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TAXING FICTIVE ORDERS: HOW AN INFORMATION-FORCING TAX CAN REDUCE MANIPULATION AND DISTORTION IN FINANCIAL PRODUCT MARKETS

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Electronic exchange "order books" reflect ready supply and demand for financial products. This article proposes that order book information is a public good and should be protected as such with an automated Pigovian tax.

Traditional prohibitions on market manipulation do not reach conduct that distorts order book information without intent to exploit the distortion. As a result, anti-manipulation authorities do not deter trading activity that generates market distortion as an incident to trading activity rather than as an end goal. The great majority of orders entered on contemporary electronic markets are cancelled before being executed. The prevalence of order cancellations makes order book information less reliable. The Dodd–Frank Act has prohibited "spoofing," or placing an order with intent to cancel it. The post-Dodd–Frank regime, however, is grossly inadequate. Punishing only intentional order cancellations is both under- and over-inclusive. Unintended order cancellations are not simply likely, but represent the great majority of orders in status quo market dynamics. Unpremeditated order cancellations can pollute the price signal no less than premeditated cancellations. On the over-inclusive side, consistent rates of bid and offer cancellations should not significantly distort prices and thus should not be punished even when planned. Furthermore, the current pre-requisite of intent results in regressive enforcement, high enforcement costs, and gross underenforcement. Finally, the regime (and the literature) neglect the costs of artificial silence and focus only on the excesses of noise. Nothing is being done to deter artificial dearths of orders.

The Pigovian tax approach proposed by this article addresses these shortfalls. The proposed approach also steers clear of typical concerns with financial transaction taxes through focusing on cancelled *rather than* executed *orders. Regulators have been concerned with their lack*

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of authority to police trading that generates high volumes of cancelled orders. This article explains why such authority is justified, as well as how current anti-manipulation regimes can be buttressed.

I. INTRODUCTION

"[The] authority of the majority is partly based upon the notion that there is more intelligence and wisdom in a number of men united than in a single individual, and that the number of the legislators is more important than their quality."

– Alexis De Tocqueville,
Democracy in America[1]

Modesty has long been both virtue and vice. Humans are fallible and have limited information. Deference and emulation temper our biases, allow us to share rich cultural and intellectual inventories. But deference and emulation have also led common sense and moral intuition to cede to foolishness and barbarism if well enough entrenched. The dynamics of excessive deference are on display daily in our financial markets.

Financial markets support mutually beneficial exchange, enabling capital formation, savings, and risk transfer. In addition to their private uses, financial markets also produce prices, an important public good. Financial product prices aggregate otherwise diffused and mute beliefs. Over the long run, the value of a financial product corresponds to the expected cash flows due to the holder of the product. Many products, however, have long durations or complex terms. Traders each have their own vantage from which they forecast a product's performance, so beliefs as to future cash flows can and do differ. Market participants know they are acting on limited information, and that others are too. This leads to a simultaneously mature and highly insecure mental predisposition. A price represents more than any one trader knows, a reality that rewards intellectual modesty. But diffidence has its costs, and traders self-consciously acting on incomplete information are susceptible to manipulation as well as over-reaction.

In the morning of May 6, 2010, the profound insecurity governing financial markets was on display as traders reacted to large sell-orders on S&P futures by reducing demand at all-but-the-lowest of prices.[2]

1. 1 ALEXIS DE TOCQUEVILLE, DEMOCRACY IN AMERICA 299 (Henry Reeve trans., Longman, Green, Longman & Roberts 1862).

2. JOINT CFTC-SEC ADVISORY COMMITTEE ON EMERGING REGULATORY ISSUES, RECOMMENDATIONS REGARDING REGULATORY RESPONSES TO THE MARKET EVENTS OF MAY 6, 2010, at 2 (Feb. 18, 2011) ("In the present environment, where high frequency and algorithmic trading

The herding resulted in a loss of approximately one trillion dollars from U.S. equity markets over the course of just a few hours.[3] This market event evolved from the independent conduct of thousands of traders and has become known as the "Flash Crash."[4] The U.S. government has alleged that a significant portion of the sell-orders that started the stampede are attributable to Navinder Singh Sarao, a young man living with his parents in an immigrant suburb of London.[5] The complaint alleges that the large sell orders were placed in a manner that guaranteed they would not be executed against and were designed to allow him to profit from purchasing S&P contracts at reduced prices.[6] Charges that a youth working an ocean away and without any serious financial or technological sophistication drastically impacted the world's deepest financial market reflect the remarkable democratization of financial access wrought by technology, as well as the attendant risks.[7]

The prices of financial products are important indicators that inform a variety of economic activity. As unpacked by this article, price information comes from two interrelated sources: the order book and the ticker tape. Order books collect orders from traders to buy or sell a financial product in an amount and at a price specified in the order. In the olden days, order books were paper notepads where exchange employees wrote down orders, manually matching traders that wanted to sell with traders that wanted to buy. Nowadays, transactions take place through electronic order books that automatically match digital orders to sell with digital orders to buy. Order books collect the demand and supply for financial products, providing the number of units "the market" (i.e., traders participating in the marketplace) would sell at increasingly higher prices and the number of units the market would buy

predominate and where exchange competition has essentially eliminated rule-based market maker obligations, liquidity problems are an inherent difficulty that must be addressed. Indeed, even in the absence of extraordinary market events, limit order books can quickly empty and prices can crash simply due to the speed and numbers of orders flowing into the market and due to the ability to instantly cancel orders.").

3. Matt Levine, *Guy Trading at Home Caused the Flash Crash*, BLOOMBERGVIEW (Apr. 21, 2015), https://www.bloomberg.com/view/articles/2015-04-21/guy-trading-at-home-caused-the-flash-crash.

4. *See* Matt Egan, *Flash Crash: Could It Happen Again?*, CNN (May 6, 2014, 3:58 PM), money.cnn.com/2014/05/06/investing/flash-crash-anniversary/.

5. Criminal Complaint, United States v. Sarao, No. 15-CR-00075 (N.D. Ill. Feb. 11, 2015); Kim Hjelmgaard & Jane Onyanga-Omara, *Alleged 'Flash Crash' Trader Lived an Unflashy Life*, USATODAY (Apr. 22, 2015), http://www.usatoday.com/story/money/business/2015/04/22/navinder-singh-sarao-british-flash-crash-trader/26174581/.

6. Criminal Complaint, *supra* note 5, ¶ 21.

7. The Department of Justice's causal theory linking Mr. Sarao's activities to the flash crash is in dispute. *See*, *e.g.*, Eric M. Aldrich, Joseph Grundfest & Gregory Laughlin, The Flash Crash: A New Deconstruction 6 (Sept. 22, 2016) (unpublished manuscript) (available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2721922).

as prices decrease. In addition to price data on current supply and demand in the order book, there is price data on executed transactions. Like the presentation of order book data, the presentation of executed transaction data has evolved with technology. Originally transmitted by telegraph and printed on a thin strip of paper, executed transaction data is today presented as pixels on screens but is still referred to as "ticker tape" data after the sound the telegraph made. Of course, the order book and ticker tape are as entwined as the present and the future—the prices at which traders are willing to buy or sell determine the prices at which transactions are executed; in turn, the prices at which transactions have been executed inform the prices at which traders are willing to buy and sell.

The ability to freely place orders and then cancel them combined with automated trading technology allows significant disinformation to enter the market. While manual cancellations were generally free, they took trader time both to process changes in economic and market conditions and to issue the instruction to cancel prior orders. Computerized processing of information allows analyses that took a day to take place in milliseconds. Orders can be sent and pulled back immediately as new data comes in.[8] This contributes to the fragility and volatility of order book information. As buy (or sell) orders arrive in large volumes, greater demand (or supply) is broadcast to the market and deferential algorithms immediately follow suit by withdrawing sell (or buy) orders. Similarly, as buy (or sell) orders are cancelled in large volumes, computerized traders react by withdrawing their buy (or sell) orders. Since 2012, the ratio of fulfilled orders to cancelled orders on U.S. securities exchanges regulated by the Securities and Exchange Commission (SEC) generally fluctuated between 1 to 14 and 1 to 30.[9] Order cancellation rates on futures markets regulated by the Commodity Futures Trading Commission (CFTC) have been lower but still cover the vast majority of all orders entered.[10] Supply and demand reflected in the order books of securities and derivatives exchanges[11] is predominantly

8. The algorithms directing trading activity take into account only predefined data feeds. Thus, reactions to developments are necessarily based on a reductive view of the conditions in the relevant market, industry, asset class, or general economy. Sharp changes in order-book information cannot be easily ignored because they may correspond to unobserved changes in broader conditions.

9. *Trade to Order Volume Ratios*, U.S. SEC. & EXCHANGE COMMISSION (Oct. 9, 2013), https://www.sec.gov/marketstructure/research/highlight-2013-01.html (Oct. 9, 2013).

10. Scott Patterson, *CFTC Targets Rapid Trades*, WALL ST. J. (Mar. 15, 2012, 9:01 PM), http://www.wsj.com/articles/SB10001424052702303863404577283850694110794 ("An estimated 80 to 90 orders are put into futures markets for every trade that actually happens . . . .").

11. The discussion in this article generally applies to many-to-many electronic markets for financial products where transactions are entered into anonymously through matching of publicly disclosed orders. Although the term "exchange" is used, the intuitions are equally applicable to platforms regulated other than as exchanges. In other words, the term exchange is not intended to refer

fictive.

Significant fluctuations in order volumes can serve strategies to move prices in ways favorable to the trader entering and cancelling orders. Such practices are forms of market manipulation and have been illegal for decades.[12] The Dodd–Frank Act passed in 2010 has further prohibited placing an order with intent to cancel it, or "spoofing," expanding the regulatory toolkit for addressing intentionally distortive activities.[13] As explored herein, these tools are unwieldy in the typical context of sophisticated, algorithmic trading, particularly where it has an international component. Furthermore, these tools do not reach trading algorithms that in effect, but unintentionally, create misleading order flow.

Orders that are cancelled, or "fictive orders," impair the public good produced through transparent financial markets.[14] This is true both where order cancellation is premeditated and when it occurs in response to market developments. First, fictive orders affect expectations as to the price at which a transaction could be entered into through misrepresenting market depth and market direction. In this manner, fictive orders tarnish the informational value of prices *ex ante*. Second, fictive orders affect trading decisions and may—as in the case of manipulation—distort the price at which transactions are entered into. In other words, fictive orders also tarnish the informational value of prices *ex post*. This article's contribution is in identifying the public-good nature of order information, understanding how the current set of protections falls short in protecting the public good, and proposing a regulatory intervention that takes the public-good nature of order information seriously while also improving on the current regimes policing price-distortive activity.

Like other commercial activity that detracts from a public good, the cancellation of orders represents pollution. The pollution analogy is apt on two dimensions. First, like pollution, fictive orders interfere with use of a shared resource, namely price information. Second, fictive orders, like pollution, may be a byproduct of valuable commercial activity. Absent environmental regulations, a coal plant may belch CO_2 not

solely to entities regulated by the Securities and Exchange Commission as "exchanges." *See* Regulation of Exchanges and Alternative Trading Systems, Exchange Act Release No. 34-39884 (Apr. 17, 1998).

12. *See* cases cited *infra* note 60.

13. Dodd–Frank Wall Street Reform and Consumer Protection Act § 747, 7 U.S.C. § 6c(a)(5) (2012); *see also* discussion *infra* Section II.A.

