Insider Trading and Market Structure

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ABSTRACT

This Article argues that the emergence of algorithmic trading raises a significant challenge for the law and policy of insider trading. It shows that securities markets are dominated by a cohort of "structural insiders." By virtue of speed and physical proximity to exchanges, these traders can systematically gain first access to new information, trade on it and change prices before the rest of the market can see its content. This Article makes three contributions. First, it introduces and develops the concept of structural insider trading. Securities markets increasingly rely on automated traders utilizing algorithms – or pre-programmed electronic instructions – for trading. Policy allows traders to enjoy important structural advantages: (i) to physically locate on or next to an exchange, shortening the time it takes for information to travel to and from the marketplace; and (ii) to receive feeds of richly detailed data directly to these co-located trading operations. With algorithms sophisticated enough to respond instantly and independently to new information, co-located automated traders can receive and trade on not-fully-public information ahead of other investors. Indeed, by the time that the rest of the market sees this information, it has long since become out-of-date. Secondly, this Article shows that structural insider trading exhibits harms that are substantially similar to those regulated under conventional theories of corporate insider trading. Structural insiders place other investors at a persistent informational disadvantage. Through their first sight of market-moving data, structural insiders can capture the best trades and erode the profits of informed traders, reducing their incentives to participate in the marketplace. Despite the similarity in harms, however, this Article shows that doctrine does not apply to restrict structural insider trading. Rather, structural insiders thrive in full view and with regulatory permission. Thirdly, the Article explores the implications of structural insider trading for the theory and doctrine of insider trading. It shows them to be increasingly incoherent in their application. In protecting investors

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against one set of insiders but not another, law and policy appear under profound strain in the face of innovative markets.

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INTRODUCTION

With high-speed algorithms driving around 50-70% of all shares trading in the U.S. by volume, automation has become the norm in the securities marketplace.[1] The impact of electronic trading, however, extends far beyond the simple fact of how shares are bought and sold. It challenges the theoretical foundation anchoring the prohibition against insider trading and the allocation of informational costs the law imposes between traders. This Article shows that that the design of modern automated markets departs from past practice by expressly giving meaningful informational advantages to select, high-speed algorithmic traders. By dint of this structural access, a cohort of firms are the first to receive, review and react to trading information – and to use this early intelligence to anticipate how others might trade. This "structural insider trading," as this Article terms it, creates harms for investors and market quality commonly seen in more conventional corporate insider trading. Yet, unlike typical corporate insider trading, traditional doctrine cannot constrain structural insiders. In institutionalizing harmful asymmetries in informational access between investors, this Article draws into relief the weakness of the prohibition to effectively perform its role as protective safeguard for confidential information in modern markets.

It is well established that the prohibition against insider trading serves to safeguard investors from systematically losing to informed insiders.[2] The law penalizes insiders that secretly profit from their knowledge at the expense of other investors, creating powerful motivation for insiders to either disclose their confidences or to refrain from trading.[3] Viewed from the perspective of the capital markets, protecting an ordinary

[1] Jeffrey MacIntosh, *High Frequency Traders: Angels or Devils?* C.D. Howe Institute Commentary No. 391, at 3-5, *available at* http://www.cdhowe.org/pdf/Commentary_391.pdf [hereinafter, "C.D. Howe"]. For an informative analysis of high frequency trading and key claims and controversies, see, Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense,* DUKE. L. J. (*forthcoming*).

[2] For overviews, DONALD C. LANGEVOORT, INSIDER TRADING: REGULATION, ENFORCEMENT & PREVENTION §§ 1:1-6 (2014); WILLIAM K.S. WANG & MARC I. STEINBERG, INSIDER TRADING §§ 2:1-4 (2d ed. 2005). See also, Victor Brudney, *Insiders, Outsiders, and Informational Advantages under the Federal Securities Laws*, 93 HARV. L. REV. 322, 354–58 (1979) (discussing the rationales underlying the prohibition).

[3] SEC v. Texas Gulf Sulphur Co., 401 F.2d 833, 848 (2d Cir. 1968); Chiarella v. United States, 445 U.S. 222, 223-226 (1980); Dirks v SEC, 463 U.S. 646, 654-69 (1983). See also, Merrill Lynch, Pierce, Fenner & Smith, Inc., Exchange Act Release No. 8459, 43 S.E.C. 933, 936-9 (Nov. 25, 1968) (on the centrality of fairness for investors as a guiding motivation for doctrine). For discussion, Donald C. Langevoort, *Rereading* Cady, Roberts*: The Ideology and Practice of Insider Trading Regulation*, 99 COLUM. L. REV. 1319, 1320 (1990) (analyzing the historical evolution of early insider trading doctrine and its application by the Securities and Exchange Commission).

investor's bargaining position against insiders can bring significant, system-wide benefit. For one, investors of all types – not just insiders – can enter the fray to trade, increasing the capital available for investment. Importantly, their dollars might also go farther. Knowing that they are not pre-destined to failure against informed insiders, investors may be willing to put more money into securities markets. With strong laws to buttress their position, investors need not discount the value of their capital to reflect the risk of being of picked off by informed, insider-experts.[4]

The theory and application of the law against insider trading, however, remains controversial and heavily contested. Doctrine is notoriously fuzzy and complicated, straining to adapt to the many permutations by which confidential information may be shared and misused by traders in modern markets.[5] Moreover, scholars have vigorously disputed the economic rationales underpinning the legal foundations of the prohibition. Professors Manne, Carlton and Fischel, for example, argue that laws against insider trading operate to the detriment of market quality by reducing the informational richness that guides everyday trading. Insiders necessarily possess the deepest, most accurate reserves of knowledge about a company and its securities. According to this literature, imposing legal constraints on their ability to trade reduces in aggregate the intelligence in capital markets – undermining market efficiency, or the ease by which securities prices capture available information.[6] Far from

[4] *See e.g.,* LANGEVOORT, *supra* note 2; WANG & MARC I. STEINBERG, *supra* note 2; William K.S. Wang, *Trading on Material Non-Public Information on Impersonal Stock Markets: Who is Harmed and Who can Sue Whom under SEC Rule 10b-5*, 54 S. CAL. L. REV. 1217, 1222-1230 (1980) (detailing the key harms of insider trading). In the finance literature, see, notably, David Easley & Maureen O'Hara, *Information and the Cost of Capital*, 59 J. FIN. 1553 (2004) (noting that investors demand a higher rate of return to hold securities with higher private information).

[5] United States vs. Newman 2014 U.S. App. LEXIS 23190 (2d Cir. 2014). For wide-ranging commentary see, THE CLS BLUE SKY BLOG, http://clsbluesky.law.columbia.edu/2015/01/28/marketplace-of-ideas-united-states-v-newman-4/; SEC v Obus 693 F.3d 276 (2d Cir. 2012) (allowing liability for unintended disclosure in the context of tipping liability); SEC v. Dorozhko, 574 F.3d 42 (2d Cir. 2009) (allowing wide liability to cover hackers that stole information for trading). For discussion, Donna M. Nagy, *Insider Trading and the Gradual Demise of Fiduciary Principles*, 94 IOWA L. REV. 1315 (2009) (analyzing the uneven application of the fiduciary principle in insider trading).

[6] Dennis W. Carlton & Daniel R. Fischel, *the Regulation of Insider Trading*, 35 STAN. L. REV. 857 (1983); HENRY G. MANNE, INSIDER TRADING AND THE STOCK MARKET (1966) (a key discussion of the efficiency-reducing impact of insider trading laws). For notable critiques and discussion, see, James D. Cox, *Insider Trading and Contracting: A Critical Response to the "Chicago School,"* DUKE. L.J. 628 (1986); Jesse M. Fried, *Insider Abstention*, 113 YALE L.J. 455, 458–59 (2003); Zohar Goshen & Gideon Parchomovsky, *On Insider Trading, Markets, and "Negative" Property Rights in Information*, 87 VA. L. REV. 1229 (2001) (observing the impediment created by insider trading laws to the flow of information in the market and arguing for allocation of informational rights to specialists). On market efficiency, see, Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970) ("a market in which prices always 'fully reflect' available information is called 'efficient'). See also, Ronald J. Gilson & Reinier H. Kraakman, *the Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 549-53 (1984); Yesha Yadav, *How Algorithmic Trading Undermines Efficiency in Capital Markets*, VAND. L. REV. (*forthcoming*) (2015) (hereinafter, "Algorithmic Trading"). Theories are discussed *infra* Part 1A.

being a matter of inviolable policy, regulating insider information in securities markets represents a trade-off. Investors might gain protection against opportunistic trading by insiders. But markets also lose a critical lens into the inner workings of public companies. With thinner reserves of insight to underpin price formation, markets are primed to under-perform in fulfilling their core function: allowing investors to deduce more exactly the future cash flows of their investments and how they can deploy their capital most effectively to generate greatest return.[7]

The interplay of these competing rationales can be seen in the design of market structure – the processes and mechanisms by which securities are bought and sold in public trading.[8] Historically, markets have relied on a select cohort of institutional traders to manage the ebb and flow of trades. These firms have been called on to buy securities using their own money when no one else is willing – and to sell securities from their own books to help markets cope with unexpected demand. In performing this "market making" function, ensuring that trading remains smooth, orderly and liquid,[9] this group of firms has occupied a central role in intermediating trading across an enormous swathe of the market. On the New York Stock Exchange (NYSE), for example, "specialist" market makers were contracted match securities buyers with sellers, to act as buyer and seller if needed, as well as to maintain "fair and orderly" markets when no one else wished to trade.[10] The NASDAQ has traditionally relied on competing sets of "dealers" to intermediate transactions between investors.[11] As essential checkpoints for securities

[7] Phillip Bond, Alex Edmans & Itay Goldstein, *The Real Effect of Financial Markets*, 4 ANN. REV. FIN. MKTS 339, 342-6 (2012) (analyzing the informational impact of prices and observing the importance of securities prices on real-world decision-making).

[8] *For discussion*, Yesha Yadav, *Insider Trading in Derivatives Markets*, 103 GEO. L. J. 381 (2015) (hereinafter, "*Insider Trading*").

[9] *See e.g.*, New York Stock Exchange, Rule 104: Dealings and Responsibilities of DMMs, http://nyserules.nyse.com/nyse/rules/nyse-rules/chp_1_3/chp_1_3_7/chp_1_3_7_9/default.asp.

[10] New York Stock Exchange, *Inside the NYSE*: *The Specialist*, http://www1.nyse.com/pdfs/specialistmagarticle.pdf; New York Stock Exchange, *Designated Market Makers*, https://www.nyse.com/publicdocs/nyse/listing/fact_sheet_dmm.pdf. It should be noted that the NYSE has moved to dismantle the "specialist" function in favor of designated market makers and, in this change, have stopped specialists from seeing all available information on order flow.

[11] Yakov Amihud & Haim Mendelson, *Market Making and Inventory*, 8 J. FIN. ECON. 31 (1980) (examining the management of inventory by a monopolistic market maker); Katrina Ellis, Roni Michaely & Maureen O'Hara, *The Making of a Dealer Market: From Entry to Equilibrium in the Trading of Nasdaq Stocks*, Working Paper, Working Paper, available at, http://forum.johnson.cornell.edu/faculty/michaely/Michaely.pdf (comparing NYSE and NASDAQ dealer vs. specialist models and analyzing trends in dealer behavior in these and other markets). See also, Robert Battalio & Robert Jennings, *Payment for Order Flow, Trading Costs, and Dealer Revenue for Market Orders at Knight Securities, L.P.*, Working Paper (1998), available at, http://pricing.free.fr/docs/vwap/knight.pdf (an early paper discussing the impact on spreads of the practice of broker-dealers purchasing order flows from retail investors). This literature is discussed in more detail *infra* Part [ ].

trading, their position has raised the risk that this small group of traders might utilize information for private gain, undercutting investors at large.[12] In response, reflecting the regulatory emphasis on protecting investor information, an elaborate body of laws has worked to constrain the behavior of traditional market makers and to place costs on their ability to utilize trading information for personal trades.[13] Indeed, finance theory widely accepts that this select group – despite all the privileges of their position – generally transacts as uninformed traders that are likely to lose money to informed investors in the marketplace.[14]

This delicate regulatory bargain has, however, seen a radical transformation with the arrival of high-speed algorithmic traders – automated electronic traders that use algorithms – or pre-programmed electronic instructions – to trade.[15] Capable of buying and selling thousands of securities within milliseconds, averaging tiny incremental gains from each trade, algorithmic traders look to rapid turnover to make their money as well as to manage their risks.[16] By virtue of constantly buying and selling, these high frequency traders (HFT) often fulfill what amounts to an economic market making function on account of being immediately available to trade with investors.[17] Where traders can buy and

[12] Hendrik Bessembinder, Jia Hao & Michael Lemmon, *Why Designate Market Makers? Affirmative Obligations and Market Quality*, Working Paper (2011) (analyzing the benefits of designated market makers for market quality); Patrick P.H. Fishe & Michel A. Robe, *The Impact of Illegal Trading in Dealer and Specialist Markets*, J. FIN. ECON. 461 (2004) (noting the ability of dealers to manage the risks of trading against corporate insiders by strategically adjusting the depth of their order books).

[13] William G. Christie and Paul H. Schultz, *Why Do NASDAQ Market-makers Avoid Odd-Eighth Quotes*, 49 J. FIN. 1813 (1994) (a seminal study noting collusion in maintaining higher spreads among dealers on the NASDAQ exchange); Prajit Dutta & Ananth Madhavan, *Competition and Collusion in Dealer Markets*, 52 J. FIN. 245 (1997) (observing that there are limited incentives for even competing dealers to reduce a high spread). On the laws traditionally applying to market makers, see discussion *infra* Part I(B)(2).

[14] *See discussion infra* Part I(B)(2).

[15] John Bates, *Algorithmic Trading and High Frequency Trading Experiences and Thoughts on Regulatory Requirements* 27-28 (July 2010) ("An algorithm is a sequence of steps to achieve a goal" and the general case of algorithmic trading is "using a computer to automate a trading strategy"), *available at* http://www.cftc.gov/ucm/groups/public/@newsroom/documents/file/tac_071410_binder.pdf; THOMAS H. CORMEN ET AL, INTRODUCTION TO ALGORITHMS, 5-6 (3rd Ed.) (2009); IOSCO Technical Comm., *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency: Consultation Report* 10 (July 2011). IOSCO Technical Comm., *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency: Consultation Report* 10 (July 2011) ("In its simplest guise, algorithmic trading may just involve the use of a basic algorithm…to feed portions of an order into the market at pre-set intervals to minimise market impact cost. At its most complex, it may entail many algorithms that are able to assimilate information from multiple markets… in fractions of a second"). For discussion and comparison between traditional market-makers and high-speed traders, Bessembinder et al., *supra* note 12.

[16] *See discussion infra* Part I(B).

[17] Albert J. Menkveld, *High Frequency Trading and the New Market-Makers*, 16 J. FIN. MKTS. 712 (2013) (discussing the benefit of this market making function for lowering the spreads investors pay to trade); For a review of the literature, SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4-6 (Mar. 2014). But see, Frank Zhang, *High-Frequency Trading, Stock Volatility, and Price Discovery*, 2-3 (Dec. 2010).

sell at pace, exiting quickly and often, their exposure to the risk of any security is fleeting, measured usually in fractions of a second. Facing lower provisioning costs, and often no legal obligations to trade in times of stress, algorithmic firms possess powerful incentives to play market maker on modern exchanges.[18]

HFT needs deep informational access to the marketplace. The ability to transact in milliseconds demands close physical access to exchange infrastructure. Traders must possess physical proximity to an exchange to reduce to a minimum the time taken for orders to reach the venue. In turn, they must be able to receive data rapidly from the marketplace and to react to it by immediately sending orders back to the exchange.[19] Without such proximity, HFT loses its competitive edge.

Exchanges have responded by re-casting their architecture to offer this proximity to traders. They sell physical space to firms to "co-locate" servers on or next to those of an exchange. Traders can also purchase detailed feeds of the exchange's data that can be sent directly to the trader's co-located servers. Finally, HFT can only happen because algorithms are pre-programmed to react automatically to new information as it emerges – without waiting for human beings to vet trades in real time.[20] These dynamics, together, place high frequency traders in a prime position to make reliable, informed gains ahead of other investors, to anticipate where markets are headed and to reach the best trades. While finance theory has typically analyzed market makers as uninformed, high frequency traders point to an opposite conclusion. Increasingly, studies reveal them to be skilled at predicting the near term direction in which markets are headed and in anticipating and trading ahead of order flow.[21]

Perhaps most critically, however, this structural access gives high-speed traders an outsized role in price formation vis-à-vis other types of trader. Through a combination of co-location, direct feeds and automated reactions to incoming information, HFTs can enjoy first-sight and first-

[18] Note that Virtu Financial, a well-known high-speed trading firm is contracted to act as designated market maker for the NYSE. New York Stock Exchange, *Designated Market Makers*, https://www.nyse.com/publicdocs/nyse/listing/fact_sheet_dmm.pdf.

[19] Robert J. Jackson & Joshua Mitts, *How the SEC Helps Speedy Traders*, Working Paper (Nov. 2014) (an impactful study demonstrating proximity between regulators and high-speed traders. The study reported that the Securities and Exchange System itself was disseminating EDGAR regulatory filings to HFT traders before other investors in the market). See also, Jonathan L. Rogers, Douglas J. Skinner & Sarah L. C. Zechman, *Run EDGAR Run: SEC Dissemination in a High-Frequency World*, Working Paper (2014).

[20] These mechanisms are discussed *infra* Part II. For a study on SEC data and HFT processing see, Robert J. Jackson, Joshua Mitts & Wei Jiang, *How Quickly Do Markets Learn: Private Information Dissemination in a Natural Experiment*, Working Paper (2014) (noting that fundamental information takes longer for HFT to process vis-à-vis news orientated information).

[21] *See discussion infra* Part IV(A)(1)-(2).

mover advantage in trading. Indeed, it is near impossible for structural outsiders to transact on up-to-the-millisecond price information. Because of co-location, direct feeds and immediate reaction, high-speed traders can receive and react to information before it can reach traders outside a co-located space. As shown in FIGURE 1, by the time information travels more broadly, high-speed traders have transacted on it, such that when outsiders catch sight of prices these have long since become out of date.[22]

This Article shows that modern markets are reliant on a cohort of high-speed "structural" insiders that receive and react to information ahead of those on the outside. Due to their ability to see and trade on not-fully-public information before anyone else, structural insiders also dominate the price formation process. This insider-advantage represents a radical departure from traditional models of market making that have sought to prevent its members from utilizing their access to exchange information for private gain. This Article analyzes the emergence of structural insiders against the theory underpinning the prohibition against insider trading. It shows that the harms of structural insider trading broadly resemble those commonly controlled under the prohibition. Yet, as it makes clear, structural advantages for HFT are perfectly legal under doctrine. Their use thrives in full view and largely enjoys the blessing of regulators, negating liability under the prohibition.[23] In highlighting the incompatibility between the theory of insider trading and the practice of structural insiders, this Article draws into relief the current weakness of the prohibition as a broad protective safeguard for information in markets.

