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Via Email

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

Re: Comment Letter of NYSE National Regarding Its Proposal to Establish Fees for the NYSE National Integrated Feed (File No. SR-NYSENAT-2020-05)

Dear Ms. Countryman:

NYSE National, Inc. (“NYSE National” or the “Exchange”) respectfully submits this comment letter in response to the Securities and Exchange Commission’s (“Commission”) June 12, 2020 Request for Information and Additional Comment on the Exchange’s proposed rule change to establish fees for the NYSE National Integrated Feed.¹ This letter also responds to the Commission’s April 1, 2020 order temporarily suspending the Exchange’s proposed rule change and instituting proceedings to determine whether to approve or disapprove the proposed fees,² as well as to the comment letters submitted by SIFMA, Healthy Markets, and Bloomberg in opposition to the Exchange’s proposed fees.³

¹ See Securities and Exchange Commission Release No. 34-89065 (June 12, 2020), 85 FR 37123 (June 19, 2020) (SR-NYSENAT-2020-05) (“Request for Information”).

² See Securities and Exchange Commission Release No. 88538 (April 1, 2020), 85 FR 19541 (April 7, 2020) (SR-NYSENAT-2020-05) (“Suspension Order”).

³ The Exchange initially filed to introduce fees for the NYSE National Integrated Feed on December 4, 2019. See Securities Exchange Act Release No. 87797 (December 18, 2019), 84 FR 71025 (December 26, 2019) (SR-NYSENAT-2019-31) (“Initial Proposal”). Pursuant to the Initial Proposal, the fees would not be implemented until February 3, 2020. The Initial Proposal was published in the Federal Register and two comment letters were submitted in response: a January 21, 2020 letter from Robert Toomey of SIFMA (“SIFMA January Letter”) and a January 16, 2020 letter from Tyler Gellasch of Healthy Markets (“Healthy Markets January Letter”). After the Commission temporarily suspended the Initial Proposal pursuant to a Suspension Order, see Securities Exchange Act Release No. 88109 (January 31, 2020) (SR-NYSENAT-2019-31) (“Initial Suspension Order”), the Exchange filed the instant proposal to introduce the fees at issue, which includes updated information about subscribers’ cancellations of the NYSE National Integrated Feed product in response to the imposition of fees. See Securities Exchange Act Release No. 88211 (February 14, 2020), 85 FR 9847 (February 20, 2020) (SR-NYSENAT-2020-05) (“Proposal”). SIFMA and Healthy Markets submitted additional comment letters

As explained in more detail below, the Exchange's proposed fees for the NYSE National Integrated Feed are consistent with the Securities Exchange Act of 1934 ("Exchange Act") for the following reasons:

- First, in NetCoalition v. SEC,⁴ which is the controlling law, the United States Court of Appeals for the District of Columbia Circuit held that an exchange can establish that its fees for market data products are fair and reasonable through either a cost-based analysis or a market-based approach showing that the fees are constrained by competition. An exchange does not have to demonstrate both – and here, the Exchange has provided ample evidence that pricing for the NYSE National Integrated Feed is constrained by competition.
- Second, under the market-based approach, the Exchange has already demonstrated that pricing for proprietary market data products such as the NYSE National Integrated Feed is constrained by competition among exchanges. Such exchange-level competition is apparent from various factors, including: (a) the determination in 2011 by the Antitrust Division of the U.S. Department of Justice that real-time proprietary market data products constitute a separate "relevant market" for antitrust purposes and that at that time there were four "major competitors" in that market – the Antitrust Division found that market competitive then and it has become more so since; (b) the high degree of fragmentation among trading venues and low barriers to entry that allow customers to start their own competing exchanges if they dislike existing market data pricing, with actual market entry, including by customers, in 2020; and (c) Professor Marc Rysman's empirical analysis showing that trading services and market data products are a platform, such that price changes on one side of the platform have effects on the other side. No further evidence is required to show that the proposed market data fees are constrained by competition and thus fair and reasonable.
- Third, the article by Professor Lawrence Glosten, submitted by SIFMA to the comment file for the Market Data Roundtable, fails to engage or rebut the empirical conclusions of Professor Rysman demonstrating that competition between the sets of joint products sold by exchanges constrains the pricing of exchange proprietary market data products. Glosten instead offers only a conclusory assertion, based on no empirical analysis, that proprietary market data products are "complements," which Professor Rysman rebuts in a second study attached to this comment letter.
- Fourth, permitting the Exchange to charge fees for the NYSE National Integrated Feed would be pro-competitive because customers who benefit from using such market data should contribute to the Exchange's costs to operate and maintain its operations as an exchange. It would reduce competition among exchanges

regarding the Proposal on March 11 and March 12, 2020, respectively (the "SIFMA March Letter" and "Healthy Markets March Letter"). Finally, in response to the Request for Information, SIFMA submitted an additional comment letter on July 10, 2020 (the "SIFMA July Letter"), as did Bloomberg ("Bloomberg Letter").

⁴ NetCoalition v. SEC, 615 F.3d 525 (D.C. Cir. 2010) ("NetCoalition I").

for the sale of non-core proprietary market data to require exchanges to choose between offering such products free of charge and not offering them at all.

- Fifth, SIFMA’s assertion that customers are “required” to purchase the NYSE National Integrated Feed is demonstrably false, as shown by (a) the proprietary market data products that firms trading on NYSE have actually purchased from four of NYSE Group’s affiliated equities exchanges (i.e., New York Stock Exchange LLC, NYSE American LLC, NYSE Arca, Inc., and NYSE National); (b) the fact that not all NYSE National members subscribe to the Exchange’s market data products; and (c) the customers that have dropped their subscription or refrained from subscribing solely because the Exchange announced the fees at issue.

For these reasons, the Exchange has demonstrated that the proposed fees are fair and reasonable and should be approved by the Commission.

1. The Exchange Is Not Required To Provide Evidence of its Costs in Order To Prove that the Proposed Fees Are Constrained by Competition

In the Request for Information, under the heading “Are the Proposed Fees Constrained by Competition?”, the Commission requests that the Exchange supply myriad additional information that “would assist its analysis of whether NYSE National has met its burden.” Specifically, the Commission asserts that, in order to fully evaluate the Exchange’s claim that exchange market data and transaction services are joint products, such that competition for order flow on the trading side of the platform acts to constrain the pricing of market data on the other side of the platform, the Commission requires additional information, including the following:

- “Information sufficient to assess whether aggregate profit margins, return on assets, or other metrics indicate the presence of competition.”⁵
- “Any other information,” – including “empirical support” – “to support the argument that competition between exchanges will limit the overall profitability of NYSE National and meaningfully constrain NYSE National’s ability to price its proprietary market data products at supracompetitive prices,” such as “disaggregated (i.e., by business line) profit-margin and return-on-assets information.”⁶

But such financial information is not required to demonstrate that competition constrains the prices of market data products. As made clear by the United States Court of Appeals for the District of Columbia Circuit in NetCoalition I, the Commission was correct in determining that it is not restricted to a cost-based analysis in evaluating whether an exchange’s proposed fees for proprietary market data products are fair and reasonable, and instead may employ a “market-based approach” that examines whether the

⁵ Request for Information, supra note 1, at 15.

⁶ Id. at 16.

exchange was subject to significant competitive forces in setting its fees.⁷ In other words, a cost-based analysis is separate and distinct from a market competition-based analysis. In its proposed rule change, the Exchange has demonstrated through a market-based analysis that its proposed fees are fair and reasonable because competition prevents the Exchange from charging supracompetitive prices for its market data products. NetCoalition I precludes the Commission from now requiring the Exchange to also provide a cost-based analysis by contending that it cannot evaluate the Exchange's market-based analysis unless the Exchange also provides evidence of its costs.⁸

2. The Exchange Has Demonstrated that the Proposed NYSE National Integrated Feed Fees Are Constrained by Highly Competitive Exchange and Data Markets

Consistent with NetCoalition I, the Exchange has already provided all of the information required to support its market-based argument that competition among exchanges constrains their pricing of proprietary data products.⁹ Such exchange-level competition is apparent from: (a) the determination in 2011 by the Antitrust Division of the U.S. Department of Justice that real-time proprietary market data is a distinct "relevant market" for antitrust purposes and that at that time there were four "major competitors" in that market, a determination that has become stronger in the intervening years with the entry of new exchanges; (b) the high degree of fragmentation among trading venues and low barriers to entry, which allow customers to start their own competing exchanges if

⁷ NetCoalition I, 615 F.3d at 535. NetCoalition I and the Commission order that it approved, Securities Exchange Act Release No. 59039, 73 FR 74770 (December 9, 2008) (SR-NYSEArca-2006-21) (the "ArcaBook Direct Order") are the sole operative statements of governing law applicable to this proceeding. In particular, the Commission's October 16, 2018 decision and order regarding the November 2010 ArcaBook filing was vacated and remanded by the D.C. Circuit and the challenge to that filing was dismissed on remand (see Securities Exchange Act Release No. 89503 (August 7, 2020)), making Bloomberg's reliance on that decision and order improper. See Bloomberg Letter at 3-6.

⁸ In its comment letter, Bloomberg argues that all fee filings based on "so-called 'market-based' forces" should be disapproved, and that exchanges should be compelled to provide information about their "costs, revenues, margins, demand, and attrition." Bloomberg Letter at 3-4. That approach cannot be squared with the Court of Appeals' holding in NetCoalition I that permits the Commission to employ a market-based approach when evaluating fee proposals and thus necessarily permits exchanges to use a market-based approach to support fee proposals. See NetCoalition I, 615 F.3d at 533-537.

⁹ Bloomberg argues that the D.C. Circuit "addressed and rejected" the theory of platform competition in NetCoalition I. That is wrong; the D.C. Circuit merely observed that because the ArcaBook Direct Order had not relied on platform competition, it could not be raised for the first time on appeal. NetCoalition I, 615 F.3d at 541 n.16. Moreover, as discussed below, since NetCoalition I, the Supreme Court has held that competition constrains prices for two-sided platforms. Ohio v. Am. Express Co., 138 S. Ct. 2274, 2285-86 (2018).

they dislike existing market data pricing; and (c) Professor Rysman's empirical analysis showing that trading services and market data products are a platform, such that price changes on one side of the platform have effects on the other side. No further evidence is required to show that the proposed market data fees are fair and reasonable.

a. The Antitrust Division of the U.S. Department of Justice Has Determined that Exchange Proprietary Data Products Is a Properly Defined Market, and that There Is Ample Competition in that Market

To begin, the Antitrust Division has already engaged in a rigorous antitrust analysis of the market for exchange proprietary data products, and determined that it is a distinct relevant market for antitrust purposes.

In 2011, the Antitrust Division sued to stop a proposed merger of NYSE Euronext (then the owner of NYSE and its affiliated exchanges) with Deutsche Börse AG ("DB") on the grounds that that merger would eliminate competition between the NYSE exchanges and the Direct Edge exchanges EDGA and EDGX, in which DB owned a substantial interest.¹⁰ In the "Competitive Impact Statement" that the Antitrust Division filed along with its Complaint, one of the "relevant markets" the Antitrust Division identified was "*real-time proprietary equity data products comprised of non-core data.*"¹¹ That is precisely the "relevant market" that covers the NYSE National Integrated Feed.

In the Complaint, the Antitrust Division alleged:

¹⁰ See December 22, 2011 Complaint, Stipulation and Order, Proposed Final Judgment, and Competitive Impact Statement filed in U.S. v. Deutsche Börse AG and NYSE Euronext, 1:11-cv-02280-BAH (D.D.C. December 22, 2011), attached here as Attachment A ("U.S. v. Deutsche Börse Filings").

¹¹ Id. at NYSE_ARCA_000523 (emphasis added). In its Competitive Impact Statement, the Antitrust Division explained that "[a]fter a thorough investigation," it found that the merger would likely substantially lessen competition in the market for "*real-time proprietary equity data products* in the United States in violation of Section 7 of the Clayton Act, 15 U.S.C. § 18." Id. at NYSE_ARCA_000519 (emphasis added). For these reasons, the Antitrust Division determined to approve the merger only on the condition that DB divest its interest in Direct Edge. The "presumption of regularity" requires the conclusion that the Antitrust Division presented these prior competition analyses regarding proprietary market data products in conformance with its rigorous antitrust analysis principles. See, e.g., Nat'l Archives & Records Admin. v. Favish, 541 U.S. 157, 174 (2004) (presumption of regularity requires a "meaningful evidentiary showing" before doubts can be entertained regarding the integrity of official acts or documents).

Ultimately, the parties dropped the proposed merger plan when European competition authorities refused to approve the deal, leaving the competitive landscape as it was when the Antitrust Division evaluated it before insisting on divestiture to preserve the existing level of competition.

- “Real-time proprietary equity data is a relevant antitrust product market and a ‘line of commerce’ within the meaning of Section 7 of the Clayton Act.”¹²
- “NYSE and Direct Edge are among only *four major competitors* that aggregate and disseminate certain market data to brokers, dealers, investors, and news organizations.”¹³
- “They sell (*or with little lead time could easily sell*) competing proprietary market data products derived from trading activities occurring both on and off their exchanges.”¹⁴
- “Each exchange (or other trading platform) owns non-core data and can *distribute it voluntarily* for a profit in competition with data from other exchanges.”¹⁵
- “NYSE and Direct Edge also are head-to-head competitors in the provision of real-time proprietary equity data. Both are well-situated to offer new real-time equity data products and equity data products that replicate portions of core data offerings, but with even faster feeds.”¹⁶

The Antitrust Division’s analysis reflects its conclusion that different exchanges compete to sell their own proprietary data products. This conclusion is entirely consistent with the conclusion of Professor Rysman, in his paper submitted by the Exchange in support of the proposal, that competition in the market for proprietary data products must be evaluated at the exchange level, where the availability of proprietary market data products from multiple exchanges constrains how any individual exchange will price its market data products as well as its trading services.¹⁷

b. Since the Antitrust Division’s 2011 Determination, the Market for Trading Data Has Become Even More Fragmented and Competitive

In the nine years since the Antitrust Division’s analysis of the exchange data market in 2011, that market has become more fragmented and less concentrated. In 2011, the Antitrust Division noted that there were four major competitors that could disseminate certain market data to market participants.

¹² U.S. v. Deutsche Börse Filings, supra note 10, at NYSE_ARCA_000487, ¶ 20.

¹³ Id. (emphasis added).

¹⁴ Id. (emphasis added).

¹⁵ Id. at NYSE_ARCA_000488, ¶ 21.

¹⁶ Id. at NYSE_ARCA_000490, ¶ 28.

¹⁷ See Marc Rysman, Stock Exchanges as Platforms for Data and Trading, December 2, 2019 (hereinafter “Rysman Paper”), attached as Exhibit 3B to the Proposal.

As the Commission itself recognized, the market for trading services in NMS stocks has become “more fragmented and competitive.”¹⁸ Today, equity trading is dispersed not only across 13 equity exchanges,¹⁹ but also across 31 alternative trading systems²⁰ and numerous broker-dealer internalizers and wholesalers, all of which compete with the Exchange for order flow. The Commission’s Division of Trading and Markets has recognized that with so many “operating equities exchanges and dozens of ATSS, there is vigorous price competition among the U.S. equity markets and, as a result, [transaction] fees are tailored and frequently modified to attract particular types of order flow, some of which is highly fluid and price sensitive.”²¹ Based on publicly-available information, no single exchange has more than 20% market share, and NYSE National’s market share is less than 2%.²²

Further, low barriers to entry mean that new exchanges may, and do, rapidly and inexpensively enter the market and compete with the Exchange.²³ And it is not merely

¹⁸ See Securities Exchange Act Release No. 51808, 84 FR 5202, 5253 (February 20, 2019) (File No. S7-05-18) (Transaction Fee Pilot for NMS Stocks Final Rule) (“Transaction Fee Pilot”); see also Hendershott and Nevo, Statement Regarding the SEC’s Proposed Order Concerning the Pricing of Depth-of-Book Market Data, In re SIFMA, Admin. Proc. File No. 3-15350 ¶¶ 43-70 (similar analysis based on data through 2014) (“Hendershott & Nevo Report”), attached here as Attachment B; Expert Report of Janusz A. Ordover, In re SIFMA, Admin. Proc. File No. 3-15350, ¶¶ 6-19 (similar) (“Ordover Report”), attached here as Attachment C. The attached versions of the Hendershott & Nevo Report and the Ordover Report are the redacted “public” versions of those documents, unredacted versions of which were submitted to the Commission under seal and remain under seal in File No. 3-15350. Both reports provide additional evidence that exchanges operate as platforms. See Hendershott & Nevo Report ¶¶ 37-42, 55-64; Ordover Report ¶¶ 6-13, 33-41, 58-59.

¹⁹ See Cboe Global Markets, U.S. Equities Market Volume Summary, available at http://markets.cboe.com/us/equities/market_share/. See generally <https://www.sec.gov/fast-answers/divisionsmarketregmrexchangeshtml.html>.

²⁰ See FINRA ATS Transparency Data, available at <https://otctransparency.finra.org/otctransparency/AtsIssueData>. A list of alternative trading systems registered with the Commission is available at <https://www.sec.gov/foia/docs/atlist.htm>.

²¹ Commission Division of Trading and Markets, Memorandum to EMSAC, dated October 20, 2015, available here: <https://www.sec.gov/spotlight/emsac/memo-maker-taker-fees-on-equities-exchanges.pdf>.

²² See Cboe Global Markets U.S. Equities Market Volume Summary, available at http://markets.cboe.com/us/equities/market_share/.

²³ See Charles M. Jones, Understanding the Market for U.S. Equity Market Data, August 31, 2018 (hereinafter “Jones Paper”), at 10-11, attached as Exhibit 3A to the

that the barriers to entry are low; there is actual entry occurring in 2020. In addition to the 13 presently-operating exchanges, three new exchanges, unaffiliated with any of the existing 13 exchanges, are expected to enter the market in 2020: Long Term Stock Exchange (LTSE), which has been approved as an equities exchange but is not yet operational;²⁴ Members Exchange (MEMX), which has also been approved as an exchange and is launching in September 2020;²⁵ and Miami International Holdings (MIAX), which currently operates options exchanges, has announced its plan to introduce equities trading on one of its registered exchanges.²⁶

c. Customers Have Established Their Own Exchanges and Thus Can Sell Their Associated Proprietary Data Products

These low barriers enable existing exchange customers to disintermediate and start their own exchanges if they think the prices charged for exchange proprietary market data products are too high. This is precisely the rationale behind the creation of MEMX, which is being formed by some of the largest and well capitalized financial firms that are also exchange customers (including Bank of America, BlackRock, Charles Schwab, Citadel, Citi, E*Trade, Fidelity, Goldman Sachs, J.P. Morgan, Jane Street, Morgan Stanley, TD Ameritrade, Virtu, and others).²⁷

Proposal; Hendershott & Nevo Report, supra note 18, ¶¶ 23(a), 51, 9; Ordovery Report, supra note 18, ¶¶ 8, 59.

²⁴ See Securities Exchange Act Release No. 85828 (May 10, 2019) (File No. 10-234) (Findings, Opinion, and Order of the Commission in the Matter of the Application of Long Term Stock Exchange, Inc. for Registration as a National Securities Exchange).

²⁵ See Securities Exchange Act Release No. 87436 (October 31, 2019) (File No. 10-237) (Notice of filing of application of MEMX LLC for registration as a national securities exchange under Section 6 of the Act); “MEMX Testing, Launch and Personnel Update,” Press Release of MEMX, August 6, 2020 (“going live in September” 2020; roll out of S&P 500 stocks, then all NMS stocks), available here: <https://memx.com/memx-testing-launch-and-personnel-update/>; “MEMX Timeline Update – Launch Set for September 4th”, Press Release of MEMX, May 8, 2020, available here: <https://memx.com/memx-timeline-update-launch-set-for-september-4th/>.

²⁶ See Press Release of Miami International Holdings Inc., dated May 17, 2019, available here: https://www.miaxoptions.com/sites/default/files/press_release-files/MIAX_Press_Release_05172019.pdf. In addition, the Dream Exchange has announced plans to become a new registered U.S. equities exchange, targeting a 2021 launch. See <https://dreamex.com/>.

²⁷ MEMX Home Page (“Founded by members for investors, MEMX aims to drive simplicity, efficiency, and competition in equity markets.”), available at <https://memx.com/>.

For example, one of MEMX's founding principles is that exchange proprietary market data prices are too high, and that MEMX will benefit its members by offering "[l]ower pricing on market data."²⁸ Nor is this a new phenomenon: exchange customers formed BATS to compete with incumbent exchanges and once registered as an exchange in 2008, did not initially charge for market data. The BATS venture was a financial success for its founders, first through recouping their investment in its initial public offering and then the subsequent sale of BATS to Cboe, which now charges for market data from those exchanges. Notably, MEMX has some of the same founding broker-dealer customers, leading some to dub MEMX "BATS 2.0."²⁹

The fact that this cycle is viable and repeatable by entities that both trade on and compete with existing exchanges confirms that barriers to entry are low and that these markets are competitive and contestable. And low barriers to entry act as a market check on high prices.³⁰

These factors demonstrate that the market for proprietary market data products is highly competitive, and that customers dissatisfied with exchanges' pricing for market data products may respond by moving their order flow to a different venue, or even by establishing competing exchanges with different pricing models.

d. Professor Rysman Has Shown that the Markets for Trading Services and Market Data Products Are Linked

Finally, the Exchange has provided the empirical analysis of Professor Rysman, who conducted a data-driven economic analysis of how stock exchanges' sale of market data products and trading services are related. As the Supreme Court explained in Ohio v. American Express:

Due to indirect network effects, two-sided platforms cannot raise prices on one side without risking a feedback loop of declining demand. And the fact that two-sided platforms charge one side a price that is below or above cost reflects differences in the two sides' demand elasticity, not

²⁸ MEMX home page, available at <https://memx.com/>.

²⁹ See "MEMX turns up the heat on US stock exchanges," Financial Times, January 9, 2019, available at <https://www.ft.com/content/4908c8b0-1418-11e9-a581-4ff78404524e>; see also "US equities exchanges: If you can't beat them, join them," Euromoney, February 13, 2019, available at <https://www.euromoney.com/article/b1d3tfby4p3y4v/us-equities-exchanges-if-you-cant-beat-them-join-them>.

³⁰ United States v. Baker Hughes, 908 F.2d 981, 987 (1990) ("In the absence of significant barriers [to entry], a company probably cannot maintain supracompetitive pricing for any length of time."); see also David S. Evans and Richard Schmalensee, Markets with Two-Sided Platforms, in 1 ISSUES IN COMPETITION LAW AND POLICY 667, 685 (ABA Section of Antitrust Law 2008) ("Evans and Schmalensee") (noting that exchange mergers in 2005 and 2006 were approved by competition authorities in part in reliance on planned and likely entry of other firms).

market power or anticompetitive pricing. Price increases on one side of the platform likewise do not suggest anticompetitive effects without some evidence that they have increased the overall cost of the platform's services.³¹

Professor Rysman explained the types of linkages between market data access and trading activities that must be present for those exchange products to be joint products, and then analyzed customers' trading activities within the NYSE group of exchanges in reaction to the NYSE Integrated Feed product in 2015 to determine that such linkages actually exist. This empirical analysis led Professor Rysman to conclude:

- “[D]ata is more valuable when it reflects more trading activity and more liquidity-providing orders. These linkages alone are enough to make platform economics necessary for understanding the pricing of market data.”³²
- “[L]inkages running in the opposite direction, from data to trading, are also very likely to exist. This is because market data from an exchange reduces uncertainty about the likelihood, price, or timing of execution for an order on that exchange. This reduction in uncertainty makes trading on that exchange more attractive for traders that subscribe to that exchange's market data. Increased trading by data subscribers, in turn, makes trading on the exchange in question more attractive for traders that do not subscribe to the exchange's market data.”³³
- The “mechanisms by which market data makes trading on an exchange more attractive for subscribers to market data . . . apply to a wide assortment of market data products, including BBO, order book, and full order-by-order depth of book data products at all exchanges.”³⁴
- “[E]mpirical evidence confirms that stock exchanges are platforms for data and trading.”³⁵
- “The platform nature of stock exchanges means that data fees cannot be analyzed in isolation, without accounting for the competitive dynamics in trading services.”³⁶

³¹ Ohio v. Am. Express Co., 138 S. Ct. at 2285-86.

³² Rysman Paper, supra note 17, ¶ 95.

³³ Id. ¶ 96.

³⁴ Id.

³⁵ Id. ¶ 97.

³⁶ Id. ¶ 98.

- “Competition is properly understood as being between platforms (i.e., stock exchanges) that balance the needs of consumers of data and traders.”³⁷
- “Data fees, data use, trading fees, and order flow are all interrelated.”³⁸
- “Competition for order flow can discipline the pricing of market data, and vice-versa.”³⁹
- “As with platforms generally, overall competition between exchanges will limit their overall profitability, not margins on any particular side of the platform.”⁴⁰

Given Professor Rysman’s conclusion that exchanges are platforms for market data and trading, the fierce competition for order flow on the trading side of the platform (discussed above) acts to constrain, or “discipline,” the pricing of market data on the other side of the platform.⁴¹ As such, fierce competition for order flow constrains any exchange from pricing its market data at a supracompetitive price, and constrains the Exchange here in setting its fees for the NYSE National Integrated Feed.⁴²

Note that Professor Rysman’s conclusions about the existence of exchange vs. exchange competition in the market for trading services and market data are not at all dependent on any assessment of the Exchange’s costs to produce the NYSE National Integrated Feed, its return on that investment, or its profit margin. Such data are not required in order for the Exchange to demonstrate the existence of platform competition

³⁷ Id.

³⁸ Id.

³⁹ Id.

⁴⁰ Id. ¶ 100.

⁴¹ Id. ¶ 98.

⁴² The Bloomberg Letter asserts (at page 7), without basis, that exchanges are platforms only insofar as they intermediate between “liquidity providers” and “liquidity takers.” But from an economic perspective, firms are platforms if they act as intermediaries between two or more sets of agents in a setting where “the decisions of each set of agents affects the outcomes of the other set of agents, typically through an externality.” Rysman, Marc, “The Economics of Two-Sided Markets,” *Journal of Economic Perspectives* 23(3) (2009): 125–143, at 125; see also Rysman Paper, supra note 17, ¶¶ 7, 17. Exchanges are thus platforms between data and trading. The Bloomberg Letter also incorrectly claims (at page 8) that “[t]he platform theory wrongly assumes that traders can readily shift orders to another exchange in response to market-data fees and thereby lower their overall costs of trading.” But platform theory assumes no such thing. Rather, firms may respond to market data fees by choosing to purchase or not to purchase a particular data product. Such choices have implications for that firm’s order routing decisions, as is documented in the Rysman Paper.

in the markets for market data and trading services, nor are they required in order for the Commission to approve the Exchange's proposed fees on the grounds that market data fees are constrained by competition.

Furthermore, the cost data that the Commission now requests would not reliably reveal the profitability of the Exchange's market data products, and therefore, would not be useful in determining whether market data fees are fair and reasonable, for three reasons.

First, as Professor Rysman explains in his supplemental paper, economists recognize "that such accounting data do not always reliably reflect economic profitability and therefore can be unreliable for evaluating the competitiveness of an industry" – especially where such costs are "disaggregated" and allocated across various units within a firm, as the Commission requests here.⁴³ Here, the data regarding the Exchange's costs are not kept in the "disaggregated" manner requested by the Commission, meaning that any such cost data would have to be imperfectly allocated across business lines.

Second, data regarding the Exchange costs are not divided between "costs to provide transaction services" and "costs to provide market data," because these products are two sides of the same coin. Artificially dividing costs between these two products would result in data that is inaccurate and unreliable. In a February 2014 report on the "Pricing of market data services" prepared for the European Commission, consulting firm Oxera observed that market data products and trading services are "joint products," because "it is not possible to provide transaction services without generating market data, and it is not possible to generate trade transaction – or market depth – data without also supplying an execution service."⁴⁴ Oxera further noted:

⁴³ See Marc Rysman, Complements, Competition, and Exchange Proprietary Data Products, August 13, 2020, ¶ 65 (hereinafter "Rysman Supplemental Paper"), attached here as Attachment D. See also Fisher & McGowan, On the Misuse of Accounting Rates of Return to Infer Monopoly Profits, 73 Am. Econ. Rev., 82, 90 (1983) ("[T]here is no way in which one can look at accounting rates of return and infer anything about relative economic profitability or, a fortiori, about the presence or absence of monopoly profits."). Even David Evans, who has submitted multiple reports on SIFMA's behalf relating to market data fees and whose writings the Supreme Court relied on in Ohio v. American Express, agrees. See Evans and Schmalensee, supra note 30, at 675 (specifically relied on by the Supreme Court, 138 S. Ct. at 2281); see also id. at 677 ("two-sided platforms have an incentive to devise rules and regulations that promote [indirect network] externalities and limit negative externalities between customers. The most sophisticated rules and regulations may be those employed by exchanges.") (emphasis added); id. at 689 ("it is incorrect to conclude, as a matter of economics, that deviations between price and marginal cost on one side provide any indication of pricing to exploit market power or to drive out competition"); id. at 691 ("it is hard to see how [cost-based tests] could be used to analyze an allegation of one-sided predation").

⁴⁴ See February 2014 report from Oxera on "Pricing of market data services," at vi, attached here as Attachment E.

With joint products, the production costs of the outputs cannot be separated – i.e., they are joint costs. . . . Joint costs are incurred when production facilities simultaneously produce two or more products in fixed proportions, such that an increase in the output of one product will necessarily mean a corresponding increase in the output of the other product. This means that the recovery of costs by a trading venue cannot be assessed effectively by the independent analysis of either trade execution services or market data services. The appropriate frame of reference for the economically efficient recovery of the costs of the secondary market activities of trading venues is at the level of combined transaction revenues and data revenues.⁴⁵

Third, to the extent NetCoalition I provides that costs *might* be relevant to a determination of the reasonableness of fees, this appears to have been based on the record in that case (which did not contain direct evidence of proprietary data product competition and platform competition) and the incorrect assumption that “in a competitive market, the price of a product is supposed to approach its marginal cost.”⁴⁶ But the economic theory that “price equals marginal cost” has limited real-world

⁴⁵ Id. at vii. Even in industries subject to direct cost-based price regulation, such as the energy industry, regulators do not require the sort of granular data the Commission seeks here. See, e.g., Accounting and Financial Reporting for Public Utilities Including RTOs, Docket No. RM04-12-000; Order No. 668, at 6-7 (“The Commission does not believe sufficient justification has been advanced to expand the proposed new accounts further as suggested by commenters. The new accounts adopted herein will provide the Commission and others with additional, more detailed information than is currently available about the major types of assets needed to perform region-wide transmission and market operations. *These assets perform joint functions and at this point the Commission believes it may be unduly burdensome to allocate the costs of these assets in greater detail.*”) (F.E.R.C. Dec. 16, 2005) (emphasis added) (available at https://www.ferc.gov/sites/default/files/2020-05/E-1_83.pdf). This is consistent with the established economic literature discussed by Professor Rysman and case law addressing joint costs. See, e.g., U.S. v. John J. Felin & Co., 334 U.S. 624, 632-34 (1948) (noting that “[t]he problem is one of ‘joint cost’ in a business which ‘produces no single major product,’ . . . with the result that no accountant has thus far ‘been able to devise a method yielding by-product or joint-cost figures which does not embody a dominance of arbitrariness and guesswork’” and that “[s]ince so much speculative approximation and guesswork entered into the determination of cost, selling price, and profit, the industry, naturally enough, was in almost continuous controversy with the Price Administrator about them”). It is also consistent with economic writings the Supreme Court relied on in Ohio v. American Express. See generally David S. Evans and Richard Schmalensee, MATCHMAKERS at 90 (2016) (“there are no simple market research questions or experiments that can reliably guide [platforms] to the optimal pair of prices.”). This is yet another reason that proprietary market data fees should not be subject to direct cost-based price regulation.

⁴⁶ NetCoalition I, 615 F.3d at 537.

application outside of agricultural commodity products. As highlighted by Professor Kenneth Elzinga, “[f]ew firms fit the textbook definition of perfect competition,” and in fact, marginal cost pricing in “technology-driven industries . . . is neither feasible nor desirable.”⁴⁷

For all these reasons, it is both inconsistent with NetCoalition I and improper as a matter of economics for the Commission to assert that it cannot evaluate the Exchange’s demonstration of platform competition in the market for proprietary data products without evidence of the Exchange’s costs, return on assets, and profits.

Rather, all the foregoing data and analysis amply demonstrate that the proposed fees are constrained by competition.

3. Professor Glosten Fails To Disprove that Trade Executions and Proprietary Market Data Are Joint Products, and Fails To Support His Assertion that Exchange Market Data Products Are “Complements”

In January 2020, after the Exchange had filed its Initial Proposal to institute fees for the NYSE National Integrated Feed, SIFMA submitted to the Market Data Roundtable comment file a paper by Professor Lawrence Glosten.⁴⁸ The Glosten Paper (i) argues that exchanges are not platforms, and (ii) claims that exchanges’ proprietary market data products are “complements” offered by “monopolistic competitors” charging supracompetitive prices.

Regarding Glosten’s first contention, at the time of his January 2020 article, Glosten had access to two different studies that the Exchange had filed with its Initial Proposal: Professor Rysman’s empirical analysis⁴⁹ and an empirical analysis by Professor Charles Jones, an economist who similarly concluded that proprietary market data is one of the joint products produced by exchanges.⁵⁰ Remarkably, the Glosten Paper fails to engage with either Professor Rysman or Professor Jones’ empirical analyses. Glosten provides

⁴⁷ Kenneth G. Elzinga & David E. Mills, The Lerner Index of Monopoly Power: Origins and Uses, 101 Am. Econ. Rev. 558, 560 (2011); see also Ordover Report, supra note 18, ¶¶ 51-54 (explaining that if firms with substantial fixed costs “were constrained to price at or close to marginal costs . . . , those firms would not be able to earn a normal return on their investments,” resulting “in firms being forced to exit the industry.”); Evans and Schmalensee, supra note 30, at 689 (“it is incorrect to conclude, as a matter of economics, that deviations between price and marginal cost on one side provide any indication of pricing to exploit market power or to drive out competition.”).

⁴⁸ Letter from Robert Tooney, “SIFMA Comment Letter on Market Data,” January 13, 2020 (File No. 4-729), attaching “Economics of the Stock Exchange Business: Proprietary Market Data” by Lawrence R. Glosten, January 2020 (“Glosten Paper”), available at <https://www.sec.gov/comments/4-729/4729-6678493-203560.pdf>.

⁴⁹ Rysman Paper, supra note 17.

⁵⁰ See Jones Paper, supra note 23.

no empirical analysis or data of any kind (nor does he contradict the Rysman or Jones' analyses and data) to support his conclusions, and he gives the Commission no basis on which to reject the detailed conclusions to the contrary reached by Professors Rysman and Jones on the basis of empirical data analyses that have not been challenged by anyone. Indeed, the Glosten Paper nowhere even mentions the Rysman or Jones analyses, even though Glosten apparently consulted Professor Jones while writing his article.⁵¹

The Glosten Paper asserts that platform competition is not a helpful framework for understanding the pricing of exchange proprietary data products because data purchases are made on a monthly or longer basis while order routing decisions are made at high frequencies.⁵² Professor Rysman refutes this claim in his supplemental paper and shows that the different timing of these two purchasing decisions by exchange clients is not inconsistent with trade executions and market data being joint products.⁵³

Glosten's second contention – that exchanges' proprietary market data products are “complements” offered by “monopolistic competitors” charging supracompetitive prices⁵⁴ – is similarly unsupported. In his supplemental paper, Professor Rysman examines Glosten's contention that exchanges' proprietary market data products are “complements” and demonstrates why that argument is unsupported. Among other things, Professor Rysman:

- demonstrates that Glosten's claim that exchange proprietary data products are complements is based on incomplete logic that contradicts the empirical evidence;
- shows that the observation that some firms buy proprietary data from all exchanges is not sufficient to show that these products are complements;
- examines the marginal returns to a firm purchasing more than one exchange's proprietary data products to show that the products are not complements; and
- shows that “monopolistic competition,” a term used by Glosten, does not apply to exchanges' pricing of proprietary data products.⁵⁵

⁵¹ See Glosten Paper, supra note 48, at 1 n.1. In addition, the Glosten Paper is based in part on the Commission's October 16, 2018 decision (id. at 3-4 & n.4), but that decision was vacated by the D.C. Circuit. See Nasdaq v. SEC, Nos. 18-1292 & 1293, Slip Op. (D.C. Cir. June 5, 2020). And that proceeding has now been dismissed in its entirety. See supra note 7.

⁵² See Glosten Paper, supra note 48, at 13.

⁵³ See Rysman Supplemental Paper, supra note 43.

⁵⁴ See Glosten Paper, supra note 48, at 2-3.

⁵⁵ Glosten's contention that proprietary market data products are complements also ignores prior exchange submissions, specifically the Hendershott & Nevo Report,

Furthermore, the Glosten Paper entirely fails to address ease of entry. Indeed, the Glosten Paper refers to “monopolistic competitors,” but fails to engage in any meaningful analysis of new competitors.⁵⁶ But any exchange’s pricing of market data must take into account the ability of its customers to create a competitive market for market data by creating new exchanges, such as BATS in 2008, or MEMX in 2020.⁵⁷

In sum, the Glosten Paper is just an opinion piece lacking analytic, empirical, or evidentiary support. As such, the Exchange’s showing that its fees are constrained by competition is unrebutted.

Given Professor Rysman, Professor Jones, and Professors Hendershott and Nevo’s data-driven conclusions that market data and trade executions are joint products and the failure of any commenters to dispute those analyses, their methodologies, or the data on which they were based with any evidence-based submissions (or to submit any contradictory data or evidence), it is undisputed that the fierce competition for order flow on the trading side of an exchange acts to constrain the pricing of market data on the other side of the exchange. Due to the availability of numerous other exchanges (and other trading venues) and the low cost both to move order flow to those substitute trading venues or create new substitute trading venues, an exchange that sets market data fees that are not at competitive levels would expect to quickly lose business to other venues. Although various exchanges may employ different strategies for pricing their market data products vis-à-vis their transaction fees for trades, the fact that market data and trade executions are joint products ensures that no exchange makes pricing decisions for one without considering, and being constrained by, the effects that price will have on the other.

which demonstrated empirically that market data *and trade execution* are complements. See Hendershott & Nevo Report, supra note 18, ¶¶ 23(d), 35, 41, 54, 71-75. Glosten neither mentions nor engages with this earlier work.

⁵⁶ See Glosten Paper, supra note 48, at 2, 11 n.20. Indeed, Glosten’s concept of “monopolistic competition” is inconsistent with platform economics. See Evans and Schmalensee, supra note 30, at 681 (“It is relatively uncommon for industries based on two-sided platforms to be monopolies or near monopolies.”).

⁵⁷ United States v. SunGard Data Sys., 172 F. Supp. 2d 172, 186 (D.D.C. 2001) (recognizing that “[a]s a matter of law, courts have generally recognized that when a customer can replace the services of an external product with an internally-created system, this captive output (i.e. the self-production of all or part of the relevant product) should be included in the same market.”). In SunGard, the court rejected the Antitrust Division’s attempt to block SunGuard’s acquisition of the disaster recovery assets of Comdisco on the basis that the acquisition would “substantially lessen competition in the market for shared hot-site disaster recovery services,” when the evidence showed that “internal hot-sites” created by customers competed with the “external shared hot-site business” engaged in by the merging parties. Id. at 173-74, 187.

4. Charging Fees for Exchange Market Data Products Is Pro-Competitive

As a result of the Commission's suspension of the Exchange's proposed fees, the Exchange has been prevented from collecting any fees for its NYSE National Integrated Feed, meaning that if the Exchange wishes to continue to make the feed available (as it presently does), it cannot charge for it. But this is not "fair and reasonable" pricing. The Exchange has created a tangible product in the NYSE National Integrated Feed that some market participants find valuable to their business, and the Exchange should be allowed to be compensated for providing it. It is both unfair and unreasonable for customers interested in purchasing the NYSE National Integrated Feed – and who *did in fact purchase* the feed while the proposed fees were in place in February and March 2020 – to receive this valuable product for free.

It is, in fact, pro-competitive to permit exchanges to charge for proprietary data feeds such as the NYSE National Integrated Feed. The revenue from selling such data feeds contributes to exchanges' costs of operating as an exchange, including maintaining and improving their trading systems, surveilling their market, and improving and creating new market data products. These developments are themselves evidence of competition,⁵⁸ enhance the markets as a whole, and benefit everyone who participates in the markets.

5. The Claim that Customers Are "Required" To Purchase the NYSE National Integrated Feed Is False, as the Empirical Data Demonstrate

In their comment letters, both SIFMA and Healthy Markets contend that the NYSE National Integrated Feed product is not subject to competitive forces because it contains depth-of-book information that is "essential" for customers to purchase.⁵⁹ But this claim is demonstrably false, as shown empirically by (i) the customers that have dropped the subscription or refrained from subscribing since the Exchange announced the fees at issue, and (ii) the proprietary market data products that firms trading on NYSE have actually purchased regarding NYSE Group's affiliated equities exchanges.

First, there is no regulatory mandate requiring any specific customers, including broker-dealers, to purchase proprietary market data products from exchanges. The Commission has specifically stated that broker-dealers are not required to purchase depth-of-book data to fulfill their best execution obligations, and more recent FINRA guidance only requires broker-dealers who otherwise choose to use proprietary data for their own trades to consider using whatever proprietary feeds they use for their own purposes to evaluate best execution for their customers.⁶⁰ The purchase of proprietary market data products is thus not required by regulation.

⁵⁸ See, e.g., Hendershott & Nevo Report, supra note 18, ¶ 45; Ordover Report, supra note 18, ¶¶ 14, 15, 46.

⁵⁹ See SIFMA January Letter at 2; see also Healthy Markets January Letter at 4 ("[O]nce the Exchange offers that feed, many market participants are effectively compelled . . . to buy it.").

⁶⁰ See ArcaBook Direct Order, 73 FR 74770, 74779 & 74788 (December 9, 2008) (broker-dealers not required to purchase depth-of-book data to fulfill best execution

Subscription to proprietary market data products is an individual business decision. Individual market participants weigh the value of individual proprietary market data products to their individual business models, and choose to invest in those products whose cost is justified by the benefits the participant expects to gain. In a highly-competitive market, individual broker-dealers may choose to purchase such products to obtain an advantage over their competitors, until so many of their competitors also purchase the same products such that to cease doing so would put a broker-dealer at a disadvantage relative to its peers. However, the fact that some number of broker-dealers all choose to buy certain data products in order to compete with each other in no way means that the purchase of such data products is “required,” or that the exchanges selling such data should be compelled to provide data products at no cost or at costs lower than those set by competitive constraints.⁶¹

Second, data compiled by the Exchange and analyzed by Professor Rysman shows that it is simply not the case that every proprietary market data purchaser buys every proprietary data product, even within a single exchange group. Professor Rysman reviewed market data subscription data from firms that traded on NYSE during two periods, December 2018 and June 2020, and then determined the percentage of firms that subscribed to any proprietary market data products that month from each of four NYSE Group exchanges: NYSE, NYSE American, NYSE Arca, and NYSE National. In both December 2018 and June 2020, less than one-third of the firms in the sample subscribed to proprietary data products from all four of the exchanges. Approximately another third of firms subscribed to proprietary data products from only one of the four exchanges analyzed. Notably, 14.6% (in December 2018) and 12.8% (in June 2020) of the firms analyzed did not subscribe to any proprietary market data products from any of the four exchanges analyzed.⁶²

The data about which of those firms purchased the NYSE Group exchanges’ Integrated Feed products are similar. The majority – approximately 60% of the firms that traded on NYSE (66.0% in December 2018; 59.6% in June 2020) – did not subscribe to any of the Integrated Feed products offered by the four NYSE Group exchanges analyzed. Less than 20% of firms that traded on NYSE (14.6% in December 2018; 19.1% in June 2020) subscribed to the Integrated Feed products from all four NYSE Group exchanges analyzed. In June 2020, of the firms that did subscribe to an Integrated Feed product,

obligations); FINRA Regulatory Notice 15-46 at 3 n.12 (“a firm that regularly accesses proprietary data feeds, in addition to the consolidated SIP feed, for its proprietary trading, would be expected to also be using these data feeds to determine the best market under prevailing market conditions when handling customer orders to meet its best execution obligations”).

⁶¹ See Ordoover Report, supra note 18, ¶ 48 (“A mandated reduction in market data fees also would predictably reduce investment and innovation in the financial platforms, including the production of improved market data products. Such reduced investment could impair the efficiency of the trading mechanism and reduce consumer welfare.”).

⁶² See Rysman Supplemental Paper, supra note 43, § 3.3, Table 1, and accompanying text.

18.3% of them chose not to subscribe to NYSE National Integrated Feed, even though it was offered at that point free of charge.⁶³

These data clearly indicate that even among the NYSE Group of exchanges, not all firms that trade on the exchanges subscribe to all of the proprietary market data products offered, and a significant percentage of such firms subscribe to no proprietary market data products at all.

Third, additional empirical data of the actual user experience of its customers compiled by the Exchange demonstrates that among the broker-dealer firms that are members of the Exchange, only between half and two-thirds of them subscribe to the NYSE National Integrated Feed. In February 2020, when fees were charged for the NYSE National Integrated Feed, only 28 out of 49 total NYSE National member firms, or 57%, subscribed to the feed, while the remaining 43% (21 of the 49 firms) chose not to subscribe to the feed.

Even after the fees were suspended, the empirical evidence shows that the NYSE National Integrated Feed is not required by NYSE National members, but is merely optional. In June 2020, out of the then-48 NYSE National member firms, only 30, or 62.5%, subscribed to the NYSE National Integrated Feed – even though, by that point, the Exchange was offering it free of charge. The members that refrained from subscribing to the feed include several broker-dealers affiliated with global banks, as well as other trading firms.

Fourth, the facts show that subscribers can, will, and do cancel their subscriptions to the NYSE National Integrated Feed if and when they conclude that the fees charged for the product exceed the value the product provides to their individual businesses. This negates any argument that subscribers are in any way “locked-in” to subscriptions for the NYSE National Integrated Feed.

The Exchange announced its proposed fees early, in December 2019, to give market participants time to determine whether the value of the NYSE National Integrated Feed to their businesses was such that they would choose to continue using the product after February 3, 2020, when it would no longer be provided for free. Even before the proposed fees went into effect on February 3, 2020, several customers informed the Exchange that they would be dropping the NYSE National Integrated Feed in response to the Exchange’s fee proposal. As the Exchange noted in the Proposal, five subscribers to the NYSE National Integrated Feed product canceled their subscriptions before the fees went into effect. In each instance, the subscriber told the Exchange that its reason for cancelling its subscription was the imminent imposition of fees. Additionally, at that time, a sixth customer informed the Exchange that if the Exchange were permitted to impose the fees, the customer would cancel its subscription to the NYSE National Integrated Feed product and instead subscribe to the NYSE National

⁶³ *Id.* § 3.3, Table 2, and accompanying text.

BBO feed, which would remain available for free. These six subscribers constituted 10.5 percent of the prior NYSE National Integrated Feed subscriber base.⁶⁴

This trend continued after the proposed fees went into effect on February 3, 2020. After that date, the sixth customer noted above did cancel its subscription to the NYSE National Integrated Feed product. Two more subscribers also requested cancellation of their subscriptions after paying the fees in February and March 2020, citing the fees as their reason for cancelling, but ultimately did not pursue cancellation once the feed became free again in April 2020. In addition, a former subscriber of the feed inquired in February 2020 about resubscribing to it, but did not proceed upon learning of the fees.

