

Note to Readers: Those who are familiar with the work by Fox, Glosten & Rauterberg on equity market issues, or who have otherwise acquired a general knowledge about equity market institutions and micro-structure economics, may wish to skim or skip entirely Parts II and III, which are on pp. 15-29.

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Quote Manipulation

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Introduction

Preventing manipulation was a primary motivation for enacting the U.S. securities laws. In the midst of the Great Depression, manipulation struck Congress and varied commentators as a principal cause of the 1929 stock market crash and the ensuing economic collapse. As a result, the Securities Exchange Act of 1934 (the “Exchange Act”) expressly prohibits manipulation pursuant to its Sections 9 and 10(b).¹ Despite this original intensity of concern, the

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1. See 15 U.S.C. § 78i(a)(2) (2012); 15 U.S.C. § 78j(b) (2012).

regulation of manipulation has, for most of the following 85 years, failed to attract much serious scholarship by either lawyers or economists. And the limited case law interpreting these statutory provisions has been rather confused.

In the last couple of decades, some academics have begun to consider one major type of manipulation: *trade-driven manipulation*.² This is where the manipulator uses purchases and/or sales to effect changes in the price of a security that permit the manipulator to make trading profits. In contrast, there continues to be almost no scholarly attention paid to another major type of manipulation: *quote-driven manipulation*. This is where the manipulator uses quotes – binding commitments posted on an exchange of a willingness, until cancelled, to buy or sell a given number of shares at a stated price – to allow her to buy or sell shares at a more favorable price in a separate transaction. Once the price for the separate transaction has been favorably changed, the manipulator is usually able to cancel her quotes before they are accepted and themselves become executed transactions. There is also little case law related to quote-driven manipulation.

These shortfalls in the scholarly literature and in the law are ironic given that the most noteworthy manipulation cases brought by the government in recent years—*Coscia*³ and *Sarao*⁴ (involving

² Until very recently, even such literature as has existed consisted of legal and economics academics largely talking past each other. Perhaps the most well-known piece in the legal literature, by Daniel Fischel and David Ross, argues that trade-driven manipulation is so difficult to identify that it is not worth regulating. Daniel R. Fischel & David J. Ross, *Should Law Prohibit “Manipulation” in Financial Markets?* 105 HARV. L. REV. 503 (1991). This piece ignored the then-developing market microstructure literature that shows that it may not be so difficult, a point also missed by Steve Thel, the strongest critic of the Fischel and Ross piece. Steve Thel, *\$850,000 in Six Minutes: The Mechanics of Securities Manipulation*, 79 CORNELL. L. REV. 219 (1994). Similarly, much of the literature on the subject by economists that does employ learning from micro-structure economics has been written without a clear notion of what the legal requirements are for a trade to be manipulative. In the last few years, some scholarship has taken a more nuanced view of trade-driven manipulation by incorporating both legal and economic arguments. See, e.g., Albert S. Kyle & S. Viswanathan, *How to Define Illegal Price Manipulation*, 98 AM. ECON. REV. 274-279 (Papers & Proceedings, 2008); Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *Stock Market Manipulation and Its Regulation*, 35 YALE J. REG. 67 (2018); MERRITT B. FOX, LAWRENCE R. GLOSTEN & GABRIEL V. RAUTERBERG D. RAUTERBERG, *THE NEW STOCK MARKET: LAW, ECONOMICS, AND POLICY* 200-240 (2019); Gina-Gail S. Fletcher, *Legitimate Yet Manipulative: The Conundrum of Open-Market Manipulation*, 68 DUKE L. J. 479 (2018).

³ *United States v. Coscia*, 866 F.3d 782 (7th Cir. 2017).

⁴ *U.S. Commodity Futures Trading Comm’n v. Nav Sarao Futures Ltd. PLC*, No. 15-CV-3398, 2016 WL 8257513 (N.D. Ill. Nov. 14, 2016)

futures market activity) and *SEC v. Taub et al*⁵ and *SEC v Lek*⁶ (involving equity market activity) – are based on allegations of quote-driven, not trade-driven behavior. In the *Sarao* case, the Department of Justice charged a single individual with a quote-driven manipulation that was alleged to have “significantly” contributed to 2010’s “Flash Crash,” whereby U.S. equity market prices temporarily declined by more than nine percent.⁷ Single individual defendants in these cases have sometimes made tens of millions of dollars using quote-based strategies.

The difficulties in assessing the appropriate reach of manipulation law begin with the statutory provisions themselves. The Exchange Act gives remarkably little guidance as to the conduct the statutory provisions cover. Section 9(a)(2) prohibits effecting “a series of transactions” in a security (i) that “creat[e] actual or apparent active trading” or affect its price, (ii) “for the purpose of inducing the purchase or sale of such security by others.”⁸ With regard to its possible application to trade-driven manipulation, the first half of the proscription targets conduct that will be involved in virtually *every* trading strategy, however benign: buying or selling a security inherently involves the creation of an actual trade and frequently affects its price. The bite of the prohibition is thus left to the second half of the proscription, the vague clause relating to purpose. With regard to § 9(a)(2)’s possible application to quote-driven manipulation, the first half of the proscription presents the opposite problem: it is unclear that the first half applies to *any* use of quotes. Placing into the market an offer to sell, or offer to buy, at a given price is clearly an “action,” but with no counterparty involved, it is hard to call it a “transaction.” And even if that problem is surmounted, there is still the problem, shared with applying § 9(a)(2) to trade-driven

⁵ Amended Complaint, *Sec. & Exch. Comm’n v. Taub et. al.*, No. 16-cv-09130 (D.N.J. Apr. 26, 2018), ECF No. 37

⁶ *Sec. & Exch. Comm’n v. Lek Sec. Corp.*, 276 F. Supp. 3d 49 (S.D.N.Y. 2017).

⁷ Nathaniel Popper & Jenny Anderson, *Trader Arrested in Manipulation That Contributed to 2010 ‘Flash Crash’*, N.Y. TIMES (Apr. 21, 2015), <http://www.nytimes.com/2015/04/22/business/dealbook/trader-in-britain-arrested-on-charges-of-manipulation-that-led-to-2010-flash-crash.html> [<http://perma.cc/R73P-L7AL>]; Suzi Ring, *Flash-Crash Trader Sarao Gets Bail in U.S. Extradition Fight*, BLOOMBERG BUS. (Apr. 22, 2015, 11:36 AM), <http://www.bloomberg.com/news/articles/2015-04-22/flash-crash-trader-sarao-gets-bail-in-u-s-extradition-fight> [<http://perma.cc/FJ45-S8E3>] (reporting that CFTC Enforcement Director Aitan Goelman said that Sarao was “a significant factor in market imbalance . . . [which] was one of the chief conditions that allowed the flash crash to occur”).

⁸ § 78i(a)(2).

manipulation, of the vague clause relating to purpose that constitutes the second half of the proscription.

As for Section 10(b), it baldly prohibits the use, in violation of an SEC rule, of “any manipulative or deceptive device” in connection with trading a security.⁹ The term “manipulative” on its face is capacious enough to potentially include within its reach behavior involving quotes, but the statute fails to define what in fact is the reach of the term, and the only SEC attempt to do so in rulemaking simply refers back again to Section 9.¹⁰

Two of us have written earlier on the appropriate application of these statutory provisions to trade-driven manipulation.¹¹ As we noted there, surprisingly little progress has been made in defining these statutory terms in the eight decades since the Exchange Act’s passage. Many commentators believe that manipulation as a general matter is simply not a sufficiently meaningful concept to justify a ban on any kind of behavior.¹² Other jurists, legal scholars, and economists believe manipulation is a useful concept, but have struggled to define the term and identify its harms, typically using an overly broad or circular definition, constrained in some cases by “I know it when I see it” bromides.¹³ We noted that for trade-driven manipulation, the result

9. § 78j(b).

10. See Exchange Act Rule 10b-1.

11. Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *Stock Market Manipulation and Its Regulation*, 35 YALE J. REG. 67 (2018)

12. E.g., Fischel & Ross, *supra* note [], at 506-07 (“[N]o satisfactory definition of [manipulation] exists . . . the concept of manipulation should be abandoned.”); Robert C. Lower, *Disruptions of the Futures Market: A Comment on Dealing with Market Manipulation*, 8 YALE J. ON REG. 391, 392 (1991) (“Manipulation is difficult to define . . . [D]rawing a line between healthy economic behavior and that which is offensive has proved to be too subjective and imprecise to produce an effective regulatory tool.”). Even the Supreme Court has at times appeared to collapse any distinction between a “manipulative” device and a “deceptive” one by requiring that any violation of Section 10(b) involves a misrepresentation. See *Schreiber v. Burlington N., Inc.*, 472 U.S. 1, 8 n.6 (1985) (“Congress used the phrase ‘manipulative or deceptive’ in § 10(b) and we have interpreted ‘manipulative’ in that context to require misrepresentation.”); *Santa Fe Indus., Inc. v. Green*, 430 U. S. 462, 476-77 (1977); *infra* Part VII; see also Steve Thel, *Regulation of Manipulation Under Section 10(b)*, 1988 COLUM. BUS. L. REV. 359 (1988) (noting the difficulties of concisely defining manipulation under federal securities law).

13. See, e.g., 2 THOMAS LEE HAZEN, THE LAW OF SECURITIES REGULATION § 12.1 (6th ed. 2010) (“The purpose of the various statutes and rules prohibiting market manipulation is to prevent activities that rig the market and to thereby facilitate operation of the ‘natural law’ of supply and demand . . . manipulation consists of any intentional interference with supply and demand.”). Another formulation defines manipulation “as *exercising unsupported price pressure* because this creates societal costs.” Mathijs Nelemans, *Redefining Trade-Based Market Manipulation*, 42 VAL. U. L. REV. 1169, 1183 (2008) (emphasis added). In these formulations, the normative criticism of the relevant conduct is doing all the work in identifying exactly what kind of behavior is supposed to be prohibited, yet no guidance is provided as to what in fact violates the norm. Alternatively, the definition can be too narrow. For example, the requirement proposed by two well-known microstructure economists is that a strategy is manipulative only if it reduces both price accuracy and liquidity. Albert Kyle & S.

has been a legal framework that lacks precision, cogency, and consistency of application. This has resulted in unpredictable and disparate outcomes for cases with similar facts, raising basic questions of fairness. Moreover, the poorly articulated normative basis for these rulings results in enforcement that is both under-inclusive and over-inclusive in ways that do a bad job of discouraging socially harmful transactions and enabling socially beneficial ones. The law and commentary on quote-driven manipulation has these same problems in spades.

In seeking to find a way out of this morass, this paper employs a similar approach to that employed in our earlier work. We start with some simple constraints on a theory of manipulation and suggest that for a quote driven strategy to be considered manipulation prohibited by the Exchange Act, four essential questions must be answered in the affirmative. First, is the strategy, purely as a conceptual matter, distinguishable from other, clearly acceptable quote-driven strategies, and does the strategy under examination cause social harm? Second, does the strategy plausibly fit under the broad dictionary meaning of the term “manipulation”? Third, are there circumstances under which the strategy can yield positive expected profits, and do they occur frequently enough to cause concern? Fourth, are there practical procedures for implementing a ban on the strategy whereby the social gains from its reduction or elimination exceed the social costs of doing so, including deterring socially valuable activity that might be erroneously identified as examples of the practice?¹⁴ In essence, this

Viswanathan, *How to Define Illegal Price Manipulation*, 98 AM. ECON. REV. 274, 274 (2008). This leaves out of the prohibition strategies that increase one and reduce the other, and the negative social impact of the market characteristic that is reduced is greater than the positive impact from the one that is increased. Attempts to define manipulation in related regulatory areas such as commodities regulation show some of the same problems. *See, e.g.*, *In re Henner*, 30 Agric. Dec. 1151 (U.S.D.A. 1971) (“‘Manipulation’ is a vague term used in a wide and inclusive manner, possessing varying shades of meaning, and almost always conveying the idea of blame-worthiness deserving of censure.”); 2 TIMOTHY J. SNIDER, REGULATION OF THE COMMODITIES FUTURES AND OPTIONS MARKETS 12.01, at 12-5 (2d ed. 1995) (calling the law of manipulation “a murky miasma of questionable analysis and unclear effect”); *see also* Jonathan R. Macey & Maureen O’Hara, *From Markets to Venues: Securities Regulation in an Evolving World*, 58 STAN. L. REV. 563, 588-90 (2005) (discussing manipulation’s negative effects on liquidity); Edward T. McDermott, *Defining Manipulation in Commodity Futures Trading: The Futures “Squeeze,”* 74 NW. U. L. REV. 202, 205 (1979) (calling manipulation law “an embarrassment—confusing, contradictory, complex, and unsophisticated”); Yesha Yadav, *The Failure of Liability in Modern Markets*, 102 VA. L. REV. 1031, 1041 (2016).