This Article makes three contributions. First, it examines the longstanding regulatory bargain that has worked to constrain those charged

[22] *See, e.g.* Robert Jarrow & Phillip Protter, *A Dysfunctional Role of High Frequency Trading in Electronic Markets* 3-6 (Johnson Sch. Research Paper Series, No. 08-2011, 2011). In the popular literature, see, notably, MICHAEL LEWIS, FLASH BOYS: A WALL STREET REVOLT (2014); SCOTT PATTERSON, DARK POOLS: THE RISE OF THE MACHINE TRADERS AND THE RIGGING OF THE STOCK MARKET, 322-333 (2013). It should be noted that these costs are complex and some scholars dispute the real costs to investors of high frequency trading. These debates are discussed infra Parts II and IV.

[23] In September 2012, the Securities and Exchange Commission fined the New York Stock Exchange to settle allegations that the NYSE had provided information to paid subscribers ahead of other traders, violating rules requiring the exchange to provide market data on a fair and reasonable basis. See, Order Instituting Administrative and Cease-and-Desist Proceedings Pursuant to Sections 19(h)(1) and 21(c) of the Securities and Exchange Act Making Findings and Imposing Sanctions and a Cease and Desist Order, Release No. 67857 (Sept. 14, 2012); Peter Lattman, *Thompson Reuters to Suspend Early Peek at Key Index,* N.Y. TIMES, Jul. 7, 2013 (noting the agreement to suspend early release of the University of Michigan's Consumer Confidence Index to paying investors. Subscribers received the information two seconds before general release.). Karen Freifeld & Nadia Damouni, *New York Attorney General Eyes Exchanges in High-Frequency Probe*, REUTERS, May. 2, 2014; Keri Geiger & Sam Mamudi, *High Speed Trading Faces New York Probe into Fairness*, BLOOMBERG. Mar. 18, 2014; Kara Scannell & Nicole Bullock, *SEC Fines NYSE Euronext $4.5m for Breaking Rules*, FIN. TIMES, Jan. 9, 2013. See also, Jackson & Mitts, *supra* note 19 (discussing responses by regulators to their observation that EDGAR filings were reaching high frequency traders ahead of others).

with making markets from utilizing their access to information for private gain.[24] An elaborate body of rules has sought to even the playing field between market makers and investors at large in public markets, preventing insiders from systematically picking off the most favorable deals. The emergence of HFT – while greatly facilitating trades and offering "economic" market making – challenges the core of this bargain. High frequency traders are expressly permitted to physically co-locate and to select rich data feeds from exchanges to co-located servers, making it possible for a group of insiders to gain unprecedented access to the price formation process in modern markets.

Secondly, taking established theories of insider trading as its starting point, this Article analyzes the costs and benefits of structural insider trading. On the one hand, structural insiders bring myriad benefits. Scholars note that markets are more liquid, efficient and cheaper to use. They are more heterogeneous in their composition and home to sophisticated experts able to trade with speed, intelligence and data to bring rapid price formation to investors at large.[25] However, structural asymmetries between investors also come with costs. I show that the harms arising under structural insider trading are remarkably close in substance to those analyzed under the conventional theory of corporate insider trading. Notably, structural insiders can systematically win against other investors by the simple fact of their positional advantage.[26] Studies note that informed investors suffer losses to HFTs.[27] Deep inequalities in the dissemination of trading information can generate uneven distribution of transaction costs, forcing those with diminished data to spend more to achieve parity with structural insiders. In all, as with corporate insider trading, some scholars are observing signs of a deeper harm to market quality, where informed investors reduce their participation in markets or are motivated to opt-out altogether on account of the costs.[28]

Thirdly, this Article points to the need for a thorough re-thinking of the doctrine and theory undergirding the prohibition against insider trading. The current design of market structure poses a serious challenge to the coherence offered by standard theory to support the doctrinal and policy lines drawn by the prohibition. As a starting point, structural insider trading redraws the classic battle lines between market efficiency versus

[24] *See e.g.* Christie & Schultz, *supra* note 13; Dutta & Madhavan, *supra* note 13.

[25] *See discussion infra* Part II(A).

[26] *See discussion infra* Part II(A). See also, Jackson & Mitts, *supra* note 13 (noting that high speed trades made gains in the time lag between which they received information from EDGAR and when this information was received more widely).

[27] *See discussion infra* Part III(B).

[28] *See discussion infra* Part III(B).

investor protection. In corporate insider trading doctrine, market efficiency has generally ceded to the goal of investor protection to establish a system of restraints irrespective of the costs to market efficiency. Structural insider trading, however, re-calibrates this old debate. Unlike informed corporate insiders, co-located high frequency traders do not bring new information to the marketplace. Rather, HFTs see new information earlier than other investors, giving them an opportunity to trade first and update prices as a consequence of their access. In this sense, they do not render the market more informed by their insider trading, just faster at reflecting information that would arrive anyway. Still, high frequency traders bring a form of "structural efficiency" to markets, owing to the speed and liquidity gains they offer. In seeking to deal with the costs and trade-offs, policymakers essentially face two choices: (i) to bring structural insider trading within the ambit of current insider trading laws; or (ii) to deal with the implications of irreconcilability. This Article proposes ideas for the former, while recognizing that the latter is the much likelier outcome. In the absence of reform, the pervasive spread of functional insider trading in markets – well outside the reach of doctrine – reveals the traditional prohibition as sorely lacking theoretical coherence in modern markets.

This Article proceeds in six Parts. Part I describes the significance of market makers to show that they behave as uninformed traders in the market. Part II moves to analyze the emergence of HFT as a dominant paradigm in trading with traders benefiting from systematic structural advantages. Part III provides a short primer on the theory and doctrine of insider trading, with Part IV applying its key tenets to structural insider trading. Part V examines implications for reform. Part VI concludes.

I. WHY MARKET STRUCTURE IS SPECIAL

Securities markets channel surplus capital from investors to enterprises that can use this money most efficiently for growth. The primary market for capital – when a company first issues its securities to the public – offers the most direct injection of investor funds into a company's coffers. Secondary markets, on the other hand, provide the mechanism by which investors enter and exit these investments, transacting with one another to ensure that capital is mobile and liquid. Secondary markets might not immediately infuse worthy businesses with cash. But they perform essential allocative and expressive functions nevertheless. As Professors Edmans, Goldstein and Jiang observe, stock

prices exert a powerful impact on corporate decision-making and can encourage tighter monitoring of firm management by investors.[29]

The structure of markets and their transactional mechanics enable price formation and capital allocation to flourish. Finance academics have long recognized the impact of a market's "microstructure" – the processes and machinery that underlie trading – on efficient stock market performance and capital investment.[30] This Part examines the fundamental pillars of market design to show that it constitutes an arena of contention between two (sometimes) competing goals of regulatory policy: investor protection and market efficiency. Ideally, markets seek to encourage maximum information in trading in order to make prices as informative as possible. At the same time, regulation seeks to protect investors that might only enter markets where they are protected from being systematically out-maneuvered by various types of informed insiders. This tension is visible in the institution of the market maker – the firm or set of firms entrusted with ensuring that markets remain liquid and stable and whose central role can give them systematic informational advantage over investors.

A. Information and Market Structure

1. The Primacy of Efficiency

Conventional economic theory underscores the importance of information for capital allocation in securities markets. In his seminal work, Professor Eugene Fama posited that developed markets arc towards

[29] Alex Edmans, Itay Goldstein & Wei Jiang, *The Real Effect of Financial Markets*, 67 J. FIN. 933 (2012) (noting the impact of prices on takeover decisions); Yadav, *Algorithmic Trading, supra* note 6 (analyzing the impact of prices on corporate governance); See also, Anat Admati & Paul Pfleiderer, *The "Wall Street Walk" and Shareholder Activism: Exit as a Form of Voice*, 22 REV. FIN. STUD. 2645 (2009) (noting the influence of shareholders and shareholder voice on resolving conflicts within management); Philip Bond, Itay Goldstein & Edward Simpson Prescott, *Market Based Corrective Actions*, 23 REV. FIN. STUD. 781 (2010); James Dow, Itay Goldstein & Alexander Guembel, *Incentives for Information Production in Markets where Prices Affect Real Investment Decisions*, Working Paper (2010); Stanley Fisher & Robert C. Merton, *Macroeconomics and Finance: the Role of the Stock Market*, NBER Working Paper 1291 (1984). See also, Franklin Allen, *Stock Markets and Resource Allocation*, in Colin Mayer and Xavier Vives (eds), CAPITAL MARKETS AND FINANCIAL INTERMEDIATION (1993) (discussing international markets and capital allocation); Solomon Tadesse, *The Allocation and Monitoring Role of Capital Markets: Theory and International Evidence*, William Davidson Institute Working Paper Number 624 (Oct. 2003); Jeffrey Wurgler, *Financial Markets and the Allocation of Capital*, Yale ICF Working Paper No. 99-08 (Jul. 1999).

[30] The literature is vast. For an overview, LAWRENCE HARRIS, TRADING AND EXCHANGES: MARKET MICROSTRUCTURE FOR PRACTITIONERS (2003).

a state of efficiency.[31] According to this hypothesis – known as the Efficient Capital Markets Hypothesis (ECMH) – prices come to reflect all available information in securities prices. Securities prices thus represent a rich signal of what securities (and the companies that issue them) are worth. In pooling the collective wisdom of all traders, prices offer an unbiased window into the present value of the future cash flows likely to derive from a set of traded securities.

Efficient markets are most informative when they bring together a variety of traders to transact with one other. As proposed by Professors Gilson and Kraakman, markets become efficient through the fluid interaction of informed, uninformed, derivatively informed and universally informed traders. In their analysis, informed and derivatively informed traders inject new information into markets. Informed traders possess private, market-moving information acquired by research or special access. Their transactions – and the price at which they are willing to trade –shift the prevailing price of a security in an efficient direction.

By contrast, derivatively informed traders simply follow, sometimes imperfectly, the lead set by informed traders. A derivatively informed trader deduces how an informed trader is likely to move and undertakes a similar pattern of trades. While a derivatively informed trader might not get the best returns from the information – because informed traders should have already captured them – she might be lucky enough to get a slice of the winnings. Importantly, derivatively informed traders are essential to price formation. They can accelerate the pace by which information enters markets, boosting the signaling power of the intelligence of informed traders.

On the other hand, uninformed and universally informed traders supply liquidity to the market. These actors might like to trade but are not sufficiently supplied with new information to trade successfully. However, their interaction with informed traders greases the wheels of the market and cancels out biases that one or other group of traders might have.[32]

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[31] Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970); Eugene F. Fama, *Market Efficiency, Long-Term Returns, and Behavioral Finance*, 49 J. FIN. ESCON. 383 (1998). This literature is extensive and subject to a detailed and wide-ranging critique. See e.g., Sanford J. Grossman & Joseph E. Stiglitz, *On the Impossibility of Informationally Efficient Markets*, 70 AM. ECON. REV. 393 (1980) (arguing that markets can never be perfectly efficient as if they were, actors would have no incentive to trade); ANDREI SCHLEIFER, INEFFICIENT MARKETS: AN INTRODUCTION TO BEHAVIORAL FINANCE (2000) (discussing the behavioral economics critique); Lawrence H. Summers, *Does the Stock Market Rationally Reflect Fundamental Values?*, 41 J. FIN. 591 (1986) In the legal literature see, e.g., Lynn A. Stout, *The Mechanisms of Market Inefficiency: Introduction to the New Finance*, 28 J. CORP. L. 635 (2002); William K.S. Wang, *Some Arguments that the Stock Market is Not Efficient*, 19 U.C. DAVIS L. REV. 341 (1986).

[32] Ronald Gilson & Reinier R. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549 (1984); Ronald J. Gilson & Reinier R. Kraakman, *The Mechanisms of Market Efficiency: Twenty Years On*, Discussion Paper (2003) (analyzing this design against the critiques put forward by behavioral

The ECMH stands as a proposition for informational efficiency in markets – in other words, how well markets react to new information in prices. It does not speak to questions of fundamental efficiency – how productively a company utilizes its capital to enhance firm value. Still, scholars posit that the ECMH provides the most unbiased estimate as to what a company might be worth more fundamentally. As Gilson and Kraakman suggest, information pertaining to a firm's fundamental efficiency is likely to be available in the market. With such intelligence scattered in the public space, its significance should come to be reflected in the prices at which securities trade. The link between informational and fundamental efficiency is far from perfect. Not all the information relating to a firm's real value may be available. And, this data might be difficult to analyze. But it is the best guide to real value that markets have.[33] This link between informational and fundamental efficiency underscores the significance of securities trading – and the mechanics that support it – for the transfer of capital between investors and businesses in the economy.

2. The Mechanics of Efficiency

The challenge for policymakers lies in translating the aspirations of theory into the hard practice of market structure. If the goal of securities markets lies in ensuring that capital can reach productive investment, information and efficiency is central. If trading mechanics can maximize the collection and pooling of information, securities prices should provide a more accurate gauge of informational and fundamental value. While a full discussion of exchange design is outside of the scope of this Article, two key features bear noting.

Price Circulation: Markets need to be supplied with a steady flow of information about activity on exchanges.[34] Investors should be able to see current prices and trading information in order to decide whether to

economists); Ronald J. Gilson & Reinier Kraakman, *Market Efficiency after the Financial Crisis: It's Still a Matter of Information Costs*, Columbia Law and Economics Working Paper No. 470 (Feb. 2014) (noting that informational efficiency under the ECMH provides the best way to proxy for fundamental efficiency) (hereinafter, "*Matter of Information Costs*"). For discussion and analysis, see, Yadav, *Algorithmic Trading* supra note 6.

[33] Gilson & Kraakman, *Matter of Information Costs*, *supra* note 32; Robert F. Stambaugh, *Does the Stock Market Rationally Reflect Fundamental Values?: Discussion*, 41 J. FIN. 601, 603-06 (1986).

[34] David Easley, Maureen O'Hara and Liyan Yang, *Differential Access to Price Information in Financial Markets*, Working Paper (2013)(noting the significance of information for price formation in markets). But see, Giovanni Cespa & Thierry Foucault, *Insiders-Outsiders, Transparency and the Value of the Ticker*, Working Paper (2008) (arguing that the most optimal model for a market is where there is either full opacity or limited transparency with a combination of insider-outsiders).

act. At a most basic level, this might extend simply to circulating the current price of securities to all traders on the exchange. When traders can see the exact prices at which securities trade, they can determine whether these might be trading at an under or over value based on the private reserves of information that they possess. Timely price data allows traders to also determine demand for a particular security - helping informed and derivatively informed traders to deduce the existence of hidden news emerging into the market.

Broadly circulated price data helps support efficiency in markets. Rather than spend money on acquiring information about current prices, a trader can instead direct investment towards real research.[35] Where heterogeneous groups of traders face fewer transaction costs, price formation should be more richly informed. The importance of publically available price data is reflected in current market practice. In the U.S., all major venues that trade securities listed on national and regional exchanges must report current quotes to the Consolidated Tape or "ticker" that circulates a stream of price-related information throughout the market.[36] Instead of forcing individual traders to invest in acquiring this data from multiple exchanges, the ticker does this job far more cheaply.

Liquidity: The ability of investors to easily move in and out of their positions helps markets to become better at revealing information about securities. If traders are unable to transact when they wish, the information they can convey by this transaction will be muted in its impact. A lack of liquidity can harm informational as well as fundamental value efficiencies. For one, if investors cannot use information to quickly exit their investment, they must bear the risk that their capital is locked-in for a period of time. Rationally, traders that cannot gain ready access to their money are likely to discount for this possibility. This calculated reduction of investment can leave productive companies receiving far fewer funds than they might otherwise deserve.[37] Moreover, the costs of capital trapped in sticky investments can result in powerful disincentives for informed traders to enter markets. If they cannot utilize their intelligence in a timely

[35] John C. Coffee, Jr., *Market Failure and the Economic Case for a Mandatory Disclosure System*, 70 VA. L. REV. 717, 720–30 (1984) (in the context of SEC disclosure, discussing the benefits of mandatory disclosure for avoiding inefficiencies in information acquisition and research); Merritt B. Fox et al., *Law, Share Price Accuracy and Economic Performance: The New Evidence*, 102 MICH. L. REV. 331, 339–41 (2003) (noting the importance of mandatory disclosure for share price efficiency). The literature in this area is considerable. For skeptical perspectives on the value of mandatory disclosure, see for example, HOMER KRIPKE, THE SEC AND CORPORATE DISCLOSURE: REGULATION IN SEARCH OF A PURPOSE (1979).

[36] Consolidated Tape Association, Overview, available at, https://www.ctaplan.com/CTA.

[37] For a discussion of the impact of liquidity on governance outcomes, see, Bengt Holmstrom and Jean Tirole. *Market Liquidity and Performance Monitoring*, 101 J. POL. ECON. 678 (1993). For discussion see, Yadav, *Algorithmic Trading*, *supra* note 6.

fashion and if prices fail to reflect the product of their trading, there is little left to coax informed traders into the marketplace.

B. Efficiency and Intermediation

To achieve the promise of efficient and liquid trading, markets have long looked to a select cohort of institutions to support the mechanics of exchange. These intermediaries have traditionally been formally charged by exchanges to "make markets," matching buyers and sellers, using their own money to stabilize trading and to maintain trading even in market stress. By dint of this role, market makers have gained positional prominence, historically intermediating a vast swathe of trades. Despite facilitating efficiency, however, market making also creates risks. The central role of market makers raises the possibility that they might utilize non-public trading information for personal profit – undercutting investors to pick off all the best trades for their own account. In response to these structural dangers, a detailed body of law has evolved to constrain the conduct of these key traders and to place costs on their access to and use of trading information for private profit.

1. Making Markets

Market makers provide liquidity.[38] Put simply, their job is to stand ready to buy and sell securities using their own money, converting securities to cash and cash to securities. To avoid the pitfalls of uneven supply and demand for securities, market makers also stabilize order flows by selling and purchasing securities to even out spikes and troughs. This means that they need to have ready cash to buy securities from investors as well as an inventory of securities for those looking to buy.[39] In each case, market makers agree to put significant resources on the line in the everyday performance of this task.