In sum, of the 57 subscribers receiving the NYSE National Integrated Feed product in November 2019, eight either canceled or intended to cancel their subscriptions due to the fees imposed by the Exchange – that is 14 percent of the prior subscriber base. These former subscribers include at least one well-known hedge fund, a brokerage firm and investment adviser affiliated with a global bank, and several broker-dealers and investment management firms.⁶⁵ An additional prospective customer walked away upon learning of the fees it would have to pay to receive the feed. This evidence directly rebuts the commenters' contentions that the NYSE National Integrated Feed is a product that all market participants are "required" to purchase and cannot walk away from if they are dissatisfied with its price.⁶⁶ These are precisely the type of "marginal buyers" whose ability to switch away disciplines pricing.⁶⁷ Professor Glosten ignores the actual experience of the marginal purchasers of this data.

⁶⁴ Proposal at 5.

⁶⁵ To preserve customer confidentiality, NYSE National is not identifying these entities in this public comment letter. NYSE National notes, however, that at least a subset of these entities are SIFMA members, and should thus be known to SIFMA. Should the Commission wish to know the identities of these entities, NYSE National would be willing to provide it in a confidential submission.

⁶⁶ Healthy Markets argues that NYSE National should provide additional information both about the subscribers who canceled (e.g., "Why were those firms subscribed in the first place? Were those firms proprietary trading firms or agency brokers? Were they data vendors? Did those firms ever send any orders to the Exchange? How often?" Healthy Markets March Letter at 5-6.) and its remaining subscribers (e.g., "Similarly, the Exchange should update and further detail information about its remaining subscribers." Id. at 6). With respect to the subscribers who canceled, NYSE National has responded in this letter with general descriptions of those subscribers, and can provide the Commission with a confidential submission identifying those subscribers. NYSE National cannot respond to Healthy Markets' request for information such as why those firms – or any subscriber to NYSE National Integrated Feed – initially subscribed, because that information is known only by the subscribers themselves, not NYSE National, especially given that many NYSE National market data customers are also NYSE National competitors.

⁶⁷ See Hendershott & Nevo Report, supra note 18, ¶ 77; Ordovery & Bamberger, Statement in Response to the Commission's Roundtable on Market Data and Market

SIFMA also argues that because “only” five firms canceled their subscriptions before the fees went into effect, “it’s likely that these purchasers are basing their decision on something other than the perceived value of the market data.”⁶⁸ This attempt to introduce speculation into this proceeding ignores the fact that, as noted in the Proposal, each of these five subscribers explicitly informed the Exchange that the reason for ending its subscription was the fact that the Exchange was imposing fees for the product.⁶⁹ If SIFMA had any evidence to contradict NYSE National’s submission (such as from SIFMA members who were among those who canceled subscriptions), NYSE National assumes that SIFMA would have included it in its comment letters. However, on the current undisputed factual record, there is no permissible basis for the Commission to reject NYSE National’s statements regarding the reasons for the cancellations at issue.

Finally, market participants have multiple sources of data other than exchanges to support their trading strategies, and those sources are growing.⁷⁰ This is still more evidence of competition.

In sum, SIFMA and Healthy Markets fail to support their claim that purchase of the feed is compelled. To the contrary, the undisputed facts show that subscribers can, will, and do cancel their subscriptions for the NYSE National Integrated Feed if they conclude that the fees charged for the product outweigh the value the product provides to their businesses. As such, pricing of the NYSE National Integrated Feed is subject to competitive constraints.

Access, available at <https://www.sec.gov/comments/4-729/4729-4930892-178427.pdf>, ¶ 6 (“In general, even if some customers are required to purchase a product from a particular supplier, the price that the supplier sets for the product depends on the choices of customers that do not have to purchase the product. Using economics terminology, the price charged to ‘inframarginal’ customers (those willing to pay more than the going price) is constrained by the actions of ‘marginal’ customers (those who are just indifferent to paying the going price and not purchasing).”).

⁶⁸ See SIFMA March Letter, *supra* note 3.

⁶⁹ Proposal at 16 (“In each instance, the subscriber told the Exchange that the reason for ending its subscription was the imminent imposition of fees.”).

⁷⁰ See, e.g., “Steve Cohen’s Point72 and other hedge funds are sending urgent requests to find a replacement after Robinhood data on hot stock trades suddenly went dark,” Business Insider (August 12, 2020) (discussing alternate sources of data used by hedge funds in running their business strategies and noting that one large fund’s “market-intelligence data team’s job is to find and vet thousands of alternative data providers each year” (emphasis added)).

Ms. Vanessa Countryman
August 14, 2020
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For all the reasons above, the Exchange has adequately supported its argument that the proposed fees are constrained by competition and should be approved by the Commission under the NetCoalition I-approved market-based approach.

Respectfully submitted,



Elizabeth K. King

cc: Honorable Jay Clayton, Chairman
Honorable Hester M. Peirce, Commissioner
Honorable Elad L. Roisman, Commissioner
Honorable Allison Herren Lee, Commissioner
Honorable Caroline A. Crenshaw, Commissioner
Brett Redfearn, Director, Division of Trading and Markets

Attachments

Attachment A

**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA**

UNITED STATES OF AMERICA,

Antitrust Division
U.S. Department of Justice
450 Fifth Street, NW, Suite 7100
Washington, DC 20530

Plaintiff,

v.

DEUTSCHE BÖRSE AG,

Mergenthalerallee 61
65760 Eschborn
Germany

and

NYSE EURONEXT,

11 Wall Street
New York, NY 10005

Defendants.

Case:
Assigned To:
Date:
Description: Antitrust

COMPLAINT

The United States of America, acting under the direction of the Attorney General of the United States, brings this civil action pursuant to the antitrust laws of the United States to enjoin the proposed merger of Deutsche Börse AG (“DB”) and NYSE Euronext (“NYSE”) and to obtain such other equitable relief as the Court deems appropriate. The United States alleges as follows:

NATURE OF ACTION

1. DB is among the largest operators of financial exchanges in the world. While most of its businesses are in Europe, DB, through various subsidiaries, is also the largest unitholder of Direct Edge Holdings LLC (“Direct Edge”), the fourth-largest operator of stock exchanges in the United States. Direct Edge competes head-to-head with NYSE and is an exchange innovator, leading in technology, pricing, and in the development of exchange models.

2. NYSE operates some of the oldest, largest, and most prestigious stock exchanges in the United States. It stands at the center of American financial markets, with its exchanges handling roughly a third of the equities traded daily in the United States, and considerably more for certain equities and certain times of day. NYSE exchanges list the vast majority of the listed exchange-traded products, including the majority of exchange-traded funds, and they supply key market data to customers making investment decisions.

3. On February 15, 2011, NYSE and DB agreed to merge in a transaction worth roughly \$9 billion. NYSE and DB propose to combine under a new Dutch holding company (“NewCo”), which would be the largest exchange group in the world, with dual headquarters in Frankfurt and New York. NewCo would own 100% of NYSE and 31.54% of Direct Edge.

4. The proposed transaction would violate Section 7 of the Clayton Act, 15 U.S.C. § 18, because it would substantially lessen competition and potential competition in at least three lines of commerce in the United States: (a) displayed equities trading services; (b) listing services for exchange-traded products (“ETPs”), including exchange-traded funds (“ETFs”); and (c) real-time proprietary equity data products.

JURISDICTION, VENUE AND COMMERCE

5. The United States brings this action under Section 15 of the Clayton Act, as amended, 15 U.S.C. § 25, to prevent and restrain defendants from violating Section 7 of the Clayton Act, as amended, 15 U.S.C. § 18.

6. The Court has subject matter jurisdiction over this action and the defendants pursuant to Section 15 of the Clayton Act, as amended, 15 U.S.C. § 25, and 28 U.S.C. §§ 1331, 1337(a), and 1345. NYSE and DB provide and sell displayed equity trading services and real-time proprietary equities trading data. NYSE also provides and sells listing services for exchange traded products. Sales of these services in the United States represent a regular, continuous, and substantial flow of interstate commerce, and have a substantial effect upon interstate commerce.

7. This Court has personal jurisdiction over each defendant and venue is proper in this District under Section 12 of the Clayton Act, 15 U.S.C. § 22, and 28 U.S.C. §§ 1391(b)(1) and (c). Defendants transact business within the District of Columbia. DB and NYSE acknowledge personal jurisdiction in this District and consent to venue.

DEFENDANTS AND THE TRANSACTION

8. DB is a German *Aktiengesellschaft* that operates financial exchanges and related businesses in the United States and Europe. It generates revenue from, among other things, listing fees, stock trading transaction fees, market data licensing fees, and technology licensing arrangements. Through its subsidiaries, DB is the largest holder of equity in Direct Edge, a leading stock exchange operator in the United States. DB owns 50% of the equity and controls Frankfurt-based Eurex Group, a leading European derivatives exchange operator. DB has announced an agreement to buy the remaining equity in Eurex after DB completes its merger

with NYSE. Eurex owns International Securities Exchange Holdings, Inc. (“ISE”), a leading options exchange in New York that also owns a 31.54% equity interest in Direct Edge. In 2010, DB’s subsidiaries earned substantial revenues from sales in the United States.

9. NYSE is a publicly traded Delaware corporation with its principal place of business located in New York, New York. The company operates financial exchanges in the United States and Europe. In the United States, NYSE operates three stock exchanges: (i) the New York Stock Exchange LLC; (ii) NYSE Arca, Inc., an all-electronic exchange; and (iii) NYSE Amex LLC, an exchange that lists the stock of primarily small- and medium-sized companies. NYSE generates revenue from, among other things, listing fees, stock trading transaction fees, market data licensing fees, and technology licensing arrangements. In 2010, NYSE earned over \$3 billion in total revenues from within the United States.

10. Direct Edge is a Delaware limited liability company with its principal place of business in Jersey City, New Jersey. Direct Edge, through its subsidiary Direct Edge Holdings, Inc., owns and operates two leading U.S. stock exchanges, EDGA Exchange, Inc. and EDGX Exchange, Inc. Direct Edge is majority-owned by a group including ISE, Goldman Sachs Group Inc., Citadel Investment Group LLC, and Knight Capital Group Inc. ISE owns 31.54% of Direct Edge and holds certain key voting and special veto rights, such as the right to veto entry by Direct Edge into options trading. ISE also has the right to appoint three members to the Direct Edge board of managers and one member to each of the corporate boards of EDGA Exchange, Inc. and EDGX Exchange, Inc. Goldman Sachs, Citadel, and Knight each own 19.9% of Direct Edge. The remaining 8.76% is owned by a group of five brokers, including affiliates of JP Morgan Chase & Co. (through LabMorgan Corp.), Bank of America (through Merrill Lynch L.P. Holdings, Inc.), Nomura Securities International, Inc., Deutsche Bank USA (through DB US

Financial Markets Holding Corporation), and Sun Partners LLC. Direct Edge's exchanges compete head-to-head with the NYSE exchanges. In 2010, Direct Edge earned substantial revenues in the United States.

11. DB and NYSE have proposed to merge into a NewCo that will house all their current corporate holdings. NewCo will be a Dutch holding company, with dual headquarters in New York City and outside Frankfurt, Germany. Combined annual net revenues of NewCo are expected to be over \$5 billion, with revenue sources including market data and technology; equities trading and listings; derivatives trading and listings; and settlement and custody. NewCo will own many of the world's leading brands in finance. Its post-merger leadership will be split between former executives from both NYSE and DB. The current DB Chief Executive Officer will stay on as Chairman, and the current NYSE CEO will remain CEO of the combined entity.

RELEVANT MARKETS

Displayed Equities Trading Services

12. Displayed equities trading services comprise a relevant antitrust product market and a "line of commerce" within the meaning of Section 7 of the Clayton Act. These services include providing mechanisms and ancillary services to facilitate the public purchase and sale of exchange-traded stocks (those defined as "NMS stock" under Rule 600(b)(47) of Regulation NMS, 17 C.F.R. § 200 *et. seq.*). These services are offered mainly by national stock exchanges registered under Section 6 of the Securities Exchange Act of 1934, 15 U.S.C. § 78f, and also by electronic communications networks ("ECNs") regulated by Regulation ATS, 17 C.F.R. §242.300 *et seq.*

13. Several key attributes separate displayed from undisplayed or “dark” equities trading services, including the continuous pre-trade publication of the best-priced quotations for buying and selling exchange-traded stocks in a national consolidated data stream, the display of certain customer limit orders (offers to buy and sell stock at particular prices), and the provision of deep and reliable liquidity for a broad array of exchange-traded stocks. Displayed trading venues, in particular those operated by NYSE, The NASDAQ OMX Group, Inc., Direct Edge, and BATS Global Markets, Inc. form the backbone of the American national market system and over the past several years have accounted for roughly 65% to 75% of the overall average daily trading volume in the United States. Broker-dealers, institutional investors, and other customers rely on displayed trading venues to provide meaningful price discovery for exchange-traded stocks and to act as exchanges of last resort, especially for thinly traded stocks, in times of market volatility or stress.

14. Undisplayed trading services account for roughly 25% to 35% of total average daily trading volume and serve a very different purpose for investors: to allow for anonymous matching of orders without publicly revealing the intention to trade before execution. Institutional investors and other traders use these services to minimize the likelihood that their trades will cause the stock price to move against their interest. Most of the undisplayed trading centers offer less liquidity on most stocks (indeed, an alternative trading system providing undisplayed trading must account for less than 5% trading volume in a stock or the venue automatically becomes displayed by regulations promulgated by the U.S. Securities and Exchange Commission (“SEC”)) and base their prices on those prevailing in the displayed equities trading centers.

15. The relevant geographic market is the United States. Trading equities on a foreign exchange is not an adequate substitute for trading on an exchange in the United States. Trading on an exchange outside the United States exposes traders to risks like foreign exchange risk, country risk, reputational risk, different or potentially lax regulatory environments for trading, lack of analyst coverage, different accounting standards, time differences, and language differences, among other things. Additionally, the majority of American companies choose to list on domestic exchanges. Therefore, to trade most publicly-listed American stocks, investors must use stock exchanges located in the United States.

16. The market for displayed equities trading services in the United States satisfies the hypothetical monopolist test. A profit-maximizing monopolist in the offering of displayed equities trading services in the United States likely would impose at least a small but significant and non-transitory increase in the price of such services. Not enough customers would switch to alternative means of trading equities in undisplayed trading centers or foreign exchanges to render this price increase unprofitable.

Listing Services for Exchange-Traded Products

17. The provision of ETP listing services constitutes a relevant antitrust product market and a “line of commerce” within the meaning of Section 7 of the Clayton Act. An ETP is typically an exchange-listed equity security instrument other than a standard corporate cash equity, the performance of which is designed to track another specific instrument, asset or group of assets, such as a market index or a selected basket of corporate stocks. ETPs are typically sponsored by firms that monitor and manage the composition and performance of the ETP. The most popular type of ETP today is an exchange-traded fund, an equity fund with a form of exchange-listed securities (often trust units) that can be traded like a stock but that is also

benchmarked against another stock, index or other asset. Buying an ETP offers a simple way for investors to diversify their portfolios without having to buy each individual corporate stock or other financial instrument directly. For instance, the SPDR S&P 500 exchange-traded fund tracks the S&P 500 U.S. stock index, which comprises widely held American stocks. ETFs and other ETPs are very popular and serve as the cornerstone of many individual investors' portfolios.

18. The relevant geographic market is the United States. Listing an ETP on a foreign exchange is not an adequate substitute for listing on an exchange in the United States. U.S. sponsors of ETPs overwhelmingly choose to list domestically, because it allows them to build brand awareness and reputation and stay close to U.S. capital markets and investors in the United States considering the purchase and sale of ETFs and other ETPs, as well as the analysts that cover ETPs and ETFs and, in many cases, the underlying or related assets, indexes, or products.

19. The market for ETP listing services in the United States satisfies the hypothetical monopolist test. A profit-maximizing monopolist that was the only present and future firm in the offering of ETP listing services in the United States likely would impose at least a small but significant and non-transitory increase in the price of ETP listings. Not enough customers would switch to alternatives to render this price increase unprofitable.

Real-time Proprietary Equity Data

20. Real-time proprietary equity data is a relevant antitrust product market and a "line of commerce" within the meaning of Section 7 of the Clayton Act. Access to affordable, reliable and timely data about the stock market is essential for informed stock trading. NYSE and Direct Edge are among only four major competitors that aggregate and disseminate certain market data to brokers, dealers, investors, and news organizations. They sell (or with little lead time could

easily sell) competing proprietary market data products derived from trading activities occurring both on and off their exchanges.

21. The product market for real-time proprietary equity data consists of what is commonly referred to in the industry as “non-core” data. Market participants generally refer to two broad categories of critical market data: “core” and “non-core.” Core data refers to the transaction data the SEC requires stock exchanges to report to securities information processors for consolidation and public distribution, including the current best bid and offer for each stock on every exchange and information on each stock trade, including the last sale. Non-core data includes trading volume and “depth of book” data that certain exchanges collect and sell, *i.e.*, the underlying quotation data on any given exchange. Non-core data helps traders determine where liquidity for a given stock exists during the day and the depth of that liquidity. Each exchange (or other trading platform) owns non-core data and can distribute it voluntarily for a profit in competition with data from other exchanges. Non-core data products can be made to replicate core data and exchanges can package and sell both core and non-core data together.

22. The market for real-time proprietary equity data satisfies the hypothetical monopolist test. A profit-maximizing monopolist in the offering of real-time proprietary equity data likely would impose at least a small but significant and non-transitory increase in the price of its equity data products. Not enough customers would switch to other products or services to render this price increase unprofitable.

23. The relevant geographic market is the United States. Real-time proprietary equity data in this context relate only to domestic trading of U.S.-listed stock. Customers needing real-time proprietary equity data relating to U.S.-listed stocks cannot turn to foreign alternatives.

ANTICOMPETITIVE EFFECTS

NYSE and Direct Edge Are Head-to-Head Competitors

24. NYSE and Direct Edge compete head-to-head in displayed equities trading services and in the provision of real-time proprietary equity data products. Direct Edge over the years has been a force in modernizing stock trading with cutting edge technology, faster trading times, lower prices, and new market models. Direct Edge began in 1998 as an electronic communication network named Attain. By 2007, it was a major trading venue owned and supported by broker-dealers Knight Capital, Citadel and Goldman Sachs. These broker-dealers used Direct Edge as a counterweight to the exchange duopoly of NYSE and NASDAQ. In December 2008, Direct Edge and ISE agreed that ISE would buy part of Direct Edge and Direct Edge would take control of the struggling ISE Stock Exchange. In March 2010, Direct Edge received approval from the SEC to convert its two ECNs into national securities exchanges under Section 6 of the Securities Exchange Act of 1934 (“Exchange Act”).

25. Direct Edge was first to offer two trading platforms using the same technology, but with different pricing schemes. EDGA historically has been operated as a lower cost exchange, being typically free or nearly free for many traders to make offers to buy or sell stock at certain posted prices (*i.e.*, “post liquidity”) as well as for customers to trade against these offers and buy and sell stock (*i.e.*, “take liquidity”), making EDGA attractive to traders sensitive to execution charges. Approximately one-third of Direct Edge volume trades over EDGA. EDGX historically has offered a more traditional pricing structure whereby the exchange normally pays customers to post liquidity and charges a fee for them to take liquidity. Although the two platforms have different pricing structures and cater to different segments, they share technology, support, code, and data centers.

26. NYSE has responded to Direct Edge's aggressive tactics in part by improving its own technology and changing its pricing. For example, NYSE in 2009 replaced its trading system in an effort to regain business lost mainly to the sophisticated electronic platforms at Direct Edge and BATS. The new system was faster, reducing transaction processing time to less than 10 milliseconds, which at the time made NYSE roughly as fast as its rivals. NYSE largely was able to stabilize its share of trading volume by implementing a new market model and introducing a new pricing scheme, which gave rebate incentives to certain designated market makers (*i.e.*, those market participants that agreed to buy and sell particular stocks at certain prices for certain amounts of time).

27. Direct Edge's investors, mainly broker-dealers, use its exchanges to put downward pressure on trading fees at NYSE and other exchanges. When possible, Direct Edge's broker-dealer investors often send trades to a Direct Edge exchange in order to keep their overall transaction costs down. In this way, Direct Edge helped spur a 2009 pricing war that substantially reduced the cost of trading stocks in the United States.

28. NYSE and Direct Edge also are head-to-head competitors in the provision of real-time proprietary equity data. Both are well-situated to offer new real-time equity data products and equity data products that replicate portions of core data offerings, but with even faster feeds.

Direct Edge Is A Potential Competitor to NYSE In Listing Services for Exchange-Traded

Products

29. Direct Edge is a potential competitor to NYSE in listing services for ETPs. An ETP, including an ETF, must be listed on a registered stock exchange in order to be widely-traded in the United States. Exchanges typically compete for listings based on market structure, market maker incentives, marketing, and other associated services.

30. NYSE dominates the business of providing listing services for ETPs. NYSE's major competitors are NASDAQ, with a small share, and recent entrant BATS. Direct Edge, as a leading operator of registered stock exchanges, is uniquely situated for entry and already imposes competitive discipline on NYSE: its potential entry has already affected NYSE decisions to innovate and its pricing decisions in its ETP listings business.

This Merger Would Substantially Lessen Competition

31. NYSE and Direct Edge are currently vigorous competitors and closely monitor each other's competitive positions in at least two highly-concentrated markets. They are also close potential competitors in a third highly-concentrated market, listing services for ETPs, in which NYSE is a dominant player. Upon consummation of the proposed transaction, NewCo would own NYSE and would be able to control NYSE's management decisions.

32. Upon consummation of the proposed transaction, NewCo also would become, through ISE, the largest equity owner and most influential member of Direct Edge. NewCo would be able to appoint three of the eleven Direct Edge managers, and one representative to each of the EDGA and EDGX exchange's respective corporate boards. NewCo would have important ancillary rights at Direct Edge: veto rights over certain major corporate actions, representation on key committees, and shareholder rights under corporate law, such as the right

to file shareholder derivative lawsuits. NewCo also would have access to Direct Edge's non-public, competitively sensitive information, and to the company's officers and employees. NewCo's ownership interests and associated rights would give it influence over Direct Edge's management decisions.

33. NewCo's presence on the Direct Edge boards would also likely chill board-level discussions of competition with NYSE. Direct Edge was formed, in part, as a customer-owned foil to NYSE and NASDAQ. When NYSE or NASDAQ fails to innovate or price competitively, broker-dealers can encourage Direct Edge to innovate or can shift their business to Direct Edge. If a NYSE-affiliate were sitting on Direct Edge boards, the broker-dealer board members would likely not want to discuss or reveal Direct Edge's potential innovations or other competitive initiatives targeting NYSE.

34. NewCo would have the incentive and ability to use its ownership, influence, and access to information as to both NYSE and Direct Edge to reduce competition between the companies in markets where they are significant competitors or potential competitors, resulting in an increase in prices or a reduction in innovation and quality for a significant number of trading, listings, and data customers.

ENTRY

35. Supply responses from competitors or entry of new potential competitors in the relevant markets—displayed equities trading services, ETP listing services, and real-time proprietary equity data—would not prevent the likely anticompetitive effects of the proposed merger. The merged firm would possess significant advantages that any new or existing competitor would have to overcome to successfully compete with the merged firm.

36. Barriers to entry into each of these markets are formidable. In the market for displayed equities trading services, any entrant would have to overcome hurdles of reputation, scale and network effects to successfully challenge the incumbents. In ETP listing services, any entrant would have to overcome numerous barriers to successfully challenge NYSE, including regulation, reputation, scale, and liquidity. Direct Edge is in a strong position to enter because it is already a registered stock exchange with reputation, scale and liquidity. Finally, competition in real-time proprietary equity data is largely limited to registered securities exchanges, and is closely linked to and derived from an exchange's presence in trading and market data collection. Only four exchange operators today have large enough public trading volume and existing facilities for collecting, aggregating, and disseminating data to meaningfully compete. They enjoy a significant advantage over any possible entrant.

VIOLATIONS ALLEGED

37. The United States incorporates the allegations of paragraphs 1 through 36.

38. The proposed transaction between DB and NYSE would substantially lessen competition in interstate trade and commerce in violation of Section 7 of the Clayton Act, 15 U.S.C. § 18.

39. Unless restrained, the transaction will have the following anticompetitive effects, among others:

- a. Actual and potential competition between NYSE and Direct Edge in displayed equities trading services and real-time proprietary equity data products in the United States will be substantially lessened;
- b. Potential competition between NYSE and Direct Edge in ETP listing services in the United States will be substantially lessened;

- c. Prices for displayed equities trading services, ETP listing services, and real-time proprietary equity data products likely will increase; and
- d. Innovation in displayed equities trading services, ETP listing services, and real-time proprietary equity data products likely will decrease.

RELIEF REQUESTED

- 40. The United States requests that:
 - a. the proposed merger of NYSE and DB be adjudged to violate Section 7 of the Clayton Act, 15 U.S.C. §18;
 - b. DB and NYSE be enjoined from carrying out the proposed merger or carrying out any other agreement, understanding, or plan by which DB and NYSE would acquire, be acquired by, or merge with each other;
 - c. The United States be awarded the costs of this action; and
 - d. The United States receives such other and further relief as the case requires and the Court deems just and proper.

Dated: December 22, 2011

Respectfully submitted,

FOR PLAINTIFF UNITED STATES:

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/s/ Leslie C. Overton
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**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA**

UNITED STATES OF AMERICA,

Plaintiff,

v.

DEUTSCHE BÖRSE AG,

and

NYSE EURONEXT,

Defendants.

Case:
Assigned to:
Assign. Date:
Description: Antitrust

**PLAINTIFF UNITED STATES’
EXPLANATION OF CONSENT DECREE PROCEDURES**

The United States submits this short memorandum summarizing the procedures regarding the Court’s entry of the proposed Final Judgment. This Judgment would settle this case pursuant to the Antitrust Procedures and Penalties Act, 15 U.S.C. § 16(b)-(h) (the “APPA”), which applies to civil antitrust cases brought and settled by the United States.

1. Today, the United States has filed a Complaint, a proposed Final Judgment, and a Stipulation and Order between the parties by which they have agreed that the Court may enter the proposed Final Judgment after the United States has complied with the APPA. The United States has also filed a Competitive Impact Statement relating to the proposed Final Judgment.

2. The APPA requires that the United States publish the proposed Final Judgment and the Competitive Impact Statement in the Federal Register and cause to be published a

summary of the terms of the proposed Final Judgment and the Competitive Impact Statement in certain newspapers at least sixty (60) days prior to entry of the proposed Final Judgment.

Defendants in this matter have agreed to arrange and bear the costs for the newspaper notices.

The notice will inform members of the public that they may submit comments about the proposed Final Judgment to the United States Department of Justice, Antitrust Division, 15 U.S.C. § 16(b)-(c).

3. During the sixty-day period, the United States will consider, and at the close of that period respond to, any comments that it has received, and it will publish the comments and the United States' responses in the Federal Register.

4. After the expiration of the sixty-day period, the United States will file with the Court the comments and the United States' responses, and it may ask the Court to enter the proposed Final Judgment (unless the United States has decided to withdraw its consent to entry of the Final Judgment, as permitted by Paragraph 2 of the Stipulation, see 15 U.S.C. § 16(d)).

5. If the United States requests that the Court enter the proposed Final Judgment after compliance with the APPA, 15 U.S.C. § 16(e)-(f), then the Court may enter the Final Judgment without a hearing, provided that it concludes that the Final Judgment is in the public interest.

Dated: December 22, 2011

Respectfully submitted,

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**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA**

UNITED STATES OF AMERICA,

Plaintiff,

v.

DEUTSCHE BÖRSE AG,

and

NYSE EURONEXT,

Defendants.

Case:
Assigned To:
Date:
Description: Antitrust

STIPULATION AND ORDER

It is stipulated by and between the undersigned parties, through their respective counsel:

1. The Court has jurisdiction over the subject matter of plaintiff's Complaint alleging defendants Deutsche Börse AG and NYSE Euronext violated Section 7 of the Clayton Act (15 U.S.C. § 18), and the parties do not object either to the Court's exercise of personal jurisdiction over them in this case, or to the propriety of venue of this action in the United States District Court for the District of Columbia. Deutsche Börse AG authorizes Thomas A. McGrath, Esq. and Jeffrey Schmidt, Esq. of Linklaters LLP to accept service of all process in this matter on its behalf, and NYSE Euronext authorizes David A. Schwartz, Esq. of Wachtell, Lipton, Rosen & Katz to accept service of all process in this matter on its behalf.

2. The parties stipulate that a Final Judgment in the form hereto attached may be filed and entered by the Court, upon the motion of any party or upon the Court's own motion, at any time after compliance with the requirements of the Antitrust Procedures and Penalties Act

(15 U.S.C. § 16), and without further notice to any party or other proceedings, provided that plaintiff has not withdrawn its consent, which it may do at any time before the entry of the proposed Final Judgment by serving notice thereof on defendants and by filing that notice with the Court.

3. The defendants agree to arrange, at their expense, publication as quickly as possible of the newspaper notice required by the APPA. The publication shall be arranged no later than five (5) calendar days after the defendants' receipt from the United States of the text of the notice and the identity of the newspaper within which the publication shall be made. Defendants shall promptly send to the United States (1) confirmation that publication of the newspaper notice has been arranged, and (2) the certification of the publication prepared by the newspaper within which notice was published.

4. The defendants stipulate that they shall not consummate the transaction sought to be enjoined by the Complaint herein before the Court has signed this Stipulation and Order.

5. From the date of the signing of this Stipulation by the parties, defendants shall abide by and comply with all the terms and provisions of the proposed Final Judgment as though the same were in full force and effect as an order of the Court, pending entry of the Final Judgment by the Court, or until expiration of time for all appeals of any Court ruling declining entry of the proposed Final Judgment.

6. This Stipulation shall apply with equal force and effect to any amended proposed Final Judgment agreed upon in writing by the parties and submitted to the Court.

7. In the event that (1) the United States withdraws its consent, as provided in paragraph two above, (2) defendants provide notice to the United States and the Court that the Business Combination Agreement dated as of February 15, 2011 has been terminated or that the

Merger of Deutsche Börse and NYSE (as defined in the proposed Final Judgment) has been abandoned; or (3) the proposed Final Judgment is not entered pursuant to this Stipulation, the time has expired for all appeals of any Court ruling declining entry of the proposed Final Judgment, and the Court has not otherwise ordered continued compliance with the terms and provisions of the proposed Final Judgment, then the parties are released from all further obligations under this Stipulation, and the making of this Stipulation shall be without prejudice to any party in this or any other proceeding.

8. The defendants represent that the actions they are required to perform pursuant to the proposed Final Judgment can and will be performed, and that the defendants will later raise no claim of mistake, hardship or difficulty of compliance as grounds for asking the Court to modify any of the provisions contained therein.

Dated: December 22, 2011

Respectfully submitted,

**FOR PLAINTIFF
UNITED STATES OF AMERICA**

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ORDER

It is SO ORDERED by the Court, this __ day of _____, 20__.

United States District Court Judge

**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA**

UNITED STATES OF AMERICA,

Plaintiff,

v.

DEUTSCHE BÖRSE AG,

and

NYSE EURONEXT,

Defendants.

Case:

Assigned To:

Date:

Description: Antitrust

[PROPOSED] FINAL JUDGMENT

WHEREAS, Plaintiff United States of America (“United States”) filed its Complaint on December 22, 2011, the United States and Defendants Deutsche Börse AG and NYSE Euronext, by their respective attorneys, have consented to entry of this Final Judgment without trial or adjudication of any issue of fact or law, and without this Final Judgment constituting any evidence against or admission by any party regarding any issue of fact or law;

AND WHEREAS, Defendants agree to be bound by the provisions of the Final Judgment pending its approval by the Court;

AND WHEREAS, the United States requires that Defendants agree to undertake certain actions and refrain from certain conduct for the purpose of remedying the loss of competition alleged in the Complaint;

AND WHEREAS, Defendants have represented to the United States that the actions and conduct restrictions can and will be undertaken and that Defendants will later raise no claim of

hardship or difficulty as grounds for asking the Court to modify any of the provisions contained below;

NOW THEREFORE, before any testimony is taken, without trial or adjudication of any issue of fact or law, and upon consent of Defendants, it is ORDERED, ADJUDGED AND DECREED:

I. JURISDICTION

This Court has jurisdiction over the subject matter of, and each of the parties to, this action. The Complaint states a claim upon which relief may be granted against defendants under Section 7 of the Clayton Act, as amended, 15 U.S.C. § 18.

II. DEFINITIONS

As used in this Final Judgment:

A. “Deutsche Börse” means defendant Deutsche Börse AG, an *Aktiengesellschaft* organized under the laws of the Federal Republic of Germany with its principal place of business in Eschborn, Germany, its successors and assigns, and its subsidiaries, divisions, groups, affiliates, partnerships, and joint ventures, and their directors, officers, managers, agents, and employees. This definition expressly includes International Securities Exchange Holdings as a subsidiary of Deutsche Börse.

B. “NYSE” means defendant NYSE Euronext, a Delaware corporation with its principal place of business in New York, New York, its successors and assigns, and its subsidiaries, divisions, groups, affiliates, partnerships, and joint ventures, and their directors, officers, managers, agents, and employees.

C. The “Deutsche Börse/NYSE Merger” means the transaction to be undertaken

pursuant to the Business Combination Agreement, dated as of February 15, 2011, by and among Deutsche Börse, NYSE, Alpha Beta Netherlands Holding N.V., and Pomme Merger Corporation, under which Deutsche Börse and NYSE will combine their businesses under a new holding company, Alpha Beta Netherlands Holding N.V.

D. “Direct Edge” means Direct Edge Holdings LLC, a Delaware limited liability company with its principal place of business in Jersey City, New Jersey, its successors and assigns, and its subsidiaries, divisions, groups, affiliates, partnerships, and joint ventures, and their directors, officers, managers, agents, and employees. Direct Edge includes, but is not limited to, its subsidiaries Direct Edge, Inc., EDGA Exchange, Inc. and EDGX Exchange, Inc.

E. “Direct Edge Equity” means any equity interest, whether voting or nonvoting, of Direct Edge that defendants own or control, directly or indirectly, including, but not limited to, the units of interest in the ownership and profits and losses of Direct Edge and such rights to receive distributions from Direct Edge (defined as “Units” in the Operating Agreement) owned by Deutsche Börse through International Securities Exchange Holdings as of the date of the filing of this Final Judgment.

F. “Divestiture Assets” means the Direct Edge Equity required to be divested under this Final Judgment.

G. “International Securities Exchange Holdings” means International Securities Exchange Holdings, Inc., a Delaware corporation with its principal place of business in New York, New York, its successors and assigns, and its subsidiaries, divisions, groups, affiliates, partnerships, and joint ventures, and their directors, officers, managers, agents, and employees.

H. “Mutual Services Agreement” means the Mutual Services Agreement by and between ISE and Direct Edge, dated as of November 4, 2010, including any modifications,

amendments, restatements, or other versions of the Mutual Services Agreement existing at the time of this Final Judgment or in the future.

I. “Operating Agreement” means the Fifth Amended and Restated Limited Liability Company Operating Agreement of Direct Edge Holdings LLC, dated as of June 12, 2010, including any modifications, amendments, restatements, or other versions of the Operating Agreement existing at the time of this Final Judgment or in the future.

J. “Own” means to have or retain any right, title, or interest in any asset, including any ability to control or direct actions with respect to such asset, either directly or indirectly, individually or through any other party.

K. “Regulatory Services Agreements” means the Regulatory Services Agreement by and between ISE and EDGX Exchange, Inc., dated as of January 21, 2010, and the Regulatory Services Agreement by and between ISE and EDGA Exchange, Inc., dated as of January 21, 2010, including any modifications, amendments, restatements, or other versions of the Regulatory Services Agreements existing at the time of this Final Judgment or in the future.

III. APPLICABILITY

This Final Judgment applies to Deutsche Börse and NYSE and all other persons in active concert or participation with any of them who receive actual notice of this Final Judgment by personal service or otherwise.

IV. CERTIFICATION OF PASSIVE INTEREST

A. Defendants are hereby ordered and directed to take all necessary steps to render the Direct Edge Equity passive and to divest the Direct Edge Equity, consistent with the time limits, rights and restrictions specified elsewhere herein and in conformance with all applicable

statutes, rules, regulations, and policies of relevant federal authorities.

B. Defendants are hereby ordered and directed, before closing of the Deutsche Börse/NYSE Merger, to provide a written plan outlining the steps defendants will take to comply with the terms of this Final Judgment, and written certification and supporting documentation to the United States demonstrating that such plan complies with this Final Judgment and that all voting, director, or other rights Deutsche Börse enjoyed under the Operating Agreement, the Certificate of Incorporation and By-Laws of EDGA Exchange, Inc., the Certificate of Incorporation and By-Laws of EDGX Exchange, Inc., or any other organizational documents of Direct Edge, have been eliminated (except any such rights specifically reserved or provided for herein).

V. DIVESTITURE OF DIRECT EDGE EQUITY

A. Defendants are ordered and directed, in a manner consistent with this Final Judgment, on or before two (2) years from the date of closing of the Deutsche Börse/NYSE Merger, to divest the Direct Edge Equity sufficient to cause defendants to own no outstanding equity in Direct Edge. The United States, in its sole discretion, may extend the two (2) year time limit in this Section V.A for up to three (3) additional extensions of one (1) year each upon written application of the Defendants.

B. Defendants are enjoined and restrained from the date of entry by the Court of the Stipulation and Order until the completion of the divestiture required by Section V.A from acquiring, directly or indirectly, any additional Direct Edge equity (including Units, options or any other forms of equity rights or warrants) or ownership interest or rights, except pursuant to a transaction that does not increase defendants' proportion of the outstanding equity of Direct Edge, such as a stock split, stock dividend, rights offering, recapitalization, reclassification,

merger, consolidation, or corporate reorganization. Any additional Direct Edge equity acquired by defendants as specifically permitted in this Section V.B shall be part of the Direct Edge Equity and be subject (1) to the divestiture obligations of Section V.A of this Final Judgment; and (2) to the rights and restrictions set forth herein.

C. The divestiture required by Section V.A may be made by open market sale, public offering, private sale, private placement, repurchase by Direct Edge, or a combination thereof, subject to the restrictions outlined herein. Such divestiture shall not be made by private sale or private placement to any person unless the United States, in its sole discretion, shall otherwise agree in writing pursuant to the procedures set out in Section VIII.

D. Defendants shall notify the United States no less than sixty (60) calendar days prior to the expiration of the time period for divestiture required by Section V.A of this Final Judgment as to the arrangements made to complete the required divestiture in a timely fashion.

E. Upon completion of the divestiture required by Section V.A, defendants may not acquire, directly or indirectly, any additional equity (in any form) or ownership interest or rights in Direct Edge.

F. Defendants may not acquire debt obligations of Direct Edge, enter into any loan agreements with Direct Edge, or provide any financing to Direct Edge.

G. Defendants shall not take any action that will impede in any way the divestiture of the Divestiture Assets.

VI. DIRECT EDGE GOVERNANCE

A. Within two (2) business days after the closing of the Deutsche Börse/NYSE Merger, any Deutsche Börse officer, director, manager, employee, affiliate, or agent shall resign from the Board of Managers or Board of Directors of Direct Edge, Direct Edge, Inc., EDGA

Exchange, Inc., and EDGX Exchange, Inc., and from any executive committees, advisory committees, or other comparable positions.

B. Except to the extent permitted elsewhere herein, from the date of the filing of this Final Judgment and until its expiration, defendants are enjoined and restrained, directly or indirectly, from:

1. Suggesting, designating or nominating, individually or as part of a group, any candidate for election to the Board of Managers or Board of Directors of Direct Edge, Direct Edge, Inc., EDGA Exchange, Inc. or EDGX Exchange, Inc., or having any officer, director, manager, employee, or agent serve as an officer, director, manager, employee, or in a comparable position with or for Direct Edge, Direct Edge, Inc., EDGA Exchange, Inc. or EDGX Exchange, Inc.;
2. participating in, being present at, or receiving any notes, minutes, or agendas of, information from, or any documents distributed in connection with, any nonpublic meeting of the Board of Managers or Board of Directors of Direct Edge, Direct Edge, Inc., EDGA Exchange, Inc., EDGX Exchange, Inc., or any committee thereof, any other governing body of Direct Edge, or any nonpublic meeting of members, shareholders, Unitholders, or any other type of equity owners of Direct Edge in which the business, operations, or ownership of Direct Edge are discussed, except to the extent it is necessary to disclose such information to the defendants in order to implement the provisions of this Final Judgment (the term “meeting” here includes any action taken by consent in lieu of a meeting);
3. voting, causing to be voted or permitting to be voted any Direct Edge shares, Units, or other equity that defendants own in any Direct Edge entity, except to the

extent that Direct Edge determines that Deutsche Börse must vote its Units in Direct Edge, in which case Deutsche Börse shall vote in an amount and manner proportional to the vote of all other votes cast by other Direct Edge owners;

4. using or attempting to use any ownership interest in Direct Edge to exert any influence over Direct Edge in the conduct of Direct Edge's business;
5. using or attempting to use any rights or duties under any agreement or relationship between Deutsche Börse and Direct Edge, including but not limited to the Regulatory Services Agreements and Mutual Services Agreement, to influence Direct Edge in the conduct of Direct Edge's business;
6. communicating to or receiving from any officer, director, manager, member, owner, employee, or agent of Direct Edge any nonpublic information regarding any aspect of defendants' or Direct Edge's business, including any plans or proposals with respect thereto; *provided, however*, that defendants shall be allowed to receive from Direct Edge quarterly financial information, including profit and loss information, of Direct Edge, to the extent necessary for defendants to comply with their financial reporting obligations; and
7. preventing, or attempting to prevent, Direct Edge from making any changes in any corporate governance documents necessary to implement the prohibitions contained in Sections IV.A, IV.B, or in this Section VI. B.

C. Except as set out elsewhere herein, nothing in this Final Judgment is intended to prevent Deutsche Börse from continuing to provide services for Direct Edge under the Regulatory Services Agreements and Mutual Services Agreement or from agreeing with Direct Edge to amend or terminate such agreements.

- a. During the period of any Regulatory Services Agreement and Mutual Services Agreement between defendants and Direct Edge, defendants shall construct and maintain in place a firewall that prevents any information obtained pursuant to those agreements from flowing to any employee of the defendants except those necessary to provide the services under the Regulatory Services Agreements and Mutual Services Agreement. Defendants shall not use information obtained pursuant to the Regulatory Services Agreements and Mutual Services Agreement for any purpose other than in connection with providing the agreed upon services under the Regulatory Services Agreements and Mutual Services Agreement. To implement this provision, defendants are required to identify those employees necessary to provide the services under the Regulatory Services Agreements and Mutual Services Agreement. All identified employees shall be prohibited from passing on information obtained pursuant to the Regulatory Services Agreements and Mutual Services Agreement to non-identified employees, and all non-identified employees shall be prohibited from receiving any information obtained pursuant to the Regulatory Services Agreements and Mutual Services Agreement. For the avoidance of doubt, identified employees of the defendants may become employees of a self-regulatory organization (as that term is defined in Section 3(a)(26) of the Securities Exchange Act of 1934) other than a self-regulatory organization owned or operated by the defendants and such employees may continue to receive information obtained pursuant to the Regulatory Services Agreements and Mutual Services Agreement as necessary to provide the services under the Regulatory Services Agreements and Mutual Services Agreement.

- b. Defendants shall, within ten (10) business days of the entry of the Stipulation and Order, submit to the Department of Justice a document setting forth in detail its procedure to effect compliance with provision VI.C.a. The Department of Justice shall have the sole discretion to approve defendant's compliance plan and shall notify defendants within three (3) business days whether it approves of or rejects the compliance plan. In the event that defendant's compliance plan is rejected, the reasons for the rejection shall be provided to defendants and defendants shall be given the opportunity to submit, within two (2) business days of receiving the notice of rejection, a revised compliance plan. If the parties cannot agree on a compliance plan within an additional three (3) business days, a plan will be devised by the Department of Justice and implemented by defendants.

VII. APPOINTMENT OF TRUSTEE

A. In the event that the United States, in its sole discretion, determines (a) that, upon receipt of the notice called for in Section V.D, defendants have not made arrangements that will result in completion of any divestiture within the time limits specified in Section V.A, (b) that defendants have not completed the divestiture required in Section V.A within the specified time limits, or (c) the defendants have not complied with the requirements of Section IV herein, the Court shall, upon application of the United States, appoint a trustee selected by the United States to effect such divestiture. Plaintiff may request a trustee before any of the time periods for divestiture specified in Section V.A expire. After the appointment of a trustee becomes effective, only that trustee shall have the right to sell the Divestiture Assets. The trustee shall have the power and authority to accomplish the divestiture to an acquirer(s) acceptable to the United States at such price and on such terms as are then obtainable upon the best reasonable effort by

the trustee, and shall have such other powers as the Court shall deem appropriate. The trustee may hire at the cost and expense of defendants any investment bankers, attorneys, or other agents, who shall be solely accountable to the trustee, reasonably necessary in the trustee's judgment to assist in the divestiture.

B. Defendants shall not object to a sale by the trustee on any ground other than the trustee's malfeasance. Any such objections by defendants must be conveyed in writing to the United States and the trustee within ten (10) calendar days after the trustee has provided the notice required under Sections VII.E and F.

C. The trustee shall serve at the cost and expense of defendants, on such terms and conditions as the United States approves, and shall account for all monies derived from the sale of the assets sold by the trustee and all costs and expenses so incurred. After approval by the Court of the trustee's accounting, including fees for its services and those of any professionals and agents retained by the trustee, all remaining money shall be paid to defendants and the trust shall then be terminated. The compensation of the trustee and any professionals and agents retained by the trustee shall be reasonable in light of the value of the Divestiture Assets and based on a fee arrangement providing the trustee with incentives based on the price and terms of the divestiture and the speed with which they are accomplished, but timeliness is paramount.

D. Defendants shall use their best efforts to assist the trustee in accomplishing the required divestiture. The trustee and any consultants, accountants, attorneys, and other persons retained by the trustee shall have full and complete access to all information held by defendants relating to the Divestiture Assets. Defendants shall take no action to interfere with or to impede the trustee's accomplishment of the divestiture.

E. After its appointment, the trustee shall file monthly reports with the United States

and the Court setting forth the trustee's efforts to accomplish the divestiture ordered under this Final Judgment. To the extent that such reports contain information that the trustee deems confidential, such reports shall not be filed in the public docket of the Court. Such reports shall include the name, address, and telephone number of each person who, during the preceding month, made an offer to acquire, expressed an interest in acquiring, entered into negotiations to acquire, or was contacted or made an inquiry about acquiring, any interest in the Divestiture Assets by means of private sale or placement, and shall describe in detail each contact with any such person. The trustee shall maintain full records of all efforts made to divest the Divestiture Assets.