14. Information that improves decision-making is a classic example of a public good. Francis M. Bator, *The Anatomy of Market Failure*, 72 Q. J. ECON. 351, 369 (1958) ("The defining quality of a pure public good is that 'each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good. . . .'"); *see* Paul A. Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. STAT. 387 (1954).

because it seeks to achieve global warming but because it is in competition with other market participants that do not expend the additional costs to build cleaner smoke stacks. In keeping with strategies to reduce pollution in other contexts, this article proposes a Pigovian tax on the pollution from cancelled orders.[15] The tax would be imposed on asymmetric order cancellation that leads to exaggerated supply or demand, and would impose higher costs on those that cancel orders in higher quantities in shorter periods of time. In other words, the impact of the tax would fall on those behaviors that are most likely to destabilize pricing. Revenue obtained from the tax can subsidize executed transactions, so as to counteract adverse effects on liquidity that may otherwise follow the tax. Furthermore, the re-distribution can be designed to mitigate a second, heretofore unregulated risk to price discovery: market participants' forbearance from order entry. Just as an excess of orders over actual supply-and-demand fundamentals can distort prices, an artificial dearth can also result in mis-information.

The rest of this paper proceeds in three parts. Part I provides an introduction to financial markets, explains how orders relate to prices, and identifies why prices serve as public goods. Part II explains the inadequacy of current regulatory approaches to maintaining price integrity, and in particular, the ill fit between scienter-based liability standards under anti-manipulation prohibitions and the anonymous, electronic trading environment in which orders are placed today. Part II also introduces the tax on fictive orders. Part III considers alternative strategies for deploying the tax on fictive orders. In assessing the tax, Part III shows how this proposal improves on prior financial transaction tax proposals. Prior proposals would tax all orders or all executed transactions; in contrast, a tax falling solely on cancelled orders carries limited adverse consequences for actual users of financial products.

II. HOW MARKETS FORM PRICES AND PROVIDE LIQUIDITY

Markets come in two varieties. There are one-to-many markets, where a single buyer or a single seller transacts with multiple counterparts. And there are many-to-many markets, where a variety of buyers and sellers come together to trade in parallel. The former model is instantiated in the local pharmacy, flower shop, or hardware store. The latter model is especially prominent in the new economy as digital technology and the Internet enable online markets where unrelated sellers can offer their products or services and unrelated buyers can bid

15. See Dennis W. Carlton & Glenn C. Loury, *The Limitation of Pigouvian Taxes as a Long-Run Remedy for Externalities: An Extension of Results*, 101 Q. J. ECON. 631 (1986) for a brief analysis of the Pigovian tax.

on them, with Uber, Airbnb, Etsy, and countless other platforms serving as examples. However, the many-to-many model has a rich tradition with commercial meeting places such as bazaars dating back millennia.

In the financial context, exchanges and other platforms create many-to-many markets, aggregating the supply and demand for financial products and routinizing the execution of transactions between counterparties that have matching interests.[16] In today's digital environment, many financial products such as equities and futures trade predominantly on electronic platforms and the execution of other financial products such as swaps is migrating to electronic platforms.[17] Dealers[18] are market participants that make a business of buying at the lowest price at which a product is offered and selling at the highest price at which the product is bid on, a practice known as "taking the spread."[19] As discussed below, this practice helps exchanges attract customers by creating opportunities for them to transact.

A. How Order Books Aggregate Supply and Demand

Supply or demand on a platform is expressed through an "order."[20] Orders to buy are referred to as "bids" and orders to sell are referred to as "offers." At the minimum, an order identifies the financial product desired to be bought or sold and the quantity of the financial product. Orders come in several varieties, most important of which are market orders and limit orders. A market order does not communicate a price and represents a bid (offer) to buy (sell) at the lowest (highest) price available at the time the order is placed. A limit order, in addition to identifying the product and quantity, defines the price at which it should be executed. As a result, limit orders may not be executed immediately when they are entered and, instead, are stored by the platform. Many

16. Dealers acting on exchanges make a business of entering buy and sell orders and profiting from the spread in prices between the lowest priced order to sell and the highest priced order to buy. This article refers to market participants that make a business from buying and selling financial products as "dealers," although the terms "market-maker" and "liquidity provider" are also commonly used. These terms have defined meanings under statutes, regulations, and exchange rules governing financial markets, but these legal definitions are not intended to be used throughout the article. *See, e.g.*, Securities Exchange Act of 1934 § 3(a)(5), 15 U.S.C. 78c(a)(5) (2012) (defining dealers in securities).

17. 7 U.S.C. § 2(h)(8) (2012); *see* Process for a Designated Contract Market or Swap Execution Facility to Make a Swap Available to Trade, Swap Transaction Compliance and Implementation Schedule, and Trade Execution Requirement Under the Commodity Exchange Act, 78 Fed. Reg. 33,606, 33,606 (June 4, 2013) (codified at 17 C.F.R. pts. 37, 38).

18. These market participants are alternately referred to as dealers, market makers, or liquidity providers, and these terms are used interchangeably throughout the article.

19. This is no different from dealers—such as used auto dealers—in non-financial markets, except that financial products are no worse for wear.

20. *See generally*, Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense*, 65 DUKE L.J. 191, 220 (2015).

platforms such as stock exchanges and futures markets publicize unexecuted limit orders, and in so doing inform market participants as to available demand and supply at different price points. This record of waiting orders is referred to as an "order book." The usefulness and protection of the informational content of order books is the topic of this article.

A hypothetical example of what an order book may look like for shares of Apple is shown in Table 1.

Price (in USD)	Bid Quantity	Offer Quantity
120.03	500,000	
120.04	250,000	
120.05	100,000	
120.06		50,000
120.07		200,000
120.08		600,000

Table 1: Order Book for Apples Shares

Table 1 shows that there is demand for 100,000 shares of Apple stock at the price of $120.05 per share, and that demand increases by 250,000 shares if the prices drops a penny, and by an additional 500,000 shares if the price falls another penny. Conversely, there is a supply of 50,000 shares at the price of $120.06 per share, and additional supply of 200,000 shares at a price one penny higher and 600,000 shares at a price that is two pennies higher. This order book reflects a fairly small spread between the price at which buyers would buy and sellers would sell.[21] The midpoint between the highest bid and lowest offer suggests that the market price of a share of Apple is approximately $120.055. The order book also reveals how many shares a seller could dispose of if she was willing to immediately accept a price within a few pennies of the market price, and similarly, how many shares a buyer could obtain if she was willing to immediately pay a price within a few pennies of the market price. Immediately is a key qualifier, because the contents of the order book may change as new orders are matched against contra-orders resting in the order book, additional limit orders are entered into the order book, or, of central importance to this article, resting orders are cancelled.

An automated order book generally matches bids and offers based on price, and then breaks ties based on the length of time that an order was

21. Penny sized increments between order book prices are used for illustration. Minimum permissible price increments between orders (called tick sizes) differ across stocks. *See* Joint Industry Plans; Order Approving the National Market System Plan to Implement a Tick Size Pilot Program, Exchange Act Release No. 34-74892 (May 6, 2015).

resting in the order book.[22] Thus, traders have incentives to place orders early. Being able to cancel orders enables a trader to place orders at prices far from the current market price so that her orders are executed before others' orders when prices move without also accepting the risk that she will be forced to enter into an undesirable transaction. These dynamics lead to large numbers of orders being entered with a "wait-and-see" attitude and then being cancelled when market prices evolve. Because it is costless to withdraw orders, the supply and demand information in order books is unreliable.

B. Price Information in Order Books Is a Public Good

Price information is a public good as it assists with a diverse set of economic decisions. Scholarship largely accepts that more accurate pricing of financial products contributes to social welfare, as discussed in more detail below.[23] The order book and the ticker tape are the two primary sources of price information on financial products. The former reports current supply and demand for a financial product, as discussed above. The latter provides price and volume data for already executed transactions.

Ticker tape data on executed transactions differs in several respects from that of order book data. Consummated transactions reflect a mutually costly exchange between market participants, and thus carry additional credibility. By its very nature, however, a consummated transaction reveals valuation decisions made by only two parties. Transaction data does not express the valuation opinions of other market participants. As a result, one foolish or desperate buyer or seller can skew the price reflected in transaction data. Furthermore, consummated transactions necessarily reflect prior as opposed to current circumstances and thus may be stale.

Even if price information for executed transactions did not suffer from the above deficiencies, it could not be decoupled from order book price information. The prices at which transactions are executed informs the prices at which orders are entered. In turn, the prices at which orders are entered informs the prices at which additional orders are entered and *determines* the prices at which transactions are executed. Because the prices at which market participants express a willingness to trade and the prices at which they do trade are codependent, order book

22. This is known as the first-in-first-out method of order matching, and some exchanges are moving away from it. Carol L. Clark, *Market Structure, Incentives, and Fragility*, CHI. FED LETTER (Fed. Reserve Bank of Chi.), Mar. 2014, at 3.

23. *See, e.g.*, Merritt B. Fox, Art Durnev, Randall Morck & Bernard Yeung, *Law, Share Price Accuracy and Economic Performance: The New Evidence*, 102 MICH. L. REV. 331, 339 (2003).

price information cannot be seen as a substitute for ticker tape price information. Rather, the integrity of the order book is reflected in the ticker tape.

Not all markets share data on executed transactions or their order books; however, those that do produce a valuable public good in so doing.[24] Finance scholars and practitioners price a financial product based on estimates of cash flows deliverable on the product.[25] These projections embedded in financial product prices inform a variety of economically significant decisions.[26] Price information helps those with financial positions, such as investors holding securities and derivatives counterparties, calculate the value of their portfolio.

Price information relating to securities assists a variety of decisions in the corporate context.[27] Accurate security prices reduce agency costs.[28] For example, share price performance helps investors and directors evaluate management, thus serving as a key input into corporate governance decisions. Mis-priced shares can lead to erroneous retention decisions, for example when a well (poorly) performing CEO is terminated (retained) because a company's share price is inaccurately depressed (inflated). Equity-based managerial compensation complements monitoring through aligning managerial interests with those of shareholders. Alignment, however, relies on share prices accurately reflecting the long-term health of the company; if management can dispose of its equity at a high price while the long-term prospects of the firm are dim, equity compensation may do little to ensure officers act in the best interests of shareholders. Securities prices also help management intelligently deploy internal resources. Through

24. *See* Patterson, *supra* note 10.

25. ZVI BODIE, ALEX KANE & ALAN J. MARCUS, INVESTMENTS 605-07 (McGraw-Hill Irwin, 7th Ed. 2008). These projections are necessarily fraught with error and may be biased or omit non-monetary benefits accorded to their holder, such as the consumption benefits of controlling a company afforded to the holder of a large enough block of shares.

26. Kevin Haeberle, *Stock Market Law and the Accuracy of Public Companies' Stock Prices*, 2015 COLUM. BUS. L. REV. 121 (2015).

27. BODIE ET AL., *supra* note 25, at 9 ("Investors in the stock market ultimately decide which companies will live and which will die. If a corporation seems to have good prospects of future profitability, investors will bid up its stock price. . . . If, on the other hand, a company's prospects seem poor, investors will bid down its stock price. . . . The process by which capital is allocated through the stock market sometimes seems wasteful. Some companies can be 'hot' for a short period of time, attract a large flow of investor capital, and then fail after only a few years. But that is an unavoidable aspect of economic progress. It is impossible to accurately predict which ventures will succeed and which will fail. But the stock market encourages allocation of capital to those firms that appear *at the time* to have the best prospects. Many smart, well-trained, and well-paid professionals analyze the prospects of firms whose shares trade on the stock market. Stock prices reflect their collective judgment.").

28. David I. Walker, *The Law and Economics of Executive Compensation: Theory and Evidence*, RESEARCH HANDBOOK ON THE ECONOMICS OF CORPORATE LAW (Claire A. Hill & Brett H. McDonnell eds., Elgar Publishers) (2012).

suggesting cash flows expected from operations in the status quo, security prices create a threshold for profitability that must be met by new projects or expansions of existing projects. Under-priced shares result in the issuer excessively expanding operations rather than returning earnings to shareholders. Over-priced shares result in businesses foregoing desirable projects. Security price information also enables a business to estimate its cost of capital. Bond yields and share prices express how much interest the issuer would have to pay or how much it would have to dilute its current shareholders to raise additional funds. Inaccurate prices may undermine financing efforts if the correction occurs during the financing or, if mis-pricing persists, lead to over- or under-allocation of capital to the firm.