These risks can grow markedly when markets face a crisis or unexpectedly become stressed. If a listed company announces a merger or faces bankruptcy, market makers can come under serious strain. In a crisis,

[38] Harold Demsetz, *The Cost of Transacting,* 82 Q. J. ECON. 33 (1968) (an early paper detailing the significance of liquidity for market quality).

[39] *See e.g.,* Amihud & Mendelsohn, *supra* note 11 (early paper discussing inventory management by dealers).

the need for securities is likely to go in one direction – either to buy or to sell securities – requiring the market maker to stand ready to meet this demand. In such cases, the downside risks can be extensive and difficult to quantify and provision for *ex ante*. Indeed, market makers face a double bind. Not only must they purchase securities when everyone else wishes to sell, but can also be left holding these distressed, sticky securities on their books. Similarly, when investors wish to buy securities because of good news, market makers must be able to provide these from a pool of their own inventory. Outsize demand might even force market makers to go out and buy these expensive assets from others in the market in order to meet unexpected demand. The importance of market makers and the inherent risks of this role mean that it has generally been performed by a fairly small and expert group of established Wall Street institutions.[40] Without confidence in the system of market making, and the quality of the institutions providing it, the system would have little credibility.[41]

Exchanges vary in the intensity of market making they offer. The NYSE, for example, has historically marketed itself as offering an expressly active form through the intermediation of a "specialist" market maker.[42] Specialists on the NYSE were charged with creating a "fair and orderly" market for one or more listed securities.[43] By this designation, a specialist had a monopoly power to set the buy and sell price for its specific securities against which all other traders could compete. It was also the one trader responsible for maintaining liquidity in its securities when no one else was willing to step in to trade. This placed the NYSE specialist under an affirmative obligation to keep the lights on even at a high personal cost to its own pocket. Indeed, the obligation to preserve order required a specialist to ensure that the prices it set did not suddenly jump, even if the riskiness or volatility of the securities might justify a sharp rise or fall. This need for price continuity combined with its monopoly over certain securities meant that the specialist could end up on the hook to cover potentially enormous liability in the marketplace.[44]

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[40] *See e.g.*, New York Stock Exchange, *Designated Market Makers*, https://www.nyse.com/publicdocs/nyse/listing/fact_sheet_dmm.pdf.

[41] Besessembinder et al., *supra* note 12 (noting the benefits of affirmative obligations on market makers).

[42] Lawrence R. Glosten, *Insider Trading, Liquidity and the Role of the Monopolist Specialist*, 62 J. BUS. 211 (1989).

[43] New York Stock Exchange, Rule 144.

[44] *For discussion,* Amihud & Mendelsohn, *supra* note 11; Bessembinder et al., *supra* note 12; Glosten, *supra* note 42. The finance literature on the advantages and disadvantages of affirmative obligations and price continuity is extensive. In recent years, responding to the emergence of automated traders competing for their business, the role of the specialist has relaxed. The NYSE has disbanded the "specialist" model in favor of a looser category of Designated Market Makers (DMMs). Unlike specialists, DMMs are not subject to extensive affirmative obligations in price continuity.

The old specialist model is only one option available to exchanges. Instead of working on a monopolistic design, market makers might also compete with one another. The NASDAQ, for example, comprises a network of several market makers that act as intermediaries to buy and sell securities to investors. Rather than relying on a single monopolist to set the prices – as was the case on the NYSE with the specialist – the NASDAQ encourages its maker makers to compete with one another. This process is designed to promote more efficient price discovery.[45] While these markets might aim to encourage competition between numerous market makers, they do not always work that way in practice.[46] Scholars have observed that, despite a multiplicity of competing firms, one or two dealers dominate trading for a particular stock. This can happen, for example, if they acted as underwriters for the IPO offering, have special knowledge about a company's industry or if they have a history of dealing in those securities.[47] In other words, dealers with better information can often have an advantage over others.

Finance theorists have debated the merits of monopolistic market makers versus more competitive models.[48] A discussion of these debates is outside the scope of this Article. The key point, however, should now be clear. Securities markets have long depended upon a small cohort of dedicated market makers for their successful operation. This role places this group of firms at the heart of trading and positions them to be central vectors that guide the flow of trades throughout the market. This structural positioning, however, creates a fundamental regulatory conundrum. Market makers anchor modern securities markets: their one and only goal is to maintain the smooth liquidity of busy markets. But, his role places them in a unique position to survey the flow of trading information in the marketplace. Though their function is critical, it also raises the risk that a select set of insiders is ideally placed to take advantage of their access to systematically make private gains at the expense of other investors.

2. Investor Protection and Market Insiders

[45] Ellis, Michaely & O'Hara, *supra* note 11, 3-6.

[46] In addition, NASDAQ has been famously implicated in collusive practices between its dealers. See, notably, Christie & Schultz, *supra* note 13.

[47] Ellis, Michaely & O'Hara, *supra* note 12, 3-6; See also, Bidisha Chakrabarty, *Do Dealers Infer Information from Order Flow,* Working Paper (noting the tendency of dealers to follow the quotes of a "lead" dealer).

[48] For a discussion of the literature, see Bessembinder et al., *supra* note 12; Ellis, Michaely & O'Hara, *supra* note 11.

Regulators have long recognized the risks of traditional market makers taking advantage of their access to information for private gain. For one, their structural position gives rise to numerous potential permutations by which such systematic advantage might be extracted. Take, for example, the classic case of market makers front-running investor orders. Here, a market maker can exploit its position to opportunistically get ahead of its clients to capture the best deals in the market for its own gain. A simple example serves to illustrate the problem. A Mutual Fund places an order with a NYSE specialist to buy 100,000 shares of Public Company at a price range of between $100-$102 per share. With the specialist able to see incoming orders on the exchange, it thinks that the Mutual Fund has private information about the Public Company that will raise the price of Public Company shares. If the shares of Public Company are trading at $100 per share, the specialist might purchase these securities for itself at $100 rather than make the trade for the Mutual Fund. If the market maker buys enough shares, its action will raise the price of the security for everyone else. Now, the Mutual Fund must pay more for its order than it might otherwise have done, and the specialist has made money at the expense of the investor simply by virtue its position.[49] Front running by market makers can be particularly pernicious for investors. Not only can it result in systematic and incremental losses to investors over time - but this loss might also act as a disincentive to informed traders looking to maximize gains from their research and insight.[50] Invariably, with the potential for large, lucrative profits, exchanges have routinely faced instances of front running on the trading floor.[51] In one infamous incident, the SEC and federal prosecutors brought civil and criminal charges against a number of elite specialist market makers on the New York Stock Exchange.[52] This group of stood

[49] For a detailed early analysis of front running and its various permutations, Jerry Markham, *Insider Trading under the Commodities Exchange Act*, 38 J. CATHOLIC U. L. REV. 69, 79-83 (1988) (showing examples of various types of front-running); SEC v Capital Gains Bureau 375 U.S. 180 (1963) (an early case of brokers scalping client orders); In *Re Application of E. F. Hutton & Co.,* Securities Exchange Act Release No. 25, 887, Fed. Sec. L. Rep. 84, 303 (Jul., 6 1988); U.S. v. Dial, 757 F. 2d. 163 (7th Cir.), *cert denied*, 474 U.S. 838 (1985).

[50] The literature is here is vast. For a discussion on the general impact of front running on informed traders, see, Sugato Chakravarty & Asani Sarkar, *Informed Trading with Multiple Competitive Brokers*, Working Paper (1996).

[51] LOUIS LOSS & JOEL SELIGMAN, SECURITIES REGULATION § 7-A-2 (2006) (detailing that, an early study by the SEC from the 1960s, showed that market specialists making proprietary trades were profitable 80% of the time).

[52] Criminal charges were brought against 15 firms, while civil charges by the SEC were brought against 20 firms. See, Press Release, Securities and Exchange Commission, SEC Institutes Enforcement Action against 20 Former New York Stock Exchange Specialists Alleging Pervasive Course of Fraudulent Trading, April 12, 2005, https://www.sec.gov/news/press/2005-54.htm. For an earlier charges against a specialist for front running violations, see, In re Fleet Specialist, Inc., Exchange Act Release No. 49499, 2004 SEC LEXIS744 (Mar. 30, 2004).

accused of making millions by front running exchange orders and trading first for their own pockets rather than for their clients. Indeed, the NYSE also faced sanction for its poor policing of its specialist traders.[53]

But, front running is far from the only risk. Small groups of dealers may collude with one other to quote higher prices to buy and sell securities to investors – pocketing the extra cash for themselves. This danger may be especially live in the world of competitive market makers – when multiple dealers are vying with each other to capture investor attention. By fixing prices (or "spreads"), investors are forced to internalize higher transaction costs, irrespective of whether they are informed or uninformed traders. Indeed, such cartelizing effects a wealth transfer to designated dealers without any corresponding informational gain for markets.[54]

Regulators have placed costs on the ability of market makers to extract private gains by virtue of their proximity to trading data. An elaborate body of regulation has grown to restrict use of such information by market makers for their own trades. Notably, exchange members are forbidden under Section 11(a) of the Securities and Exchange Act 1934 from front running their client's orders to make personal profit on trades.[55] While specialists have enjoyed an exemption from this prohibition, Section 11's stipulations are heavily bolstered by exchange rulemaking. In discharging their duty to effectively supervise their trading venues, exchanges prescribe detailed sets of rules to control what dealers and market makers are permitted to do with the information they acquire. Rules 104 and 92 of the NYSE, for example, articulate a statement of the rules and responsibilities for market makers. The NYSE's old Rule 92 generally prohibited its specialists from utilizing information acquired in their role from front running customer orders.[56] Exchanges like the NASDAQ similarly set out detailed rules to ensure that opportunistic dealers do not purloin investor information.[57] Where dealers fail to comply, they face

[53] THE ECONOMIST, *Specialists Stumble*, April 14, 2005, http://www.economist.com/node/3871250. See also, BLOOMBERG, *CALPERS Sues NYSE Firms*, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aUUw5xkA1kkg; Press Release, SEC, SEC Charges The New York Stock Exchange with Failing to Police Specialists (Apr. 12, 2005).

[54] Christie & Schultz, *supra* note 13 (the study noted that NASDAQ market makers never quoted spreads of 1/8th, even though those on other exchanges utilized the full range of spreads available for similar or the same securities.

[55] 17 C.F.R. § 240.11a-1 (2008). It should be noted that specialists are generally exempt from this prohibition.

[56] NYSE Rule 92 (2003). NYSE's Rule 92 has since been repealed and replaced by Rule 5230. Rule 5320 reflects FINRA's prohibition against front running, as articulated by FINRA Rule 5320 (the Manning Rule). FINRA Regulatory Notice 11-24 (May 2011); Release No. 34-65164; File No. SR-NYSE-2011-43, http://www.sec.gov/rules/sro/nyse/2011/34-65164.pdf.

[57] NASDAQ, Equity Rules, http://nasdaq.cchwallstreet.com/nasdaq/main/nasdaq-equityrules/chp_1_1/default.asp;

punishment from both exchanges and regulators, creating high costs of public and private sanction.

While commentators have raised doubts about the effectiveness of exchange enforcement, evidence broadly suggests that these rules work. Finance theory and empirical scholarship observes that market makers behave, on average, like *uninformed* traders. As articulated in their seminal work, Professors Glosten and Milgrom observe that market makers are primed to lose out to informed traders.[58] Despite their structural advantages, market makers suffer systematic adverse selection costs against informed traders. In other words, rather than investors losing to the all-seeing market maker, it is the market maker that loses money to the informed trader.[59] For example, when NASDAQ market makers were caught in a scheme of tacit collusion, as discussed above, they were forced to undergo thoroughgoing reform of their practices to eliminate the artificially high spreads. Post-reform, a study of NASDAQ spreads showed that, while these had (obviously) fallen in response to reform efforts, the greatest decrease was for spreads in low-volume stocks. Because such stocks saw relatively less trading, those that did trade were likely to do so when they had meaningful private information. The steeper fall in spreads for low-volume stock suggested that NASDAQ dealers might have been especially live to the adverse selection costs created by informed dealings in such securities and charged much more to compensate for this risk.[60]

Indeed, this asymmetry in the relative positions of the informed trader and market maker constitutes the central dilemma of market making. Knowing they are going to lose against the informed traders, market makers must compensate themselves for these losses and to creatively mitigate the risks they confront (e.g. by charging higher spreads or by tightly managing their inventory of securities).[61]

In summary, our securities markets have historically depended on a small cohort of market makers for their smooth functioning – to always

[58] Lawrence R. Glosten & Paul R. Milgrom, *Bid, Ask and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders*, 14 FIN. ECON. 71 (1985); See also, David Easley & Maureen O'Hara, *Price, Trade Size and Information in Securities Markets*, 19 J. FIN. ECON. 69 (1987). On adverse selection in general see, George Akerlof, *The Market for Lemons: Quality, Uncertainty and the Market Mechanism*, 84 Q. J. ECON. 488 (1970).

[59] The literature on this issue is vast. Historically, scholars have noted that the adverse selection problem is generally less pronounced in the case of the old NYSE specialist with full sight of the order book. For discussion and analysis, Kevin Rock, *The Specialists Order Book and Price Anomalies,* Working Paper (1990).

[60] Michael Barclay et al., *The Effects of Market Reform on the Trading Costs and Depths of NASDAQ Stocks*, 54 J. FIN. 1 (1999); See also, Bruno Biais et al., *Imperfect Competition in Financial Markets: Island vs. NASDAQ*, Working Paper (2002).

[61] Lawrence R. Glosten & Lawrence E. Harris, *Estimating the Components of the Bid/Ask Spread*, 21 J. FIN. ECON. 123, 126-8 (1987). See also, James F. Gammill, Jr., *Financial Markets Design When Traders Have Private Information* (1986).

provide liquidity in good times and bad. Without their intervention, markets are left vulnerable to periodic shocks of supply and demand that can distort pricing and create entry and exit costs for investors. While market makers have gained positional privilege in markets – historically relied upon to intermediate trades as specialists or as dealers – they have also been heavily regulated. Policymakers have struck a delicate bargain, recognizing the central position of market makers but also placing costs on their ability to utilize trading information for private gain. This balance broadly reflects a recognized allocation of information costs between market insiders – the market makers – and investors at large. Regulation has sought to protect investor information from being systematically undercut by structural insiders, leaving these insiders to internalize the costs of protecting themselves against more informed investors.

II. THE MODERN INTERMEDIARY

This Part analyzes the emergence of high frequency trading (HFT). Traditional market makers have ceded ground to high-speed electronic traders that fulfill the basic economic functions of a market maker without being burdened by the full panoply of legal duties that accompany the designation.[62] As markets have grown ever more reliant on ultra-fast traders to provide liquidity, the long-held allocation of information costs between market makers and investors has been radically transformed. Combining speed, physical access and superior information from exchanges, a select cohort of HFT market makers have acquired a prize position from which to view not-fully-public information and to utilize this special access for private profit.

A. Economic Market Making

1. Algorithmic Trading

Algorithmic trading refers to the use of algorithms – or pre-programmed electronic instructions – to undertake nearly all parts of the

[62] Foresight, *The Future of Computer Trading in Financial Markets: Final Project Report*, Government Office for Science (London), at 20-50 (2012) (discussing the rise of automated trading in a variety of trading strategies).

trading process.[63] Rather than rely on human beings to follow a strategy, submit orders, route them to the best exchanges and to execute trades, traders can instead program algorithms to complete these tasks. With computers on the frontlines, trades can progress rapidly, deploy complex data and transact enormous volumes of securities across multiple exchanges accurately and profitably.

Algorithmic trading includes a subset of extremely rapid, high-volume securities dealing – high frequency trading (HFT) – characterized by traders buying and selling securities in milliseconds and microseconds. While there remains no clear definition of HFT, the SEC has proposed some key features that serve to broadly distinguish HFT traders from other algorithmic actors. For example, HFT firms are usually proprietary firms that trade for themselves and use their own money. Rather than make trades for clients, as traditional dealers have done, HFT firms transact to make money for their own purse. Without clients to look after, HFT traders have far fewer regulatory constraints (e.g. with respect to front-running) and can pursue their own strategies. In addition to being proprietary firms, HFT traders show rapid turnover of securities, locate at or near exchanges and usually end the day without any open positions.[64] HFT firms are specialized trading firms rather than household names, including Virtu Financial, Teza Technologies, Jump Trading, Tower Research – relative newcomers rather than part of Wall Street's old guard.[65]

HFT has become a dominant paradigm in securities trading. By some estimates, HFT is responsible for around 50-70% of all equities trading by volume.[66] In the futures market, for example, studies suggest that around 60% of trading by volume is driven by HFT.[67] Using HFT, securities trade at speeds measured in milliseconds and microseconds, with traders able to enter and exit their positions in tiny intervals of time.[68] At

[63] *See sources cited supra* note 15.

[64] SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4-5 (Mar. 2014).

[65] Greg Laughlin, *Insights into High Frequency Trading from the Virtu Initial Public Offering*, 2-4, Working Paper.

[66] Michael Mackenzie, *High Frequency Trading under Scrutiny*, FIN. TIMES, Jan. 9. 2013. These figures can vary between studies and are difficult to determine definitively, For a wide review of the studies, SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4-7 (Mar. 2014).

[67] *See, e.g.* C.G Howe, *supra* note 1.

[68] SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4 (Mar. 2014); David Easley, Marcos M. López de Prado & Maureen O'Hara, *The Volume Clock: Insights into the High-Frequency Paradigm*, J. P'FOLIO MGMT., May 2012 (noting the importance of volume as well as speed trading in HFT).

this tempo, engaging human decision-making is impossible. HFT traders necessarily depend on sophisticated algorithms for their operations.[69]

Market Making: HFT is especially conducive to market making.[70] Traditionally, market makers stand ready to buy and sell securities using their own money in an effort to ensure that investors face low transaction costs. Algorithmic traders fulfill the economic function of market making by harnessing speed, high-volume trading and data analysis to make a market, rather than being formally contracted to do so by an exchange.