F. If the trustee has not accomplished such divestiture within six (6) months after his or her appointment, the trustee shall promptly file with the Court a report setting forth: (1) the trustee's efforts to accomplish the required divestiture, (2) the reasons, in the trustee's judgment, why the required divestiture has not been accomplished, and (3) the trustee's recommendations. To the extent such reports contain information that the trustee deems confidential, such reports shall not be filed in the public docket of the Court. The trustee at the same time shall furnish such reports to the United States, which shall have the right to make additional recommendations consistent with the purpose of the trust. The Court thereafter shall enter such orders as it deems appropriate to carry out the purpose of this Final Judgment, which may, if necessary, include extending the trust and the term of the trustee's appointment by a period requested by the United States.

VIII. NOTICE OF PROPOSED DIVESTITURE

A. Within two (2) business days following execution of a definitive divestiture agreement for private sale or private placement, defendants or the trustee, whichever is then

responsible for effecting the divestiture required herein, shall notify the United States of any proposed divestiture required by this Final Judgment. If the trustee is responsible, it shall similarly notify defendants. The notice shall set forth the details of the proposed divestiture and list the name, address, and telephone number of each person not previously identified who offered or expressed an interest in or desire to acquire any ownership interest in the Divestiture Assets, together with full details of the same.

B. Within fifteen (15) calendar days of receipt by the United States of such notice, the United States may request from defendants, the proposed Acquirer(s), any other third party, or the trustee, if applicable, additional information concerning the proposed divestiture, the proposed Acquirer(s), and any other potential Acquirer. Defendants and the trustee shall furnish any additional information requested within fifteen (15) calendar days of the receipt of the request, unless the parties shall otherwise agree.

C. Within thirty (30) calendar days after receipt of the notice or within twenty (20) calendar days after the United States has been provided the additional information requested from defendants, the proposed Acquirer(s), any third party, and the trustee, whichever is later, the United States shall provide written notice to defendants and the trustee, if there is one, stating whether or not it objects to the proposed divestiture. If the United States provides written notice that it does not object, the divestiture may be consummated, subject only to defendants' limited right to object to the sale under Section VII.B of this Final Judgment. Absent written notice that the United States does not object to the proposed Acquirer(s) or upon objection by the United States, a divestiture proposed under Section V or Section VII shall not be consummated. Upon objection by defendants under Section VII.B, a divestiture proposed under Section VII shall not be consummated unless approved by the Court.

IX. FINANCING

Defendants shall not finance all or any part of any purchase made pursuant to this Final Judgment.

X. COMPLIANCE INSPECTION

A. For the purpose of determining or securing compliance with this Final Judgment, or determining whether the Final Judgment should be modified or vacated, and subject to any legally recognized privilege, duly authorized representatives of the United States Department of Justice, including consultants and other persons retained by the United States, shall, upon written request of a duly authorized representative of the Assistant Attorney General in charge of the Antitrust Division, and on reasonable notice to defendants, be permitted:

1. access during defendants' office hours to inspect and copy, or at the option of the United States, to require defendants to provide hard copies or electronic copies of, all books, ledgers, accounts, records, data, and documents in the possession, custody, or control of defendants, relating to any matters contained in this Final Judgment; and
2. to interview, either informally or on the record, defendants' officers, employees, or agents, who may have their individual counsel present, regarding such matters. The interviews shall be subject to the reasonable convenience of the interviewee and without restraint or interference by defendants.

B. Upon written request of a duly authorized representative of the Assistant Attorney General in charge of the Antitrust Division, defendants shall submit written reports or responses to written interrogatories, under oath if requested, relating to any of the matters contained in this

Final Judgment as may be requested.

C. No information or documents obtained by the means provided in this section shall be divulged by the United States to any person other than an authorized representative of the executive branch of the United States, except in the course of legal proceedings to which the United States is a party (including grand jury proceedings), or for the purpose of securing compliance with this Final Judgment, or as otherwise required by law.

D. If, at the time information or documents are furnished by defendants to the United States, defendants represent and identify in writing the material in any such information or documents to which a claim of protection may be asserted under Rule 26(c)(1)(G) of the Federal Rules of Civil Procedure, and defendants mark each pertinent page of such material, "Subject to claim of protection under Rule 26(c)(1)(G) of the Federal Rules of Civil Procedure," then the United States shall give defendants ten (10) calendar days notice prior to divulging such material in any legal proceeding (other than a grand jury proceeding).

XI. NO REACQUISITION

Defendants may not reacquire any part of the Divestiture Assets or any other equity interest in Direct Edge during the term of this Final Judgment.

XII. RETENTION OF JURISDICTION

This Court retains jurisdiction to enable any party to this Final Judgment to apply to this Court at any time for such further orders and directions as may be necessary or appropriate to carry out or construe this Final Judgment, to modify or terminate any of its provisions, to enforce compliance, and to punish any violations of its provisions.

XIII. EXPIRATION OF FINAL JUDGMENT

Unless extended by this Court, this Final Judgment shall expire ten (10) years from the date of its entry.

XIV. PUBLIC INTEREST DETERMINATION

Entry of this Final Judgment is in the public interest. The parties have complied with the requirements of the Antitrust Procedures and Penalties Act, 15 U.S.C. § 16, including making copies available to the public of this Final Judgment, the Competitive Impact Statement, and any comments thereon and the United States's responses to comments. Based upon the record before the Court, which includes the Competitive Impact Statement and any comments and response to comments filed with the Court, entry of this Final Judgment is in the public interest.

DATED: _____

Court approval subject to
the Antitrust Procedures and
Penalties Act, 15 U.S.C. § 16.

United States District Judge

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA**

UNITED STATES OF AMERICA,

Plaintiff,

v.

DEUTSCHE BÖRSE AG,

and

NYSE EURONEXT,

Defendants.

Case:
Assigned to:
Assign. Date:
Description: Antitrust

COMPETITIVE IMPACT STATEMENT

Plaintiff United States of America (“United States”), pursuant to Section 2(b) of the Antitrust Procedures and Penalties Act (“APPA” or “Tunney Act”), 15 U.S.C. § 16(b)-(h), files this Competitive Impact Statement relating to the proposed Final Judgment submitted for entry in this civil antitrust proceeding.

I. NATURE AND PURPOSE OF THIS PROCEEDING

On February 15, 2011, NYSE Euronext (“NYSE”) and Deutsche Börse AG (“DB”), two of the world’s leading owners and operators of financial exchanges, agreed to merge in a transaction valued at approximately \$9 billion. NYSE and DB are seeking to combine their businesses and create the largest exchange group in the world under a new Dutch holding company (“NewCo”). NewCo would have dual headquarters in Frankfurt and New York.

Both NYSE and DB have substantial operations in the United States, including between them interests in five major American stock exchanges. NYSE is one of the two largest and most prestigious stock exchange operators in the United States. It owns the New York Stock Exchange LLC, NYSE Arca, Inc., and NYSE Amex LLC. DB, through a series of subsidiaries, is the largest unitholder of Direct Edge Holdings LLC (“Direct Edge”), which operates the EDGA and EDGX electronic exchanges and is the fourth largest stock exchange operator in the United States by volume of shares traded. Direct Edge is considered an innovator in the exchange space and a competitive constraint on NYSE. This transaction therefore poses a significant risk that NewCo could use its influence to dampen the competitive zeal of Direct Edge. The United States brought this lawsuit on December 22, 2011, seeking to enjoin the proposed transaction. After a thorough investigation, the United States believes that the likely effect of the merger would be to lessen substantially competition and potential competition in displayed equities trading services, listing services for exchange-traded products, including exchange-traded funds, and real-time proprietary equity data products in the United States in violation of Section 7 of the Clayton Act, 15 U.S.C. § 18.

Simultaneous with the filing of the complaint, the United States filed a proposed Final Judgment designed to remedy the Section 7 violation. Under the proposed Final Judgment, which is explained more fully below, Defendants are subject to affirmative obligations to divest DB of its holdings in Direct Edge and to immediately eliminate DB’s ability, through its subsidiaries, to influence the business and governance of Direct Edge.

The United States and Defendants have stipulated that the proposed Final Judgment may be entered after compliance with the APPA, unless the United States withdraws its consent. Entry of the proposed Final Judgment would terminate this action, except that this

Court would retain jurisdiction to construe, modify, or enforce the proposed Final Judgment and to punish violations thereof.

II. DESCRIPTION OF THE EVENTS GIVING RISE TO THE ALLEGED VIOLATION

A. The Defendants and the Proposed Transaction

DB is a German *Aktiengesellschaft* that runs financial exchanges and ancillary businesses in the United States and Europe. DB generates revenue from several sources, including fees for securities listings and trading, fees for market data, and charges for licensing of exchange-related technology. DB, through its subsidiaries, is the largest holder of equity in Direct Edge, a leading stock exchange operator in the United States. DB owns 50% of the equity and controls Frankfurt-based Eurex Group, a leading European derivatives exchange operator. DB has announced an agreement to buy the remaining equity in Eurex after DB completes its merger with NYSE. Eurex owns International Securities Exchange Holdings, Inc. (“ISE”), a leading options exchange in New York that also owns a 31.54% equity interest in Direct Edge. In 2010, DB’s ISE and Eurex subsidiaries earned substantial revenues from sales in the United States.

NYSE is a publicly traded Delaware corporation with its principal place of business in New York, New York. NYSE operates financial exchanges in the United States and across Europe. In the United States, NYSE operates the New York Stock Exchange, which is the storied hybrid exchange with both trading floor and electronic components; NYSE Arca, which is an all-electronic exchange; and NYSE Amex, the former American Stock Exchange, which targets mainly small- and medium-sized companies. NYSE also generates revenue from a wide range of exchange-related businesses, including securities listings, trading, data licensing,

and technology licensing. In 2010, NYSE earned more than \$3 billion in total revenues from within the United States.

Direct Edge is a Delaware limited liability company with its principal place of business in Jersey City, New Jersey. Direct Edge, through its subsidiary Direct Edge Holdings, Inc., owns and operates two leading U.S. stock exchanges, EDGA Exchange, Inc. and EDGX Exchange, Inc. Direct Edge is majority-owned by ISE, Goldman Sachs Group Inc., Citadel Investment Group LLC, and Knight Capital Group Inc. ISE owns 31.54% of Direct Edge and holds certain key voting and special veto rights, such as the right to veto entry by Direct Edge into options trading. ISE also has the right to appoint three members to the Direct Edge board of managers and one member to each of the corporate boards of EDGA Exchange, Inc. and EDGX Exchange, Inc. Goldman Sachs, Citadel, and Knight each own 19.9% of Direct Edge. The remaining 8.76% is owned by a group of five brokers, including affiliates of JP Morgan Chase & Co. (through LabMorgan Corp.), Bank of America (through Merrill Lynch L.P. Holdings, Inc.), Nomura Securities International, Inc., Deutsche Bank USA (through DB US Financial Markets Holding Corporation), and Sun Partners LLC. Direct Edge's exchanges compete head to head with the NYSE exchanges. In 2010, Direct Edge earned substantial revenues from within the United States.

B. Relevant Markets

Antitrust law, including Section 7 of the Clayton Act, protects consumers from anticompetitive conduct, such as a firm's acquisition of the ability to raise prices or reduce innovation. Market definition assists antitrust analysis by focusing attention on those markets where competitive effects are likely to be felt. Well-defined markets include both sellers and buyers, whose conduct most strongly influences the nature and magnitude of competitive

effects. Defining relevant markets in merger cases frequently begins by identifying a collection of products or set of services over which a hypothetical profit maximizing monopolist likely would impose at least small but significant and non-transitory increase in price. Defining markets in this way ensures that antitrust analysis takes account of a broad enough set of products to evaluate whether a transaction is likely to lead to a substantial lessening of competition.

Here, the investigation revealed three relevant markets. The first is displayed equities trading services, which includes stock trading services offered by trading venues that publicly disclose certain key information about quotes and transactions. Registered stock exchanges and electronic communication networks offer such displayed trading services. Displayed trading services are accompanied by the continuous pre-trade publication of the best-priced quotations for buying and selling exchange-traded stocks in a national consolidated data stream, the display of certain customer limit orders (offers to buy and sell stock at particular prices), and the provision of deep and reliable liquidity for a broad array of exchange-traded stocks. Displayed equities trading services form the backbone of the American national market system and facilitate equity price discovery in the United States. Displayed services are by their nature very different from undisplayed equity trading services, like dark pools, which offer no pre-trade transparency and cater mainly to institutional traders looking to buy or sell large volumes of stock while minimizing stock price movement.

A second relevant market consists of the listing services for exchange-traded products (“ETPs”). An ETP is typically an exchanged-listed equity security instrument other than a standard corporate cash equity, the performance of which is designed to track another specific instrument, asset or group of assets, such as a market index or a specific basket of corporate

stocks. ETPs typically are sponsored by firms that determine the composition of the ETP and then manage it for investors. The most popular type of ETP today is an exchange-traded fund (“ETF”), which is a security traded like a stock that is designed to replicate the returns of a stock, index or similar asset. Exchanges compete to list, or offer for trading, ETPs in exchange for listing fees and fees for ancillary services. Exchanges compete for listings mainly on the basis of their market structure, market maker incentives, marketing, and other associated services. ETP listings are a separate relevant market because there are no reasonable substitutes for listing an ETP if a sponsoring firm wants a widely-traded product with access to the liquidity offered by exchanges. In addition to which, only registered exchanges can offer these listing services.

A third relevant market encompasses real-time proprietary equity data products comprised of non-core data. There are two general types of equity data: “core” and “non-core.” Core data refers to the transaction data the U.S. Securities and Exchange Commission requires stock exchanges to aggregate and distribute publicly, including the current best bid and offer for each stock on every exchange and information on each stock trade, including the last sale. Non-core data includes trading volume and “depth of book” data that certain exchanges collect and sell, *i.e.*, the underlying quotation data on any given exchange. Non-core data helps traders determine where liquidity for a given stock exists during the day and the depth of that liquidity. Access to market data is critical to many market participants and followers, who are willing to pay a premium for the best price, quote, volume, and other data available about exchange-listed equities being traded on the exchanges. Each exchange (or other trading venue) owns its non-core data and can distribute it for a profit. Proprietary data products can be made to replicate core data and exchanges can package and provide both core

and non-core data together. NYSE and Direct Edge, as registered exchange operators, are among only four major competitors supplying real-time proprietary equity data products derived from trading activities.

Antitrust analysis must also consider the geographic dimensions of competition. Here, the relevant geographic markets exist within the United States and are not affected by competition outside the United States. The competitive dynamics for each of the three markets is distinctly different outside the United States.

C. Competitive Effects

NewCo would have the incentive and ability to significantly influence the competitive conduct of Direct Edge through ISE's voting interest, governance rights, or other shareholder rights under corporate law, like the right to file shareholder derivative suits. NewCo would likely use its influence to induce Direct Edge to compete less aggressively, to coordinate Direct Edge's conduct with the NYSE exchanges, or to disrupt day-to-day business activities at Direct Edge.

NewCo's presence on the Direct Edge boards would chill discussion of head-to-head competition with the NYSE stock exchanges. Direct Edge was formed, in part, by a group of broker-dealers intending to constrain the two large stock exchange operators in the United States, NYSE and NASDAQ. The broker-dealer owners of Direct Edge, and others, can and do turn their trades to Direct Edge when NYSE or NASDAQ fails to compete aggressively.

Finally, NewCo also would gain access to non-public, competitively sensitive information about Direct Edge. This access would likely enhance NewCo's ability to coordinate the behavior of the NYSE and Direct Edge exchanges, or make the accommodating responses of NYSE faster and more targeted. And if Direct Edge gained access to

competitively sensitive NYSE information, it would further elevate the risk of coordinated effects.

Finally, even if it were unable to influence Direct Edge, NewCo would likely have, as a result of the partial ownership interest in Direct Edge, a reduced incentive to direct the NYSE exchanges to compete as aggressively against the Direct Edge exchanges. Since NewCo would share Direct Edge's losses inflicted by the NYSE exchanges, this may lead NewCo to behave in ways that would reduce those losses.

Supply responses from competitors or entry of potential competitors in any of the relevant markets would not prevent the likely anticompetitive effects of the proposed merger. The merged firm would possess significant advantages that any new or existing competitor would have to overcome to successfully compete with the merged firm. Entrants face significant entry barriers including hurdles of reputation, scale and network effects to successfully challenge the incumbents in the markets for displayed equities trading services, listing services for ETPs, and real-time proprietary equity data products.

III. EXPLANATION OF THE PROPOSED FINAL JUDGMENT

The proposed Final Judgment is designed to preserve competition in displayed equities trading services, listing services for exchange-traded products, and real-time proprietary equity data products by restricting NewCo's ability to influence Direct Edge and by eliminating NewCo's equity stake in Direct Edge. The proposed Final Judgment has two principal requirements: (1) the complete divestiture of Defendants' equity stake in Direct Edge, and (2) the immediate suspension of Defendants' ability to participate in the governance or business of Direct Edge. The proposed Final Judgment also has several sections designed to ensure its effectiveness and adequate compliance. Each of these sections is discussed below.

Before closing the DB-NYSE transaction, the proposed Final Judgment requires the Defendants provide a written plan explaining the steps they will take to render DB's interest in Direct Edge passive until such time as the divestiture occurs. Defendants must also certify that the plan complies with all applicable laws and that all voting, director, or other rights DB held have been eliminated, except as otherwise been provided for in the order. Within two calendar days of closing the transaction, any DB officer, director, manager, employee, affiliate, or agent must resign from the boards of all Direct Edge entities.

Further, from the date of the filing of the Final Judgment, the Defendants are prohibited from suggesting or nominating any candidate for election to the board of any Direct Edge entities or having any officer, director, manager, employee, or agent serve as an officer, director, manager, employee with or for any Direct Edge entities. The Defendants are also prohibited from any participation in a nonpublic meeting of any Direct Edge entities or in otherwise receiving any nonpublic information from any Direct Edge employee or board member, except to the extent necessary to fulfill the provisions of the proposed Final Judgment or to fulfill financial reporting obligations. The Defendants are further prohibited from voting except to the extent necessary to fulfill the provisions of the proposed Final Judgment, in which case they must vote their shares in proportion to how the other owners vote.

The Defendants are also prohibited from using their ownership interest in Direct Edge to exert any influence over it or to prevent it from making any necessary changes to its corporate governance documents to comply with the Final Judgment. The proposed Final Judgment provides that the Defendants must continue to provide regulatory and backup facility services to Direct Edge pursuant to existing contracts, and requires that the Defendants implement a firewall to prevent any inappropriate use of information gained by the Defendants

about Direct Edge's business as a result of those contracts. The firewall requires that only the employees of the Defendants specifically necessary to provide the agreed upon services may receive any information from Direct Edge under those agreements, and those employees are prohibited from using any such information for any purpose other than providing the agreed upon services. This provision will allow Direct Edge to continue to receive its contracted services while reducing the opportunities for the Defendants to misuse any information provided by Direct Edge under the agreement. The anticipated effect of all these provisions is to maintain Direct Edge as an independent and viable competitor.

The proposed Final Judgment provides a two-year period, which the United States in its sole discretion may extend up to three additional years, for Defendants to divest all equity ownership in Direct Edge. The assets may be divested by open market sale, public offering, private sale, private placement, or repurchase by Direct Edge. If the assets are divested by private sale or private placement the United States must, in its sole discretion, approve the buyers of the assets. This provision ensures that the divestiture itself does not create any competitive issues. To maintain the complete independence of Direct Edge after the divestiture, the proposed Final Judgment prohibits the Defendants from financing any part of any purchase made pursuant to the Final Judgment.

In the event that Defendants are unable to take the steps required by the proposed Final Judgment to render their Direct Edge interest passive or create a plan demonstrating their compliance with the proposed Final Judgment, or do not accomplish the divestiture as prescribed in the proposed Final Judgment, Section VII of the Final Judgment provides that the Court will appoint a trustee selected by the United States to effect the divestiture upon the request of the United States. If a trustee is appointed, the proposed Final Judgment provides

that Defendants will pay all costs and expenses of the trustee. After his or her appointment becomes effective, the trustee will file monthly reports with the Court and the United States setting forth his or her efforts to accomplish the divestiture. At the end of six months, if the divestiture has not been accomplished, the trustee and the United States will make recommendations to the Court, which shall enter such orders as appropriate in order to carry out the purpose of the trust, including extending the trust or the term of the trustee's appointment.

The proposed Final Judgment lasts for ten years, and prohibits the Defendants from acquiring any additional equity interest in Direct Edge during that time. It also provides procedures for the United States to access the Defendants' records and personnel in order to secure compliance with the terms of the Final Judgment.

The proposed Final Judgment will eliminate the anticompetitive effects of the acquisition by maintaining Direct Edge as an independent and vibrant competitive constraint in displayed equities trading services, listing services for exchange-traded products, and real-time proprietary equity data products in the United States.

IV. REMEDIES APPLICABLE TO POTENTIAL PRIVATE LITIGANTS

Section 4 of the Clayton Act, 15 U.S.C. § 15, provides that any person who has been injured as a result of conduct prohibited by the antitrust laws may bring suit in federal court to recover three times the damages the person has suffered, as well as costs and reasonable attorneys' fees. Entry of the proposed Final Judgment will neither impair nor assist the bringing of any private antitrust damage action. Under the provisions of Section 5(a) of the Clayton Act, 15 U.S.C. § 16(a), the proposed Final Judgment has no *prima facie* effect in any subsequent private lawsuit that may be brought against Defendants.

V. **PROCEDURES APPLICABLE FOR APPROVAL OR MODIFICATION
OF THE PROPOSED FINAL JUDGMENT**

The United States and Defendants have stipulated the proposed Final Judgment may be entered by the Court after compliance with the provisions of the APPA, provided that the United States has not withdrawn its consent. The APPA conditions entry upon the Court's determination that the proposed Final Judgment is in the public interest.

The APPA provides a period of at least 60 days preceding the effective date of the proposed Final Judgment within which any person may submit to the United States written comments regarding the proposed Final Judgment. Any person who wishes to comment should do so within 60 days of the date of publication of this Competitive Impact Statement in the Federal Register, or the last date of publication in a newspaper of the summary of this Competitive Impact Statement, whichever is later. All comments received during this period will be considered by the United States, which remains free to withdraw its consent to the proposed Final Judgment at any time prior to the Court's entry of judgment. The comments and the response of the United States will be filed with the Court and published in the Federal Register.

Written comments should be submitted to:

James J. Tierney
Chief, Networks & Technology Enforcement Section
Antitrust Division
United States Department of Justice
450 Fifth Street, NW, Suite 7100
Washington, DC 20530

The proposed Final Judgment provides that the Court retains jurisdiction over this action, and the parties may apply to the Court for any order necessary or appropriate for the modification, interpretation, or enforcement of the Final Judgment.

VI. ALTERNATIVES TO THE PROPOSED FINAL JUDGMENT

The United States considered, as an alternative to the proposed Final Judgment, seeking preliminary and permanent injunctions against Defendants' transaction and proceeding to a full trial on the merits. The United States is satisfied, however, that the relief in the proposed Final Judgment will preserve competition in the markets for displayed equities trading services, listing services for exchange-traded products, and real-time proprietary equity data products. Thus, the proposed Final Judgment would protect competition as effectively as would any remedy available through litigation, but avoids the time, expense, and uncertainty of a full trial on the merits.

**VII. STANDARD OF REVIEW UNDER THE APPA
FOR PROPOSED FINAL JUDGMENT**

The Clayton Act, as amended by the APPA, requires that proposed consent judgments in antitrust cases brought by the United States be subject to a 60-day comment period, after which the Court shall determine whether entry of the proposed Final Judgment “is in the public interest.” 15 U.S.C. § 16(e)(1). In making that determination, the Court, in accordance with the statute as amended in 2004, is required to consider:

- (A) the competitive impact of such judgment, including termination of alleged violations, provisions for enforcement and modification, duration of relief sought, anticipated effects of alternative remedies actually considered, whether its terms are ambiguous, and any other competitive considerations bearing upon the adequacy of such judgment that the court deems necessary to a determination of whether the consent judgment is in the public interest; and
- (B) the impact of entry of such judgment upon competition in the relevant market or markets, upon the public generally and individuals alleging specific injury from the violations set forth in the complaint including consideration of the public benefit, if any, to be derived from a determination of the issues at trial.

15 U.S.C. § 16(e)(1)(A) & (B). In considering these statutory factors, the Court's inquiry is necessarily a limited one as the United States is entitled to "broad discretion to settle with the Defendant within the reaches of the public interest." *United States v. Microsoft Corp.*, 56 F.3d 1448, 1461 (D.C. Cir. 1995); *see generally United States v. SBC Commc'ns, Inc.*, 489 F. Supp. 2d 1 (D.D.C. 2007) (assessing public interest standard under the Tunney Act); *United States v. InBev N.V./S.A.*, 2009-2 Trade Cas. (CCH) ¶ 76,736, 2009 U.S. Dist. LEXIS 84787, No. 08-1965 (JR), at *3 (D.D.C. Aug. 11, 2009) (noting that the court's review of a consent judgment is limited and only inquires "into whether the government's determination that the proposed remedies will cure the antitrust violations alleged in the complaint was reasonable, and whether the mechanism to enforce the final judgment are clear and manageable").¹

Under the APPA a court considers, among other things, the relationship between the remedy secured and the specific allegations set forth in the United States's complaint, whether the decree is sufficiently clear, whether enforcement mechanisms are sufficient, and whether the decree may positively harm third parties. *See Microsoft*, 56 F.3d at 1458-62. With respect to the adequacy of the relief secured by the decree, a court may not "engage in an unrestricted evaluation of what relief would best serve the public." *United States v. BNS, Inc.*, 858 F.2d 456, 462 (9th Cir. 1988) (citing *United States v. Bechtel Corp.*, 648 F.2d 660, 666 (9th Cir. 1981)); *see also Microsoft*, 56 F.3d at 1460-62; *United States v. Alcoa, Inc.*, 152 F. Supp. 2d 37, 40 (D.D.C. 2001); *InBev*, 2009 U.S. Dist. LEXIS 84787, at *3. Courts have held that:

[t]he balancing of competing social and political interests affected by a proposed antitrust consent decree must be left, in the first instance, to

¹ The 2004 amendments substituted "shall" for "may" in directing relevant factors for a court to consider and amended the list of factors to focus on competitive considerations and to address potentially ambiguous judgment terms. *Compare* 15 U.S.C. § 16(e) (2004), *with* 15 U.S.C. § 16(e)(1) (2006); *see also SBC Commc'ns*, 489 F. Supp. 2d at 11 (concluding that the 2004 amendments "effected minimal changes" to Tunney Act review).

the discretion of the Attorney General. The court's role in protecting the public interest is one of insuring that the government has not breached its duty to the public in consenting to the decree. The court is required to determine not whether a particular decree is the one that will best serve society, but whether the settlement is '*within the reaches of the public interest.*' More elaborate requirements might undermine the effectiveness of antitrust enforcement by consent decree.

Bechtel, 648 F.2d at 666 (emphasis added) (citations omitted).² In determining whether a proposed settlement is in the public interest, a district court "must accord deference to the government's predictions about the efficacy of its remedies, and may not require that the remedies perfectly match the alleged violations." *SBC Commc'ns*, 489 F. Supp. 2d at 17; *see also Microsoft*, 56 F.3d at 1461 (noting the need for courts to be "deferential to the government's predictions as to the effect of the proposed remedies"); *United States v. Archer-Daniels-Midland Co.*, 272 F. Supp. 2d 1, 6 (D.D.C. 2003) (noting that the court should grant due respect to the United States's prediction as to the effect of proposed remedies, its perception of the market structure, and its views of the nature of the case).

In addition, "a proposed decree must be approved even if it falls short of the remedy the court would impose on its own, as long as it falls within the range of acceptability or is 'within the reaches of public interest.'" *United States v. Am. Tel. & Tel. Co.*, 552 F. Supp. 131, 151 (D.D.C. 1982) (citations omitted) (quoting *United States v. Gillette Co.*, 406 F. Supp. 713, 716 (D. Mass. 1975)), *aff'd sub nom. Maryland v. United States*, 460 U.S. 1001 (1983); *see also United States v. Alcan Aluminum Ltd.*, 605 F. Supp. 619, 622 (W.D. Ky. 1985) (approving the

² *Cf. BNS*, 858 F.2d at 464 (holding that the court's "ultimate authority under the [APPA] is limited to approving or disapproving the consent decree"); *United States v. Gillette Co.*, 406 F. Supp. 713, 716 (D. Mass. 1975) (noting that, in this way, the court is constrained to "look at the overall picture not hypercritically, nor with a microscope, but with an artist's reducing glass"). *See generally Microsoft*, 56 F.3d at 1461 (discussing whether "the remedies [obtained in the decree are] so inconsonant with the allegations charged as to fall outside of the 'reaches of the public interest.'").

consent decree even though the court would have imposed a greater remedy). To meet this standard, the United States “need only provide a factual basis for concluding that the settlements are reasonably adequate remedies for the alleged harms.” *SBC Commc’ns*, 489 F. Supp. 2d at 17.

Moreover, the Court’s role under the APPA is limited to reviewing the remedy in relationship to the violations that the United States has alleged in its complaint, and does not authorize the court to “construct [its] own hypothetical case and then evaluate the decree against that case.” *Microsoft*, 56 F.3d at 1459; *see also InBev*, 2009 U.S. Dist. LEXIS 84787, at *20 (“[T]he ‘public interest’ is not to be measured by comparing the violations alleged in the complaint against those the court believes could have, or even should have, been alleged.”). Because the “court’s authority to review the decree depends entirely on the government’s exercising its prosecutorial discretion by bringing a case in the first place,” it follows that “the court is only authorized to review the decree itself,” and not to “effectively redraft the complaint” to inquire into other matters that the United States did not pursue. *Microsoft*, 56 F.3d. at 1459-60. Courts “cannot look beyond the complaint in making the public interest determination unless the complaint is drafted so narrowly as to make a mockery of judicial power.” *SBC Commc’ns*, 489 F. Supp. 2d at 15.

In its 2004 amendments, Congress made clear its intent to preserve the practical benefits of utilizing consent decrees in antitrust enforcement, adding the unambiguous instruction that “[n]othing in this section shall be construed to require the court to conduct an evidentiary hearing or to require the court to permit anyone to intervene.” 15 U.S.C. § 16(e)(2). This language effectuates what Congress intended when it enacted the Tunney Act in 1974, as Senator Tunney explained: “[t]he court is nowhere compelled to go to trial or to

engage in extended proceedings which might have the effect of vitiating the benefits of prompt and less costly settlement through the consent decree process.” 119 *Cong. Rec.* 24,598 (1973) (statement of Senator Tunney). Rather, the procedure for the public interest determination is left to the discretion of the Court, with the recognition that the court’s “scope of review remains sharply proscribed by precedent and the nature of Tunney Act proceedings.” *SBC Commc’ns*, 489 F. Supp. 2d at 11.³

VIII. DETERMINATIVE DOCUMENTS

There are no determinative materials or documents within the meaning of the APPA that the United States considered in formulating the proposed Final Judgment.

³ See *United States v. Enova Corp.*, 107 F. Supp. 2d 10, 17 (D.D.C. 2000) (noting that the “Tunney Act expressly allows the court to make its public interest determination on the basis of the competitive impact statement and response to comments alone”); *United States v. Mid-Am. Dairymen, Inc.*, 1977-1 Trade Cas. (CCH) ¶ 61,508, at 71,980 (W.D. Mo. 1977) (“Absent a showing of corrupt failure of the government to discharge its duty, the Court, in making its public interest finding, should . . . carefully consider the explanations of the government in the competitive impact statement and its responses to comments in order to determine whether those explanations are reasonable under the circumstances.”); S. Rep. No. 93-298, 93d Cong., 1st Sess., at 6 (1973) (“Where the public interest can be meaningfully evaluated simply on the basis of briefs and oral arguments, that is the approach that should be utilized.”).

Dated: December 22, 2011

Respectfully submitted,

FOR PLAINTIFF
UNITED STATES OF AMERICA

/s/ Alexander P. Okuliar

Alexander P. Okuliar (D.C. Bar No. 481103)

Attorney

U.S. Department of Justice

Antitrust Division

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CERTIFICATE OF SERVICE

I, Alexander P. Okuliar, hereby certify that on December 22, 2011, I caused a copy of the foregoing Complaint, proposed Final Judgment, Stipulation and Order, Competitive Impact Statement, and Plaintiff United States' Explanation of Procedures for Entry of the Final Judgment to be served on defendants Deutsche Börse AG and NYSE Euronext by mailing the documents via email to the duly authorized legal representatives of the defendants, as follows:

For Deutsche Börse AG:

Thomas A. McGrath
Linklaters LLP
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New York, New York 10105
Email: Thomas.McGrath@linklaters.com

For NYSE Euronext:

David A. Schwartz
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FOR PLAINTIFF
UNITED STATES OF AMERICA

/s/ Alexander P. Okuliar
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Fax: (202) 532-4656
alexander.okuliar@usdoj.gov

CIVIL COVER SHEET

A 11-2280 BAH

JS-44
(Rev. 1/05 DC)

<p>I (a) PLAINTIFFS</p> <p>United States of America</p> <hr/> <p>(b) COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF (EXCEPT IN U.S. PLAINTIFF CASES)</p> <hr/> <p>(c) ATTORNEYS (FIRM NAME, ADDRESS, AND TELEPHONE NUMBER)</p> <p>Alexander P. Okuliar, Nina B. Hale, & Travis R. Chapman U.S. Department of Justice, Antitrust Division 450 Fifth Street, NW, Suite 7100 Washington, D.C. 20530 (202) 532-4564</p>	<p>DEFENDANTS</p> <p>DEUTSCHE BÖRSE AG; NYSE EURONEXT</p> <hr/> <p>COUNTY OF RESIDENCE OF FIRST LISTED DEFENDANT (IN U.S. PLAINTIFF CASES ONLY) <u>99999</u></p> <p>NOTE: IN 1 AND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF</p> <hr/> <p>Case: 1:11-cv-02280 Assigned To : Howell, Beryl A. Assign. Date : 12/22/2011 Description: Antitrust</p>
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<p>II. BASIS OF JURISDICTION (PLACE AN x IN ONE BOX ONLY)</p> <p><input checked="" type="radio"/> 1 U.S. Government Plaintiff</p> <p><input type="radio"/> 2 U.S. Government Defendant</p> <p><input type="radio"/> 3 Federal Question (U.S. Government Not a Party)</p> <p><input type="radio"/> 4 Diversity (Indicate Citizenship of Parties in item III)</p>	<p>III CITIZENSHIP OF PRINCIPAL PARTIES (PLACE AN x IN ONE BOX FOR PLAINTIFF AND ONE BOX FOR DEFENDANT) FOR DIVERSITY CASES ONLY!</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>PTF</th> <th>DFT</th> <th></th> <th>PTF</th> <th>DFT</th> </tr> </thead> <tbody> <tr> <td>Citizen of this State</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td>Incorporated or Principal Place of Business in This State</td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Citizen of Another State</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td>Incorporated and Principal Place of Business in Another State</td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Citizen or Subject of a Foreign Country</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td>Foreign Nation</td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </tbody> </table>		PTF	DFT		PTF	DFT	Citizen of this State	<input type="radio"/>	<input type="radio"/>	Incorporated or Principal Place of Business in This State	<input type="radio"/>	<input type="radio"/>	Citizen of Another State	<input type="radio"/>	<input type="radio"/>	Incorporated and Principal Place of Business in Another State	<input type="radio"/>	<input type="radio"/>	Citizen or Subject of a Foreign Country	<input type="radio"/>	<input type="radio"/>	Foreign Nation	<input type="radio"/>	<input type="radio"/>
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Citizen or Subject of a Foreign Country	<input type="radio"/>	<input type="radio"/>	Foreign Nation	<input type="radio"/>	<input type="radio"/>																				

IV. CASE ASSIGNMENT AND NATURE OF SUIT

(Place a X in one category, A-N, that best represents your cause of action and one in a corresponding Nature of Suit)

<p><input checked="" type="radio"/> A. Antitrust</p> <p><input checked="" type="checkbox"/> 410 Antitrust</p>	<p><input type="radio"/> B. Personal Injury/Malpractice</p> <p><input type="checkbox"/> 310 Airplane</p> <p><input type="checkbox"/> 315 Airplane Product Liability</p> <p><input type="checkbox"/> 320 Assault, Libel & Slander</p> <p><input type="checkbox"/> 330 Federal Employers Liability</p> <p><input type="checkbox"/> 340 Marine</p> <p><input type="checkbox"/> 345 Marine Product Liability</p> <p><input type="checkbox"/> 350 Motor Vehicle</p> <p><input type="checkbox"/> 355 Motor Vehicle Product Liability</p> <p><input type="checkbox"/> 360 Other Personal Injury</p> <p><input type="checkbox"/> 362 Medical Malpractice</p> <p><input type="checkbox"/> 365 Product Liability</p> <p><input type="checkbox"/> 368 Asbestos Product Liability</p>	<p><input type="radio"/> C. Administrative Agency Review</p> <p><input type="checkbox"/> 151 Medicare Act</p> <p>Social Security:</p> <p><input type="checkbox"/> 861 HIA ((1395ff)</p> <p><input type="checkbox"/> 862 Black Lung (923)</p> <p><input type="checkbox"/> 863 DIWC/DIWW (405(g)</p> <p><input type="checkbox"/> 864 SSID Title XVI</p> <p><input type="checkbox"/> 865 RSI (405(g)</p> <p>Other Statutes</p> <p><input type="checkbox"/> 891 Agricultural Acts</p> <p><input type="checkbox"/> 892 Economic Stabilization Act</p> <p><input type="checkbox"/> 893 Environmental Matters</p> <p><input type="checkbox"/> 894 Energy Allocation Act</p> <p><input type="checkbox"/> 890 Other Statutory Actions (If Administrative Agency is Involved)</p>	<p><input type="radio"/> D. Temporary Restraining Order/Preliminary Injunction</p> <p>Any nature of suit from any category may be selected for this category of case assignment.</p> <p>*(If Antitrust, then A governs)*</p>
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E. General Civil (Other) OR **F. Pro Se General Civil**

<p>Real Property</p> <p><input type="checkbox"/> 210 Land Condemnation</p> <p><input type="checkbox"/> 220 Foreclosure</p> <p><input type="checkbox"/> 230 Rent, Lease & Ejectment</p> <p><input type="checkbox"/> 240 Torts to Land</p> <p><input type="checkbox"/> 245 Tort Product Liability</p> <p><input type="checkbox"/> 290 All Other Real Property</p> <p>Personal Property</p> <p><input type="checkbox"/> 370 Other Fraud</p> <p><input type="checkbox"/> 371 Truth in Lending</p> <p><input type="checkbox"/> 380 Other Personal Property Damage</p> <p><input type="checkbox"/> 385 Property Damage Product Liability</p>	<p>Bankruptcy</p> <p><input type="checkbox"/> 422 Appeal 28 USC 158</p> <p><input type="checkbox"/> 423 Withdrawal 28 USC 157</p> <p>Prisoner Petitions</p> <p><input type="checkbox"/> 535 Death Penalty</p> <p><input type="checkbox"/> 540 Mandamus & Other</p> <p><input type="checkbox"/> 550 Civil Rights</p> <p><input type="checkbox"/> 555 Prison Condition</p> <p>Property Rights</p> <p><input type="checkbox"/> 820 Copyrights</p> <p><input type="checkbox"/> 830 Patent</p> <p><input type="checkbox"/> 840 Trademark</p> <p>Federal Tax Suits</p> <p><input type="checkbox"/> 870 Taxes (US plaintiff or defendant</p> <p><input type="checkbox"/> 871 IRS-Third Party 26 USC 7609</p>	<p>Forfeiture/Penalty</p> <p><input type="checkbox"/> 610 Agriculture</p> <p><input type="checkbox"/> 620 Other Food & Drug</p> <p><input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881</p> <p><input type="checkbox"/> 630 Liquor Laws</p> <p><input type="checkbox"/> 640 RR & Truck</p> <p><input type="checkbox"/> 650 Airline Regs</p> <p><input type="checkbox"/> 660 Occupational Safety/Health</p> <p><input type="checkbox"/> 690 Other</p> <p>Other Statutes</p> <p><input type="checkbox"/> 400 State Reapportionment</p> <p><input type="checkbox"/> 430 Banks & Banking</p> <p><input type="checkbox"/> 450 Commerce/ICC Rates/etc.</p> <p><input type="checkbox"/> 460 Deportation</p>	<p><input type="checkbox"/> 470 Racketeer Influenced & Corrupt Organizations</p> <p><input type="checkbox"/> 480 Consumer Credit</p> <p><input type="checkbox"/> 490 Cable/Satellite TV</p> <p><input type="checkbox"/> 810 Selective Service</p> <p><input type="checkbox"/> 850 Securities/Commodities/Exchange</p> <p><input type="checkbox"/> 875 Customer Challenge 12 USC 3410</p> <p><input type="checkbox"/> 900 Appeal of fee determination under equal access to Justice</p> <p><input type="checkbox"/> 950 Constitutionality of State Statutes</p> <p><input type="checkbox"/> 890 Other Statutory Actions (if not administrative agency review or Privacy Act</p>
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<input type="radio"/> G. Habeas Corpus/ 2255 <input type="checkbox"/> 530 Habeas Corpus-General <input type="checkbox"/> 510 Motion/Vacate Sentence	<input type="radio"/> H. Employment Discrimination <input type="checkbox"/> 442 Civil Rights-Employment (criteria: race, gender/sex, national origin, discrimination, disability age, religion, retaliation) *(If pro se, select this deck)*	<input type="radio"/> I. FOIA/PRIVACY ACT <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 890 Other Statutory Actions (if Privacy Act) *(If pro se, select this deck)*	<input type="radio"/> J. Student Loan <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (excluding veterans)
<input type="radio"/> K. Labor/ERISA (non-employment) <input type="checkbox"/> 710 Fair Labor Standards Act <input type="checkbox"/> 720 Labor/Mgmt. Relations <input type="checkbox"/> 730 Labor/Mgmt. Reporting & Disclosure Act <input type="checkbox"/> 740 Labor Railway Act <input type="checkbox"/> 790 Other Labor Litigation <input type="checkbox"/> 791 Empl. Ret. Inc. Security Act	<input type="radio"/> L. Other Civil Rights (non-employment) <input type="checkbox"/> 441 Voting (if not Voting Rights Act) <input type="checkbox"/> 443 Housing/Accommodations <input type="checkbox"/> 444 Welfare <input type="checkbox"/> 440 Other Civil Rights <input type="checkbox"/> 445 American w/Disabilities-Employment <input type="checkbox"/> 446 Americans w/Disabilities-Other	<input type="radio"/> M. Contract <input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholder's Suits <input type="checkbox"/> 190 Other Contracts <input type="checkbox"/> 195 Contract Product Liability <input type="checkbox"/> 196 Franchise	<input type="radio"/> N. Three-Judge Court <input type="checkbox"/> 441 Civil Rights-Voting (if Voting Rights Act)

ORIGIN

1 Original Proceeding
 2 Removed from State Court
 3 Remanded from Appellate Court
 4 Reinstated or Reopened
 5 Transferred from another district (specify)
 6 Multi district Litigation
 7 Appeal to District Judge from Mag. Judge

VI. CAUSE OF ACTION (CITE THE U.S. CIVIL STATUTE UNDER WHICH YOU ARE FILING AND WRITE A BRIEF STATEMENT OF CAUSE.)
 Section 7 of the Clayton Act, as amended, 15 U.S.C. § 18 Proposed acquisition violates statute

VII. REQUESTED IN COMPLAINT CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23 DEMAND \$ _____ JURY DEMAND: YES NO Check YES only if demanded in complaint

VIII. RELATED CASE(S) IF ANY (See instruction) YES NO If yes, please complete related case form

DATE 12/22/2011 SIGNATURE OF ATTORNEY OF RECORD

INSTRUCTIONS FOR COMPLETING CIVIL COVER SHEET JS-44
 Authority for Civil Cover Sheet

The JS-44 civil cover sheet and the information contained herein neither replaces nor supplements the filings and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. Consequently a civil cover sheet is submitted to the Clerk of Court for each civil complaint filed. Listed below are tips for completing the civil cover sheet. These tips coincide with the Roman Numerals on the Cover Sheet.

- I. COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF/DEFENDANT (b) County of residence. Use 11001 to indicate plaintiff is resident of Washington, D.C., 88888 if plaintiff is resident of the United States but not of Washington, D.C., and 99999 if plaintiff is outside the United States.
- III. CITIZENSHIP OF PRINCIPAL PARTIES. This section is completed only if diversity of citizenship was selected as the Basis of Jurisdiction under Section II.
- IV. CASE ASSIGNMENT AND NATURE OF SUIT. The assignment of a judge to your case will depend on the category you select that best represents the primary cause of action found in your complaint. You may select only one category. You must also select one corresponding nature of suit found under the category of case.
- VI. CAUSE OF ACTION. Cite the US Civil Statute under which you are filing and write a brief statement of the primary cause.
- VIII. RELATED CASES, IF ANY. If you indicated that there is a related case, you must complete a related case form, which may be obtained from the Clerk's Office.

Because of the need for accurate and complete information, you should ensure the accuracy of the information provided prior to signing the form.

Attachment B

TGFCEVGF XGTUKQP

Before the
Securities and Exchange Commission

In the Matter of the Application of
Securities Industry and Financial Markets Association
for Review of Actions Taken by Self-Regulatory Organizations
Administrative Proceeding File No. 3-15350

Statement Regarding the SEC's Proposed Order Concerning the
Pricing of Depth-of-Book Market Data

Professor Terrence Hendershott, Ph.D., and
Professor Aviv Nevo, Ph.D.

January 26, 2015

TGFCEVGF XGTUQP

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I. Qualifications

A. Terrence Hendershott

1. My name is Terrence Hendershott. I am a Professor at the Haas School of Business at the University of California, Berkeley, where I hold the Cheryl and Christian Valentine Chair.
2. My expertise and research interests include management of information systems, the role of information technology in financial markets, electronic communications networks and stock exchange design, regulation of financial markets, and high-frequency trading. I have published numerous articles on the impact of information technology on financial markets, the structure and regulation of financial markets, the interaction between trading and asset price dynamics, and high-frequency trading in leading economics and finance journals, including *Journal of Finance*, *Journal of Financial Economics*, *Review of Financial Studies*, and *Review of Economic Studies*. I have received awards from the Western Finance Association and the Financial Management Association for my research on equity trading and market microstructure.
3. I teach undergraduate- and graduate-level courses at the Haas School of Business on operations management, information technology strategy, and high-frequency finance. I serve on the editorial boards of leading operations management and finance journals, such as *Management Science*, *Journal of Financial Markets*, and *Decision Support Systems*.
4. In addition to my academic work, I have served as the visiting economist at the New York Stock Exchange from 2005 to 2006, as a member of the NASDAQ Economic Advisory Board from 2004 to 2007, and as chair of the NASDAQ Economic Advisory Board in 2007. I have also consulted for a number of high-frequency trading firms and investment firms, some of which are SIFMA members.
5. A detailed listing of my educational background and publications is set forth in my curriculum vitae, which is attached to this declaration as Appendix A. The only testimony that I have given within the past four years has been in connection with a confidential arbitration.

B. Aviv Nevo

6. My name is Aviv Nevo. I am a Professor in the Department of Economics at Northwestern University, and a Professor of Marketing at Northwestern's Kellogg School of Business. I have also held faculty positions at the MIT Sloan School of Business and in the Department of Economics at the University of California, Berkeley.

7. My expertise and research interests include empirical industrial organization, competition economics, and econometrics. My research has focused in particular on estimating demand for consumer packaged goods and its implications for price competition, mergers, marketing, and consumer welfare. My work has been published in a number of leading economics journals, including the *American Economic Review*, *Econometrica*, and the *RAND Journal of Economics*. I am also co-editor of the *RAND Journal of Economics*, the leading Industrial Organization journal, and have served as an editor and referee for other scholarly economics journals.

