] The result is that

> a trading firm can keep its order on a certain exchange for up to half a second without matching an existing buy or sell order on another

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[69] *See* Iati, *supra* note 13 (quoting TABB group's estimate).
[70] *See* Arnuk & Saluzzi, *supra* note 58 (providing in-depth analysis of the different types of trading strategies and the potential problems that these strategies cause for the national markets).
[71] *See* Hutchinson, *supra* note 63. (stating that rebate traders take advantage of volume rebates of about 0.25 cents per share offered by exchanges to brokers who post orders); *see also* Patterson & Rogow, *supra* note 11 (stating that these rebates are about one-third a penny a share).
[72] Hutchinson, *supra* note 63.
[73] Arnuk & Saluzzi, *supra* note 57.
[74] *See* Patterson & Rogow, *supra* note 11 (describing flash orders and the reasons why some exchanges allowed them).

> exchange, a move that puts it in a position of poster, rather than responder. The hope is that another trader who needs to buy or sell quickly steps in on the other side of the trade . . . [a] dynamic that boosts the chance the flash-order trader will complete the trade on the exchange and get the rebate.[75]

¶28 Traders who benefit from the use of flash orders are shown the buy and sell orders ahead of everyone else in the marketplace in exchange for a fee. With this very small advance notice of market conditions, high frequency traders can use their super-computers to conduct rapid statistical analysis of the changing market state and trade ahead of the public market.

¶29 The use of flash orders in automated trading was virtually unheard of until last year when financial blogs started criticizing firms such as Goldman Sachs for gaining unfair profits through the practice.[76] Recently, there has been a great deal of controversy over this practice and the SEC has proposed an outright ban on the use of flash orders.[77] The next section will explore the controversy and legal issues surrounding these trading strategies as well as the pros and cons of high frequency trading.

III. CONTROVERSY AND LEGALITY

A. Recent Controversy and Legal Issues

¶30 Because high frequency trading strategies utilize ultralow latency, co-location and expensive technology to seemingly front-run the markets, there has been a great deal of controversy recently over some of the trading strategies employed by HFT firms. Additionally, "unlike registered broker-dealers, many HFT players aren't regulated or committed to the capital requirements for market-making in particular stocks."[78] The major debate over high frequency trading came into the public spotlight with the attempted theft of Goldman Sach's HFT platform last summer and has expanded to criticism over HFT firms like GETCO and the legality of the HFT strategies themselves.[79]

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[75] *Id.*

[76] For an example of one such financial blog containing multiple entries criticizing these practices, see ZeroHedge, http://www.zerohedge.com (last visited Mar. 26, 2010).

[77] The controversy and legality of this practice is discussed in greater detail in Part III of this iBrief.

[78] Scott Powell, *Wall Street's New Race Toward Danger*, BARRON'S, Mar. 8, 2010, http://online.barrons.com/article/SB126783128753256821.html.

[79] *See, e.g.*, Mathew Goldstein, Commentary, *A Goldman trading scandal?*, REUTERS (July 5, 2009, 11:11:00 EST), http://blogs.reuters.com/commentaries/2009/07/05/a-goldman-trading-scandal/

¶31 The use of flash orders and dark pools has been another area of apprehension, and the SEC has already promulgated regulations to curb their use. Lastly, concern has been raised over "naked access," which may leave the markets vulnerable to devastation at the hands of reckless HF traders. Despite these reservations, there is still evidence to suggest that HFT benefits the markets and curbing its use would be to the detriment of all investors.

1. Attempted Theft at Goldman Sachs

¶32 In July 2009, Goldman Sach's proprietary algorithmic trading code was allegedly stolen by a Russian immigrant named Sergey Aleynikov.[80] The platform that Aleynikov tried to steal was the proprietary trading system that Goldman uses in its algorithmic trading of stocks and commodities, a high-frequency trading platform that Aleynikov himself supposedly helped create.[81] Federal authorities claimed the platform contained Goldman's top secret mathematical formulas and algorithms that the company utilizes to generate massive profits.

