sifma

Invested in America

January 13, 2020

Via Electronic Mail (rule-comments@sec.gov)

Ms. Vanessa Countryman
Secretary
U.S. Securities and Exchange Commission
100 F Street NE., Washington, DC 20549

Re: ***File No. 4-729: SIFMA Comment Letter on Market Data***

Dear Ms. Countryman:

The Securities Industry and Financial Markets Association ("SIFMA")[1] submits this letter and the attached study conducted by Professor Lawrence R. Glosten of Columbia Business School[2] to the U.S. Securities and Exchange Commission ("Commission"). The attached study shows that market data products from competing exchanges are complementary, which, based on well-established economic theory, naturally results in supra-monopoly prices. Accordingly, as supported by Professor Glosten's analysis, the Commission should seriously question exchanges' arguments that their market data products are priced reasonably and constrained by competitive forces, even if the Commission accounts for the theory of "Platform Competition."

The attached study provides a clear explanation why we continue to see ever-increasing costs in market data.[3] The cost of trading on an exchange typically remains reasonable due to competing exchanges offering substitute services. However, market data from one exchange is not a substitute for the market data from other exchanges. Each exchange has a de facto monopoly over its own market data. Additionally, these market data products are complementary because the ability of participants to evaluate the market, and therefore the utility and value of market data, increases with the addition of market data products from other exchanges. As shown

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1 SIFMA is the leading trade association for broker-dealers, investment banks and asset managers operating in the U.S. and global capital markets. On behalf of our industry's nearly 1 million employees, we advocate for legislation, regulation and business policy, affecting retail and institutional investors, equity and fixed income markets and related products and services. We serve as an industry coordinating body to promote fair and orderly markets, informed regulatory compliance, and efficient market operations and resiliency. We also provide a forum for industry policy and professional development. SIFMA, with offices in New York and Washington, D.C., is the U.S. regional member of the Global Financial Markets Association (GFMA). For more information, visit http://www.sifma.org.

2 S. Sloan Colt Professor of Banking and International Finance, Columbia Business School.

3 *See* Letter from Melissa McGregor and T.R. Lazo, SIFMA to Brent J. Fields, dated Oct. 2018 *available at* https://www.sec.gov/comments/4-729/4729-4559181-176197.pdf.

in the attached paper, monopolistic competition with complementary goods leads to not only supra-competitive prices, but supra-monopoly prices.

Ultimately, the attached study explains why, as SIFMA has maintained for years, complementary exchange data is not priced in a competitive or reasonable fashion, despite the competition for order flow. The study highlights that the market for market data is inconsistent with platform theory because, among reasons: (1) the decision of where to trade occurs in milliseconds while the decision of which data to purchase occurs on the order of months or longer; and (2) not all purchasers of market data execute trades on exchanges. Additionally, for the reasons described in the study, exchanges have little incentive to reduce the prices for their own market data because any theoretical increase in demand would be shared with other exchanges. For example, a reduction in the cost to trade on an exchange may result in increased trading volume, and theoretically increase demand for an exchange's market data; however, the exchange will not see a corresponding increase in the sale of market data as the corresponding decrease in trading volume on another exchange keeps the overall demand for the market data package constant. Additionally, exchanges have yet to show the ability to increase their trading volume by reducing their price of market data.

For these reasons, we ask the Commission to make improvements to the market data structure[4] and closely analyze exchanges' fee filings in determining whether the filing satisfies the applicable standards under the Securities Exchange Act of 1934.[5]

* * *

SIFMA greatly appreciates the Commission's consideration of the issues raised above and would be pleased to discuss these comments in greater detail. If you have any questions or need any additional information, please contact me at [redacted] or [redacted].

Sincerely,

Robert Toomey
Managing Director and
Associate General Counsel

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4 *See* Letter from Theodore R. Lazo, SIFMA to Vanessa Countryman, SEC, dated September 18, 2019 *available at* https://www.sec.gov/comments/4-729/4729-6148210-192292.pdf.