8. I teach Ph.D.-level courses in industrial organization and econometrics, and have supervised the dissertations of numerous Ph.D. candidates. I have also delivered invited lectures on econometrics and industrial organization in leading institutions around the world including at Tel-Aviv University, the Federal Trade Commission ("FTC"), University College London and Centro de Estudios Monetarios y Fiancieras in Madrid.

9. I served as Deputy Assistant Attorney General for Economic Analysis in the Antitrust Division at the United States Department of Justice ("DOJ") in 2013–2014. In this role I advised on merger, as well as civil and criminal, investigations. I also led the division's Economic Analysis Group of over 60 Ph.D. economists and statistical analysts, which works jointly with the division's legal teams to assess the likely competitive impact of proposed mergers or allegedly anticompetitive practices.

10. I am a research associate at the National Bureau of Economic Research, and was elected a Fellow of the Econometric Society in 2013. I was awarded several research grants from the National Science Foundation including an Early Career Development grant in 2001. I was awarded the Sloan Research Fellowship in 2003.

11. A detailed listing of my educational background and publications is set forth in my curriculum vitae, which is attached to this report as Appendix B, and a list of my previous expert testimony is attached as Appendix C.

II. Assignment and Case Background

A. Assignment

12. We have been asked by counsel for NYSE Arca to provide an opinion as to whether competitive forces discipline and constrain NYSE Arca's pricing of ArcaBook. Specifically, we have been asked to examine (a) whether competition for order flow between exchanges and other trading platforms disciplines NYSE Arca's pricing of ArcaBook, and (b) whether the availability of depth-of-book data supplied by different exchanges constrains NYSE Arca's pricing of ArcaBook. We understand that this report, which documents our findings, will be submitted as part of the record in a Securities and Exchange Commission ("SEC") proceeding.

13. Professor Hendershott is being compensated at the rate of \$875 per hour for his work in this matter. Professor Nevo is being compensated at the rate of \$850 per hour for his work in this matter. Our compensation is not contingent upon the outcome of this matter. Although this is a joint report and we worked together on and are in agreement regarding all of the results and conclusions expressed herein, Professor Hendershott had primary responsibility for Sections IV and V, while Professor Nevo had primary responsibility for Section VI. Under our joint direction, Cornerstone Research performed research and other assistance in preparing this report. A list of the materials we have relied on in preparing this report is attached as Appendix D. We reserve the right to amend or update the opinions offered in this report should additional information be made available to us.¹

¹ In particular, we understand that even if the Securities and Exchange Commission ("SEC") finds that significant competitive forces constrain pricing decisions, proprietary market data prices might not satisfy the Exchange Act if there was a countervailing reason to find that market forces should not be permitted to control such prices. See Court Opinion in *NetCoalition v. Securities and Exchange Commission*, United States Court of Appeals for the District of Columbia Circuit, Case No. 09-1042 ("*NetCoalition I*"), August 6, 2010, p. 11. We further understand that the SEC's test requires an opponent of price decisions to demonstrate the existence of countervailing reasons to believe that market forces should not be allowed to control pricing decisions, such as an attempt by an exchange to apply pricing decisions in a discriminatory way by penalizing the users of alternative platforms through higher

B. Summary of Proceedings to Date

14. In May 2006, NYSE Arca filed a proposed rule change (the “2006 Rule Change”) with the Securities and Exchange Commission (“SEC”) to establish fees for the receipt and use of NYSE’s ArcaBook depth-of-book data product.² Depth-of-book data for a stock exchange describe outstanding limit orders to purchase stocks and to sell stocks.

15. The SEC approved the proposed rule change in December 2008 after a lengthy rule-making process, concluding that NYSE Arca was subject to significant competitive forces, including competition between exchanges for order flow and the availability of alternate sources of depth-of-book data, which would constrain the pricing of ArcaBook.³ Following the SEC’s 2008 approval, NYSE Arca began assessing the permitted fees for ArcaBook data.

16. The record available to the SEC contained several economic analyses, including a report submitted on behalf of two trade associations, SIFMA and NetCoalition (the “SIFMA/NetCoalition Initial Submission”),⁴ an analysis prepared by Professor Janusz Ordover and Dr. Gustavo Bamberger on behalf of NASDAQ,⁵ and rebuttal to the Ordover-Bamberger report submitted by SIFMA and NetCoalition (the “SIFMA/NetCoalition Rebuttal Submission”).⁶ The SIFMA/NetCoalition Submission concluded that “the Exchange likely has significant market power over the pricing of its depth-of-book market data; the availability of the alternative sources of depth-of-book data that the SEC identifies would not constrain that market

prices. If SIFMA does try to satisfy this exception in its merits filing, we will express our views on whatever SIFMA might submit regarding this exception.

² Filing of Proposed Rule Change Relating to Approval of Market Data Fees for NYSE Arca Data, SEC Release No. 34-53952, 71 FR 33496, June 9, 2006.

³ Securities Exchange Act Release No. 59039 (December 2, 2008), 73 FR 74770 (December 9, 2008).

⁴ Dr. David S. Evans, “An Economic Assessment of Whether ‘Significant Competitive Forces’ Constrain an Exchange’s Pricing of Its Depth-of-Book Market Data,” July 10, 2008 (“SIFMA/NetCoalition Initial Submission”).

⁵ Statement of Janusz Ordover and Gustavo Bamberger, August 1, 2008 (“Ordover-Bamberger Report”).

⁶ Dr. David S. Evans, “Response to Ordover and Bamberger’s Statement Regarding the SEC’s Proposed Order Concerning The Pricing of Depth-of-Book Market Data,” October 10, 2008 (“SIFMA/NetCoalition Rebuttal Submission”). SIFMA and NetCoalition submitted an additional study of market data pricing prepared by the Securities Litigation & Consulting Group. See “An Economic Study of Securities Market Data Pricing by the Exchanges,” Securities Litigation & Consulting Group, Inc., July 10, 2008 (“SLCG Report”). The SLCG Report concluded that “[t]he two dominant exchanges are exercising monopoly pricing power by charging broker dealers and the investing public fees for depth-of-book data that are significantly higher than the relevant costs associated with distributing the data. Therefore, the [SEC] ... cannot reasonably rely on competitive forces to result in competitive prices for exchange market data sold by the two dominant exchanges.”

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power; and competition for order flow would not constrain that market power.”⁷ Professor Ordover and Dr. Bamberger disagreed, concluding that two competitive forces — platform competition among exchanges, and the availability of alternative sources of non-core market data — would both constrain prices of non-core data products.”⁸

17. NetCoalition and SIFMA petitioned the United States Court of Appeals for the D.C. Circuit (“the D.C. Circuit”) for review of the SEC’s decision, asserting that the SEC’s conclusion that competitive forces would constrain ArcaBook fees was not supported by sufficient evidence.⁹

18. The D.C. Circuit rejected two of NetCoalition’s three challenges to the SEC’s decision, holding that the SEC’s “market-based” approach to regulation of ArcaBook pricing is permissible under the Exchange Act and is not an arbitrary departure from its previous discussions of cost-based methods to analyze certain prices.¹⁰ However, it concluded that the SEC had “failed to disclose a reasoned basis [] for concluding that NYSE Arca is subject to significant competitive forces in pricing ArcaBook” and vacated the SEC’s 2008 order for that reason.¹¹ The court found that the record lacked adequate support for the SEC’s conclusion that competition between exchanges for order flow constrains market data prices.¹² The court also found “insufficient” evidence provided by the SEC to establish that traders would in fact switch to any of the four alternatives the SEC had identified as potential substitutes.¹³

19. In July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act (“Dodd-Frank”) became law. Dodd-Frank changed the requirement that the SEC approve a change in

⁷ SIFMA/NetCoalition Initial Submission, p. 2.

⁸ Ordover-Bamberger Report, p. 3.

⁹ Court Opinion in *NetCoalition I*, p. 12.

¹⁰ Court Opinion in *NetCoalition I*, pp. 17, 20.

¹¹ Court Opinion in *NetCoalition I*, p. 32.

¹² Court Opinion in *NetCoalition I*, pp. 26–27.

¹³ Court Opinion in *NetCoalition I*, p. 32.

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market data fee rules before the change became effective; henceforth, changes to rules setting market data fees would take effect when filed with the SEC.¹⁴

20. Subsequent to the enactment of Dodd-Frank, NYSE Arca filed a new proposed rule change with the SEC.¹⁵ The rule change took effect immediately. NetCoalition and SIFMA asked the SEC to suspend the rule change, and appealed to the D.C. Circuit after the SEC did not do so. The D.C. Circuit dismissed the appeal, finding its ruling in *NetCoalition I* “inoperative” because the SEC is no longer required to approve a self-regulatory organization (“SRO”)’s fee rule before it becomes effective. However, the court stated that the requirements for analyzing fee changes established in *NetCoalition I* remain in effect.¹⁶

21. Following the decision in *NetCoalition II*, SIFMA filed an application with the SEC challenging the ArcaBook fees that NYSE Arca first proposed in 2008.¹⁷ SIFMA asserts that NYSE Arca has offered no evidence that it was subject to significant competitive forces in setting the challenged fees and has provided no evidence of the cost of collecting and distributing the data at issue. SIFMA further claims that because its members cannot obtain depth-of-book data services without paying the fees at issue, it is subject to a limitation on access to depth-of-book data.¹⁸

III. Summary of Opinions

22. The overriding conclusion from our analysis is that competitive forces discipline and constrain NYSE Arca’s pricing of ArcaBook, and in particular disciplined and constrained the fees that NYSE Arca set when ArcaBook first became a paid market data product in January

¹⁴ Court Opinion in *NetCoalition and Securities Industry and Financial Markets Association v. Securities and Exchange Commission*, United States Court of Appeals for the District of Columbia Circuit, Case No. 10-1421 (*NetCoalition I*), April 30, 2013, p. 3.

¹⁵ Proposed rule change by NYSE Arca Pursuant to Rule 19b-4 under the Securities Exchange Act of 1934, File No. SR-2010-97, November 1, 2010 (“NYSE Arca 2010 Proposed Rule Change”).

¹⁶ Court Opinion in *NetCoalition II*, p. 22 (“[*NetCoalition I*] remains a controlling statement of the law as to what sections 6 and 11A of the Exchange Act require of SRO fees.”).

¹⁷ Application for An Order Setting Aside Rule Change of NYSE Arca, Inc. Limiting Access to Its Services, Admin. Proc. File No. 3-15350.

¹⁸ Order Establishing Procedures and Referring Applications for Review to Administrative Law Judge for Additional Proceedings, Admin. Proc. File Nos. 3-15350, 3-15351, May 16, 2014, p. 13.

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2009. We find that (1) competition for order flow and (2) competition for depth-of-book data products both impose significant competitive constraints on NYSE Arca's pricing of ArcaBook.¹⁹

23. The following facts regarding the marketplace support our conclusions:

- a. Over the last 10 years the marketplace has seen entry by a large number of exchanges and alternative trading systems such as dark pools, and these entrants have captured significant share from NYSE and NASDAQ.²⁰ This implies that the marketplace is highly competitive, and that barriers to entry are low.
- b. Trading volume for individual stocks is not concentrated at particular exchanges. Individual exchanges face significant competition for order flow from other trading platforms. As a consequence, individual exchanges do not maintain an exclusive hold on trading for a particular security (or the depth-of-book data that are generated from trading).
- c. Trade volume on NYSE Arca decreased after the price of ArcaBook increased in 2009, after controlling for potentially confounding effects. Economic theory tells us that the negative relationship between order flow and the price of depth-of-book data disciplines and constrains the price of depth-of-book data, particularly since order flow comprises a significant fraction of NYSE Arca's revenue.
- d. ArcaBook prices are set in a manner that would not be optimal for a single-product firm selling only depth-of-book data. Rather, ArcaBook pricing is consistent with pricing by a multiproduct firm that seeks to optimize joint profits from the sale of two complementary products, transaction services and depth-of-book data. We observe

¹⁹ Because this proceeding relates to the first fees imposed for ArcaBook, our analysis focuses on the time period during which that price change took place.

²⁰ Because some exchanges, such as NYSE Arca, are members of a family of related exchanges, on occasion this report refers to the families rather than individual exchanges. For example, at the times of the fee changes at issue here, NYSE Arca was an indirect wholly-owned affiliate of NYSE Euronext, and thus we sometimes refer to the NYSE exchanges to mean the U.S. equities exchanges owned by NYSE Euronext (likewise, we refer to NYSE Euronext's revenue as a group). When we refer to NYSE Arca, we mean NYSE Arca itself. In the context of this paragraph, we refer to the general capture of market share by dark pools from the exchanges in the NYSE Euronext and NASDAQ groups.

- empirically each of the elements that economic theory predicts in the presence of demand complementarity: ArcaBook subscriptions and NYSE Arca trading volume both decline in response to an increase in ArcaBook prices, and NYSE Arca prices ArcaBook in the inelastic region of the demand curve. We conclude that NYSE Arca sets ArcaBook prices to maximize joint profits from multiple exchange products and services rather than profits from ArcaBook alone.
- e. Many customers purchase one depth-of-book data product but not all depth-of-book data products, and the specific product that they purchase changes over time. The existence of such customers implies that depth-of-book products are indeed substitutes, and that competition between these substitutes disciplines pricing. These purchasing patterns for depth-of-book data flatly contradict the assertion that all buyers must purchase depth-of-book data products from all significant trading venues.
 - f. Individual exchanges do not maintain an exclusive hold on depth-of-book data for a particular stock, and traders can obtain depth-of-book information about a particular stock from competing depth-of-book products offered by different exchanges. Trading for nearly all stocks is unconcentrated or moderately concentrated (following definitions used by the DOJ and FTC) and distributed across a variety of different exchanges and alternative trading platforms. We find that for any pair of exchanges we examine, conditional on being traded on one exchange the trade volume-weighted probability that the same stock is traded on the other exchange is more than 99%.
 - g. Economic theory and empirical evidence in the academic literature tell us that competing depth-of-book data products contain similar information. This provides further confirmation that competing depth-of-book products are viable substitutes, and that the availability of substitutes constrains depth-of-book pricing.
24. Finally, we conclude that a measure of competition previously discussed in prior related proceedings, pricing above marginal cost, is not appropriate. As widely recognized in economics, the equivalence of price and marginal cost is not an appropriate measure of the competitiveness of an industry. The measures we examine, including concentration and ease of

entry, demonstrate that this is a competitive marketplace that will constrain the pricing of depth-of-book products.

IV. Depth-of-Book Data

25. This section explains what depth-of-book data are, discusses how subscribers use depth-of-book data, distinguishes professional and non-professional users of depth-of-book data, and describes the different presentations of depth-of-book data available to users and subscribers.

26. Modern exchanges typically operate as open limit-order books. A limit order is an instruction to trade at the best available price, but only if that price is no worse than the limit price specified by the trader. For buy limit orders, the execution price must be at or below the limit price. For sell limit orders, the execution price must be at or above the limit price.²¹ A trade occurs when an order arrives with a limit price better than or equal to the price in a pre-existing limit order on the opposite side of the market.²² Limit orders are matched together using priority rules based on price and time. Because trading on exchanges typically occurs at discrete prices of one cent, limit orders at the same price are placed in a first-in-first-out queue with orders submitted earlier trading first.

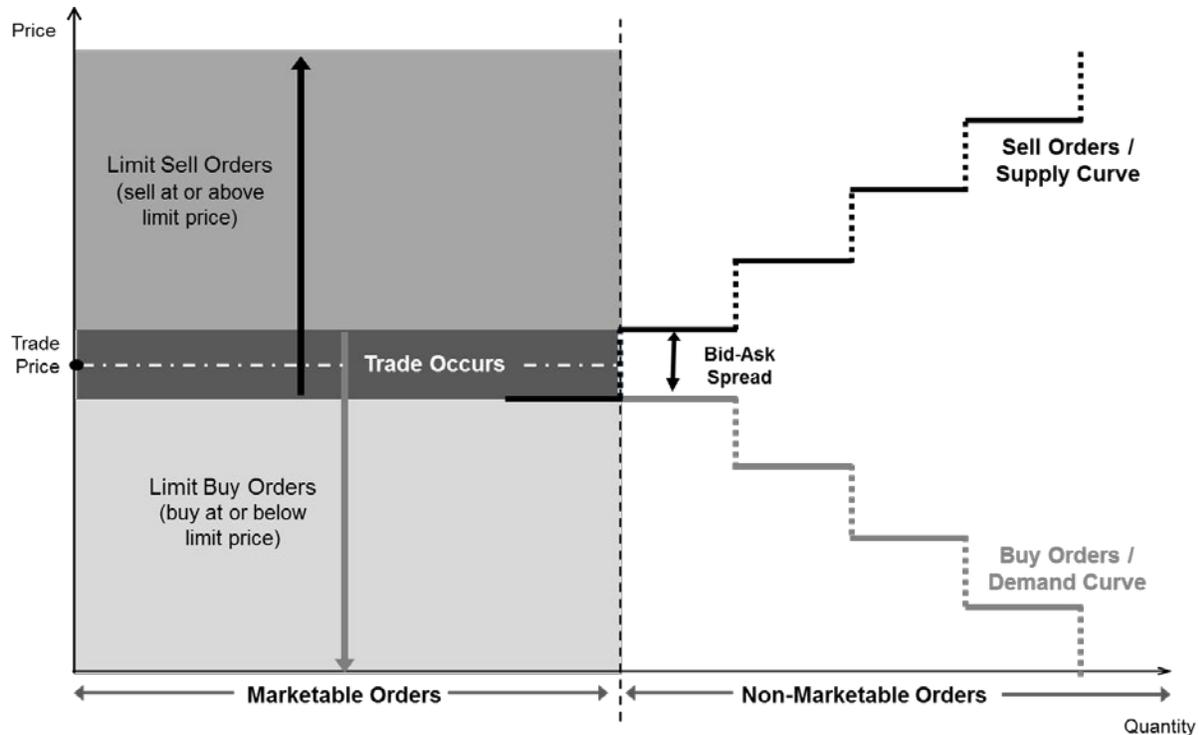
27. The limit-order book, which consists of all pending displayed limit orders, is summarized in depth-of-book data. The depth-of-book data provide a different view of available liquidity than the “top-of-book” data, which provide the quantities available at the best (lowest) offer price and the best (highest) bid price. An exchange’s depth-of-book data include the quantity of shares available in all displayed limit orders submitted at prices away from the market, that is, buy orders at prices equal to or less than the best available bid, and sell orders at prices equal to or greater than the best available offer. These data provide a broader (but not complete) view of

²¹ See Harris, L., *Trading and Exchanges: Market Microstructure for Participants* (Oxford University Press, 2003), p. 73.

²² In other words, a trade occurs when either (1) a sell limit order arrives with a limit price equal to or below the limit price of an existing buy order, or (2) a buy limit order arrives with a limit price equal to or above the limit price of an existing sell order.

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available liquidity.²³ In effect, the depth-of-book data trace the demand curve (limit buy orders) for a given stock at prices less than the market price, and the supply curve (limit sell orders) at prices greater than the market price.²⁴ See Figure 1 below.



28. Market participants do not need depth-of-book data to trade, but can use such data for a variety of purposes.

- a. Traders looking to trade immediately can use depth-of-book data to reduce uncertainty with respect to price, quantity, and the likelihood of execution. For example, given a large sell order that exceeds the liquidity available at the top of the buy book, a trader can use depth-of-book data to estimate the liquidity available at lower prices to predict the weighted average price to execute the order, often referred to as the price impact of the order. If the depth-of-book data show a steeper demand

²³ Note that some exchanges allow traders to submit non-displayed limit orders. Depth-of-book data products do not include such orders. As a result, depth-of-book data do not provide a perfect picture of all available market depth even for the exchange that it covers.

²⁴ Because a limit buy order above the market price and a limit sell order below the market price can be executed in the market at the price specified in the order, these orders are referred to as *marketable* orders.

- curve, an incremental decrease in price will result in a relatively smaller increase in the quantity of matching orders. As a result, a trader trying to fill a large order will have to continue lowering price to get enough volume to fill that order, and therefore can expect to have a larger overall price impact, resulting in a lower average sale price.
- b. Traders not needing immediacy can submit limit orders to lower their price impact. Depth-of-book data allow traders to estimate the size of the queue in which new orders would arrive and the place in the queue of existing limit orders. Because orders placed earlier at the same price typically execute first, information about the queue length allows traders to forecast the likelihood limit orders will execute and how long it may take for those orders to execute.
 - c. Traders can use depth-of-book data to enhance their estimates of the price impact of trading immediately and the probability and timing of limit order executions in each exchange. Traders and their brokers can use this information to determine which exchange to send their orders to, in addition to the price and size of those orders. These are often described as order routing decisions.
 - d. Traders can also use depth-of-book data to implement more sophisticated trading strategies, including high-frequency trading. If information in the limit-order book helps traders understand the strategies of other traders, then depth-of-book data can help forecast future price movements; this information can be incorporated in their trading strategies.²⁵
 - e. Securities firms can use depth-of-book data for order matching functions required for operation of a securities trading platform. Indeed, many operators of off-exchange platforms that compete with stock exchanges (such as dark pools and alternative trading systems (“ATsS”)) purchase depth-of-book data from the exchanges and use these data to run competing trading platforms. The exchanges have developed specific pricing for such uses, as we explain below.

²⁵ See, e.g., Mizrach, B., “The Next Tick on Nasdaq,” *Quantitative Finance* 8 (2008), pp. 19–40.

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29. Depth-of-book data are directly implicated in only a small share of trades (3.3%, according to one academic article) that occurs outside the national best bid and offer (“NBBO”).²⁶ For the remaining 96.7% of trades, which occur at or within the NBBO, depth-of-book data are not necessary. Traders can use core or consolidated data to identify which exchanges offer the best prices for the traders’ chosen quantities. These facts explain why only a relatively small subset of core data users subscribe to depth-of-book data.²⁷

30. All of the major exchanges, including NYSE, NYSE Arca, NASDAQ, BATS, and DirectEdge, sell real-time depth-of-book data feeds.²⁸ The exchanges generally charge a flat access fee, and charge additional fees that depend on the number and type of users within the institution and how the institution uses the data.²⁹ It is important to note that anyone who wants to buy depth-of-book data can do so, either directly from an exchange or through a redistributor of such data (such as Thomson Reuters or a broker-dealer). And the pricing for depth-of-book data is uniformly applied to similarly-situated subscribers; it is not tied (positively or negatively) to where the subscriber routes its order flow. Thus, market participants are free to select the venues to which they route order flow and from which they buy market data (including depth-of-book data) based on which venues and products provide the best value proposition for them.

31. A display subscription allows subscribers to view depth-of-book data on a display device (e.g., a computer screen or a Bloomberg terminal), but does not grant subscribers access to the underlying data for use in other applications. Exchanges generally charge different display fees for professional and non-professional users. Professional subscribers are persons licensed by or

²⁶ Holden, C., and S. Jacobsen, “Liquidity Measurement Problems in Fast, Competitive Markets: Expensive and Cheap Solutions,” *Journal of Finance* 69, no. 4 (August 2014), p. 1764.

²⁷ Court Opinion in *NetCoalition I*, p. 26. In particular, this explains why the pricing for depth-of-book data has little or no impact on retail traders. Retail traders’ orders are much smaller in size than other traders’ orders. See, e.g., Lee, C., and Radhakrishna, B., “Inferring investor behavior: Evidence from TORQ data,” *Journal of Financial Markets*, 3(2) (2000), pp. 83-111, and Barber, B. M., Odean, T., and Zhu, N., “Do retail trades move markets?,” *Review of Financial Studies*, 22(1) (2009), pp. 151-186. Therefore, for small retail trades, the overwhelming majority of retail traders have no need for depth-of-book data because their trades are executed at prices at or better than the NBBO, meaning that the existence of limit orders outside the NBBO is irrelevant to them.

²⁸ NYSE depth-of-book data feeds include NYSE OpenBook and NYSE ArcaBook. NASDAQ depth-of-book data feeds include NASDAQ TotalView and OpenView. Direct Edge offers EdgeBook Depth and EdgeBook Attributed, and BATS offers Multicast PITCH.

²⁹ See, for example, the NYSE Arca fee schedule at <http://www.nyxdata.com/Data-Products/NYSE-ArcaBook> and the NASDAQ fee schedule at <http://www.nasdaqtrader.com/Trader.aspx?id=DPUSdata>, last accessed on 1/21/15.

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registered with a securities or commodities trading regulator or who, among other things, provide investment advice or analysis. Non-professional subscribers are anyone else (e.g., retail customers who obtain access to the data through a brokerage firm). Some exchanges, including NASDAQ and NYSE Arca, place a cap on the number of non-professional display subscribers to which fees apply by offering a fixed enterprise fee under which the buyer can license an unlimited number of non-professional subscribers. For example, NYSE Arca currently applies a monthly fee cap of \$40,000 to any broker-dealer for non-professional ArcaBook subscribers that maintain brokerage accounts with the broker-dealer.³⁰ Per the cap, [REDACTED], paid \$40,000 in November 2014 for its non-professional subscriber base of [REDACTED].³¹ Absent the fee cap, [REDACTED] would have paid more than [REDACTED] in non-professional display fees for the month of November. Given that it is at the cap, [REDACTED] can offer ArcaBook to additional non-professional customers at no additional costs to itself.³²

32. A non-display subscription allows use of depth-of-book data in computer applications that support automated trading, routing, and the operation of trading platforms. Non-display uses include high-frequency and algorithmic trading, automated order and quote generation, price referencing for algorithmic trading or smart order routing, and even the operation of dark pools and ATSS.³³ Fees for non-display use are typically flat fees rather than per-device or per-user fees. Some exchanges, including NYSE Arca, charge a higher fee for internal non-display use by an institution's employees, and a lower fee for managed non-display use in which the licensing institution's employees use a limited set of non-display applications hosted by a third-party service provider.³⁴ [REDACTED], for example, is a high-frequency trading firm that

³⁰ NYSE ArcaBook, NYSE Market Data, <http://www.nyxdata.com/Data-Products/NYSE-ArcaBook>, last accessed 1/21/15.

³¹ NYSE Subscriber Data.

³² Note that the effect of a cap on ArcaBook non-professional display fees is pro-competitive as compared to a price schedule that does not include such caps. The cap reduces the cost of non-professional fees for large subscribers such as [REDACTED], and creates an incentive for wider use and broader distribution of ArcaBook data.

³³ See, e.g., Notice of Filing and Immediate Effectiveness of Proposed Rule Change Establishing Non-Display Usage Fees for NYSE Arca Integrated Feed, NYSE ArcaBook, NYSE Arca Trades, and NYSE Arca BBO, and a Redistribution Fee for NYSE ArcaBook, April 5, 2013, p. 8, <http://www.sec.gov/rules/sro/nysearca/2013/34-69315.pdf>.

³⁴ See, e.g., Notice of Filing and Immediate Effectiveness of Proposed Rule Change Establishing Non-Display Usage Fees for NYSE Arca Integrated Feed, NYSE ArcaBook, NYSE Arca Trades, and NYSE Arca BBO, and a

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receives ArcaBook data on its managed non-display devices and pays NYSE Arca the managed non-display fee of \$1,800 per month.³⁵ [REDACTED], is an example of a firm that pays the internal non-display fee of \$5,000 per month.³⁶

33. Subscribers of non-display data can have a big impact on an exchange's trading volume. They account for a relatively large volume of orders on the exchanges, and therefore enjoy significant bargaining power relative to the exchange operators that supply depth-of-book data. Non-display users include high-frequency traders that account for a significant fraction of trading volume.³⁷

34. Many subscribers of non-display depth-of-book data are also actual or potential competitors to the registered exchanges. As noted in Section V.B, large trading entities such as Citadel, Goldman Sachs, and Knight Capital Group have invested in electronic trading platforms ("electronic communications networks" or "ECNs") and dark pools. Loss of trading volume from buyers of non-display depth-of-book data can reduce the exchange's trading volume and can reduce the value of the exchange's depth-of-book data product to other customers.

V. Industry Background

35. Understanding the competitive forces that affect depth-of book data pricing requires an understanding of the broader context in which this competition occurs. In this section, we first explain how depth-of-book data products are not stand-alone products, but instead are jointly produced with other products generated by exchanges, in particular with trade execution services. The fact that depth-of-book data and trade execution services are jointly supplied means that their cost of production cannot be separated in an economically meaningful way. Next, we discuss how depth-of-book data and trade execution services are linked on the demand

Redistribution Fee for NYSE ArcaBook, April 5, 2013, pp. 9–11, <http://www.sec.gov/rules/sro/nysearca/2013/34-69315.pdf>.

³⁵ NYSE Subscriber Data.

³⁶ NYSE Subscriber Data.

³⁷ See Brogaard, J., T. Hendershott, and Ryan Riordan, "High Frequency Trading and Price Discovery," *Review of Financial Studies* 27 (2014), pp. 2267–2306 (finding that high-frequency traders from 26 firms account for approximately 40% of trading volume in large cap stocks); and Menkveld, A. J., "High-Frequency Trading and the New Market Makers," *Journal of Financial Markets* 16 (2013), pp. 712–740 (showing that attracting a single high-frequency trading firm can be crucial to assure successful entry by a new electronic market).

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side for trading services. The parties on both sides of this matter have agreed that greater order flow at an exchange makes that exchange's depth-of-book data more valuable to customers.³⁸ We point out that when a market participant purchases depth-of-book data from an exchange, it becomes more likely to place orders on that exchange; in other words, depth-of-book data sales is a demand shifter for trade execution services at that exchange. These demand-side facts indicate that depth-of-book data and trade execution services are demand complements, which has implications for their joint pricing. The existence of demand- and supply-side linkages makes it unlikely that depth-of-book data vendors price their depth-of-book data independently of their pricing of trade execution services. And that linkage suggests that exchanges like NYSE Arca have an incentive to keep trading costs (including the price of depth-of-book data) low, to encourage trading at the exchange.

36. This section continues by pointing out that changes in technology and regulations have resulted in the growth of new exchanges and non-exchange trade execution services, such as dark pools. Competition for order flow (or trade execution services), which was "fierce" in the 2008–2010 period,³⁹ has gotten even stronger, which means that the discipline that competition imposes on depth-of-book data pricing has become stronger.

A. Stock Exchanges Compete as Platforms

37. Competition in depth-of-book data is one element of broader platform competition between stock exchanges.

38. Stock exchanges are multiproduct platforms. Exchanges today offer an array of different, complementary products and services that facilitate trading in securities. These include:

- a. Listing services. Exchanges charge fees for corporations to list their stock for trading on the exchange. In return, a listed corporation gains access to liquidity for its stock, monitoring of trading in its stock, and a signal to investors that its stock is of high

³⁸ See Court Opinion in *NetCoalition I*, p. 24.

³⁹ See Court Opinion in *NetCoalition I*, p. 24.

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- quality.⁴⁰ Listing fees typically include an initial listing fee and an annual continued listing fee.⁴¹
- b. Index services. Stock exchanges create indices that represent the value of different combinations of listed stocks, and license these indices to asset managers, charging a fee in return for the use of the index.
 - c. Order execution services. On most stock exchanges, traders pay a per-share fee for orders that “take” liquidity (i.e., execute against existing orders in the exchange’s order book), and receive a rebate for orders that “make” liquidity (i.e., add to the exchange’s order book). The take fee is typically slightly larger than the make rebate. Fees for a given order depend on a number of variables, including order size, stock price, customer type, and order routing.⁴²
 - d. Data services. Data products sold by stock exchanges fall into two categories, core (or “consolidated”) and non-core (or “proprietary”) data. Core data products are those that satisfy the SEC requirement that all exchanges provide data describing bids, offers, and last sale prices to a centralized securities information processor that

⁴⁰ Ramos, S., “Competition Between Stock Exchanges: A Survey” (HEC-University of Lausanne, FAME and CEMAF/ISCTE, February 2003), pp. 26–27.

⁴¹ See NYSE Arca – Schedule of Fees and Charges, http://www1.nyse.com/pdfs/NYSEArca_Listing_Fees.pdf, last accessed 1/24/15; NASDAQ Initial Listing Guide, <https://listingcenter.nasdaqomx.com/assets/initialguide.pdf>, last accessed 1/24/15; and NASDAQ Continued Listing Guide, <https://listingcenter.nasdaqomx.com/assets/continuedguide.pdf>, last accessed 1/24/15.

⁴² See NYSE Trading Information, <https://www.nyse.com/markets/nyse/trading-info>; NYSE Arca Equities, Inc. Schedule of Fees and Charges for Exchange Services, January 1, 2015, https://www.nyse.com/publicdocs/nyse/markets/nyse-arca/NYSE_Arca_Marketplace_Fees.pdf; BATS BZX Exchange Fee Schedule, Effective January 12, 2015, http://www.bats.com/us/equities/membership/fee_schedule/bzx/; BATS BYX Exchange Fee Schedule, Effective January 12, 2015, http://www.bats.com/us/equities/membership/fee_schedule/byx/; EDGA Exchange, Inc. Fee Schedule, Effective January 16, 2015, http://www.bats.com/us/equities/membership/fee_schedule/edga/; EDGX Exchange, Inc. Fee Schedule, Effective January 16, 2015, http://www.bats.com/us/equities/membership/fee_schedule/edgx/; NasdaqTrader.com – Price List - Trading Connectivity, <http://www.nasdaqtrader.com/Trader.aspx?id=PriceListTrading2>; NasdaqTrader.com – BX Pricing List-Trading & Connectivity, http://www.nasdaqtrader.com/Trader.aspx?id=bx_pricing; NasdaqTrader.com – PSX Pricing List, http://www.nasdaqtrader.com/Trader.aspx?id=PSX_Pricing (all websites last accessed on 1/25/15).

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offers consolidated data to the public.⁴³ Non-core data products sold by exchanges (typically on a monthly subscription basis) include the ArcaBook depth-of-book data feed at issue in this proceeding and a variety of other real-time data and data reports.⁴⁴

- e. Network and data center colocation services. These services support trading by specific market participants who elect to locate their interfaces as close to the markets as possible for reasons specific to their business models (such as high-frequency or algorithmic trading firms).⁴⁵

39. Exhibit 1 shows the composition of NYSE Euronext revenue across these different services from 2006 through 2013. Order execution services accounted for approximately two-thirds of NYSE Euronext revenue over this period. NYSE Euronext's market data revenue, which includes U.S. sales of core and non-core data products and European sales of market data products, accounted for approximately 9% of total revenue annually during the same period.

40. Basic economic principles tell us that an exchange's objective is to maximize joint profits realized from all products and services generated from the trading platform, rather than maximize the profits realized from an individual product or service. This has two important implications for analysis of competition.

41. First, analysis of a price change for a particular product or line of products must account not only for the effect of the change on revenues from that product, but also for the impact of the price change on revenues of other products sold by the exchange. Economic theory tell us that a

⁴³ The last trades and best quotes for securities listed on the NYSE ("Tape A securities") and securities listed on BATS, NYSE Arca, NYSE market, and other regional exchanges ("Tape B securities") are disseminated by the Consolidated Tape Association through two data streams, the Consolidated Quotation System and Consolidated Tape System. The last trades and best quotes for securities listed on NASDAQ ("Tape C securities") are disseminated by the OTC UTP operating committee. These data are sold to professional and non-professional investors, news outlets, and other buyers. All participants who provide data to the three tapes share in the revenue from these sales. See Consolidated Tape Association, CTA Announcements, <https://www.ctaplan.com>, last accessed 1/24/15.

⁴⁴ Other real-time data feeds include best quote, last trade, index values, trading status alerts, and analytics products that measure market sentiment. Reports cover a wide variety of data, including historical data, short sales, short interest, corporate action/event reports, and listing notices.

⁴⁵ See, for example, O'Hara, M., "High Frequency Market Microstructure" (Johnson Graduate School of Management Working Paper, 2014), p. 5; and NASDAQTrader.com, NASDAQ OMX Co-Location, <http://www.nasdaqtrader.com/Trader.aspx?id=colo>, last accessed 1/24/15.

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firm will set the price of complementary goods at a lower price than if these goods were priced and sold by separate or independent firms, because an increase in the price of one product will hurt revenues and profits from the other products.⁴⁶ Exchanges are not solely, or even primarily, data vendors. As is evident in Exhibit 1, most of NYSE Euronext's revenue comes from order execution services. Therefore, an exchange's pricing of data products should take into account the (negative) impact a market data price increase will have on revenues from trading volume. In other words, at a fundamental level, exchanges like NYSE Arca must be concerned about traders' *overall* costs of doing business on NYSE Arca to encourage trading on NYSE Arca as compared to competing exchanges.

42. Second, because stock exchanges supply a platform that provides multiple services (not all of which may be used by all customers), analysis of the profits, as opposed to revenues, from a single product is impracticable as a matter of economics. Costs incurred to supply trading and data services are *joint* costs, and no economically meaningful allocation of such costs between individual services exists.⁴⁷ Profits can be examined on a joint basis, but without allocation of joint costs to individual services, one cannot meaningfully examine the profits of individual services that rely on the underlying multiproduct platform.

B. Regulatory and Technical Changes Have Intensified Competition and Increased Fragmentation of U.S. Stock Exchanges in the Last Decade

43. Technological advancements coupled with regulatory changes have spurred the creation of alternatives to traditional securities exchanges and have fostered competition in the market for listings, order flow, execution and transaction reports.

⁴⁶ Tirole, J., *The Theory of Industrial Organization* (MIT Press, 1988), p. 70.

⁴⁷ See Viscusi, W., J. Harrington, and J. Vernon, *Economics of Regulation and Antitrust*, 4th ed. (MIT Press, 2005), p. 444 ("the particular method [of cost allocation] may appear quite reasonable, but the essential point is that it is necessarily arbitrary. And more importantly, such cost allocations lead to prices that have no necessary relationship to marginal costs."). See also Carlton, D., and J. Perloff, *Modern Industrial Organization*, 4th ed. (Addison-Wesley, 2005), pp. 50–51 ("[T]here is no unambiguous measure of average cost. Although total cost is well-defined, there is no one unique output level to choose when to products are produced.").

1. Changes in Technology

44. On the technology side, advances in telecommunications and computing power over the last 20 years have dramatically reduced the cost of entry and have made possible new methods of making markets, faster channels for dissemination of financial information, greater access to exchanges, improved order-routing, and algorithmic trading.⁴⁸ The first non-exchange electronic trading platforms—or ECNs—emerged in the 1990s as alternative trading platforms for institutional investors.⁴⁹ The ECNs Island/Instinet and Archipelago were acquired by NASDAQ and NYSE, respectively.⁵⁰ Other ECNs such as BATS and Direct Edge were subsequently started by large trading entities.⁵¹ BATS was spun off from Tradebot Systems in 2005,⁵² and early investors in Direct Edge included Knight Capital Group, and Goldman Sachs.⁵³ BATS, Direct Edge, and other “exchange-like” platforms such as Turquoise and Chi-X have gained significant share from incumbent exchanges in the United States and around the world.⁵⁴ Startup

⁴⁸ Cantillon, E., and P. Yin, “Competition between Exchanges: A Research Agenda,” *International Journal of Industrial Organization* 29 (2011), pp. 329–336; see also Chew, M., “Reform of Financial Services: The Effect on the Regulator,” *Singapore Journal of International and Comparative Law* 5 (2001); Harris, L., *Trading & Exchanges: Market Microstructure for Participants* (Oxford University Press, 2003), pp. 524–525 (“New trading systems have proliferated largely due to advances in communications and computing technologies. New communications technologies have given traders instantaneous presence in markets that they formerly could not attend. ... Instantaneous market data reporting systems and order-routing systems now allow traders anywhere in the world to see and act upon opportunities wherever they occur. ... New computing technologies have allowed market centers to organize sophisticated algorithm-based order-matching systems that would be impossible to implement by hand.”).

⁴⁹ Cantillon, E., and P. Yin, “Competition between Exchanges: A Research Agenda,” *International Journal of Industrial Organization* 29 (2011), pp. 329–336.

⁵⁰ See “NASDAQ to Acquire Instinet,” <http://www.nasdaq.com/investorrelations/faqs.pdf>, last accessed 1/24/15; and “SEC approves NYSE, Archipelago merger,” http://usatoday30.usatoday.com/money/markets/us/2006-02-28-nyse-archipelago-ap_x.htm, last accessed 1/24/15.

⁵¹ Consortiums of large securities firms have also started electronic trading systems in many other asset classes. Examples include BrokerTec for U.S. Treasuries, MarketAxess for corporate bonds, and Electronic Broking Service (EBS) for currencies. See BrokerTec, <http://www.icap.com/what-we-do/electronic/BrokerTec.aspx>, last accessed 1/24/15; MarketAxess, <http://www.marketaxess.com/trading/highgrade.php>, last accessed 1/24/15; EBS, <http://www.ebs.com/about-us.aspx>, last accessed 1/24/15.

⁵² “About Us,” Tradebot Systems, <http://www.tradebotsystems.com/about.asp>.

⁵³ De La Merced, M., and N. Popper, “BATS and Direct Edge to Merge, Taking on Older Rivals,” *New York Times*, August 26, 2013.

⁵⁴ He, P., et al., “The Determinants of Alternative Trading Venue Market Share: Global Evidence from the Introduction of Chi-X,” *Journal of Financial Markets* 22 (2015), pp. 28–49.

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costs for an exchange have fallen in response to falling development costs for automated systems.⁵⁵

45. In order to compete, trading venues have cut fees and invested in providing lower-latency services to their clients, so that a trade can be processed in just a few microseconds and market data can be provided in real time.⁵⁶ For instance, competitive pressures led the New York Stock Exchange to make major expenditures for new technology and operation of its systems, which resulted in a drop in the trading latency on the New York Stock Exchange from 350 milliseconds in 2007 to five milliseconds in 2009.⁵⁷ Innovative product enhancements like this, which have also occurred with respect to market data products, are evidence that a firm is operating within a competitive marketplace, because firms that are not subject to competitive pressure do not feel the need to innovate to attract new customers and retain existing ones.

2. Regulatory Changes

46. These technological changes led the SEC to adopt a number of rule changes in the last 20 years in an express effort to foster competition among trading venues by integrating alternative trading systems into the exchange-based trading infrastructure, limiting the regulatory burden imposed on small trading venues such as ECNs, and weaving individual trading platforms together into a single national market system.

47. The SEC adopted rule changes in 1996—the Limit-order Display Rule and the “ECN amendment” to its Quote Rule—that required NASDAQ dealers to display publicly limit-order quotes placed on ECNs. The SEC’s objective was to provide investors “more competitive quotes through the mandatory display of customer limit orders and the dissemination of superior prices

⁵⁵ Domowitz, I., and B. Steil, “Automation, Trading Costs, and the Structure of the Securities Trading Industry,” in *Brookings-Wharton Papers on Financial Services*, edited by R. Litan and A. Santomero, 1999, pp. 33–81; see also Harris, L., *Trading & Exchanges: Market Microstructure for Participants* (Oxford University Press, 2003), p. 525 (“New computing technologies... have allowed market centers to lower the costs of existing services in addition to providing new services.”).

⁵⁶ Menkveld, A., “High-Frequency Traders and Market Structure,” *Financial Review* 49 (2014), pp. 333–344.

⁵⁷ Menkveld, A., and M. Zoican, “Need for Speed? Exchange Latency and Liquidity” (Tinbergen Institute Discussion Paper 14-097/IV/DSF78, July 22, 2014).

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placed in proprietary trading systems,”⁵⁸ and thereby allow investors to “compete with market maker quotations and narrow the size of the bid-ask spread.”⁵⁹

48. The SEC provided further support for alternative trading systems in 1998 with the adoption of Regulation ATS, which shelters alternative trading systems from some regulation so long as they remain small (i.e., during at least four of the preceding six calendar months having an average daily trading volume of less than 5% of the aggregate average daily share volume for a stock).⁶⁰ The rule defines an “ATS” as any system that “(1) would constitute, maintain, or provide a marketplace or facilities for bringing together purchasers and sellers of securities or for otherwise performing with respect to securities the functions commonly performed by a stock exchange under proposed Rule 3b-12 of the Exchange Act; and (2) would not regulate its members or surveil its own market.”⁶¹

49. Finally, in 2006, the SEC adopted Regulation NMS, a comprehensive set of rules designed to carry out the SEC’s statutory mandate to establish a national market system for equities.⁶² Rules adopted as part of Regulation NMS have opened the trading industry to competition from new trading platforms, and have linked multiple individual trading platforms together into a national market system.⁶³ Specifically, the Order Protection Rule imposes a “trade-through” provision under which trading platforms must provide traders with the best price available across all trading platforms, and generally prohibits trades at prices inferior to the best

⁵⁸ Barclay, M., et al., “Effects of Market Reform on the Trading Costs and Depths of Nasdaq Stocks,” *Journal of Finance* 54, no. 1 (February 1999), p. 2.

⁵⁹ “NASD Rulemaking: Order Approving a Proposed Rule Change to Permanently Expand the NASD’s Rule Permitting Market Makers to Display Their Actual Quotation Size,” SEC Release 34-40211, July 15, 1998, <http://www.sec.gov/rules/sro/nd9821o.htm>.

⁶⁰ See Securities and Exchange Commission, 17 CFR Parts 202, 240, 242 and 249, Release No. 34-40760, File No. S7-12-98, at § 242.301(b)(3).

⁶¹ Securities and Exchange Commission, 17 CFR Parts 201, 240, 242 and 249, Release No. 34-39884, File No. S7-12-98.

⁶² See “Regulation NMS,” Securities Exchange Act Release No. 70 FR 37496, 37498-37499 (June 29, 2005) (discussion of national market system principles and objectives).

⁶³ Securities and Exchange Commission, 17 CFR Parts 200, 201, 230, 240, 242, 249, and 270, Release No. 34-51808, File No. S7-10-04.

prices quoted on other trading platforms.⁶⁴ The rule requires trading centers to “establish, maintain, and enforce written policies and procedures reasonably designed to prevent the execution of trades at prices inferior to protected quotations displayed by other trading centers, subject to an applicable exception.”⁶⁵ To facilitate smooth operation of the trade-through rule, Regulation NMS also requires all securities markets to provide an automatically executable quote.⁶⁶

3. Impact: Increased Entry, More Competitors, and Fragmentation of Trading Volume Across Exchanges and Dark Pools

50. The impact of the technical and regulatory changes discussed in the preceding sections has been dramatic. The largest incumbent exchanges, NYSE and NASDAQ, accounted for approximately 75% of trading volume in early 2007, after Regulation NMS took effect. The incumbent exchanges’ share of trading volume has since declined by approximately 35 points. Today, approximately a dozen exchanges, including NYSE, NASDAQ, NYSE Arca, and several BATS and Direct Edge exchanges, compete with a variety of alternative trading systems such as dark pools for trades in the same securities. See Exhibit 2. Recent exchange entrants such as BATS and Direct Edge have captured some trading volume from the incumbent exchanges, but ECNs and other alternative trading systems have captured the largest share of trade volume from the incumbent exchanges. Volume for these platforms, which report trades through trade reporting facilities (“TRFs”) operated by (among others) NASDAQ and NYSE, is shown in Exhibit 2 under “Total TRF.”