14. A practice or regulation can lead to a social harm if it reduces economic efficiency in a particular way or systematically leads to unfair results. It can lead to a social gain if it improves economic efficiency or ameliorates some unfairness. *See infra* Part II. Thus, the desirability of a regulation that seeks to prohibit a given practice depends on whether, considering on a net basis all the social

four-question approach begins with some minimal rules of statutory interpretation to define the outer borders of what is plausibly within the reach of the prohibitions of quote-driven manipulation under Sections 9 and 10(b).

We utilize this approach to analyze four quote-driven strategies that have been labeled as “manipulative” in at least some commentary and found to be illegal in at least some actions against persons undertaking them.

In advance of describing each of these four strategies, a two paragraph introduction to the way modern equity markets work and associated vocabulary is in order. Equities trade on a variety of trading venues, almost all of which are *electronic limit order books*, in which a trader can post a *limit order*, which is a firm commitment (until cancelled) to buy or sell up to a specified number of shares at a quoted price. For a posted sell limit order, this stated limit price is an “*offer*.” For a posted buy limit order, this stated limit price is a “*bid*.” Bids and offers are often referred to as *quotes*. A computer (the venue’s *matching engine*) matches these posted limit orders, referred to as “*non-marketable limit orders*,” with incoming buy and sell *marketable orders*, which are orders that have terms allowing them to execute at what is then the nationally best available price in the market, the best offer being referred to as the NBO and the best bid being referred to as the NBB.¹⁵

Today, high-frequency traders (HFTs) post a significant portion of the limit orders that are matched in this fashion and result in executed trades.¹⁶ An HFT uses high-speed communications to constantly update its information concerning transactions occurring in each stock that it regularly trades, as well as changes in the buy and sell limit orders posted by others on every major trading venue. The

harms and benefits involved in a comparison between a world with and without the regulation, the world with the regulation is superior to the world without it.

15: Marketable orders include both “market orders” and “marketable limit orders.” A “market order” is where the person submitting the order commits to trading at whatever is the best available price in the market. The computer will also match the limit orders posted on the venue with “marketable limit orders.” A buy limit order is “marketable” when it has a limit price greater than or equal to the lowest offer in the market and a sell limit order is “marketable” when it has a limit price less than or equal to the highest bid. It is “non-marketable” if it is at a price equal to or inferior to the best offer or bid in the market.

16: See Jonathan A. Brogaard, Terrence Hendershott and Ryan Riordan, *High Frequency Trading and Price Discovery*, 27 REV. FIN. STUDIES, 2267 (2013) (finding based on NASDAQ data set that HFTs supply liquidity for 51 percent of all trades and provide the market quotes 50 percent of the time); This is confirmed by Allen Carrion, *Very fast money: High-frequency trading on the NASDAQ*, 16 J. FIN. MKTS. 680 (2013); see also generally Albert J. Menkveld, *High Frequency Trading and the New Market Makers*, 16 J. FIN. MKTS. 712 (2013) (exploring the role of HFTs as market makers in today’s market).

HFT automatically feeds this information into a computer that uses algorithms to change the limit prices and quantities associated with the HFT's own limit orders posted on each of the various trading venues.¹⁷

Against this background, consider the four quoting strategies that have been labelled as manipulative in at least some commentary and cases and that will be explored and assessed in this paper. Each of these strategies involves three steps, with the first step being what differentiates it from the others.

“At-or-away quote manipulation” involves, as its first step, submitting to an exchange one or more quotes, each for a large number of shares at a price equal to, or less favorable than the preexisting best quote in the market. So, if the quotes are offers, the price of each is equal to or above the preexisting NBO, and if the quotes are bids, the price of each is at or below the preexisting NBB.

“Inside-the-spread quote manipulation” involves, as its first step, submitting one or more quotes at prices within the spread between the then preexisting NBO and NBB. So, if the quotes are offers, the price of each is below the preexisting NBO, and if the quotes are bids, the price of each is above the preexisting NBB.

“Opening quote manipulation” involves, as its first step, submitting one or more quotes as part of the auction process that constitutes an exchange's daily opening.

“Auto-quote manipulation” involves, as its first step, submitting a quote on an exchange that is inside the spread between the preexisting NBO and NBB and as a result alters the price at which transactions are executed by broker-dealers acting as so-called “internalizers.” An internalizer purchases order flow from retail brokers and promises to execute these orders at prices equal to, or slightly better than, the NBO for purchases and the NBB for sales.

[Note to Readers: in this partial draft, we will only fully consider one of these forms of manipulation – at-or-away quote manipulation. We will also provide a detailed description of auto-

¹⁷ See Charles R. Korsmo, *High-Frequency Trading: A Regulatory Strategy*, 48 U. RICH. L. REV. 523, 540 (2014) (defining attributes of HFTs).

quote manipulation and provide the sketch of a social welfare analysis of the practice.]

The other two steps are the same for each of these four kinds of manipulation. One step is that the manipulator engages in an actual transaction in the opposite direction from its quote activity. So, the manipulator purchases shares if its quotes were offers, and sells shares if its quotes were bids. It is the anticipation of this actual purchase or sale that was the motivation for the quotes: the intent behind the manipulator's quotes was to influence the quoting behavior of other market participants in order to allow the manipulator's actual purchase or sale to occur at a more favorable price. The other additional step is for the manipulator to cancel the quotes (assuming they have not already been executed against), either just before or just after the actual purchase or sale.

Each of these steps – submitting the quotes, cancelling of the quotes, and the actual purchase or sale of shares – is, by itself, a perfectly acceptable form of behavior of a kind that is at the core of any efficiently operating secondary market for securities. What the critical commentators and case opinions find problematic are the three steps being undertaken together, combined with the intent to have the quotes favorably influence the price at which the actual transaction occurs. But what is the social harm, if any, when the manipulator succeeds? Often missing in these accounts by commentators and jurists is a perspicuous identification of exactly who is hurt and who is helped if the practice is left unregulated and how this would change if the practice instead were legally prohibited. Our framework allows a comparison of the two worlds in terms of economic efficiency and the fairness of the various market participants' resulting wealth positions. We then use that analysis to derive an approach that can enable regulators to deter genuinely socially undesirable quote-driven activity without unnecessarily deterring similarly appearing, but socially useful, quoting. Interestingly, although objections to certain quoting practices are often framed in terms of their unfairness, we argue that they are often undesirable mostly on straightforward efficiency grounds.

The framework we develop draws our normative and analytical building blocks from central results in microstructure and financial economics. Normatively, we argue that the main social functions of trading markets relate to guiding the efficient allocation of capital among firms and between households and enterprise over time, with the liquidity and price accuracy of a market serving as useful proxies for these ultimate social functions. Analytically, we present an informal model of how the secondary equity market typically functions.

The remainder of this Article proceeds as follows: Part I provides an overview of the workings of the four forms of quoting practices that are at least sometimes considered manipulative: at-or-away quote manipulation, inside-the-spread quote manipulation, opening quote manipulation, and auto-quote manipulation. Part II establishes our normative framework for assessing whether a potentially manipulative quoting strategy is actually socially undesirable and whether the social benefits of prohibiting the strategy outweigh the costs. There we identify the ways in which quote-driven manipulation and its regulation can affect the efficiency with which the economy operates. We also explain how we evaluate the fairness of a given practice. Part III briefly explores the basic institutional and economic features of the stock market to provide the tools necessary for understanding complex trading strategies. For those familiar with our recent work concerning various aspects of regulating stock trading markets, Parts II and III will be unnecessary.¹⁸ Parts IV, V, VI and VII consider, respectively, the efficiency and fairness implications of the four basic forms of quote-driven manipulation. Part VIII deploys what has come before it to illuminate and assess the existing statutory framework and case law relating to these four quoting practices. We then conclude.

I. Overview

A. *Understanding the Types of Quote-Driven Manipulation*

The starting point, undertaken here, is to understand the workings of each of the four kinds of quote manipulation mentioned above.

1. At-or-Away Quote Manipulation

At-or-away quote manipulation, as noted above, involves submitting to an exchange one or more quotes for a large number of shares at prices equal to, or less favorable than, the preexisting best quote in the market. It depends on the following empirically verified observations. Upon the arrival of an offer for a large number of shares at a price equal to, or higher than, the pre-existing NBO, market participants tend to react in the same fashion as if bad news had arrived

18. Portions of these Parts draw significantly from more detailed treatments in our prior work. See Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense*, 65 DUKE L.J. 191, 217-26 (2015) [hereinafter Fox et al., *Sense and Nonsense*]; see also Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *Informed Trading and Its Regulation*, J. CORP. L. (2018) [hereinafter Fox et al., *Informed Trading*].

about the issuer. Similarly, upon the arrival of a bid for a large number of shares at a price equal to, or lower than, the NBB, market participants react in the same fashion as if good news arrived about the issuer.

The computer-based algorithmic trading programs of HFTs reflect this observation. As noted above, HFTs are a major source of liquidity in the modern stock market, posting a significant portion of the bid and offer quotes that result in trades. These quotes constitute the prices at which other traders can transact. HFTs revise their quotes at rapid speeds and at high volume based on information that they receive concerning purchases and sales of shares that are occurring and changes in quotes. HFTs can see and react very quickly when such an offer or bid arrives and they can use this speed to their advantage. In response to a new offer for a large number of shares at or above the NBO, HFTs will cancel their bids. And because they may well also wish to lower their offers to a level at or below the pre-existing NBB, they are also likely to wish to clear the market of remaining other bids, and the only way of doing this is to send in marketable sell orders to execute against those bids. Because an HFT doing this believes that that the appropriate new offer price is at or below the pre-existing NBB, sending in these bid-clearing sell orders would appear costless to it since it is selling at a price at or above what it would buy shares for.

At-or-away quote manipulation is best understood through an example involving a manipulator named Atlee. Immediately prior to Atlee's first move, the NBO for ABC shares is \$10.12 and the NBB \$10.10, each for 1500 shares. All of these existing quotes were submitted by liquidity supplying HFTs. In the first stage of the manipulation, Atlee starts by placing a 1000 share non-marketable buy order at \$10.10. He immediately follows this by placing a 10,000 share non-marketable sell limit order at \$10.12. This large order on the offer side induces the HFT liquidity suppliers to cancel all their \$10.10 bids, totaling 1500 shares. That leaves just Atlee's 1000 share bid. The HFTs then submit sell limit orders at \$10.10 for 1000 shares, reflecting their belief that the price of ABC shares is going to fall and that they will wish to quote offers at that price or below. These execute against Atlee's 1000 share \$10.10 bid. Atlee immediately cancels his 10,000 share \$10.12 offer, no part of which has been executed against.¹⁹ So at

¹⁹ Even if the slower market participants still put in marketable buy orders that execute at \$10.12, any quotes not yet cancelled by the HFT liquidity suppliers

this point, Atlee has bought 1,000 shares at \$10.10 and has no bids or offers outstanding.