Security price information also informs employees, vendors, and other constituents making firm-specific investments as to the health of the firm.[29] Inaccurate share prices may lead to inefficient transactions (or inefficiently-foregone transactions) between the issuer and its counterparties. For example, a prospective employee may turn down employment based on inaccurately-depressed share price out of concern that insolvency is near and she would soon have to retrain for a new employer. Or a vendor may invest in custom-built machine tools to supply parts to a firm based on the firm's inflated share prices only to have to scrap the tools when the firm enters liquidation.

Prices in derivatives markets similarly inform (and, if incorrect, misinform) significant business decisions. Derivatives allow parties to enter into positions based on operational or financial risks encountered in their business.[30] For example, derivatives may be used to take positions on interest rates, currency exchange rates, physical commodity prices (such as metal, energy and foodstuffs), or even the weather and population longevity.[31] Derivative prices inform firms as to the cost of hedging risks (for example, the costs to a soda producer of corn syrup inputs or fuel costs to an airline). Derivative prices also enable firms to value and manage their inventories, such as where credit default swap (CDS) prices are used by a bank to estimate default likelihood on a loan to a borrower referenced in the CDS.

In appreciating the usefulness of accurate price information to a variety of economic decisions, it is important not to forget limitations on

29. Urska Velikonja, *The Cost of Securities Fraud*, 54 WM. & MARY L. REV. 1887, 1911 (2013).

30. Derivatives—like other financial instruments—may be used for socially adverse ends. *See* Henry T.C. Hu & Bernard Black, *Hedge Funds, Insiders, and the Decoupling of Economic and Voting Ownership: Empty Voting and Hidden (Morphable) Ownership*, 13 J. CORP. FIN. 343 (2007).

31. *See* Corn Prods. Ref. Co. v. Comm'r, 350 U.S. 46 (1955) (discussing role of hedging through corn futures contracts in the business of a corn product manufacturer, and in particular, why the liquidation of corn future contracts is subject to taxation as ordinary income).

the accuracy of prices. Financial theory does not assert that prices accurately express future cash flows from financial products; rather, financial theory supports that, in markets with low transaction costs, prices reflect available information regarding future cash flows.[32] Some of the mechanics through which prices adjust to new information are discussed below, and as will be apparent in that discussion, the costs of transacting figure prominently into the responsiveness of prices to new information. Yet however incomplete prices may be in reflecting cash flows due on an instrument, they serve as a valuable source of information.

Order book price information is interdependent with ticker tape price information, as discussed above. Thus, all price information relies on order book integrity. In addition, the order book provides price information that is not found on the ticker tape—in particular, current supply and demand curves for a financial product. Protecting the accuracy of order book price information as discussed in this article helps assure both the accuracy of the ticker tape and the reliability of the unique price information found in the order book. Protecting price information is justified because it represents a public good. However, as discussed next, there may be costs to preserving the accuracy of price information. These costs are discussed, and then the next part turns to the current regime for protecting price information.

C. Financial Market Quality is a Function of Price Accuracy and Liquidity

Price discovery refers to the process through which prices adjust to reflect new information available to one or more market participants.[33] For example, an industry analyst may identify that a competitor has filed a patent for a disruptive technology that will obsolesce an issuer's product. That analyst may model resulting decreases in issuer revenues and, on the basis of those decreases, calculate a discount to the issuer's currently anticipated cash flows. The analyst may then sell the issuer's stock short at a price below that prevailing in the market.[34] That short

32. Ronald J. Gilson & Reinier Kraakman, *Market Efficiency After the Financial Crisis: It's Still a Matter of Information Costs*, 100 VA. L. REV. 313, 317–18 (2014).

33. Robert J. Jackson, Jr., Wei Jiang & Joshua Mitts, *How Quickly Do Markets Learn? Private Information Dissemination in a Natural Experiment* 2–3 (Columbia Bus. Sch., Research Paper No. 15-6, 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2544128 ("[T]he theoretical literature . . . has developed a thorough framework for how securities prices incorporate private information through the work of informed traders. . . .").

34. A short sale is a sale of an asset that is not held in inventory, which is made with the expectation of purchasing that asset at a later time. Short sales are made by traders expecting prices to decline, so that the sold asset can be repurchased at a lower price. To deliver the asset at the time of the

sale will reduce share price through two vectors. First, it will simply reduce demand at the highest price point(s) from the market. For example, in the Apple illustration above, if the analyst sold 100,000 shares at $120.05, the highest bid remaining in the market would be for $120.04. Second, transactions disclose information to the market. A large sale of securities tells the market that either the seller needs cash or that the seller believes the securities will lose value.[35] Which of those two causes leads to a sale is unknown. However, there is some non-zero likelihood of each motivation, so the buyer would downwardly adjust its expectations in response to the transaction. Scholars believe and empirical evidence supports that market prices impound private information revealed through changes in supply or demand for financial products.[36] Accordingly, the result of the informed short sale would be to reduce the demand for the issuer's stock. This reduction represents order-book-price data learning from the analyst, albeit understanding only that prices are expected to decline and not why they would.

Rules designed to benefit price discovery can impede liquidity, and vice versa. The process of price discovery produces winners and losers. Informed traders profit at the expense of the less informed traders. In addition to redistributing wealth, this process may have regressive consequences to the extent that uninformed traders tend to be pension funds, mutual funds and other stores of savings for retail investors. The reward of informed traders at the expense of uninformed traders may also drive the latter from participating in the market. Departure of potential counterparties can impair market function through downgrading a platform from many-to-many to some-to-some.[37]

Uninformed investors that place non-marketable[38] limit orders benefit the market through providing "liquidity."[39] Liquidity refers to the costs

short sale, the seller generally has to borrow it from another party (and then on purchasing the asset from the market, "return" the purchased asset to the borrower).

35. Disposing of securities raises cash. That cash may then be used to make other investments, (e.g., to diversify the investment portfolio) or the cash may be used for non-investment purposes. Note that diversification can occur through purchasing under-represented investments in addition to selling over-represented investments.

36. *See* Merritt B. Fox, Lawrence R. Glosten & Gabriel V. Rauterberg, *The New Stock Market: Sense and Nonsense*, 65 DUKE L.J. 191, 220 (2015) ("With a sufficient number of trades, the market price will come to reflect private information."); John D. Montgomery, *Spoofing, Market Manipulation and the Limit-Order Book*, NAVIGANT 1 (May 3, 2016), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2780579.

37. *See generally* George Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q. J. ECON. 488 (1970).

38. Non-marketable limit orders refer to those limit orders that are not immediately executed against other limit orders waiting in the order book.

39. Informed investors may also place limit orders that increase liquidity, but as they generally have a sense of the direction in which the market is moving, informed traders generally place marketable buy orders (if they expect prices to increase) or sell orders (if they expect prices to decrease).

of executing a transaction within a market, and thus largely depends on the availability of counterparties willing to trade. If the midpoint between the lowest offer and the highest bid represents an approximation of the market price, the difference between the midpoint and the lowest offer represents a premium that a buyer would have to pay over the market price to obtain the desired instrument; and similarly, the difference between the midpoint and the highest bid represents the discount that a seller would have to accept to dispose of the instrument. Of course, depending on the size of the order, the quantity at the lowest offer or highest bid may be insufficient to satisfy the full order; as a result, more complex measures of liquidity exist for characterizing the ease of transacting through a particular market.[40]

Exchanges seek to have fulsome order books to attract customers. After all, who would go to a bazaar where no goods were changing hands? A variety of traders supply limit orders.[41] To fill their order books, some exchanges offer bounties to traders placing limit orders that are subsequently executed against.[42] Although exchange rules vary, these bounties are usually reserved for dealers that meet minimum order volume requirements.[43] Because limit orders at the same price are executed based on how long they have been exposed to the market through the order book, traders have incentives to place limit orders early and then potentially cancel as market conditions evolve. The bounty paid to liquidity providers is offset by a premium charged to those placing marketable orders that execute against resting orders (i.e., liquidity providers are subsidized, whereas liquidity takers are charged).[44] A second source of revenues to liquidity providers is the "spread," or the difference in price between how much they pay to take an instrument into inventory and how much they receive on disposing of an instrument. In the Apple stock example above, if a liquidity provider was buying at $120.05 per share and selling at $120.06 per share, the

40. Michael J. Fleming, *Measuring Treasury Market Liquidity*, ECON. POL'Y REV., Sept. 2003 at 83.

41. Market participants alternately known as dealers, market makers, or liquidity providers make a business of entering limit orders on exchanges and profiting from the spread. *See supra* note 16. However, retail traders and institutions investing on their behalf can and do also engage in placing limit orders. As a clarifying note responding to some early readers, exchanges themselves do not place orders; rather, they design the environment for attracting liquidity and maintaining price integrity. Exchanges administer the mechanics of order entry, matching, and execution, and, subject to regulatory requirements, police trading conduct and support market integrity. Exchanges may also supply ancillary services, such as data feeds based on orders and executions.

42. *NYSE Trading Information*, NYSE, https://www.nyse.com/markets/nyse/trading-info#trading-fees (last visited Aug. 28, 2016).

43. *See, e.g.*, *Membership*, EURONEXT, https://www.euronext.com/nl/membership/liquidity-providers-and-market-makers (last visited Nov. 6, 2016).

44. *NYSE Trading Information*, *supra* note 42.

liquidity provider would earn a penny on each pair of offsetting transactions.

To the extent liquidity providers are not themselves informed, they are susceptible to losses when transacting with informed traders. While market prices stay constant, a liquidity provider can continue to earn revenues from the spread. However, if market prices deteriorate, a liquidity provider's inventory will devalue (or, conversely where inventory is negative, a short position[45] will become more expensive to cover as market prices rise). To stay in business, liquidity providers must obtain enough revenue to offset inventory losses from market movements.[46] To compensate for expected losses, scholars have posited that liquidity providers increase the spread between their bids and offers in the presence of informed traders.[47] In particular, a liquidity provider's standing offer reflects the provider's expectation that the matching bid may be from a trader with information suggesting that prices are going up; and reciprocally, the liquidity provider's standing bid reflects expectations that the matching offer may be from a trader with information suggesting prices are going to decline.[48] Empirical evidence supports these suppositions, showing that liquidity providers decrease their bids in response to excess supply and increase their offers in response to excess demand.[49]

The availability of liquidity determines whether parties can enter into transactions, which in turn can serve important social goals. The costs of selling a security inform how much a purchaser would pay for it in the first place, and thus reduce how much capital investors would contribute to the issuer in exchange for the security. This reduction is known as the illiquidity discount. The illiquidity discount links the health of primary markets, where issuers obtain capital to finance operations in exchange for claims on their assets, to the health of secondary markets, where the securities are subsequently traded. Liquidity also impacts capacity to save. The costs attendant on purchasing a security determine how easy it is to convert cash into

45. *See supra* note 34.

46. Unbiased fluctuations in market price are as likely to profit as harm the liquidity provider. As a result, liquidity providers are less concerned with volatility than directional movements in market price.

47. *See* Lawrence R. Glosten & Lawrence E. Harris, *Estimating the Components of the Bid/Ask Spread*, 21 J. FIN. ECON. 123 (1988); Kalok Chan, Y. Peter Chung & Herb Johnson, *The Intraday Behavior of Bid-Ask Spreads for NYSE Stocks and CBOE Options*, 30 J. FIN. & QUANTITATIVE ANALYSIS 329 (1995).

48. Lawrence R. Glosten & Lawrence E. Harris, *Estimating the Components of the Bid/Ask Spread*, 21 J. FIN. ECON. 123 (1988); Kalok Chan, Y. Peter Chung & Herb Johnson, *The Intraday Behavior of Bid-Ask Spreads for NYSE Stocks and CBOE Options*, 30 J. FIN. & QUANTITATIVE ANALYSIS 329 (1995).