¶33 Because this theft also coincided with the current U.S. recession, speculation became rampant over this "new" technology. Some in the national media have speculated that such a theft could collapse the economy.[82] Some in the financial press have portrayed Aleykinov as a mass criminal who sought to use this technology to unhinge the fabric of our society; others speculated that such computer programs could derail an entire bank with the push of a button.[83]

¶34 High frequency trading had finally gone public, and it wasn't pretty. In the months that followed, dozens of other news stories discussed the practices of Goldman Sachs, specialized HFT firms, and high frequency trading generally. Since then, various lawmakers, government agencies, and financial executives have battled over the merits and drawbacks of HFT.

2. Current Areas of Controversy

¶35 More recently, the controversy related to high frequency trading has centered on the legality of the strategies themselves; in other words, whether certain practices related to HFT are inherently unfair to the average investor. If so, could these strategies have even possibly lead to the financial

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(detailing the attempted theft of the trading software and its possible implications for Goldman Sachs).

[80] *See id.*

[81] *Id.*

[82] *See* Jonathan Weil, *Goldman Sachs Loses Grip on its Doomsday Machine,* BLOOMBERG, July 9, 2009, http://www.bloomberg.com/apps/news?pid=20601039&sid=aFeyqdzYcizc.

[83] *See, e.g.*, *id.*

crisis? More recent media focus has also centered on the use of "flash orders" and the SEC's proposition of banning them.[84] Another related area gaining criticism is the use of "dark pools" by those attempting to evade high-frequency traders.[85]

¶36 Because of rampant accusations that flash orders favor insiders, some lawmakers have urged the SEC to ban them. Senator Charles Schumer, for instance, sent letters to SEC Chairman Mary Schapiro late last summer demanding changes. Schumer argued that flash orders allow market insiders to utilize "rapid trading platforms to trade ahead of those orders and profit from advanced knowledge of buying and selling activity."[86] Because of this outcry, the NASDAQ OMX stopped offering flash order types on September 1, 2009.[87] Finally, on September 17, 2009, the SEC proposed banning flash orders entirely. The SEC's proposed rule amendment would eliminate the flash order exception from Rule 602 of Reg. NMS under the Securities Act of 1934.[88] Under the proposed rule, the tactic of flashing marketable prices to certain market participants would be banned entirely. Instead, "exchanges and [Alternative Trading Systems] would be required to handle marketable orders that they are unable to execute at the best displayed prices in another manner, such as by routing marketable orders away to execute against the best displayed quotations at another exchange."[89] Playing off of the concerns of lawmakers, the SEC has reasoned that flash orders "no longer serve the interests of long-term

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[84] *See, e.g.*, Edgar Ortega & Eric Martin, *Schumer Asks SEC to Ban Flash Orders Used by High Speed Traders*, BLOOMBERG, July 24, 2009, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=ajcRCWFi5MLs.

[85] A dark pool, also known as a "dark pool of liquidity" is a crossing network that provides liquidity that is not displayed on order books. Dark pools are useful for traders who wish to move large numbers of shares anonymously, without revealing themselves to the open market. For further definition and various articles related to dark pools, see *Dark Pools*, AUTOMATED TRADER, http://www.automatedtrader.net/glossary/Dark+Pools (last visited Mar. 26, 2010).

[86] Ortega, *supra* note 84.

[87] Jacob Bunge & Kevin Kingsbury, *UPDATE: Nasdaq to Stop Offering Flash Order Types on Sep. 1,* DOW JONES NEWSWIRE, Aug. 6, 2009, http://www.nasdaq.com/aspx/stock-market-news-story.aspx?storyid=200908061413dowjonesdjonline000813&title=update-nasdaq-to-stop-offering-flash-order-types-on-sep-1.