Now Atlee enters the second stage of this manipulation, reversing the strategy used in the first stage. He submits a 1,000 share non-marketable sell limit order at \$10.12 and a 10,000 share non-marketable buy limit order at \$10.10. Again, the HFTs respond by cancelling their offers at whatever price they are now set and submitting marketable buy orders at \$10.12 for 1000 shares, which execute against Atlee's 1000 share offer at \$10.12. Atlee then cancels his 10,000 share bid at \$10.10, none of which has been executed against.

Atlee is now flat, having first bought 1000 shares for \$10.10 and then sold 1000 shares at \$10.12, collecting \$20.00 all in a matter of milliseconds. He also likely collected rebates of about \$4.00 for the roundtrip transaction (\$.20 per hundred shares times 2000/100).

Although \$24 might not seem like much, the whole process is automated and can be repeated in milliseconds for this security and many others and on a repeated basis over time. That this can work is evidenced by the cases that we will discuss in Part VIII. In one example involving the futures market, Sarao, the manipulator, was alleged to have made over \$40 million in five years. Its potential for working is also demonstrated by empirical work that shows that large relative size at the offer does predict a price decline and large relative size at the bid does predict a price increase.²⁰

2. Inside-the-Spread Quote Manipulation

Inside-the-spread manipulation involves, as noted above, submitting one or more quotes at prices within the spread between the then preexisting NBO and NBB. **[Further description and example to come.]**

will be first in line to be hit, likely leaving Atlee's quote totally (as assumed here), or at least mostly, unexecuted against.

²⁰ This was first pointed out in Huang and Stoll (1994 RFS) which shows that $\log(\text{Ask size}/\text{Bid size})$ is negatively related to short term (5-minute) log price changes. This qualitative relation is confirmed in Harris and Panchapagesan (2005 JFM) and in a more recent working paper by [].

3. Opening Quote Manipulation

Opening quote manipulation involves, as noted above, submitting one or more quotes as part of the auction process that constitutes an exchange's daily opening. **[Further description and example to come.]**

4. Auto-quote Manipulation

Auto-quote manipulation involves submitting a quote on an exchange that is inside the spread between the preexisting NBO and NBB. Because the quote is an improvement on what had been the best quote in the market before, it becomes the market's new best bid or offer, depending on whether it is a purchase or sale order. This alters the price at which transactions are executed by so-called "internalizers." An internalizer purchases order flow from retail brokers for a fee and promises to execute these orders at prices slightly better than the NBO for purchases and the NBB for sales. In other words, the internalizer "auto-quotes."

The ultimate goal of the auto-quote manipulator is to engage in either a sale or a purchase of a security at a more favorable price than would otherwise be available in the market. If a sale is desired, the manipulator first sends a small non-marketable limit buy order to an exchange with a limit price that is above the pre-existing NBB.²¹ This is an improvement over the preexisting quote and so it establishes a new, higher NBB. The manipulator almost immediately thereafter sends a larger marketable sell order to a broker that she knows uses an internalizer. Her sale order executes at the internalizer at a price set by the new higher NBB. So the manipulator is able to sell her shares for a higher price than if she had not sent the non-marketable buy limit order to the exchange. As a last step, the manipulator then cancels the non-marketable buy order.

Where the manipulator instead wishes to purchase shares, her moves are just a mirror image of all this, with a small non-marketable sell order sent to the exchange at a price below the pre-existing NBO. Because this strategy is designed to improve the terms of a trade going in a single direction, it contrasts with at-or-away quote manipulation, in which the manipulation involves first putting on a position and then

²¹ Note that by definition, because the order is non-marketable, the price will also be below the pre-existing NBO.

taking off the position. While most of the prosecutions targeting auto-quote manipulation occurred in the early 2000s, an industry insider has indicated that this behavior is something that internalizers still intensely watch for.²²

As an example, we imagine that a manipulator named Autumn wants to sell 1,500 shares of Grindrod Shipping Holdings, LTD (GRIN). The current NBB is \$2.50 and NBO is \$2.62. She has chosen to hold her portfolio, including the GRIN shares, in a brokerage account with TD Ameritrade (TDA). She knows that TDA typically sends marketable orders to an internalizer,²³ which will execute her sell order at a slight improvement over the NBB prevailing at the time it is received.

Autumn also has a brokerage account at Interactive Brokers (IB), which she knows typically sends all its retail orders to an exchange.²⁴ She authorizes IB to submit a GRIN buy limit order for 100 shares priced at \$2.54. IB routes the order to an exchange, ARCA. When it arrives, it is now the best bid in the market and so the NBB moves up to \$2.54. Almost immediately thereafter, she instructs TDA to submit for her a GRIN marketable sell limit order for 1500 shares with a limit price of \$2.50. TDA promptly sends her sell order to Virtu Americas and it executes there for \$2.54 (the new NBB as a result of the buy order Autumn had sent via IB to ARCA) plus Virtu's promised slight price improvement. Autumn then cancels the 100 share buy limit order on ARCA. Autumn has now received \$60.00 more (1500 shares x \$.04) than she would have absent the manipulated quote.²⁵

²² Private conversation with Jamil Nazarali, Global Head of Business Development, Citadel Securities.

²³ The SEC's Regulation NMS Rule 605 requires a broker to report periodically on which venues it is sending its customers' orders to. TD Ameritrade's Rule 605 reports indicate that they send most marketable orders to internalizers such as Virtu Americas and Citadel.

²⁴ Interactive Brokers' Rule 605 reports indicate that, at least in recent quarters, they send all customer orders to exchanges, not to internalizers. Even without knowing IB's patterns, Autumn could have specified that her order be sent to a particular exchange and IB would have been required to follow this direction. Doing so might have raised suspicions that she was undertaking an auto-quote manipulation and, if she were investigated, certainly would have added to the evidence that this was her intent.

²⁵ Autumn's speed in submitting the sell order to TDA is important to minimize the chance that the buy order sent to IB doesn't execute with the NBB then

B. The Role of Purpose

In legal opinions and commentary related to Section 9(a)(2), a great deal turns on the “purpose” of the transactions involved. Similarly, the concept of a “manipulative . . . device” under Section 10(b) implies some kind of scienter, a concept that relates to intent. In each of the four types of quote manipulation described immediately above, the intent of the quoting activity was to influence in a favorable direction the price at which the actual purchase or sale occurred. Determining the purpose for which a given quote was submitted raises, of course, notoriously difficult questions. Most notably, the purpose motivating an individual to quote is inherently subjective. Accordingly, at a practical level, the questions of what constitutes an improper purpose, and what constitutes satisfactory evidence of that improper purpose, are inseparable.

Before we can ascertain what evidence would be adequate to establish an improper purpose for a quote, however, it is still important to have a clear conceptual idea of what constitutes an improper purpose. Consider an individual who submitted a quote and not long after engages in an actual transaction going in the opposite direction, cancelling the quote at about the same time, because she received new information concerning either the prospects of the issuer or concerning other quotes or trades relating to the issuer’s shares. Or consider an individual who engages in the actual transaction to improve her risk/return ratio in response to some change involving other securities in her portfolio that occurs after making the quote. We presumably would not wish to prohibit such quoting even though it may inevitably have had a favorable influence on the price at which the actual transaction occurs. The individual with whom we would potentially be concerned is instead the individual who engages in the quoting behavior in anticipation of an actual transaction going the other way and solely for the purpose of executing this actual transaction at a more favorable price. As we will explore further in Parts IV-VII, quoting behavior of this sort is socially undesirable.

This approach to the concept of what is socially undesirable quote-driven manipulation is similar to that adopted by Lawrence

shifting back to its old level, which would totally frustrate the manipulation. Notice, though, the manipulation still largely works if the buy order executes after the sell order but before the buy order can be cancelled. In that case, Autumn would still have managed to sell 900 shares at \$2.54, yielding \$56 more than she otherwise would have received. She would have repurchased the other 100 shares at \$2.54, the same price she sold them for. The higher the buy order, the more she can get for her sell order. But the higher it is, the more likely it will be executed against before it is cancelled, whether before her sell order executes, wiping out all her gain, or after, with a partial loss of the gain.

Harris for what he considers socially undesirable trade-driven manipulation: “The distinguishing difference between bluffers and informed speculators is that the speculators trade on opinions about fundamental values that they base on fundamental information. Bluffers behave as though they are informed speculators, and they hope that others will believe they are well-informed speculators, but they do not have well-founded opinions about values. Instead, they try to fool other traders into thinking they do.”²⁶ It is also close to a concept of trade-driven manipulation recognized by Fischel and Ross:

- (1) The trading is intended to move prices in a certain direction;
- (2) the trader has no belief that the prices would move in this direction but for the trade; and
- (3) the resulting profit comes solely from the trader’s ability to move prices and not from his possession of valuable information.²⁷

For quote-driven manipulation, the parallel idea would be that the quote does not represent an assessment by the person submitting it that having the quote executed against would, at the time it was made, be to her advantage. Fischel and Ross, however, did not think that their concept of trade-driven manipulation could be operationalized because they think it is too difficult to obtain satisfactory evidence concerning intent and that as a result any attempt would chill too many legitimate, socially useful transactions. We have disagreed with their belief in the case of trade-driven manipulation and, as will be developed in this paper, we think it is also possible to develop evidentiary tests suggesting that a given sequence of quoting, transacting and quote cancelling associated with any one of the four types of quote manipulation was undertaken for an improper purpose. We share, however, their concern about chilling socially useful market activities that are part of similarly appearing sequences. Thus, these evidentiary tests need to be designed to avoid significant such chilling.

[Note to Readers: Those who are familiar with the work by Fox, Glosten & Rauterberg on equity market issues, or who have otherwise acquired a general knowledge about equity market institutions and micro-structure economics, may wish to skim or skip entirely Parts II and III, which are on pp. 15-29.]

²⁶ Harris, *supra* note [], at 266.

²⁷ Fischel & Ross, *supra* note [].

II. The Normative Framework

Assessing the social value of a quoting strategy and the desirability of prohibiting it by deeming it illegal manipulation requires reference to the basic functions served by the equity trading market and the role that quoting plays in it. It also requires recognition that if a particular form of quoting takes place and its extent is generally understood, other actors in the system will generally take these facts into account in determining their own actions. Thus, the normative question is how the existence of a given quoting practice—and any attempts to regulate it—affect the system’s ultimate capacity to further the multiple social goals that equity trading markets are expected to serve and that form the justificatory basis for regulation when these markets fall short.

A. Social Goals

Five basic social goals animate most discussion of secondary equity markets²⁸ and their regulation: (i) promoting the efficient allocation of capital so that it goes to the most promising new investment projects; (ii) promoting the efficient operation of the economy’s existing productive capacity; (iii) promoting the efficient allocation of resources between current and future periods so as to best satisfy the needs of firms seeking funds for real investments (trading the promise of future dollars to obtain current dollars) and the needs of savers seeking to forgo current consumption in order to enjoy future consumption (trading current dollars to obtain the promise of future dollars); (iv) promoting the efficient allocation among investors of the risks associated with holding securities so that their volatility is borne by risk-averse investors with the least disutility; and (v) operating fairly and fostering an overall sense of fairness. In addition, any intelligent discussion of the desirability of manipulation and its regulation must take into account the impact of the trading on the real resources that society devotes to trading in, and operating, the stock market, and to the enforcement and compliance costs associated with its regulation, including the socially useful transactions that any regulation may deter.