HFT traders submit orders to buy and sell securities usually trading for themselves using their own money.[71] Instead of holding onto securities for days or hours, HFT traders enter and exit positions in milliseconds or less. By harnessing speed and rapid turnover of trades, HFT firms can perform hundreds of thousands of trades in a day and act as a willing and available trading partners for investors. Rather than waiting for old-style market makers to match buyers and sellers or to take the trade on their own books, HFT firms offer an immediate deal, reducing search costs and execution uncertainty for investors.[72]

The HFT market-making model offers a multiplicity of benefits. Firms can make sure and steady profits by undertaking large volumes of trades over a day – taking a tiny slice of profit from each one. For example, Virtu Financial, a prominent HFT firm, is reported to transact in around 160 million shares per day across 800,000 trades, with an average profit of around $0.0027 per share ($440k per day for equities trading). Indeed, Virtu's business model has been so successful that it has lost money on only one out of 1,278 trading days – likely attributable to technological error, rather than a bad day of unprofitable trades.[73] Taken together, predictable and accretive gains are made even more attractive given the attenuated risks assumed by the ultra fast algorithmic trader. Instead of keeping securities on their books for an extended period of time, as old-style market makers may have done, the exposure HFT traders face is fleeting. With these momentary exposures to securities, firms do not

[69] SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4 (Mar. 2014).

[70] C.G Howe, *supra* note 1, 4-5.

[71] SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4 (Mar. 2014).

[72] Brogaard et al., *supra* note 17; Menkveld, *supra* note 17; Easley et al., *supra* note 68.

[73] Greg Laughlin, *Insights into High Frequency Trading from the Virtu Initial Public Offering*, 2-4, Working Paper. Virtu trades across many markets, not just those for equities. It is estimated that Virtu probably performs around 2.5-3 million trades across all asset classes. Professor Laughlin estimates that Virtu is responsible for between 3-5% of the volume of equities trading in the U.S. See also, VIRTU FINANCIAL, FORM S-1, https://www.sec.gov/Archives/edgar/data/1592386/000104746914002070/a2218589zs-1.htm. For discussion of HFT profits using bid-ask spreads and cross-market strategies, see, Menkveld, *supra* note 17.

have to invest in deeply researching their fundamental, future performance, but only how prices might shift in the very short term. And, without affirmative contractual obligations to remain on the market, HFT firms do not have to provision for the possibility they might be called upon to remain on the exchange in times of trouble. If crisis hits, such firms can and do leave – and return only when market conditions are more forgiving.[74] With exit a cheap option, HFT firms need invest even less in value-relevant research.[75]

HFT has proven popular with exchanges and trading platforms. For a start, as the example of Virtu Financial indicates, rapid-fire algorithmic trading represents a volume driven business.[76] Bringing millions of trades per day to the marketplace, HFT generates sizable boosts in revenue for exchanges on account of the fees paid by traders as well as investors.[77] More fundamentally, scholars speak to an improvement in market quality and lower transaction costs for investors.[78] Liquidity is abundant and immediate. With algorithmic market makers facing fewer risks, spreads have fallen. Based on one study examining the impact of the "new market makers," Professor Menkveld highlighted an almost 50% drop in spreads with the arrival of a HFT on an exchange.[79]

Given the benefits that HFT has brought for liquidity, HFT traders enjoy access to structural advantages in the marketplace that have, in practice, yielded unprecedented informational advantages. In particular, HFT traders benefit from: (i) physical proximity to exchanges; (ii) rich data feeds of exchange activities; (iii) programming that enables instant reaction to new information. Together, these essential attributes of HFT

[74] Pradeep Yadav, Vikas Raman and Michel Robe, *Man vs. Machine: Liquidity Supply and Market Fragility*, Working Paper (July 2014).

[75] Andrei Kirilenko et al., *The Flash Crash: The Impact of High Frequency Trading on an Electronic Market* (May 26, 2011).

[76] NANEX RESEARCH, FRIENDS WITHOUT BENEFITS (Aug. 9, 2012), http://www.nanex.net/aqck2/3528.html (noting that traders were submitting around 460 times more quotes for trades in 2012 than in 2000)' For discussion, see, Yadav, *Algorithmic Trading*, supra note 6. See also, Easley et al., *supra* note 68.

[77] Scott Patterson & Andrew Ackerman, *Regulators Weigh Curbs on Trading Fees*, WALL ST. J., Apr. 14, 2014 (noting the fee structure of exchanges and discussing debates for reform).

[78] Jonathan Brogaard, Terence Hendershott & Ryan Riordan, *High Frequency Trading and Price Discovery* (European Central Bank Working Paper Series No. 1602, 2013); SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4-6 (Mar. 2014). But see, Yadav, *Algorithmic Trading*, *supra* note 6; Zhang, *supra* note 17 (on the transient and poor quality of liquidity offered by HFT).

[79] *See, especially*, Menkveld, *supra* note 17. But see, Yadav, *Algorithmic Trading*, *supra* note 6; Zhang, *supra* note 13 (discussing the low-quality of the liquidity created by HFT). It is also worth noting that HFT liquidity can evaporate in times of market stress. See, STAFFS OF THE CFTC AND SEC, FINDINGS REGARDING THE EVENTS OF MAY 6, 2010 45 (2010), *available at* http://www.sec.gov/news/studies/2010/marketevents-report.pdf. For a fuller discussion of the literature and the problems for efficiency, fundamental traders and regulation created by HFT, see, Yadav, *Algorithmic Trading, supra* note 6.

work to allow certain HFTs to have preferential access to information, to trade on it and change prices before the information reaches the broader market. In past iterations of market making, regulation and markets sought to create a separation between providing liquidity and private information trading. The arrival of HFT blurs this distinction irreversibly.

2. Physical Proximity

The ability of traders to physically place their computer servers next to those of an exchange constitutes a critically important means of facilitating HFT. Indeed, the SEC identifies colocation as a key feature of HFT.[80] With speed essential, HFT is ultimately constrained by geography. If a firm's orders must travel long or looping distances to reach an exchange, it faces a problem vis-à-vis competitors situated closer to the market. Distances delay the arrival of a trader's orders. They also increase the time it takes for traders to receive information from the exchange.[81]

Co-location describes the practice of exchanges offering trading firms physical proximity to exchange order-matching engines. This means that an exchange allows trading firms to situate their servers in the exchange building or in data centers that are owned and operated by the exchange.[82] This proximity brings significant advantages. Because of colocation, a trader might reduce its execution time by one millisecond – the time it would generally take for its order to travel 100 miles.[83] With greater proximity, a trader can capture the best available offering price for Public Company shares because its order gets to the exchange matching engines faster than those of an outsider-competitor. The incremental

[80] SECURITIES AND EXCHANGE COMMISSION, EQUITY MARKET STRUCTURE LITERATURE REVIEW: HIGH FREQUENCY TRADING, 4 (Mar. 2014). See also, Michael J. Aitken et al., *Trade Size, High Frequency Trading, and Co-Location Around the World*, Working Paper (March 2014) (noting that the arrival of HFT traders motivates exchanges to offer colocation services).

[81] *See, e.g.* Jerry Adler, *Raging Bulls: How Wall Street Got Addicted to Light-Speed Trading*, WIRED MAGAZINE, March 3, 2012; Matthew Phillips, *My Laser is Faster than Your Laser*, BLOOMBERG, Apr. 23, 2012, http://www.bloomberg.com/bw/articles/2012-04-23/high-speed-trading-my-laser-is-faster-than-your-laser; Scott Patterson, *High-Speed Stock Traders Turn to Laser Beams*, WALL ST. J., Feb. 11, 2014. Notable examples have included the construction of a $300m transatlantic fiber-optic cable to connect markets in London and New York, primed to shave 5.2 milliseconds off the time it takes an order to travel from London to New York and back. To reduce the execution time for trades between New York and Chicago, HFT firms have backed the creation of a new cable between the cities, designed to reduce the round-trip trading time by around 3 milliseconds. By one estimate, trading firms spent around $2.2 billion in 2010 on trading infrastructure

[82] *See e.g. Colocation Services*, EUREX, http://www.eurexchange.com/exchange-en/technology/co-location-services ("Co-location hosting means that exchange participants trading applications are located in the same data center as Eurex Exchange's matching engines.").

[83] FINANCIAL TIMES, *Lexicon: Definition of Colocation*, http://lexicon.ft.com/Term?term=co_location.

advantage of a just a single millisecond can prove extremely lucrative for a trader over time. Commentators from the market research firm, the Tabb Forum, estimate that a just one millisecond of advantage in trading can translate into $100m for a single trader when multiplied over a year.[84] In the absence of co-location, such tiny, incremental slivers of gain would be impossible without traders internalizing the cost of some significant private investment in trading infrastructure to boost transmission speeds.

Co-location also represents a boon for exchanges, bringing financial as well as reputational gain. Given that even tiny profits per trade give rise to paydays for HFT traders, major exchanges make sizable financial gains by charging traders fees for co-location privileges.[85] Recent years have seen the major national exchanges buy up and move trading operations to large data hubs capable of housing volumes of co-located servers to cope with the demand. In 2010, for example, the NYSE moved its matching engines to a 400,000 square foot data center in Mahwah, New Jersey and began shifting trading in some stocks from New York City to Mahwah. Colocation rights in the NYSE's facilities sold out quickly, prompting calls for the NYSE to further expand these data centers.[86] Traders usually transact on multiple markets and submit orders to many exchanges at once. This means that they often seek out opportunities for strategic co-location close to the matching engines of several exchanges. For example, with the NYSE housing its data center in Mahwah (north New Jersey) and the NASDAQ locating its matching engines in Carteret (south New Jersey), traders routinely seek to trade from Secaucus, a geographical mid-point between the two data centers. With the significance of such multi-market trading, exchanges and their data centers also offer high-end communication services between trading hubs, charging fees for use of this sophisticated infrastructure.

From the regulatory standpoint, co-location has faced few meaningful constraints.[87] Exchanges must ensure that the terms on which they offer co-location services are brought to the SEC for review and are in

[84] Ted Oberhaus, *High Frequency Trading: the Colocation Advantage*, TABB FORUM, 23 May 2014.

[85] *See e.g.*, NYSE EURONEXT, ANNUAL REPORT (FORM 10-K) 8, 41, 66 (Dec. 2012)

[86] Rich Miller, *NYSE Opens Mahwah Data Center*, DATA CENTER KNOWLEDGE, Aug. 9, 2010, http://www.datacenterknowledge.com/archives/2010/08/09/nyse-opens-mahwah-data-center/. Traders usually transact on multiple markets and submit orders to many exchanges at once. This means that they seek out opportunities for strategic colocation close to the matching engines of several exchanges. For example, with the NYSE housing its data center in Mahwah (north New Jersey) and the NASDAQ locating its matching engines in Carteret (south New Jersey), traders routinely seek to trade from Secaucus, a geographical mid-point between the two data centers. With the significance of cross-market trading, exchanges and their data centers also offer high-end communication services between trading hubs, charging fees for use of this sophisticated infrastructure. *Can We Get Closer: What's next in Co-location*, MARKETS MEDIA, Jun. 22, 2012, http://marketsmedia.com/closer-whats-co-location/.

[87] Securities and Exchange Act 1934 § 19(b)(1) (15 U.S.C. 78s(b)(1))

compliance with core exchange rules and applicable securities laws. Under the Securities and Exchange Act 1934, exchange services must be made available to traders in a manner that does not discriminate between them, harm investors or disturb the operation of a free and open market for trade.[88] Any fees and dues should be shared between an exchange's members and users of its facilities in a reasonable manner.[89] Besides these overarching stipulations, co-location has not come under deeper, more searching scrutiny.[90] While the SEC fined the NYSE for its failure to provide colocation services on an equitable basis, it did so without interrogating the actual place and existence of co-location in the market.[91]

3. Access to Information

Traders of all stripes can subscribe to detailed data feeds from exchanges that provide deeper and faster access to trading information. HFT traders – owing to the fact of co-location – can see this information, trade on it and change prices before it reaches the wider market.[92]

The NBBO: Current regulation tilts the balance to allow HFTs to receive fast feeds of data directly from exchanges. By law, exchanges must compete to deliver the best price for listed securities and display this price publically for the market. The policy goal is straight-forward: investors should be able to trade at the best displayed price in the so-called "National Market System" (NMS) or the combined network of competing public exchanges in the U.S.[93] To achieve this best displayed price – known as the National Best Bid Offer price (NBBO) for any security, exchanges must regularly submit their best quotes into a single repository – the so-called Securities Information Processor or SIP – designed to consolidate this information from the exchanges, to aggregate the various quotes and deliver the best NBBO for the market. The SIP ensures that the

[88] Securities and Exchange Act 1934 § 6(b)(5) (15 U.S.C. 78f(b)(5)).

[89] Securities and Exchange Act 1934 § 6(b)(4) (15 U.S.C. 78f(b)(4)).

[90] *See e.g.*, Release No. 34-67666, Sec. & Exchange Comm'n, Self-Regulatory Organizations; New York Stock Exchange LLC; Order Approving a Proposed Rule Change Amending the New York Stock Exchange Price List to Provide for Additional Colocation Services and Establish Related Fees (Aug. 15, 2012).

[91] Press Release, Sec. & Exchange Comm'n, SEC Charges NYSE, NYSE ARCA, and NYSE MKT for Repeated Failures to Operate in Accordance With Exchange Rules (May. 1, 2014). It should be noted that the SEC requested comments on the costs and benefits of colocation as well as on its fairness for markets in 2010, but without taking further action since its request. See, Concept Release on Equity Market Structure, Release No. 34-61358 (SEC, Feb. 2010), 59-60.

[92] Gary Stone, *SIP and Direct Feeds Latency: What are the Rules?* BLOOMBERG TRADEBOOK (May 15, 2014) (noting that colocation allows SIP information to reach co-located actors faster).

[93] Regulation National Market System Rule 600, 17 CFR 242.600; Regulation National Market System Rule 611, 17 CFR 242.611.

National Market System is continually generating a best national price or NBBO for investors and maintaining a clear benchmark to safeguard investors from being short-changed by opportunists.[94]

While a laudable end, the process of generating the NBBO also creates informational deficits and processing costs. First, it builds delay into the system. Information must be submitted to the SIP, which consolidates all the data and generates an output for consumption by the market. This takes time. The delay is significant. In the milliseconds it takes for the SIP to deliver its display price, HFT trades occur and prices are impacted as a result. As such, by the time the SIP reacts with a price, its read of the market is already long out of date.

Secondly, the information that exchanges must supply to generate the NBBO – their best quotes to buy and sell a security – is only thinly informative. To get a fuller picture, more detail is desirable, particularly to understand the deeper demand for a security, the size of orders, who is trading and their strategies.[95]

The Demand for More Information: Inevitably, delays involved in generating the SIP as well as gaps in the data comprising it, generate demand for more comprehensive and fast data. With trading occurring in microseconds, even small delays in generating the NBBO are significant. For those traders that thrive on exploiting small, flitting price discrepancies at high speeds, trading on the NBBO alone is also not gainful.

Exchanges, alongside a host of data collection specialists, have responded by selling subscriptions to "direct feeds" that connect an exchange with servers belonging to traders. These feeds are proprietary to individual exchanges and usually come with an expensive price tag.[96]

Direct feeds bring considerable benefits for all traders that receive them – but especially for those that are physically co-located with an exchange. Rather than relying on the SIP to collect and consolidate data to deliver a market-wide NBBO, traders can complete this task themselves. By gathering data from the different exchanges, parsing it and estimating their own NBBO, traders may be able to calibrate a more exact benchmark privately. Individual traders can also develop a more detailed picture of

[94] There are two main SIPs, one providing the NBBO for stocks listed on the NASDAQ and another providing the NBBO for stocks listed on the NYSE. For discussion, Shenwei Ding et al., *How Slow is the NBBO? A Comparison with Direct Exchange Feeds*, Working Paper (Jul. 8 2013), 3-4 (comparing the impact of delays in receiving information from the SIPs vs. direct feeds).

[95] For instance, until December 2013, orders for fewer than 100 shares were excluded from the data reported to the SIP. However, as Professor O'Hara et al. observed, even small orders are critical for price discovery, making their exclusion detrimental to price discovery. See, Maureen O'Hara et al., *What's Not There: the Odd-Lot Bias in TAQ Data*, Working Paper (Jul. 2011); FINRA, TRADE REPORTING AND FREQUENTLY ASKED QUESTIONS, http://www.finra.org/Industry/Regulation/Guidance/P038942.

[96] Gary Stone, *SIP and Direct Feeds Latency: What are the Rules?* BLOOMBERG TRADEBOOK (May 15, 2014).

market activity. Data included in direct feeds is often much richer than the information provided to the SIP. Instead of just offering data on best and last quotes, proprietary direct feeds are often much more detailed, including information about various order types and their size.[97] Exchanges might offer traders a menu of options, giving them a choice of subscription feeds that vary in the depth and detail that they provide.[98] Traders can also buy raw data from exchanges, that is, data that emerges fresh from exchanges and has not gone through the cleaning and collation liable to add micro-delays to information delivery.[99] These raw feeds are designed to convey information at ultra-fast speed and to cater especially to those traders that rely on rapid-fire information flows to make money.

Regulation requires exchanges to provide broad access to their data. As centerpieces of the market's infrastructure, exchanges must provide information to all investors in a manner that is fair and non-discriminatory.[100] However, the reach of this obligation is carefully drawn. It emphasizes that exchanges must submit their data to a SIP or a data feed in a manner that does not discriminate between investors. It does not require that exchanges check that traders all receive this information at the same time. Indeed, the SEC is express in its commitment to ensuring that exchange communications adhere only to supplying data to a SIP and to a direct feed at the same time. As shown in FIGURE 1, this leaves exchanges able to offer direct feeds to subscribers, so long as they provide data to SIP and to the proprietary feed simultaneously. Otherwise, the disparity in the speed and content of direct feeds versus information emerging through the SIP poses little by way of regulatory concern.[101]

4. Programming

Importantly, to trade in microseconds, HFT algorithms must be in a position to harness this programming to trade independently in real-time.[102] Human programmers cannot control the trade-by-trade decision-

[97] Ding et al., *supra* note 94, 1-2.

[98] *See e.g.*, NASDAQ OMX, US AND GLOBAL DATA FEEDS, http://www.nasdaqtrader.com/trader.aspx?id=dpspecs.

[99] *See e.g.* INTERACTIVE DATA, ULTRA LOW LATENCY DIRECT DATA FEEDS, http://www.interactivedata.com/uploads/File/2010-Q4/rts/Direct%20Data%20Feeds.pdf.

[100] Regulation National Market System Rule 603, 17 CFR 242.603.

[101] Stone, *supra* note 96. Regulation National Market System Rule 603(a).