[88] Proposed Amendments to Rule 610 of Regulation NMS, 75 Fed. Reg. 20,738, 20,762–63 (Apr. 20, 2010) (to be codified at 17 C.F.R. pt. 242), *available at* http://frwebgate3.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=YbRXEb/8/2/0&WAISaction=retrieve.

[89] Elimination of Flash Order Exception from Rule 602 of Regulation NMS, SEC, Sept. 18, 2009, http://www.sec.gov/rules/proposed/2009/34-60684.pdf [hereinafter *SEC Proposed Rule*].

investors and could detract from the efficiency of the national market system".[90] The SEC believes the wide use of automated high frequency trading on today's exchanges has detracted from the original purpose of flash orders and could create a "two-tiered market."[91]

¶37 While the SEC's proposed rule has not yet gone into effect,[92] there is still much fighting to be done, as options leaders and industry executives speak out against the proposed ban. For instance, options leaders believe that the ban should only apply to the equity industry and have stated that flash orders benefit retail investors by keeping costs lower.[93] These concerns appear warranted, and the SEC should probably take them into account before applying a wide-reaching ban on the practice. Much of the difficulty in regulating such practices occurs because of the wide use of automated trading on both sides (buy and sell sides) of the spectrum and the political issues that have dominated the debate over how to better regulate the financial markets. The SEC is mainly concerned with the possible creation of a two-tiered market system, which favors those with sophisticated computer systems over retail investors. Both the traditional investors and the high frequency traders utilize many of the same exchanges and trading platforms to get deals done. This approach could lead to problems in the future as the exchanges continue to re-calibrate fee structures and technology to attract high frequency traders.[94] Because of the possibility of such measures being implemented, the SEC has begun taking steps to try to solve potential problems related to this bifurcated market structure and what it means for the broader investing public.[95]

¶38 Mirroring the flash order controversy is recent speculation over the use of so-called "dark pools of liquidity" (dark pools). Dark pools are

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[90] *Id.* at 16.

[91] *See id.* at 31–33 (advancing the SEC's concerns that flash orders may create a two-tiered market in which the public does not have access, through the consolidated quotation data streams, to information about the best available prices for listed securities, because the public would not receive flashed information in the consolidated quotation data).

[92] As of May 27, 2010, the rule had not yet been adopted. Some exchanges, such as Direct Edge, still offer flash orders.

[93] *See* Christine Birkner, *Flash Orders Under Attack*, FUTURES, Jan. 1, 2010, http://www.futuresmag.com/Issues/2010/January-2010/Pages/Flash-orders-under-attack.aspx (quoting industry leaders who claim that the flash order ban "may restrict or eliminate price improvement auctions in the options market" and limit trading venue choice for retail investors).

[94] Jeremy Grant, *Quick View: A High-frequency End-game*, FT.COM (Oct. 13, 2009, 11:14AM), http://www.ft.com/cms/s/0/4dbd933c-b7d8-11de-8ca9-00144feab49a.html?nclick_check=1 (on file with author).

[95] *See generally* SEC Proposed Rule, *supra* note 86 (stating that regulators will have to deal with the emergence of the two-tiered market system).

anonymous trading pools that traders turn to instead of public exchanges such as the NYSE to avoid revealing their identities and giving competitors clues about their trading strategies.[96] There are roughly 40 dark pools operating today, some privately operated, but most operated by broker-dealers. "Dark pools find matches for blocks of shares without publishing the orders or the identities of the institutions."[97] Many of these dark pools developed as a means of evading high frequency traders by tipping off the markets. For instance, dark pools such as Liquidnet developed specifically with the goal of allowing large anonymous trades without tipping off high frequency arbitragers that a big order is in the market and moving prices.[98] Today, crossing systems like Liquidnet, Goldman Sach's Sigma X and Credit Suisse's Advanced Execution Services handle more than 10% of stock trades.[99] Their widespread use and lack of transparency has now turned lawmakers' attention on their possible regulation.