51. Dark pools are a notable example of the new types of trading systems encouraged by Regulation ATS. While often similar to standard markets in terms of order types and matching rules, they differ in that they do not provide pre-trade market data. That is, although dark pools report trading through TRFs, they do not supply the same core and depth-of-book data provided

⁶⁴ Mary Jo White, Chair of the Securities and Exchange Commission, “Intermediation in the Modern Securities Markets: Putting Technology and Competition to Work for Investors,” (speech, Economic Club of New York, NY, June 20, 2014), <http://www.sec.gov/News/Speech/Detail/Speech/1370542122012#.VIi0nTHF98E> .

⁶⁵ Securities and Exchange Commission, 17 CFR Parts 200, 201, 230, 240, 242, 249, and 270, Release No. 34-51808, File No. S7-10-04.

⁶⁶ Schmerken, I., “Making Markets Move,” Wall Street & Technology, July 26, 2004.

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by registered exchanges. Dark pools account for a significant portion of the increase in TRF volume shown in Exhibit 2. Dark pools are owned by exchanges, by large brokerages, and by independent companies; for example, Goldman Sachs formed the ATS known as Sigma X in 2005.⁶⁷ By the end of 2012, 50 different dark pools traded U.S. equities, and the 19 for which data were available accounted for more than 14% of consolidated volume in 2013.⁶⁸ Some academic researchers estimate that “dark trading venues” account for more than a third of U.S. equities trading volume.⁶⁹ The proliferation of dark pools and their success in attracting trading volume is clear evidence that barriers to entry in the exchange industry are low, and suggests that under the current regulatory regime low barriers to entry provide competitive discipline in the U.S. exchange industry.

52. Finally, we note that this analysis of competitive conditions in the U.S. exchange industry contradicts the portrait of the industry offered by the 2008 SIFMA/NetCoalition Submission. The report noted the “dominance of NYSE Group and NASDAQ in pertinent liquidity” and asserted that competition in depth-of-book data was a duopoly.⁷⁰ Exhibit 2 demonstrates that the claim of “dominance” was not accurate at the time and is even less accurate today, as the concentration of trading across U.S. equities exchanges has fallen dramatically since then. We take up this point in greater detail in Section VI below.

VI. Analysis of Competition and Depth-of-Book Data Pricing

53. Analysis of competition in the marketplace for depth-of-book data products should follow well-established methods used both in the academic literature and antitrust analysis.⁷¹

⁶⁷ Mehta, N., “Goldman Sachs to Offer Canada Dark Pool as Order Rules Change,” *Bloomberg*, August 18, 2011, <http://www.bloomberg.com/news/2011-08-18/goldman-sachs-introduces-sigma-x-canada.html>

⁶⁸ Buti, S., et al., “Dark Pool Trading Strategies, Market Quality and Welfare” (working paper, January 2014), citing research published by Rosenblatt Securities; see also Kwan, A., et al., “Trading Rules, Competition for Order Flow and Market Fragmentation,” *Journal of Financial Economics*, Vol. 115, Issue 2, February 2015, pp. 330–348.

⁶⁹ Kwan, A., et al., “Trading Rules, Competition for Order Flow and Market Fragmentation,” *Journal of Financial Economics*, Vol. 115, Issue 2, February 2015, pp. 330–348 (“[D]ark trading venues are introducing new trading systems with potentially faster execution, greater anonymity, lower costs of trading, and more liquidity. By early 2014, more than a third of all U.S. stock trading volume takes place on dark trading venues.”).

⁷⁰ SIFMA/NetCoalition Initial Submission, p. 7; SIFMA/NetCoalition Rebuttal Submission, p. 5.

⁷¹ Congress and the SEC impose a unique regulatory structure on registered exchanges (which does not apply in the same way to dark pools and does not apply at all to the sale of market data by certain vendors such as Bloomberg).

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Using the tools and methods of antitrust analysis, we show that competition constrains the pricing of depth-of-book data. In particular, we show that (a) platform competition places downward pricing pressure on the price of depth-of-book data products, and (b) the willingness of some customers to substitute to other depth-of-book data products if NYSE Arca were to raise the ArcaBook price also constrains the ability of NYSE Arca to set supracompetitive prices.

54. We first demonstrate that the market for trading platforms is competitive using the standard metrics of antitrust analysis. Next, we demonstrate that competition for order flow will discipline depth-of-book data pricing. We provide empirical evidence that pricing of depth-of-book data products affects trading volume. In addition, based on an examination of subscriber response to ArcaBook price increases, we conclude that NYSE Arca pricing of ArcaBook accounts for the complementary relationship between depth-of-book data and order flow. Further, we conclude that competing depth-of-book products offered by, among others, NASDAQ, NYSE, and NYSE Arca are substitutes that constrain depth-of-book data product prices. We find that many customers do not subscribe to all depth-of-book data products and are willing to substitute one product for competing products. We also find that trading for individual stocks is distributed across different exchanges in a manner that allows competing depth-of-book products to act as substitutes that constrain pricing. We conclude this section by explaining why some measures of competition discussed in prior related proceedings are inappropriate here.

A. The Market for Trading Platforms Is Competitive and Contestable

55. As shown in Section V.B above, the market for trading platforms is competitive and contestable. In the last decade, new trading platforms have entered the market, traders can and have taken their order flow to new trading platforms, and, as we show in Exhibit 2, the incumbent exchanges have lost substantial market share. The implication for NYSE Arca today is clear: the threat of further migration to other trading venues disciplines NYSE Arca's pricing as a general matter. If an exchange tried to reap supracompetitive rents on depth-of-book data products, another trading platform could meet that exchange's pricing on other dimensions in

We address how exchange regulatory restrictions affect traditional antitrust analysis, as necessary, where noted in our report.

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which trading platforms compete and undercut the exchange's depth-of-book data prices. In other words, because exchanges must compete by keeping the overall cost of trading low, economic theory predicts that vigorous platform competition should discipline depth-of-book data pricing.

56. A prior submission by SIFMA/NetCoalition asserted that evidence of competition between exchanges as quantified by aggregate trading volume shares is irrelevant because trading volume may be concentrated at the level of individual stocks.⁷² Another expert retained by SIFMA similarly asserted that trading in the 10 most active NASDAQ- and NYSE-listed stocks is “highly concentrated,” that trading for most stocks is highly concentrated, and that trading for a particular stock is dominated by the listing exchange.⁷³

57. To demonstrate that these assertions are not correct, we examine the concentration of trading volume across exchanges for essentially all stocks and exchange traded funds (“ETFs”) traded in November 2014.⁷⁴ As a measure of concentration, we use the Herfindahl-Hirschman Index (“HHI”), which we compute individually for each security in our analysis. The HHI is a standard measure of industry concentration.⁷⁵

58. The HHI for an individual stock is the sum of the squared percentage share of trading volume across each of the exchanges on which it trades. The HHI ranges from near zero when volume is spread across a large number of very small trading venues to a maximum value of 10,000 when the market consists of only one trading venue. A lower HHI value indicates less concentration of trading volume, and a higher value indicates a higher degree of concentration. For example, a stock with trading volume divided equally across just two exchanges (i.e., 50% share each) would have an HHI of 5,000, while a stock with trading volume divided equally

⁷² See, e.g., SIFMA/NetCoalition Initial Submission, p. 7 (suggesting that an exchange with a significant share of trading in Google may not have a significant share of trading in AT&T).

⁷³ SLCG Report, pp. 10, 19.

⁷⁴ Our analysis relies on TAQ data obtained from Tick Data; the data for November 2014 contain trades for more than 8,200 different stocks and ETFs.

⁷⁵ See, e.g., Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines §5.3, 2010; Carlton, D., and J. Perloff, *Modern Industrial Organization*, 4th ed. (Addison-Wesley, 2005), p. 255.

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across four trading platforms would have an HHI of 2,500.⁷⁶ A symmetric market with 10 participants would have an HHI of 1,000.

59. The DOJ and FTC Horizontal Merger Guidelines provide guidance on what level of HHI constitutes a “concentrated” market. Markets with an HHI below 1,500 are considered unconcentrated, and those with an HHI between 1,500 and 2,500 are considered moderately concentrated. A market needs to have an HHI above 2,500 to be considered concentrated.⁷⁷

60. We compute HHI by exchange owner rather than by exchange. For example, because the NASDAQ, NASDAQ OMX, and NASDAQ PSX exchanges have a common owner, we combine the trading volume on each of these exchanges before computing the total trading volume.⁷⁸ This is a conservative measure of concentration because it assumes fewer market participants and produces larger HHI values. The measured HHIs would have been lower had we computed the HHIs with each individual exchange’s shares counted separately.

61. We find that the concentration of aggregate trading volume by exchange owner is low. The aggregate HHI value is 1,362 in November 2014, which meets the DOJ’s definition of an unconcentrated market. We disaggregate trading volume and compute HHI values for the trading volume of individual stocks by exchange owner, and we find that trading for nearly all stocks is unconcentrated or moderately concentrated and distributed across a variety of different exchanges and alternative trading platforms. Exhibits 3 and 4 report our results.

- a. Across approximately 8,200 securities that we examined, the mean HHI weighted by market capitalization is 1,849. This means there is less concentration of trading volume for stocks in a typical portfolio than in a market in which trading is divided equally across five different trading platforms (which would have an HHI of 2,000).

⁷⁶ In the first case, we compute HHI as $50^2 + 50^2 = 5,000$. In the second case, HHI is computed as $4 \cdot (25^2) = 2,500$.

⁷⁷ See Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines, §5.3, 2010.

⁷⁸ Our analysis also includes trades executed on off-exchange platforms (e.g., dark pools) and reported via the NYSE or NASDAQ TRFs. TRF data report aggregate volume, but do not report the underlying off-exchange platform for each trade. Academic literature indicates that TRF data report trades for 50 different off-exchange trading platforms. See, e.g., Buti, S., et al., “Dark Pool Trading Strategies, Market Quality and Welfare” (working paper, January 2014). In our analysis we assume that TRF-reported trading volume is distributed evenly across 50 different separately owned off-exchange platforms.

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- b. For 90% of stocks, the HHI for trading volume is less than 2,500. This means that for 90% of stocks, trading volume is no more concentrated than in a symmetric, four-firm market (i.e., a market in which trading volume is distributed evenly across four different trading platforms).
- c. Stocks that exhibit concentrated trading volume are more likely to be small-cap and thinly traded stocks. Indeed, trading volume is concentrated *because* the stocks are thinly traded. Specifically, the 10% of stocks with HHI above 2,500 account for just 3% of trading volume and 3% of market capitalization across all stocks in the sample. We find similar results for stocks for which trading volume HHI exceeded 5,000 in November 2014. Stocks in this group comprise 1.5% of the 8,207 stocks in our analysis, but account for just 0.008% of average daily trading volume.⁷⁹

62. This HHI computation is conservative in several ways. First, as previously noted, the computation is not done by individual exchange, but by exchange owner; that is, we compute HHI using a stock's combined trading volume across all exchanges with a common owner, rather than its trading volume on each individual exchange. This approach produces larger HHI values than a computation by individual exchange.⁸⁰ Treating exchanges individually, we find that the weighted average HHI is 1,191 (versus 1,849), that 95% of stocks (versus 90%) have a trading volume HHI less than 2,500, and that the 5% of stocks with an HHI above 2,500 account for just 0.4% of trading volume.⁸¹

63. Second, as we discussed in Section V.B, in recent years new exchange entrants as well as dark pools have captured a significant share of trading volume. The concentration of trading volume has diminished considerably as a result. In 2006, the HHI for aggregate trading volume by exchange owner was nearly 5,000, well above the threshold at which the DOJ deems a market concentrated, but has since fallen to a level that the DOJ deems unconcentrated. See Exhibit 5.

⁷⁹ See workpapers submitted in association with this report.

⁸⁰ A numerical example clarifies the point. Two exchanges, each with 20% market share, add 800 points to an HHI index if treated as individual exchanges, but if treated as a single entity due to a common owner, they add 1,600 points to the index.

⁸¹ See Exhibit 3.

The HHI values discussed above would overstate concentration going forward if new entrants or recent entrants already in the market were to capture additional share.

64. Statements from the DOJ suggest that it shares our view that the market is competitive and contestable. For example, in its review of the proposed acquisition of Instinet Group Inc. by NASDAQ and the proposed merger of NYSE and Archipelago Holdings Inc., the DOJ concluded that “the imminent entry of these enterprises [including regional stock exchanges supported by investments from some of the nation’s largest securities firms and investment banks] should result in additional, viable alternatives to the two merged firms sufficient to ensure that the markets remain competitive.”⁸² Similarly, when reviewing the proposed merger between NYSE Euronext and Deutsche Börse AG, the DOJ noted that “NYSE and Direct Edge compete head-to-head in displayed equities trading services.”⁸³

B. Competition for Order Flow Disciplines Depth-of-Book Data Pricing

65. The lack of concentration in trading volume, whether in the aggregate or at the level of specific securities as shown in the previous section, is evidence that competition disciplines exchange fees by the possibility of loss of order flow and trading volume. Academic researchers have shown this for transaction fees.⁸⁴ Economic theory predicts the same should be true for depth-of-book data fees as well; as they increase, thereby increasing the relative cost of trading at a given exchange, all else equal order flow volume should shift to other exchanges. Here we provide evidence that this is, in fact, true for ArcaBook prices. In particular, we show two categories of evidence. First, we present regression results that demonstrate that an actual increase in the price of ArcaBook reduced trading volume. These results imply that when considering an increase in ArcaBook prices, NYSE Arca needs to take into account lost revenue from reduced trading volume. The lost revenue from reduced trading volume will discipline any incentive it might otherwise have to increase ArcaBook prices. Second, we find that prices for

⁸² See DOJ Press Release, “Investigations Conclude Acquisition of Instinet Group Inc. by NASDAQ and Merger of NYSE and Archipelago Holdings Would Not Reduce Competition,” November 16, 2005.

⁸³ U.S. v. Deutsche Börse AG and NYSE Euronext Complaint, p. 10.

⁸⁴ See, e.g., Cardella, L., J. Hao, and I. Kalcheva, “Make and Take Fees in the U.S. Equity Market” (working paper, April 29, 2013), p. 22. The authors conclude that exchanges that reduce transaction fees increase their market share.

ArcaBook are consistent with NYSE Arca accounting for the impact on trading volume when setting the price of ArcaBook. Specifically, we find that ArcaBook prices are set in a manner that would not be optimal for a single-product firm selling only depth-of-book data. Rather, ArcaBook pricing is consistent with pricing by a multiproduct firm that seeks to optimize joint profits from the sale of transaction services and depth-of-book data.

1. Trading Volume Decreases When the Price of Depth-of-Book Data Increases

66. Academic work has found that the availability of depth-of-book data affects trading activity.⁸⁵ We test the related hypothesis that an increase in ArcaBook prices would result in a decline in NYSE Arca's trading volume using an increase in the price of ArcaBook that took effect in January 2009. The change introduced a fee structure for ArcaBook subscribers. Previously ArcaBook had been made available for free. The fee structure included a monthly per-customer access fee, a monthly per-subscriber device fee, and a fee cap for non-professional users. As discussed above, the January 2009 depth-of-book data product fee implementation had been proposed in May 2006 by NYSE Arca and was approved by the SEC in December 2008 after a lengthy rule-making process.⁸⁶ We focus on the January 2009 event not only because it is the focus of this litigation, but for three additional reasons. First, there were relatively few confounding events (i.e., changes in trading fees for all exchanges and changes in other exchanges' depth-of-book data products and prices) surrounding this event, which allows us to better isolate the impact of a change in the price of ArcaBook on NYSE Arca's trading volume. Second, the January 2009 event was a significant price increase: the monthly access fee increased from \$0 to \$750, and the monthly device fee increased from \$0 to \$10 for non-

⁸⁵ See Hendershott, T., and C. Jones, "Island Goes Dark: Transparency, Fragmentation, and Regulation," *Review of Financial Studies* 18, no. 3 (2005). The authors find that once Island, an ATS, stopped displaying its limit-order book in some securities, its share of trading activity fell significantly. This result was also cited in NYSE Arca's rule change filings with the SEC. See Proposed rule change by NYSE Arca Pursuant to Rule 19b-4 under the Securities Exchange Act of 1934, File No. SR-2010-97, November 1, 2010 ("NYSE Arca 2010 Proposed Rule Change"), p. 14.

⁸⁶ "Self-Regulatory Organizations; Notice of Filing and Immediate Effectiveness of Proposed Rule Change by NYSE Arca, Inc. Relating to Fees for NYSE Arca Depth-of-Book Data," SEC Release 34-63291, November 9, 2010, <http://www.gpo.gov/fdsys/pkg/FR-2010-11-17/pdf/2010-28893.pdf>.

professional subscribers and \$30 for professional subscribers. Lastly, the price increase affected the full subscriber base of ArcaBook.

67. We analyze how much of the change in NYSE Arca’s trading volume in the U.S. equities market is explained by the change in ArcaBook prices, using the six-month window around the January 2009 event, that is, July 2008 to June 2009. A six-month window before and after the January 2009 event covers a full year of trading activity and provides a large enough sample to analyze the effect of this event on NYSE Arca’s trading volume. We test the impact of the January 2009 price change on trading volume using two regression specifications. In both specifications, we isolate the impact of the January 2009 event on NYSE Arca’s trading volume from confounding events that occurred during this period by using “control” groups that were subject to the same market events. With the ratio of NYSE Arca’s trading volume divided by total trading volume as the dependent variable, our first specification uses the volume traded through all stock exchanges as a control. In our second specification, the dependent variable is the ratio of NYSE Arca’s trading volume divided by the total trading volume of traditional exchanges, that is, total market volume less volume on alternative trading systems such as dark pools. Thus, in this specification, volume traded through traditional stock exchanges acts as a control. In both of these specifications we use an indicator variable (the “effective date” indicator) as the explanatory variable that captures the impact of the January 2009 event; the indicator variable has a value of 0 before January 1, 2009 and a value of 1 thereafter.

68. In both of the control regressions, the estimated coefficient for the “effective date” indicator is negative and statistically significant at the 5% significance level. A negative coefficient suggests that when NYSE Arca implemented this price change, its share of trading volume relative to the rest of all exchanges’ trading volume (or its share relative to the rest of the traditional exchanges’ trading volume) went down, which is consistent with the hypothesis that depth-of-book data pricing negatively impacts trading volume on the exchange. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

69. As a sensitivity check of the six-month window we chose, we ran our regressions with a three-month window around the January 2009 event, that is, October 2008 through March 2009. The shorter window, with less data before and after the event, could be more sensitive to random events in the data. Indeed, this is probably why one would not want to look at an even shorter window. On the other hand, if one is concerned that our control regressions do not fully deal with confounding events, then by using a shorter time window we expect to see fewer confounding market events that might impact NYSE Arca’s order flow. We find that, much like the six-month window regression results, the coefficient of the dummy variable called “effective date” was negative and statistically significant at a 5% significance level. [REDACTED]

[REDACTED]

70. These results suggest that NYSE Arca lost share in trading volume following the January 1, 2009 ArcaBook price increase. This is consistent with the theory that if an exchange operating in a competitive trading platform market were to increase its depth-of-book data prices, the cost of trading at that exchange would increase relative to other trading venues. As a result, one would expect to see (all else being equal) a decline in the order flow of that exchange. This result supports the hypothesis that competition for order flow disciplines depth-of-book data price changes.

87 [REDACTED]

2. ArcaBook Pricing Reflects the Complementary Relationship between Depth-of-Book Data and Order Flow

71. Economic theory tells us that a firm aiming to maximize profits from a single product should not price that product on the inelastic part of the demand curve because it could increase profits by raising price.⁸⁸ Put differently, if a profit-maximizing firm sets a price for a single product that falls on the inelastic part of the demand curve it faces, this is evidence that the firm is not acting to maximize profits from that single product.

72. Generally speaking, if demand for an individual product is inelastic, then a firm can increase its revenues (and profits) from that product by increasing price by a small amount. For example, suppose that the price elasticity of demand is -0.5 (i.e., a 1% increase in price induces a 0.5% decrease in the quantity demanded), and a firm raises its price by 10%. The price increase has two opposing effects on revenue, the output effect and the price effect. Revenue will fall by 5% due to the 5% decrease in quantity sold (the output effect), but revenue from the remaining 95% of unit sales will increase due to the price increase (the price effect). Because demand is inelastic, the price effect is larger than the output effect, and revenue increases. Furthermore, profit will increase because revenue is higher and costs are either unchanged, if marginal costs are zero, or lower, if marginal cost is positive, because the quantity produced is lower. Thus, if demand is inelastic, a profit-maximizing firm can always increase revenue and profits from the sale of a single product by raising price by a small amount. It follows that the profit-maximizing price for a single product is never on the inelastic portion of the demand curve.⁸⁹

73. On the other hand, if the firm seeks to maximize profits from the sale of two complementary products, then the optimal price for one product may be on the inelastic part of the demand curve. Products are complementary when an increase in the price of one product

⁸⁸ In economics, elasticity is a commonly used measure of the responsiveness of one variable to changes in a second, related variable. Elasticity measures the percentage change in the first variable given a 1% change in the second variable. For example, price elasticity of demand measures the percentage decrease in quantity demanded in response to a 1% change in price. Demand is said to be *elastic* if quantity demanded decreases by more than 1% in response to a 1% increase in price, and *inelastic* if quantity demanded decreases by less than 1%. If demand is elastic, then revenues decline in response to a price increase, as the decline in unit sales is greater than the increase in price. If demand is inelastic, revenues increase in response to a price increase, as the decline in unit sales is smaller than the increase in price.

⁸⁹ Varian, H., *Intermediate Microeconomics: A Modern Approach* (Norton & Company, 2003), p. 421.

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reduces sales of the other product. As a result, the output effect of a price increase is larger for a firm selling two complementary products than for a single-product firm facing the same demand curve. If the output effect from the second product is sufficiently large, the profit-maximizing price for the two-product firm may be low enough that it falls on the inelastic portion of the demand curve.⁹⁰

74. As mentioned above, NYSE Arca began charging for ArcaBook in January 2009; previously, ArcaBook was available at no charge. The customer response to this price increase is generally in the expected direction. The number of institutions purchasing ArcaBook and the number of ArcaBook subscribers decreased in the months after NYSE Arca began charging for ArcaBook. [REDACTED]

[REDACTED]⁹¹ Because the percentage change in both professional subscribers and ArcaBook subscriber accounts is substantially smaller in magnitude than the percentage change in price,⁹² we conclude that demand for ArcaBook at 2009 prices is inelastic. This does not mean that competition does not constrain ArcaBook pricing.

75. The SLCG Report submitted on behalf of SIFMA asserted that demand for depth-of-book data is inelastic.⁹³ We disagree with SLCG's conclusion based on this assertion.⁹⁴ As we explain above, no profit-maximizing firm considering a product in isolation sets the product's price in the inelastic region of the demand curve it faces. However, ArcaBook pricing is consistent with the conduct of a firm seeking to maximize joint profits from a portfolio of products. Moreover, we observe empirically each of the elements that economic theory predicts in the presence of

⁹⁰ In some instances, it may be optimal for a firm to set the price of one complement not only on the inelastic portion of the demand curve but at a price below marginal cost. See Tirole, J., *The Theory of Industrial Organization* (MIT Press, 1988), p. 70 ("An interesting phenomenon that may arise with complements is that one or several of the goods may be sold below marginal cost..., so as to raise the demand for other goods sufficiently.").

⁹¹ [REDACTED]

⁹² We treat the change in price as a decrease from the January 2009 price to the previous price of \$0.

⁹³ See SLCG Report, pp. 22–24.

⁹⁴ See SLCG Report, p. 22.

demand complementarity: ArcaBook subscriptions and NYSE Arca trading volume both decline in response to a price increase. [REDACTED]

[REDACTED] This provides clear support for our conclusion that competition for order flow disciplines NYSE Arca’s depth-of-book data pricing conduct: when considering an increase in ArcaBook prices, NYSE Arca must balance the revenue gained from depth-of-book data against the revenue lost due to reduced order flow. Moreover, because depth-of-book data account for less than 9% of total revenue (see Exhibit 1), while trading fees account for approximately two-thirds of total revenue, the balance is even less likely to tilt toward depth-of-book price increases.

C. Availability of Depth-of-Book Data Products from Other Exchanges Disciplines ArcaBook Pricing

76. We find compelling evidence that depth-of-book data products provided by NYSE, NYSE Arca, and NASDAQ are substitutes, and as such serve to constrain the pricing conduct of the exchanges. Three arguments support this conclusion.

77. First, we reviewed depth-of-book subscriber lists for NYSE Arca, NYSE OpenBook, and NASDAQ depth-of-book data products, and find direct evidence that, notwithstanding SIFMA’s claims to the contrary, many subscribers to one product do not purchase all available depth-of-book data products. The existence of marginal buyers with the ability to switch between products disciplines pricing conduct, even if other buyers purchase depth-of-book data from all exchanges.

78. Second, we introduce empirical evidence that directly contradicts prior assertions by SIFMA that competing depth-of-book data products cannot be substitutes because the adequacy of depth-of-book data from a particular exchange varies by stock. SIFMA argued that “[a] trader interested in trading AT&T stock needs data on AT&T trading—if one exchange has a significant share of trading in AT&T, data from another exchange that has a significant share of trading in Google is not directly pertinent to the AT&T investment decision.”⁹⁵ We examine

⁹⁵ SIFMA/NetCoalition Initial Submission, p. 7 (“In analyzing market power over depth-of-book data, it is important to recognize that the depth-of-book data for a given stock are unique. The depth-of book data on trading in AT&T are distinct from the depth-of-book data on trading in Google. A trader interested in trading AT&T stock needs data

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trading by venue, and find no support for the proposition that exchanges that supply depth-of-book data dominate trading in individual securities. We conclude that the depth-of-book data products supplied by different exchanges act as substitutes for market participants seeking depth-of-book information about a particular stock.

79. Finally, theory tells us that competing depth-of-book data products should contain similar information. This is contrary to arguments made previously in these proceedings that a depth-of-book data product on a particular exchange is “unique” and therefore has no possible substitute from another exchange.

80. Before turning to the details of these analyses, we note that the DOJ has also concluded in its review of some proposed stock exchange merger and acquisition transactions that competing proprietary market data products are substitutes. For example, as mentioned above, in filings related to the proposed merger of Deutsche Börse AG and NYSE Euronext in 2011, the DOJ identified Direct Edge and NYSE as “head-to-head competitors in the provision of real-time proprietary equity data.”⁹⁶ The DOJ’s competitive impact statement noted that it sought to “maintain[ing] Direct Edge as an independent and vibrant competitive constraint in [...] *real-time proprietary equity data products in the United States.*”⁹⁷ Finally, in its analysis of a competing bid for NYSE Euronext submitted jointly by NASDAQ and Intercontinental Exchange, the DOJ

on AT&T trading—if one exchange has a significant share of trading in AT&T, data from another exchange that has a significant share of trading in Google is not directly pertinent to the AT&T investment decision.”). See also SIFMA/NetCoalition Rebuttal Submission, pp. 6–7 (“Nor do [the SEC’s experts] explain how one set of depth-of-book data for all securities on one exchange could be reasonably substitutable for depth-of-book data for all securities on another exchange.”). See also SLCG Report, pp. 5–6, emphasis added (“Consumers of depth-of-book data, therefore, *must purchase exclusive data from each dominant exchange* to obtain accurate information about the true nature of liquidity regarding the individual stocks listed on those exchanges.”).

⁹⁶ See U.S. v. Deutsche Börse AG and NYSE Euronext Complaint, December 22, 2011, pp. 10–11.

⁹⁷ See U.S. v. Deutsche Börse AG and NYSE Euronext Competitive Impact Statement, December 22, 2011, p. 11, emphasis added. Note also that exchanges advertise their depth-of-book products on the basis of price. For instance, BATS/Direct Edge promote their new BATS One Feed depth-of-book product in part based on what it asserts is the lower price of this product relative to those offered by competitor exchanges. See BATS One Feed Fact Sheet, http://cdn.batstrading.com/resources/market_data/products/bats_bats-one-feed.pdf, last accessed 1/25/15 (“The BATS One Feed is 60% less expensive per professional user and more than 85% less expensive for an enterprise license for professional users (50% less for non-professional users) when compared to a similar competitor exchange product.”). If exchanges were monopolists in depth-of-book data, as SIFMA has asserted, then we would not expect to see them compete against each other on the basis of price.

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described NASDAQ and NYSE as “the largest two competitors providing certain real-time proprietary equity data products.”⁹⁸

1. Many Market Participants Do Not Purchase All Available Depth-of-Book Data Products

81. SIFMA and NetCoalition assert in their 2008 Submissions that depth-of-book data products offered by different exchanges do not constrain pricing because “depth-of-book data from all exchanges with substantial trading are required” in order to obtain a “reasonably comprehensive picture of liquidity below the top of the book.”⁹⁹

82. To understand purchasing patterns for depth-of-book data and test SIFMA’s assertion as to the data that market participants require, we compared customer lists for ArcaBook, OpenBook, and NASDAQ depth-of-book data products. We find that purchase patterns across different depth-of-book products flatly contradict the assertion that all market participants must purchase depth-of-book data products from all significant trading platforms. Some customers purchase one product but not all products, and the specific products that they use changed over time.

83. We first analyzed depth-of-book data purchases for a sample of 114 institutions that purchased NASDAQ depth-of-book data products at some point during a 94-month period from January 2007 to October 2014.¹⁰⁰ Our analysis is conditional on the purchase of NASDAQ depth-of-book data products. That is, we examine only those months in which a subscriber purchased NASDAQ depth-of-book data.¹⁰¹ Exhibit 7 summarizes our results. We find that, in addition to purchasing NASDAQ depth-of-book data products, subscribers

⁹⁸ See DOJ Press Release, “Nasdaq OMX Group Inc. and Intercontinental Exchange Inc. Abandon Their Proposed Acquisition of NYSE Euronext After Justice Department Threatens Lawsuit,” May 16, 2011.

⁹⁹ SIFMA/NetCoalition Initial Submission, p. 6, emphasis added. See also SIFMA Rebuttal Submission, p. 6 (“[A]s a matter of marketplace reality, a broker-dealer needs the depth-of-book data feeds from each significant venue on which a given security trades for a useful perspective of available liquidity.”).

¹⁰⁰ The sample of 120 professional subscribers was randomly drawn from a list of approximately 1,000 subscribers that purchased depth-of-book data directly from NASDAQ. Two of the 120 subscribers are owned by the same entity and were therefore treated as one, and five subscribers did not purchase during the analysis period, reducing the sample to 114 subscribers.

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[REDACTED]

[REDACTED]

[REDACTED]

84. [REDACTED]

¹⁰³

[REDACTED]

¹⁰² Under “related name” matching criteria, NASDAQ and NYSE customers are considered a match if (a) if their names are the same except for differences in punctuation, abbreviations (e.g., “LLC” vs. “LTD”), or spaces; (b) the NYSE account name is the same as or similar to the parent firm associated with the sampled NASDAQ customer; or (c) the NYSE account name is associated with the sampled NASDAQ parent name or customer name, including subsidiaries, merged entities, and other related branches of the sampled NASDAQ customer. Under these criteria, a single NASDAQ customer may match a large number of NYSE customers. [REDACTED]

¹⁰³ Under “exact name” matching criteria, NYSE and NASDAQ accounts are considered a match if their names are otherwise the same except for punctuation, abbreviations, or spaces.

85. We also reviewed subscriber data for NASDAQ's depth-of-book data product, and identified NASDAQ depth-of-book data subscribers that (i) never subscribed to ArcaBook, or (ii) at some point stopped subscribing to ArcaBook. These customers include the following:¹⁰⁴

- [REDACTED] subscribed to NASDAQ's depth-of-book data products continually over an eight-year period from January 2007 through November 2014, but purchased an ArcaBook professional subscription for less than three years over the same period. [REDACTED] purchased ArcaBook from December 2006 to October 2008, terminated its ArcaBook subscription shortly before NYSE Arca began charging a fee for ArcaBook in January 2009, and subsequently purchased ArcaBook for several brief periods (May - June 2012, March 2013, and March - November 2014).
- [REDACTED] purchased professional and non-professional depth-of-book subscriptions from NASDAQ continually over an eight-year period from January 2007 through November 2014, but never purchased non-professional ArcaBook subscriptions and dramatically reduced professional subscriptions to ArcaBook in 2010.
- [REDACTED] purchased non-professional depth-of-book subscriptions from NASDAQ continually over eight years from January 2007 through November 2014, but never purchased non-professional subscriptions to OpenBook, and purchased ArcaBook non-professional subscriptions for less than two years during the same period.
- [REDACTED] used NASDAQ depth-of-book data continually over eight years from January 2007 through November 2014, but purchased professional subscriptions to ArcaBook for only six years during the same period.
- [REDACTED] purchased professional depth-of-book subscriptions from NASDAQ continually over eight years from January 2007 through November 2014, but dropped ArcaBook professional subscriptions for three periods during the same period.
- [REDACTED] purchased professional depth-of-book subscriptions from NASDAQ beginning in December 2013, but never purchased ArcaBook.

¹⁰⁴ NYSE subscriber data and NASDAQ subscriber data.

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- [REDACTED] purchased professional depth-of-book subscriptions from NASDAQ between July 2011 and May 2012, but never purchased ArcaBook.
- [REDACTED] purchased professional depth-of-book subscriptions from NASDAQ between July 2006 and May 2009, but never purchased ArcaBook.

86. Comparing OpenBook and ArcaBook customer lists, we find a number of institutions that used either ArcaBook or OpenBook but not both over an extended period. In other instances, buyers used both products but terminated their ArcaBook subscription at the time of an ArcaBook price increase. For example:¹⁰⁵

- [REDACTED] subscribed to non-professional ArcaBook subscriptions over two years, but NYSE data indicate that [REDACTED] has never used OpenBook, the NYSE depth-of-book product.
- [REDACTED] purchased non-professional ArcaBook subscriptions over three years, but has never used OpenBook.
- [REDACTED] canceled its professional subscription to ArcaBook in January 2009, just as NYSE Arca instituted fees for ArcaBook, but continued to subscribe to OpenBook through November 2014.
- [REDACTED] canceled its professional subscription to ArcaBook in February 2014, shortly after an increase in ArcaBook fees, but continued to subscribe to OpenBook through November 2014.

87. These data clearly demonstrate that market data subscribers can and do (a) choose not to use all depth-of-book products at all times, and (b) switch between depth-of-book products (sometimes more than once) as their needs change and possibly in response to price changes.

¹⁰⁵ NYSE Subscriber Data.

2. Securities Are Traded Across Multiple Exchanges, Allowing for Substitution between Depth-of-Book Products

88. If depth-of-book products offered by different exchanges are to act as substitutes, each exchange must maintain a limit-order book for most stocks. This means that the exchanges must have a large overlap in the stocks they trade. We find that this is indeed the case: if a security is traded on one exchange, the probability that it is also traded on other exchanges is high, and if probabilities are weighted by trading volume, the probability is over 99%. This contradicts SIFMA's assertion that trading in specific securities is dominated by individual exchanges that could, in theory, exercise market power in pricing their respective depth-of-book products.¹⁰⁶

89. We find a large overlap in securities traded on different exchanges. We consider five individual exchanges that offer depth-of-book data: NYSE, NYSE Arca, NASDAQ, BATS, and Direct Edge X. For each pair among these five exchanges, we calculate the probability that a security is traded on Exchange A conditional on that security being traded on Exchange B.¹⁰⁷ The conditional probabilities range from 72% to 98%. See Exhibit 8. For example, we find a 78% probability that a security trades on NYSE Arca if it trades on NYSE, a 92% probability that it trades on NYSE Arca if it trades on NASDAQ, and a 98% probability that a security trades on NYSE Arca if it trades on BATS.

90. This analysis understates the degree to which exchanges overlap, as securities that are not traded across multiple exchanges account for a very small fraction of trading volume. If we weight conditional probabilities by trade volume, which is the more relevant measure for depth-of-book purchasers,¹⁰⁸ we find an overlap in trading between exchanges that uniformly exceeds 99% for every pair that we consider. We find a 99.5% probability that a security trades on NYSE Arca if it trades on NYSE, a 99.8% probability that it trades on NYSE Arca if it trades on NASDAQ, and a 99.9% probability that a security trades on NYSE Arca if it trades on BATS.

¹⁰⁶ See, e.g., SIFMA/NetCoalition Initial Submission, p. 7.

¹⁰⁷ We quantify the probability that a stock trades on other exchanges given that it trades on the NYSE. However, because NYSE trades only NYSE-listed stocks, we do not examine the probability that a stock trades on NYSE given that it trades on another exchange.

¹⁰⁸ Depth-of-book data for thinly traded securities would need to have significantly more value per trading volume to justify equally weighting the conditional probabilities across securities.

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See Exhibit 8. This means that there is only negligible trading volume that is not covered by multiple exchanges. For example, Bank of America is the fourth-largest stock in terms of trading volume in November 2014 and is traded on all five of the exchanges considered in our analysis.¹⁰⁹ Similarly, Apple, the sixth-largest stock in terms of trading volume in November 2014, is traded on all exchanges except for NYSE, where it is not traded because it is not an NYSE-listed stock.

91. Finally, the HHI analysis discussed in Section VI.A above supports the same conclusion. Trading is distributed across a variety of different exchanges and alternative trading platforms. For nearly all of the approximately 8,200 stocks we examined, no single platform dominates trading. As a result, individual exchanges cannot maintain an exclusive hold on depth-of-book data for a particular stock, and the depth-of-book data products supplied by different exchanges act as substitutes for market participants seeking depth-of-book information about a particular stock.

3. Depth-of-Book Information Is Correlated across Exchanges

92. Previously in these proceedings, SIFMA argued that “depth-of-book data for a given stock are unique,” particularly “if one exchange has a significant share of trading in [the stock].”¹¹⁰ Our results above show that this situation is rarely encountered in today’s markets. Moreover, theory and empirical evidence demonstrate that depth-of-book information about limit orders is correlated across exchanges. Theoretically, limit orders are submitted until new limit orders are no longer expected to be profitable.¹¹¹ If exchanges are identical, the zero-profit

¹⁰⁹ Note that this stock could also be traded on other platforms that we have not included in this analysis.

¹¹⁰ See SIFMA/NetCoalition Initial Submission, p. 7 (“In analyzing market power over depth-of-book data, it is important to recognize that the depth-of-book data for a given stock are unique.”). The court in *NetCoalition I* adopted this view as well, in our view mistakenly. See Court Opinion in *NetCoalition I*, p. 21 (“The risk that NYSE Arca could exercise market power appears to be elevated in the pricing of its proprietary non-core data. There is no dispute that NYSE Arca is the ‘exclusive’ provider of this data. While many exchanges sell Google stock, only NYSE Arca offers access to the Google limit orders included in its depth-of-book product, ArcaBook.”). As demonstrated above, the predicate for this view is incorrect.

¹¹¹ Glosten, L., “Is the Electronic Open Limit Order Book Inevitable?,” *Journal of Finance* 49 (1994), pp. 1127–1161; Parlour, C., and D. Seppi, “Liquidity-Based Competition for Order Flow,” *Review of Financial Studies* 16 (2003), pp. 301–343; and Foucault, T., and A. Menkveld, “Competition for Order Flow and Smart Order Routing Systems,” *Journal of Finance* 63 (2008), pp. 119–158.

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conditions for limit-order submissions are identical, the limit-order books are identical, and the exchanges' depth-of-book data are perfect substitutes. If the exchanges' customers differ, then the depth-of-book data may be less than perfectly correlated. However, traders who are active in both exchanges cause changes in the limit-order books of both exchanges to be correlated. The correlation in changes in the limit-order books occurs after both trades and new limit-order submissions.¹¹² Such commonality in changes to limit-order books implies that traders purchasing depth-of-book data from one exchange can forecast the limit-order book on other exchanges for which they do not purchase depth-of-book data. Traders' ability to forecast liquidity in other exchanges can reduce the value of purchasing depth-of-book data from multiple exchanges. This is consistent with the above examples of customers purchasing NASDAQ's depth-of-book data, but not Arcabook.

D. Tests of Competitive Conditions Suggested Previously Are Inappropriate

93. The D.C. Circuit suggested, in dicta as we understand, that pricing above marginal cost would be an indication that a market is non-competitive.¹¹³ Similarly, SLCG claimed on behalf of SIFMA that a difference between price and marginal cost indicates "a high degree of monopoly power."¹¹⁴ This position is misguided, and, even though we have not seen any evidence that marginal costs can be determined here,¹¹⁵ we will elaborate.

94. Although economic theory holds that price is equal to marginal cost in the textbook model of perfectly competitive markets,¹¹⁶ it is widely recognized that in reality few markets

¹¹² For theory and empirical evidence on these common movements in limit-order books across exchanges see Van Kervel, V., "Competition for Order Flow with Fast and Slow Traders" (working paper, October 2014), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2021988.

¹¹³ Court Opinion in *NetCoalition I*, pp. 20–21 ("We do not mean to say that a cost analysis is irrelevant. On the contrary, in a competitive market, the price of a product is supposed to approach its marginal cost. [] Thus, the costs of collecting and distributing market data can indicate whether an exchange is taking 'excessive profits' or subsidizing its service with another source of revenue, as the SEC has recognized.").

¹¹⁴ SLCG Report, p. 26.

¹¹⁵ Note that for a multiproduct firm, such as exchanges, there is no unambiguous way to allocate costs or identify marginal costs for the individual products. See Viscusi, W., J. Harrington, and J. Vernon, *Economics of Regulation and Antitrust*, 4th ed. (MIT Press, 2005), p. 444; Carlton, D., and J. Perloff, *Modern Industrial Organization*, 4th ed. (Addison-Wesley, 2005), pp. 50–51.

¹¹⁶ In the textbook model of perfect competition, firms are price takers, products are perfect substitutes, fixed costs are zero, and firms can freely enter and exit. For a discussion of the perfectly competitive market model, see

meet the conditions for that textbook model of perfect competition.¹¹⁷ As an initial matter, competing products generally are differentiated and therefore are not perfect substitutes for one another. Most goods have some differentiating features that provide suppliers some degree of market power.¹¹⁸ Another important departure from the perfectly competitive model occurs when fixed costs are high and production exhibits economies of scale. In these industries, the cost of producing and selling one more unit (i.e., marginal cost) is low relative to the high fixed cost of the operation itself. As a result, the price must exceed the low marginal costs to cover the overall fixed costs.¹¹⁹ If price does not exceed marginal cost, the firm will not be viable. The mere fact that price exceeds marginal costs in these industries is not an indication that the industry is not competitive.¹²⁰ Indeed, the Antitrust Modernization Committee pointed out in its 2007 report that “[a]ntitrust analysis also must recognize that a price above marginal cost, by itself, does not necessarily suggest that a firm has market power that should be relevant in an antitrust matter or is operating anticompetitively in a relevant antitrust market.”¹²¹

95. The marketplace for exchanges, under the SEC’s stewardship, has seen increased competition and decreased concentration. In the exchange marketplace, fixed costs constitute a

Pindyck, R., and D. Rubinfeld, *Microeconomics*, 5th ed. (Prentice Hall, 2001), pp. 252–253. See also Carlton, D., and J. Perloff, *Modern Industrial Organization*, 4th ed. (Addison Wesley, 2005), pp. 56–57.

¹¹⁷ See Kaplow, L., and C. Shapiro, “Antitrust,” in *Handbook of Law and Economics*, edited by A. Polinsky and S. Shavell (Elsevier, 2007), Ch. 15, Vol. 2, p. 1079. See also Carlton, D., and J. Perloff, *Modern Industrial Organization*, 4th ed. (Addison Wesley, 2005), p. 84.

¹¹⁸ See Shapiro, C., “Mergers with Differentiated Products,” Address before the American Bar Association, November 9, 1995, reprinted in *Antitrust* (Spring 1996).

¹¹⁹ See Kaplow, L., and C. Shapiro, “Antitrust,” in *Handbook of Law and Economics*, edited by A. Polinsky and S. Shavell (Elsevier, 2007), Ch. 15, Vol. 2, p. 1079, emphasis added (“In practice *almost all firms have some degree of technical market power*. Although the notion of a perfectly competitive market is extremely useful as a theoretical construct, *most real-world markets depart at least somewhat from this ideal*. An important reason for this phenomenon is *that marginal cost is often below average cost, most notably for products with high fixed costs and few or no capacity constraints, such as computer software, books, music, and movies. In such cases, price must exceed marginal cost for firms to remain viable in the long run.*”).

¹²⁰ See Shapiro, C., (1995), “Mergers with Differentiated Products,” Address before the American Bar Association, November 9, 1995, reprinted in *Antitrust* (Spring 1996), emphasis added (“Economists have long realized that firms selling differentiated products have some ‘market power’ in a technical economic sense, although *typically not nearly enough to rise to the level of ‘monopoly’ power.*”). See also Kaplow, L., and C. Shapiro, “Antitrust,” in *Handbook of Law and Economics*, edited by A. Polinsky and S. Shavell (Elsevier, 2007), p. 1088 (“In any event, as with all measures of technical market power, it is important to keep in mind the distinction between the extent of market power and whether particular conduct should give rise to antitrust liability.”).

¹²¹ See *Antitrust Modernization Commission Report and Recommendations*, April 2007, p. 40.

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significant fraction of overall costs, hence average costs exceed marginal cost and firms must therefore charge positive margins in order to cover these costs. If this were not the case, firms would go out of business. The true measure of the competitiveness of this industry is whether there are significant barriers to entry. The discussion in Section V.B of recent entry events clearly demonstrates that barriers to entry in this industry are minimal and decreasing.

Executed January 26, 2015

A handwritten signature in cursive script, reading "Terrence J. Hendershott".

Terrence J. Hendershott, Ph.D.

A handwritten signature in cursive script, reading "Aviv Nevo".

Aviv Nevo, Ph.D.

Exhibit 1: NYSE Euronext Revenues

(in millions and as percentages of total revenue)

	2006	2007	2008	2009	2010	2011	2012	Q1 – Q3 2013 ^[3]
Transaction and Clearing Fees ^[4]	\$1,349	\$2,760	\$3,536	\$3,427	\$3,128	\$3,162	\$2,393	\$1,845
	57%	70%	75%	73%	71%	69%	64%	65%
Technology Services ^[5]	\$137	\$130	\$159	\$223	\$318	\$358	\$341	\$231
	6%	3%	3%	5%	7%	8%	9%	8%
Market Data ^[6]	\$223	\$371	\$428	\$403	\$373	\$371	\$348	\$265
	9%	9%	9%	9%	8%	8%	9%	9%
Listing ^[7]	\$356	\$385	\$395	\$407	\$422	\$446	\$448	\$334
	15%	10%	8%	9%	10%	10%	12%	12%
Other Revenue ^[8]	\$311	\$292	\$184	\$224	\$184	\$215	\$219	\$173
	13%	7%	4%	5%	4%	5%	6%	6%
Total Revenue	\$2,376	\$3,938	\$4,702	\$4,684	\$4,425	\$4,552	\$3,749	\$2,848

Source: SEC Filings

Note:

[1] Includes Archipelago revenues following the merger with NYSE on March 7, 2006.

[2] Includes Euronext revenues after the merger with NYSE on April 4, 2007.

[3] NYSE Euronext was acquired by Intercontinental Exchange in November 2013.

[4] Transaction and clearing fees include transaction charges for executing trades on cash markets, and trading and clearing charges of derivatives contracts in the US and Europe.

[5] Technology services revenue includes network and data center colocation services, software licenses, maintenance fees and consulting services.