49. *Id.*

income earning investments. The higher the transaction costs of saving, the less consumption will be deferred to the future. Higher transaction costs can impoverish the elderly and reduce the transmission of wealth across generations. The costs of security transactions also inform how expensive it is to diversify an investment portfolio. Absent diversification, investors are exposed to risk without concomitant reward. Because individuals are risk averse and need steady cash flows to support their standard of living, uncompensated variation in returns is undesirable.

Illiquidity also has adverse consequence in derivatives markets. Many companies use derivatives to hedge risk.[50] Risk may derive from the fluctuation in prices of inputs such as metals, energy, and agricultural products; or risk may derive from volatility of financial variables such as interest rates on outstanding debt or currency exchange rates at which international revenues are repatriated. In either case, derivatives may be used to reduce exposure to fluctuation such as through purchasing futures on inputs or entering into swaps on interest and currency exchange rates. Reducing liquidity in derivatives markets has the effect of making these risk management transactions more expensive and thus increasing the uncertainty that businesses and individuals contend with.

As already noted above, and will be revisited throughout this paper, a tension exists between the accuracy of a market's prices and the market's liquidity. Market policies must frequently negotiate tradeoffs between, on the one hand, the benefits of price discovery, and on the other hand, the benefits of liquidity. Insufficient liquidity or insufficient price discovery can have negative externalities, and thus any regulations affecting either should be carefully designed to balance the competing public interests. This balance is considered in the next two parts as the current regime protecting order-book information and the proposed improvement on it are discussed.

III. REMEDIES TO FICTIVE TRADING

Order cancellations may impose two types of harms. The first, where the cancellation exploits other market participants to the advantage of the trader placing and cancelling orders, is effectively a form of theft. The second, which can occur irrespective of whether the cancellation is premeditated, is a form of pollution. In designing a regulatory response to these two forms of harm, what relevance should the trader's mental

50. Henk Berkman & Michael E. Bradbury, *Empirical Evidence on the Corporate Use of Derivatives*, 25 FIN. MGMT. 5 (1996).

state have?

Professor Raskolnikov explores the significance of intent as a predicate to liability, creating a useful frame to parse the two distinct harms that order cancellation may cause.[51] Private, nonconsensual transfers are "irredeemably inefficient acts."[52] Although the transfer itself may be neutral from a purely utilitarian standpoint—as *ex ante* neither party is likelier to receive greater utility from the transferred resource—social resources will be wasted in contending over the transfer. The transferor will invest in accomplishing the transfer and the transferee will invest in resisting it. Unintentional acts with distributive consequences do not result in the same dissipation through effectuation and defense. For this reason, an economist would argue, we do not punish the person accidentally taking another's umbrella from a pile at the entrance of a restaurant, but do punish the person that steals an umbrella from a briefcase. Manipulation through fictive orders is an example of coercive transfer, where one party expends efforts to distort prices while other market participants expend efforts not to be exploited through manipulation.[53] As discussed in more detail below, prohibitions on manipulation have been in place to deter this conduct; however, they are of limited effectiveness due to the difficulties of showing requisite mens rea.

Even if a trader does not intend to distort prices through entering and cancelling orders, distortion can be harmful. The cancellation of orders can impose harm even where it does not lead to a coerced transfer.[54] As introduced above, the order book should be seen as a public good. Demand and supply curves exhibited in the order book help inform decisions.[55] The impairment of order book information results in social harm irrespective of whether the impairment is intentional. Contemporary financial regulation fails to recognize this second type of harm from fictive orders.

Securities and derivatives laws attach liability to price-distorting conduct such as order cancellations only in the presence of recklessness

51. Alex Raskolnikov, *Irredeemably Inefficient Acts: A Threat to Markets, Firms, and the Fisc*, 102 GEO. L.J. 1133 (2014).

52. *Id.* at 1135.

53. Either an information cost story or a behavioralist story, which I believe are synonymous but politically distinct narratives of the same phenomena, explain the observed market response to order imbalances. *See generally* Jon D. Hanson & Douglas A. Kysar, *Taking Behavioralism Seriously: The Problem of Market Manipulation*, 74 N.Y.U. L. REV. 630 (1999).

54. Regulators have raised concerns that electronic traders do not internalize the harm done by their fictive orders. JOINT CFTC-SEC ADVISORY COMMITTEE, *supra* note 2, at 11–12.

55. Order book price information also helps determine the prices at which transactions are executed, affecting the second source of price information—the ticker tape.

or more culpable scienter.[56] These scienter-based standards have been ineffective at protecting price integrity on securities and derivatives exchanges. As explained by Andrew Ceresney, Director of the SEC's Division of Enforcement, trading practices may "disrupt[] our markets or call[] into question the fair operation or integrity of our markets, whether [they consist of] fraudulent misconduct or unreasonable failures—which often can be as harmful as fraudulent conduct."[57] In the absence of regulatory response to cancellation dynamics, traditional principles of contract law allowing for withdrawal of an offer prior to acceptance do not adequately recognize the interests of third parties in price information.[58] This is particularly true given the absence of reputational means to discipline distortive cancellations due to the anonymous nature of electronic trading. This part develops on these observations, explaining why the current regime for addressing fictive trading is inadequate. The current regime only weakly deters manipulation and does not protect the order book from unintentional cancellations that pollute price information.

A. Prohibitions on Spoofing and Other Forms of Manipulation

The Dodd–Frank Act added section 4c(a) to the Commodity Exchange Act (CEA) to expressly prohibit "spoofing" when trading derivatives.[59] Spoofing is defined as entry of an order with *intent* to cancel it. Intent to manipulate prices through the cancellation is not required to violate the prohibition on spoofing. Although enforcement on account of spoofing has been extremely rare,[60] a number of

56. *See* discussion *infra* Section II.A.

57. Andrew Ceresney, Director, Divison of Enforcement, Market Structure Enforcement: Looking Back and Forward (Nov. 2, 2015), http://www.sec.gov/news/speech/ceresney-speech-sifma-ny-regional-seminar.html ("Errors in implementing policies and procedures can directly affect the market as a whole and cause significant harm.").

58. Regulations requiring controls over trading software can deter inadvertent order entry, but fail to internalize the costs to market participants where algorithms produce imbalanced order cancellation by design. Exchange Act Rule 15c3-5 requires a broker or dealer who accesses markets to have, document, and maintain a system of risk management controls and procedures that are reasonably designed to manage the risk of its market access. Two categories of risk are subject to management under the rule: (1) financial risk, such as that posed by erroneous orders or orders that exceed capital and credit limits; and (2) regulatory risk, such as the risk that pre-trade regulatory requirements will not be satisfied. 17 C.F.R. § 240.15c3-5 (2016). The rule is designed to reduce risks from increased trading automation and to help ensure that firms have mechanisms in place to minimize the impact purposeful as well as accidental damaging trading conduct.

59. Criminal Complaint, *supra* note 5, ¶ 51.

60. In addition to the case against Sarao, there have been two other criminal cases for spoofing: Waiver of Indictment, United States v. Milrud, No. 2:15-cr-00455 (D.N.J. Sept. 10, 2015) and Indictment, United States v. Coscia, No. 14-cr-00551 (N.D. Ill. Oct. 1, 2014). As of January 1, 2016, of the three, only the case against Michael Coscia has proceeded through trial, which ended in a guilty verdict on all counts (including the first guilty verdict for criminal violation of the CEA's anti-spoofing

exchanges have regularly experienced daily cancellation to trade ratios exceeding 1 to 10.[61] In other words, the average trader should expect with 90% likelihood that she cancels any order she places. Of course, there is heterogeneity across traders and not all times of the day are equal. A look at trading data will show that some traders regularly cancel well over 90% of their orders. The distinction between intentionally canceling orders and knowing with 90% (or much higher) certainty that any order being placed will be cancelled and then placing hundreds if not thousands of them on an hourly basis is like the distinction between intentionally shooting a group of people and indiscriminately firing an automatic weapon into a crowd. The difference between the two scenarios is that the latter is (thankfully) extremely rare, while the former is the norm on many electronic exchanges. The scienter requirement is at best absurd when it is the sole dividing line between widely and persistently practiced conduct and prohibited conduct.[62]

Of the handful of cases that have thus far been brought for spoofing,

provision). Jury Verdict, United States v. Coscia, No. 14-cr-00551 (N.D. Ill. Nov. 3, 2015). In addition, there have been a handful of cases involving spoofing that were brought by the CFTC under the anti-spoofing or more general anti-manipulation provision, with the majority of them having been settled. CFTC v. Oystacher, No. 15-cv-9196, 2016 BL 273700 (N.D. Ill. Oct. 19, 2015); Complaint, CFTC v. Khara, No. 1:15-cv-03497 (S.D.N.Y. May 5, 2015); Complaint, CFTC v. Nav Sarao Futures Ltd. PLC, No. 1:15-cv-03398 (N.D. Ill. Apr. 17, 2015); *In re* Panther Energy Trading LLC, CFTC No. 13-26, 2013 WL 3817473 (July 22, 2013); Complaint, CFTC v. Moncada, No. 1:12-cv-8791 (S.D.N.Y. Dec. 4, 2012); *In re* Gelber Group, LLC, CFTC No. 13-15, 2013 WL 525839 (Feb. 8, 2013); *In re* Bunge Global Markets, Inc., CFTC No. 11-10, 2011 WL 1099346 (Mar. 22, 2011); *In re* UBS AG and UBS Sec. Japan Co., Ltd., CFTC No. 13-09, 2012 WL 6642376 (Dec. 19, 2012); *In re* RP Martin Holdings Ltd. and Martin Brokers (UK) Ltd., CFTC No. 14-16, 2014 WL 2003211 (May 15, 2014). The SEC has also brought cases for conduct involving intentional order cancellations, frequently against the broker–dealers through which the orders were placed on the theory of inadequate customer supervision. Briargate Trading, LLC, Securities Act Release No. 9959, Exchange Act Release No. 76104, 2015 WL 5868196 (Oct. 8, 2015); Complaint, SEC v. Milrud, No. 2:15-cv-00237 (D.N.J. Jan. 13, 2015); Wedbush Sec. Inc., Exchange Act Release No. 73652, 110 SEC Docket 1687, 2014 WL 6480278 (Nov. 20, 2014); Visionary Trading LLC, Exchange Act Release No. 71871, 108 SEC Docket 2594, 2014 WL 1338258 (Apr. 4, 2014); Biremis Corp., Exchange Act Release No. 68456, 105 SEC Docket 862, 2012 WL 6587520 (Dec. 18, 2012); Hold Brothers On-Line Inv. Servs., LLC, Exchange Act Release No. 67924, 104 SEC Docket 2686, 2012 WL 4359224 (Sept. 25, 2012); Pomper, SEC Lit. Release No. 17221 (Nov. 5, 2001), SEC Lit. Release No. 17479 (Apr. 19, 2002).

61. *Summary Metrics by Exchange*, U.S. SEC. AND EXCHANGE COMMISSION (last updated Feb. 2, 2017), https://www.sec.gov/opa/data/market-structure/marketstructuredata-by-exchange.html (follow "Market Activity Metrics by Exchange, 2012 Q1 - 2016 Q4 (zip, 1.5 mb)" hyperlink; then view "stock_cancel_to_trade".)