5 *See, e.g.*,15 U.S.C. 78f(b)(4); 78f(b)(5); and 78f(b)(8).

cc: The Honorable Jay Clayton, Chairman
The Honorable Robert J. Jackson, Jr., Commissioner
The Honorable Allison Herren Lee, Commissioner
The Honorable Hester M. Peirce, Commissioner
The Honorable Elad L. Roisman, Commissioner

Brett Redfearn, Director, Division of Trading & Markets
David S. Shillman, Associate Director, Division of Trading & Markets

S.P. Kothari, Chief Economist and Director, Division of Economic and Risk Analysis

Economics of the Stock Exchange Business:

Proprietary Market Data

Lawrence R. Glosten[1]

January 2020

[1] S. Sloan Colt Professor of Banking and International Finance, Columbia Business School. I am solely responsible for the contents of this paper. I thank Charles Jones and Merritt Fox for helpful conversations. SIFMA provided financial support for this research.

The purpose of this paper is to further analyze the economics of the exchange business in order to assess how competitive the price of exchange proprietary data is likely to be. The conclusion will be that there is reason to doubt that exchange data is priced in a competitive fashion, despite the competition for order flow that constrains trading fees. Specifically, prices for market data products do not affect the decision of where to place orders and therefore don't significantly affect order flow decisions. Even if market data fees count as part of the total cost of trading, that component doesn't affect the marginal incentives regarding whether to execute a trade on a given platform or whether to purchase a given exchange's data. The decision regarding where to trade is driven by the terms of trade at the time of the transaction. The decision to purchase data is driven by the price of all data because the exchanges proprietary market data are complementary products.

The argument is made in the following steps. Exchanges are what may be called "monopolistic competitors" in that they all offer trading services and data, but these are not perfect substitutes (e.g. NYSE and NASDAQ products are not perfect substitutes for one another). In the trading services area, trading on any one exchange is a substitute for trading on another exchange, but there are likely enough differences to render the substitutes to be less than perfect. In contrast, the data from one exchange is not a substitute for the data from other exchanges. In fact, I will argue below that the data from competing exchanges are complementary. That is, NYSE data become more useful when combined with NASDAQ data and vice versa. The argument extends to the other exchanges as well. It has been known since the famous economist Augustin Cournot pointed it out in 1838 that monopolistic competition

with complementary goods leads to not only supra-competitive prices, but supra-monopoly prices.[2]

The prices an exchange charges for trading services, net fees or fees minus rebates, appear to be quite reasonable consistent with the exchanges offering substitute products.[3] On the other hand, the market data prices charged by some exchanges appear to be high in the sense that there have been dramatic increases in the last eight or nine years. This is consistent with the exchanges competing with complementary products. This observation is at odds with the "platform competition" argument that an exchange will charge low prices for data to attract trading. On the contrary, the exchanges charge reasonable prices for trading, because trading services are substitutes and subject to strong competitive forces, and they charge high prices for data because exchanges' data are complements.

The observation that exchange data are complementary has been noted before[4] but I will go into greater detail, in the next section, about why this should be the case, at least for a significant number of purchasers of the market data. I will then discuss why, in theory, competing complementary goods prices end up, in equilibrium, being high. Finally, I will comment on some prior assertions on the topic of proprietary data and trading fees and rebates.

I. Proprietary Exchange Data are Complements

It is very likely that there are many exchange member firms and others that obtain proprietary data from all exchanges. This is supported on page 29 of the Commission's ruling of October 16, 2018 referring to NASDAQ testimony "…the approximately 100 highly

[2] Cournot, Augustin. Recherches sur les Principes Mathematiques de la Theorie des Richesses, Paris: Hachette, 1838. (English translation by N. T. Bacon published in Economic Classics [Macmillan, 1897] and reprinted in 1960 by Augustus M. Kelly.)
[3] An estimate will be provided below
[4] For example, see Brief of Amicus Curiae Investors Exchange LLC in Support of Respondent and Intervenor for Respondent, USCA Case #18-1292, Document #1787641, filed 05/13/2019

sophisticated trading firms that pursue algorithmic trading strategies that may require all depth-of-book data from every exchange, …" If these traders find it important to have all proprietary data, then for these exchange clients the depth-of-book data from any one exchange is complementary to the depth-of-book data from all other exchanges.

Logic would suggest that there are three types of proprietary data purchasers for whom, at the right price, purchase of all data would be optimal: Large Brokerage Houses; Proprietary Traders ("PTs"); and off-exchange trading venues such as Alternative Trading Systems ("ATSs"). We must consider how the data are useful for these customers in order to understand the nature of the demand for data.