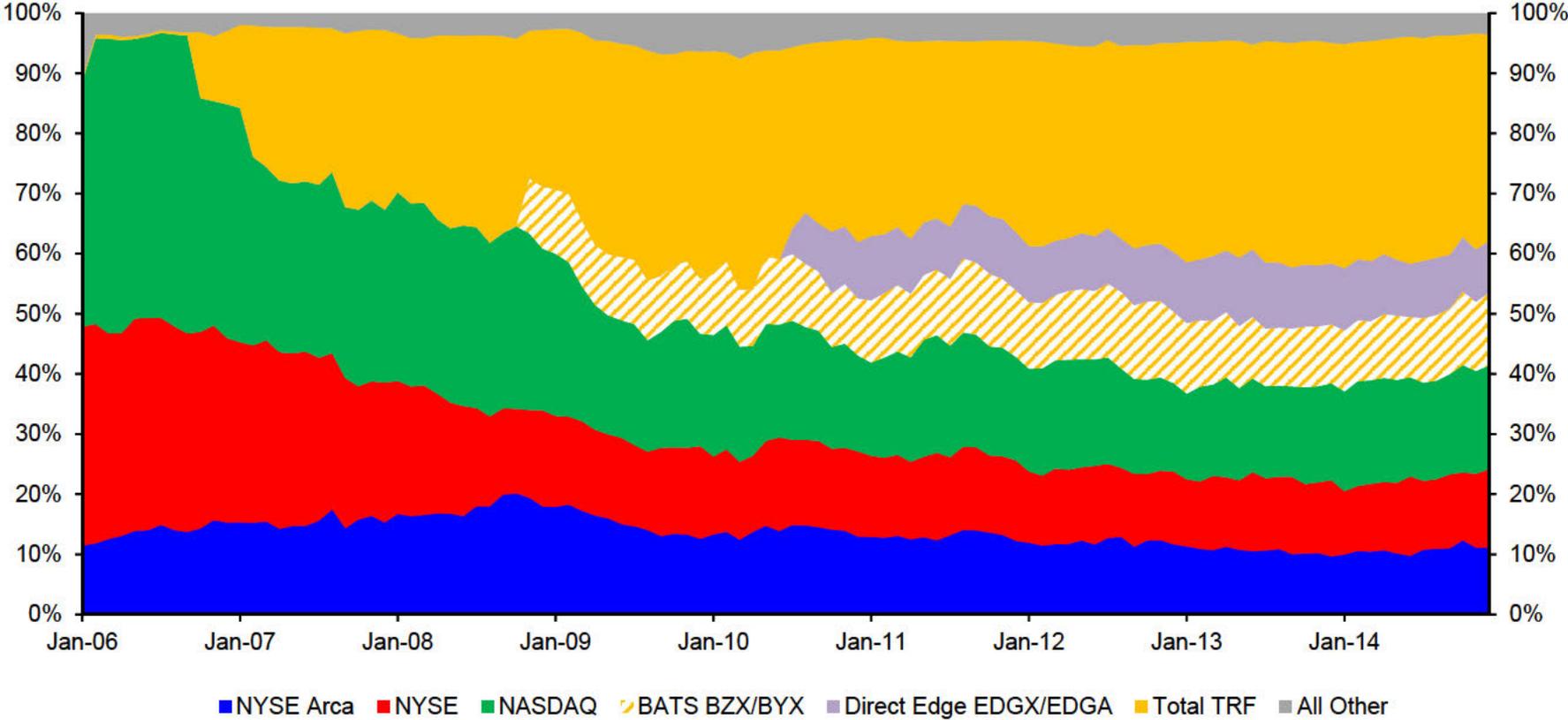
[6] Market data revenue includes sales of core and proprietary, non-core market data products in the US, and sales of market data products in Europe.

[7] Listing revenue includes revenue from original listing fees, other corporate-related actions such as stock splits, and annual fees for continued listing.

[8] Other revenue includes trading license fees, fees for facilities, fees for servicing existing listed companies, and other services.

REDACTED VERSION

Exhibit 2: Platform Shares of U.S. Equities Trading January 2006 – November 2014



Source: NYSE Aggregated Trade Data

Note:

- [1] The percentage of U.S. equities trading accounted for by each trading platform is calculated based on the monthly number of shares traded.
- [2] The New York Stock Exchange and Archipelago Holdings, Inc. merged on 3/7/06 to create the NYSE Arca platform.
- [3] BATS BZX was introduced as an ECN in 2005, reported trades through TRFs until October 2008, and operated thereafter as a registered national securities exchange. The BATS BYX exchange was introduced in October 2010.
- [4] Direct Edge EDGX and EDGA operated as ECNs and reported trades through TRFs until July 2010, and operated thereafter as registered national securities exchanges.
- [5] "Total TRF" includes NASDAQ TRF, NYSE TRF, ADF, BSE TRF, and NSX TRF. TRFs are trade reporting facilities used by off-exchange trading platforms (e.g., ECNs and dark pools) to report trades.
- [6] "All Other" includes NYSE MKT, OMX BX, CHX, NSX, CBOE, OMX PHLX, OMX PSX, and ISE before it was decommissioned in July 2010.

REDACTED VERSION

Exhibit 3: Trading Volume Concentration Analysis November 2014

HHI Calculation Method ^[1]	Securities with HHI < 2500				All Securities		
	Number of Securities ^[2]	% of Total Number of Securities ^[2]	% of Total Trading Volume ^[2]	% of Total November 2014 Market Cap ^[3]	Mean HHI ^[2]	Mean HHI (Weighted by Trading Volume) ^[2]	Mean HHI (Weighted by Market Cap) ^[3]
By Exchange Owner ^[4]	7,412	90.3%	97.2%	97.5%	1,673	1,702	1,849
By Exchange	7,780	94.8%	99.6%	99.7%	1,257	1,076	1,191

Source: Tick Data; CRSP

Note:

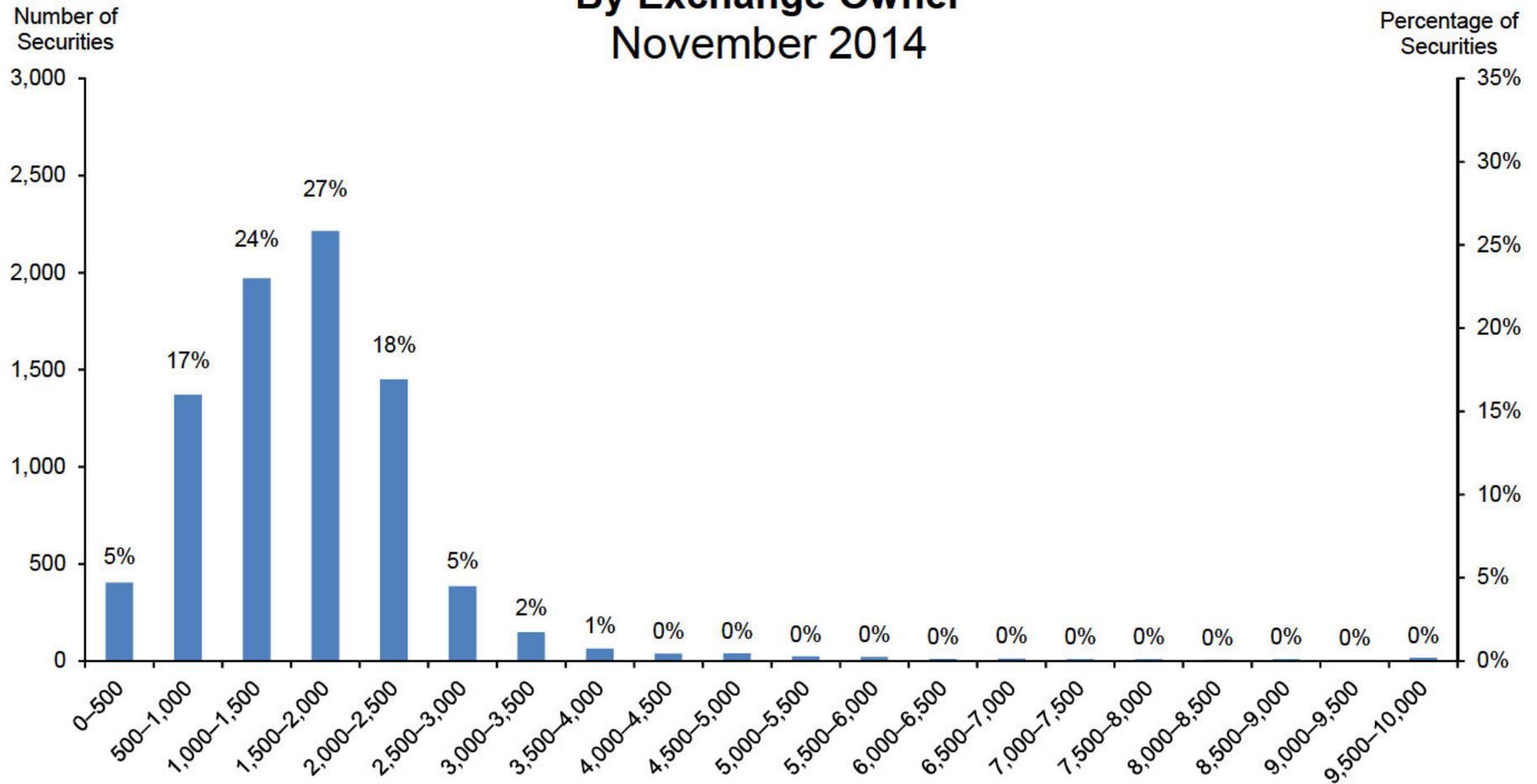
[1] HHI values also reflect trades executed on off-exchange platforms and reported via NYSE or NASDAQ TRF. Because TRF data do not report the underlying off-exchange platform, the computation assumes that TRF-reported volume is distributed symmetrically across 50 different off-exchange platforms.

[2] Tick Data trade data are available for 8,207 securities in November 2014.

[3] CRSP market cap data are available for 7,078 of the securities for which trade data are available in November 2014. The total November 2014 market cap is calculated as the sum of the November 2014 market caps for the 7,078 securities for which both trade data and market cap data are available. Each security's November 2014 market cap is calculated as the average end-of-day market cap during the 19 trading days in November 2014.

[4] To calculate each security's HHI, exchanges are grouped by exchange owner. The NYSE group includes the NYSE, NYSE Arca, and NYSE MKT exchanges. The NASDAQ group includes the NASDAQ, OMX PSX (f/k/a Philadelphia), and OMX BX (f/k/a Boston) exchanges. The BATS group includes the BATS BZX, BATS BYX, Direct Edge EDGA, and Direct Edge EDGX exchanges.

Exhibit 4: Trading Volume Concentration Analysis By Exchange Owner November 2014



Source: Tick Data

Note:

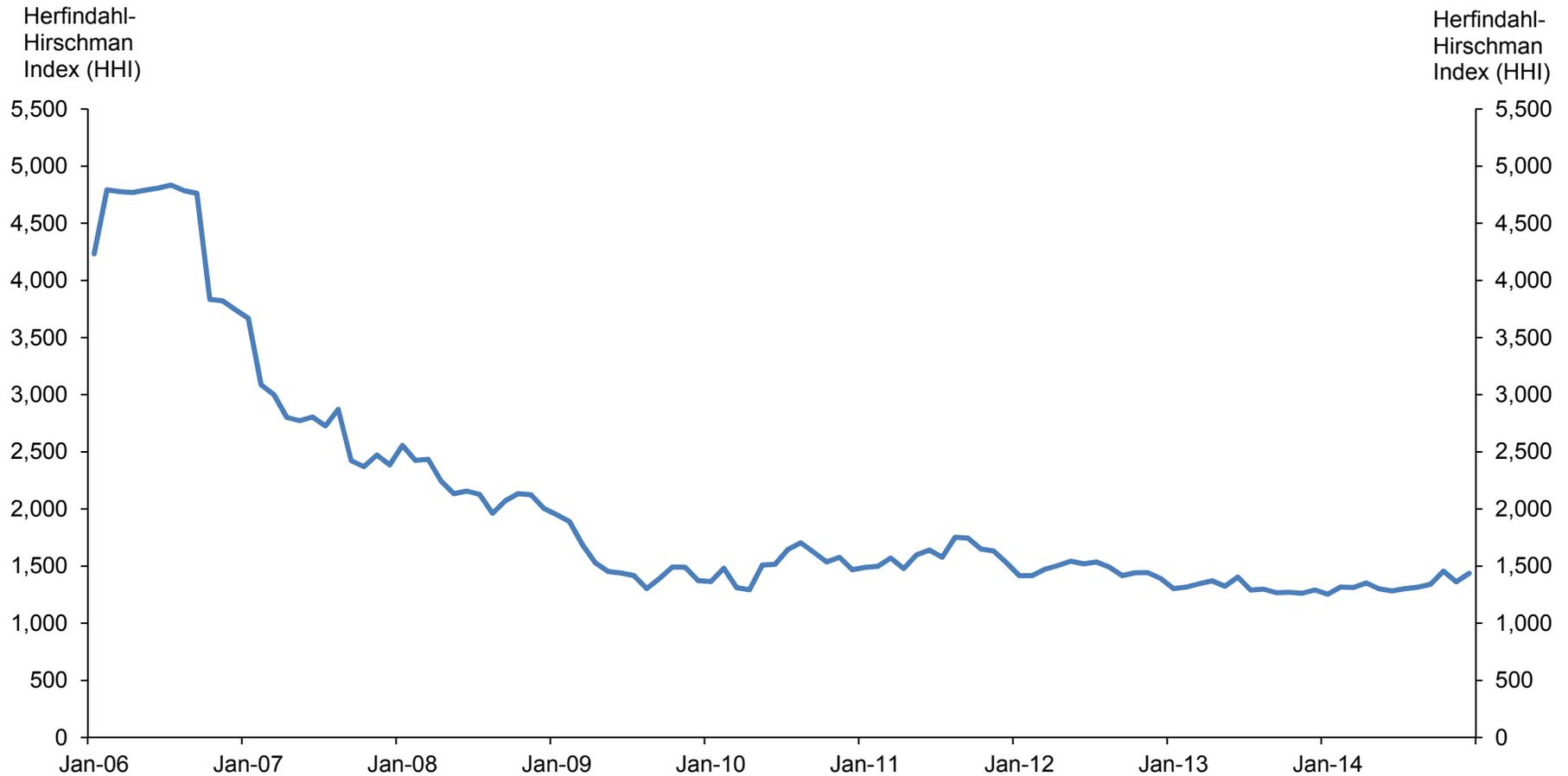
[1] The chart shows the distribution of individual HHI values for the trading volume of 8,207 individual securities. For each security, the HHI is computed as the sum of squared trading volume shares on each individual exchange, grouped by exchange owner.

[2] The computation includes trades reported on the following exchanges: NYSE, NYSE Arca, and NYSE MKT; NASDAQ, NASDAQ OMX, and NASDAQ PSX; BATS BZX, BATS BYX, Direct Edge EDGA, and Direct Edge EDGX; and Chicago Stock Exchange.

[3] The computation also includes trades executed on off-exchange platforms and reported via NYSE or NASDAQ TRF. Because TRF data do not report the underlying off-exchange platform, the computation assumes that TRF-reported volume is distributed symmetrically across 50 different off-exchange platforms.

REDACTED VERSION

Exhibit 5: Trading Volume Concentration Analysis HHI Values for U.S. Equities Market Over Time



Source: NYSE; Buti, Rindi, and Werner (2014)

Note:

[1] HHI is calculated for each month as the sum of squared market share from each exchange owner.

[2] Market shares from individual exchanges are grouped together by exchange owner: NYSE Group (NYSE, NYSE Arca, Amex), NASDAQ Group (NASDAQ, Boston, PHLX, and PSX), BATS Group (BATS, BATSX, EDGA, and EDGX), TRFs (NYSE TRF, NASDAQ TRF, ADF, BSE TRF, and NSX TRF), and all others (ISE, CHX, NSX, and CBOE).

[3] The curve would be lower but for the grouping of trades by exchange owner.

[4] Because TRF data do not report the underlying off-exchange platform, the computation assumes that TRF-reported volume is distributed symmetrically across 50 different off-exchange platforms.

REDACTED VERSION

[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

[REDACTED]

Exhibit 8: Overlap in Securities Traded on Different Exchanges November 2014

Conditional on Trading on Probability that a Security Is Traded on	By Security Count (Unweighted)					Weighted by Security Trade Volume				
	NYSE	NYSE Arca	NASDAQ	BATS	Direct- Edge X	NYSE	NYSE Arca	NASDAQ	BATS	Direct- Edge X
NYSE Arca	78.3%	100.0%	91.8%	98.3%	96.4%	99.5%	100.0%	99.8%	99.9%	99.8%
NASDAQ	76.8%	89.1%	100.0%	98.2%	95.7%	99.5%	99.7%	100.0%	99.9%	99.8%
BATS	72.1%	81.3%	83.7%	100.0%	89.2%	99.2%	99.3%	99.4%	100.0%	99.4%
DirectEdge X	76.4%	84.7%	86.6%	94.8%	100.0%	99.4%	99.4%	99.4%	99.6%	100.0%

Source: Tick Data

Note:

[1] The table shows the probability that a security is traded on one exchange (listed in the first column of the table), conditional on that same security trading on a second exchange (listed in the column headings). We present both unweighted and trade volume-weighted probabilities. For example, the unweighted probability that a security is traded on NYSE Arca, given that it trades on NYSE, is 78.3%. In other words, 78.3% of the securities traded on NYSE are also traded on NYSE Arca. The trade volume-weighted probability that a security is traded on NYSE Arca, given that it trades on NYSE, is 99.5%, meaning that the securities traded on NYSE that are also traded on NYSE Arca account for 99.5% of the total NYSE trading volume.

[2] A security is said to be traded on an exchange if it was traded on that exchange in any non-zero amount every day during November 2014.

[3] Because NYSE trades only NYSE-listed stocks, we do not examine the probability that a stock trades on NYSE given that it trades on another exchange.

Appendix A

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Revised 2015

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Education

Ph.D., Operations, Information, and Technology, Graduate School of Business, Stanford University, 1999.
B.S., Mathematics and Statistics, Miami University, 1989.

Publications

- Are Institutions Informed about News? (with Dmitry Livdan and Norman Schürhoff) *Journal of Financial Economics*, forthcoming.
- Click or Call? Auction versus Search in the Over-the-Counter Market (with Ananth Madhavan), *Journal of Finance* 70 (February 2015), 419-447.
- Price Pressures (with Albert Menkveld), *Journal of Financial Economics*, 114 (December 2014), 405-423.
- High-Frequency Trading and Price Discovery (with Jonathan Brogaard and Ryan Riordan), *Review of Financial Studies* 27 (August 2014), 2267-2306.
- How Slow is the NBBO? A Comparison with Direct Exchange Feeds (with Shengwei Ding and John Hanna), *Financial Review* 49 (May 2014), 313-332.
- High-Frequency Trading and the Execution Costs of Institutional Investors (with Jonathan Brogaard, Stefan Hunt, and Carla Ysusi), *Financial Review* 49 (May 2014), 345-369.
- Levelling the Trading Field (with David Easley and Tarun Ramadorai), *Journal of Financial Markets* 17 (January 2014), 65-93.
- The Intended and Collateral Effects of Short-Sale Bans as a Regulatory Tool (with Ethan Namvar and Blake Phillips), *Journal of Investment Management* 11 (2013), 5-13.
- Algorithmic Trading and the Market for Liquidity (with Ryan Riordan), *Journal of Financial and Quantitative Analysis* 48 (August 2013), 1001-1024. Won 2013 Philip Brown Prize .
- Informed Trading and Portfolio Returns (with Alex Boulatov and Dmitry Livdan), *Review of Economic Studies* 80 (January 2013), 35-72.
- Automation, Speed, and Stock Market Quality: The NYSE's Hybrid (with Pam Moulton), *Journal of Financial Markets* 14 (November 2011), 568-604.
- Does Algorithmic Trading Increase Liquidity? (with Charles Jones and Albert Menkveld), *Journal of Finance*, *Journal of Finance* 66 (February 2011), 1-33. Won New York Stock Exchange Euronext Award for best paper on equity trading, Western Finance Association (2008). Finalist for the Smith-Breeden Prize for best paper published in the *Journal of Finance*.
- Time Variation in Liquidity: The Role of Market Maker Inventories and Revenues (with Carole Comerton-Forde, Charles Jones, Pam Moulton, and Mark Seasholes), *Journal of Finance* 65 (February 2010), 295-331. Won Nasdaq Award for best paper on market microstructure, Financial Management Association (2007).
- The NFL Should Auction Possession in Overtime Games (with Yeon-Koo Che), *Economists' Voice* 9 (October 2009), <http://www.bepress.com/ev/vol6/iss9/art5/>.
- A Comparison of Trading and Non-Trading Mechanisms for Price Discovery (with Michael Barclay), *Journal of Empirical Finance* 15 (December 2008), 839-849.
- How to Divide the Possession of a Football? (with Yeon-Koo Che), *Economics Letters* 99 (June 2008), 561-565.
- Order Consolidation, Price Efficiency, and Extreme Liquidity Shocks (with Michael Barclay and Charles Jones), *Journal of Financial and Quantitative Analysis* 43 (March 2008), 93-121.
- Market Maker Inventories and Stock Prices (with Mark Seasholes), *American Economic Review (P&P)* 97 (May 2007), 210-214.
- Automation versus Intermediation: Evidence from Treasuries Going Off the Run (with Michael Barclay and Kenneth Kotz), *Journal of Finance* 61 (October 2006), 2395-2414.

Appendix A

- A Model of Direct and Intermediated Sales (with Jie Zhang), *Journal of Economics & Management Strategy* 15 (Summer 2006), 279-316.
- Island Goes Dark: Transparency, Fragmentation, and Regulation (with Charles Jones), *Review of Financial Studies* 18 (Fall 2005), 743-793.
- Trade-through Prohibitions and Market Quality (with Charles Jones), *Journal of Financial Markets* 8 (February 2005), 1-23.
- Liquidity Externalities and Adverse Selection: Evidence from Trading After Hours (with Michael Barclay), *Journal of Finance* 59 (April 2004), 681-710.
- Competition Among Trading Venues: Information and Trading on Electronic Communications Networks (with Michael Barclay and Tim McCormick), *Journal of Finance* 58 (December 2003), 2637-2666. Won New York Stock Exchange Award for best paper on equity trading, Western Finance Association (2001). Nominated for the Smith-Breeden Prize for best paper published in the *Journal of Finance*.
- Price Discovery and Trading After Hours (with Michael Barclay), *Review of Financial Studies* 16 (Winter 2003), 1041-1073.
- Electronic Trading Systems in Financial Markets, *IEEE-IT Professional* 5 (Jul/Aug 2003), 10-14.
- The Future of Virtual Malls (with Patric Hendershott and Robert Hendershott), *Real Estate Finance* 18 (Spring 2001), 25-32.
- Crossing Networks and Dealer Markets: Competition and Performance (with Haim Mendelson), *Journal of Finance* 55 (October 2000), 2071-2115. Nominated for the Smith-Breeden Prize for best paper published in the *Journal of Finance*.
- Bundling and Optimal Auctions of Multiple Products (with Christopher Avery), *Review of Economic Studies* 67 (July 2000), 483-497.
- Will the Internet Reduce the Demand for Mall Space? (with Patric Hendershott and Robert Hendershott), *Real Estate Finance* 17 (Spring 2000), 41-46.

Working Papers

- Asset Price Dynamics with Limited Attention (with Albert Menkveld, Sunny Li, and Mark Seasholes).
- Market Predictability and Non-Informational Trading (with Mark Seasholes).

Books, Reviews, and Chapters

- Handbook of Economics and Information Systems (Editor), Elsevier, ISBN 0444517715.
- Implementation Shortfall with Transitory Price Effects (with Charles Jones and Albert Menkveld), chapter in High Frequency Trading: A Survival Guide, Eds. David Easley, Marcos Lopez de Prado, and Maureen O'Hara, Risk Books.
- Book Review of Econometrics of Financial High-Frequency Data, by Nikolaus Hautsch, *Quantitative Finance* (2013).

Other Publications

- Automated Trading, *Encyclopedia of Quantitative Finance*.
- Preface to the Focus Theme Section: 'Financial Market Engineering' (with Dirk Neumann, Robert Schwartz, Bruce Weber, and Christof Weinhardt), *Electronic Markets* 16 (May 2006), 98-100.
- An Economic View of Information Systems (with Krishnan Anand), Introduction to Special Issue on Information Systems and Economics, *Decision Support Systems* 41 (May 2006), 683-687.
- Wall St's appeal for new rules is not altruistic, *Financial Times*, comment/op-ed, 7/21/2004, p. 13.
- Should the Outcome of a Coin Flip Mean So Much in NFL Overtime? Bid for the Ball (with Jonathan Berk), *Wall Street Journal Online*, 12/22/2003.

Honors, Awards, Miscellaneous

- Cheryl and Christian Valentine Chair, Haas School of Business, UC Berkeley (2012-)
- Barbara and Gerson Bakar Faculty Fellow, Haas School of Business, UC Berkeley (2011-2012)
- Visiting Scholar, University of Sydney (2010)
- Net Institute Grant (2009)
- Kauffman Foundation Entrepreneurship & Innovation Research Grant (2008-2009)

Appendix A

- New York Stock Exchange Euronext Award for best paper on equity trading, Western Finance Association (2008)
- Visiting Fellow, The Paul Woolley Centre for the Study of Capital Market Dysfunctionality, London School of Economics (2008)
- Nasdaq Award for best paper on market microstructure, Financial Management Association (2007)
- Visiting Professor, Université Paris-Dauphine (2007, 2008, 2009, 2010, 2012, 2013)
- Nasdaq Economic Advisory Board, (2004-7; Chair 2007)
- Visiting Economist, New York Stock Exchange (2005-2006)
- National Science Foundation Grant #0133848, CAREER: Electronic Trading Systems (2002-2006)
- Schwabacher Fellow (outstanding teaching and research), University of California, Berkeley (2005-2006)
- Junior Faculty Research Grant, Committee on Research, University of California, Berkeley (2001, 2003)
- New York Stock Exchange Award for best paper on equity trading, Western Finance Association (2001)
- Simon School Teaching Honor Roll, University of Rochester (2000, 2001)
- Xerox Assistant Professor, University of Rochester (1999-2001)
- Frye Fellowship, Stanford University (1992)
- Chiles Fellowship, Stanford University (1991)

Teaching Experience

- High-Frequency Finance (MFE 230T), UC Berkeley.
- Analytic Decision Modeling Using Spreadsheets (UGBA 104), UC, Berkeley.
- Information Technology Strategy (MBA 247B, ENGIN 298A, INFOSYS 290, UGBA 196), UC, Berkeley.
- Operations Management (MBA and EW MBA 204), UC, Berkeley.
- Financial Information Systems (CIS 446/Finance 446), University of Rochester.
- Investment Management and Trading Strategies (Finance 434), Simon School, University of Rochester.

Professional Service

Editorial:

- Associate Editor, *Management Science*, 2010-
- Associate Editor, *Journal of Financial Markets*, 2012-
- Co-Editor, *Journal of Economics and Management Strategy*, 2006-2013
- Associate Editor, *Information Systems Research*, 2004-5
- Associate Editor, *Decision Support Systems*, 2003-
- Advisory Editor, *Handbooks in Information Systems*, Elsevier
- Guest Editor, Focus Theme Section: 'Financial Market Engineering', *Electronic Markets*
- Guest Editor, Special Issue on Information Systems and Economics, *Decision Support Systems*

Conferences:

- Western Finance Association, program committee, 2011-
- Napa Conference on Financial Markets, program committee, 2009-
- European Finance Association, program committee, 2001-2004, 2012-
- Society for Financial Econometrics and Tinbergen University (Amsterdam) Conference on Measuring and Understanding Asset Price Changes: The Price of Liquidity, and the Liquidity of Price, program committee, 2011
- NYSE-Euronext/Dauphine University, 3rd Workshop on Financial Market Quality, organizer, 2010
- NYSE Euronext & Tinbergen Institute Workshop on Liquidity and Volatility, program committee, 2009
- National Institute of Securities Markets Conference on Structure, Microstructure and Regulation of Securities Markets, Mumbai, India, program committee, 2008
- NYSE-Euronext/Dauphine University, 2nd Workshop on Financial Market Quality, organizer, 2008
- INFORMS Conference on Information Systems and Technology, program committee, 2000-6
- Microstructure of International Financial Markets, Hyderabad, India, program committee, 2006
- FinanceCom (International Workshop on Finance Industry Enterprise, Applications & Services), program committee, 2005-

Appendix A

Referee in these areas for the following journals:

- Information Systems: *Management Science*, *Information Systems Research*, *Decision Support Systems*, *ACM Transactions on Internet Technology*, *Journal of Organizational Computing and Electronic Commerce*, *Electronic Commerce Research*, *Electronic Markets*, *Journal of Association for Information Systems*, International Conference on Information Systems, Hawaii International Conference on Systems Science, NSF: Digital Society & Technology and CAREER Panels
- Finance: *Journal of Finance*, *Journal of Financial Economics*, *Review of Financial Studies*, *Journal of Business*, *Journal of Financial and Quantitative Analysis*, *Journal of Financial Markets*, *Journal of Financial Intermediation*, *Journal of Futures Markets*, *Journal of Financial Econometrics*, *Journal of Empirical Finance*, *Review of Financial Economics*, *Financial Review*, *Journal of Banking and Finance*, *Journal of Business Finance and Accounting*
- Economics: *American Economic Review*, *Econometrica*, *Journal of Political Economy*, *Review of Economic Studies*, *Quarterly Journal of Economics*, *RAND Journal of Economics*, *Journal of Economics & Management Strategy*, *Economic Theory*, *Review of Economic Design*, *Empirical Economics*, *Regional Science and Urban Economics*, *Review of Industrial Organization*
- Operations/Management/Other: *Management Science*, *Manufacturing & Service Operations Management*, *Operations Research*, *Annals of Operations Research*, *European Journal of Operations Research*, *California Management Review*

Conference Presentations

- High-Frequency Trading and the 2008 Short-Sale Ban, Modeling High-Frequency Trading Activity workshop, Banff, Canada, September 2013, Vanderbilt Conference on Institutional Investors and Price Efficiency, Nashville, TN, October 2013.
- Click or Call? Auction versus Search in the Over-the-Counter Market, Western Finance Association, Las Vegas, June 2012, Stern Microstructure Conference, New York, June 2012, Federal Reserve Bank of New York Workshop, October 2012.
- High Frequency Trading and Price Discovery, Toulouse School of Economics High-Frequency Trading conference, Paris, France, April 2013, 5th Hedge Fund Research Conference, Paris, France, January 2013, American Finance Association, San Diego, CA, January 2013, Frontiers of Finance, Warwick, United Kingdom, September 2012, Georgetown University Financial Markets Quality Conference, Washington, DC, September 2012, Fifth Erasmus Liquidity Conference, Rotterdam, Netherlands, July 2012, University of Notre Dame & NASDAQ OMX Conference on Current Topics in Financial Regulation, Washington, DC, June 2012, Workshop on High Frequency Trading: Financial and Regulatory Implications, Madrid, Spain, October 2011.
- Risk Sharing, Costly Participation, and Monthly Returns, European Retail Investment Conference, Stuttgart, Germany, February, 2011, 6th Annual Central Bank Workshop on the Microstructure of Financial Markets, New York, New York, October 2010.
- Informed Trading and Portfolio Returns, NYSE-Euronext/Dauphine University, 3rd Workshop on Financial Market Quality, Paris, France, May 2010.
- Algorithmic Trading and Information, University of Sydney 4th Annual Microstructure Conference, Sydney Australia, March 2010, New York University Courant Institute of Mathematical Sciences 2nd Annual Algorithmic Trading Conference: Dynamic Portfolios, Optimal Execution, and Risk, February, 2010, Workshop on Information Systems and Economics, Phoenix, AZ, December 2009, German Finance Association, Frankfurt, Germany, October 2009, IDEI-R Conference on Investment Banking and Financial Markets, Toulouse, France, March 2009.
- Price Pressures, Western Finance Association, Victoria, BC, June 2010, National Bureau of Economic Research Market Microstructure Meetings, Boston, MA, October 2009, Society for Financial Econometrics/Stevanovich Center for Financial Mathematics conference on Liquidity, Credit Risk and Extreme Events, Chicago, IL, October 2009, 5th Annual Central Bank Workshop on the Microstructure of Financial Markets, Zurich, Switzerland, October 2009.
- Market Predictability and Non-Information Trading, University of Sydney 3rd Annual Microstructure Conference, Sydney Australia, March 2009, Financial Intermediation Research Society, Prague, Czech Republic, May 2009, 5th Empirical Asset Pricing Retreat, Amsterdam, Netherlands, June 2009.

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- Does Algorithmic Trading Improve Liquidity? Western Finance Association, Waikoloa, HI, June 2008, Center for Financial Studies Conference on The Industrial Organization of Securities Markets: Competition, Liquidity, and Network Externalities, Frankfurt, Germany, June 2008, Université Paris-Dauphine & NYSE-Euronext Workshop on Financial Market Quality, Paris, France, May 2008, MTS Conference on Financial Markets, Rome, Italy, December 2007.
- Speed and Stock Market Quality: The NYSE's Hybrid, Financial Management Association, Dallas, TX, October, 2008, Western Finance Association, Waikoloa, HI, June 2008, National Bureau of Economic Research Market Microstructure Meetings, Boston, MA, October 2007.
- Pricing Mechanisms in Securities Markets, Russell Pricing Roundtable, New York, NY, February 2008.
- Market Maker Inventories and Liquidity, American Finance Association Meetings, New Orleans, LA, January 2008, Trading Frictions in Asset Markets, Santa Barbara, CA, December 2007.
- The Impact of Trading Technology: Evidence from the 1980 NYSE Post Upgrades (now titled The Price of Latency), Central Bank Workshop on the Microstructure of Financial Markets, Budapest, Hungary, September 2007, SEC-AMF Conference on the Structure and Regulation of Financial Markets, Paris, France, May 2007, Microstructure of International Financial Markets Conference, Hyderabad, India, December 2006, Workshop on Information Systems and Economics, Evanston, IL, December 2006.
- Liquidity Provision and Stock Return Predictability, European Summer Symposium in Financial Markets, Gerzensee, Switzerland, July 2007.
- Market Maker Revenues and Stock Market Liquidity, National Bureau of Economic Research Market Microstructure Meetings, Boston, MA, May 2007.
- Market Maker Inventories and Stock Prices, American Economic Association Meetings, Chicago, IL, January 2007, Workshop on the Microstructure of Foreign Exchange and Equity Markets, Bank of Canada, Ottawa, Canada, October 2006, Stanford Institute of Theoretical Economics workshop on Asset Pricing, Liquidity and Capital Immobility, Stanford, CA, July 2006, National Bureau of Economic Research Market Microstructure Meetings, Boston, MA, May 2006.
- Hybrid Market at New York Stock Exchange, Norges Bank Conference on the Microstructure of Equity and Currency Markets, Oslo, Norway, September 2005.
- Automation versus Intermediation: Evidence from Treasuries Going Off the Run, MTS Conference on Financial Markets, Vienna, Austria, December 2004, Workshop on Information Systems and Economics, Washington, DC, December 2004, National Bureau of Economic Research Market Microstructure Meetings, Santa Monica, CA, July 2004.
- Island Goes Dark: Transparency, Fragmentation, and Regulation, American Finance Association Meetings, San Diego, CA, January 2004.
- Order Consolidation, Price Efficiency, and Extreme Liquidity Shocks, The Financial Intermediation Research Society Conference on Banking, Corporate Finance and Intermediation, Shanghai, China, June 2006, Western Finance Association Meetings, Vancouver, Canada, June 2004, Center for Financial Studies Conference on Market Design, Frankfurt, Germany, June 2004, Workshop on Information Systems and Economics, Seattle, WA, December 2003.
- Liquidity Externalities and Adverse Selection: Evidence from Trading After Hours, Review of Financial Studies Conference on Investments in Imperfect Capital Markets, Northwestern University, April 2002.
- Direct and Intermediated Sales by a Monopolist, Stanford Institute of Theoretical Economics workshop on the Economics of the Internet, Stanford University, June 2002, Workshop on Information Systems and Economics, New Orleans, LA, December 2001, Econometric Society Meetings, Maryland, June 2001.
- Competition Among Trading Venues: Information and Trading on Electronic Communications Networks, American Finance Association Meetings, Washington, DC, January 2003, Workshop on Information Systems and Economics, New Orleans, LA, December 2001, Western Finance Association Meetings, Tucson, AZ, June 2001, Financial Markets Research Center Conference on Market Quality, Vanderbilt University, April 2001, National Bureau of Economic Research Market Microstructure Meetings, Cambridge, MA, December 2000.
- Price Discovery and Trading After Hours, American Finance Association Meetings, New Orleans, LA, January 2001, Nasdaq – Notre Dame Microstructure Conference, Notre Dame University, September

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2000, National Bureau of Economic Research Market Microstructure Meetings, Cambridge, MA, May 2000, Workshop on Information Systems and Economics, Charlotte, NC, December 1999.

- Crossing Networks and Dealer Markets: Performance and Competition, New York Stock Exchange Conference on Equity Markets in Transition, Scottsdale, AZ, December 1999.

Invited Presentations

- High-Frequency Trading and the 2008 Short-Sale Ban, University of Texas, Austin, Center for Analytical Finance Quarterly Lecture, UC Santa Cruz
- Asset Price Dynamics with Limited Attention, Washington University in St. Louis, New York University, HEC Paris.
- High Frequency Trading and Price Discovery, Chulalongkorn University, BlackRock.
- Click or Call? Auction versus Search in the Over-the-Counter Market, BlackRock.
- Are Institutions Informed about News? University of Lugano, Erasmus University, Dauphine University-Paris, University of South Australia, University of Arizona.
- Technology, Competition, Market Structure, and Regulation, Autorité des Marchés Financiers.
- Price Pressures, Columbia University, University of New South Wales, ESSEC Business School, Dauphine University-Paris.
- Algorithmic Trading and Information, University of Texas, Austin, Goldman Sachs.
- Informed Trading and Portfolio Returns, University of Lausanne, Ecole Polytechnique Fédérale de Lausanne, Dauphine University-Paris.
- Market Predictability and Non-Information Trading, Hong Kong University of Science and Technology.
- Does Algorithmic Trading Improve Liquidity? IROC-DeGroot Luncheon Lecture, Southern Methodist University, ESSEC Business School, Bank of Canada, University of Amsterdam (Tinbergen Institute), Nasdaq Economic Advisory Board, New York Stock Exchange Economic Research.
- Speed and Stock Market Quality: The NYSE's Hybrid, London School of Economics.
- Technology in Financial Markets: Competition and Market Quality, Dauphine University-Paris.
- The Price of Latency, Nasdaq Economic Advisory Board, Carnegie Mellon University, HEC Paris, Georgia Institute of Technology, University of California, Davis.
- Market Maker Inventories and Liquidity, Securities and Exchange Commission, Office of Economic Analysis.
- Market Maker Inventories and Stock Prices, Federal Reserve Bank of New York, New York Stock Exchange Economic Research.
- Automation versus Intermediation: Evidence from Treasuries Going Off the Run, University of Washington, Stanford University.
- Island Goes Dark: Transparency, Fragmentation, and Regulation, Courant Institute-New York University Mathematical Finance Seminar, HEC Montreal, University of Southern California, University of California, Irvine, New York Stock Exchange Economic Research.
- Order Consolidation, Price Efficiency, and Extreme Liquidity Shocks, Nasdaq Economic Advisory Board, University of California, Berkeley.
- Liquidity Externalities and Adverse Selection: Evidence from Trading After Hours, Nasdaq Economic Research, University of California, Berkeley.
- Competition Among Trading Venues: Information and Trading on Electronic Communications Networks, University of Texas at Austin, University of California, Berkeley, University of California, Davis, Notre Dame University, Queens University, University of Rochester.
- Price Discovery and Trading After Hours, University of California, Los Angeles, Ohio State University, Stanford University, University of Rochester.
- Electronic Exchanges and the Disintermediation of Dealer Markets, Harvard University, Ohio State University, University of Rochester, Carnegie Mellon University, University of Pennsylvania, University of Arizona, University of Texas at Austin, Hong Kong University of Science and Technology, Purdue University, New York University, University of Washington.

Appendix B

January 2015

AVIV NEVO

Department of Economics, Northwestern University
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Education

B.Sc. Mathematics and Economics, with Special Honors, Tel-Aviv University, Tel-Aviv, Israel, 1991
A.M. Economics, Harvard University, Cambridge, MA, 1994
Ph.D. Economics, Harvard University, Cambridge, MA, 1997

Current Appointments

Professor, Department of Economics, Northwestern University, Evanston, IL, 2004- present
Professor, Marketing Department, Kellogg School of Business, Northwestern University, Evanston, IL, 2008- present
Research Associate, National Bureau of Economic Research, Cambridge, MA, 2003- present

Past Positions

Deputy Assistant Attorney General for Economic Analysis, Antitrust Division, Department of Justice, Washington, DC, 2013-2014
HSBC Research Professor, Department of Economics, Northwestern University, Evanston, IL, 2009-2011
Visiting Associate Professor, Sloan School of Business and Department of Economics, MIT, Cambridge, MA, Fall 2003-Spring 2004
Associate Professor, Department of Economics, University of California, Berkeley, CA, 2003-2004
Visiting Assistant Professor, Center for Study of Industrial Organization, Northwestern University, Evanston, IL, Fall 2000-Spring 2001
Faculty Research Fellow, National Bureau of Economic Research, Cambridge, MA, 1997- 2003
Assistant Professor, Department of Economics, University of California, Berkeley, CA, 1997-2003

Fellowships and Awards

Fellow of the Econometric Society, elected 2013
Compass Prize 2007 (prize for the paper making the most significant contribution to the understanding and implementation of competition policy)
Sloan Research Fellowship, 2003
Alfred P. Sloan Doctoral Dissertation Fellowship, 1996-1997
Graduate Fellowship, Harvard University 1992-1994
Graduate Society Fellowship Term Time Award, Harvard University 1995-1996

Grants

NSF grant SES-1324851, "An Empirical Study of Broadband Internet Service," 2013-2016 (joint with

Appendix B

John Turner and Jonathan Williams)

NSF grant SES-1130382, "A Framework for Demand and Pricing Dynamics," 2011-14 (joint with Igal Hendel)

Co-Op agreement USDA ERS, 2005-2014

NSF CAREER grant SES-0093967, "Empirical Studies of Dynamics in Industrial Organization," 2001-6
University of Wisconsin at Madison, Food System Research Group Grant, 2002 (joint with Igal Hendel)

UC Berkeley, Career Development Grant, 2001

Intel Corporation Millennium Grant, 1997-2000

UC Berkeley, Junior Faculty Research Grant, 1997-1998, 1998-1999, 1999-2000, 2000-2001

Lectures and Mini-Courses

Course on Empirical Analysis of Imperfectly Competitive Markets, CEMFI Summer School, Madrid, Spain, August 2012

Course on Topics in Empirical IO, Tel-Aviv University, Tel-Aviv, Israel, August 2012

Annual "Econometrics Methods Lectures," NBER Summer Institute, July 2012

Invited talk, Econometric Society World Congress, Shanghai, China, August 2010.

Lectures on Econometric Methods for Antitrust, FTC, Spring 2010

Master class in Empirical IO, Center for Microdata Methods and Practice, University College London, London, UK, November 2004

Mini-course in Empirical IO, Research Institute of Industrial Economics, Stockholm, Sweden, December 2002

Smith Chair Lecturer, Brigham Young University, February 2001

Visiting Senior Lecturer, Tel-Aviv University, Tel-Aviv, Israel, June 1999

Review of Economic Studies European Tour Speaker, May 1997

Published and Forthcoming Papers

"Mergers When Prices Are Negotiated: Evidence from the Hospital Industry", *American Economic Review*, 105(1), January 2015, 172-203 (joint with Gautam Gowrisankaran and Bob Town)

"Do Prices and Attributes Explain International Differences in Food Purchases?", *American Economic Review*, 104(3), March 2014, 832-67 (joint with Pierre Dubois and Rachel Griffith)

"Intertemporal Price Discrimination in Storable Goods Markets", *American Economic Review* 103(7), December 2013, 2722-51 (joint with Igal Hendel)

"Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games" *Advances in Economics and Econometrics: Theory and Applications: Tenth World Congress*, 2013 (joint with Victor Aguirregabiria)

"Identification with Imperfect Instruments", *Review of Economics and Statistics*, August 2012, Vol 94(3), 659-671 (joint with Adam Rosen).

"Empirical Models of Consumer Behavior", *Annual Review of Economics*, Volume 3 (2011), 51-75

"Taking the Dogma Out of Econometrics: Structural Modeling and Credible Inference", *The Journal of*

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Economic Perspectives, Spring 2010, 69-82 (joint with Michael Whinston)

- “Recording Discrepancies in Nielsen Homescan Data: Are They Present and Do They Matter?”, *Quantitative Marketing and Economics*, Volume 8, Issue 2 (2010), 207-239 (joint with Liran Einav and Ephraim Leibtag)
- “The Relative Performance of Real Estate Marketing: MLS versus FSBOMadison.com”, *American Economic Review* 99 (5), December 2009, 1878-98 (joint with Igal Hendel, and Francois Ortalo-Magne)
- “Consumer Shopping Behavior: How Much Do Consumers Save?” *The Journal of Economic Perspectives* 23(2), Spring 2009, 99-120 (joint with Rachel Griffith, Andrew Leicester and Ephraim Leibtag)
- “An Approach for Extending Dynamic Models to Settings with Multi-Product Firms”, *Economics Letters*, 100 (2008), 49-52 (joint with Federico Rossi)
- “Merger Simulation,” *The New Palgrave Dictionary of Economics*, 2008
- “Empirical Models of Imperfect Competition: A Discussion”, *Advances in Economics and Econometrics: Theory and Applications: Ninth World Congress*, 2007 (joint with Liran Einav)
- “Measuring the Implications of Sales and Consumer Inventory Behavior”, *Econometrica*, 74(6), 1637-1673, 2006 (joint with Igal Hendel). Awarded the *Compass Prize 2007* (prize for the paper making the most significant contribution to the understanding and implementation of competition policy.)
- “Sales and Consumer Inventory”, *The RAND Journal of Economics*, 37(3), 543-561, 2006 (joint with Igal Hendel)
- “Academic Journal Pricing and the Demand of Libraries”, *American Economic Review*, 447-452, 2005 (joint with Daniel L. Rubinfeld and Mark McCabe)
- “Inter-temporal Substitution and Storable Products”, *Journal of the European Economic Association*, 2(2), 536-547, 2004 (joint with Igal Hendel)
- “The Post-Promotion Dip Puzzle: What Do the Data Have to Say?,” *Quantitative Marketing and Economics*, 1(4), 409-424, 2003 (joint with Igal Hendel)
- “New Products, Quality Changes and Welfare Measures Computed from Estimated Demand Systems”, *The Review of Economics and Statistics*, 85(2), 266-275, 2003
- “Using Weights to Adjust for Sample Selection When Auxiliary Information is Available”, *Journal of Business and Economic Statistics*, 21(1), 43-52, 2003
- “Why Do Manufacturers Issue Coupons? An Empirical Analysis of Breakfast Cereals”, *The RAND Journal of Economics*, 33(2), 319-339, 2002 (joint with Catherine Wolfram)

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- “Sample Selection and Information-Theoretic Alternatives to GMM”, *Journal of Econometrics*, 107(1), 149-157, 2002
- “Measuring Market Power in the Ready-to-Eat Cereal Industry”, *Econometrica*, 69(2), 307-342, 2001
- “A Practitioner’s Guide to Estimation of Random Coefficients Logit Models of Demand”, *Journal of Economics & Management Strategy*, 9(4), 513-548, 2000
- “Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry”, *The RAND Journal of Economics*, 31(3), 395-421, 2000. Reprinted in P. Joskow and M. Waterson ed., *Empirical Industrial Organization*, Edward Elgar, 2004.
- “Identification of the Oligopoly Solution Concept in a Differentiated Products Industry”, *Economics Letters*, 59(3), 391-395, 1998

Working Papers

- “Usage Based Pricing and Demand for Residential Broadband” (joint with John Turner and Jonathan Williams)
- “The Elasticity of Substitution between Time and Market Goods: Evidence from the Great Recession” (joint with Arlene Wong)
- “Habit Formation and Nutrition: Evidence from Consumer Migration” (joint with Pierre Dubois and Rachel Griffith)
- “Why Does the Average Price Fall During High Demand Periods?,” (joint with Kostis Hatzitaskos)
- “Pricing of Academic Journals,” (joint with Daniel L. Rubinfeld and Mark McCabe)
- Non-Linear Pricing of Storable Goods,” (joint with Igal Hendel and Alessandro Lizzeri)

Professional Activities

- Co-Editor**, *The RAND Journal of Economics*, 2011 –
- Editor**, *The Journal of Industrial Economics*, 2009 – 2011
- Editorial Board**, *Quantitative Economics*, 2009 – 2013
- Board of Editors**, *American Economic Journal: Microeconomics*, 2009 – 2013
- Foreign Editor**, *Review of Economics Studies*, 2007 – 2013
- Associate Editor**, *The RAND Journal of Economics*, 2007 - 2011
- Associate Editor**, *Journal of Industrial Economics*, 2002 – 2009
- Associate Editor**, *Quantitative Marketing and Economics*, 2002 – 2013
- Editorial Board**, *Marketing Science*, 2002 – 2010
- Advisory Board**, *Journal of Agricultural & Food Industrial Organization*, 2002 - 2013

Refereeing for (partial list): *American Economic Review*, *Econometrica*, *Econometric Reviews*, *Economic Journal*, *Economic Theory*, *European Economic Review*, *International Journal of*

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Industrial Organization, Journal of Business and Economics Statistics, Journal of Econometrics, Journal of Economics & Management Strategy, Journal of Industrial Economics, Journal of Law and Economics, Journal of Law, Economics and Organizations, Journal of Marketing Research, Journal of Political Economy, Journal of Public Economics, Management Science, Marketing Science, National Science Foundation, Quarterly Journal of Economics, Rand Journal of Economics, Review of Economic Studies.