¶39 Because of concerns that these private venues limit transparency in the securities markets and may put smaller investors at a disadvantage, lawmakers have called out for limits to be placed on the number of transactions on dark pools.[100] The anonymity of dark pools may give cover to sharp operators known as "gamers" who could harm investors through predatory trading at ultra low latency.[101] It has also been suggested that dark pools can siphon liquidity from exchange markets and arbitrarily decide

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[96] In a dark pool, the trader signals the intent to buy or sell through indications of interest ("IOIs") to other participants. The amount of information conveyed in an IOI varies: some mention only the name of the stock and the general size of the trade; others identify the side, size and price information. Somewhere between the two extremes is a point at which the IOI conveys sufficient information to permit the parties to trade; at this point, the IOI is said to be "actionable." *See, e.g.*, *SEC Proposes Regulation of Dark Pools*, MORRISON & FOERSTER LLP, Nov. 16, 2009, at 2 [hereinafter *MoFo News Bulletin*], *available at* http://www.mofo.com/files/uploads/Images/091116DarkPools.pdf.

[97] Rob Curran, *Trading in a Dark Pool? Watch for Sharks,* WALL ST. J. MARKETBEAT BLOG (Aug. 18, 2008, 1:06PM), http://blogs.wsj.com/marketbeat/2008/08/18/trading-in-a-dark-pool-watch-for-sharks/.

[98] *See* MOYER & LAMBERT, *supra* note 6.

[99] *See* Jonathan Spicer & Rachelle Younglai, *SEC mulls ways to shed light on dark pools,* REUTERS, Oct. 20, 2009, http://www.reuters.com/article/idUSTRE59K50K20091021 (stating that dark pools account for an estimated 10 to 15 percent of U.S. equity volumes).

[100] Jesse Westbrook & Whitney Kisling, *Dark Pool Trade Limit Said to Be Cut 95% in SEC Plan (Update 3),* BLOOMBERG, Oct. 20, 2009, http://www.bloomberg.com/apps/news?pid=20601087&sid=aSBh9eVcv_3U.

[101] *See* Curran, *supra* note 97 (explaining how gamers ping a dark pool to drive up the price of a stock to gouge a profit from buyers).

who can trade on the pool and who cannot,[102] which could lead to front-running and undetected insider trading. This type of activity undermines market efficiency since stock prices may not adequately reflect market movement and trading activity. For these reasons, the SEC has also proposed changes to its existing ATS regulations, which include subjecting certain Indicator's of Interest (IOI's) to disclosure requirements, lowering the ATS trading volume threshold for displaying best priced orders on the tape, and amending the existing rules to require post-trade transparency comparable to that required of registered exchanges.[103]

¶40 While such regulations would decrease market ambiguity, they also could cause problems for some investors, especially those in small and mid-cap markets who trade primarily on these alternative trading systems and those looking to evade high frequency traders. For instance, real time reporting of the venue where print occurred may only benefit ultralow latency investors, instead of the "average Joe" investor. Because of high frequency trading's prominence, the next few years of changing regulations will be extremely interesting. The SEC has a very difficult job ahead of it in attempting to regulate these innovative practices while at the same time upholding the agency's primary concerns: protecting the average investor and ensuring markets remain relatively efficient.

¶41 The last major area of concern is with the practice of "naked access" between high frequency outfits and broker-dealers. Naked, or sponsored access, allows traders to send orders directly to exchanges using a brokerage's computer identification code.[104] Critics say naked access heightens the risk of reckless trades (by HF traders) that could destabilize the broader market. Exchanges often don't know the identity of firms using sponsored access, because the only way to identify the firms is through the computer code.[105] Additionally, the lack of regulation on naked access allows a reckless high frequency trader to conceivably pump out hundreds of thousands of faulty orders in the two minute period it typically takes to rectify a trading system glitch.[106] Sang Lee, a market analyst from Aite

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[102] *See* Westbrook & Kisling, *supra* note 100.