[102] IRENE ALDRIDGE, HIGH FREQUENCY TRADING: A PRACTICAL GUIDE TO ALGORITHMIC STRATEGIES AND TRADING SYSTEMS (2010), 20-31; RISHI NARANG, INSIDE THE BLACK BOX: A SIMPLE GUIDE TO QUANTITATIVE AND HIGH-FREQUENCY TRADING, 24-62 (2013); Christian Dunis, Andrew Harris & Sweet Leong, *Optimizing Intraday Trading Models with Genetic Algorithms*, http://www.ljmu.ac.uk/afe/afe_docs/cibef0499.pdf. For examples of some common basic models for

making of HFT algorithms, nor can they dictate the exact responses of algorithms to changing market conditions. As Professors Kearns and Nevmyvaka note, HFT algorithms can also be sophisticated enough to learn from their successes and failures and to anticipate the future impact of their own trading.[103] This means that algorithms will collect information, collate and analyze it, and arrive at a reaction by submitting orders into the marketplace – all without the intervention of their human programmers. If their trades make a loss, algorithms might also adjust their next moves, limit or even stop trading. This entire process generally occurs in millionths of a second. At this volume and tempo, there is little scope for slower traders to view market activity in real time.[104]

The point is simply this. HFT algorithms are programmed to receive and trade on data as soon as they receive it. In combination with co-location and data feeds, automated analysis and response brings significant structural advantage. HFT algorithms can see data first – by virtue of co-location and direct feeds – and transact on this information instantly. As FIGURE 1 shows, by the time information reaches the wider market, co-located HFTs have traded on it and rendered it obsolete.

B. Summary

Markets have undergone a sea change in how they generate efficiencies. Rather than rely on a small cohort of institutions to maintain liquidity, modern markets depend on a group of high-speed firms for volume, liquidity and investor participation. In fulfilling this market making function, HFT traders enjoy first access to trading information that enables them to see market information first and to change prices before information reaches the wider market.

Reflecting this transition, current market structure institutionalizes an entirely new allocation of information costs for market makers. Seen historically, the positional power of dealers over markets gave rise to a system of rules and regulations that placed costs on their attempts to extract information for private advantage. While far from airtight – given the numerous violations that have taken place over the years – regulation

trading see, Sham Kakade et al., *Competitive Algorithms for VWAP and Limit Order Trading*, Working Paper (2004), online at, https://www.cis.upenn.edu/~mkearns/papers/vwap.pdf.

[103] Michael Kearns & Yuriy Nevmyvaka, *Machine Learning for Market Microstructure and High Frequency Trading* in David Easley, Marcos Lopez de Prado and Maureen O'Hara (eds), HIGH FREQUENCY TRADING – NEW REALITIES FOR TRADERS, MARKETS AND REGULATORS (2013).

[104] Kearns & Nevmyvaka, *supra* note 103.

sought to instill parity of bargaining power between everyday investors and the small coterie of dealers that intermediated their trades.

Today, the landscape looks very different. Algorithmic traders – trading largely for themselves – exercise systematically superior structural access to exchange information. By a combination of physical proximity, rich data feeds and instantaneous algorithmic reaction to emerging news, HFT traders can receive and react to information ahead of investors that lack any one of these three assets. Seen from the point of view of market design, HFT traders increasingly appear to form a class of structural insiders with real access to information and an outsize ability to impact price formation on modern exchanges.

III. INSIDER TRADING LAW AND POLICY

The prohibition against insider trading powerfully governs the flow of information in securities markets.[105] In its doctrinal design, it imposes hard constraints on the ability of various insiders to transact in the information that they possess. Broadly, doctrine rests on the theory that insiders with private stores of non-public information pose a risk to the rest of the market and to investors at large. If insiders are able to trade freely, they will win systematically and leave others to face repeated losses over time. From the market's perspective, theory suggests, the risk of harm is particularly substantial. With one set of investors enriched by the simple fact of their insider status, others should be rationally incentivized to leave, taking their money and insights elsewhere and diminishing the power of capital markets.[106] While doctrine remains notoriously unclear in its application – and indeed conflicted in parts[107] – the social and economic harms targeted by the prohibition speak to core interests in information.[108]

[105] *Preet Bharara's Key Insider Trading Cases,* N.Y. TIMES (DEALBOOK), Dec. 10, 2014 (noting that the U.S. District Attorney for the Southern District of New York has secured 85 guilty pleas and convictions between March 2010 and December 2014); SECURITIES AND EXCHANGE COMMISSION, SEC ENFORCEMENT CASES: INSIDER TRADING CASES, http://www.sec.gov/spotlight/insidertrading/cases.shtml.

[106] The literature in this area is vast and a detailed discussion is outside the scope of this Article. For a review of the debates, see, Yadav, *Insider Trading*, *supra* note 8. For an excellent discussion of the key pillars of doctrine and policy and theoretical debates underlying insider trading, see, JOHN R. MACEY, INSIDER TRADING: ECONOMICS, POLITICS AND POLICY (1991); DONALD C. LANGEVOORT, INSIDER TRADING REGULATION, ENFORCEMENT & PREVENTION (2008); WILLIAM K. S. WANG & MARC I. STEINBERG, INSIDER TRADING (2D ED. 2005).

[107] *See e.g.*, United States vs. Newman 2014 U.S. App. LEXIS 23190 (2d Cir. 2014). For wide-ranging commentary see, THE CLS BLUE SKY BLOG, http://clsbluesky.law.columbia.edu/2015/01/28/marketplace-of-ideas-united-states-v-newman-4/; SEC v. Dorozhko 574 F.3d 42 (2d Cir. 2009).

[108] *See sources cited supra* note 6.

This Part examines the basic rationales that have conventionally justified the founding tenets of doctrine: (i) investor protection; (ii) equal access and fairness; and (iii) supporting capital markets. It outlines the central harms targeted by law and policy – and examines the tension the prohibition creates for market efficiency. This analysis sets the groundwork for examining the application of these rationales to market structure and the emergence of a class of structural insiders under HFT.

A. Primer on Doctrine

The law and policy of insider trading is notoriously complex and deeply contested. A full discussion of these debates is outside the scope of this Article. Still, the basic structure of the law is well understood.[109]

At its core, the prohibition against insider trading aims to stop select individuals – those who enjoy special access to confidential corporate information – from trading secretly on this intelligence. The policy looks to safeguard investor protection, broadly understood. By promoting investor interests, it also seeks to encourage active and liquid markets that bring all types of investor to the trading floor.[110]

The intuitive appeal of these justifying rationales has long masked the challenge of translating them into workable doctrine. Part of this difficulty lies in the decision to situate the prohibition within the larger law against fraud in Section 10b of the Exchange Act 1934 and its Rule 10b-5.[111] By grounding the prohibition in the doctrine against fraud, determining questions of liability has required showing some form of deception on the part of the insider-trader.[112] Liability now largely rests on three basic grounds under Rule 10b-5.[113]

Classical Theory: The classical theory of insider trading liability targets the paradigmatic case of a privileged cohort of informed insiders using this advantage to trade. Its focus lies in catching the managers and officers of a company that trade in that company's stock using confidential

[109] This account draws on my article, Yadav, *Insider Trading*, *supra* note 8, 390-397.

[110] In re Merrill Lynch, Pierce, Fenner & Smith, Inc., 43 S.E.C. 933, 936-8 (1968) (laws prevent the "inherent unfairness involved where one takes advantage of information intended to be available only for a corporate purpose and not for the personal benefit of anyone"). But see, Goshen & Parchmovksy, *supra* note 6 (arguing that the main goal of securities regulation is to promote a market in information). See also, Arturo Bris, *Do Insider Trading Laws Work?* Working Paper (2000) (noting the profitability of insider trading for corporate executives).

[111] In re Cady, Roberts & Co., 40 S.E.C. 907 (1961). For earlier decision placing insider trading within anti-fraud canon, see, Strong v. Repide, 213 U.S. 419 (1909).

[112] Jonathan R. Macey, INSIDER TRADING: ECONOMICS, POLITICS AND POLICY, 3-7 (1991).

[113] Technically, there are probably four major grounds. Here, I do not discuss insider trading liability under Exchange Act Rule 14e-3, which arises in the specific context of merges and acquisitions.

insider knowledge. When insiders trade, the losers are shareholders – both current and future investors in the company who miss out on favorable trading opportunities or are left holding worthless securities. The winners are those that – as directors and managers – are classically viewed as custodians of shareholder capital.[114] Following the decision in *Chiarella v. United States*, the law punishes defendants that owe a special bond of loyalty – i.e., those that owe a fiduciary duty of trust and protection.[115] The concept of fiduciary duty plays a critical role in crafting liability for insider trading. Insider officer-managers that are subject to this duty cannot trade on confidential information without first telling shareholders of their intention to do so. Or, they cannot trade. This disclose-or-abstain principle places a meaningful cost on directors and managers who wish to trade secretly on their company's information.

It is worth briefly noting the deeper theoretical significance of the limitations created by the requirement for a breach of fiduciary duty. Prior to *Chiarella*, the law had emphasized that all investors must have roughly equal access to corporate information. Under *Texas Gulf Sulphur*, the Second Circuit determined that equal access should be the founding rationale governing liability. In theory, this imposed liability on anyone in possession of material non-public information – not just fiduciary insiders with access. *Chiarella*, however, firmly circumscribes the range of potential defendants and anchors liability in the wrong of breaching a fiduciary norm, rather than simply coming into possession of non-public information.[116] From the legal standpoint, the fiduciary duty performs a further helpful function. The fact of breaching it and failing to properly make disclosure delivers the "deception" required under Rule 10b-5.[117]

Misappropriation: In addition to corporate insiders owing a fiduciary duty to their shareholders, the law also punishes actors that breach their fiduciary duty to a "source" of confidential information. The misappropriation theory of liability, as established by *U.S. v O'Hagan* takes a broad view of protecting confidential corporate information. Rather

[114] In re Cady, Roberts & Co., 40 S.E.C. 907 (1961).

[115] SEC v. Texas Gulf Sulphur Co., 401 F.2d 833, 848 (2d Cir. 1968); Chiarella v. United States, 445 U.S. 222, 223-226 (1980); Dirks v SEC, 463 U.S. 646, 654-69 (1983).

[116] SEC v. Texas Gulf Sulphur Co., 401 F.2d 833, 847-848 (2d Cir. 1968), cert. denied, 394 U.S. 976 (1969) ("…all investors trading on impersonal exchanges have relatively equal access to material information."); Matter of Cady, Roberts & Co., 40 S.E.C. 907, 912-915 (1961).

[117] Chiarella v. United States, 445 U.S. 222, 223-226 (1980). For discussion, Donald C. Langevoort, *Fine Distinctions in the Contemporary Law of Insider Trading*, COLUM. BUS. L. REV. 429 (2013), 429, 431-33, (2013) (discussing the centrality of "constructive fraud" as grounding Rule 10b-5 liability for insider trading under *Chiarella*); Adam C. Pritchard, *Justice Lewis F. Powell, Jr., and the Counterrevolution in the Federal Securities Laws*, 52 DUKE L. J. 841, 845-7; 932-40 (2003) (discussing the role of Justice Powell in entrenching the importance of the fiduciary principle); Stephen M. Bainbridge, *Incorporating State Law Fiduciary Duties into the Federal Insider Trading Prohibition*, 52 WASH. & LEE. L. REV. 1189, 1192-5 (1995). But see, Nagy, *supra* note 4.

than confine its reach to select company officers, the scope of the misappropriation doctrine is more diffuse.[118] Under *O'Hagan,* breaching a fiduciary duty to a source of information – such as an employer – constitutes the deception needed to ground a claim for insider trading.[119] Where a lawyer or accountant, for example, uses her access to confidential client information to extract secrets and trade, *O'Hagan* offers redress. Here, a defendant does not owe a fiduciary duty as director to the shareholders of the company in whose securities she has traded. Rather her duty is to her own employer – the accountancy firm or law firm. She breaches her fiduciary promise by secreting confidential information acquired by dint of her employment and misusing it to trade.[120]

The misappropriation theory has grounded recent SEC rulemaking in the area of insider trading. Reflecting the protective approach of the misappropriation theory, Rule 10b5-2 crystallizes grounds on which liability for insider trading may be based. The Rule stipulates that a duty of trust and confidence is sufficient to ground liability in relationships that are less legally formal than those involving a fiduciary. A habit of maintaining confidences, familial bonds of trust, or explicit agreements to respect confidentiality can all bring undisclosed trading within the scope of the Rule10b5-2 prohibition.[121] Similarly, emerging case law hints at expansive protection for confidential information. The case of *SEC v Dorozhko* is particularly telling. In this case, the Second Circuit found that a group of hackers that stole information and traded on it could show the requisite deception for Rule 10b-5 liability. As Professors Langevoort and Nagy observe, the broadening scope of misappropriation reveals a deep discomfort among policymakers and the courts with trading on confidential information. That laws must stretch to sanction news ways in which information may be pilfered and used reflects this suspicion.[122]

Regulation Fair Disclosure (Reg FD): Regulation FD expressly embraces the foundational principles of equal access and fairness

[118] *See e.g.* Brudney, *supra* note 2; Carlton & Fischel, *supra* note 6; Goshen & Parchmovksy, *supra* note 6 (noting the gap between the goals of securities regulation and insider trading); Langevoort, *Fine Distinctions*, *supra* note 117; Nagy, *supra* note 4 (discussing shifting doctrine in insider trading law).

[119] As Professor Langevoort notes, the SEC has sought to codify a broader reading of the misappropriation theory under Rule 10b5-2. Under this theory, insider trading may be grounded on a broken pact of confidentiality. For discussion, see, Langevoort, *Fine Distinctions*, *supra* note 117, Parts II-III. For insightful discussion, Richard W. Painter, et al., *Don't Ask, Just Tell: Insider Trading After* United States v. O'Hagan, 84 VA. L. REV. 153 (1998).

[120] United States v. Falcone, 257 F.3d 226 (2d Cir. 2001) (a warehouse worker leaked copies of a business magazine before the magazine went to print).

[121] Rule 10b5-2 17 CFR 240.10b5-2.

[122] Langevoort, *Fine Distinctions*, *supra* note 117, 450-455; Nagy, *supra* note 4. In August 2015, U.S. authorities also charged a ring of Ukraine-based hackers for stealing corporate press releases before these were released. See, Gina Chon, U.S. *Insider Trading Ring Used by Hackers*, FIN. TIMES, Aug. 11, 2015).

underlying the prohibition. It should be noted that Reg FD does not ground a breach of Rule 10b-5.[123] Under Reg FD, issuers are not allowed to make selective disclosure to favored analysts or investment professionals. The Regulation requires that any disclosure that companies make must be made simultaneously to everyone. This prevents professionals with opportunities to gain insider access – by virtue of their stature or influence – from enjoying a first look at important corporate disclosures. Reg FD supports the basic philosophy of a regulatory system premised on market-wide distribution of corporate information. By emphasizing public disclosure – or no disclosure at all – it underscores the significance of investor access above all – ahead even of the limiting role playing by fiduciary status as a backstop to liability. Crucially, just as *Chiarella* scaled back liability through the requirement for a fiduciary duty and extinguished the place of equal access in insider trading jurisprudence, Reg FD returns it, in part, back into key doctrine.[124]

B. Insider Trading Harms

The three heads of liability control perceived harms in the marketplace. To be sure, doctrine maps imprecisely onto these spectrum of wrongs. Still, despite the contested application of the prohibition, it seeks to broadly protect: (i) investors and their rights in information; (ii) fairness and equal access; and (iii) integrity of capital markets.

Investor Losses and Bargaining Position: At its core, the prohibition works to even out the playing field between insiders and other investors. Conventionally, securities' trading by corporate insiders poses an obvious problem for other investors.[125] Those with superior knowledge will always end up on the winning side of the deal. Armed with confidential insights about the inner workings of a company, insiders are well placed to know when to trade, what to trade and how much the securities are worth. Their incentives will rationally push in favor of using this knowledge most profitably, extracting maximum gains at the expense

[123] Yadav, *Insider Trading*, *supra* note 8. For discussion, Langevoort, *Fine Distinctions*, *supra* note 117, 450-460. Selective Disclosure and Insider Trading, 65 Fed. Reg. 51716, 51729 (final rule, Aug. 24, 2000).

[124] For analysis on Reg FD, its rationales and effectiveness, Jill Fisch, *Regulation FD: An Alternative Approach to Addressing Information Asymmetry* in Stephen Bainbridge (ed), RESEARCH HANDBOOK OF INSIDER TRADING (2013).

[125] Joel Seligman, *the Reformulation of Federal Securities Law Concerning Nonpublic Information*, 73 GEO. L. J. 1083 (1985) (emphasizing the significance of investor protection as the guiding principle of securities regulation). See also, Sung Hui Kim, *Insider Trading as Private Corruption*, 61 UCLA L. REV. (2014) (identifying private corruption as a central harm).

of lesser informed players.[126] Moreover, when insiders take advantage of the best trading opportunities, they will leave fewer lucrative picks for everyone else.[127] Both under the classical theory as well as misappropriation, the prohibition places costs on corporate and other constructive insiders that wish to trade. Either they must forego their advantage by revealing their cache of confidential insight to the market – or they must abstain from trading.[128] If they choose to proceed, their gains are reduced by any punishment levied and/or by the costs that they must internalize to hide their trading against encroaching regulators. In any event, insiders are made to think twice before trading – and, the lopsided playing field, tilted against investors, look a little more even by the less lucrative trade-off for insiders.

The apparent insidiousness of insider trading is most apparent in jurisprudence underlying the misappropriation theory of insider trading. As Professor Langevoort observes, the expansion of liability under *O'Hagan* to cover a disparate range of actors points to a judicial view of insider trading as manifest high deceit in capital markets.[129] Indeed, misappropriation – by its very terminology – seeks to protect property rights inhering in corporate information. As the expansion of the misappropriation doctrine in Rule 10b5-2 makes clear, the principle of preserving corporate confidentiality and control rights has become a touchstone guiding modern rulemaking and jurisprudence.[130] The responsibility of protecting corporate confidentiality now lies with a range of outsiders, including corporate advisors, concerned family members, associates, or corporate publishers.

Misappropriation thus relies on the theory that confidential information constitutes an asset belonging to corporate shareholders who should be able to extract its full value for themselves. After *O'Hagan*, constructive insiders like lawyers and accountants are not permitted to help themselves to the value generated by information, even though their relationship to shareholders is indirect. Any attempt to undercut the property rights in information – in its capacity as shareholder asset –

[126] Jesse M. Fried, *Insider Abstention*, 113 YALE L. J. 458, 459 (2004) (analyzing insider trading by choosing when not to trade, as much as when trades are made).

[127] William K.S. Wang, *Trading on Material Non-Public Information on Impersonal Stock Markets: Who is Harmed and Who can Sue Whom under SEC Rule 10b-5*, 54 S. CAL. L. REV. 1217, 1222-1230 (1980) (detailing the key harms of insider trading).

[128] But see Fried, *supra* note 126 (on abstaining with insider information).

[129] Langevoort, *Re-reading Cady Roberts*, *supra* note 3.