Co-organizer, NBER Price Dynamics Workshop Summer Institute, July 2012, 2013, 2014

Program Committee, EARIE 2012, Rome, Italy

Program Committee, 2010 Econometric Society World Congress

Program Committee, AEA meeting, Atlanta, GA, January 2010

Scientific Committee, FTC-Northwestern Conference, 2009, 2010, 2011

Program Coordinator, *Review of Economic Studies* European Tour Speaker, May 2009

Program Committee, EC² meeting, Roma 19-20 December 2008

Program Committee, 2007 QME Conference, Chicago, IL

Co-organizer, IO, Marketing and Macro Conference at the Chicago Fed, December 2006

Program Committee, 2005 Econometric Society World Congress

Co-organizer, SITE Workshop, July 2004

Program Committee, 2004 Winter Econometric Society Meetings

Organizer, NBER Productivity Fall Meeting, December 2003

Co-organizer, NBER Industrial Organization Winter Meeting, January 2000

Co-organizer, Econometrics in Tel-Aviv Conference, June 1999

Dissertation Supervision (completion year, first job)

Eric Emch (1999, DOJ); Chris Knittel (2000, Boston University); Allison Evans Cuellar (2001, Columbia University); Ying Zhao (2001, Hong Kong Science and Technology); Sharon Horsky (2001, The Interdisciplinary Center Herzliya); Rene Kamita (2002, DOJ); Erin Mansur (2002, Yale University); Simone Peart Boyce (2002, Analysis Group); Sofia Berto Villas-Boas (2002, University of California, Berkeley); Marta Wosinska (2002, Harvard Business School); Rebecca Hellerstein (2003, New York Fed); Hyun Jin Lee (2003); Pinar Karaca (2004, RAND); Jorge Tovar (2004, Los Andes University, Bogotá, Colombia); Fernando Ferreira (2004, Wharton); Matt Lewis (2004, Ohio State University); Celeste Saravia (2004, Cornerstone Research); Allan Collard-Wexler (2006, New York University); Ambarish Chandra (2006, University of British Columbia); Joao Macieira (2007, Virginia Tech); Federico Rossi (2008, NC State); Steve Kryukov (2008, Carnegie Mellon); Min Chen (2008, Charles River Associates); Thor Sletten (2008, Criterion Economics); Yongbae Lee (2008, Barclays Global Investors); Kanishka Misra (2009, London Business School); James Roberts (2009, Duke University); Paul Grieco (2010, Penn State); Mateo Caronia (2010, Deloitte Transfer Pricing); Ryan McDevitt (2010, University of Rochester); Jason O'Conner (2010, FTC), Kei Kawai (2011, NYU), Andre Trindade (2011, Bates White), Ketan Patel (2012, Getgo), Javier Donna (2012, The Ohio State University), Joseph Goodman (2012, Compass-Lexcon), Jose-Miguel Abito (2013, Wharton), Mark Chicu (2013, Bates-White), Marit Hinnosaar (2013, Collegio Carlo Alberto), Tiago Pires (2013, University of North Carolina), Guillermo Marshall (2014, University of Illinois); Fernando Luco (2014, Texas A&M)

Appendix C

AVIV NEVO EXPERT EXPERIENCE

Retained as testifying expert

1. Regulatory proceedings involving a tobacco manufacturer; 2013
 - » Retained by tobacco manufacturer as an expert; report filed
2. *Myers et al. v. General Mills, Inc.*, United States District Court for the District of New Jersey; 2012
 - » Retained by General Mills as a class certification expert
3. Merger in a service industry reviewed by the FTC; 2011
 - » Retained by the FTC
4. *AMD v. Intel*, United States District Court for the District of Delaware; 2009
 - » Retained as rebuttal expert

Retained as consulting expert

5. Private IP and antitrust litigation in an agricultural industry; 2013
 - » Retained as consulting expert on liability and damages issues
6. Merger in the mining industry reviewed by the Canadian Competition Bureau; 2010
 - » Retained by the Canadian Competition Bureau
7. Merger in the pharmaceutical industry reviewed by the FTC; 2009
 - » Retained by merging parties
8. Arbitration between tobacco manufacturers and settling states to resolve a dispute related to the non-participating manufacturer adjustment of the Tobacco Master Settlement Agreement; 2009
 - » Consultant to the Decision Maker appointed by the parties
 - » Duties involved evaluating expert reports from the parties, leading a team that constructed original analyses, questioning the parties' experts, and writing a decision report
9. Class action in a transportation industry; 2008
 - » Retained by plaintiffs as consulting expert on liability and damages

10. Alleged price fixing in a high-tech industry; 2008
 - » Retained by plaintiffs as consulting expert on liability and damages rebuttal report

11. Merger in supermarket industry reviewed by the FTC; 2007
 - » Retained by parties as consulting expert

Appendix D

Documents Relied Upon by Terrence Hendershott, Ph.D. and Aviv Nevo Ph.D.

<u>Document Title, Bates Numbers</u>	<u>Document Date</u>
Legal Pleadings	
Court Opinion in re <i>NetCoalition v. Securities and Exchange Commission</i>	August 6, 2010
Complaint in re <i>U.S. v. Deutsche Börse AG and NYSE Euronext</i>	December 22, 2011
Competitive Impact Statement in re <i>U.S. v. Deutsche Börse AG and NYSE Euronext</i>	December 22, 2011
Court Opinion in re <i>NetCoalition and Securities Industry and Financial Markets Association v. Securities and Exchange Commission</i>	April 30, 2013
Reports and Submissions	
Statement of Janusz Ordover and Gustavo Banmberger, with Appendices A-B	August 1, 2008
Evans, David “An Economic Assessment of Whether ‘Significant Competitive Forces’ Constrain an Exchange’s Pricing of Its Depth-Of-Book Market Data”	July 10, 2008
An Economic Study of Securities Market Data Pricing by the Exchanges Prepared by Securities Litigation & Consulting Group, Inc.	July 10, 2008
Evans, David, “Response to Ordover and Bamberger’s Statement Regarding the SEC’s Proposed Order Concerning The Pricing Of Depth of-Book Market Data”	October 10, 2008
Academic Literature and Books	
Tirole, Jean, <i>The Theory of Industrial Organization</i> , MIT, 1988	
Glosten, Lawrence R., “Is the Electronic Open Limit Order Book Inevitable?” <i>The Journal of Finance</i> , Vol. 49, No. 4, September 1994, pp. 1127-1161	
Domowitz, Ian and Benn Steil, “Automation, Trading Costs, and the Structure of the Securities Trading Industry,” In <i>Brookings-Wharton Papers on Financial Services</i> , edited by Robert E. Litan and Anthony M. Santomero, 33-81, 1999	
Barclay, Michael J., William G. Christie, Jeffrey H. Harris, et al., “Effects of Market Reform on the Trading Costs and Depths of Nasdaq Stocks,” <i>The Journal of Finance</i> , Vol. , No. 1, February 1999, pp. 1-34	
Lee, Charles M.C., and Balkrishna Radhakrishna, “Inferring Investor Behavior: Evidence from TORQ Data,” <i>Journal of Financial Markets</i> , Vol. 3, Issue 2, May 2000, pp. 83-111	
Chew, Margaret, “Reform of Financial Services: The Effect on the Regulator,” <i>Singapore Journal of International and Comparative Law</i> . Vol. 5, 2001, pp. 569-592	
Pindyck Robert S. and Daniel L. Rubinfeld, <i>Microeconomics</i> , Prentice Hall, 5 th ed., 2001	
Harris, Larry, <i>Trading and Exchanges: Market Microstructure for Participants</i> , Oxford University Press, 2003	
Varian, Hal R, <i>Intermediate Microeconomics: A Modern Approach</i> , Norton & Company, 6 th ed., 2003	
Ramos, Sofia A., “Competition Between Stock Exchanges: A Survey,” FAME Research Paper No. 77, February 2003	
Parlour, Christine A. and Duane J. Seppi, “Liquidity-Based Competition for Order Flow,” <i>The Review of Financial Studies</i> , Vol. 16, No. 2, Summer 2003, pp. 301-343	
Carlton, Dennis W. and Jeffrey M. Perloff, <i>Modern Industrial Organization</i> , 4 th ed., Addison-Wesley, 2005,	

- Hendershott, Terrence and Charles M. Jones, "Island Goes Dark: Transparency, Fragmentation, and Regulation," *The Review of Financial Studies*, Vol. 18, No. 3, 2005, pp.743-793
- Viscusi, Kip W., Joseph E. Harrington, and John M. Vernon, *Economics of Regulation and Antitrust*, 4th ed. MIT, 2005
- Kaplow, Louis and Carl Shapiro, "Antitrust," In *Handbook of Law and Economics*, edited by A. Mitchell Polinsky and Steven Shavell, 1073-1225, Elsevier, 2007
- "Antitrust Law and the 'New Economy,'" In *Antitrust Modernization Commission Report and Recommendations*, April 2007
- Foucault Thierry and Albert J. Menkveld, "Competition for Order Flow and Smart Order Routing Systems," *The Journal of Finance*, Vol. 63, No. 1, February 2008, pp. 119-158
- Mizrach, Bruce, "The Next Tick on NASDQ," *Quantitative Finance*, Vol. 8, no. 1, February 2008, pp. 19-40
- Barber, Brad M., Terrance Odean, and Ning Zhu, "Do Retail Trades Move Markets?" *The Review of Financial Studies*, Vol. 22, No. 1, 2009, pp. 151-186
- Cantillon, Estelle and Pai-Ling Yin, "Competition Between Exchanges: a Research Agenda," *International Journal of Industrial Organization*, Vol. 29, 2011, pp. 329-336
- Menkveld, Albert J., "High-Frequency Trading and the New Market Makers," *Journal of Financial Markets*, Vol. 16, 2013, pp. 712-740
- Cardella, Laura, Jia Hao, and Ivalina Kalcheva, "Make and Take Fees in the U.S. Equity Market," April 2013
- Brogaard, Jonathan , Terrence Hendershott, and Ryan Riordan, "High Frequency Trading and Price Discovery," *Review of Financial Studies*, Vol. 27, No. 8, 2014 , pp. 2267-2306
- O'Hara, Maureen. "High Frequency Market Microstructure," 2014
- Menkveld. Albert J., "High-Frequency Traders and Market Structure," *The Financial Review*, Vol. 49, 2014, pp. 333-344
- Buti,Sabrina, Brabara Rindi, and Ingrid M. Werner, "Dark Pools Trading Strategies, Market Quality and Welfare," January 2014
- Menkveld, Albert J., and Marius A. Zoican, "Need for Speed? Exchange Latency and Liquidity," Tinbergen Institute Discussion Paper TI 14-097/IV/DSF78, July 22, 2014
- Holden, Craig W., and Stacey Jacobsen, "Liquidity Measurement Problems in Fast, Competitive Markets: Expensive and Cheap Solutions," *Journal of Finance*, Vol. 69, No. 4, August 2014, pp. 1747-1785
- Van Kervel, Vincent, "Competition for Order Flow with Fast and Slow Traders," October 2014
- Kwan, Amy, Ronald Masulis, and Thomas McInish, "Trading Rules, Competition for Order Flow and Market Fragmentation," *Journal of Financial Economics*, Vol. 115, 2015, pp. 330-348
- He, William Peng, Elvis Jarnecic, and Yubo Liu, "The Determinants of Alternative Trading Venue Market Share: Global Evidence from the Introduction of Chi-X," *Journal of Financial Markets*, Vol. 22, January 2015, pp. 27-49

Public Press and Internet Resources

- Shapiro, Carl, "Mergers with Differentiated Products," Address Before the American Bar Association November 9, 1995
- "NASD Rulemaking: Order Approving a Proposed Rule Change to Permanently Expand the NASD's Rule Permitting Market Makers to Display Their Actual Quotation Size," SEC Release 34-40211; File No. SR-NASD-98-21, available at <http://www.sec.gov/rules/sro/nd9821o.htm> July 15, 1998
- Schmerken, Ivy, "Making Markets Move," WallStreet & Technology July 26, 2004

Document Title, Bates Numbers	Document Date
“Regulation NMS,” Securities Exchange Act Release No. 70 FR 37496, 37498-37499	June 29, 2005
DOJ Press Release, “Investigations Conclude Acquisition of Instinet Group Inc. by NASDAQ and Merger of NYSE and Archipelago Holdings Would Not Reduce Competition”	November 16, 2005
Filing of Proposed Rule Change Relating to Approval of Market Data Fees for NYSE Arca Data, SEC Release No. 34-53952, 71 FR 33496	June 9, 2006
Securities Exchange Act Release No. 59039	December 2, 2008
Securities Exchange Act Release No. 73 FR 74770	December 9, 2008
Horizontal Merger Guidelines, Department of Justice and Federal Trade Commission	August 19, 2010
Proposed Rule Change by NYSE Arca Pursuant to Rule 19b-4 Under the Securities Exchange Act of 1934 File No. SR-2010-97	November 1, 2010
“Self-Regulatory Organizations; Notice of Filing and Immediate Effectiveness of Proposed Rule Change by NYSE Arca, Inc. Relating to Fees for NYSE Arca Depth-of-Book Data,” SEC Release 34-63291, available at http://www.gpo.gov/fdsys/pkg/FR-2010-11-17/pdf/2010-28893.pdf	November 9, 2010
DOJ Press Release, “Nasdaq OMX Group Inc. and Intercontinental Exchange Inc. Abandon Their Proposed Acquisition of NYSE Euronext After Justice Department Threatens Lawsuit,”	May 16, 2011
Mehta, Nina, “Goldman Sachs to Offer Canada Dark Pool as Order Rules Change,” Bloomberg, available at http://www.bloomberg.com/news/2011-08-18/goldman-sachs-introduces-sigma-x-canada.html	August 18, 2011
Self-Regulatory Organizations; NYSE Arca, Inc.; Notice of Filing and Immediate Effectiveness of Proposed Rule Change Establishing Non-Display Usage Fees for NYSE Arca Integrated Feed, NYSE ArcaBook, NYSE Arca Trades, and NYSE Arca BBO, and a Redistribution Fee for NYSE ArcaBook, SEC Release No. 34-69315; File No. SR-NYSEArca-2013-37, available at http://www.sec.gov/rules/sro/nysearca/2013/34-69315.pdf	April 5, 2013
De La Merced, Michael J. and Nathaniel Popper, “BATS and Direct Edge to Merge, Taking on Older Rivals,” <i>The New York Times</i>	August 26, 2013
Securities and Exchange Commission, 17 CFR Parts 202, 240, 242 and 249, Release No. 34-40760, File No. S7-12-98 at § 242.301(b)(3)	
Securities and Exchange Commission, 17 CFR Parts 201, 240, 242 and 249 Release 34-39884; File No. S7-12-98, available at http://www.sec.gov/rules/proposed/34-39884.pdf	
Securities and Exchange Commission, 17 CFR Parts 200, 201, 230, 240, 242, 249, and 270 Release No. 34-51808; File No. S7-10-04, available at http://www.sec.gov/rules/final/34-51808.pdf	
White, Mary Jo, “Intermediation in the Modern Securities Markets: Putting Technology and Competition to Work for Investors,” SEC, available at http://www.sec.gov/News/Speech/Detail/Speech/1370542122012#.VIi0nTHF98E	June 20, 2014
NYSE Trading Information, available at https://www.nyse.com/markets/nyse/trading-info	
NYSE Arca – Schedule of Fees and Charges, http://www1.nyse.com/pdfs/NYSEArca_Listing_Fees.pdf , available at https://www.nyse.com/publicdocs/nyse/markets/nyse-arca/NYSE_Arca_Marketplace_Fees.pdf accessed on 1/25/15	
BATS BYX Exchange Fee Schedule, Effective January 12, 2015, available at http://www.bats.com/us/equities/membership/fee_schedule/bzx/ accessed on 1/25/15	
BATS BYX Exchange Fee Schedule, Effective January 12, 2015, available at http://www.bats.com/us/equities/membership/fee_schedule/byx/ accessed on 1/25/15	
EDGA Exchange, Inc. Fee Schedule, Effective January 16, 2015, available at http://www.bats.com/us/equities/membership/fee_schedule/edga/ accessed on 1/25/15	
EDGX Exchange, Inc. Fee Schedule, Effective January 16, 2015, accessed 1/24/15, available at http://www.bats.com/us/equities/membership/fee_schedule/edgx/ accessed on 1/25/15	

Document Title, Bates Numbers**Document Date**

NasdaqTrader.com – Price List - Trading Connectivity, available at <http://www.nasdaqtrader.com/Trader.aspx?id=PriceListTrading2> accessed on 1/25/15

NasdaqTrader.com – BX Pricing List-Trading & Connectivity, available at http://www.nasdaqtrader.com/Trader.aspx?id=bx_pricing accessed on 1/25/15

NasdaqTrader.com – PSX Pricing List, available at http://www.nasdaqtrader.com/Trader.aspx?id=PSX_Pricing

“About Us,” Tradebot Systems, available at <http://www.tradebotsystems.com/about.asp>.

BrokerTec, available at <http://www.icap.com/what-we-do/electronic/BrokerTec.aspx>, accessed 1/24/15

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NYSE Euronext Form 10-K for the Fiscal Year Ended December 31, 2011	February 29, 2012
NYSE Euronext Form 10-K for the Fiscal Year Ended December 31, 2012	February 26, 2013
NYSE Euronext Form 10-Q for the Quarterly Period Ended September 30, 2013	November 5, 2013

Data

TICK Data
NASDAQ Subscriber Data
NYSE Subscriber Data

Document Title, Bates Numbers

Document Date

NYSE Aggregated Trade Data

CRSP

Miscellaneous

Order Establishing Procedures and Referring Applications for Review to Administrative Law Judge for Additional Proceedings, Admin. Proc. File Nos. 3-15350, 3-15351 May 16, 2014

Application for An Order Setting Aside Rule Change of NYSE Arca, Inc. Limiting Access to Its Services, Admin. Proc. File No. 3-15350

All other materials cited in this report and in the exhibits to this report.

Attachment C

HIGHLY CONFIDENTIAL

UNITED STATES OF AMERICA
before the
SECURITIES AND EXCHANGE COMMISSION

In The Matter of the Application of:

SECURITIES INDUSTRY AND FINANCIAL
MARKETS ASSOCIATION

for Review of Actions Taken by
Self-Regulatory Organizations

Admin. Proc. File No. 3-15350

The Honorable Brenda P. Murray,
Chief Administrative Law Judge

Expert Report of Janusz A. Ordover

January 26, 2015

REDACTED VERSION

I. INTRODUCTION

A. Qualifications

1. My name is Janusz A. Ordover. I am a Professor of Economics and former Director of the Masters in Economics Program at New York University, where I have taught since 1973. From 1991 – 1992, I served as Deputy Assistant Attorney General for Economics at the Antitrust Division of the United States Department of Justice. As the chief economist for the Antitrust Division, I was responsible for formulating and implementing the economic aspects of antitrust policy and enforcement of the United States, including co-drafting the 1992 U.S. Department of Justice and Federal Trade Commission *Horizontal Merger Guidelines*. I also had ultimate responsibility for all of the economic analyses conducted by the Department of Justice in connection with its antitrust investigations and litigation. In addition, I am a Senior Consultant to Compass Lexecon, a leading economic consulting firm.

2. I have authored and co-authored numerous articles on industrial organization economics, law and economics, antitrust, and intellectual property. In particular, I have written and testified on the issues of pricing of information as well as on the benefits and costs of regulatory interventions in markets. My curriculum vitae, which contains a complete list of my publications, as well as a list of the matters in which I have provided testimony as an expert in the past four years, are being produced concurrently with this report.

B. Summary of Conclusions

3. I understand that the Securities Industry and Financial Markets Association (“SIFMA”) has filed applications for review challenging more than five dozen rule changes affecting certain fees charged for “non-core market data” by certain self-regulatory organizations, including the NASDAQ Stock Market (“NASDAQ”).¹ In this proceeding, SIFMA

1. See Commission Order dated May 16, 2014, File Nos. 3-15350, 3-15351.

challenges “certain rule changes adopted by Nasdaq and NYSE Arca that impose fees for access to depth-of-book market data products.”²

4. I have been asked by counsel for NASDAQ to provide an economic analysis of four issues that have been raised by the Securities and Exchange Commission (“the Commission”) in its ArcaBook Order and/or by the D.C. Circuit in its *NetCoalition I* opinion.

Specifically:

- a. Whether NASDAQ is “subject to significant competitive forces in setting the terms of its proposal for non-core data, including the level of any fees”?³
 - I conclude that it is. See Section III.
- b. Are there competitive alternatives to purchasing depth-of-book data from NASDAQ that provide a competitive constraint on NASDAQ’s pricing? In particular, whether “traders who want depth-of-book data [from NASDAQ] would decline to purchase it if met with a supracompetitive price” in sufficient numbers to constrain NASDAQ’s pricing?⁴
 - I conclude that there are such alternatives and that traders would be able to do so. See Section IV.
- c. Does the economic evidence show that “order flow competition constrains [NASDAQ’s] market data prices”?⁵
 - I conclude that it does. See Section V.
- d. Whether, from an economic perspective, a market-based approach to establishing pricing in this market, as opposed to government regulation, is likely to lead to greater efficiency and enhance consumer welfare?⁶
 - I conclude that it is. See Section VI.

I have also been asked to evaluate SIFMA’s claim that “the cost of producing market data would be direct, if not the best, evidence of whether competition constrains” the price of market

2. SIFMA Request for Issuance of Subpoenas (Dec. 4, 2014).

3. ArcaBook Order, 73 Fed. Reg. at 74,781.

4. *NetCoalition v. SEC*, 615 F.3d 525, 542-43 (D.C. Cir. 2010).

5. *Id.* at 541.

6. The ArcaBook Order asks specifically whether there is “a substantial countervailing basis to find that the terms” of the proposal violate the Exchange Act, despite the existence of competitive forces. See 73 Fed. Reg. at 74,781. I limit my analysis to an examination of the economics of the market and the likely economic impact of government regulation over pricing in this market.

information, such as depth-of-book products.⁷ I conclude that SIFMA's claim is wrong as a matter of economics and public policy. See Section VII.

5. In addressing these questions, I and Compass Lexecon personnel under my supervision have reviewed a variety of materials; a list of those materials is being produced concurrently with this report. These materials include, without limitation, emails reflecting communications between NASDAQ and its customers, NASDAQ internal presentations, and documents presented to NASDAQ's Board of Directors. These materials fully support my conclusions, and I have provided illustrative examples in the report that follows. In addition, I intend to review all expert reports that are filed in this matter, and I reserve the right to rely on or respond to such evidence. I reach the following major conclusions:

- NASDAQ is subject to significant competitive forces in setting the terms of its proposal for non-core data, including the level of any fees. In particular, I find that the prices of NASDAQ's depth-of-book products are constrained by two types of significant competitive forces:
 - NASDAQ's prices for depth-of-book products are constrained by competition from alternative depth-of-book products, as well as the option to simply decline to purchase NASDAQ's depth-of-book products;
 - NASDAQ's prices for depth-of-book products also are constrained by competition for order flow from other trading platforms, including the threat that customers will divert order flow to other trading platforms (i.e., "platform competition" constrains the price of market data).
- I find no basis for any concern that the terms under which NASDAQ offers depth-of-book products harm market participants.
 - Depth-of-book data products are widely available. The terms under which NASDAQ offers its depth-of-book products do not "unreasonably discriminate" against retail investors or any other group of market participants.
 - A regulatory intervention in a market where competition is effective is likely to lead to a variety of unintended, harmful effects. For example, in the case of depth-of-book data, the reduction in price that SIFMA appears to be advocating could lead to an increase in net trading fees and thus a decline in liquidity on "lit" trading platforms, as well as a reduction in investments to produce more and better market data.

7. See SIFMA Comment Letter and Petition for Disapproval, December 8, 2010 ("SIFMA Letter") at 6. SIFMA's claim was specifically about data products sold by NYSE Arca.

- SIFMA's claim that "the cost of producing market data would be direct, if not the best, evidence of whether competition constrains" the price of market information is wrong as a matter of economics and public policy.
 - In general, in markets whose participants have substantial fixed costs and low marginal costs, competition cannot and does not result in prices equal to any measure of marginal costs because such an outcome would result in a firm with those characteristics failing to earn a normal return on its investment.
 - For a firm that produces "joint products" and incurs "joint costs," it is not possible to meaningfully calculate a rate of return on an individual product because doing so requires an allocation of the joint costs across the array of joint products, which *per force* is arbitrary. Accordingly, for such a firm, it is improper and arbitrary to define a competitive pricing level by comparing prices to marginal or incremental costs.

II. BACKGROUND INFORMATION ON TRADING PLATFORMS AND MARKET DATA

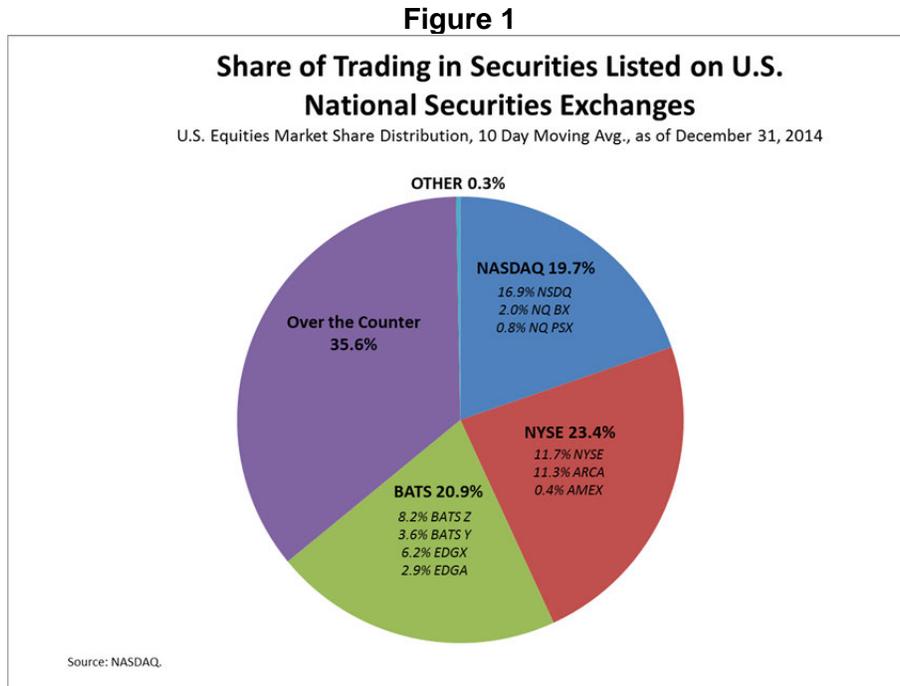
6. Trading platform operators, including NASDAQ, the New York Stock Exchange ("NYSE") and BATS Global Markets ("BATS"), compete on a variety of dimensions,⁸ including the provision of trading services, listing services, technology services, index services and market data.⁹ Exchanges have little or no economic incentive to develop and sell a new product or service unless the new product or service is expected to increase the exchange's total revenue more than its total cost. Different trading platforms may choose different pricing strategies for different services. For example, a platform owner may choose to distribute non-core market information "at no cost" to increase demand for trade execution services on that platform. All else equal, that owner will thus be able to earn more for trade execution services than a platform owner that separately charges for market information.

7. Exchanges like NASDAQ, NYSE and BATS compete with each other to provide trading services, as well as with a variety of alternate trading platforms that allow over-the-counter trading. Over-the-counter trading reflects the activities of a large number of entities, including "dark pools," which are multilateral organizations that "pool" the orders of traders. The

8. Trading platform operators, such as NASDAQ, can operate several platforms. NASDAQ, for example, operates the NASDAQ platform as well as the BX and PSX platforms.

9. The Commission mandates that certain types of market information – referred to as "core data" – be made available to all customers. The pricing of core data is subject to regulatory procedures and constraints. See *NetCoalition I*, 615 F.3d at 529.

identities of traders in dark pools, and the prices at which they trade, are not generally known. For this reason, trading in dark pools and other over-the-counter trading is sometimes referred to as “dark,” to distinguish it from trading on exchanges, which is referred to as “lit.” Figure 1 presents the trading shares by platform operator at the end of 2014, and shows that no single platform or platform operator accounts for even 25 percent of trading in U.S. equities.

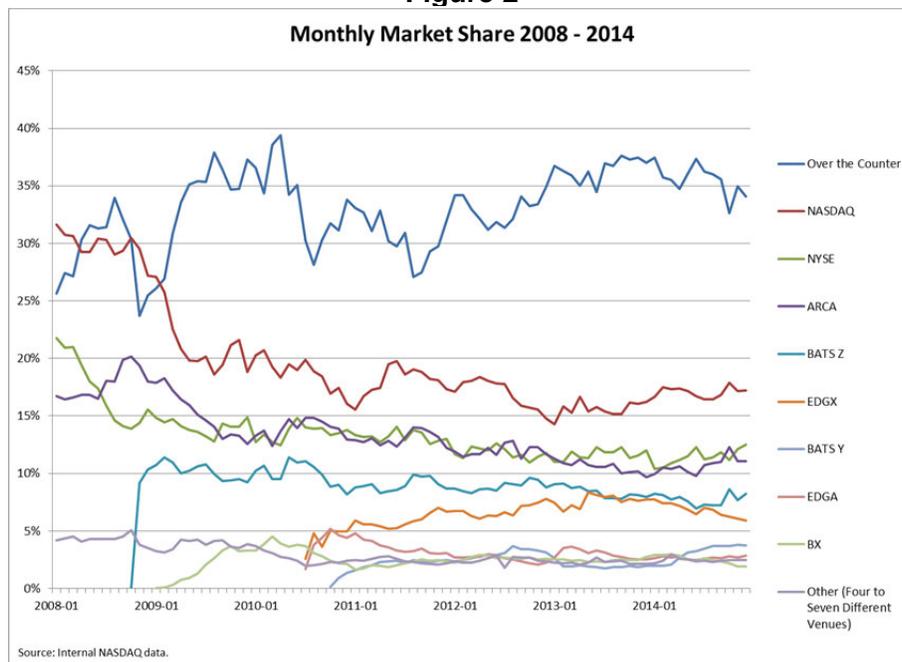


8. Figure 2 shows trading shares by platform since 2008. The rapid rise of BATS and Direct Edge, and the substantial increase in over-the-counter trading (including dark pools), indicates that the business of trading equities is not characterized by substantial barriers to entry or expansion.¹⁰ In the last six years, NASDAQ’s share fell from about 32 percent to about 17 percent; similarly, the share of the NYSE platform fell from about 22 percent to about 13 percent, and the share of the NYSE Arca platform fell from about 17 percent to about 11 percent. In contrast, during the same period, the share of over-the-counter trading increased

10. Both BATS and Direct Edge began as alternative trading platforms. See Jacob Bunge, “BATS, Direct Edge in Talks to Merge: Deal Would Create Second-Largest U.S. Stock-Market Operator,” *Wall Street Journal*, August 23, 2013 (“Direct Edge traces its roots to the 1998 launch of an electronic-trading platform called Attain. BATS was founded in 2005 by Tradebot, a high-frequency trading firm.”).

from about 26 percent to 34 percent. BATS entered as an exchange in late 2008 (with its BATS Z platform), and quickly captured a share of about 10 percent. BATS's second platform (BATS Y) entered as an exchange in late 2010 and had a share of about four percent at the end of 2014. The two Direct Edge platforms entered as exchanges in July 2010 and had an aggregate share of about 10 percent within six months. I understand that entry continued in 2014 with the launch of the Miami Stock Exchange, and is expected to continue in 2015 with the IEX trading platform registering as an exchange.

Figure 2



9. Furthermore, the recent merger of BATS with Direct Edge, which was approved by the Commission in 2014, has been described as further increasing the competition faced by NASDAQ and NYSE for trade flow:

The merged Bats Global Markets, whose owners include Goldman Sachs Group Inc., Morgan Stanley, Credit Suisse (CSGN) Group AG, Citadel LLC, Citigroup Inc. (C) and KCG Holdings Inc. (KCG), will run four exchanges that claim more than 20 percent of daily equity volume to challenge NYSE for the most market share. NYSE and Nasdaq, which converted to public companies about a decade ago, have battled growing competition from Bats and Direct Edge as well as alternative trading venues run by some of the same Wall Street firms that once owned them. Combining the broker-owned exchanges will only heighten the threat, according to Brad Katsuyama, chief executive officer of IEX Group Inc., which runs a dark pool aimed at large investors. "The combination of Bats and Direct Edge now has all the large brokers sitting around the same table, which is definitely not a positive thing for NYSE and Nasdaq given the

percentage of orders concentrated with these brokers,” said Katsuyama, whose IEX venue plans to become an exchange.¹¹

10. The BATS/Direct Edge merger also has been described as increasing competition for market data. Senior executives at the merged firm “said they saw opportunities to take existing business from Nasdaq and the N.Y.S.E. The older companies make a lot of money selling data to customers, which is possible because of the amount of trading they host. The combined trading volume of BATS and Direct Edge should allow them to come up with their own data offering.”¹²

11. Several of the owners of BATS, including Bank of America Merrill Lynch, Citadel, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, Instinet, J.P.Morgan, KCG, Morgan Stanley and Wedbush, are members of SIFMA; several of these SIFMA members or related entities (Bank of America, Citigroup, Credit Suisse, Goldman Sachs and J.P. Morgan) filed declarations on behalf of SIFMA in this matter.¹³ That is, several members of SIFMA, through their ownership of BATS, have been able to enter the exchange business and compete with NASDAQ and NYSE for trade execution services and the sale of depth-of-book data.

12. By the end of 2014, only 33.2 percent of trading on NYSE-listed stocks, in the aggregate, took place on the NYSE and NYSE Arca platforms.¹⁴ In the same period, NASDAQ’s share of trading in NASDAQ-listed securities was only 30.1 percent.¹⁵ This

11. Sam Mamudi, Bloomberg, “Bats-Direct Edge Merger Puts Traders in Control of Venues,” January 31, 2014.

12. See Michael J. de la Merced and Nathaniel Popper, “BATS and Direct Edge to Merge, Taking on Older Rivals,” *New York Times*, August 26, 2013.

13. See http://www.batsglobalmarkets.com/our_company/facts/owners/ (“BATS Global Markets is a privately-held company with ownership by a consortium of investors, including: Bank of America Merrill Lynch, Citadel, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, Instinet, J.P.Morgan, KCG Holdings, Lime Brokerage, Morgan Stanley, Spectrum Equity, TA Associates, Tradebot Systems, and Wedbush.”). For a list of SIFMA members, see <http://www.sifma.org/amg-member-directory/>.

14. Based on information from the last 10 trading days of December 2014. See <http://nasdaqtrader.com/trader.aspx?id=FullVolumeSummary>.

15. See <http://nasdaqtrader.com/trader.aspx?id=FullVolumeSummary>. Two other platforms owned by NASDAQ, BX and PSX, accounted for an additional 2.5 percent of trading of

evidence shows that no trading platform has a “monopoly” on generating market data on shares listed on that platform.¹⁶

13. NASDAQ sells a variety of depth-of-book products. NASDAQ’s Level 2 product provides information on the best price quoted by each market participant, but does not include every price quoted by each participant. NASDAQ’s TotalView product includes every bid and offer (i.e., the TotalView product contains all of the information in the Level 2 product as well as additional information). NASDAQ offers both Level 2 and TotalView data products for stocks listed on NASDAQ. NASDAQ also offers customers the option of purchasing depth-of-book information on stocks traded on NASDAQ but listed on NYSE and other exchanges. Depth-of-book information for non-NASDAQ listed stocks is called “OpenView.”¹⁷

III. THERE IS ROBUST COMPETITION FOR THE SALE OF DEPTH-OF-BOOK DATA

14. The behavior of NASDAQ and the other exchanges reflects the existence of robust competition for the sale of depth-of-book data, including competition on innovation, product quality, service and price. As a result of this competition, over the past several years market data products from NASDAQ and the other exchanges have been enhanced substantially, while data fees have not increased substantially.

15. The competitive drive toward innovation and product enhancement is illustrated by NASDAQ’s product improvements over the last several years. Some of these innovations have been aimed at improving the quality of NASDAQ’s data products; others have been aimed at increasing the ease of usage or the quality of the user interface; and others have been aimed at reducing customers’ costs of using or accessing NASDAQ’s data. NASDAQ has offered

(...continued)

NASDAQ-listed shares.

16. Although any firm can be described as the “exclusive” seller of its product, it is not appropriate as a matter of economics to describe every firm that sells a differentiated product as a monopolist. For example, General Motors is the “exclusive” seller of Chevrolet cars, but is not a monopolist in a market for automobiles or even in a narrower “market” for family sedans.

17. See Attachment 1 for a description of NASDAQ pricing for depth-of-book products.

depth-of-book products called Level 2, TotalView and OpenView for many years, but I understand that each product has been enhanced numerous times since its introduction, and that these enhancements included: increases in speed of transmission; additions to content; and changes in format and delivery options to improve efficiency.

16. These innovations and product enhancements are consistent with the behavior of a firm in a competitive marketplace, as NASDAQ has sought to improve its product quality (or reduce the costs of usage and implementation) in order to improve its competitive standing in the marketplace, and it has marketed its products to its customers on the basis of these product attributes. Moreover, in many cases these product enhancements were not accompanied by price increases, consistent with competitive constraints on prices.¹⁸ Also consistent with the presence of robust competition for the sale of depth-of-book market, NASDAQ's competitors have been investing in the development and marketing of data products and attempting to match NASDAQ's innovations. This has fueled a competitive "arms race" that has benefited customers through improved products and service and lower costs.¹⁹

17. Finally, the available evidence reflects effective price competition. For example, in seeking approval from the NASDAQ Board [REDACTED]

[REDACTED]

[REDACTED]

18. For example, in a December 2012 rule filing in connection with its Level 2 product, NASDAQ explained that, despite making numerous enhancements to the product (such as capacity upgrades and adding data sets), the fee for Level 2 Professional/Corporate subscribers did not increase for nearly 30 years – from its introduction in 1983 until 2012. See SR-NASDAQ-2012-133 at 5 of 35.

19. See, for example, [REDACTED] *see also* http://cdn.batstrading.com/resources/market_data/products/bats_bats-one-feed.pdf ("BATS One Feed will have the most comprehensive content of any exchange-provided market data product with respect to real-time market information.").

NASDAQ has undertaken extensive efforts to improve its data products and market them aggressively in order to expand the sales of its depth-of-book market data.²⁴

19. In Sections IV and V of this report, I discuss in greater detail the sources of the competitive pressure that constrain NASDAQ's pricing and other competitive behavior, including competition from other exchanges' data products and competition to attract order flow.

IV. PRICES OF NASDAQ'S DEPTH-OF-BOOK PRODUCTS ARE CONSTRAINED BY COMPETITION FROM VENDORS OF OTHER DEPTH-OF-BOOK PRODUCTS

20. Market participants have access to data streams from several suppliers of depth-of-book information. Such data are widely distributed and used by a broad range of data users. NASDAQ depth-of-book products, for example, are purchased by many "subscribers," including both Professional/Corporate and Non-Professional subscribers.²⁵ In December 2014, NASDAQ collected usage fees for depth-of-book products [REDACTED]. Of this total, [REDACTED] were Professional/Corporate subscribers and [REDACTED] were Non-Professional subscribers. The substantial number of subscribers to NASDAQ depth-of-book products indicates that substantial numbers of both types of subscribers derive value from the data that exceeds the price of the data.

21. Because the depth-of-book information from different providers is not necessarily identical, vendors of depth-of-book data compete for customers along several dimensions, including pricing, but not exclusively on price.

[REDACTED]

24. See *id.* at 4 [REDACTED]

25. A NASDAQ customer (e.g., Citigroup, TD Ameritrade) can distribute depth-of-book products to multiple "subscribers," either "internally" (e.g., to traders employed by that customer) or "externally" (e.g., to its clients). A NASDAQ customer typically pays one distributor fee and "usage" fees per subscriber.

- NYSE Arca sells NYSE ArcaBook, a depth-of-book data product that “shows the full limit order book for NYSE Arca traded securities on a real time basis.”²⁶ NYSE also sells NYSE OpenBook, which provides depth-of-book information for the NYSE exchange.
- BATS currently offers depth-of-book products from its exchanges.²⁷ BATS also plans to offer BATS One Feed, a data product that shows “market participants a comprehensive, unified view of the market from all four BATS equity exchanges: BZX Exchange, BYX Exchange, EDGX Exchange and EDGA Exchange.”²⁸ BATS plans to offer two versions of this product, BATS One Summary Feed and BATS One Premium Feed. Both products “provide aggregated quote and trade updates for the BATS Exchanges. The BATS One Premium Feed also includes five levels of aggregate depth information for all four exchanges.”²⁹

22. Even if different data providers’ products are not identical, partial overlaps in terms of the quality of data and other features can nevertheless be highly effective in constraining prices that NASDAQ can charge for its depth-of-book data. To illustrate the point, although Coke and Pepsi are not identical products, competition between them – as well as with other sellers of carbonated soft drinks – constrains their prices to consumers.³⁰ Indisputably, because the loss of data customers also affects the demand for trading, it acts as an additional constraint on NASDAQ’s pricing strategies (see Section V, below).

23. Internal NASDAQ documents indicate that traders’ ability to switch among depth-of-book data suppliers has exerted downward pressure on NASDAQ’s prices. For example, in March 2010, NASDAQ adopted a “non-display” fee cap of \$30,000 per month for internal distributors of TotalView data in response to a competitive threat.³¹ Specifically, [REDACTED]

26. See <http://www.nyxdata.com/Data-Products/NYSE-ArcaBook>.

27. See http://www.batstrading.com/market_data/products/.

28. See http://cdn.batstrading.com/resources/market_data/products/bats_bats-one-feed.pdf.

29. *Id.*

30. Of course, the competitive constraint is more effective the higher is the share of current purchasers that can readily switch some or all of their purchases from NASDAQ (say) to all other data sources in response to changes in relative prices for data charged by different vendors and/or changes in relative data quality. This means that constraints will be effective if there is a “rich” demand “margin” such that an increase in price will induce a significant portion of current customers (buyers of data) to either switch to other sources of data or to repress the intensity of usage.

31. A non-display fee is assessed on subscribers that use the depth-of-book data without displaying it on a screen.

[REDACTED]

[REDACTED] as one would find in an effectively competitive marketplace.³²

24. For another example, in [REDACTED] a customer complained about NASDAQ's depth-of-book fees and threatened to

[REDACTED]

25. Furthermore, NASDAQ internal analyses reflect trader behavior which indicates that customers can, and do, switch depth-of-book data providers. For example, an internal NASDAQ analysis of TotalView customers from [REDACTED] found that "in [REDACTED] we lost [REDACTED] firms while on the other hand adding [REDACTED]" Similarly, "in [REDACTED] we lost [REDACTED] firms while on the other hand adding [REDACTED]"³⁴ These gains and losses of customers indicate that such customers have alternatives to NASDAQ's data products. Similarly, NASDAQ's internal documents indicate that customers turn down depth-of-book data products because they can get sufficient information for their trading purposes without purchasing depth-of-book data, which puts further downward pressure on pricing for those products.³⁵

26. I have analyzed information on NASDAQ's depth-of-book customers, and I find similar patterns of trader behavior – that is, NASDAQ has added as well as lost a substantial number of customers in every year during the period 2008 – 2014.³⁶ See Figure 3, which shows

32. See [REDACTED]

33. [REDACTED]

34. See [REDACTED]

35. See *id.* [REDACTED]

36. NASDAQ does not track the names of external subscribers to its depth-of-book products, so if a customer switches from being an internal to an external subscriber (i.e., a customer switches from buying depth-of-book data directly from NASDAQ to purchasing it through a distributor, such as Bloomberg) that customer would appear as a "loss" in my analysis;

annual churn rates of [REDACTED] Because the data needs of actual and potential buyers are likely to be stable, such churn rates are substantial.³⁸



27. In addition to customers that stopped taking NASDAQ depth-of-book data completely, other customers substantially increased or reduced (or both) the number of subscribers that received that data. For example: [REDACTED] increased its number of subscribers from about [REDACTED], then reduced its number of subscribers for NASDAQ depth-of-book data to [REDACTED]. Similarly, [REDACTED] increased its subscriber count from [REDACTED] then reduced its number of subscribers to [REDACTED]. [REDACTED] increased its subscriber count

(...continued)

similarly, if a customer switches from being an external to an internal subscriber, it would appear as an “add” in my analysis.

37. I calculate the churn rate as the sum of annual customer additions and losses divided by the total number of customers in that year. In this analysis, I do not control for changes in the total number of firms trading (e.g., I do not control for changes in financial markets associated with the recent Great Recession).

38. My analysis is based on customers purchasing any depth-of-book data from NASDAQ. The internal NASDAQ study appears to be based only on customers purchasing depth-of-book data for internal distribution, so the two studies are not directly comparable.

from [REDACTED] to [REDACTED] in [REDACTED], [REDACTED] had only about [REDACTED] subscribers.