B. The Use of Ex Post and Ex Ante Analysis

Understanding the impact of an ongoing quoting practice on these five basic social goals is most easily understood by starting with a single instance of the practice and seeing the ex post effect of the transaction. From this, we can see the impact of the quoting activity on the wealth position of the various participants involved, which in turn

28. In the primary market, stocks are purchased from the company issuing those stocks, while in the secondary market, traders buy and sell stocks from each other. Stock exchanges are secondary markets.

is a guide to the incentives that the availability of the practice generates. Then we can consider, from an ex ante perspective, the impact of the practice as a generally-known ongoing phenomenon occurring over the long run within a competitive environment. This ex ante analysis allows us to see what the efficiency and fairness implications of the practice are. As is relatively standard in the law and economics literature concerning corporate and securities law, we evaluate efficiency in Kaldor-Hicks terms,²⁹ and consider fairness in terms of a practice's effects on various participants' wealth positions from the ex ante perspective.³⁰

The initial four basic values and cost considerations listed above, and even the “sense of fairness” that we mention with respect to the fifth, all go to the efficiency aspect of the problem. The “operating fairly” aspect of the fifth value goes to the ultimate underlying fairness. Conceptions of fairness are too many and too multifarious to address generally in-depth. However, fairness also plays too prominent a role in public criticism of the securities markets to entirely ignore. Our strategy here is simply to take as an exemplar one prominent conception of fairness that frequently appears in commentary on markets.³¹ We argue that this conception of fairness is of limited use in assessing quoting behavior and leave things at that. More generally, we think that many of the concerns fairness targets, while genuine, can be more perspicuously articulated within an efficiency framework. The choice of the ex ante perspective to assess underlying fairness implies that if a practice does not affect a market participant's *expected* outcomes, it is not unfair. Because the practice is available and another person engages in it, a given transaction entered into by the participant may leave her worse off. But the practice is not unfair to the participant if, on average, she is not worse off entering into such transactions due to the practice. The idea that fairness can be assessed in terms of expected outcomes is bolstered by the fact that most investors engage in many transactions over time, and, like the myriad of other risks that

29. John R. Hicks, *The Foundations of Welfare Economics*, 49 *ECON. J.* 696 (1939); Nicholas Kaldor, *Welfare Propositions of Economics and Interpersonal Comparisons of Utility*, 49 *ECON. J.* 549 (1939) (together introducing the Kaldor-Hicks conception of efficiency). The Kaldor-Hicks conception of efficiency, with all its limitations, remains the standard welfare criterion in law-and-economics analyses of corporate and securities law. Cf. REINIER KRAAKMAN ET AL., *THE ANATOMY OF CORPORATE LAW: A COMPARATIVE AND FUNCTIONAL APPROACH* 23 n.87 (3d ed. 2017).

30. Other conceptions of fairness are of course possible (and plausible), and to the extent that such views are held, this Article simply offers a complementary critique of manipulation.

31. See, e.g., MICHAEL LEWIS, *FLASH BOYS: A WALL STREET REVOLT* (2014).

investors undertake, the risk of being hurt by the practice can essentially be eliminated by holding a diversified portfolio. To the extent that any of the assumptions in this characterization—repeated transactions or diversification—turn out not to characterize a given trader, then our argument above will not apply.³² This approach to fairness may also have far less appeal in other arenas of social life.

What we will see is that each of the different kinds of quote manipulation that we examine does not have unfair effects from this *ex ante* perspective. However, the perspective will reveal that relative to a practice's effective elimination by regulation, the free occurrence of the practice can affect certain classes of participants favorably or unfavorably in terms of the rents paid on their specialized assets, skills, or abilities. A prospective flow of rents is not an entitlement, however. In a market economy, the offer of rents to prompt the suppliers of specialized inputs to come forward is simply the mechanism by which these resources get directed to support a particular activity. In other words, such rents are an inevitable part of the use of a market economy to allocate resources and no particular flow of rents, say for the work of talented engineers, is any more or less fair than any other as long as the resulting allocation of resources is desirable. We judge such a resulting allocation of resources in terms of whether it is efficient or not, leaving fairness based corrections to more general policies of redistribution. Thus, we consider whether the indirect wealth effects from a given quoting practice are desirable or not as depending on whether the resulting allocation of productive resources enhances efficiency.

C. Market Characteristics that Impact on These Goals

A given quoting strategy may impact these five social goals in complex ways that are related to a stock market's two most important characteristics: the price accuracy and the liquidity of the stocks trading in it.³³ The social impact of any given form of quoting activity is most easily evaluated through a two-step process: first assessing the effect of the type of quoting on each of these two market characteristics and then identifying the effect of the characteristic on the five basic social goals discussed above.

32. See Alicia J. Davis, *Are Investors' Gains and Losses from Securities Fraud Equal Over Time? Theory and Evidence* (Univ. of Michigan Law Sch., Empirical Legal Studies Ctr. Working Paper Series, no. 09-002, 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1121198 [<http://perma.cc/GNJ7-KBEG>] (arguing, *inter alia*, that diversification assumptions are often false).

33. THIERRY FOUCAULT, MARCO PAGANO & AILSA RÖELL, MARKET LIQUIDITY: THEORY, EVIDENCE, AND POLICY 31 (2013) ("The two main roles of a securities market are to provide trading services for investors who wish to alter their portfolios, and to determine prices that can guide the allocation of capital by investors and firms [A] market is efficient if it enables investors to trade quickly and cheaply (i.e., if it is liquid) and if it incorporates new information quickly and accurately into prices.").

1. Price Accuracy

Price accuracy relates to the accuracy with which the market price of an issuer's shares predicts the issuer's future cash flows. Because the price of any new share offering by a publicly traded issuer will be determined largely by the price of its already outstanding shares in the stock market, more accurate stock market prices will lead to capital raised by new share issuances being more likely to go to the issuers with the most promising new real investment projects, the first basic social goal.³⁴ Share price also influences the availability of new project funding from other outside sources and the willingness of managers to use internal funds for investment, and so greater price accuracy assists the efficient allocation of capital in these other ways as well.³⁵

More generally, more accurate share prices help reveal managers who are performing poorly both in terms of their deployment of internal funds for new investment projects (again assisting the efficient allocation of capital) and in terms of their management of the issuer's current assets (assisting the efficient operation of the economy's existing productive capacity, the second basic social goal).³⁶ They also improve the effectiveness of share price compensation schemes, the threats of hostile takeovers, and activist hedge fund pressures as incentives for better managerial decision-making in terms of promoting these first two basic social goals.³⁷

Over time, more accurate share prices also likely lead to a greater sense of fairness on the part of investors, part of the fifth basic social goal, because they will experience fewer negative surprises at some point in time after their purchase or sale.³⁸

34. See, e.g., Qi Chen, Itay Goldstein & Wei Jiang, *Price Informativeness and Investment Sensitivity to Stock Price*, 12 REV. FIN. STUD. 619 (2007) (showing that the number of investment decisions tend to increase when a stock's price has just risen).

35. See Merritt B. Fox, *Civil Liability and Mandatory Disclosure*, 109 COLUM. L. REV. 237, 260-64 (2009); Marcel Kahan, *Securities Laws and the Social Costs of "Inaccurate" Stock Prices*, 41 DUKE L.J. 977 (1992).

36. *Id.* at 258-60.

37. *Id.* There is ample empirical evidence to suggest that accurate price signals do in fact have efficiency-enhancing effects on managerial decisions. See FOUCAULT ET AL., *supra* note 33, at 361-68 (collecting relevant empirical studies); see, e.g., Philip Bond, Alex Edmans & Itay Goldstein, *The Real Effects of Financial Markets*, 4 ANN. REV. FIN. ECON. 339 (2012).

38. In an efficient market, the market price, whether it is relatively accurate or inaccurate, is an unbiased predictor of an issuer's future cash flows. If it is inaccurate, it is just more likely to be far off, one way or the other, from how things ultimately turn out. Thus an efficient, but relatively inaccurate, price would result in as many positive surprises as negative ones. To many investors, the negative surprise

2. Liquidity

A second characteristic is how liquid the market is. Liquidity is a multi-dimensional concept that relates to the size of a trade, the price at which it is accomplished, and the time it takes to accomplish the trade. Generally, the larger the size of the purchase or sale and the faster one wishes to accomplish it, the less desirable will be the price. The more liquid the market is, however, the less severe these tradeoffs are. For a small retail purchase or sale of stock, the “bid-ask spread” (the spread between the best available bid and best available offer in the market) is a good measure of liquidity because the trader can effect a buy or sell transaction immediately at those respective prices and, in essence, will be paying half the spread to do so. For larger orders, the volume of stock available at prices not too inferior to this best bid or offer (the “depth of the book”) is relevant as well.³⁹

Liquidity also has an impact on a number of social goals:

a. More Efficient Allocation of Resources Over Time

To start, the prospect of greater liquidity promotes more efficient allocation of society’s scarce resources between uses that support current consumption and uses that support new real investment that in turn allows greater consumption in the future. This relates to the third basic social goal, the efficient allocation of resources with regard to consumption over time. Consider this first in terms of enterprises seeking new capital to devote to real investment projects through the issuance of stock. In essence, they are purchasers of current dollars in return for the promise of future dollars. The more liquid an issuer’s shares, the more valuable their shares are to hold for any given level of expected future cash flow.⁴⁰ Thus, when an issuer offers shares in the primary market, the more liquid that investors anticipate the shares will be in the future, the higher the price at which the issuer can sell its shares, all else equal. Hence, the lower will be the issuer’s cost of capital.⁴¹

is likely to be more salient, however. So when a negative surprise materializes, it generates a sense of grievance even though, *ex ante*, a positive surprise was equally likely. *See, e.g.*, DONALD C. LANGEVOORT, *SELLING HOPE, SELLING RISK* 11 (2016).

39. This concept of the best bid and offer—the prices at which small retail traders can fill, respectively, a market sell order and a market buy order—and the idea of depth of book will be explored further in Part III *infra*.

40. For a purchaser of the shares in the primary market—the sellers of current dollars in return for the promise of receiving future dollars—more liquidity means it is less costly to sell her shares in the future to provide for future consumption because the bid will be less below the mid-point. In addition, more liquidity means that buyers in the market at the time of this sale would value the shares more highly so that this mid-point will be higher. This is so for two reasons. First, it is less expensive for these buyers because the offer price they pay will be less above the mid-point. Second, it will be less expensive for these buyers to sell at yet some further point in the future because the bid then will be less below the mid-point.

41. The cost of capital is lower because the prospect of a smaller bid-ask spread results in the issuer’s expected future cash flow being discounted to

In welfare economics terms, illiquidity, just like a tax, results in a “wedge” between the value of what the savers (the purchasers of future dollars) expect to receive in the future and the value of what the entrepreneurs or issuers (the suppliers of future dollars in the form of future dividend streams) expect to give up in the future.⁴² This wedge prevents certain transactions from occurring that would have occurred if the shares were expected to be more liquid. The fact that, absent this wedge, the issuer and savers would have willingly entered into these transactions means that the transactions prevented by illiquidity are ones that would have made both parties better off on an expected basis. These lost transactions are projects with expected returns that are lower than those of the marginal project that gets funded in a world with a certain degree of illiquidity, but still high enough to make some people feel that, absent liquidity concerns, sacrificing their current dollars for the projects’ promises of future ones would be a worthwhile exchange.⁴³

In essence, illiquidity harms the efficiency with which society allocates its scarce resources between uses that support current consumption and uses that support consumption in the future. Savers save less, and entrepreneurs and issuers engage in less real investment, than the levels that would be mutually more advantageous but for the savers’ concerns about the liquidity of the issuers’ shares.

b. More Efficient Allocation of Risk

Greater liquidity also promotes the more efficient allocation of risk, the fourth basic social goal. At any given point in time, each investor has an optimal portfolio in terms of the proportion of his total wealth that is invested in risky securities and the proportion of this risky security portfolio that should be invested in each available risky security. An investor’s taste for safety versus risk may stay relatively steady over at least the medium run. However, almost everything else determining what portfolio is optimal for him—for example his personal circumstances, the risk-free rate of interest, the expected returns associated with each available risky asset, and the variances of

present value at a lower discount rate. See Yakov Amihud & Haim Mendelson, *Asset Pricing and the Bid-Ask Spread*, 17 J. FIN. ECON. 223 (1986); Yakov Amihud & Haim Mendelson, *Liquidity and Asset Prices: Financial Management Implications*, 17 FIN. MGMT. 5 (1988).