62. Although this language is strong, I believe it is defensible. The outcome here—order cancellation—represents the great majority of outcomes from the conduct in question—the placing of an order. Thus, many traders know that their regular placement of orders will result in the great majority being cancelled. This is unlike the example of a car manufacturer that knows some vehicles will fail because relatively few vehicles do fail, and where a failure occurs, product liability theory can lead to internalization of (some of the) costs. In contrast, the degradation of price information in the order book cannot be deterred through private suit (or public action).

the most famous is against a young man who lived with his parents in a modest house in an immigrant suburb near London, Navinder Singh Sarao.[63] Mr. Sarao is accused of extensive spoofing that lasted over 200 days and, most dramatically, contributing to the so called "Flash Crash" of May 6, 2010 when financial markets lost approximately $1 trillion (only to recover later that same day).[64] Mr. Sarao's manipulative strategy consisted of placing and then canceling large sell orders to project excess supply.[65] The fictive supply drove down prices, allowing Sarao to buy low and then, after canceling his fictive sell orders, sell high. In total, Sarao is alleged to have made over $40 million in trading.[66] Because he wrote e-mails saying as much, there is little doubt that Mr. Sarao intended to cancel the orders being placed on his behalf by software he customized. In general, cases alleging spoofing are thought to be difficult to win due to the technical nature of the conduct and lack of direct evidence on the mental state.[67] If enforcement authorities pursue spoofing cases solely where direct evidence of mental state is available, such as in Sarao's case, to the exclusion of cases where the pattern of conduct plainly shows that expansive order cancellation was consciously expected by the trader, the results will be regressive enforcement and gross under-enforcement.[68]

There is authority to punish distortive trading outside the prohibition on spoofing derivatives. Derivatives and securities laws both prohibit manipulative trading on exchanges under sections 6(c)(c) and 9(a)(2) of

63. Suzi Ring, John Detrixhe & Liam Vaughan, *The Alleged Flash-Trading Mastermind Lived With His Parents and Couldn't Drive*, BLOOMBERG BUSINESS (June 9, 2015, 12:01 AM), http://www.bloomberg.com/news/articles/2015-06-09/the-alleged-flash-trading-mastermind-lived-with-his-parents-and-couldn-t-drive.

64. Criminal Complaint, *supra* note 5.

65. *Id*. ¶ 14 ("By placing multiple large-volume orders . . . at different price points, Sarao created the false appearance of substantial supply in order to fraudulently induce other market participants to react to his deceptive market information. Sarao thus artificially depressed . . . prices. With the aid of an automated trading program, Sarao was able to all but eliminate his risk of unintentionally executing these orders by modifying and ultimately canceling them before execution. Meanwhile, he exploited his manipulation to reap large trading profits by executing other, real orders.").

66. *Id*. ¶ 39.

67. Jacob Gershman, *Spoofing Trial Gets Underway in Chicago*, WALL ST. J.: L. BLOG (Oct. 26, 2015, 10:51 AM), http://blogs.wsj.com/law/2015/10/26/spoofing-trial-gets-underway-in-chicago/.

68. Evidence of a trader's intent to cancel an order may be obtained from multiple sources. Besides e-mails and other records in which a trader may admit an intention to cancel orders, the government may look at the code directing trading activity. The logic according to which orders are placed and cancelled by the code will reflect whether some orders are placed in a manner designed to ensure they are not executed. Reviewing e-mails and similar evidence, however, poses lower costs to prosecutors than analyzing complex trading software. Law schools, business schools, investment banks, and other institutions inculcate us to avoid writing when discussing sensitive subjects. As a result, cheaply accessible evidence of intent is more likely to be left by traders from less privileged backgrounds.

the CEA and section 9 of the Exchange Act.[69] Violation of these sections also requires specific intent.[70] Proving manipulation in securities markets requires showing that a practice was "intended to mislead investors by artificially affecting market activity."[71] Actions for manipulation of derivatives markets require the following showing:

> [(1)] the accused ha[s] the ability to influence market prices; (2) that the accused specifically intended to create or effect a price or price trend that does not reflect legitimate forces of supply and demand; (3) that artificial prices existed; and (4) that the accused caused the artificial prices.[72]

The second prong of this standard will rarely be met by automatic trading systems, even where they frequently or almost always cancel the orders they place. That is because the cancellations may be characterized as reacting to market dynamics rather than intending to lead them. Such would be the case with market makers canceling their lowest offers as prices rise (or, reciprocally, canceling their highest bids as prices decline).

Furthermore, even where an automatic trading system was designed to cancel orders to exploit the resulting moves in prices, identifying such a trading system among the legion of other algorithms engaging in

69. The SEC has brought several actions against traders using fictive orders to manipulate prices. *See*, *e.g.*, In the Briargate Trading, LLC, Securities Act Release No. 9959, Exchange Act Release No. 76104, 2015 WL 5868196 (Oct. 8, 2015); SEC v. Milrud, No. 2:15-cv-00237 (D.N.J. Jan. 13, 2015); Visionary Trading LLC, Exchange Act Release No. 71871, 108 SEC Docket 2594, 2014 WL 1338258 (Apr. 4, 2014). These actions, however, involved traders who had specifically intended to create or affect a price or price trend that does not reflect legitimate forces of supply and demand. Additional actions for order cancellations in securities markets have been brought by the Financial Industry Regulatory Authority (FINRA) for violations of FINRA Rule 2010 (just and equitable principles of trade), Exchange Act § 15(c)(3), 15 U.S.C. 178o(c)(3) (2012) (market access deficiencies), and/or FINRA Rule 3110 (supervisory failures).

70. There are additional prohibitions under securities and derivatives law against fraud committed through material statements or omissions, where the fraud must be intentional or reckless. An argument may be made that fictitious quotes are in themselves material misstatements so that market manipulation may be punished on the basis of reckless conduct (rather than solely intent). However, even this argument would need to establish some level of scienter beyond negligence. Under the SEC and CFTC rules prohibiting fraudulent conduct, supporting "recklessness" requires a showing of "an extreme departure from the standard of ordinary care, . . . which presents a danger of misleading buyers or sellers that is either known to the defendant or is so obvious that the actor must have been aware of it." City of Phila. v. Fleming Cos., 264 F.3d 1245, 1258 (10th Cir. 2001). It is hard to see how this standard may ever be met where cancellations are over ten times more common than executed transactions in the market and there is no public data as to the distribution of cancellations by industry participants.

71. Santa Fe Indus. v. Green, 430 U.S. 462, 476 (1977).

72. Prohibition on the Employment, or Attempted Employment, of Manipulative and Deceptive Devises and Prohibition on Price Manipulation, 76 Fed. Reg. 41398, 41407 (July 14, 2011) (to be codified at 17 C.F.R. pt. 180) (emphasis added) (internal citation omitted).

substantial order cancellations would be difficult. Based solely on observing trading behavior, how can a regulator tell if an algorithm is designed to profit from issuing orders and then cancelling them or happens to profit from such behavior while pursuing other ends? A broad subpoena for traders' code, even if feasible to obtain, would yield an evidentiary record that would be extraordinarily expensive to review, analyze, and—where suspect designs were identified—translate for a neutral fact finder. In this system, we should expect that consistent manipulation takes place without prosecution—at least at a low level.

Sarao's case and other actions against manipulation highlight a separate challenge to addressing price distortive trading through traditional enforcement means.[73] U.S. authorities have been stymied by the international nature of distortive trading. Andrew Ceresney has observed this struggle:

> An additional complexity [in bringing anti-manipulation cases] is that this type of trading often originates overseas, from traders who access the U.S. markets through broker–dealers that act as market access providers. For example, the recent case against [a] Canadian man involved traders mostly based in China and Korea, and our case several years ago against Biremis Corporation and its co-owners involved four-to-five thousand traders in over thirty different countries.[74]

By taxing order cancellation, fictive order entry may be deterred without having to engage in complex jurisdictional negotiation. The non-trivial challenges of extradition and other cross-border processes add to the otherwise significant administrative costs of investigating and bringing enforcement actions against complex and technical activity.[75]

The ubiquity of order cancellations in today's financial markets poses a puzzle when contrasted to the few dozen enforcement cases that have been brought for spoofing and related conduct. Enforcement may be disproportionate for one of two reasons. Either the cancellations are benign and the lack of cases represents judicious use of enforcement discretion, or the cancellations are malign and enforcement is constrained by legal, political, resource-based, or other considerations.

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73. *See, e.g.*, Complaint, CFTC v. Khara, No. 1:15-cv-03497 (S.D.N.Y. May 5, 2015).

74. Ceresney, *supra* note 57.

75. *Id.* ("[O]ur market structure investigations are increasingly dominated by our need to understand the technology that forms the backbone of our markets. This includes the computer codes that direct those systems; and more and more, studying computer codes, and the data logs that show how the codes operate, are essential steps in our investigations. It is often the case that we simply cannot do a meaningful market structure investigation without analyzing extremely large sets of orders and trades.").

The former would be the case if order cancellation does not actually undermine price accuracy. Cancellations may be largely innocuous if they do not affect the balance of supply and demand reflected in the order book.[76] It is understood that the order book is an incomplete representation of overall supply and demand in the market. As noted above, orders may be cancelled. Furthermore, some supply and demand is not (immediately) expressed in orders, particularly when the supply and demand is conditional on events that have yet to occur. For purposes of accurate pricing, it is important only that there be a predictable relationship between the supply and demand expressed in the order book and the overall supply and demand outstanding in the market. Only activity that disrupts the relationship between observed supply and demand in the order book and actual supply and demand impairs the public good of order book price information. It is this activity that warrants regulation.

Supply and demand reflected in order books may be exaggerated as well as understated; trading conduct that has either effect may be distortive. In the absence of cancellations, order entry is costly and ultimately self-fulfilling—a bid order represents demand irrespective of whether the trader placing it intends to enter into a transaction unless that bid order can be cancelled. Cancellation, however, allows traders to costlessly distort market expectations through entering orders and canceling them prior to their execution.[77] Although any cancellation introduces noise into the estimate of supply and demand, cancellations are particularly pernicious when they disproportionately affect demand or supply. These cases implicate the balance of demand and supply in the market, rather than simply the volume. Greater distortion will occur if the entry and cancellation of a set of orders occurs in a shorter period. Tighter timelines between entry and cancellation expose the trader to a lower risk that the order will be matched. Faster cancellation is also likely to contribute to greater volatility and increase processing costs for other market participants.

Technology has enabled disruption through reducing the costs of high levels of order entry and cancellation, even by relatively insignificant market participants like Navinder Sarao.[78] Technology has also increased sensitivity to market trends through enabling trading to

76. Even in this case, however, unbiased cancellations increase the noise-to-signal ratio in order-book information.

77. Even without order cancellations, however, it is conceivable that the relationship between supply and demand reflected in the order book and actual supply and demand is disrupted through fluctuations in the speed with which actual supply and demand is expressed in orders.

78. Technology is a sufficient but not necessary predicate to distortive order cancellation. *See* Waiver of Indictment, United States v. Milrud, No. 2:15-cr-00455 (D.N.J. Sept. 10, 2015).

process and respond to market trends almost instantaneously.[79] Heightened sensitivity can lead to the converse of distortive order cancellation, namely excessive order forbearance. Algorithms guiding trading detect changes in market depth or direction reflected in order book information, and can respond through withdrawing order flow pending re-equilibration. Withdrawal itself creates a signal that may lead other algorithmic traders to withdraw and thus create an artificial dearth of orders that under-represents supply and demand. It was Sarao's exaggeration of supply as well as responsive reduction of demand by unrelated market participants that precipitated the artificial decline of prices in the morning of May 6, 2010. There is, however, a notable difference between the vulnerability of price information to order exaggeration and understatement. The former may be accomplished by a single trader. In contrast, because in typical circumstances no single trader represents a significant portion of order flow, a single trader's withdrawal from the market cannot, generally speaking, distort price information. However, the correlated withdrawal of traders in response to market events such as spoofing can and has led to distortionary under-statement of supply and demand.

Cancellations may be the byproduct of trading algorithms intended to reap profits through means other than market manipulation. Irrespective of the intent behind cancellations, fictive orders can distort price information and social welfare would be improved through forcing traders to internalize the cost of these distortions.[80] Statistically, it is highly unlikely that strategies relying on frequent order cancellations do not distort supply and demand levels *ex post* even if bids and offers are entered at the same rate and are equally likely to be cancelled *ex ante*. This phenomenon is explored in more detail below, but the intuition is simple. If we take a large number of coins and start flipping each of those coins, some coins will exhibit repeated streaks of heads or tails. In other words, although *ex ante* the coins are as likely to come up heads as they are to come up tails, in practice, some coins will exhibit more of one than the other. These coins are analogous to algorithmic trading that enters and cancels bids and offers with equal *ex ante* probability. Even in this ideally unbiased scenario, some algorithms will generate

79. Graham Partington, Richard Philip & Amy Kwan, *Is High Frequency Trading Beneficial to Market Quality?* (Ctr. for Int'l Fin. And Regulation, Paper No. 083/2015, 2015), http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2673873.