[130] *See, e.g.*, Langevoort, *Fine Distinctions*, *supra* note 117 (discussing the protection offered by the case of *SEC v Obus* in the context of tipper-tippee liability where liability attached to an instance of reckless tipping). But see, *U.S. vs. Newman*, where the standard appears to have tightened. In *Newman*, notably, there must be a clear showing of personal benefit on the part of the tipper and knowledge of this fact on the part of the tippee. *Obus* and *Newman* are cases whose resolution is difficult to reconcile.

constitutes a harm worthy of public sanction. Certainly, this property rights theory of harm failed is not always theoretically consistent.[131] But, it seems increasingly powerful. As seen in *Doroszko*, the property rights rationale underlying misappropriation is carried to its logical conclusion overriding the need to show a fiduciary relationship to ground liability.[132]

Fairness and Equal Access: Fairness and equal access to information constitutes an important, albeit attenuated rationale for regulating information flows in markets. In early decisions – notably, *In re Cady Roberts* and *Texas Gulf Sulphur* – the SEC and the court expressly rooted the prohibition in the need to promote a level playing field between investors and to sustain broad access to investor information. *Cady Roberts*, for example, underscored the "inherent unfairness" of a party with access to corporate information taking advantage of it to make deals with someone holding no such privilege. Concern that corporate insiders might believe themselves institutionally entitled to win was considered intolerable under doctrine.[133] This strong tilt towards broad investor interests was resoundingly embraced in *Texas Gulf Sulphur*. Here, the court sought to equalize, as far as possible, the informational costs that different investors face. After *Chiarella*, however, the significance of investor equality and access to information as a regulatory imperative has diminished substantially. The central place of fiduciary duties as a prerequisite for liability highlights high legal tolerance for asymmetries than what was expressed in *Cady Roberts* and *Texas Gulf Sulphur*.

But, equality of access – and fairness for investors – still animates the law. This is most evident in SEC rulemaking. While Reg FD runs counter to *Chiarella*, it legislates back into law some of what *Chiarella* took away. Under *Reg FD*, public companies cannot prefer one type of informational intermediary – brokers, investment analysts, institutional investors and certain existing shareholders – ahead of investors at large. Attempts by public companies to give informational favors to select actors can fall foul of regulation. While it is by no means as robust a statement supporting equal access and fairness as *Cady Roberts* or *Texas Gulf*, Reg

[131] *See e.g.*, Carlton & Fischel, *supra* note 6; Goshen & Parchmovsky, *supra* note 6. As these scholars observe, recognizing the primacy of corporate ownership rights in information pushes in favor of allowing companies to also be capable of assigning those rights in accordance with their own internal preferences. If companies really "own" their confidential information, they should be able to decide who can trade using it. That this is not the way the law works suggests that other considerations are at play. It seems that misappropriation is concerned with protecting corporate confidentiality more broadly, ensuring that it is not easily undermined by an indeterminate set of outsiders trading on company secrets.

[132] In *Newman*, there is a narrowing of liability in the context of tipper-tippee liability. However, this points to a narrowing in the context of the classical theory of liability rather than under misappropriation.

[133] Matter of Cady, Roberts & Co., 40 S.E.C. 907, 912 (1961). See also, Merrill Lynch, Pierce, Fenner & Smith, Inc., Exchange Act Release No. 8459, 43 S.E.C. 933, 936-9 (Nov. 25, 1968)

FD highlights the continuing deep roots cast by the equal access and fairness rationales in the regulation of information flows.[134]

Supporting Capital Markets: Where one set of insiders is primed to win by virtue of their insider status rather than any special skill, perceptions of unfairness can force even talented investors to stay away from the market.[135] Systemic asymmetries between informed insiders on the one hand and outsider investors on the other can, scholars observe, also levy a real economic toll on capital markets. With trading on securities markets anonymous, such that investors cannot know if they are trading with insiders, rational traders will discount for the risks of being caught on the wrong side of the bargain. In the absence of laws prohibiting insider trading, investors will internalize the costs of privately policing their own risks, reducing the capital they bring to markets or leaving markets if these risks become too great.[136] As Professor Wang further argues, investors face serious disincentives driving them away from capital markets, not just because they will lose, but also because insiders will always take the best opportunities to transact, leaving few carrots behind for others.

The harm goes beyond the bare fact of the amount of capital that investors might bring to securities markets to also include the quality of their participation. Informed investors face the greatest costs in the absence of the prohibition. Returning to conventional theories of market efficiency, prices depend on fundamentally informed traders to infuse markets with their insights. This dynamic relies, crucially, on informed investors to make money from their interaction with capital markets. If corporate insiders are permitted to trade, they capture the best deals in the markets ahead even of informed investors that do not have insider status. Informed investors may be especially circumspect about entering markets to trade, or trade only when they might have a surer chance of gaining.

C. The Costs of the Prohibition

Restrictions on insider trading reflect a deep-seated tension that exists between the SEC's investor protection and capital formation goals.[137] On the one hand, the goal of securities regulation lies in promoting robust, fulsome mandatory disclosure by public companies.

[134] Fisch, *supra* note 124.

[135] Donald C. Langevoort, *Re-reading Cady* Roberts, *supra* note 3, 1319, 1320 (1999).

[136] Brudney, *supra* note 2; Wang, *supra* note 4.

[137] SECURITIES AND EXCHANGE COMMISSION, THE INVESTOR'S ADVOCATE: HOW THE SEC PROTECTS INVESTORS, MAINTAINS MARKET INTEGRITY, AND FACILITATES CAPITAL FORMATION, http://www.sec.gov/about/whatwedo.shtml#.VOfLRvnF-So.

With vibrant flows of information, prices should be more accurate and markets more efficient at delivering capital to valuable enterprises.[138] On the other side, however, the prohibition pushes in the opposite direction. Primarily, it restricts trading by the quintessentially informed trader: corporate insiders capable of imparting valuable intelligence to price formation.[139] Professor Manne, for example, has famously contested the benefits of the prohibition, arguing that its application stifles information flows and undermines market efficiencies.[140] Harm to market efficiency, in turn, results in deeper harm to market quality – where prices are thinly informative for all types of investors. Professors Goshen and Parchmovksy note the damaging impact of the prohibition on efficiency in securities trading – but from the perspective of companies losing the value of their information rights. If misappropriation hinges on privileging a company's property rights in their information, it follows that companies might benefit from assigning their rights to information entrepreneurs like analysts to motivate them to research and analyze more effectively.[141] Scholars lament the contradiction between the policy aspirations of promoting informed markets on one hand and restricting the trading of informed insiders on the other.[142]

Despite continued critiques, policy weighs in favor of investor protection as the driving rationale anchoring the prohibition against insider trading. As seen in the expansion of the misappropriation doctrine, particularly after *Dorozhko* and Rule 10b5-2, policymakers have sought cures to the harms caused by unequal access to information between investors and pervasive asymmetries in the bargain between insiders and investors and large. Shifting doctrinal boundaries continue to re-calibrate how intensively the law polices information sharing in its various permutations.[143] However, as a matter of policy, the prohibition continues to exercise a powerful hold over markets and to police the allocation of information costs between insiders and investors.

[138] The issue of market and capital allocative efficiency is complicated and underpinned by significant literature. For discussion, Yadav, *Algorithmic Trading, supra* note 6.

[139] *See e.g.,* Goshen & Parchmovsky, *supra* note 6.

[140] Manne, *supra* note 6.

[141] Goshen & Parchmovsky, *supra* note 6.

[142] Carlton & Fischel, *supra* note 6; Goshen & Parchmovsky, *supra* note 6.

[143] *U.S. v. Newman*, *supra* note 5.

IV. INSIDER TRADING AND MARKET STRUCTURE

While the prohibition targets harms to investor information as its core rationale, its co-existence alongside algorithmic market structure poses one of the strongest challenges to its effectiveness. This Part evaluates the interaction between the prohibition and high-speed algorithmic trading. It shows that preferred structural access for HFT traders to market information creates harms of the kind that have traditionally fallen within the purview of the prohibition. Moreover, these harms reach deeply into the mechanisms that govern securities trading and that intersect with key measures of market quality – its efficiency, liquidity and ability to allocate capital. Still, as shown here, current doctrine does not constrain the harms generated by structural insiders. This Part shows that while the harms of structural insider trading may be co-extensive with those of traditional corporate insider trading – doctrine only applies to the latter. With the law reaching but falling short of its policy goal to fix the costs of all types of trading by insiders, questions must follow about its broader efficacy for the ever-innovative marketplace.[144]

A. Harms of Structural Insider Trading

Modern markets depend on a select cohort of high-speed traders for their smooth functioning. As analyzed in Parts I and II, HFTs have, in large part, supplanted traditional market makers, whose position and influence on everyday trading has declined with the rise of automation.[145] Owing to physical proximity through co-location, information feeds from exchanges as well as automatic responses to price changes, HFT traders receive and react to trading information ahead of the wider market. This first sight of exchange data for a select group of traders, and the advantages it bestows, raise questions about its impact on investors and market quality, broadly construed.

1. Investor Protection

[144] See also, Yadav, *Insider Trading in Derivatives Markets*, *supra* note 8.

[145] Bessembinder et al., *supra* note 12.

The prohibition has traditionally safeguarded markets against the creation of a systematically uneven playing field between corporate insiders and investors at large. Insiders with the best access to corporate secrets are likely to perform better than everyone else. First, insiders will catch the most favorable trading windows. Secondly, outsiders are precluded from trading, and will also lose money to insiders.

Similarly, first sight of exchange data gives HFT traders an edge against other "outsider" traders. This first look provides several ways for traders to make consistent gains ahead of other investors.

Forecasting Markets: Similar to more conventional corporate insider trading, the ability to catch first sight of exchange data helps HFT traders to forecast the direction in which markets are headed. Subscription data feeds from exchanges provide insights about the order flows on the exchange, the best current quotes to buy and sell securities. Feeds also offer insight into the imbalances in buy and sell orders that indicate the direction of net demand for particular securities. The NASDAQ "Total View" feed, for example – the most comprehensive data feed sold by NASDAQ – advertises the "full depth of the market at every level." The Total View promises subscribers information about "all displayed quotes attributed to specific market participants" as well as "total displayed anonymous interest." With additional information about imbalances in demand, the feed can provide investors with extensive insight into nuanced market movements – the current best order, likely demand, potential future price direction and so on.[146] FIGURE 1 illustrates the dynamic. Constant streams of such data – reaching co-located servers first – can help traders to capture gains: (i) knowing the current best quotes, depth and demand, HFT traders can react immediately to submit a better quote that hits the co-located exchange before those outside co-location have even seen the primary information; (ii) to recognize market momentum and trade in the direction of future demand; or (iii) to exit positions preemptively in recognition of potential trouble. These advantages can work to create more chances for HFT traders to capture better deals than "outsider" investors and to reduce the trading opportunities that these outsiders enjoy.

Finance scholarship highlights the predictive dynamic of HFT. This ability to "see" market activity ahead of others creates a systematically uneven playing field and lower levels of uncertainty for structural insider HFTs versus other types of trader. In an important study, Professors Brogaard, Hendershott and Riordan observe that HFT traders make markets more efficient by predictively trading in the direction of

[146] NASDAQ GLOBAL DATA PRODUCTS, TOTAL VIEW FACT SHEET, http://www.nasdaqtrader.com/content/ProductsServices/DataProducts/TotalView/TotalViewProFactSheet.pdf.

future price changes. The authors also observe that HFT traders correct momentary pricing errors by trading against them. This suggests that HFT traders are adept at interpreting market data to spot mispricing and to trade quickly to correct problems. The canny ability of HFTs to predict market direction ahead of other traders – over a period of few seconds at least – would appear to point to the ability to read the market better, quicker and earlier than others.[147] Without access to co-location, direct feeds and highly expert programming to automatically react to new information, such predictive success would not be possible. Importantly, by virtue of this structural advantage, its insiders enjoy a better chance of winning over other types of trader.

Anticipating Order Flows: The ability of HFT traders to gain first sight of market data and to anticipate order flows can be profitable if HFTs understand how fundamentally informed traders are likely to transact. By anticipating informed traders – those who make money by investing in fundamental research – HFTs can make a surer profit by trading in the direction of demand. There are numerous techniques that HFTs might use to anticipate orders. For example, HFTs can take advantage of the multiplicity of competing exchanges in the National Market System to race ahead of other traders from one exchange to another. If Public Company shares trade in the National Market System, they may be bought and sold on various U.S. exchanges like the NYSE or the NASDAQ. If a Mutual Fund wishes to buy 100,000 shares of Public Company, it may have to go to several exchanges to purchase these securities. The Mutual Fund order first goes to Exchange A, where 10,000 shares may be available for $100 per share. HFTs can see this order enter Exchange A. They can then quickly race to Exchanges B and C and buy up 90,000 shares at the best price, eventually selling them to the Mutual Fund at a higher price.

HFTs can thus get ahead of informed traders – and take a small slice of the available profit. They step into the middle between a fundamentally informed trader and the best available quote, raising (slightly) the price that the informed investor pays.[148]

These trends are far from theoretical. Scholars are observing anticipation in action and increased costs for informed investors. In one study looking at a year's worth of NASDAQ trades, Professor Hirschey

[147] Jonathan Brogaard, Terence Hendershott & Ryan Riordan, *High Frequency Trading and Price Discovery* (European Central Bank Working Paper Series No. 1602, (2013); Alain Chaboud, Benjamin Chiquoine, Erik Hjalmarsson & Clara Vega, *Rise of the Machines: Algorithmic Trading in the Foreign Exchange Market* (July 5, 2013) (higher efficiencies in foreign exchange markets); Austin Gerig, *High-Frequency Trading Synchronizes Prices in Financial Markets* (Nov. 2015) (contemporaneous changes in prices across securities markets).

[148] Robert Jarrow & Phillip Protter, *A Dysfunctional Role of High Frequency Trading in Electronic Markets* 3-6 (Johnson Sch. Research Paper Series, No. 08-2011, 2011) (discussing predatory trading). For a discussion of the literature, see, Yadav, *Algorithmic Trading*, *supra* note 6, Part III(C).

finds evidence of HFT traders anticipating the transactions of non-HFT investors and trading ahead of them.[149] According to this study, anticipation is pronounced in trades for smaller or mid-cap stocks – the kinds of securities that typically see trading from more informed investors.[150] In another study simulating human trading in the presence of a machine trader, Professors Cvitanic and Kirilenko find that the arrival of an automated trader impacts the price that investors pay. Notably, the authors saw costs increase for investors when the machine trader entered the simulation – owing, the authors posited, to the automated actor taking the best quotes on the market ahead of other investors.[151]

Anticipating the orders of informed traders represents a rational strategy for HFT traders with first sight of market data. For a start, gains should be more predictable when HFT know that they will always have an available buyer ready and willing to pay for the deal. By trading ahead of informed traders, HFT can become synthetically informed for themselves by copying the behavior of information traders, rather than using their own resources to develop native expertise. Moreover, as proprietary traders using their own money to trade, HFT traders do not owe any legal duty that might prevent them from transacting ahead of informed traders in the marketplace. In an arms-length marketplace, HFTs are simply optimizing superior skill and sophistication for advantage.

In short, investors face costs in using private information for trading, including loss of trading opportunity and investment in schemes to HFT structural insiders.[152] Arguably, this erosion of informational rights should normally be enough to trigger scrutiny under doctrine.[153] As seen in *Cady Roberts*, *O'Hagan* and *Dorozhko*, courts have vigorously guarded the value of investor rights in information against erosion by privileged insiders. This erosion has usually been a sufficient harm to justify intervention without requiring that these losses be balanced against the gains that might accrue for efficiency.

2. Equal Access to Information

[149] Nicholas H. Hirschey, *Do High Frequency Traders Anticipate Buying and Selling Pressure*, Working Paper (2013).

[150] Barclay et al., *supra* note 60.

[151] Jaksa Cvitanic & Andrei Kirilenko, *High Frequency Traders and Asset Prices*, Working Paper (Mar. 2011); See also, Lin Tong, *A Blessing or a Curse? The Impact of High Frequency Trading on Institutional Investors*, Working Paper (Nov. 2013), at 2-5. For discussion of the literature with respect to fundamental efficiency, see, Yadav, *Algorithmic Trading*, *supra* note 6.

[152] Hirschey, *supra* note 149, 1-3.

[153] NANEX RESEARCH, FRIENDS WITHOUT BENEFITS (Aug. 9, 2012), http://www.nanex.net/aqck2/3528.html.

Equal access to information has provided a powerful animating rationale for the prohibition, though the weight of its influence has waned after *Chiarella*. With jurisprudence emphasizing a fiduciary duty as a prerequisite for liability, securing equal access to information is less pressing as a matter of policy than it once might have been. However, as Reg FD shows, equal access to information has not disappeared from the canon as a legitimate ambition for rulemaking. Set alongside the intricate regulatory framework governing mandatory disclosure from public companies, equal access fits into a regulatory system premised heavily on disclosure that seeks to widely secure information for investors at large.

First, algorithmic markets foster structural inequalities in information access through the advantages of co-location and direct feeds. Automatic programming help traders make the most of this access by trading instantly. Informative feeds like the NASDAQ "Total View" service offer investors rich reserves of data and the ability to choose layers of depth and detail.[154] The NYSE similarly offers a range of information feeds to cover different grades of detail across its various markets.[155] Transmitted to co-located servers, those able to garner access to these services gain a first sight of information from the market.[156]

It is arguable, however, that there is nothing especially unequal or new about these arrangements. Indeed, they might even fit established patterns of behavior long embedded in market design. Traders have often been close to exchanges to trade – the trading pits, for example, comprising traders dealing with each other face-to-face. Moreover, anyone can buy the data feeds offered by exchanges. As long as they have the money and technology to stream the data to their offices, there is little preventing them from purchasing the high depth of information on offer.

There is much merit in these arguments. At face value, they explain away today's differences in structural access as natural and as roughly replicating a historical allocation of information costs between actors. However, they are incomplete. They fail to wrestle with the question whether today's markets reflect a fundamental and qualitatively different model of dissemination and what the impact of this design is within the larger project of mandatory disclosure in regulation. Both inquiries contest the view that today's markets are nothing new.

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[154] NASDAQ U.S. AND GLOBAL DATA FEEDS, http://www.nasdaqtrader.com/trader.aspx?id=dpspecs.