[103] *See* Regulation of Non-Public Trading Interest, 74 Fed. Reg. 61208 (Nov. 23, 2009) (to be codified at 17 C.F.R. pt. 242), *available at* http://www.sec.gov/rules/proposed/2009/34-60997.pdf.

[104] There are two basic ways a firm can trade on an exchange: by becoming a registered broker with the SEC and becoming a member of an exchange, or by paying a registered broker to use the broker's computer code to trade – sponsored access. *E.g.*, Scott Patterson, *Study Lays Bare Breath of 'Naked' Access*, WALL ST. J. (Dec. 15, 2009), http://online.wsj.com/article/SB10001424052748704121504574594280915231254.html.

[105] *Id.*

[106] *See* MOYER & LAMBERT, *supra* note 6.

Group, believes that "[i]n the worst case scenario, electronic fat fingering or intentional trading fraud could take down not only the sponsored participants, but also the sponsoring broker and its counterparties, leading to an uncontrollable domino effect that would threaten overall systematic market stability."[107] Because of these doomsday scenarios and others advanced by some Democratic lawmakers, the SEC will most likely propose rules to limit this practice in the upcoming months.

B. Is High Frequency Trading Harmful or Beneficial to the National Market System?

¶42 The recent controversy over high frequency trading raises the question of whether HFT is actually harmful or beneficial to the national market system. The potential benefits of high frequency are that it adds liquidity to the markets, speeds execution time, and narrows the price spreads between markets and exchanges. HFT firms may even be better liquidity providers than the specialists of the past because they do not have a conflict of interest. Additionally, computerized trading rewards firms for investing in technology, so the "technological arms race" may just be a matter of survival of the fittest. However, the low to zero capital requirements that these so-claimed "liquidity providers" carry is problematic and speculation over the danger that unchecked HF trading could cause to the entire system is truly frightening. In actuality, the true effects of HFT are difficult to measure, and much more research must be done by institutions and lawmakers before these questions can accurately be answered. This section analyzes the problems and benefits associated with HFT.

1. Problems with High Frequency Trading

¶43 Criticism over high frequency trading will most likely continue as the U.S. attempts to implement regulatory overhaul of the financial services industry. Despite this, high frequency trading is likely to grow in use, even with the new rules. Lawmakers must realize the complexities of the practice and the weigh the possible costs and benefits against each other if effective rules are to be put in place and the markets are to function efficiently.

¶44 On the one hand, high frequency trading is worrisome because of the lack of information available on its potential uses, the possibility that it could be used to manipulate the markets or obtain an unfair advantage, and its potential to lead to another financial crisis. Although the practice has been around for a number of years, many of the strategies that institutions

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[107] Whitney Kisling, *'Naked' Access Grows to 38% of U.S. Trading Volume, Aite Says,* BLOOMBERG, Dec. 14, 2009, http://www.bloomberg.com/apps/news?pid=20601103&sid=aec6LS8kLmFk.

and HFT firms employ are extremely secretive, and not much is known about the specifics of how they work. There is neither government nor industry oversight over the types of trading algorithms being developed, and many of these programs are so cutting edge that only a few mathematicians and engineers understand how to operate them. The potential problems related to theft by rival traders or insiders such as Aleynikov are vast. While there are messaging standards put in place for electronic trading, such as the FIX Protocol,[108] the fact remains that this form of trading is largely unchecked. The ambiguities related to flash trading and trading on ATS's such as dark pools also increases skepticism of illegal activity. While flash orders are likely on their way out, dark pools are still only recently becoming illuminated.