42. See FOUCAULT ET AL., *supra* note 33 at 322-25 (analyzing how illiquidity functions as a wedge separating transaction prices from assets’ fundamental values).

43. HARRIS, *supra* note [], at 214-15.

the returns on each such asset and the co-variances among them—may be subject to frequent change. Thus what constitutes an optimal portfolio is likely to be always shifting. By reducing the transaction costs associated with both the purchase and sale of securities, greater liquidity allows the individual investor to cost effectively adjust her portfolio over time to keep it closer at each moment to what at that point is optimal for her.

c. Greater Share Price Accuracy

More liquidity also lowers the transaction costs associated with speculative trading based on acquiring a variety of bits of publicly available information and observation of the world and analyzing them to make more accurate predictions of an issuer's cash flows, i.e., trading which creates fundamental-value information. Thus, more liquidity stimulates such activity and in the process increases share price accuracy, with the attendant benefits discussed just above in terms of more efficient capital allocation and utilization of existing productive capacity—the first two basic social goals.

III. The Workings of the Equity Market

A basic understanding of how the equity market works is a necessary starting point for determining any particular quoting strategy's impact on price accuracy and liquidity. Accordingly, this Part provides a quick survey of the different types of participants; the nature of trading venues and the types of orders used on them; how liquidity is generated; and the determinants of the prices at which transactions occur. From what follows, the reader will be able to see a baseline description of how the market would work in the absence of at-or-away quote manipulation, inside-the-spread quote manipulation, opening quote manipulation, and auto-quote manipulation, and will have the tools to understand the discussion in Parts IV, V, VI and VII concerning the impact of each of these quoting strategies if it is present in the market.

A. Market Participants and Their Reasons for Trading

Traders in the market can be broken down into four categories: informed traders, uninformed traders, noise traders, and anti-noise traders.⁴⁴ In addition, the buyers and sellers in the market include professional suppliers of liquidity. As will be developed in Parts IV, V, VI, and VII, a trader utilizing at-or-away quote manipulation, inside-the-spread quote manipulation, opening quote manipulation, or auto-quote manipulation has a special kind of private information: the

⁴⁴. While separating traders into informed and uninformed is a basic building block of microstructure economics, our taxonomy owes much in general to Larry Harris's work. See HARRIS, *supra* [], at 194.

knowledge that the quote she has submitted into the market does not represent an assessment that it would be advantageous to her to have her quote executed against. This information in some ways makes her similar to an informed trader when she engages in her actual purchase or sale. In the baseline description of the market that follows, however, we are assuming that there are no traders engaging in any type of quote manipulation.

1. Informed Traders

Informed traders are motivated to buy or sell based on information that allows a more accurate appraisal of the stock's value than what its current market price implies. This information can be one of several kinds. Fundamental-value information is an estimate of the future cash flows to a shareholder discounted to present value. Such information is based on a person gathering bits of publicly available information or observations about the world and analyzing what the person has learned in a sophisticated way that allows a superior assessment of these cash flows.⁴⁵ Announcement information involves information contained in an announcement by an issuer or other institution with obvious implications as to the issuer's future cash flows. Announcement information remains profitable only during the brief period of time between the announcement and when the information is fully reflected in price. Issuer inside information is information held within an issuer that is relevant to predicting its future cash flows but is not yet public and reflected in price. Non-issuer inside information is information relevant to predicting an issuer's future cash flows that is held within an institution other than an issuer and is not yet public and reflected in price.

As developed below, informed trading, on the one hand, moves share price on average in the direction of greater accuracy, and, on the other hand, reduces liquidity.⁴⁶ Thus it is necessary to net out the tradeoff between the positive social impact from improved share price accuracy and the negative social impact from decreased liquidity. Two of us have concluded in another paper that trading on the basis of fundamental-value information is socially desirable, while trading on the basis of announcement information, issuer inside information and

45. *Id.* at 194 (discussing the different forms of information on which an informed trader may transact).

46. *See infra* Section III.C.

non-issuer inside information (unless permitted by the non-issuer institution that generated the information) is socially undesirable.⁴⁷

2. Uninformed Traders

Uninformed traders buy and sell shares without possession of information that allows a more accurate appraisal of the stock's value than the assessment of value of the stock implied by current market prices. A trade by an uninformed person can be motivated by one of several reasons. For example, a purchase of a share is a way of deferring until a later period the consumption in the current period that the cash the trader possesses would otherwise permit. In the later period when the purchaser wishes to consume, she sells the share. The expected return at the time of purchase will simply be the expected return on the market as a whole adjusted to reflect the risk characteristics of the particular firm's shares.⁴⁸ Thus neither the purchase nor the sale of the share is motivated by information not yet reflected in share price at the time of the transaction. A purchase or sale of a share of stock may also be motivated by a change in what constitutes an investor's optimal portfolio—the mix of securities that achieves the best tradeoff of risk for return and that best suits the investor's tastes in terms of how risk averse she is and her particular circumstances—and thus again is not motivated by information yet to be reflected in share price at the time of the transaction. As noted in Part I, facilitating trades associated with consumption deferral and portfolio risk adjustment is one of the social benefits that a well-functioning stock market can provide. The market can also be a source of entertainment for traders who do not believe they have any special information, but buy and sell because they enjoy gambling.

3. Price Sensitive Fundamental Value Traders

Each price-sensitive fundamental value trader has her own reservation price for buying and for selling a given stock that is a product of her own best estimate of the issuer's future cash flows based on her particular analysis of publicly available information, how long or short she already is in the issuer's shares, and a discount to reflect the chance that what appears to be an attractive purchase or sale price might be the result of informed trading.⁴⁹ Often these fundamental value traders are traders who, though not in the business of supplying liquidity like professional liquidity suppliers, have submitted non-marketable limit orders. Thus they are showing that they are interested

47. See Fox et al., *Informed Trading*, *supra* note 18.

48. RICHARD BREALEY, STEWART MYERS & FRANKLIN ALLEN, *PRINCIPLES OF CORPORATE FINANCE* 302-08, 689 (11th ed. 2013).

49. See MERRITT B. FOX, *FINANCE AND INDUSTRIAL PERFORMANCE: THEORY, PRACTICE AND POLICY*, 34-43, 55-57 (1988).

in buying or selling shares of an issuer, but only if they can do so at a more favorable price than the current NBO or NBB.

4. Professional Liquidity Suppliers

The professional supplier of liquidity in an issuer's shares engages in both their frequent purchase and frequent sale, making a business out of standing ready to buy and sell these shares up to stated amounts at quoted prices (respectively a "bid" and an "offer" or "ask"). Today, this is typically a proprietary high frequency trader ("HFT"). An HFT uses high-speed communications to constantly update its information concerning transactions and the quotes of others occurring in each stock that it regularly trades and changes its own quotes accordingly, rather than using information about the issuer itself to determine these quotes. Thus the professional liquidity supplier is not "informed" in the sense that we use the term here. Indeed, because of its unique intermediary market making role, unlike all other buyers and sellers of securities in the market, we will not refer to it as a "trader."

B. Trading Venues and Orders

Any given stock is potentially traded in each of a number of competing venues. As previewed in the introduction, almost all these venues are *electronic limit order books*, where a liquidity supplier or a trader can post, as a *limit order*, its firm commitment to buy or sell up to a specified number of shares at a quoted price. This limit order remains posted on an exchange until it is either executed against or cancelled. The price of the lowest priced sell limit order or orders posted on any exchange in the country is the national best offer (NBO). The price of the highest priced buy order or orders posted on any exchange in the country is the national best bid (NBB). A computer (the venue's *matching engine*) matches posted limit orders with incoming buy and sell *marketable orders*. A marketable order can be a market order or a marketable limit order. A *market order* is an order from a trader willing to trade immediately and unconditionally at whatever is the best available price in the market. A *marketable limit order*, if a buy order, has a limit price at or above the NBO, and so, on its terms, can execute immediately against a posted limit order with the NBO. For the same reasons, a sell limit order is marketable if its limit price is at or below the NBB. The limit orders that are posted on exchanges and constitute the available quotes in the market are referred to as *non-marketable limit orders*. These are posted since they do not execute immediately upon submission. This is because, if they are sell limit orders, they are above the NBB, and if they are buy limit

orders, they are below the NBO. The law requires as a general matter that a venue not allow a marketable order to execute on it if that venue's own best offer is above the NBO or its own best bid is below the NBB.⁵⁰

HFTs, acting as professional liquidity suppliers, post a significant portion of the non-marketable limit orders that constitute the quotes in the market,⁵¹ but any trader can also submit a non-marketable limit order and these become quotes also. The law further requires that orders transact at the best prices displayed at any stock exchange.

C. The Economics of Liquidity Provision

What follows provides a baseline of how securities markets would work if there were no quote manipulation of any of the four kinds identified in this paper. With this baseline set, the four Parts that follow will consider, respectively, the impact of each these four kinds. Throughout the baseline, we will assume that, for expository simplicity, all the non-marketable limit orders posted on trading venues are from HFT professional liquidity suppliers and all traders use market orders. The four kinds of quote manipulators we then consider in the Parts that follow would typically not be liquidity supplying HFTs but, by definition, would themselves also be submitting non-marketable limit orders.

1. The Liquidity Supply Business

The professional liquidity supplier makes money if on average it sells the shares that it buys for more than the price paid.⁵² Doing so is not as easy as it might seem, even though at any one point in time the liquidity supplier's offer is always higher than its bid. The problem begins with the fact that the stock market is largely anonymous. Thus, the person with whom a liquidity supplier transacts generally does not reveal her identity and, what, if anything, she knows. So there is always the possibility that she is an informed trader. Liquidity suppliers, as will be demonstrated immediately below, lose money on average when they transact with informed traders.

50. See 17 C.F.R. § 242.611(a)(1) (2015) (establishing the rule); *id.* § 242.600(b) (defining relevant terms).

51. See Jonathan A. Brogaard, Terrence Hendershott & Ryan Riordan, *High Frequency Trading and Price Discovery*, 8 REV. FIN. STUD. 2267 (2014) (finding that HFTs supply liquidity for forty-two percent of all trades and provide the market quotes forty-two percent of the time).

52. As used here, "makes money" means that the revenues that it generates from its sales at the offer exceed its expenditures from its purchases at the bid. For purposes of simplicity, the analysis here assumes that liquidity supply involves no costs of operations or utility decreasing risks to its principals and requires no capital. This is because these other costs are not relevant to the points being made. There is in fact empirical evidence that the adverse selection factors being discussed here account for a majority of the spread between the bid and the ask in most markets. See HARRIS, *supra* note [], at 158.

2. Transacting with Informed Versus Uninformed Traders

An informed trader will buy from the liquidity supplier only when her superior assessment of the stock's value suggests that the value is above the liquidity provider's offer. And she will sell to the liquidity supplier only when her superior assessment suggests that the value is below the liquidity provider's bid. Thus, in transactions with an informed trader, the liquidity supplier sells at prices that the informed trader's information suggests is below the value of the stock, and buys at prices that the informed trader's information suggests is above the value of the stock. These transactions on average will be losing transactions for the liquidity supplier. In essence, the liquidity supplier faces a classic adverse selection situation.⁵³

Fortunately for the liquidity supplier, the rest of its transactions are with uninformed traders. On average, these transactions should be profitable. The assessment of value of the stock implied by current market prices is the midpoint between the NBO and NBB. Because the uninformed trader has no private information, there is no reason to think that on average this market assessment is wrong. So when a liquidity supplier purchases from an uninformed trader at the NBB and sells to an uninformed trader at the NBO, each of these transactions on average yields an expected profit equal to half the spread between the two quotes, with the liquidity supplier on average buying for a little less than value and selling for a little more than value.