[155] NYSE, DATA PRODUCTS, http://www.nyxdata.com/Data-Products/Real-Time-Data

[156] NASDAQ, CO-LOCATION, http://www.nasdaqtrader.com/Trader.aspx?id=colo

However, concerns about equal access appear pertinent owing to the significant disparity in the quality of information received between one set of investors – those that subscribe to feeds and are co-located – versus those that choose to not to rely on these services. Discussed in Part II, U.S. public markets typically display prices through the consolidated ticker tape. This displays the best offer and sale price for a security, generated by all exchanges submitting their best numbers into an aggregator – the Systems Information Processor or SIP. One big problem with the ticker is that its information is almost always out of date. In the time it takes for information to be collected to deliver a market price, HFTs and others have already traded and rendered this price obsolete. To the extent that the market price is nearly always an artifact, it is worthwhile challenging its relevance as a trading tool as well as a key benchmark for governance.[157]

Additionally, the data underpinning feeds is not only much faster but also significantly richer in its composition than that reflected in the public ticker. When it comes to trading, subscribers to exchange feeds can select from a menu of options, offering enormous detail to help traders make the best trading decisions. The ticker, by contrast, comprises a much thinner reserve of data, essentially the best bids and offers on all the different exchanges that make up the national market in the U.S.[158] This gap in content is unsurprising. Exchanges have little private incentive to enrich the ticker feed beyond the minimum required to generate the national best bid and offer price. However, as centers of exchange, they hold enormous quantities of data that may easily be packaged and sold to willing market participants. The revenue that exchanges can make from this information should rationally drive exchanges to focus their efforts on developing richer reserves of information and technology for subscribers rather than on the SIP. Indeed, leading exchanges invest heavily in cutting-edge technology designed to communicate information as fast and fully as possible to co-located servers. For example, exchanges promise wireless communications between data centers using top-of-the-line microwave transmission designed to reduce a round-trip times for trades by 1-2 microseconds. Structural HFT insiders appear to be driving this innovation in information collection and transmission.[159]

Secondly, this disparity in information flows sits uneasily within the larger context of mandatory disclosure, designed to make information cheaply available to investors at large. As reflected in the disclosure system underlying U.S. securities regulation, public companies internalize

[157] Edmans, Goldstein & Jiang, *supra* note 29.

[158] *See discussion supra* Part II(A)(3).

[159] NASDAQ, COS-LOCATION, http://www.nasdaqtrader.com/Trader.aspx?id=colo.

significant costs in publishing detailed information about their organization and activities for the market. Targeting investors at large, this disclosure function as subsidized access to private information for investors at large, designed to foster efficient trading in securities markets. Deep disparities in access to trading data go against this bargain.

HFT programming, co-location and data feeds mean that an enormous swathe of the market – those that rely on the SIP – are effectively excluded from sight of up-to-date market information, and do not exert direct impact on immediate price formation (FIGURE 1). This is significant for the traditional taxonomy of efficient prices. Informative prices reflect the collective trading of heterogeneous actors, each bringing their insight to the exchange. Where markets systematically give outsize access to one or other group of trader in the price formation process, concerns might fairly be raised about the larger project of securing richly informed prices. While this does not mean that outsider investors cannot and will not participate in markets, it does signify that their decisions are likely to be based on a dated reading of the market. At the level of principle, this disparity raises questions about what degree of inequality of access to trading information is tolerable within the larger policy of securities trading. With *Chiarella* and Reg FD pulling in opposite directions, there is little guidance on how to resolve this question.

3. Investor Protection and Market Quality

The fundamental question is whether differential access to exchange data creates harms for market quality, broadly understood. By the conventional account, theory paints a bleak picture. From the viewpoint of investor protection, the harms can be substantial and far-reaching. If insiders repeatedly get the best deals, then other investors have little incentive to remain on the market, or to deploy their capital fully. Markets are eventually drained of their power to allocate capital, leaving public companies with far fewer sources of funding and signaling mechanisms to advertise their value.[160]

Algorithmic markets present two sources of risk for diminished market quality: (i) first sight of exchange data adversely impacts outsider investors, particularly through anticipation strategies that result in outsiders losing a slice of their gains; (ii) unequal access to pricing

[160] Brudney, *supra* note 2; Wang, *supra* note 4.

information creates deep disparities in the information received by different types of investor.[161]

Market Flight: If outsider investors are constantly seeing their orders anticipated and a slice of their winnings diminished, they might leave markets or to change how they transact in them. This problem is most serious for informed traders, who invest in research and seek to trade strategically to take advantage of specific market windows. Traditionally, law and markets sought ways to foster greater trading by informed investors by placing constraints on designated market makers to extract information by virtue of their positional power.

Emerging scholarship paints a mixed picture. As Hirschey, Cvitanic and Kirilenko note, informed traders face losses as well as a slew of transaction costs from structural insiders: (i) losses on trades where the best deals are sealed by HFTs; and (ii) strategic costs to hide their trades from HFTs[162] There is little in the scholarship to suggest that informed investors are fleeing markets in response to their structural disadvantage. HFT traders, particularly as market makers, can offer lowered spreads for investors. To the extent that investors value the trade-off, the loss of some their informational gains to HFTs may simply be internalized as a cost of doing business.[163] Secondly, the losses imposed by structural disadvantages may simply be too small to be meaningful for large traders to be overly concerned about them. If informed traders really consider a transaction worth making, they should do so irrespective of whether an HFT takes fractions of a penny on each share.

But, it is far too early to summarily dismiss theory's concerns about investor participation and market quality. Even if investors might not leave markets in numbers, they might yet alter how they participate in them. Concerns about seeing their best intelligence anticipated might foster greater reliance on evasive techniques to strategically hide orders or to trade them off exchange. Cumulatively, widespread cloak-and-dagger behavior in markets, particularly from informed traders, can prove problematic. Their signals will end up becoming more costly to interpret, diminishing the expressive potential of markets and securities prices.

[161] For fuller discussion, see, Yadav, *Algorithmic Trading*, *supra* note 8. The scholarship on the larger question of HFT and market quality is considerable, a full discussion of which is outside the scope of this Article.

[162] The issue on whether HFT makes markets volatile is complex. For a survey of the literature, see, SEC, *supra* note 68, 9-10.

[163] See also, Jackson, Jiang & Mitts, *supra* note 19 (suggesting that fundamental information takes longer (around 10 seconds) to emerge in prices than short-term information, potentially pointing to a continued role for information traders). Nataliya Bershova & Dmitri Rakhin, *High-Frequency Trading and Long-Term Investors: A View from the Buy-Side*, Working Paper (2013) (showing a fall in the spreads faced by investors in Tokyo and London stock exchanges despite the increase in volatility on account of HFT).

Where investors internalize added costs of interpreting overly complex signaling, investor participation may grow more cautious as a whole.

Some anecdotal accounts of investor behavior suggest that investors are more deliberate about where they trade. In addition to popular public outcry,[164] industry efforts have prompted the creation of trading venues that limit the structural advantages enjoyed by HFTs. Institutional investors – such as hedge funds, mutual funds and insurers – are funding efforts to build private trading venues and platforms that are less vulnerable to anticipation by HFTs.[165] Rather than trading on public exchanges, institutional investors are seeking out private venues that limit access to HFTs. While this does not signal an outright flight from exchanges, it does point to investors specifically selecting venues to avoid structural insiders. If informed investors possess high quality insights, they may favor trading outside of public exchanges, lowering the quality of price formation on the national market.

Equal Access: The disparity of information reaching investors via exchanges is also problematic from the perspective of market quality. It increases the costs of procuring information for investors. If the ticker is significantly more diminished in the information it conveys and largely out of date by the time it reaches the market, investors face stronger pressures to spend to acquire subscription feeds from multiple exchanges. Indeed, even those that spend on data feeds will receive old data if they are located outside of co-located centers. Scholars suggest that the ability of exchanges to commoditize and sell information undermines market quality. It motivates those with less price information to retreat from the market. Knowing that they have poorer access to informative prices, Professors Easley, O'Hara and Yang show that such "price uninformed" traders reduce their involvement in trading, undermining liquidity in the process.[166] Also, because informed traders must also spend on data feeds, they can have less money to spend on research.[167]

Fundamentally, however, these information costs for investors challenge the conventional mechanisms by which markets become efficient. Recalling Gilson and Kraakman's interaction between informed, derivatively informed and uninformed traders, subscription costs for information feeds create higher entry costs for traders. The impact may be felt more strongly amid the ranks of derivatively informed and uniformed

[164] *Notably*, MICHAEL LEWIS, FLASH BOYS: A WALL STREET REVOLT (2014).

[165] *See e.g.,* IEX, About IEX, http://www.iextrading.com/about/; Stephen Foley, *Big Fund Investors Form New Dark Pool Trading Venue*, FIN. TIMES, Jan 19, 2015. On issues with dark pools, fragmentation and transparency, see, Amy Kwan, Ronald W. Masulis & Thomas H. McInish, *Trading Rules, Competition for Order Flow and Market Fragmentation*, J. FIN. ECON. (*forthcoming*).

[166] Easley, O'Hara & Yang, *supra* note 34, 2-3.

[167] Easley, O'Hara & Yang, *supra* note 34, 2-3.

traders.[168] Derivatively informed firms must pay more to extract the data they need to follow and mimic the behavior of informed traders. Uninformed traders will lose anyway to more informed players but they will suffer higher transaction costs to purchase market data. Even informed traders – who should make greatest gains while trading – will need to spend more in purchasing information from exchanges. While prospective profits might justify these costs for informed traders, higher information expenditures may eventually become more difficult to justify for those making less certain returns. If uniformed investors drop out of the market, informed traders might have few others left to transact with – and trading with each other – they may eventually see fewer profits themselves.

HFT structural insiders – while still paying for exchange information – face a proportionally lower bundle of risks and transaction costs. Acquiring deep informational access to the marketplace constitutes an essential prerequisite for HFT. However, the gains from investment are considerable. HFTs succeed by generating steady and certain gains by making markets and anticipating order flows. By being able to make small gains from informed, derivatively informed and uniformed traders, HFTs do not need to invest in fundamentally researching securities or in losing consistently losing to informed traders.

B. Doctrinal Reach

Structural insiders – and their potential to generate harms and asymmetries similar to those seen in more conventional examples of insider trading – might suggest greater legal scrutiny be given to their operation. However, the flourishing of structural insiders in modern markets highlights the limits of doctrine. Notwithstanding the capacity of a small cohort of insiders to systematically access not-fully-public information for private trading, there is little doctrine can do to remedy any harms. On the question of whether structural insiders are the legal insiders conventionally held to account under regulation, the response is straightforward: despite their systematic informational advantage, structural insiders do not fall within the strictures of the law.

The Classical Theory: Structural insiders fall far from the purview of the classical account of insider trading. The classical theory controls those closest to company management and that are subject to a fiduciary obligation to shareholders. Under *Dirks* and *Chiarella,* a fiduciary

[168] Easley, O'Hara & Yang, *supra* note 34, 2-3.

responsibility to shareholders remains necessary to establish liability. The securities trading apparatus is removed from the internal machinations of a company and the fiduciary responsibilities that usually company it.

The Misappropriation Theory: Structural insiders also fall outside the purview of the misappropriation theory, despite its breadth and the easing of the requirement to show a fiduciary duty. Under the misappropriation theory, liability for insider trading can attach to those that trade on information they obtain by breaching a fiduciary responsibility to the source of the information. Under Rule 10b5-2, liability can cover those that breach promises to maintain confidentiality and who trade on secrets shared within relationships of trust and confidence.[169] One could argue, at a stretch, that structural insiders extract information from exchanges for trading before it becomes public. Like *Chiarella*, the printer that made full use of its first sight of corporate documents to make informed trades, structural insiders similarly see information before vast swathes of the market and trade for personal gain. Unlike *Chiarella* however, who would most probably be liable under misappropriation, structural insiders have no need to worry. Open dealing and disclosure negate liability. Where transactions occur in the open, there is little deception, nullifying the reach of Rule 10b-5.

With structural insider trading, dealings take place in full public view. Much of the apparatus driving the creation of co-location and direct feeds occurs with regulatory blessing. Co-location arrangements are subject to review by the SEC and a public comment process that ensures that any changes in those terms are open to debate.[170] Direct feeds are advertised, often including the prices and products offered.[171]

With both colocation and direct feeds accepted by law and publically advertised, the reach of the law – even under the wide berth allowed by misappropriation seems limited. This disconnect poses a problem for the current law's aspiration to offer full cover for the harms of systemic information asymmetries in the market. At least presently, the harms might exist but the law cannot cure them.

Reg FD: Finally, *Reg FD* applies to corporate issuers – not to traders or exchanges. Moreover, following *Dirks* and *Chiarella*, the law does not adhere to equal access as a central imperative in securities trading. To the extent that exchanges are obliged to make information available widely, their mandate lies in ensuring that their data is submitted simultaneously into their SIP and direct feeds. Within this framework, by the letter of the law, structural insiders appear once more to fall in line.

[169] *See discussion infra* Part II(A)(3).
[170] *See discussion infra* Part II(A)(3).
[171] *See discussion infra* Part II(A)(3).

V. IMPLICATIONS

Structural insiders have transformed the conventional bargain underlying the allocation of information costs in securities markets. HFT has created a class of informed insider capable of transacting ahead of other types of market actors. With this structural advantage, HFTs are well placed to predict future order flows, anticipate informed investors and to make more certain gains by trading before information becomes fully public. These systematic informational advantages institutionalize practices that are generally anathema to the law and policy of insider trading. Emerging evidence suggests that these structural asymmetries foster recognized harms: (i) costs to investors, especially informed traders; (ii) deep disparities in access to information; (iii) diminished market quality. This similarity of harm to conventional insider trading notwithstanding, current doctrine is clearly ill suited to offer a remedy.

This Part surveys the implications of structural insiders for the law and policy of insider trading. First, it explores whether the usual justification for tolerating insider trading – enhancing informational efficiency – credibly holds with respect to HFT structural insiders. Without a justification supporting structural insiders, asymmetries in access to information become more difficult to sustain. Otherwise, it is clear that reconciling market structure with the underlying policy of the prohibition requires developing strategies to more fully equalize the playing field between HFT insiders and other actors.

Secondly, without reform, the place of the prohibition as a catch-all protection for confidential corporate information becomes significantly weaker. Where the law allows insider trading in one context, but punishes it elsewhere, the doctrinal and policy coherence of the prohibition begins to look decidedly tenuous and points to a need for urgent reform.

A. The Efficiency Rationale

Critics of the prohibition have long perceived it as a stifling influence on the ability of high-quality information to enter securities prices.[172] Their disapproval has rested on the seeming incompatibility of

[172] *See sources cited infra* note 6.

prohibition with the larger policy goal of assuring richly informed, efficient markets. If corporate insiders are prevented from trading, markets lose out on arguably their most reliable and deeply informed source of insight. According to this view, the greater goal of achieving informational efficiency in securities prices trumps other policy objectives like investor protection, or least makes them less compelling. If trading by corporate insiders brings systematic gains for informational efficiency, scholars argue, the prohibition should give way in favor of realizing this goal.

Perhaps the strongest justification for the continued informational advantage enjoyed by HFT structural insiders lies in its possible contribution to efficient markets. If HFTs bring more informed trading to securities prices, these welfare gains might offset the weight of the harms detailed in this Article.

Are HFT Markets More Informative: It is necessary to distinguish the informational content of prices, from the speed at which this information enters prices. Co-located HFT traders do not add to the informational richness of markets, though they may bring prices to respond faster to the arrival of new information.[173] Even then, it is essential to ask whether these gains in speed are sufficiently meaningful to justify the costs of structural asymmetries.

Corporate insiders have the best access to company secrets. As detailed by Professors Carlton and Fischel, corporate insiders can impart uniquely in-depth knowledge by transacting on the information they possess.[174] Precisely because of their superior position, they are viewed with deep suspicion by law and policy, primed to pick off other investors with their store of credible, confidential information. While rules against corporate insider trading might benefit investor protection, the market also loses out on an essential source of substantive and reliable insight.

The same cannot be said for HFT insiders. Recall that HFTs benefit from structural access to gain information on: (i) order flows in markets, delivered by rich data feeds from exchanges to co-located servers; (ii) informed orders; and (iii) first sight of general market information delivered through data feeds. HFTs mine current and emerging data, rather than procuring fundamental information akin to informed traders and company insiders. It makes little sense for traders committed to exiting their investment in microseconds to engage in meaningful research. Rather, HFTs can do best by using their speed and structural access to deduce and trade on near-term trading trends.[175]

[173] On HFT and fundamental allocative efficiency see, Yadav, *Algorithmic Trading*, *supra* note 6.

[174] *See generally*, Carlton & Fischel, *supra* note 6.

[175] Hirschey, *supra* note 149.

In contrast to conventional corporate insiders, restricting preferential structural access for HFTs should not directly reduce the informational content of trading. Co-located HFTs are simply extracting information from present and past market conditions, rather than supplying fresh intelligence for price formation. Informed traders should continue to transact as will those that are derivatively informed or uninformed.[176] Their interactions should continue to generate prices reflecting the sum of collective wisdom. The traditional efficiency rationale that might make the case for loosening the prohibition does not hold. Structural access for HFTs does not directly make markets fundamentally more informative.

Indeed, it might even be said to reduce the informational content of prices if informed traders leave markets because HFTs systematically anticipate trades.[177] Structural insider trading can lead informed investors to reduce their expenditure on research and to lower or modify how they participate in public markets. Some fundamental investors are already developing strategies to avoid co-located HFTs by building their own private venues for trading – fragmenting liquidity and making it harder to deduce the meaning of their trading. Short of leaving markets, expenditure on such evasions point to informed investors modifying their behavior in response to being rationally picked off by an advantaged group of traders. Where such behavior is widespread among informed traders, the social costs to markets may be pervasively reflected in poorer prices.

Efficiency is, of course, a complicated notion. While HFTs might not contribute to actual informational content, their trading boosts the speed by which intelligence enters prices. HFTs help make markets more sensitive to new information. Consistent with the taxonomy proposed by Professors Gilson and Kraakman, HFTs – acting as derivatively informed traders – can enhance the velocity by which information is incorporated into prices. By anticipating the transactions of informed traders and rapidly transacting to reflect this intelligence, fundamental information can emerge much faster into prices than it might otherwise have done.[178] Further, beyond the operational mechanics by which information enters markets, efficiency gains can also arise indirectly. Due to the lower transaction costs offered by HFT, notably in the form of reduced spreads, more investors might be encouraged to trade. Informed investors might even enter markets more willingly, open to using a broader array of

[176] Jackson, Jiang & Mitts. *supra* note 20.

[177] *See discussion supra* Part IV(A)(3).

[178] Hirschey, *supra* note 149; Brogaard et al., *supra* note 17 (observing the ability of HFT to anticipate short term price trends); Gerig, *supra* note 147 (noting the ability of HFT traders to make markets efficient across various asset classes).

significant as well as not-so-significant information on account of cheaper entry and exit costs.