80. As recent incidents of inadvertent market disruption have shown, trading algorithms can distort prices and skew markets significantly even where they are not designed to profit through manipulation. Knight Capital Ams. LLC, Exchange Act Release No. 70694, 107 SEC Docket 2303, 2013 WL 5631976 (Oct. 16, 2013); Goldman, Sachs & Co., Exchange Act Release No. 75331, 2015 WL 3956011 (June 30, 2015).

more bids and some will generate more offers.[81] Although it is possible, it is not plausible that widespread trends in order cancellation do not adversely affect price discovery.

As discussed above, current regulation of distortive order entry is based on enforcement actions that must show mens rea. This approach is inadequate for addressing distortive activities that are a byproduct rather than the goal of trading activity. Not only is enforcement authority limited, but what enforcement authority there is may not be fully utilized.

There may be a second response to the puzzle of why so little enforcement occurs notwithstanding the ubiquity of order cancellations. Even if cancellations do distort prices, there may be respectable or simply practical constraints on policing them. The costs of penalizing traders that engage in distortive cancellations[82] may be greater than the benefits from improved price accuracy. The costs may come in one of two forms. First, administrative costs would have to be expended to investigate and bring actions against distortionary traders. The SEC has acknowledged the difficulty and expense of bringing anti-manipulation actions.[83] Cases of intentional market manipulation can go unpunished due to the burdens of showing mens rea as well as jurisdictional challenges when trading takes place in a cross-border context. Second, there may be broader costs to society for penalizing fictive orders to the extent that order cancellation and other distortive conduct enables liquidity provision.

An automated tax, or fee, charged upon order cancellation has significant potential to improve on the current balance between protecting the accuracy of prices, eliciting liquidity, and minimizing administrative costs. The design of the proposed tax on fictive orders takes both of these costs into account, keeping administrative costs low and targeting trading behavior to reduce impact on liquidity. It is standard to deploy Pigovian taxes in contexts where private conduct imposes externalities on third parties, such as through polluting a public

81. One may argue that among a set of traders, the imbalance created by one trader may offset the imbalance created by another trader (e.g., an artificial excess of bids may offset an artificial excess of orders). This is no more likely to be true than the imbalance created by one trader exacerbating the imbalance created by another. Thus we cannot assume that misleading noise will be drowned out by other noise, because that other noise may be misleading in the same direction. As discussed below, the paper's proposal would only tax significant order cancellation imbalances and thus occasional small imbalances (or symmetric cancellations) would not be affected. However, an elaboration on the tax may be developed that measures the net rate of bid/offer cancellations in the market for a product and only penalizes asymmetric cancelations that increase that rate.

82. See *infra* Section III.A for a discussion of which cancellation activities are more likely to distort prices.

83. *See* Ring, et al., *supra* note 63.

resource.[84] The public resource in the trading context is the supply and demand curve data provided by the order book. The tax should be carefully designed to protect that public good while differentiating between more and less pernicious—as well as benign—forms of trading activity. A proposal for such a tax is developed in the next part. The proposal protects the nature of order books as a public good, while also deterring manipulative cancellation strategies. Because manipulation both deters liquidity and distorts prices, the strategy can increase both liquidity and price discovery.[85] It is key to note that the proposal is not simply the introduction of a Pigovian tax to protect a public good. The proposal is specifically to introduce an *automated* Pigovian tax in a fully digital context where behavior can be perfectly and freely tracked. It is the tremendous difference in administrative costs that primarily commends the proposed tax. Before turning to the proposal, however, it is useful to situate the debate on price distortion through order cancellation within the traditional contractual framework governing offers and execution of contracts.

B. Contractual Principles Neglect Third-Party Interest in Price Information

Without more, an offer to enter into an agreement may usually be withdrawn by the offeror prior to its acceptance.[86] There are exceptions where by its terms, the offer is firm for a period of time.[87] However, in the typical case, no contractual rights or obligations arise on account of an offer until it has been accepted.[88] Furthermore, warranties and other default terms observable in some transactional contexts enable withdrawal from a transaction subsequent to its execution.[89] Why isn't liberal optionality as to execution equally justified with respect to financial transactions taking place through public order books?

Common principles of contract formation view agreements as vehicles to mutually beneficial exchange between the counterparties. This view ignores the positive externalities from information regarding

84. See Carlton & Loury, *supra* note 15.

85. Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711 (2006).

86. RESTATEMENT (SECOND) OF CONTRACTS § 36 (AM. LAW INSTIT. 1981).

87. *See* U.C.C. § 2-205 (AM. LAW. INSTIT. 2014) ("An offer by a merchant to buy or sell goods in a signed writing which by its terms gives assurance that it will be held open is not revocable, for lack of consideration, during the time stated or if no time is stated for a reasonable time, but in no event may such period of irrevocability exceed three months.").

88. *See* Melvin Eisenberg, *The Revocation of Offers*, 2004 WIS. L. REV. 271, 271 (2004).

89. Omri Ben-Shahar & Eric A. Posner, *The Right to Withdraw in Contract Law*, 40 J. LEGAL STUD. 115 (2011).

parties' willingness to enter into contractual arrangements. In the case of idiosyncratic transactions, such as the contract with a neighbor to mow a lawn, the public benefits from reliable information as to supply and demand curves is slight. The value of information increases with the volume of fungible transactions expected in the market, for example, the price at which a merchant might sell a lawn mower. With respect to fungible assets, price information as to prior transactions helps third-party market participants value their inventory (in the case of sellers) and budget for purchases (in the case of buyers). Financial products are not simply fungible assets. As discussed earlier, their prices are proxies informing important business decisions such as management retention, project selection, and hedging. As a result, third parties derive unusually high informational value from the terms on which others transact in financial products. Preserving the positive informational externality from transparent financial markets is the first justification for distinguishing transactions in financial products from ordinary contractual arrangements.

The second justification also stems from the fungibility of exchange-traded financial products.[90] The fungibility of transactions and the fact that financial assets—unlike cars, homes, and most other assets—do not deteriorate with use or time means that reselling is an alternative to non-execution. In other words, a bidder that is forced to go through with the purchase and denied a rescission right will at worst be able to turn around and sell the instrument. Some loss may be experienced on the sale, which would consist of a mix of transaction costs and a decrease in the value of the instrument. The former represents a social loss; the latter represents a private loss to the bidder but an offsetting private gain to the prior seller.[91] Thus, in markets where transaction costs are low, the social costs of removing optionality to cancel the order or unwind the transaction should also be low.

90. Bilateral swaps are traditionally non-fungible due to the idiosyncratic credit risk of each counterparty, however, clearing brings fungibility to swap markets. *See* Ilya Beylin, *A Reassessment of the Clearing Mandate: How the Clearing Mandate Affects Swap Trading Behavior and the Consequences for Systemic Risk*, 68 RUTGERS U. L. REV. 1141 (2015).

91. To the extent that the bidder in this example is a liquidity provider, its losses may result in it widening the spread at which it is willing to transact. This widening of the spread will lead to social losses as parties forego transacting. However, the inability to cancel an order also results in the liquidity provider transacting at a lower spread than it would have otherwise and thus enabling additional transactions. The net result—absent transaction costs—should be expected to be neutral as counterparties on subsequent transactions end up subsidizing counterparties on the transactions that could not be cancelled.

C. Anonymity Precludes Reputational Constraints on Fictive Orders

The electronic environment for trading financial products differs in fundamental respects from other contexts for exchange. In addition to the differences noted above, most securities and derivatives exchanges function on the basis of anonymity. The identity of the party standing behind a bid or offer is unknown to other market participants, rather only the quantity and price is known. Anonymity prevents discipline through reputational feedback. For example, when a new order arrives from a hedge fund that has cancelled 999,998 of its last 1,000,000 orders there is no way to distinguish that unreliable order from a rock-solid order placed by a mutual fund that has executed 1,000,000 of its last 1,000,000 orders. In contrast, if a merchant advertised it was selling lawn mowers for $150 and then, after customers showed up to the store, cancelled the offer, reputational repercussions would serve as both an *ex ante* deterrent to the cancellation and an *ex post* signal to further prospective customers to take the merchant's offer with some salt.

This failing of anonymous markets for financial products may partly be remedied by the exchange tracking order cancellation rates by trader and enriching order information with the cancellation rate of the trader placing the order. This approach would increase the informational burden on market participants—requiring them to appreciate not only the order book, but the reliability of the orders in it—however, it would also make the relationship between the order book and actual supply and demand more predictable. Qualification of orders with cancellation rates as well as other characteristics (e.g., if an order is of a type that lapses at a certain time or under certain conditions) would assist market participants in predicting actual supply and demand based on order book information. These advances in order book transparency are desirable. However, because price information is a public good, advances in order book content voluntarily developed by exchanges and other commercial market participants should not be expected to attain socially optimal levels.

Disclosure enriching order book information may be mandated, but this policy would not yield ideal results. Parsing through mandated disclosures would impose information-processing costs on market participants. Relative to a tax on fictive orders, mandatory disclosure would impose costs on those trading in the market generally rather than those parties cancelling their order flow. As a result, the costs imposed by order cancellations would not be internalized by the traders placing the orders and the externality of order cancellation would be mitigated but not internalized. Put simply: it would be other market participants that bear the costs of understanding disclosure rather than those who engage in distortive high-volume orders and cancellations. Furthermore,

disclosure of cancellation rates may undermine anonymity. Anonymity in financial markets allows traders to execute transactions without letting other market participants learn their positions. This feature protects traders from strategic behavior such as where market participants know that a party has a large position that it is seeking to liquidate, and take advantage of the impending supply by reducing demand at all but the lowest prices.[92] If cancellation rates were published, they could be used to track traders with unusual cancellation rates. However, this risk could be mitigated by rounding or binning cancellation rates. Enrichment of order book information with cancellation rates and other order characteristics (such as whether the order would expire at a given time) would be helpful and could mitigate distortion from fictive orders; however, because parsing disclosure is costly, it may be a second best solution relative to the Pigovian tax proposed by this paper.

IV. IMPLEMENTING A TAX ON FICTIVE TRADING

A trader placing an order has private information as to the likelihood the order will be cancelled: only the trader knows the conditions under which she would cancel the order. A tax imposed on cancellations encourages traders to self-screen when placing an order. In the status quo, traders can enter orders irrespective of how unlikely the order is to be executed. If a tax were imposed, traders would omit placing orders that were both (a) likely to be cancelled, and (b) unlikely to produce much gain if executed. How the tax is designed will affect just which orders a trader will forego. At the outset, however, the administrative advantage to an automated tax should be noted. Beyond the fixed costs of developing the tax software, the costs of applying it on a market-wide basis are minimal.[93] Unlike enforcement actions, which require investigative and litigation resources, a tax automatically withdrawn

92. Terrence Hendershott, *Electronic Trading in Financial Markets*, IT PROF., July/Aug. 2003, at 12, http://faculty.haas.berkeley.edu/hender/ITpro.pdf ("Anonymity is potentially important for informed institutional investors, because less-informed traders may attempt to copy their strategy. In addition, if other market participants can obtain prior or contemporaneous knowledge of transactions, they may attempt to trade before the institutional investors can complete their trades, a practice known as front running. In financial markets, any sort of front running or information leakage is a serious concern.").