¶45 The lack of understanding of HFT leads many to believe companies like Goldman or GETCO may be engaging in illegal activities and that HF traders game the markets to obtain an unfair advantage. Other criticism is levied at the low barriers to entry to becoming a HF trader and the degree to which exchanges court HFT firms with the use of rebates. Since these rebates drive up the price of the brokers who take liquidity from the market, the costs of these rebates could conceivably be passed on to investors. In describing liquidity rebate trading, one commentator even described the exchanges as "drug dealers trying to control their turf and the HFT's are the drug addicts."[109] While these concerns may appear far-fetched, they do raise important questions about the inherent fairness of automated trading when levied against non-institutional investors. Stock volatility due to predatory algorithmic trading is also concerning. "[Predatory algorithmic] strategies are designed to cause institutional [algorithmic] orders to buy or sell shares at prices higher or lower than where the stock had been trading, creating a situation where the predatory algorithm can lock in a profit from the artificial increase or decrease in price."[110] Such algorithmic trading and short-selling could cause a stock to move 10 – 15 cents without any tangible rationale.[111]

¶46 Playing off of the notion that program trading helped cause the crash of '87, some Wharton professors also believe that fully automated

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[108] *See* The FIX Protocol Organization, http://www.fixprotocol.org/what-is-fix.shtml (last visited Jan. 13, 2010) (detailing the background and function of the FIX Protocol as a series of messaging specifications for the electronic communication of trade-related messages).

[109] JSaluzzi, *HFT Roundtable*, THEMISTRADING.COM (Jun. 17, 2009, 12:05PM), http://blog.themistrading.com/?p=158.

[110] *See* ARNUK & SALUZZI, *supra* note 58 at 2.

[111] *See id.*

trading by HFT firms could cause a similar collapse in the future.[112] Similarly, concern over "naked access" is recognized by both lawmakers and industry insiders alike.[113] The possibility of reckless trading by HF algo-traders is something that must be taken into serious consideration if future financial disasters are to be averted. It has been proposed that automated trading on strategies that key off the same factors, such as price dips in specific stocks, could cause programs to jump on the bandwagon at the same time and create a crisis.[114] The possibility that another financial catastrophe could occur in a matter of seconds due to a reckless trader is reason enough for investigation and future regulation.

2. Benefits of High Frequency Trading

¶47 On the other hand, variations of automated trading have been around for nearly twenty years now, and the arguments that the markets and exchanges have evolved to compensate for this and are better off do seem to have merit. There is evidence to suggest that high frequency trading has dramatically lowered spreads in the most available stocks and closed gaps across markets.[115] Reductions in the bid-ask spreads also reduce trading costs for fund investors. According to Gus Sauter, chief investment officer of the Vanguard Group mutual fund company, "generally, wide spreads are seen as kind of inefficiency, with buyers and sellers having difficulty agreeing on a price that accurately reflects what is known about a stock. Narrow spreads mean the market is working better."[116] By increasing the speed at which trades can be made on both the buy and sell sides, such actions could actually increase market efficiency. Sauter also believes that HFT reduces "market-impact" cost by making it easier to break up big trades into little ones while still conducting them quickly.[117] Because of

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[112] *See The Impact of High-frequency Trading: Manipulation, Distortion or a Better-functioning Market?*, KNOWLEDGE@WHARTON (Sept. 30, 2009), http://knowledge.wharton.upenn.edu/article.cfm?articleid=2345 [hereinafter *Knowledge@Wharton*] (on file with author) (containing statements by various UPENN Wharton professors on the impact of HFT).
[113] *See* JSaluzzi, *supra* note 109.
[114] ARNUK & SALUZZI, *supra* note 58, at 3.
[115] *See* Burton Malkiel, *High-frequency Trading Benefits Both Large and Small Investors*, FIN. TIMES, Dec. 15, 2009, at 24, *available at* http://www.ft.com/cms/s/0/33881656-e918-11de-a756-00144feab49a.html (explaining the various "misconceptions" about HFT and the benefits of the practice).
[116] Knowledge@Wharton, *supra* note 112.
[117] *See id.* (stating that trading costs from spreads and market impact have been cut in half over the past decade, from 0.5% of the trade amount for big company stocks to 0.25%).

these benefits, critics of high frequency trading may be missing the bigger picture: HFT adds liquidity, speeds execution and narrows spreads.[118]