In sum, whatever the source of an informed trader's private information, the liquidity provider will be subject to adverse selection and will on average lose money when it buys at the bid from informed sellers or sells at the offer to informed buyers. The liquidity provider can still break even, however, as long as there are enough uninformed traders willing to suffer the inevitable expected trading losses of buying at the offer and selling at the bid. There simply needs to be a large enough spread between the bid and offer that the losses accrued by transacting with informed traders are offset by the profits accrued from transacting with uninformed investors.

53. See generally George A. Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488 (1970) (analyzing how informational asymmetries can drive declines in the quality of goods traded in a market until only "lemons" are left). Liquidity suppliers face the constant threat that they are trading under conditions of information asymmetry and are thus only transacting when the trade is adverse to their interests.

3. How Liquidity Suppliers Set Their Bids and Offers

A liquidity supplier operates in a competitive market. To survive, it must set its quotes aggressively enough to attract business, but not so aggressively that the money it makes by buying from, and selling to, uninformed traders is less than what it loses by engaging in such transactions with informed traders. Thus, in a world where a liquidity supplier rationally expects a higher level of informed trading, it will need to set its offers higher and bids lower to break even and survive in a competitive market.⁵⁴

A liquidity supplier knows that there is a certain possibility that the next marketable order that arrives to execute against one of its quotes will be from an informed trader. The liquidity supplier knows that if the next marketable order to arrive is a buy, there is a certain chance that it is motivated by positive private information and no chance it is motivated by negative private information. Similarly, if the next order to arrive is a sell, there is a certain chance that it is motivated by negative private information and no chance it is motivated by positive private information. Thus, the liquidity supplier knows that whichever kind of order arrives next, it will alter the liquidity supplier's estimate of the stock's value: up if the order is a buy and down if it is a sell order. The offer and the bid are set in advance of knowing which it will be, but with the offer being contingent on the next arriving order being a buy and the bid on it being a sell. Thus, when a liquidity supplier is deciding on its offer price, it knows that an informed trader will only transact against this price if the information possessed by the informed trader is positive and thus that the arrival of a buy order will cause the liquidity supplier to revise its estimate upward. So, for a transaction with a buy order to be regret free, the liquidity supplier must, in advance of the arrival of the order, set its offer quote, based on the information it then knows, to reflect this upward revision of estimated value that will inevitably accompany the buy order's arrival. The same logic applies for setting the bid: to be regret-free it must reflect the downward revision that would inevitably accompany the arrival of a sell order. Once one kind of order or the other arrives, the liquidity supplier has new information and the process starts over again. Thus, in a world where the liquidity supplier rationally expects a higher level of informed trading, these upward and downward revisions will be larger and so again, it will need its offers higher and bids lower.⁵⁵

54. A more complete model of how the bid-ask spread is set would include a consideration of the costs of operations, compensation for the utility decreasing risks to its principals of having a not fully diversified portfolio concentrated in particular securities, and the need for capital. *See supra* note 52. Breaking even in the long run requires covering these costs and a normal market return on capital.

55. *See* Lawrence R. Glosten & Paul R. Milgrom, *Bid, Ask and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders*,

4. The Pattern of Transaction Prices in the Presence of Informed Trading

This description of how liquidity suppliers set their quotes highlights an important byproduct of rational liquidity provision in a market with informed traders. Liquidity suppliers will be constantly updating valuations in response to transactions. With a sufficient number of trades, the market price will come to reflect the informed trader's information. The behavior of rational liquidity providers thus reflects a kind of "invisible hand": simply as a result of their efforts to avoid losses to informed traders, liquidity providers are repeatedly revising their quotes so that, with time, they come to fully reflect informed traders' information.

For example, suppose that there were one or more informed traders possessing a particular piece of positive information. During their period of trading, there would of course also be buying and selling by uninformed traders. So both marketable buy and marketable sell orders will arrive at trading venues, but there will be more buys than sells. As a result, although there will be ups and downs in the offers and bids as the liquidity-supplier estimates of value move up and down with the arrival of each buy and sell order, the ups will predominate and the mid-point between the bid and offer will trend upward until the offer gets high enough that it equals or exceeds the informed traders' estimate of the share's value. Empirical evidence strongly supports the results from these adverse selection models. Analyses of intraday changes in quotes and in the prices of executed transactions consistently show that they respond to the pattern of buy and sell orders at the time.⁵⁶ Simulations suggest that the adjustment in price described here often completes itself quite quickly.

D. Complications to the Model

The discussion above strips away, for expository simplicity, many of the institutional features of today's equity markets. Some of

14 J. FIN. ECON. 71 (1985) (providing a model of trading behavior under information asymmetries in securities markets).

56. See Kalok Chan, Y. Peter Chung & Herb Johnson, *The Intraday Behavior of Bid-Ask Spreads for NYSE Stocks and CBOE Options*, 30 J. FIN. & QUANT. ANAL. 329 (1995) (suggesting that adverse selection is an important determinant of the intraday behavior of bid-ask spreads); Lawrence R. Glosten & Lawrence E. Harris, *Estimating the Components of the Bid-Ask Spread*, 21 J. FIN. ECON. 123 (1988) (estimating a model in which the bid-ask spread is divided into an adverse selection component and a transitory component due to inventory costs, clearing costs, and other factors).

these excised features, though, come into play at various points in our analysis of the four kinds of quote manipulation. It is useful to note the most important ones here.

1. Internalizers and Payment for Order Flow

For a fee, a brokerage firm may sell to another firm its full order flow of buy and sell marketable orders from a certain kind of customer – typically a retail investor – who is considered generally uninformed. The other firm, referred to as an “internalizer,” promises that each purchased order that it executes will be at a price that is at least slightly improved over the best offer or bid available in the market at the time the order is placed by the customer. For instance, shares might be purchased from sell-order customers at perhaps \$.0001 over the NBB and shares sold to buy-order customers at that amount below the NBO. The payments the broker selling customer order flow receives from the internalizer are referred to as “payment for order flow.”⁵⁷

[To come: brief discussions of the use of non-marketable limit orders by ordinary traders, maker-taker rebates for non-marketable orders and fees for marketable orders, tick size, and HFTs crossing the spread]

IV. At-or-Away Quote Manipulation

Recall that at-or-away quote manipulation involves, as its first step, submitting to an exchange one or more quotes, each for a large number of shares at a price equal to, or less favorable than, the preexisting best quote in the market. It is based on the observation, confirmed by empirical studies, that the arrival of an offer for a large number of shares at a price equal to, or higher than, the pre-existing NBO is followed by market participants acting in the same fashion as if bad news had arrived about the issuer, and that the arrival of a bid for a large number of shares at a price equal to, or lower than, the NBB, is followed by market participants acting in the same fashion as if good news arrived about the issuer. The algorithmic trading programs of HFT liquidity suppliers reflect this observation.

The analysis below suggests that at-or-away quote manipulation is a market practice that gives rise to an affirmative answer to each of the four foundational questions posed at the beginning, and hence is an appropriate target of a ban under the Exchange Act. It is socially harmful in a way that makes it distinguishable as a conceptual matter from other trading strategies. It also fits under a broad dictionary

57. Allen Ferrell, *A Proposal for Solving the “Payment for Order Flow” Problem*, 74 S. CAL. L. REV. 1027, 1028 (2001).

meaning of the word “manipulation.”⁵⁸ There are circumstances under which the strategy can yield positive expected profits. And there are situations where it will be provable that a trader has reason to know of the existence of these circumstances, meaning that if legal sanctions are only imposed when such a situation can be proved to have existed, not many socially valuable transactions—ones not driven by this strategy—will be deterred.

Our analysis backing up these conclusions, set out below, is built on the Atlee example in Part I. The first steps are to recall the details of the example and to consider why the practice can make Atlee money. We then assess the wealth transfer implications of at-or-away quote manipulation. That starts with examining the ex post effects of what Atlee did. Making trading profits is a zero sum game: Atlee made positive trading profits and so someone else lost money. After this ex post analysis, we consider, from an ex ante perspective, what the impact of the practice is as a generally known ongoing phenomenon occurring over the longer run within a competitive environment. From this, we can make conclusions both about the efficiency implications of the practice in terms of liquidity and share price accuracy and the fairness of its impact on different members of society. Finally, we consider whether there are practical ways of deterring this practice without at the same time chilling a significant amount of socially useful activity, and whether, instead of relying on a legal prohibition, there is a mechanism in the market generating self-protection that it would be better to rely upon.

A. Recalling the Atlee Example of At-or-Away Quote Manipulation

Recall that immediately prior to Atlee’s first move, the NBO for ABC shares is \$10.12 and the NBB \$10.10, each for 1500 shares. All these quotes were submitted by liquidity supplying HFTs. Atlee starts by placing a 1000 share non-marketable buy order at \$10.10. He immediately follows this by placing a 10,000 share non-marketable sell limit order at \$10.12. This large order on the offer side induces the HFT liquidity suppliers to cancel all their \$10.10 bids and to submit sell limit orders at \$10.10 for 1000 shares. These actions reflect their belief that the price of ABC shares is going to fall and their desire to

58. In its definition of “manipulate,” the Merriam-Webster dictionary includes “to change by artful or unfair means so as to serve one’s purpose.” *Manipulate*, MERRIAM-WEBSTER’S COLLEGIATE DICTIONARY (11th ed. 2009).

clear out the remaining bids at \$10.00 so that they can submit new offers at that price or lower.

The HFTs' marketable sell orders execute against Atlee's 1000 share \$10.10 bid. Atlee immediately cancels his 10,000 share \$10.12 offer, no part of which has been executed against.⁵⁹

Now Atlee enters into a mirror-image set of actions. He submits a 1,000 share non-marketable sell limit order at \$10.12 and a 10,000 share non-marketable buy limit order at \$10.10. Again, the liquidity supplying HFTs respond by cancelling their sell orders (to the extent that they were not cancelled in response to the first stage or were restored when Atlee's large sell quote was cancelled) and submitting marketable buy orders at \$10.12 for 1000 shares, which execute against Atlee's 1000 share order offer at \$10.12. Atlee then cancels his 10,000 share bid at \$10.10, none of which has been executed against.

At the end, Atlee is flat, having first bought 1000 shares, for \$10.10, and then sold 1000 shares, at \$10.12. In the roundtrip, he collected \$20.00 all in a matter of milliseconds. He also likely collected rebates of about \$4.00 for the roundtrip transaction (\$.20 per hundred shares times 2000/100). Unless there are other developments in the market during the very brief time of this two-sided manipulation, the bid and offer should return to \$10.10 and \$10.12, respectively.

B. Why Does At-or-Away Quote Manipulation Work?

The question of why at-or-away quote manipulation works has not really been adequately explained by market microstructure theorists. One possible approach, though, goes as follows. The equilibrium in a limit order book derived in the standard microstructure models⁶⁰ assumes a world with continuous prices. Real world exchanges, though, have a minimum tick size, typically a penny, and use time priority (first in, first out) to determine which quotes at the same price get executed against first. A limit order book with these features will have the offer side of the book being an upper step function

⁵⁹ Even, in the small fraction of the second that all this is going on, slower market participants still put in marketable buy orders that execute at \$10.12, any remaining quotes submitted by the HFT liquidity suppliers will be first in line to be hit, likely leaving Atlee's quote totally (as assumed here), or at least mostly, unexecuted against.

⁶⁰ See, e.g., Glosten (1994).

approximation of the continuous price equilibrium. The bid side of the book will be a lower step function approximation.

In this world with a penny tick, there would still be a consensus as to the “true” offer price, bid price, and mid-point price, i.e., the ones that would have prevailed if prices had in fact been continuous. No liquidity supplier will be willing to sell at below this true offer price, or buy at above this true bid price. If this true offer price is close to, but below, the NBO, the offer size will be small relative to where it would be if it were close to, but above, the next tick below the NBO. Conversely, if this true bid price were close to, but below, the next tick above the NBB, the bid size will be large relative to where it would have been if it were close to, but below the NBB.