I first consider how brokers use proprietary data. Many commentators at the October 2018 SEC Roundtable on Market Data and Market Access asserted that to be competitive, brokers need to have the most informative and fastest data products. They need data that are faster than the SIP[5] data and include odd-lot quotes for smaller trades and depth of book for larger trades. As an example, Mehmet Kinak[6], of T. Rowe Price said "*If a broker is routing using SIP data, they're not routing my flow. They can route someone else's but they're not eligible to get my flow, period. That's not negotiable*."

For smaller trades, the fast data can identify where and when there is, momentarily, a lower offer or higher bid. For high priced stocks, seeing the odd-lot orders that are not part of the SIP's data can be particularly useful for finding the best quotes. But notice that determining if a quote is best requires the universe of quotes. Similarly, for the use of size information, knowing that

[5] SIP is the acronym for Securities Information Processor and is the default source of information on transactions and top of the book quotes
[6] Vice President and Global Head of Systematic Trading and Market Structure

the NYSE does or does not have size behind the quotes is only useful if that availability can be compared to that on the other exchanges.

One expert report concludes that the state of an exchange's order book in a name can be used to predict the state of the order book in that name at other exchanges.[7] Even if this is the case, it misses the challenge of getting customers the very best executions. To get that requires spotting idiosyncratic changes such as the arrival of a quote improving order at one exchange, cancellation of a quote at another or the increase or decrease in depth at yet another exchange. The mean state of the order books may be predictable, but it is the volatility of the order books, the unpredictable relative moves in the order books that provide brokers the opportunity to bring value to their customers. Capturing these elusive moves requires observing the universe of the fastest and most informative data products.

PT are perhaps the second most significant exchange data purchasers. To the extent that these traders are engaged in cross-market (approximate) arbitrage it is obvious that their demand is for the entire data package since the arbitrage requires knowing bids and offers in all lit trading venues. And, again, demand for the data depends upon the price of the entire package not the individual prices charged by the exchanges.

For example, one alleged PT strategy is so-called mid-point arbitrage, which works as follows. Suppose the market in a particular name is .11 to .15 when a new, lower offer arrives at .12 with 1000 shares. It will take some time for this information to come out via the SIP and so a fast PT with fast data can send an Immediate or Cancel sell order for 1000 shares to an ATS that relies on the SIP, hoping to find a mid-point peg order to buy. If successful, the PT can then turn

[7] Expert report submitted by Terrence Hendershott and Aviv Nevo

around and buy from the newly posted .12 offer making a penny per share. Obviously, the profitability of this relies on volume. That is, it relies on finding such quote changes on as many exchanges as possible. Notably, the profitability of the strategy also relies on finding ATSs that use only the SIP. As I show below, in fact a significant number of ATSs do use the SIP, while a similar number rely on proprietary data from all or almost of all exchanges.

Another feature of the proprietary feeds that PTs may find useful is that such data would typically include odd-lot quotes, something that is not provided by the SIP data. Since the odd-lot quotes are not in the SIP, they cannot lock or cross the market for a security. Yet, for example, a direct feed odd-lot sell order on NYSE Arca could be below the NBO determined on NASDAQ presenting a small arbitrage opportunity to a fast PT. Furthermore, a direct feed odd-lot sell order could be priced below the SIP midpoint, presenting the midpoint arbitrage pointed out above.

Depth of book is important information that can inform traders on the potential direction of market price movement[8]. Quoting from the NASDAQ website, "*Depth of book allows traders to view where orders are bunched or placed in real time, and how those bids and asks affect price. Seeing how order activity organically generates and organizes itself can help traders gain a better sense of future price movements.*"[9] This is also backed by academic scholarship.[10] The paper shows that at the time, specialists used limit order book imbalances to guide their quoting and trading and that such guidance was profitable. At the time the data was generated, the NYSE was the dominant trading venue for NYSE listed stocks. With fragmented markets, it is

[8] A recent conviction in a case prosecuted by the SEC against Avalon FA revealed expert testimony by Terrence Hendershott that illustrated the ability of layered, spoofing orders to move quotes.
[9] See https://www.nasdaq.com/articles/depth-of-book%3A-getting-the-full-view-2018-09-27
[10] Harris, Lawrence E. and Venkatesh Panchapagesan, "The information content of the limit order book: evidence from NYSE specialist trading decisions," Journal of Financial Markets 8 (2005), pp. 25-67

not clear the extent to which buy-sell imbalance on one exchange will be predictive. The evidence from the SEC case against Avalon[11] suggests that it might be. Still, it must be the case that a more global view, i.e. the view across all exchanges, of buy-sell imbalance would provide stronger predictions for the direction of future price movements. In particular, it might limit the damage done by spoofers.