¶48 Healthy competition is also essential to the free market, and HFT strategies developed to adapt to our more tech-heavy society. By recruiting the best and the brightest programmers and "quants" from the nation's top colleges, various firms can ensure that they remain competitive in this new national market. Such competition among high-frequency traders may serve to tighten bid-offer spreads, "reducing transaction costs for all market participants, both institutional and retail."[119] While institutional investors or specialized HF firms could benefit directly from HFT by hiring their own algo-traders or outsourcing their investing activities to other HF firms, individual investors may also benefit indirectly. "Individual investors are the ultimate beneficiaries when their pension funds and mutual funds can transact large volumes of trades anonymously with great speed and at lower cost."[120]Although smaller active traders may be at a disadvantage when directly trading securities, nearly all who have money in funds will benefit indirectly. Protecting the mutual fund investor at the expense of individual traders is arguably more important if the greatest good is to be achieved for the greatest majority. While HFT has caused the trading game to change, the fact also remains that high frequency trading is not illegal (at least not yet).

CONCLUSION

¶49 Because of its relative novelty and the uncertainty related to many of the trading strategies being used today, the debate over high frequency trading will likely continue long into the future. As both old and new emerging markets continue to become highly digitized, algorithmic trading strategies will constantly advance by those with the resources and intelligence to stay ahead of the competition. High frequency trading appears to be an irreversible trading trend in the U.S. and at its current pace will only expand its share of the U.S. stock market in the next few years. It appears "there is no way to put the technology genie (and hence market innovations) back in the bottle,"[121] and government agencies will find themselves with the increasingly difficult task of how to monitor and, if necessary, regulate the trading innovations that develop.

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[118] *See* MOYER & LAMBERT, *supra* note 6.
[119] Malkiel, *supra* note 115.
[120] *Id.*
[121] Whitney Kisling, *Celent: High-Frequency Trading to Grow Even With New Rules,* BUSINESS WEEK, Dec. 18, 2009, *available at* http://www.businessweek.com/investor/content/dec2009/pi20091218_113945.htm (quoting David Easthope, a San Franciso-based analyst for Celent).

¶50 It is still uncertain whether HFT is more beneficial or harmful to the national market structure. While the individual investor sitting at home trading stocks online will be at an increasing disadvantage, high frequency trading may benefit the majority of investors in the long-run. As some have argued, the "fact is technology will always add opportunities for smart people to find new ways to profit. The problem isn't the intent to profit, the problem is the impact on others who aren't so smart or simply don't have access to the technology."[122] However, the lack of regulation of these practices and potential problems to our nation's capital structure cannot be overlooked. If many trades involve simultaneous buy and sell orders by the same trader, high frequency trading may not actually be making as large a contribution to liquidity as the big trading numbers suggest.

¶51 In regulating HFT and its related practices, the SEC must walk a fine line in protecting small investors while also maintaining fair and efficient markets for all. Current efforts to regulate flash orders do seem to be a step in the right direction. However, any new rules advanced must take into account the competitive market's ability to adapt and both the long and short term effects on different types of investors. Possible solutions may lie in introducing rules that eliminate the effects of pinging, or introducing certain taxes on share transactions or rules that curb the more harmful types of algo-trading across the board.[123] Regardless, it is vital that government agencies and institutions alike study these matters more thoroughly before issuing any new regulations.

¶52 Although the future of HFT remains uncertain, it is clear that innovative technology will continue to rule the financial world. If we are to remain a free market, lawmakers must grapple with the very difficult question of how to most effectively regulate the changing national markets while at the same time allowing them to evolve naturally. This problem will no doubt be a recurring one as the evolution of technology continues to shape our financial markets.

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[122] *See* Hutchinson, *supra* note 62 (containing a comment by one reader, Andrew Jefferson, dated Aug. 14, 2009, following Hutchinson's article).

[123] *See, e.g.*, ARNUK & SALUZZI, *supra* note 58, at 5 (advancing many different regulatory measures that could possibly be put in place to stop the harmful effects of "toxic" high frequency trading).