At least absent manipulators such as Atlee, if the NBO and NBB remain unchanged but there is an increase in the number of shares offered at the NBO relative to the number bid at the NBB, this would suggest a drop in the true midpoint price. Consider the following example. At the start, the NBO for ABC shares is \$10.12, with 1500 shares offered, and the NBB is \$10.10, with 1500 shares bid. Assume that this reflects the true offer price for ABC shares being \$10.115 and the true bid price being \$10.105, with the midpoint being \$10.11 and the implied spread in the continuous market being \$.01. Then the number of shares offered at \$10.12 increases relative to the number bid at \$10.00. These respective changes in the number of shares offered and bid would imply a downward valuation ABC shares in the market, because, if such a downward valuation occurred, it would be more attractive to more people to sell ABC shares at \$10.12 and less attractive to buy them at \$10.10.

This theory cannot be the whole story, however. Empirical studies show that large size in quotes away from the best (above the NBO or below the NBB) also predict a change in price. Cases suggest that manipulators can take advantage of this effect as well, with apparently successful manipulations employing large away quotes on one side of the book and then the other in the same way that Atlee employed large quotes first at the NBO and then at the NBB. The discrete tick size theory, set out here, has nothing to say about why the large away quotes predict price changes and why manipulations based on this observation should work. Something else must be at work and whatever explains the large-order-away-from-the-best-quote

phenomenon probably explains as well in part the large-order-at-the-best-quote phenomenon exemplified by the Atlee example.

One possible explanation for the large-order-away-from-best-quote phenomenon would be that non-marketable orders are placed by price sensitive fundamental value traders who become informed traders as well in the sense that they receive private information that they believe will stay private for a while. Assume, prior to receiving this negative information, such a trader, based on all publicly available information, had a more favorable view of ABC than is implied by the market consensus on its value (i.e., the midpoint between the NBO of \$10.12 and NBB of \$10.10). As a result, he is “over-weighted” in ABC, i.e., a substantially larger portion of his portfolio is devoted to ABC shares than would be the amount that would, through diversification, minimize the risk associated with this portfolio. His more favorable assessment of the expected return from holding ABC justified taking this extra risk. How much he would want to be over-weighted, though, depends on the difference between his assessment and the consensus market assessment. Suppose the trader then receives some negative private information, but his assessment of ABC is still more favorable than the market consensus, just less so. He would still wish to be over-weighted, but less so. He might not only put in limit sell orders at the NBO, but also put in limit orders at prices above the NBO, since, if ABC’s price went up but the trader’s assessment stayed the same, he would want to be even less over-weighted than would result from his sales at the NBO. Thus the posting of a limit order at a price above the NBO could be the result of someone who has negative information.

In any event, whatever the reason, if, in response to a large order at or away from the NBO, market participants act as though someone has new negative information about the issuer, this strongly suggests that in fact such orders are signals that this is the case.

C. Wealth Transfers: Fairness and Efficiency

Considering the fairness and efficiency effects of at-or-away quote manipulation starts with examining the ex post effects of what Atlee did. This is followed by a look at the practice from an ex ante perspective, considering what the impact of the practice is as a generally known ongoing phenomenon occurring over the longer run within a competitive environment. We can then draw conclusions both about the efficiency implications of the practice in terms of liquidity and share price accuracy and the fairness of its impact on different members of society.

1. Assessing the Impact of the Practice from an Ex Post

Perspective

The distributive question is who has benefited from this activity and who has been harmed. Because secondary market trading in pursuit of profits is a zero-sum game,⁶¹ gains and losses by different market participants are mirror images of each other and must sum to zero. Atlee made \$20 in trading profits. He purchased 1000 shares for \$10.10 and sold them for \$10.12. The losers were HFTs, that, as a group, lost \$20. They were induced into selling 1000 shares for \$10.10 and buying 1000 shares at \$10.12 when they otherwise would not have. No one else is affected in this simple story.⁶²

2. Ex Ante Perspective

Now assume, not unrealistically, that all the players have unbiased (though not necessarily accurate) expectations concerning the prevalence of successful at-or-away quote manipulation, and that all the players operate within a competitive environment. We want to compare what the longer run equilibrium would look like in a world where such a quoting strategy is occurring freely with a world where it is somehow blocked. The object is to see how the availability of the practice affects the wealth positions of the various participants and the implications of these effects in terms of fairness and, through the incentives they create, on efficiency.

61. See LARRY HARRIS, TRADING AND ELECTRONIC MARKETS: WHAT INVESTMENT PROFESSIONALS NEED TO KNOW 22 (2015) (suggesting that “[t]rading is a zero-sum game when gains and losses are measured relative to the market index”).

⁶² In our simple story, no one else is affected. It is, of course, possible, for example, that some marketable sell orders submitted by ordinary traders by chance arrive in the very brief time before the HFTs execute against Atlee’s \$10.10 bid, but that would just dilute the effect of Atlee’s manipulation since he would simply be providing liquidity to these sellers at the price that the non-manipulated market suggested was appropriate. There also could be, in addition to Atlee’s bids at \$10.10, bids submitted by ordinary traders willing to be patient in hopes of being able to buy at a lower price than the offer. These traders, who move more slowly than HFTs and thus would not cancel their bids, would, in the end, be happy to have their bids executed against, but selling to these ordinary investors just adds to the losses that the HFTs will suffer from the manipulation. It is also possible that the NBB would decline very, very briefly before Atlee’s mirror set of actions but, in that case, so would the offer. So a few ordinary trader sellers might lose, but a few buyers would win by a comparable amount. The mirror set of actions will have the opposite effects.

a. Manipulators

At-or-away quote manipulators will generate positive trading profits from engaging in the practice. The resources necessary to conduct a business in such quote manipulation are a combination of ordinary and specialized inputs. The ordinary inputs are physical, organizational, and financial assets that could equally usefully be deployed elsewhere in the economy. The specialized inputs are the efforts of key persons who possess abilities and skills uniquely useful for predicting such situations and acting on them. All of these inputs will be drawn into this business up to the point where, at the margin, the expected profits from successfully predicting and acting on such situations equals the costs of paying for the inputs. This activity occurs in an openly competitive environment and so the suppliers of the ordinary inputs will be paid a market return comparable to what they would earn if the resources they supplied were deployed instead another way. Thus, whether at-or-away quote manipulation occurs freely or not has no effect on their wealth positions. The persons with uniquely useful abilities and skills will be paid greater rents than they would be paid if they had to work in a different business because at-or-away quote manipulation was somehow blocked. Thus their wealth positions will be enhanced if such manipulation is allowed to occur freely.

b. Liquidity Suppliers

Viewing the effects of at-or-away quote manipulation on liquidity suppliers from an *ex ante* perspective requires attention to two different phenomena. One is the trading losses that the suppliers sustain when they sell at a price equal to the pre-existing bid and buy back at one equal to the pre-existing offer. The other is the damage that the manipulation does to the information environment that liquidity suppliers use to protect themselves in their quoting activity against adverse selection by informed traders.

i. Trading losses. As we have seen from the example, *ex post*, liquidity suppliers will lose in their transactions with a successful at-or-away quote manipulator because the reversing purchases from the manipulators are at higher prices than the initial sales to them.

It is an interesting question who ultimately bears these costs, however. For the HFTs, these are not ordinary adverse selection costs that arise from liquidity supply, selling to investors with private positive information and buying from ones with private negative information. This point is best understood by considering an alternative scenario where Atlee would be creating adverse selection costs through his manipulation. Suppose Atlee did not put in his bid for 1000 shares at \$10.10, but did put in his large quote at \$10.12. The

large quote sent a sufficiently negative signal that it pushed prices down by more than the spread so that the new NBO, say \$10.09, was below the pre-existing NBB of \$10.10. In this scenario, Atlee then buys at the new offer. After cancelling the large quote, the bid returns to \$10.10 and Atlee sells the shares for \$10.10 that he bought for \$10.09.

In this alternative scenario, Atlee would in essence be an informed trader because he would know that the large quote at the NBO did not represent bad news when predictably other market players would think that it did. From the *ex ante* perspective, losses of that sort would be passed on by the liquidity suppliers to the other traders in the market. In a simple model, like that set out in Part III, where the only cost to liquidity supply is adverse selection, to survive in a competitive market, a liquidity supplier must set its bids and offers so that these losses and gains balance out.⁶³ If its spreads are wider than this, it will not attract orders because they will be undercut by other liquidity suppliers. If they are narrower than this, at least some of its inputs will be receiving less than a market return, and thus the business will not be able to survive in the longer run.

In contrast, in the Atlee scenario that is in fact our focus, where he does submit the 1000 share bid at \$10.10, the HFTs' losses, rather than coming directly from their liquidity supplying activity, arise because the HFTs choose not to wait until marketable sell orders by ordinary investors executed against the bids in the market at \$10.10 submitted by persons whom the HFTs (incorrectly) thought were just persons other than professional liquidity suppliers who failed to cancel because they were unaware of Atlee's large order at the pre-existing NBO and its negative implications. The HFTs make this choice to clear the market themselves in these kinds of situations in essence as an opportunity to expand their businesses by quoting during a period of time that they otherwise would not have been because there would still be bids at or above the price at which they wish to quote offers. So the choice by an HFT to engage in this kind of activity is more like a larger overall cost of business related to how much quoting they can provide during the year.

The existence of at-or-away quote manipulation is thus more like other real world costs of being in the liquidity supply business not captured by the simple pure adverse selection model. These would include what must be paid to personnel, a market return on the capital needed for real estate and equipment and for engaging in the trading

63. See *supra* Section III.C..

itself, and compensation for the undiversified nature of the portfolio that the business will be holding most of the time. At least over the long run, the spread must be wide enough to cover these costs as well for liquidity suppliers to stay in business and provide liquidity at the level they do, or it must erode what are still positive rents for particular inputs into what is competitive business. In other words, at-or-away quote manipulation is a cost of providing liquidity at this level, which may or may not be passed on through a wider spread.

ii. Detecting informed trading. The presence of at-or-away quote manipulation in the market has a more indirect effect on liquidity suppliers, however, because it makes the incidence of informed trading harder to detect. Although, as noted above, we are not sure of the exact mechanisms, the very fact that large orders at or away from the best quote predict price changes indicates that such orders are a signal that informed trading is going on. If at-or-away quote manipulation is occurring from time to time in the market, this signal gets muddled. When the liquidity supplier sees a large at-or-away quote, it cannot be sure whether this is due to informed trading or a manipulation.

The less well liquidity suppliers can detect the incidence of informed trading, the less well they can protect themselves against adverse selection losses by changing their quotes in response to what they learn. This means that the spread is wider because liquidity suppliers anticipate more in the way of adverse selection losses. In accordance with the simple model in Part III, this clearly will be a cost that will be passed on to traders in the form of a wider spread.

iii. Ultimate incidence of the negative effects on liquidity suppliers. To the extent, if any, that the trading losses associated with at-or-away quote manipulation cannot be passed on to traders in the form of a higher spread, they will have a direct negative effect on persons associated with the business by reducing the rents they receive for their participation.

To the extent that liquidity suppliers can pass on, through a wider spread, the trading costs to them associated with at-or-away quote manipulations, they will still have a negative effect on the wealth positions of certain persons associated with the liquidity supply business, but only indirectly. The same goes for the negative effect of the manipulation on liquidity suppliers' ability to detect informed trading and protect themselves in their quoting activity. A wider spread increases the cost of trading. This means that less trading occurs. Less trading means less of both their ordinary and specialized inputs will be pulled into the business. Suppliers of the ordinary inputs will earn the same ordinary market return whatever the level of liquidity supply activity. For persons with abilities and skills uniquely useful for liquidity supply, however, they will be paid less in rents and so their

wealth positions would be negatively affected by the prospect of successful manipulation of this type.

c. Uninformed Traders

In the simple story that we tell in the Atlee example, uninformed investors are not directly involved because the whole manipulation takes so little time. Thus few if any of their marketable orders would, for example, execute against Atlee's \$10.10 bid and if any did, they would receive the same price as if the manipulation had not occurred. It is possible that the NBB would decline briefly before Atlee's mirror set of actions but, in that case, so would the NBO. So where sellers might lose, buyers would win by a comparable amount. From an ex ante point of view, an uninformed investor is as likely to be a buyer as a seller, hence, on an expected basis the impact to uninformed investors of manipulation is zero. Moreover, the mirror set of actions will have the opposite effects on buyers versus sellers, but again, there is no impact on an expected basis.