Depth of book can also allow the PT to find "holes" in the limit order book—prices above the offer or below the bid which contain no quotes. A hole can be filled by a PT quote thus securing time priority should the quotes rise or fall to the level of the hole.

A final source of demand for data is even more obviously dependent on the universe of data from all lit venues. Many ATSs are required by their members to base midpoint (and other) peg order executions on the best bids and offers determined by the exchange proprietary data rather than the SIP[12]. The examples of PT strategies that rely on fast and complete data (including odd-lot orders) discussed above suggests why this would be valuable.[13]

ATSs may purchase the less expensive data product with only top of book, but again, it must be from almost every exchange and it must be fast. The only price they care about is the price for the package they choose. It is also possible that exchanges buy the direct feed data from

[11] Case 1:17-cv-01789-DLC, SEC v Vali Management Partners

[12] A Fellow of the Program in the Law and Economics of Capital Markets, a participant in a seminar at Columbia, 4/19/15, remarked that after Flash Boys came out, the members of its ATS required that the ATS acquire the direct feed data. See https://capital-markets.law.columbia.edu/events/new-stock-market-sense-and-nonsense .

[13] I have done a search of all ATS-N filings available at https://www.sec.gov/divisions/marketreg/form-ats-n-filings.html Twelve of the 31 filers rely solely on the SIP. A few of these have specialty platforms that are not vulnerable to low latency trading strategies. Five of the filing ATSs report using direct feeds from some but not all exchanges. Twelve of the ATSs report purchasing all direct feeds. ATSs with higher trading volume typically use all or some direct feeds.

other exchanges for the same reason that ATSs do—to make their mid-point peg orders more attractive. We know that IEX does since it is mentioned in its Amicus Brief.[14]

This discussion concerns three types of purchasers of proprietary exchange data. They represent a significant share of the market, but not all of it. Resellers of the data are another source of demand and depending upon the business model, they may require all exchange data, or only some of the data.

There are purchasers of data that apparently only buy one exchange's data. Presumably that purchase decision is based on price and what I might call "coverage." To provide a larger view of the market, the data should come from an exchange with a large enough share of volume traded, and a long enough time that the exchange is at the NBBO. To be economical, it should be inexpensive. This market segment will have much more price elastic demand for the exchange product. I will speculate on the effect of this demand in the next section.

II. Equilibrium with Competition to Sell Complementary Products

As noted in the introduction, the industrial organization of the proprietary data market is one typically referred to as monopolistic competition. Only NYSE has NYSE data; only NASDAQ has NASDAQ data. They are, however, competing. This section will show how this competition plays out. I will initially assume that the only sources of demand for the product arise from brokers, PTs and ATSs. I will also assume that these potential purchasers are "price takers," in order to avoid dealing with issues related to bargaining, which has been the accepted

[14] See citation in footnote 4

approach in other analyses of the demand for market data. Thus, for example, a broker looks at the prices of all the data and decides either it is worth buying the data or it is not.[15]

The problem each exchange faces in pricing its data is thus: "given what my competitors are charging, what is my best price." An equilibrium is when every competitor's price is the best response to all other competitors' prices. The important thing to note is that demand for each exchange's data is a function not of that exchange's price, but the price of the total package of data from all exchanges.[16] Also note that each potential buyer either buys or does not. Thus, buyers will be those for whom the benefit of all of the data, including avoiding the cost of not buying the data when their competitors do, exceeds the total cost of the data. We can imagine that different potential purchasers have different reservation prices and hence demand at a set of prices is the proportion of the potential market with reservation prices above the total cost of data at those prices. It is assumed that these reservation prices have a continuous distribution so that the expected industry demand curve is downward sloping. That is, total demand declines as prices increase not from product substitution, but from decisions not to purchase the data at all.

We can now consider the problem from the point of view of any one exchange. The marginal benefit of raising the price by a small amount is the increase in revenue given the level of demand. The marginal cost to raising the price is that this increases the total price for all the data leading to a reduction in demand and hence reduction in revenue at the current price. The optimal price is where the marginal benefit and marginal cost are equal.[17] The important observation is that when one exchange increases its price, the price of the total data package

[15] I focus here on only the proprietary data. I will discuss the markets for trading services and data in the next section

[16] I will assume that all the exchanges are the same for simplicity.