93. At the outset, the proposal is to incentivize exchanges to implement taxes on fictive orders. Experimentation and sensitivity to differences in trading among product types may lead to successful models that can be imposed across exchanges. The magnitude of the tax could vary by product. Current average order cancellation rates can be used to create benchmarks, excesses beyond which would be taxed. The tax could be adjusted through applying a number of factors, including: (a) transaction size, with larger transactions subject to higher taxes if cancelled; and (b) responsiveness of liquidity measures to the tax, with markets where the tax has a lower impact on liquidity being subject to a higher tax.

from a trader's account upon cancellation is highly scalable and is efficiently deployed even against minor violations (which may add up to significant distortion in the aggregate). This is a special feature of the electronic trading environment, where each new order and cancellation can be reviewed automatically without additional human oversight. As a result, the tax offers an inexpensive, comprehensive, and focused means for deterring price-distorting orders. Manual enforcement tools, in contrast, are expensive, selective, and potentially prone to greater error.[94]

A. Fictive Order Taxes Can Preserve Liquidity

A tax on price-distortive order cancellations may be objected to on liquidity preservation grounds. The argument would be that some rate of order cancellations is necessary to carry out market making strategies. Market makers adjust their spread, i.e., the difference between their highest bid and lowest offer, to recoup losses on transactions with informed parties.[95] Adjusting the spread involves canceling resting limit orders within the spread. Thus, cancellations supporting market-making strategies may on net benefit markets through their role in increasing liquidity.

Refinements to the tax structure or adaptation by market makers can allow liquidity provision strategies relying on cancellations to persist. First, the tax could be structured so as to exempt cancellations of bids that are balanced out by cancellations of offers. Cancelled orders would be treated as offsetting not merely if one was a bid and the other an offer, but if they were equidistant from the market midpoint. If demand and supply are exaggerated to the same extent, it is less likely that traders' expectations of price movements are altered.[96] Second, no charge may apply to imbalances so long as they do not exceed a *de minimis* threshold that could be adjusted upward based on executed transactions entered into by the trader. The *de minimis* quota and the tax

94. If a trader knows that its next order will be cancelled with probability of p and the tax on the cancellation will be t, then the trader will only place the order if the expected value of the executed transaction, y, satisfies the following formula: $y \geq pt/(1-p)$. Note that this formula is synonymous with the expected value of the order being greater than zero, or $y(1-p) - pt \geq 0$. For a given tax (t), this inequality can be satisfied by decreasing p or increasing y. As a result, a tax on cancellations will incentivize traders to forego placing orders that (a) have a higher likelihood of being cancelled, and (b) have lower expected returns if executed. Notably, reducing p both reduces the denominator and increases the numerator in the decisional formula, so the former type of screening is likely to predominate (in other words, a 1% decrease in p has a greater effect than a 1% increase in y). However, it is clear that taxes on cancellations will not only reduce the incidence of cancelled orders but also increase the minimum expected profit that would motivate an order being placed.

95. *See* Fox, et al., *supra* note 36.

96. *See supra* note 81.

could be applied on the basis of how many orders were cancelled in a given unit of time. Tighter timelines between entry and cancellation expose the trader to a lower risk that the order will be matched, thus increasing the likelihood the order will result in distorting expectations rather than providing liquidity. Faster cancellation is also likely to contribute to greater volatility and increase processing costs for other market participants. The speed of cancellation should be qualified by the distance of the order from the market midpoint, as less marketable orders can be left in the order book without the risk of being matched for longer periods of time. In other words, an order at or near the market price may be cancelled after a shorter period of time without incurring the tax than an order outside the marketable range. In this manner, liquidity providers would have buffers to absorb *ex post* distortive effects from strategies that are *ex ante* as likely to generate executed bids as offers; and these buffers would expand with the amount of liquidity actually being provided by the trader. Third, in addition to buffers to exclude *de minimis* quantities of cancellations, the tax could be structured to apply in a non-linear fashion. Small numbers of cancellations exceeding the *de minimis* threshold might result in a nominal fee; however, increasingly greater imbalances would result in fees that increase super-linearly (e.g., quadratically) to impose significantly higher burdens on strategies that result in abnormally high rates of cancellation. By focusing penalties on high-volume, imbalanced entry of fictive orders, the tax would reduce both manipulative conduct and the use of trading strategies that incidentally produced distortive trends. In other words, in keeping with the work of Arthur Pigou, the tax would be aimed at order cancellations producing a negative externality rather than order cancellations generally.

Market makers and other traders with legitimate reasons for reducing orders would not be significantly burdened by a tax taking this structure. That is because traders could continue to enter the same levels of demand and supply into the order book, but do so via what are popularly referred to as "iceberg" orders. Iceberg orders are limit orders that are reflected only in (small) part in the order book; when that small part is executed against, another small part of the order is revealed in the order book, and so on, until the full order is filled.[97] For example, an iceberg order to buy 100,000 shares of IBM may appear as a bid for 1,000 shares of IBM in the order book, with a new 1,000 share bid generated once the first 1,000 shares are purchased and so on 98 more times until the full order is filled. Like icebergs, which float with only a small

97. *Iceberg* Order, INVESTOPEDIA, http://www.investopedia.com/terms/i/icebergorder.asp (last visited Jan. 16, 2017).

portion showing above water, the magnitude of an iceberg order is largely invisible. This order type was originally created for institutional investors and other traders placing large bids or offers so they could execute without moving prices against them.[98] However, the iceberg order also allows market makers to place a large block of liquidity into the order book without distorting prices on its cancellation. Because the tax would be levied only on the visible part of a cancelled order (because the invisible part has no capacity to misrepresent supply and demand), the total tax burden could remain minimal.

Revenues from order cancellations can be redistributed to market participants contributing to liquidity and the accuracy of the order book. This can be done through transferring proceeds to those that execute orders, with proportionately greater amounts being transferred to those executing orders when order book volumes are low. This targeted subsidy can offset the deterrent effect the tax may have on order entry.[99] Furthermore, by allocating more of the subsidy to traders maintaining liquidity in conditions of scarcity (e.g., traders entering bids when demand has withdrawn and prices are declining), the tax can counteract market dynamics that lead to artificial under-statement of supply and demand in the order book.

Through thoughtful design of the tax and adjustment on the part of market participants, the burden of the tax could be focused on those that pollute markets with misinformation. The pollution analogy is apt on two dimensions. First, like pollution, fictive orders interfere with use of a shared resource, namely price information. Second, fictive orders, like pollution, may be a byproduct of valuable commercial activity. To arguments that in some cases order cancellation enables liquidity provision, it may be observed that notwithstanding the benefits of economic activity it may accompany, we fine pollution to reduce its incidence and encourage adaptations of cleaner technologies.

Notably, cleaner technology may involve a new market structure without a prominent role for market makers. Market makers are not a predicate for effective market function. Although described as providing "liquidity," they in effect provide a form of financing and are substitute for other forms of financing. This becomes evident when the operations of an archetypal market maker are considered. Market makers traditionally end each day "flat," meaning that a market maker executes as many bids as offers.[100] In other words, market makers act as

98. *Id.*

99. The subsidy would increase *y* in the preceding formula. *See* Eisenberg, *supra* note 88.

100. *See, eg.*, U.S. GOV'T ACCOUNTABILITY OFFICE, RECENT ACTIONS APPEAR TO HAVE INITIALLY REDUCED FAILURES TO DELIVER, BUT MORE INDUSTRY GUIDANCE IS NEEDED 17 (2009), http://www.gao.gov/assets/290/289477.pdf ("According to SEC . . . most [market makers] seek a net

intermediaries between market participants that desire to change their net positions, but market makers do not themselves enter into net non-zero positions for appreciable periods of time. A market maker allows a seller to dispose of a position notwithstanding that there is no buyer in the market at the time (and reciprocally, through carrying short inventories, a market maker can enable a buyer to obtain a position notwithstanding that there is no seller). As an equivalent to selling a position to a market maker, the seller could accept a non-recourse loan[101] collateralized by the position from a third party and when a buyer arrives, repay that loan, reclaim the position, and sell it to the buyer. The two transactional structures are equivalent from the perspective of the seller and the buyer. Arbitrage analysis implies that the interest received on the loan would be equivalent to the aggregate discount the seller provides to the market maker and the premium the market maker charges to the buyer. Thus market making only has a useful function (and merits preservation) to the extent that non-recourse financing of the asset is inefficient.[102] To the extent that introduction of pollution taxes on fictive orders inhibits market making, the inhibition will have no social costs to the extent that alternative financing exists for the asset.

The trade-off between liquidity and price integrity explains why simply banning exchanges from supporting order cancellations would not be as productive as a Pigovian tax. Some liquidity provision strategies rely on order cancellations. These could not be executed if orders could no longer be cancelled, with accompanying losses in liquidity. In other words, the net social impact of some strategies involving order cancellations is likely to be positive and banning these strategies outright, rather than forcing traders to internalize the harms, will forego potentially productive activity. That said, because short-term financing is a substitute for liquidity provision, the social costs may be limited through development of short term financing markets for financial products.

'flat' position in a security at the end of each day—offsetting short sales of a security with purchases of that security. . . .").

101. If it was desirable to reduce risk of market intermediaries, the loan could be made with recourse to the borrower (presumably reducing the interest rate payable but diversifying the lender as between the risk of loss on the collateral's and the borrower's unsecured credit).

102. An objection may be that exit of liquidity providers would reduce the number of executed transactions and thus reduce the public good benefits of the ticker tape. This assumes, however, that intra-day repo markets were non-transparent. Transparency could be imposed through, among other means, regulation.

B. Fictive Order Taxes Survive Critiques of Financial Transaction Taxes

This article's proposal to tax order cancellations is new to the academic literature in law, however, there have been prior proposals to tax financial activities. In particular, scholars have proposed and jurisdictions have implemented taxes on executed financial transactions. These taxes have been subject to a variety of criticisms. As discussed below, these criticisms are largely inapplicable to a tax on fictive transactions.

1. Financial Transaction Taxes Discourage Transfers

Taxing the transfer of a financial asset but not its retention biases financial decision-making away from accumulating and rebalancing financial portfolios through secondary markets.[103] As a result, the private benefits realized from capital contribution, investment, and risk transfer may be foregone. On first pass, the taxation of cancelled orders should not affect the rate of transactions. By definition, executed transactions are outside of the scope of a tax on fictive orders. More realistically, however, a trader placing an order will expect with some likelihood that conditions evolve prior to the order's execution in a manner that justifies its cancellation.[104] As a result, a tax on fictive transactions may, at the margin, decrease transactional volumes. This reduction may be counteracted, as already suggested, through using proceeds from the tax to subsidize executed transactions.[105]

Even without the cross-subsidy, the impact on transactional volumes is likely to be significantly lower since it is *cancelled* rather than *executed* orders that are taxed. A tax on consummated transactions fully falls on those that actually engage in transfers of financial assets. In contrast, a tax on order cancellations designed to deter exaggeration of supply or demand disproportionately affects traders following fickle, high-volume trading strategies. Trading designed to take advantage of small pricing discrepancies, where the desirability of entering into a transaction at a given price is sensitive to market movements observable over short periods, is likely to absorb the brunt of the tax. Arbitrage trading based on divergences between similar assets traded in different

103. Daniel Shaviro, *The Financial Transactions Tax Versus (?) the Financial Activities Tax* (N.Y. Univ. Sch. of Law, Research Paper No. 12-04, 2012), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1989163 [hereafter *FTT versus FTA*].

104. *See* Eisenberg, *supra* note 88.

105. The social value of marginal (as opposed to deeply inframarginal) trades in financial instruments is questionable.

markets represents a common example of such strategies. This type of trading, generally speaking, does not significantly further the goals of capital formation, savings, or risk transfer served by financial markets. Rather, at best, it accelerates price discovery through improving the accuracy of prices reflected in the record of executed transactions. Deterrence of such trading shows a tension between the public good provided by the order book and the public good provided by the ticker tape.[106] A more accurate reflection of current supply and demand can come at the expense of loss of granularity in the price data from executed transactions.