The expected cost to uninformed traders from at-or-away quote manipulation is instead indirect. It arises from the need, in the cycle over time of a purchase and sale, to pay any increase in spread because this kind of manipulation is occurring. They will purchase at the offer but only be able to sell at the bid. Calculating the ultimate incidence of this cost on uninformed traders is a bit complicated, however. When an issuer's entrepreneurs and initial investors engage in an initial public offering, the shares they are offering will be discounted to reflect the prospect that the spread must be paid with each subsequent sale and purchase in the secondary market as well as the prospect that any future equity offerings by the issuer over time will be similarly discounted. So, the entrepreneurs and early investors receive less than if there were no impact on the spread by this kind of manipulation. This discount continues at the same level for as long as the firm appears to have a long run future. For uninformed investors who buy and sell less frequently than average, this discount makes the purchase a bargain and so they are gainers from at-or-away quote manipulation. Those who buy and sell more frequently than average⁶⁴ are hurt by repeatedly paying the spread more than they are helped by the discount, and so they are losers from the practice.

64. Brad M. Barber & Terrence Odean, *The Behavior of Individual Investors*, in HANDBOOK OF THE ECONOMICS OF FINANCE 1533, 1534 (George M. Constantinides, Milton Harris & Rene M. Stulz eds., 2013) ("Many apparently uninformed investors trade actively, speculatively, and to their detriment.").

d. Informed Traders

Informed traders of each kind pay the same increased spread due to the presence of at-or-away quote manipulation that uninformed traders do. This increase in their cost of doing business has a depressing effect on the level of each of the kinds of informed activity. This decreases the level of resources going into each of these activities, with a negative wealth impact on the suppliers of the specialized inputs.

3. Fairness Considerations

Based on the survey above, we can see that freely occurring at-or-away quote manipulation will not affect the wealth position of uninformed traders from an ex ante point of view because it is unlikely that it will affect the price at which they transact and if it does, they are as likely to benefit as to be hurt. It may add to the riskiness of their trading, but this is a risk that can typically be eliminated by holding a diversified portfolio. They will face an increase in the bid-ask spread, but on average this will be compensated by the lower cost of buying shares that earn a given expected return.

Any wider bid-ask spread will result in fewer resources being drawn into the businesses of liquidity supply and fundamental-value informed trading, thereby decreasing the wealth positions of their specialized input suppliers. A prospective flow of rents is not an entitlement, however. In a market economy, the offer of rents to prompt the suppliers of specialized inputs to come forward is simply the mechanism by which these resources get directed to the activity for which they are most particularly suited. The effects on the rents being paid in the case of the businesses being considered here do not raise any greater fairness issues than do the rents paid persons with special abilities and skills across the whole market-based part of our economy. The bottom line is that the more serious normative question concerning at-or-away quote manipulation is whether its effect on the allocation of resources enhances or decreases efficiency.

4. Efficiency Considerations

From an efficiency point of view, at-or-away quote manipulation has no redeeming virtues. Although it will not directly affect price accuracy in any important way, it consumes resources that could be usefully employed elsewhere in the economy and it likely has a negative impact on liquidity, which in turn indirectly can hurt price accuracy in ways that are socially harmful.

a. Price Accuracy

As our discussion of the workings of the market shows, in the absence of manipulation, market prices have the remarkable quality of reflecting a large amount of information relevant to predicting an issuer's future cash flows. At-or-away quote manipulation, in its direct effects, is unlikely to move price away from where it otherwise would be, and if it does, it will be for such a brief time as to have no real economy efficiency implications. So, interestingly, although most commentators and jurists focus on the price distortion effects of manipulation of all kinds, reduced price accuracy is not an important direct consequence of at-or-away quote manipulation. Recall that the ways that accurate prices benefit the economy is by helping to allocate the economy's scarce capital to the most promising potential real investment projects and by improving the utilization of the economy's existing productive capacity through optimizing the signals provided to management about investment decisions and the signals given to boards and shareholders about the quality of management decisions.⁶⁵ This form of manipulation is either going to have no direct effect on prices or only ones for a very brief period of time. Very short run distortions in price of the kind that will typically occur with at-or-away quote manipulation will not seriously undermine the role that share prices play in guiding the real economy in these ways.

However, this form of manipulation can have an indirect effect on longer run price accuracy in ways that can be important to the real economy through its impact on liquidity and, among the various kinds of informed trading. The level of fundamental-value informed trading will be most sensitive to this increase in cost. This is because fundamental-value informed traders create, at a cost to them, the information on which they trade. A wider spread means their trading will be less profitable and so they have less incentive to create information. In contrast, the level of issuer insider and non-issuer insider informed trading and trading based on the tips of such insiders depends mostly on the opportunities that the insiders encounter in their employment.

The decrease in the level of fundamental-value informed trading is unfortunate because the social gain from its contribution to long run price accuracy exceeds the social costs of the activity.⁶⁶ Thus, the social disadvantage from a lower level of fundamental-value informed

65. See *supra* Section II.C.1.

66. See Fox et al., *Informed Trading*, *supra* note 18.

trading is likely to dominate the advantage from the likely smaller decrease in the other, socially undesirable, forms of informed trading.

It may also be that large at-or-away quotes are more a signal of informed trading going on by announcement traders and issuer and non-issuer insider informed trading, although this idea is more speculative. If so, the manipulation's muddying of the signal that informed trading is going on is particularly unfortunate since it masks the socially disadvantageous types of informed trading more than the socially advantageous type.

b. Liquidity

The prospect of freely occurring at-or-away quote manipulation will lessen liquidity. It will definitely do so, through its muddying of the signal of at-or-away quotes, and the consequent widening of spreads. Although it is less clear, the trading costs associated with buying at what had been the bid and selling at what had been the offer may also widen spreads.

As discussed in Part II, less liquidity reduces social welfare because of the resulting misallocation of resources over time and misallocation of risk: socially beneficial transactions fail to occur, leaving investors with suboptimal, riskier portfolios, and driving up the cost of capital for firms.⁶⁷ By raising the costs of fundamental-value informed trading and thereby lessening the incentives to search out and trade on new information, less liquidity also reduces longer run share price accuracy.⁶⁸

c. Resource Misallocation

If at-or-away quote manipulation were freely permitted, it would pull resources into a socially useless business. If not, these extra resources would be used elsewhere in the economy, positively contributing to the production of goods and services.

d. Market Confidence

There is one additional, more nebulous efficiency consideration: market confidence. This relates to a sense among investors that the market is fair, part of the fifth basic social goal discussed above. Even if at-or-away quote manipulation does not in fact decrease the wealth position of ordinary investors, and any additional risk created by it can be diversified away, public awareness that it occurs may hurt everyday investors' "confidence" in the stock market. Such manipulations may strike the public as unfair and improper in some way that is harmful to

67. *See supra* Section II.C.2.

68. *Id.*

them. As a result, to the detriment of both them and others, they may participate in the stock market to a lesser degree.⁶⁹ Typically, the best response to public misunderstanding is to resolve it through education, but where a perception may be especially difficult to eradicate and it is causing damage, then that perception may provide an independent policy ground for prohibiting the relevant conduct.

B. The Appropriateness of Legal Sanctions

As noted in the introduction, some commentators oppose regulation of any type of manipulation, at least beyond such obvious abuses as wash or matched sales. Their concern is that no observable conduct separates manipulative market activity from market activity that serves socially useful purposes. Determining the purpose of the transaction is highly speculative. The question then is, will making at-or-away quote manipulation illegal deter much socially worthwhile quoting activity as well? Will persons contemplating making a socially worthwhile quote fear that it might be mistaken for a manipulative one?

Where there is a pattern of repeated sequences of large quotes on one side followed almost immediately by a smaller quote on the other side and then, upon execution of this smaller quote, the cancellation of the initial large quote, we think that the intent to use the first quote to get a more advantageous price for the transaction going the other way is clear, even more so when all this is immediately followed by a mirror set of actions. A sudden change in the information obtained by a trader could explain an occasional incidence of such a sequence of quoting, trading and cancellation, but an established pattern of such sequences as a significant percentage of all market activity is not plausibly caused by sudden information changes.

A more interesting objection to including at-or-away quote manipulation within the reach of prohibitions on manipulation is the idea that the market itself can take care of the problem. There is anecdotal evidence that when an at-or-away quote manipulator has

69. See Lydia Saad, *U.S. Stock Ownership Stays at Record Low*, GALLUP ECON. (May 8, 2013), <http://news.gallup.com/poll/162353/stock-ownership-stays-record-low.aspx> [<http://perma.cc/FU35-QUMR>]. Michael Lewis attributes this drop, which has occurred in the face of a sharply rising market over the last five years, to a sense that the market is unfair. See MICHAEL LEWIS, *FLASH BOYS: A WALL STREET REVOLT 200-01* (2014); see also Editorial Bd., *The Hidden Cost of Trading Stocks*, N.Y. TIMES (June 22, 2014), <http://www.nytimes.com/2014/06/23/opinion/best-execution-and-rebates-for-brokers.html> [<http://perma.cc/5U2M-MM2E>].

been very active in a market for a while, liquidity suppliers begin to discount the meaning of large quotes at or away from the best quote in the market and decline to respond in the way that the manipulator hopes for. Even if this in fact is going on, we are not convinced that it is a good reason to give this quoting strategy a pass, however. An epidemic can be brought under control if enough people take precautions. But the epidemic still has caused problems in the interim, and, after it is vanquished, people will gradually stop taking precautions again and another epidemic will come along eventually. Moreover, the precautions themselves are costly. In the context of quote manipulation, the very discounting of the meaning of the large quotes is the extreme muddying of the signal that is coming from the at-or-away quotes that are in fact indications that informed trading is going on. This lessens the ability of liquidity suppliers to protect themselves against such trading and widens spreads.

[Social welfare analysis of Atlee's collection of \$4.00 in rebates to come]

V. Inside the Quote Manipulation

[Social welfare analysis of inside-the-quote manipulation to come]

VI. Market Opening Manipulation

[Social welfare analysis of market opening manipulation to come]

VII. Auto-Quote Manipulation

Here is a sketch of the social welfare analysis of auto-quote manipulation. Internalizers offer execution inside the spread and pay brokers payment for order flow because retail orders are largely uninformed and so involve little or no adverse selection risk. To the extent that the brokerage business is competitive, this payment for order flow gets passed on to retail investors in the form of services for commissions at below cost. In fact, we see that many brokers today charge retail customers no commission at all.

The existence of the internalization business thus reduces trading costs for retail investors which has all the advantages for them of improved liquidity. At the same time, however, it widens spreads on the exchanges because there are few uninformed investors trading there. These wider spreads make fundamental value informed trading more expensive and thus mean that prices are less accurate in ways that negatively affect the real economy.

It is not clear, though, that the increased liquidity for retail investors is worth the decrease in share price accuracy in ways that are helpful to the functioning of the real economy.

Auto-quote manipulation increases the cost of the internalization business. As part of their effort to control their costs of doing business, internalizers will make efforts to weed out auto-execution manipulators and stop dealing with brokers who do not help them in this regard. However, given the lack of clarity about the effect of internalization on the tradeoff between retail liquidity and price accuracy, is there any reason to add legal regulation into this mix?

VIII. The Law of Manipulation

[Description and assessment of current state of the law with respect to quote manipulation to come]