[17] I have assumed that the costs associated with producing data are all fixed. That is, an additional access to the data is provided at zero marginal cost.

increases and hence the demand for data at all the exchanges decreases rather than increasing revenue and market share at other exchanges from substitution in a competitive market. That is, the price increasing exchange imposes a negative externality on the other exchanges rather than the more standard positive externality due to substitution. To understand the equilibrium price, it is useful to see what the monopoly prices would be.

The case of a monopolist, in today's exchange environment should be interpreted as a single parent company owning and operating all the exchanges. The marginal benefit to raising the price on any one of the monopolist's exchanges is just the demand for that exchange's data times the incremental price change. The marginal cost is the reduction in total revenue due to the reduction in demand at all the exchanges times the incremental price change. That is the monopolist internalizes the negative externality.

Now consider an individual exchange making the pricing decision. In this case, the marginal cost is just the reduction in that exchange's revenue due to the reduction in demand at that exchange times the incremental price. An individual competing exchange does not consider the reduction in revenue due to a reduction in demand of all other exchanges the way a monopolist would. The marginal cost of raising the price, for one exchange, is lower than the marginal cost to the industry. Accordingly, to the individual exchange, the monopoly price for its data (the price charged for its data if one entity owned all the exchanges) is lower than its optimal price due to the complimentary nature of the products.

Since the monopoly prices maximize industry revenue, and since the aggregate price in the equilibrium with competing exchanges is higher, we immediately arrive at the result that everyone, including data purchasers could be made better off with reduced prices. The problem is, no single exchange has an incentive to do that. Holding other exchanges prices constant, the

benefit to an exchange reducing its price is the increase in revenue which comes from the increase in demand. That is, it is the exchange's price times the increase in demand. The rest of the benefit to reducing the price is enjoyed by the other exchanges, not the exchange reducing the price. Just as there is a negative externality associated with one exchange increasing the price, there is a positive externality associated with lowering the price. Thus, there is an incentive for each exchange to charge more than the industry revenue maximizing price.

Another way to see this analysis is to consider the price elasticity of demand. A reduction in the price by a single exchange, naturally leads to an increase in demand. However, the increase is across the entire industry. Since the data products are complements, there is no substitution from other exchanges to the price decreasing exchange. As a consequence, the elasticity of demand for a single exchange's data is low even at fairly high prices—for example at the monopoly price. By the definition of inelasticity, when demand is inelastic, a price increase increases revenue. This leads each exchange to raise its price to above the price that a monopolist owner of all the exchanges would charge.

There is a corollary to the above analysis. With three exchange owners, each owner internalizes the effect a change in price has on the four or so exchanges it owns. This will tend to lead, in theory, to lower prices for the data.[18] The aggregate price will still tend to be above the monopoly price but will be lower than if there were 12 separate pricing decisions.[19] This may have been a contributing consideration in the consolidation of exchange ownership that we have seen over the past five or so years.[20]

[18] However, I note that NYSE has filed for permission to raise the price of data on NYSE National.
[19] I am leaving out IEX since it has decided at this point to provide its data for free.
[20] LTSE has received SEC approval for a new stock exchange and MEMX and MIAX are seeking approval for same. It will be interesting to see if these individual exchanges remain independently owned.

The point of the above analysis is not to show that the aggregate price of data must be above the monopoly price. It is only to show that it is not enough to assert that the exchanges are competing, and that, as one would normally expect, competition drives prices down. Clearly, they are competing. But, if the market for exchange data is dominated by purchasers who consider the data complementary products, competition leads to a higher aggregate price. And as noted above, the decision to purchase market data is made independent of and prior to the separate decision of whether to trade on a given exchange at a point in time.

These higher prices may be attenuated by a group of potential purchasers that do not consider the data complementary and who desire data from only a single exchange. I do not know if such a group exists, but for this hypothetical group, price and quality of the data could be determining factors. This segment of the market might limit itself to choosing one of the four largest exchanges by notional volume. In this case, competition will work to lower the price of data. How much it will help will depend upon the size of this alternative market. Indeed, it is possible that competition in this market segment will bring the price to below the monopoly price. It will not likely bring it to something like a competitive price. The forces of complementarity are likely to be very powerful.