These indirect benefits for markets reflect a new trade-off for theory. Whereas a failure to include corporate insiders in everyday trading results in real information loss, limiting informational privileges of HFT presents a quite different proposition. The reserve of information stays he same. Its cost, however, changes. Deprived by degrees of their access to early sight of exchange information, HFTs may charge more for their services as liquidity providers and economic market markers.[179] Rather than mediating a trade-off between investor protection versus efficient markets, insider-trading policy must referee a new debate: are the harms of HFT access to insider information justified by apparent gains for structural efficiencies (reduced spreads and more liquidity)?[180]

Even here, some additional considerations factor into the analysis. It is arguable that the gains in the speed by which information arrives because of HFTs are too marginal to be meaningful. Advantages are measured in milliseconds and microseconds. It is at least debatable whether such ultra-fast price changes convey sufficient gains in transaction costs and liquidity to justify the costs of structural insider trading.

The dilemma for scholars and policymakers lies in the difficulty of the comparison. Whereas the traditional trade-off in insider trading concerns itself squarely with calibrating a tolerable loss of information in favor of investor protection, the modern equation balances investor protection versus investor tolerance for transaction costs. Information loss does not come into the picture. To the extent that insider trading law and policy confronts relative gains and losses in information, dealing with questions of structural pay-offs presents a problem.

B. Reconciling Policy and Practice

If policymakers consider the harms of structural insider trading as sufficiently serious to merit evaluation, options for reform will be costly and far-reaching, necessitating structural change. With tens of billions of dollars already spent on transforming exchange infrastructure, attempts at re-thinking the current design will require overcoming path dependencies

[179] Katya Malinova, Andreas Park & Ryan Riordan, *Do Retail Investors Suffer from High Frequency Traders*, Working Paper (2013) (noting that a tax affecting high frequency traders in Canada increased market wide bid-ask spreads by 9%).

[180] Note that commentators still argue that reduced transaction costs through lower spreads are illusory, as investors can face high costs of deciphering data as well as losses through order anticipation.

and transactional habits that are baked into the market's trading structure. With this in mind, I set out below some first steps towards a better fit between insider trading laws and market design.

Equalizing Access: As this Article has shown, market structure comprises a cohort of structural insiders that enjoy first sight of not-fully-public exchange information. Importantly, their structural advantage derives from a convergence of three basic benefits acting together: (i) physical proximity to exchanges through co-location; (ii) direct feeds of detail-rich information from exchanges to co-located servers; and (iii) the ability of HFTs to transact automatically and instantaneously to this information. This trifecta of structural gain means that HFTs see information first and can transact on it before anyone else has had a chance to act. Not only does this advantage permit HFTs to see the state of the market before any one else, but also to alter it first based on their private trading preferences. In other words, HFTs have an advantageous window into current prices as well as a uniquely powerful ability to contribute to price formation. With outsider investors facing a longer, costlier road to informational insight and price impact, the asymmetry in access to all-important exchange information is obvious. This asymmetry means that HFTs can see order flows more clearly as well as anticipate orders, potentially at a cost to informed and other types of investor.

This structure suggests that a change to any one of these factors – physical co-location, direct feeds or automatic algorithmic decision-making – might be sufficient to bring greater equality between investors. If reform can reduce the advantage offered by any one of three features, HFTs might end up on a more even playing field with other traders.

But, this approach is unlikely to be especially effective. Altering the entry rules to use co-location, direct feeds or instant algorithmic decision-making ends up becoming over-inclusive in each case. That is, in addition to covering HFTs, restrictions also reach to cover traders who enjoy no special, first-access advantage with respect to exchange information. An example serves to illustrate the problem. Take the case of the gains achievable by direct feeds of exchange information. These rich data streams often communicate directly with co-located servers, but they can be purchased by anyone willing to spend the money. Suppose that lawmakers move to restrict the use of direct feeds, stipulating for example, that they be standardized across exchanges and include less information than is currently on offer. In theory, HFTs will see some losses, because their data feeds are less in-depth and perhaps not sufficiently informative to provide a fulsome idea of order flows. But, everyone else will as well. Structural outsiders will see thinner information and be forced to privately invest in overcoming any deficiencies. Similarly, physical co-location

might not be a problem in itself. Co-located servers can be used by those that wish to be close to an exchange and may in theory include a range of trader, not necessarily only those that wish to trade at ultra fast speeds. Moreover, even if co-location servers are dismantled, there is little stopping those that wish to trade faster to buy up real estate privately as close as possible to an exchange.

A larger, structural approach is needed. One possible model lies in building small delays into order submissions sent to the exchange. Rather than traders competing with each other on the speed by which orders reach an exchange, in-built delays work to slightly even the playing field between traders. Delays – even by a few hundred microseconds – can allow a wider array of algorithmic trader to compete for orders on an exchange. With some micro or milliseconds worth of a delay in place, orders from institutional traders might not be systematically usurped in part by the innately faster trader. While HFTs can still receive direct feeds and be co-located, the insights received through early sight of this information do not have to result in systematic gains for the HFT. With delays part of order submission, HFTs have to internalize higher time costs in utilizing the insights they acquire in the market. With higher costs, their gains vis-à-vis other traders are reduced. While HFTs may still be slightly advantaged and may even see their orders reach the exchange before those sent by other traders, in-built delays can reduce the frequency by which this advantage is realized. Put more simply, delays in sending orders for execution roughly proxy designed to reduce the impact of structural informational advantage. Just as designated market makers have long faced restrictions in how they could use any informational access for their private trading, the structure of high frequency markets demands a new design. Instead of relying on rules to prevent anticipation of order flows or informed traders – that may be over-inclusive and difficult to enforce delays in the system can instead work to add a small cost to inherent informational advantage.[181]

Crucially, delays help mitigate the disadvantage that outsider investors face in contributing to price formation. This Article shows that structural insiders play an outsize role in price formation. Because outsiders struggle to see up-to-date prices, they are effectively trading on stale information. The singular influence of structural insiders on prices can preclude others from also exercising a meaningful role. Notionally, a delay in order submission can help reduce the disparity in access to price data. With delays, outsiders may be better able to transact on up-to-date

[181] Eric Budish, Peter Crampton & John Shim, *The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response*, Working Paper (Dec. 23, 2013) (the authors detail the gains of batching orders in bundles to slow down the pace of trading).

information. They may be able to at least see the latest prices, before HFTs can submit orders to trade on them and update prices. While HFTs might retain an advantage, a clearer sight of prices for other investors allows them to better understand the meaning of prices and to influence their formation more fully.

The idea of building delays into markets is gaining some traction, with attempts within the industry to develop platforms that work to more fully equalize the playing field between HFTs and other investors. Made famous in Michael Lewis' *Flash Boys*, the IEX exchange, for example, imposes a mandatory delay of 350 microseconds on incoming orders to reduce the structural gains available to HFTs. It still offers direct feeds of its data to subscribers from its Secaucus presence, but harnesses delays to open up its venue for competition by a variety of trader.[182]

But, building delays into the system is neither easy nor without its own set of problems. For one, calibrating the right length of delay presents an especially difficult conundrum. It must achieve a finely tuned balance between dampening the advantage of structural insiders – and still preserving the benefits of HFT. To the extent that HFT is viewed positively as a boon for liquidity and a curb on transaction costs, policy (and investors) might wish to maintain HFT presence in markets. The IEX exchange, for example, is reported to host HFT participation of anywhere between 17-34%, depending on how one measures HFT activity.[183] There is, of course, no perfect number. But, in the absence of investor tolerance for higher transaction costs, policymakers might well look for a goldilocks figure balancing investor protection with the gains of structural efficiency.

Also, viewed philosophically, delays designed to disproportionately impact faster traders sit uncomfortably with how markets have worked in the past. Markets usually reward speed and guile, not punish it. Traders have always fought to generate gains in speed, racing to get to the best trades ahead of their competitors – so that HFT is arguably not all that different a practice when set alongside this larger continuum.[184] This line of criticism is understandable. Using the tool of time delays as a proxy to correct structural imbalances in access to information is imprecise – relying on limits on speed in place of deeper structural change. Still, as this Article has shown, the structural informational advantage accorded to HFTs in today's markets is

[182] IEX Trading Alert 023 (Nov. 3 2013), http://www.iextrading.com/trading/alerts/2014/023/; IEX, About IEX, http://www.iextrading.com/about/.

[183] Bradley Hope, *Debate Over High-Frequency Trading on IEX Muddied by Trade Counting,* WALL ST. J. (MONEYBEAT), Aug. 11, 2014, http://blogs.wsj.com/moneybeat/2014/08/11/debate-over-high-frequency-trading-on-iex-muddied-by-trade-counting/.

[184] Easley et al., *supra* note 68.

something new. It is a departure from past practice where market makers were scrupulously scrutinized for signs they might be exploiting their positional access for private gain. With such determinations impossible, as HFTs trade for their own books rather than for clients or as formal market makers, novel approaches are needed. Seen from this perspective, imposing costs through mandatory delays – while far from ideal – provides a way forward to better align existing the information costs imposed by insider trading laws with existing practice.

C. The Impact of Irreconcilability

In the absence of reform, modern market structure poses an existential challenge to the law and policy of the prohibition against insider trading. This Article shows that: (i) modern markets systematically give select HFT traders first access to not-fully-public information; (ii) this special structural access for HFT traders produces harms in the market that are commonly controlled by the prohibition against insider trading; and (iii) despite falling within the ambit of harms controlled by the prohibition, doctrine has no power to remedy them. Viewed through the lens of market infrastructure, it becomes clear that conventional doctrine is poorly equipped to deal with the complexities of increasing innovation.[185]

The non-application of current insider trading laws to market structure appears remarkable in the context of their larger role in policing securities markets. Their extraordinary power has been on full display after the financial crisis, as seen in a slew of high-profile civil and criminal proceedings against some of Wall Street's former stars. Cases against business tycoons like Raj Rajaratnam of the Galleon Fund, Rajat Gupta, former head of McKinsey as well as Steve Cohen's SAC Capital have evidenced the high confidence public authorities have placed in the policing power of the prohibition.[186] While doctrine suffered a notable setback in the wake of *U.S. v. Newman* – a case limiting the reach of tipper-tippee liability under the classical theory of insider trading – the power of the prohibition has otherwise been on the ascendancy.[187]

This argument put forward in this Article, however, calls into question the efficacy of the prohibition to fulfill its role as a protective

[185] Yadav, *Insider Trading in Derivatives Markets*, *supra* note 8.

[186] SECURITIES AND EXCHANGE COMMISSION, SEC ENFORCEMENT CASES: INSIDER TRADING CASES, http://www.sec.gov/spotlight/insidertrading/cases.shtml.

[187] SEC v. Cuban; United States vs. Newman 2014 U.S. App. LEXIS 23190 (2d Cir. 2014). For discussion, Langevoort, *Fine Distinctions*, *supra* note 117.

safeguard for confidential information in public markets. First, as this Article has shown, doctrine places significant costs on corporate insiders as well as a wide range of outsider fiduciaries. The interplay between the classical theory, misappropriation, Reg FD and Rule 10b5-2 create a complex lattice of constraints that limit insider trading on confidential, corporate information. Deferring to the goal of investor protection, insiders internalize high costs in the form of lost profits, missed opportunities, and the capital costs of holding or divesting of their securities. And, critically, the market relies on these protections to hold, assuring investors-at-large that they can trade without discounting for the risks that corporate insiders will always beat them to the best trades.[188]

Despite imposing heavy constraints on corporate insiders, structural insiders are left untouched under doctrine. On the one hand, this is understandable. Corporate insider trading punishes a deception on investors, as evidenced by the need to show a breach of fiduciary duty. Corporate insiders also pose the real danger for investors. Possessing the deepest sources of internal information, informed insiders can easily outwit investors with the force of their high quality information and their persuasive influence on price formation. On this basis, it makes sense that the prohibition should focus its resources on controlling the conduct of corporate insiders – rather than on the structural insiders that simply operationalize the trading process.

But, this argument strains under interrogation. The prohibition cannot reach instances of structural insider trading because there is no obvious deception. HFTs operate in open view and their practices are institutionalized by private exchanges as well as through regulatory permission meaning that the misappropriation theory of liability, cannot apply. Still, insider-trading doctrine has never really been rooted in a robust notion of deception in the first place.[189] *Chiarella* and *Dirks* tenuously read deception into the Rule 10b-5 prohibition using the legal convenience offered by the breach of fiduciary duty. Deception, as properly understood under Rule 10b-5 liability for fraud and manipulation connects weakly, if at all, to the notion of a breach of fiduciary duty in insider trading.[190] Moreover, on whether corporate insiders possess the most risk to investors, the law has worked hard to protect investors against those whose informational access to corporations has been indirect.[191] In other words, the law has paid only passing heed to the quality of information held by insiders, looking only for the artifice of fiduciary duty

[188] Wang, *supra* note 4.

[189] Langevoort, *Fine Distinctions*, *supra* note 117.

[190] Santa Fe v. Green 430 U.S. 462 (1977); 425 U.S. 185 (1976).

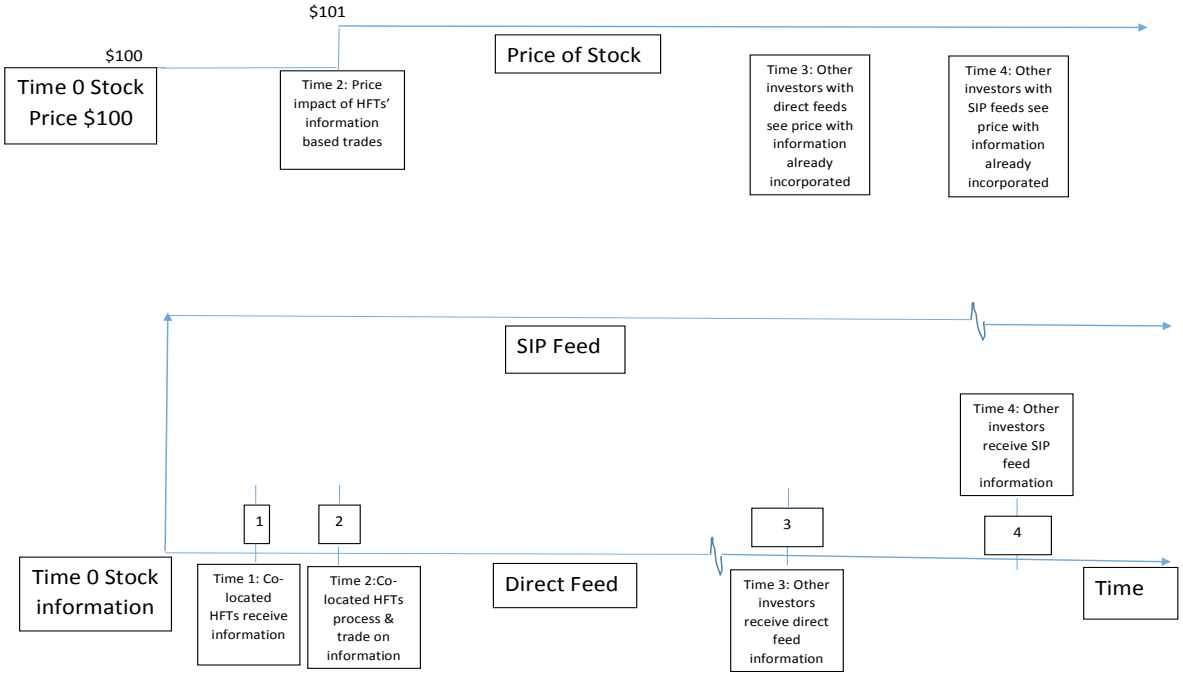
[191] SEC v. Dorozkho 574 F.3d 42 (2d Cir. 2009).

to ground liability. As shown in the expansion of liability under the misappropriation doctrine and Rule 10b5-2, whether defendants possessed strong, market-moving information has never been a primary concern for the law. Rather, the key question has hinged on the loss of profitable privileges in information for investors in favor of a cohort of insiders.

As shown here, the harms generated by structural insider trading are largely co-extensive with those seen in more conventional, corporate cases. While they might seem different on the surface, the costs they create sit along a continuum long familiar to scholars of insider trading. Loss of information through order anticipation, unequal access to information, as well as potential for deterioration in market quality on account of insider trading have all been observed, to varying degrees, in the case of HFT. That the law applies to one set of insiders to control such harms – but not another – points to a legal regime sorely out-paced by innovation and unable to consistently fulfill its basic function. The rise of structural insider trading, fundamentally, calls into question the inner coherence of the prohibition and points to the need to re-think its foundations deeply. If the law can only apply effectively to core corporate insiders, this should be made explicit and doctrine re-calibrated to reflect this limited reach. But, even this narrower application poses a problem. Why should the law protect investors from one set of insiders, but leave them open to harm from another? If it is ultimately a question of safeguarding investor protection, there does not appear to be any good answer to the inquiry.

VI. CONCLUSION

This Article shows that the emergence of high frequency trading – and the structural practices that have facilitated it – profoundly challenge the foundations of the prohibition against insider trading. While HFT has brought ample benefits to securities trading, preferential access to information for fast traders exhibit similar harms to those seen in conventional corporate insider trading. Structural insider trading also re-casts the usual debates that have pit investor protection against market efficiency. Policymakers now face trade-offs calibrated between investor harms and structural efficiencies as they craft legislative objectives for market design. This Article represents a first step in identifying these doctrinal and policy uncertainties underlying the prohibition in modern, algorithmic markets. It calls for urgent analysis and debate to identify further complexities and regulatory responses to more coherently regulate the flows of confidential information in securities markets.



VII. FIGURE 1

WHAT HAPPENS WITH EXCHANGE INFORMATION?

Figure 1 provides a schematic outline of how information is incorporated into prices in a market with co-located HFTs. Suppose that new information on Stock X is fed at Time 0 (simultaneously) into the direct feed and the SIP feed. Suppose also that Stock X is trading at $100 at time 0, and the net effect of this information will be to eventually change the price of Stock X to $101. This information travels about 1000 feet along the direct feed to the co-located servers of HFTs and reaches them at Time 1. HFTs algorithmically review and process the information and trade on it. The orders are sent for execution back about 1000 feet to the exchange server and get executed at Time 2. The trading actions of co-located HFTs changes the price to $101 at Time 2. All of this action takes place potentially in the space of microseconds. The information travels along the direct feed for (say) 100 miles and reaches other direct-feed investors at Time 3, well after the trading actions of HFTs have already impacted the price at Time 2. The information also travels along the SIP for (say) a 100 miles and reaches other SIP investors at Time 4, typically after Time 3 and, in any case, well after Time 2.