2. Financial Transaction Taxes Impede Commercial Coordination

Financial transaction taxes, like other taxes on commercial inputs, have been criticized for impeding business coordination.107 The more transfers of inputs are taxed, the more expensive it is for businesses to coordinate production through vertical supply contracts.108 This general observation has limited applicability in the financial product context. Financial products are generally not generated through a staged process in which successive market participants refine and combine inputs.109 A security is produced by an issuer and, once produced, is not altered by subsequent transferees. Similarly, derivatives contracts are produced exclusively through the interaction of the counterparties. The concern that financial transaction taxes will impede financial engineering is misplaced. If anything, a successful tool for reducing price manipulation can encourage the creation of new financial products. It is young financial products that are most susceptible to manipulation as they tend to trade in thin markets where relatively low levels of abuse can have appreciable price impact.

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106. As shown in *supra*, note 94, the imposition of a tax on order cancellations increases the expected profit that would have to be realized from a transaction for a non-zero probability of cancellation. As a result, the tax will deter informed trading based on less significant insights regarding the direction of prices while informed trading based on more substantial realizations will continue. Thus information will accumulate with informed traders before being released into the market through trading. This will result in increasing the increment from market price at which new informed transactions are entered into. This increase, however, is likely to be small. Unlike liquidity providers that may enter in limit orders and then cancel them as market conditions change, informed traders are likely to enter marketable orders that are immediately executed, locking in expected gains from price movement. As a result, informed traders are unlikely to be significantly deterred by the tax.

107. *See, e.g.*, *FTT versus FTA*, *supra* note 103.

108. *Id.*

109. A prominent exception is securities issued by vehicles that themselves have collected financial positions through purchasing securities and entering into derivatives contracts. Examples include securitization vehicles. However, assembly of these vehicles does not require order cancellation.

3. Financial Transaction Taxes Are Susceptible to Avoidance

Financial transaction taxes may be ineffectual and counter-productive if they can be avoided through shifting transactions to another jurisdiction or another instrument.110 Sweden's experience in the late 1980s stands as a stark reminder of the dangers of a poorly designed transaction tax: within four years of the introduction of a tax linked to receipt of Swedish brokerage services, more than half of Sweden's domestic securities trading moved to London.111 As a result, cross-jurisdictional harmonization and administrative complexities in imposing equivalent treatment on transactions in different places or different instruments pose substantial challenges to the implementation of financial transaction taxes.112 In contrast to wholesale migration of trading activity, strategic responses to a tax on fictive transactions may lead to sorting that improves market quality.

Self-selective departure of traders prone to high levels of distortive order cancellations would contribute to specialization of markets. Traders pursuing strategies involving little order cancellation would continue to participate in the markets where the tax was imposed. In fact, certain traders may find these markets more attractive following the decline of volatility in order book volumes. On the other hand, traders relying on strategies that generate frequent and imbalanced order cancellation would migrate to other markets where the tax was lower or absent.

C. Alternatives and Precedents to Fictive Order Taxes

Some financial exchanges have voluntarily imposed fees on distortive activity such as order modifications and cancellations. As one example, on a product-by-product basis, the CME imposes fees on traders that depart from benchmark ratios of order cancellations and modifications to order executions.[113] Known as the "Messaging Efficiency Program,"

110. *See, e.g.*, LEONARD E. BURMAN, WILLIAM G. GALE, SARAH GAULT, BRYAN KIM, JIM NUNNS & STEVE ROSENTHAL, TAX POLICY CTR., FINANCIAL TRANSACTION TAXES IN THEORY AND PRACTICE (2015), http://www.brookings.edu/~/media/Research/Files/Papers/2015/07/Financial-Tax-Transactions/FINANCIAL-TRANSACTION-TAXES.pdf (explaining the deterioration of Swedish equity markets following the implementation of a poorly designed financial transaction tax).

111. *Id.*; *FTT versus FTA*, *supra* note 103; MARION G. WROBEL, PARLIAMENT OF CANADA, FINANCIAL TRANSACTION TAXES: THE INTERNATIONAL EXPERIENCE AND THE LESSONS FOR CANADA (1996), http://www.lop.parl.gc.ca/content/lop/researchpublications/bp419-e.htm.

112. WROBEL, *supra* note 111.

113. *See* CME GROUP, CME GLOBEX MESSAGING EFFICIENCY PROGRAM VERSION 8.4 (2016), http://www.cmegroup.com/globex/files/revisedmep.pdf ("To encourage responsible messaging practices, ensure efficient market operations, allow for broad market participation and foster high quality liquid markets, CME Group adopted revisions to the CME Globex Messaging Efficiency

this voluntarily adopted policy tracks cancellations, modifications, and orders with certain "fill or kill" or "fill and kill" conditions.[114] Cancellations and modifications have similar effects in that they alter the supply or demand levels reflected in an order book. The CME also targets "fill or kill" [FOK] orders (i.e., orders that must be filled in full or are cancelled), as well as "fill and kill" [FAK] orders with minimum quantities attached (i.e., orders that must be filled to a specified extent to avoid being cancelled).

The Messaging Efficiency Program applies relatively crude scoring. Five forms of trading activity are assigned a score: modifications assigned 1; cancellations, FAK orders (with qualifying minima), and FOK orders assigned 3; and new orders assigned 0.[115] The sum of these message types issued to the platform defines the numerator, and the total number of executed orders defines the denominator. In this manner, a higher score is given where more distortive orders are generated relative to the liquidity provided. Even though the ratios are generally calculated at the executing firm level, the CME retains discretion to apply the ratio on more granular levels to target distortive desks or traders.[116]

The Messaging Efficiency Program can support order book integrity, but is a blunter tool than the suggested tax on fictive orders. Unlike the proposed fictive trade tax, the Message Efficiency Program does not distinguish between offsetting cancellations of bids and offers and asymmetric cancellations that lead to exaggerated supply or demand. As a result, the fees imposed on those that exceed benchmark ratios fail to narrowly target distortive trading behavior. Instead, the Message Efficiency Program targets use of platform resources that does not result in trade execution.

The Messaging Efficiency Program is susceptible to additional criticisms. The equivalent treatment of FAK orders (with qualifying minima) and FOK orders, on the one hand, with cancelled orders, on the other hand, fails to recognize that FAKs and FOKs can and do result in executed transactions. Moreover, FAKs and FOKs are placed with no potential for deception as the conditions for their cancellation are declared expressly when the order is being placed. Although to a platform user, an unexecuted FAK or FOK may appear identical to an order that is placed and then cancelled, that similarity is due to failure to

Program."). As background, the CME is a storied financial institution (previously known as the Chicago Mercantile Exchange) that provides exchange and clearing services for a number of financial contracts.

114. *Id.*

115. *Id.*

116. *Id.*

obtain liquidity from the platform rather than any misconduct by the user. If the CME enriches order book information to include FAK and FOK characteristics, the fleeting and conditional nature of these orders would be clear to other traders and would not have potential to distort expected supply and demand. Even without annotation, FAKs and FOKs do not have the same potential distortive impact because their cancellation is not subject to discretionary timing. Either the order is sufficiently filled or it is not, and this is wholly outside of the trader's control. In contrast, a trader can cancel a resting order if and when she wishes.

Finally, modifications to increase order size should be treated as harmless rather than penalized because the trader can alternately send a second order with the additional volume.[117] Similar to the discussion of fictive trade tax design above, modifications should also be distinguished based on whether they occur symmetrically with respect to bid and offer orders as well as their timing relative to the placement of the initial order. Notwithstanding these potential criticisms, the CME's approach represents a major and insightful step towards recognizing and protecting the value of the order book.

Scholars have shown that similar exchange rules have been able to improve market function, supporting that the proposed tax on order cancellation may be desirable. The Oslo Stock Exchange implemented a fee based on high order-to-trade ratios measured in one-second increments.[118] Empirical analysis has found that this fee improved most measures of market quality.[119] In contrast, an Italian exchange fee on order cancellations exceeding specified ratios in the course of a day has been found to impair market quality.[120] Following introduction of the fee, the depth of liquidity available declined as would be expected when market makers withdraw from liquidity-providing strategies that rely on order cancellation to protect the market maker from shifts in prices. The

117. The availability of a costless alternative to increase order size through a second order can also be seen as an argument that taxing modifications effecting increases should not matter as these transactions would migrate into new orders.

118. Kjell Jørgensen, Johannes Skjeltorp & Bernt Arne Ødegaard, Throttling Hyperactive Robots: Order to Trade Ratios at the Oslo Stock Exchange 9-10 (Mar. 2016) (unpublished manuscript) (available at http://people.stern.nyu.edu/jhasbrou/SternMicroMtg/SternMicroMtg2016/Papers/93.pdf); *see Oslo Børs to Discourage Excessive Order Activity*, OSLO BØRS (May 24, 2012), http://www.oslobors.no/ob_eng/Oslo-Boers/About-Oslo-Boers/News-from-Oslo-Boers/Oslo-Boers-to-discourage-excessive-order-activity. The Oslo Stock Exchange fee applies where the number of orders input relative to each order carried out exceeds 70. The order activity that is included in the calculation of this ratio principally relates to orders that are cancelled or amended within one second, and where the change does not contribute to improved pricing or volume.

119. Jørgensen et al., supra note 118 at 15.

120. Sylvain Friederich & Richard Payne, *Order-to-Trade Ratios and Market Liquidity*, 50 J. BANKING & FIN. 214, 222 (2015).

Italian example illustrates the importance of applying the tax on market distortive activity rather than on cancellations generally, and that the timing of order cancellation relative to order entry matters. Balanced order cancellation or cancellation that occurs over a longer time horizon is less likely to impact prices and should be taxed at lower levels (if at all). Like the prohibition on spoofing, the Italian tax is over-inclusive in failing to distinguish benign from pernicious order cancellations. Similarly, a Canadian exchange fee on both order and transaction activity has been seen as unsuccessful.[121] Because the Canadian fee falls on both cancelled and executed orders (as well as transactions), it is expected to reduce liquidity as well as returns from informed trading. Scholarship supports these predictions, finding that the Canadian fee reduced market liquidity and the returns realized by retail investors.[122]

The appropriate structure of taxes on fictive orders is likely to vary with product type (as different products trade in differing quantities, frequencies, and price increments) as well as market characteristics.[123] Exchange experience shows that the design of the fee on order cancellations is fundamental to a successful balancing of the interests served by electronic markets. Design flaws can increase costs for all market participants, impede liquidity, reduce ticker tape price discovery, and otherwise undermine market function. The devil is in the detail, and further experimentation with tax structures by exchanges is desirable before a regulatory prescription is imposed. To that end, exchanges should be delegated ample authority to develop taxes on order cancellations and the implementation of such taxes may be given credit against other market integrity oriented obligations imposed on exchanges. For instance, an exchange that has demonstrated through event studies that it has implemented a tax that improves reliability of order book information without sacrificing liquidity may be allowed to devote fewer resources to investigation of market manipulation activity. Because exchanges are frequently in dependent relationships with their liquidity providers, claims that taxes benefit order book quality should be reviewed skeptically.

V. CONCLUSION

Current anti-manipulation and anti-spoofing prohibitions are inadequate to protect markets in an era of algorithmic, high-speed

121. Katya Malinova, Andreas Park & Ryan Riordan, Do Retail Traders Suffer from High Frequency Traders? 1 (Oct. 3, 2013) (unpublished manuscript) (available at http://qed.econ.queensu.ca/pub/faculty/milne/322/IIROC_FeeChange_submission_KM_AP3.pdf).

122. *Id.*

123. See *supra* note 93.

trading. Intent is costly and difficult to establish, and under-enforcement is the apparent norm. The current regime only weakly protects markets from expropriation through manipulation, and does not protect the public-good nature of order book information. The Pigovian tax proposed in this paper would protect order book price information from pollution and supplement existing, inadequate protections from manipulation. This tax would improve on heretofore proposed financial transaction taxes. Key to the proposal is that it would apply an *automated* tax to activity that takes place in a fully digital context where behavior can be perfectly and freely tracked. The pricing, i.e., appropriate amount to escrow and forfeit based on net order cancellations would vary by instrument. The proceeds can be used to subsidize orders during times when traders withdraw from the market. It remains for future empirical research to determine appropriate parameters for levying the tax.