III. Platform Theory

One recently proposed analysis of exchange competition has relied on "two-sided platform theory" stressing that the goal of the exchange is to bring together, on a platform, two groups of persons.[21] When these groups get together, they generate transactions. Certainly, bringing together buyers and sellers is what an exchange does, but in the context of platform theory, it is

[21] Ordover and Bamberger Report

more useful to think of exchanges as bringing together liquidity suppliers and liquidity demanders.

Analysis of the exchange as a platform shows that the "chicken and egg" problem leads to very strong competition. After all, liquidity demanders will not go to an exchange with no liquidity suppliers and vice versa. Analysis further predicts that different platforms may use very different approaches to pricing, and indeed that is what we observe. Maker/Taker exchanges reward liquidity suppliers with rebates and charge liquidity demanders fees. And there is a broad range of rebates and fees paid and received by the exchange. Taker/Maker exchanges reward liquidity takers with rebates and charge liquidity makers fees. It appears that the net fees, fees minus rebates, are in fact very close to zero suggesting very active competition for trading services. Budish et al estimate that net trading fees are in the neighborhood of .0001% for a $100 stock.[22]

The question to be answered, though, is how the market for data fits into this two-sided platform competition to provide trading services. It is not immediately obvious since the time scale of deciding where to trade and deciding which data to purchase are so different. The former occurs on the order of milliseconds and depends upon the quotes, fees and rebates at the time of a transaction while the latter is made on a monthly or longer basis. Even if data are inputs to trading decisions, that markets are related does not imply that market data prices are constrained by the same competitive forces that constrain trading fees.

The first thing to note is that NYSE Arca data, for example, are necessary for algorithmic trading on NYSE Arca. They are not, for sophisticated traders, sufficient. As the discussion in

[22]Will the Market fix the Market? A Theory of Stock Exchange Competition and Innovation," Budish, Eric, Robin S. Lee and John J. Shim, NBER Working Paper number 25855 p. 38

section **I** suggests, traders will trade on NYSE Arca at a particular millisecond if data from all the exchanges suggest that NYSE Arca is the best place to trade at that time. We come back to the observation that fast data products are complementary and as such that platform theory predicted competition cannot be relied upon to conclude that prices for proprietary data will be low. If NYSE Arca reduces its net fees to trade on its exchange, it may reasonably expect an increase in volume. And this increase in volume may well make NYSE Arca data more valuable. This is not likely to increase its sales of data or have an impact on its price, however, since its increase in volume will likely come from a decrease in volume elsewhere leaving the over-all effect on the value of all exchange data largely unchanged.

On the other hand, if NYSE Arca reduces its price of data, it is unlikely to increase its trading volume. First, ATSs appear to be significant purchasers but they do not trade. Brokers and PTs do, but their trading decisions are a function of the terms of trade on NYSE Arca relative to the other exchanges at the time of a trade. That is why sophisticated traders require data from all exchanges to remain profitable. So, the reduction in data price is unlikely to cause an increase in market share. We have some evidence for this. In a recent SEC filing by NYSE Chicago, the exchange petitioned to eliminate Market Data Revenue Rebates arguing that the rebates had not led to the increase in market share that it had anticipated.[23]

IV. Platforms as multi-product entities

The Ordover and Bamberger Statement observes that exchanges provide trading services and data and that one cannot evaluate competitiveness by observing only one price. This observation does not apply to ATSs because they do not trade on the exchanges. Brokers and PTs do pay for both trading services and data but that does not mean that the competition for

[23] Securities and Exchange Commission, Release No. 34-87422, File No. SR-NYSECHX-2019-16, October 30, 2019.

trading services constrains data prices to a competitive level. It is important to note, moreover, that for brokers, what is paid for trading services are the net fees. We all agree that net fees are reasonable.[24] It is not appropriate, however, to observe that since at least one client receives more in rebates from NASDAQ than it pays for data and connectivity, that the market must be competitive.[25] To see this, we need to delve into how fees and rebates affect the equilibrium quoting on the exchange.

Market microstructure theory can be used to predict the equilibrium involving trading fees and quoting, independent of the market for data.[26] It is easiest to describe if we ignore the minimum price variation of a penny. Suppose that taking account of all costs associated with providing liquidity, and no rebate, the spread would be 2 cents. Now suppose that a rebate of a tenth of a penny per share is offered. Competition among liquidity suppliers will lead to a reduction of the offer by .1 cents and an increase in the bid by .1 cents. As a result, the spread will be 1.8 cents. To fund the rebate, liquidity takers need to pay a fee. If they pay a fee of .1 cents, then they are happy to send their orders since they are getting a .1 cent reduction in the half spread. If they are charged more, they will find this exchange unattractive relative to an exchange that has no rebate and fee. Thus, we would expect that in equilibrium the net fee, fee minus rebate, to be very close to zero and liquidity suppliers and demanders find the rebate and fee irrelevant. Of course, the spread cannot change by a fractional penny, but that just means for stocks that trade at a one or two cent spread (or more), the average spread will be reduced by .2 cents. The important point is that there is little reason to think that for active PT liquidity

[24] There is a recent literature on the tiered pricing of rebates and fees, arguing that perhaps they are not so competitive. See, Spatt, Chester, "Is Equity Market Exchange Structure Anti-Competitive?" Working paper, revised 2019. Still the calculations of Budish et al referenced above indicate that they are quite low.
[25] This observation is made in the Ordover and Bamberger Report.
[26] This is discussed in *The New Equity Market: Law, Economics and Policy* by Merritt Fox, Lawrence Glosten and Gabriel Rauterberg, Columbia University Press, 2019

suppliers, rebates (or fees) are relevant.[27] In fact, Chris Concannon, when asked about making markets with different fees and rebates stated that the profits per share, net of fees or rebates, were roughly the same across the markets suggesting a competitive market for trading services.[28] The rebate paid or even fee charged for providing liquidity did not affect profitability since the quotes reacted to the rebates and fees. This is also shown in an IEX working paper.[29] The paper shows that realized spreads measured 5 minutes from transactions, and gross of fees or rebates are all negative for maker/taker exchanges and positive for taker/maker exchanges. Net of fees or rebates all are slightly positive and tightly bunched.[30] That is, liquidity providers who receive rebates on average lose money on their trades, which losses are compensated for by rebates. Liquidity providers who pay fees make profitable trades, on average, which profits are mostly given up in fees.

It is likely that the entity that received more rebates from NASDAQ than it paid for data and connectivity, as reported in the Ordover and Bamberger Statement was a high-volume liquidity providing PT. That does not mean that the PT pays a negative price to access NASDAQ. Rather, it provides a service to NASDAQ by making a market and gets compensated with rebates. In

[27] This statement should not be taken out of context. Theory and data suggest that the rebates and fees are irrelevant for PTs. This does not mean that they are irrelevant for retail nonmarketable users. My co-authors and I have argued elsewhere that they may well be undesirable. See *The New Stock Market* op cit.

[28] Mr. Concannon led a discussion entitled "High Frequency Trading" on November 29, 2012 at an event sponsored by the Program in the Law and Economics of Capital Markets, A joint program of the Columbia University Law and Business Schools. Reference to the event is at https://capital-markets.law.columbia.edu/events/high-frequency-trading but unfortunately the video of the event has been lost.

[29] Wah, Elaine, Stan Feldman, Francis Chung, Allison Bishop and Daniel Aisen, "A comparison of Execution Quality across U. S. Stock Exchanges" available at https://iextrading.com/docs/A%20Comparison%20of%20Execution%20Quality%20across%20U.S.%20Stock%20Exchanges.pdf p. 28

[30] The "realized spread" is the difference between the offer and the spread midpoint some units of time later in the event of a transaction at the offer and the difference between the spread midpoint some units of time in the future and the bid in the event of a transaction at the bid. It is meant to measure the profitability of providing liquidity.

fact, theory would suggest that the rebates received are more or less equal to the lost net trading revenue due to trading on tighter spreads.

V. Conclusion

I have argued that there are reasons to think that the market for exchange proprietary market data involves strategic competitors selling complementary goods. The value, for example, of NYSE Arca's data is enhanced by having data from all exchanges, and we know many firms buy data from all exchanges. This has a rather dramatic effect on the outcome from competition. Since a data price increase by one exchange theoretically decreases the demand for data on all exchanges, that single exchange does not evaluate the full effect of its price increase. This leads, in theory, to supra-competitive pricing. This is true in the context of thinking of an exchange as a two-sided platform. The exchanges compete aggressively, and this leads to reasonable net trading fees, but it does not necessarily lead to low data prices because a low data price does not necessarily lead to more trade. Thus, it seems prudent to question both whether exchange market data prices are constrained by the competition for order flow and whether the data prices are in fact reasonable.