28. In general, it is not possible to determine from the available data why a customer started or stopped purchasing NASDAQ depth-of-book data. However, based on information I have received in this proceeding, I can compare the names of NASDAQ's depth-of-book customers to NYSE's ArcaBook customers. My analysis shows that NASDAQ customers such as [REDACTED] appear to have switched to or from a NASDAQ depth-of-book product to a NYSE Arca product at least once in the years [REDACTED]

[REDACTED]⁹

29. These data, together with my analysis of customer churn, indicate the existence of significant competitive constraints on NASDAQ's depth-of-book data pricing. Significant numbers of NASDAQ's customers can drop NASDAQ's depth-of-book data products (or reduce the number of users in their enterprise) if NASDAQ were to price those products above their value in the competitive marketplace.

30. SIFMA claims that traders must "have a full picture of liquidity for a given security he or she wishes to trade."⁴⁰ That is, SIFMA implies that traders must have depth-of-book data from all trading platforms in order to trade any security effectively. As such, traders allegedly do not view alternate sources of depth-of-book data as substitute products. SIFMA's claim is wrong:

39. My analysis is based on a comparison of customer names maintained in databases by NASDAQ and NYSE. However, customer names are not standardized across databases, so it is not always possible to determine whether a customer name in one database represents the same entity as a customer name in the other database. Because NASDAQ does not track the names of external subscribers to its depth-of-book products, I am unable to identify external subscribers that switch between NASDAQ and NYSE depth-of-book products (e.g., I am not able to determine if a Bloomberg external subscriber switched from a NASDAQ depth-of-book product to NYSE Arcabook).

40. SIFMA Letter at 10.

- First, although depth-of-book data are used by a variety of market participants, many participants in the equity markets engage in a broad range of financial market activities without relying on NASDAQ depth-of-book data, which indicates that such data are not “essential.”⁴¹ For example, I understand that about 400,000 professional subscribers purchase NASDAQ core data, which shows that many market participants trade (or consider trading) on the NASDAQ platform without purchasing its depth-of-book data. For example, I understand that some traders engage in strategies based on the use of “pegged-to-market” limit orders, which are designed to execute at a purchase price that is at a constant differential from the national best offer or national best bid, and do not involve the use of depth-of-book data.⁴²
- Second, no trader has a “full picture of liquidity” because not all trading is “lit.” For example, as Figure 1 shows, about 35 percent of trades occur “over-the-counter” (e.g., in dark pools or through within-broker “internalization”). Indeed, a growing share of trading that is not “lit” indicates that other financial considerations can readily outweigh the alleged benefits of access to the full picture of liquidity. Thus, depth-of-book data from any or all of the exchanges, although of value to some traders, provides at best a proxy for total liquidity for any particular security at any given point in time.
- Third, even market participants that purchase depth-of-book data do not buy all available depth-of-book data, which shows that many market participants find a subset of the available depth-of-book information adequate for their trading strategies. For example, there is roughly the same number of Level 2 Professional/Corporate subscribers as TotalView Professional/Corporate subscribers [REDACTED]. This indicates that many professionals who purchase some NASDAQ depth-of-book data do not find it necessary to “have a full picture of liquidity.”⁴³ Indeed, if SIFMA’s claim were correct, no market participant would purchase NASDAQ’s Level 2 product because it does not provide a “full picture of liquidity” even on the NASDAQ platform.
- Fourth, some market participants that purchase depth-of-book data from one platform do not purchase such data from multiple platforms, which indicates that for many participants that do use depth-of-book data, it is not necessary to have a “full picture of liquidity” in order to engage in their preferred trading activities. For these market participants, depth-of-book data from just one platform is plainly sufficient. Consequently, for these participants, there is some degree of potential substitution across different sources of depth-of-book data. For example, I find that, on an annual basis, approximately [REDACTED] percent of NASDAQ depth-of-book customers do not purchase NYSE ArcaBook data.⁴⁴

41. There are various definitions of what it means to be an “essential” product or input. Stated simply, an essential input is an input such that absent access to the input, a firm is unable to participate in the marketplace. A less stringent definition states that a firm without access to the input is at a material competitive disadvantage vis-à-vis other market participants.

42. I understand that transaction fees for pegged-to-market limit orders on the NASDAQ exchange are the same as for other limit orders.

43. A similar number of Professional/Corporate subscribers purchase only OpenView depth-of-book products.

44. This analysis is also based on a comparison of customer names maintained in databases by NASDAQ and NYSE.

31. I understand that there may be some customers who may have a “preference” for NASDAQ depth-of-book data. But the fact that some customers may prefer the products of a particular seller does not demonstrate that the seller has the ability to charge prices significantly above competitive levels or can act without regard to competitive forces. For example, some soda drinkers may sufficiently prefer Coke to Pepsi that they would not switch to Pepsi even in the presence of a significant increase in its price. But in the absence of an ability to identify those customers and charge a higher price to them, the presence of such customers does not suggest that Coca-Cola can set prices without regard to competitive constraints. Indeed, it is the presence of customers who would switch in response to a change in relative prices that creates the relevant competitive constraint.

32. There is no ready mechanism whereby NASDAQ can effectively identify customers that have a strong preference for its data products or for executing trades on the NASDAQ platform. Also, I am not aware of any evidence that NASDAQ’s customers cannot move order flow to another platform if efficient trading on NASDAQ – which includes paying for data – becomes more expensive relative to rival “lit” platforms and dark pools. As I discuss in the following section, a threat of moving order flow to another platform is a credible mechanism for constraining rates on data.⁴⁵ In any case, if the costs of certain trading strategies on NASDAQ get out of line with the costs of executing strategies elsewhere, a trader with a preference for trading on NASDAQ can readily shift trading activity to another venue or pursue another strategy and punish NASDAQ for supra-competitive pricing.

45. Because of the regulatory context (e.g., prices are filed; the same price is offered to customers with similar characteristics, such as professional vs. non-professional), depth-of-book prices do not always change rapidly in response to changing market conditions. Certainly, these prices cannot change with day-to-day fluctuations in the volume of transactions on any given trading platform. Over time, underlying changes in the product (such as improvements/innovations), as well as dynamic changes in other market factors (such as the value of the product) are likely to trigger “step” changes in prices and/or the introduction of new fees. As in non-regulated industries, such price changes are not, by themselves, evidence that prices are not constrained by significant market forces.

V. NASDAQ'S PRICES FOR DEPTH-OF-BOOK PRODUCTS ARE ALSO CONSTRAINED BY COMPETITION FOR ORDER FLOW FROM OTHER TRADING PLATFORMS

33. For market participants that use trading strategies requiring depth-of-book data products from the platform on which they tend to trade, the total cost of trading on that platform includes the costs of trading (i.e., trading fees and/or rebates) plus the cost of depth-of-book data (as well as other trading costs, such as telecommunications expenses).⁴⁶ For these market participants, an increase in the price of depth-of-book data increases the “total cost” of trading on that platform.

34. A trading platform must attract orders. This is the fundamental point that needs to be kept in mind when considering public policy towards non-core data pricing. Simply stated, an exchange such as NASDAQ must take into consideration that increasing the price for its depth-of-book product risks losing the business of market participants with trading strategies that make use of NASDAQ depth-of-book data to trade on the NASDAQ exchange.

35. Many of the entities that purchase depth-of-book data products from NASDAQ also provide a substantial number of trades to the NASDAQ platform. These customers can – and do – shift their trading volume from one platform to another. The trading volume from these customers is important to the success of an exchange such as NASDAQ and its platform competitors. Customers that provide substantial trading volume are sophisticated, and they recognize the importance of the trading volume that they provide to NASDAQ and other platforms. Such customers thus can use the threat of shifting trading volume away from a platform (or the promise of shifting trading volume to a platform) to put downward pressure on NASDAQ's prices, including obtaining concessions on depth-of-book data pricing.⁴⁷ For this

46. Some market participants may choose to trade on one platform but use market data from another platform.

47. NASDAQ data customers can, and do, discontinue (or limit) purchasing depth-of-book data from NASDAQ on a monthly basis. Thus, when a trader is deciding whether or not to buy depth-of-book data (or discontinue buying it), the data cost becomes effectively a “marginal” decision.

reason, the total price of trading on NASDAQ is constrained by competition for order flow. As NASDAQ explains in its internal documents, “[f]requently, the sale of [data products] is to the same person responsible for the order flow decision, which creates challenges where the prospect may try to bundle the purchase decision across our business units.”⁴⁸

36. NASDAQ’s documents reflect examples of clients switching, or threatening to switch, order flow in order to constrain NASDAQ’s prices for depth-of-book data products (or, more generally, to put downward pressure on the total cost of trading). For example, in [REDACTED] [REDACTED] objected to NASDAQ’s initiation of a fee for non-display usage, and a [REDACTED] representative told NASDAQ that

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] In addition, [REDACTED]

[REDACTED]

[REDACTED]

37. In another example, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

48. [REDACTED] *see also id* [REDACTED]

49. See [REDACTED]

50. See [REDACTED]

[REDACTED]

38. Similarly, [REDACTED]

[REDACTED]

39. Despite these examples of competition for order flow across exchanges, SIFMA claims that there is no evidence of this type of “platform competition”:

[a]lthough market share for order flow is volatile and changes dramatically, the Notice identifies no such volatility in the market for depth-of-book data. That market shares for order flow and depth-of-book data do not move in tandem further demonstrates that

51. See [REDACTED]

52. See [REDACTED]

53. See [REDACTED]

54. See [REDACTED]

these two products are not jointly bought and sold, undercutting the entire premise of the “platform competition” theory.⁵⁵

SIFMA’s basic premise and claim are inconsistent with economics and evidence.

40. A comparison of shares of order flow and sales of depth-of-book data over short time periods (e.g., “during which market share for order flow is volatile”) does not indicate whether competition for order flow constrains the price of depth-of-book products. Trading decisions can be made on a minute-by-minute basis. Decisions on purchasing any type of data, including depth-of-book data, typically will be made over substantially longer time spans (months or even years), so the share of order flow and the share of depth-of-book data products may not move “in tandem” over time, especially the shorter the time frame under consideration. However, NASDAQ’s customers appreciate this relationship – [REDACTED]

[REDACTED] Moreover, there is an obvious relationship inasmuch as trading on an exchange generates data from that exchange, and more and better data facilitates trading. This is a fundamental relationship between trade flows and data that SIFMA totally ignores.

41. Market share for order flow can be volatile for a variety of reasons unrelated to the cost of depth-of-book data (e.g., certain stocks tend to be more heavily traded on a particular exchange, so shifts in the volume of trading for those stocks can cause shifts in order flow market share). The relevant question is whether competition for trading volume exerts a competitive constraint on the pricing of depth-of-book data. NASDAQ’s customers are sophisticated financial market participants that have demonstrated (as in the above examples) that they are aware of the importance of the trading volume that they provide to NASDAQ and other exchanges. In this respect, it is notable that as the role of an exchange wanes, the demand for data from that exchange also will wane. It is plain that for data-pricing purposes, it

55. SIFMA Letter at 15.

is the long(er)-run relationship that is relevant and not day-to-day volatility in trading that depends on numerous short-term and longer-term shocks.

VI. A MARKET-BASED APPROACH TO PRICING CONDUCE TO ENHANCED EFFICIENCY AND CONSUMER WELFARE IN COMPARISON TO GOVERNMENT-REGULATED PRICING

42. I understand that the second prong of the SEC's two-part test is whether, even in the presence of significant competitive forces, there are sound policy reasons for concluding that market forces should not be permitted to dictate NASDAQ's depth-of-book data pricing. I am aware of no economic basis to reach such a conclusion here and SIFMA's declarants have not advanced any.

43. As an initial matter, I have seen no evidence that NASDAQ's market data fees cause any inefficiencies in trading, or interfere in any other competitor's ability to sell its products in the competitive marketplace. Market participants make unilateral decisions on whether to purchase market data, and if so how much of it (e.g., Level 2 vs. TotalView) and which options (e.g., display vs. non-display) to purchase. Depth-of-book data are available on standard terms; purchasers of NASDAQ depth-of-book products are not required to trade on a NASDAQ exchange and are not required to purchase depth-of-book products only from NASDAQ. And neither do the price terms offered by NASDAQ depend on whether the customer purchases depth-of-book data from other suppliers (e.g., NASDAQ does not offer a lower price to purchasers that buy depth-of-book data only from NASDAQ). NASDAQ does not implement any commercial strategies with respect to its depth-of-book products that at times may raise competitive concerns.

44. I also find no evidence of "unreasonable discrimination" against any group of market participants. For example, NASDAQ makes available the same depth-of-book data products to both Professional/Corporate and Non-Professional market participants. The only difference is that Non-Professional per-subscriber fees are far lower than the Professional/Corporate per-subscriber fees. I understand that this type of price differentiation –

i.e., lower fees for retail investors – is common in the securities industry and is not considered “unreasonable discrimination.” In addition, because NASDAQ itself does not engage in any trading activities, it has no commercial interest in using data products to advantage itself as a trader: a concern that has arisen in other settings.

45. Furthermore, the particular change in NASDAQ pricing policy at issue in this proceeding is limited to the introduction of “distributor fees” and “direct access fees” on NASDAQ’s Level 2 product.⁵⁶ Prior to the introduction of these fees in 2010, NASDAQ had already been charging the same type of distributor and access fees on its TotalView product. That is, the fees at issue in this proceeding impact only Level 2 customers. I see no basis to conclude that charging distributor fees to Level 2 customers “unreasonably discriminates” against Level 2 customers when TotalView customers are paying similar fees.⁵⁷

46. Unnecessary regulatory intervention in a market where competition is effective is likely to lead to a variety of unintended, harmful effects. For example, in the case of depth-of-book data, the reduction in price that SIFMA appears to be demanding would, all else equal, be expected to reduce the revenues earned by NASDAQ and other exchanges that sell depth-of-book data. In response to a loss in revenue, exchanges would be likely to (1) increase net trading fees; and/or (2) reduce investment in platform businesses, including the production and dissemination of new and innovative market data products.

47. Both outcomes can have substantial harmful effects on market participants. Increases in exchanges’ net trading fees would harm market participants that currently trade on

56. A “direct access” fee allows a customer to directly access NASDAQ’s Level 2 data fees (i.e., instead of accessing the Level 2 data through a distributor). See Attachment 1.

57. I understand that customers that purchased and distributed both Level 2 and TotalView products prior to the fee change in 2010, and thus were already paying distributor and access fees for TotalView products, were not charged additional fees for distributing Level 2 depth-of-book information. As a result, many customers did not pay higher fees as a result of the rule change. For example, I understand that the payments of the nine SIFMA declarants did not increase as a result of the rule change. See Brief of the NASDAQ Stock Market LLC in Response to SIFMA’s Opening Brief Regarding Satisfaction of Jurisdictional Requirements, August 18, 2014, Exhibit A.

exchanges and affect the efficiency of financial markets. Furthermore, such increases in net trading fees on “lit” exchanges would likely increase the share of trading that occurs over-the-counter, and thus reduce liquidity on “lit” trading platforms, further fragment the trading flows, and ultimately reduce the quality of available market data. In this regard, it is notable that some SIFMA members compete with NASDAQ through their over-the-counter trading platforms (or through their ownership interest in BATS). Where one competitor seeks regulatory intervention to hinder a competitor’s ability to set price or distribute its products in a manner dictated by competitive forces, the risk that regulatory intervention could adversely affect the marketplace and harm consumers is particularly acute.

48. A mandated reduction in market data fees also would predictably reduce investment and innovation in the financial platforms, including the production of improved market data products. Such reduced investment could impair the efficiency of the trading mechanism and reduce consumer welfare.

VII. SIFMA’S CLAIM THAT “THE COST OF PRODUCING MARKET DATA” IS THE PROPER GAUGE FOR DETERMINING WHETHER THE PRICE OF MARKET INFORMATION IS SUBJECT TO SIGNIFICANT COMPETITIVE FORCES IS WRONG AS A MATTER OF ECONOMICS AND PUBLIC POLICY

49. SIFMA claims that “the costs incurred in collecting and distributing depth-of-book data itself are relevant in assessing the reasonableness of the fees an exchange charges for the data because ‘in a competitive market, the price of a product is supposed to approach its marginal cost, i.e., the seller’s cost of producing one additional unit.’”⁵⁸ SIFMA’s claim is wrong as matter of economics and public policy. Despite SIFMA’s claims that the “marginal cost” of producing data should be reviewed in this proceeding, SIFMA provides no guidance on how it believes such information should be used to evaluate the degree of competition faced by NASDAQ for its depth-of-book products.

58. SIFMA Letter at 5 – 6 (citation omitted).

50. In this market – as in many markets – a more appropriate methodology to evaluate the presence or absence of competition and market power is through an assessment of the structure of the market and the existence of competitive forces that constrain pricing (as I have presented in the earlier sections of this report). Furthermore, I show that evaluating the competitive constraints faced by NASDAQ on the basis of the marginal costs of data production, or reported margins or rates of return on its data business, is not economically meaningful.

A. Marginal-Cost Pricing is Not Sustainable in Industries with High Fixed Costs and Low Marginal Costs

51. SIFMA's citation is to the *NetCoalition I* decision, which cites *Tejas Power Corp.* for the proposition that "[i]n a competitive market, where neither buyer nor seller has significant market power, it is rational ... to infer that price is close to marginal cost, such that the seller makes only a normal return on its investment."⁵⁹ SIFMA's position here is wrong because it ignores that, over the long-haul, firms must earn at least a normal risk-adjusted return on their investments in order to remain viable.

52. In general, in markets in which firms have substantial fixed costs and low marginal costs, which results in increasing returns to scale, competition cannot and does not result in prices equal to marginal costs. Indeed, if firms were constrained to price at or close to marginal costs in such markets, those firms would not be able to earn a normal return on their investments. This, in turn, would result in firms being forced to exit the industry. Thus, SIFMA's notion that only prices equal to marginal cost are consistent with competition is wrong as a matter of economics and public policy.

53. Prices that are above marginal cost are common in industries with substantial fixed costs and low marginal costs, such as content businesses, even if competition is fierce. This is because, in content markets (including data), pricing at marginal cost simply would not provide a sufficient return to permit suppliers to recover their costs of producing and supplying

59. *NetCoalition I*, 615 F.3d at 537 (emphasis added).

the content to the customer. For example, the price of a hardcover book is far in excess of the marginal cost of printing and distributing the book content to an incremental customer. But it is an obvious economic fallacy to conclude that pricing above marginal cost indicates that a publisher of a copyrighted hardcover book is a “monopolist” in an economically meaningful sense. Competition among publishers and book titles does not drive book prices to marginal costs because a publisher needs to cover the “first copy” costs that are incurred whether the book sells few copies or becomes a bestseller. Competition among publishers – like competition among trading venues, “lit” or “dark” – constrains the overall rates of return.

54. SIFMA members likely understand this point since they do not invariably price their own services at marginal cost. For example, SIFMA declarant Bloomberg, which produces and disseminates content, prices its products (e.g., fees on Bloomberg terminals) in excess of its marginal costs (i.e., the marginal cost of providing information to one more subscriber once that information has been developed is close to zero). I understand that Bloomberg also “passes through” the usage fees for NASDAQ depth-of-book data and charges its clients an additional fee for receiving the data. In contrast, I understand that some SIFMA members (e.g., Charles Schwab, TD Ameritrade) purchase depth-of-book data from NASDAQ and provide that information to their customers “for free.” That is, these SIFMA members price the information product to their customers at “below” marginal cost and make up their losses on other products, which they price “above” marginal cost. In general, such a practice is only economically feasible if those same SIFMA members charge those (or other) customers more than marginal cost for other services. SIFMA members unilaterally choose how to structure their fees – above or below the relevant marginal cost – subject only to competitive considerations.

B. Product-Specific Measures of Profit or Margin are Not Economically Meaningful in Industries with Joint Products and Joint Costs

55. In markets with “joint products” with “joint costs,” it is not possible to meaningfully calculate a “competitive” or “supra-competitive” rate of return or margin on an individual product. This is because an allocation of the joint costs, which affects the rates of return across joint

products, is to some extent arbitrary. Trading platforms such as exchanges provide a variety of services and products, including trade execution services and market data. Because market data is both an input to and a byproduct of executing trades on a particular platform, market data and trade execution services are examples of “joint products” with “joint costs.”⁶⁰ To illustrate: one could “allocate” all the costs of the platform to trading, to data production, or anywhere in between. The resulting rates of return or profits on trading or data would depend on the chosen allocation rule – not on the presence or absence of competition. Thus, NASDAQ’s reported margins on its market data business reflect an accounting allocation of common costs between the trading and the market data businesses that were adopted for a variety of internal business reasons. These accounting returns provide no indication about the extent of competition in the market data business.⁶¹

56. The costs incurred by the platforms include directly “allocable costs” as well as costs that are jointly incurred on behalf of subsets or all the relevant products and services.⁶² For accounting purposes, joint costs may be allocated across business lines for particular business reasons (such as a need to have a particular business unit be responsible for managing a particular cost center). However, from an economic standpoint, no one such

60. It is widely accepted that there is no meaningful way to allocate “common costs” across different joint products. For this reason, “cost-based” regulation of the price of market data would require inherently arbitrary cost allocations.

61. See Franklin M. Fisher and John J. McGowan, “On the Misuse of Accounting Rates of Return to Infer Monopoly Profits,” *American Economic Review*, 1983.

62. A classic example of joint products with joint costs is “beef and hides.” A farmer who raises cattle and sells beef and hides incurs joint costs – such as the cost of cattle feed – that cannot be unambiguously allocated to either beef or hides. Thus, there is no economically meaningful way to calculate the “margin” that a farmer earns on beef as compared to the margin the farmer earns on hides. Competition among farmers will constrain the margin a farmer earns on cattle, which reflects revenue from sales of both beef and hides and the total costs of raising cattle. Beef and hides then contribute to the recovery of joint and common costs in proportion to each product’s markup of the realized price over product-specific marginal cost multiplied by the volume of sales. Note, however, that this is an *ex post* calculation that can only be made once sales volumes and product prices are known.

allocation methodology is preferred to another and all have problems for the overall efficiency of a firm's operations, business decisions, and potential long-term viability.

57. Even if one product in a high-fixed cost industry could be regarded as simply a by-product of another activity, that would not mean that its price should be forced to zero. Instead, insofar as there is demand for that product at a positive price, the price for that product should reflect that demand. A positive price will tend to reduce the burden of cost recovery on the other product and reduce its price with beneficial effects on the volume of activity. Thus, even if information could be "produced" at zero marginal cost, which it is not, economic principles mandate that it nevertheless ought to be priced to the willing buyers at a price higher than the associated marginal cost.⁶³

58. The total return that a trading platform earns reflects the total revenues it receives from all of the products it sells, including sales of the joint products, and the total costs it incurs, including joint costs. Competition among trading platforms predictably constrains the aggregate return each platform earns from its sale of joint and other products, although different platforms may choose different strategies of pricing and cost recovery.

59. As already discussed, competition among trading platforms is intense, and can be expected to constrain the aggregate return each platform earns from its sale of joint products. From the standpoint of overall efficiency and the economic health of the financial market system(s), what matters is that the long-run, risk-corrected rates of return on operating the platforms are constrained to competitive levels and that the efficient functioning of the financial markets is not impeded by barriers to trading and information acquisition and dissemination.⁶⁴ SIFMA has not provided any evidence that NASDAQ earns a supra-

63. In certain circumstances (e.g., when a firm produces complementary products), deviations from this prescription can be warranted.

64. For a discussion of efficiency in financial markets, see Larry Harris, *Trading and Exchanges: Market Microstructure for Practitioners*, 2002.

competitive return on its platform businesses (i.e., including trading services and market data) or that entry into operation of trading venues, including dark pools, is protected by entry barriers.

C. SIFMA's Position Implies that Cost-Based Regulation Should be Used to Regulate the Price of Depth-of-Book Data Products

60. SIFMA has stated that "it has never been our position that the Exchange Act requires strict, cost-of-service ratemaking."⁶⁵ Nevertheless, SIFMA appears to be claiming that competition does not sufficiently constrain the price of depth-of-book data.

61. Because SIFMA takes the position that depth-of-book pricing is not constrained by competition, presumably SIFMA believes that such prices need to be constrained by some form of regulation or regulatory oversight. Furthermore, SIFMA's demand for cost information suggests that it believes that appropriate prices must be tied in some way to costs. Although SIFMA claims not to be advocating "strict, cost-of-service ratemaking," its proposal provides no guidance to a decision-maker regarding the mechanism for setting prices for depth-of-book data. It is widely accepted that cost-based regulation can create significant inefficiencies and distortions. At least in part for this reason, such regulation has been widely abandoned or replaced with other forms of regulation in a variety of industries (e.g., telecommunications).

VIII. SUMMARY OF CONCLUSIONS

62. The prices of NASDAQ's depth-of-book products are constrained by two types of significant competitive forces (1) competition from alternative depth-of-book products, as well as the option to simply decline to purchase NASDAQ's depth-of-book products; and (2) competition for order flow from other trading platforms, including the threat that customers will divert order flow to other trading platforms.

63. I find no basis for any concern that the terms under which NASDAQ offers depth-of-book products harm market participants. Depth-of-book data products are widely available. The terms under which NASDAQ offers its depth-of-book products do not "unreasonably

65. SIFMA Letter at 6.

discriminate” against retail investors or any other group of market participants. A regulatory intervention in a market where competition is effective is likely to lead to a variety of unintended, harmful effects.

64. In general, in markets whose participants have substantial fixed costs and low marginal costs, competition cannot and does not result in prices equal to any measure of marginal costs because such an outcome would result in a firm with those characteristics failing to earn a normal return on its investment. Furthermore, for a firm that produces “joint products” and incurs “joint costs,” it is not possible to meaningfully calculate a rate of return on an individual product because doing so requires an arbitrary allocation of the joint costs across the array of joint products. Accordingly, for such a firm, it is improper and arbitrary to define a competitive pricing level by comparing prices to marginal or incremental costs.

A handwritten signature in black ink, appearing to read 'J. Ordover'.

Janusz A. Ordover

Attachment 1

Description of NASDAQ Pricing of Depth-of-Book Products

1. The price of purchasing NASDAQ depth-of-book information depends on a variety of factors. For example, the “usage fee” for Level 2 information differs for “Professional/Corporate” and “Non-Professional” subscribers. In particular, the current usage fee for Level 2 information is \$50 per month per Professional/Corporate subscriber and \$9 per month per Non-Professional subscriber. The usage fee for OpenView information for Level 2 customers is \$6 per month per Professional/Corporate subscriber (i.e., a subscriber that purchases Level 2 and OpenView pays \$56 = \$50 + \$6 per month per Professional/Corporate subscriber) and \$1 per month per Non-Professional subscriber.¹ NASDAQ also offers “enterprise licenses” that allow a customer that meets specified criteria to choose between paying a fixed monthly fee plus a reduced rate per subscriber,² or a fixed fee for an unlimited number of subscribers. Both types of license can be used to reduce the cost of depth-of-book data.

2. In addition, “direct access” customers (i.e., customers that receive a direct data feed from NASDAQ) can choose to pay for “non-display” subscribers (e.g., computers that receive depth-of-book information directly from NASDAQ). NASDAQ direct access customers pay a “tiered” monthly fee that depends on the number of subscribers (e.g., \$3,300 per month for 11 to 29 subscribers).

3. In addition to usage fees, NASDAQ also charges “distributor” fees for Level 2 and OpenView information. For example, a firm that purchases Level 2 information for

1. A customer can pay one usage fee for a subscriber taking Level 2 and OpenView data (i.e., \$56 per month). I understand that a customer may instead pay two usage fees (i.e., \$50 for Level 2 and \$6 for OpenView) for the same subscriber.

2. For example, a TotalView / OpenView enterprise license in 2015 for Professional/Corporate subscribers was priced at \$100,000 per month plus applicable Level 2 subscriber fees (i.e., a holder of an enterprise license paid the monthly Level 2 fee instead of the higher TotalView / OpenView fee per subscriber).

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NASDAQ-listed stocks pays a fee of \$1,000 per month for internal distribution or \$2,500 per month for external distribution (e.g., distribution of Level 2 information to its clients). A direct access customer also pays a monthly fee (e.g., \$2,000 for NASDAQ-listed stocks). See Table 1 for a reproduction of NASDAQ’s current price list for Level 2 products (with or without OpenView information).

4. Customers can also choose options that allow them to distribute the NASDAQ data feed widely through their own customized applications (Managed Data Solution; Enhanced Display Solution).

Table 1

Nasdaq Level 2		
Entitlement Name	Security Coverage	Monthly Fee
<u>Usage Fees</u>		
Nasdaq Level 2 with Nasdaq OpenView	Nasdaq Issues	Professional/Corporate: \$50 per subscriber Non-Professional: \$9 per subscriber
	NYSE and NYSE MKT Issues	Professional/Corporate: \$6 per subscriber Non-Professional: \$1 per subscriber
Enhanced Display Solution	Nasdaq Issues	Professional/Corporate: \$74 per subscriber Non-Professional: \$14 per subscriber
	NYSE and NYSE MKT Issues	Professional/Corporate: \$6 per subscriber Non-Professional: \$1 per subscriber
<u>Nasdaq Depth Non-Display (Direct Access Only)</u>	Nasdaq, NYSE and NYSE MKT Issues	1 to 10 subscribers = \$300 per subscriber 11 to 29 subscribers = \$3,300 30 to 49 subscribers = \$9,000 50 to 99 subscribers = \$15,000 100 to 249 subscribers = \$30,000 250 subscribers or more = \$75,000
<u>Nasdaq Depth Non-Display Platform</u>	Nasdaq, NYSE and NYSE MKT Issues	\$5,000 per Trading Platform (up to a maximum charge of \$15,000)
Managed Data Solution (Internal Use Only)	Nasdaq, NYSE and NYSE MKT Issues	Professional/Corporate: \$300 per subscriber Non-Professional: \$60 per subscriber
<u>Depth Distributor Fees</u>		
Nasdaq Depth Fee for NQDS	Nasdaq Issues	Internal Distribution: \$1,000 per firm External Distribution: \$2,500 per firm Direct Access: \$2,000 per firm
Nasdaq Depth Fee for OpenView	NYSE and NYSE MKT Issues	Internal Distribution: \$500 per firm External Distribution: \$1,250 per firm Direct Access: \$1,000 per firm
<u>Enhanced Display Solution</u>	Nasdaq, NYSE and NYSE MKT Issues	1 to 399 Subscribers = \$4,000 400 to 999 Subscribers = \$7,500 1,000 or more Subscribers = \$15,000 plus applicable EDS Level 2 and OpenView subscriber fees

Source: <http://www.nasdaqtrader.com/Trader.aspx?id=DPUSData>.

5. The pricing of NASDAQ’s TotalView product has a similar structure – for example, TotalView customers also pay usage fees that depend on Professional/Corporate vs. Non-Corporate status and distributor fees that depend on internal vs. external distribution. I understand that the specific NASDAQ rule change at issue in this proceeding is the introduction

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of distributor fees on NASDAQ's Level 2 product in 2010. That is, prior to that rule change, NASDAQ charged only usage fees for its Level 2 product, while it charged usage and distributor fees for its TotalView product.

Attachment D

Complements, Competition, and Exchange Proprietary Data Products

Professor Marc Rysman, Ph.D.

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1. QUALIFICATIONS AND ASSIGNMENT

1. My name is Marc Rysman and I am a Professor of Economics at Boston University, where I teach courses on industrial organization, econometrics, antitrust, and regulation. I received my Ph.D. in Economics from the University of Wisconsin at Madison in 1999. My research focuses on industrial organization and competition, and the related issues of antitrust and regulation. I have investigated a variety of industries, including credit ratings agencies, telecommunication, Yellow Pages directories, payment cards, and consumer electronics.

2. From 2009 to 2019, I was a Visiting Scholar at the Federal Reserve Bank of Boston. I have been a Visiting Associate Professor at MIT (2007–2008), a Visiting Scholar at Harvard University (2003–2004, 2014–2015), a Visiting Fellow at Northwestern University (2003), and a Visiting Scholar at the Federal Reserve Bank of Minneapolis (2003).

3. I have won numerous teaching and research awards, including the Neu Family Award for Teaching Excellence in Economics (2006 and 2012), Networks, Electronic Commerce and Telecommunications (NET) Institute Grants (2003, 2005, and 2009), National Science Foundation Grants (2001, 2004, 2006, and 2009), and the Christensen Award in Empirical Economics (1997, with Philip A. Haile, now of Yale University).

4. I have published numerous articles in top peer-reviewed journals in the field of Economics, including in the *American Economic Review*, *Journal of Industrial Economics*, *International Journal of Industrial Organization*, *RAND Journal of Economics*, *Journal of Political Economy*, *Review of Economic Studies*, and the *Journal of Economic Perspectives*. I was an Editor of the *RAND Journal of Economics* during 2014–2020.

5. I was previously asked by the New York Stock Exchange Group (“NYSE Group”) to analyze how platform economics applies to stock exchanges’ sale of market data products and trading services.¹ I performed an empirical analysis of available data in response to that request, and based on that analysis I concluded, among other things, that stock exchanges are classic examples of platform companies, that there are strong linkages between market data and trading, that the platform nature of stock exchanges means that market data fees cannot be analyzed in isolation without accounting for the competitive dynamics associated with trading services, that competition among equity exchanges is properly understood as being among platforms, and that such platform competition can discipline stock exchanges’ overall pricing and profitability.

6. I had undertaken that analysis with a view towards a rule filing with the SEC by NYSE National in support of its establishment of fees for its NYSE National Integrated Feed. In

¹ Rysman, Marc. 2019. “Exchanges as Platforms for Data and Trading.” Mimeo (“Rysman Platforms Paper”).

response to that filing I understand that Prof. Lawrence Glosten has authored a paper, commissioned by SIFMA, suggesting that platform economics do not discipline the pricing of stock exchange market data products and that such products instead should be viewed as complements allowing for “supra-monopoly” pricing.² I have been asked by NYSE Group to submit this response to his paper, which explains the economics of complements as they apply to exchange proprietary data products and points to ways in which Prof. Glosten’s reasoning is unsupported and incorrect. I have also been asked to comment on certain aspects of the SEC’s request for additional information regarding NYSE National’s proposed rule change.³

7. NYSE Group provided financial support for this research. I was assisted in my analysis by staff of Cornerstone Research, who worked under my direction.

² Glosten, Lawrence R. “Economics of the Stock Exchange Business: Proprietary Market Data.” Mimeo, January 2020 (“Glosten Report”). The Glosten Report was attached to the Letter from Robert Toomey, SIFMA to Vanessa Countryman, U.S. Securities and Exchange Commission, “File No. 4-729: SIFMA Comment Letter on Market Data,” January 13, 2020.

³ Request for Information and Additional Comment on a Proposed Rule Change to Establish Fees for the NYSE National Integrated Feed, Release No. 34-89065; File No. SR-NYSENAT-2020-05, U.S. Securities and Exchange Commission, June 12, 2020 (“SEC Request for Information”).

2. EXECUTIVE SUMMARY

8. In recent months, it has been suggested that exchange proprietary data products are complements and that this inexorably leads to “supra-competitive” or “supra-monopoly” pricing.⁴ This argument is supported by reference to a classic result obtained by French economist Auguste Cournot in the 19th century that monopolist producers of complementary products will set prices for their products above the level that a single joint monopolist would set.⁵

9. This argument is most developed in the Glostén Report, which sets out three conclusions: (a) that exchange proprietary data products are complements; (b) that this complementarity leads to supracompetitive pricing of exchange proprietary data products; and (c) that this complementarity impedes competition for order flow from generating competitive discipline on exchanges’ overall platforms, which include data sales.

10. As I show in this paper, the argument that exchange proprietary data products are complements has not been established and is based on incomplete economic logic that contradicts the available empirical evidence. In particular, the Glostén Report fails to define what a complement is and provides no arguments or evidence that convincingly establish that exchange proprietary data products are complements. In Section 3.1, I explain how one would properly define and test for complementarity; in Section 3.2, I explain why the observation that many firms buy proprietary data from all exchanges is not sufficient to show that these products are complements; and in Section 3.3, I present statistics on data purchases by firms trading on NYSE that show that most firms do not buy data from all exchanges.

11. In Section 4.1, I present a simple example of trading firms’ financial incentives to purchase exchange proprietary data where these products are substitutes, *not* complements.

⁴ Glostén Report, pp. 3, 17. This view was also popularized in a blog post by Prof. Craig Pirrong of the University of Houston. Pirrong, Craig. “The Simple (and Very Old) Economics of the Stock Market Data Pricing Controversy.” Streetwise Professor, September 20, 2019, <https://streetwiseprofessor.com/the-simple-and-very-old-economics-of-the-stock-market-data-pricing-controversy/>. The argument was foreshadowed in a 2019 amicus brief submitted by SIFMA that argued that “[t]he most active market participants simply cannot trade competitively, manage the risk of their positions, or effectively satisfy their regulatory obligations to secure the best trades for their clients without purchasing proprietary data from all, or virtually all, of the exchanges. This allows exchanges to reap excessive profits from market data.” Brief of Amicus Curiae Investors Exchange LLC in Support of Respondent and Intervenor for Respondent, USCA Case #18-1292 (D.C. Cir.), filed May 13, 2019. The idea also appears in a report filed by Dr. David Evans in his role as expert witness for SIFMA in the litigation that led to the SIFMA circuit court amicus filing, where he asserted that “NASDAQ and NYSE Arca depth-of-book data are complements in the sense that both sources of depth-of-book data are more valuable together” and “[p]roducers could sell more collectively if they lowered their prices because each of their products would become more valuable if the prices of complementary products were also lower.” Expert Report of Dr. David Evans, *In the Matter of the Application of Securities Industry and Financial Markets Association for Review of Actions Taken by Self-Regulatory Organizations*, Administrative Proceeding File No. 3-15350, March 6, 2015, ¶ 29 and fn 19.

⁵ Cournot, Antoine Augustin. 1897. *Researches into the Mathematical Principles of the Theory of Wealth*. London: Macmillan, & Co., pp. 99–116.

That is, the value of data from NYSE (for instance) is greater if the purchaser does not already have data from NASDAQ than if it does (i.e., there are decreasing marginal returns to purchases of data from different exchanges). As I explain in Section 4.2, this insight is strengthened by the fact that the information conveyed by exchange proprietary data, particularly depth-of-book data of the type included in the NYSE National Integrated Feed, is likely to be correlated across exchanges. In Section 4.3, I adapt the example slightly to consider the specific economics of arbitrage trading across exchanges. Even in cross-exchange arbitrage trading, data from a third exchange is not a complement to data from the first two.

12. In Section 5, I clarify technical terminology that appears in the Glosten Report. First, Prof. Glosten’s use of the term “monopolistic competition” is puzzling – monopolistic competition implies free entry of firms and zero profits to producers. It is true that there has been a recent increase in the number of lit and unlit trading centers, and a decrease in concentration among exchanges. However, Prof. Glosten’s discussion of exchanges’ pricing of proprietary data products emphasizes strategic pricing incentives and not free entry, and thus seems as odds with concept of monopolistic competition.

13. Second, Prof. Glosten’s assertion that “platform competition” is not a helpful framework for understanding the pricing of exchange proprietary data products is unsupported. Contrary to Prof. Glosten’s depiction, the fact that data purchases are made on a monthly or longer basis while order routing decisions are made at high frequencies does not rule out important links between the two. In previous research (which Prof. Glosten does not engage with), I have provided both conceptual and empirical evidence that the linkages are relevant.⁶ Moreover, his argument that the linkage is broken because firms require data from all exchanges is contradicted by statistics on purchases of proprietary data products that I report in Section 3.3.

14. Section 6 takes on two separate questions that arose in the context of the SEC Request for Information. First, I explain that the conclusion that all “sides” of a platform must be analyzed jointly in order to evaluate pricing and competition does not depend on the size of a particular platform. In any case, NYSE Group’s share of U.S. equities trading is below thresholds considered indicative of substantial market power. Second, I note that economists are generally wary of using accounting measures of profitability, such as those requested by the SEC, to evaluate competition.

⁶ Rysman Platforms Paper.

3. COMPLEMENTS, COMPETITION, AND PURCHASES OF PROPRIETARY DATA PRODUCTS

15. In this section, I set the stage by providing a rigorous and testable definition of complementarity (Section 3.1), I explain why observing that many firms purchase all available data products would not imply that they are complements (Section 3.2), and I show empirically that most firms do not purchase all available data products from all exchanges (Section 3.3).

3.1. What are complements and how would one test for complementarity?

16. A standard definition of complements is “two goods for which an increase in the price of one leads to a decrease in demand for the other.”⁷ Consider the effects of a price decrease for one good in the presence of complements. A standard result is that consumers would buy more of that good.⁸ This price decrease would also increase demand for the complementary good; this means that consumers would be willing to pay more for it and would be willing to buy more of it at the same price.

17. Textbook examples of complements include computers and software and ice cream and fudge sauce, goods that are typically used together and where one enhances the value of the other.⁹ Some complements are only ever used together, like right and left shoes; these are known as “perfect complements.”¹⁰

18. Goods for which the relationship is reversed, so that an increase in the price of one leads to an *increase* in the demand for the other, are substitutes. Classic examples of substitutes are goods that satisfy similar needs, like ice cream and frozen yogurt or sweaters and sweatshirts.¹¹ While such substitute products can be used in place of each other, consumers often purchase several of them – most people own both sweaters and sweatshirts.

19. The notion of complements can be applied to exchange proprietary data products. Data from different exchanges, for instance, would be complements *if* an increase in the price of one led to a *decrease* in the demand for the other (and vice-versa). Prof. Glosten does not engage with this notion – he has not empirically tested, or even directly argued, that this

⁷ Mankiw, N. Gregory. 2012. *Principles of Macroeconomics*. Mason: Cengage Learning, p. 70.

⁸ The “law of demand” states that demand curves are downward sloping, so that a decrease in price leads to a higher quantity being demanded. See, Mankiw, N. Gregory. 2012. *Principles of Macroeconomics*. Mason: Cengage Learning, p. 67.

⁹ Mankiw, N. Gregory. 2012. *Principles of Macroeconomics*. Mason: Cengage Learning, p. 70.

¹⁰ Besanko, A. David and Ronald R. Braeutigam. 2011. *Microeconomics*. John Wiley & Sons Inc., p. 93.

¹¹ Mankiw, N. Gregory. 2012. *Principles of Macroeconomics*. Mason: Cengage Learning, p. 70.

definition of complements actually applies to any specific exchange data products.¹² For example, he does not test whether an increase in the price of any specific exchange proprietary data product has led to a decrease in the demand for another exchange's proprietary data product.

20. A closely related definition of complementarity is that two goods are considered complements if the incremental value of consuming one good is greater when the other good is being consumed than when it is not.¹³ In other words, the benefit of consuming both goods together is greater than the sum of the benefits of consuming each separately. Thus, the question of whether exchange proprietary data products are complements can be boiled down to whether the purchase of one exchange proprietary data product would generate more incremental profits to *the purchaser* if it already subscribed to another proprietary data feed than if it did not.¹⁴ That is, if proprietary data products from different exchanges were complements, NYSE's proprietary data would be worth more to its buyer (whether the buyer is a trading firm, a broker, an alternative trading system ("ATS") or dark pool operator, or a redistributor) when the buyer also purchases NASDAQ proprietary data than when it does not.

21. In Section 1 of his submission, Prof. Glosten provides several examples of how purchasers of exchange proprietary data use that data, and argues that subscribing to proprietary data from more or all exchanges can increase profits. However, most products, including substitutes, provide increasing value as consumers accumulate more of them.¹⁵ That does not establish that products are complements. To be a complement, adding a data product must provide *more value* than the previous products. Prof. Glosten's arguments do not make this case or engage with this concept. In Section 4, I develop a simple example in

¹² Prof. Glosten's claim that "NYSE data become more useful when combined with NASDAQ data and vice versa" relies on the definition of complements, but he does not test whether any specific products are in fact complements and he does not explain why this should be the case in any detail. In Section 4, I provide an example in which this is *not* the case. See, Glosten Report, p. 2.

¹³ For a discussion of the relationship between the two definitions, see Samuelson, Paul A. 1974. "Complementarity: An Essay on the 40th Anniversary of the Hicks-Allen Revolution in Demand Theory." *Journal of Economic Literature*, 12(4): 1255-1289. Samuelson refers to the definition of complementarity in terms of marginal returns as the "Edgeworth-Pareto" definition. Samuelson shows that the definitions can differ if there are important income effects or risk aversion, but those are typically unimportant when the consumers are large firms (which is sometimes, but not always, the case for proprietary market data subscriptions). A well-known paper on complements that uses the Edgeworth-Pareto definition of complements is Gentzkow, Matthew. 2007. "Valuing New Goods in a Model with Complementarity: Online Newspapers." *American Economic Review*, 97(3): 713-744.

¹⁴ In this sense, proprietary market data purchasers' demand functions can be derived from their profit functions, where data products are inputs to their production functions. In this context, inputs are complements if the mixed partial derivative of the production function is positive: if the marginal product of a unit of good A is greater the greater the number of units of good B being used, then inputs A and B are considered complements. See, Milgrom, Paul and Chris Shannon. 1994. "Monotone Comparative Statics." *Econometrica*, 62(1): 157-180, p. 172.

¹⁵ For example, automobiles are substitutes, but most consumers would experience an increase in utility if they had another automobile. The additional utility from going from two to three cars is less than going from zero to one or from one to two, but still positive. That is, automobiles provide decreasing returns.

which it is in fact *not* the case. In my example, additional data from different exchanges generate decreasing marginal returns rather than increasing marginal returns, so that exchange proprietary data products are not complements.

3.2. Competition, not complementarity, drives some firms to purchase multiple proprietary data products

22. Products that are purchased together are not necessarily complements. One of Prof. Glosten’s arguments that exchange proprietary data products are complements is that “[i]t is very likely that there are many exchange member firms and others that obtain proprietary data from all exchanges.”¹⁶ As an initial matter, Prof. Glosten provides no empirical evidence for his statement. But even if true, this would not establish that exchange proprietary data products are complements. It may simply be that the value of proprietary data to those who choose to buy it is high relative to its price. Similarly, it may be a consequence of competition among proprietary data purchasers pushing them to deliver higher quality. Moreover, as I document in Section 3.3, Prof. Glosten’s premise is not true empirically – most large trading firms do not purchase proprietary data from all, or even most, exchanges.

23. Some market participants have argued that they must purchase the most sophisticated and complete data feeds from all exchanges in order to be competitive. For example, Doug Cifu, co-founder and chief executive officer of Virtu Financial, has stated that “[w]ithout proprietary data feeds, there's not a firm today, either as a market maker or an institutional agency broker or prop trading firm that can exist. It's just that simple.”¹⁷ Prof. Glosten also highlights remarks by Mehmet Kinak, Vice President and Global Head of Systematic Trading and Market Structure at T. Rowe Price, that “[i]f 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.”¹⁸

24. An observation that some buyers purchase all available products, even if true, does not imply that those products are complements. As an example, blueberries and strawberries are substitutes – they satisfy similar desires, and an increase in the price of strawberries would

¹⁶ Glosten Report, p. 3.

¹⁷ “Roundtable on Market Data Products, Market Access Services, and Their Associated Fees,” U.S. Securities and Exchange Commission, October 25, 2018, p. 58. Similarly, Simon Emrich, head of market structure strategies at Norges Bank Investment Management, asserted that “brokers can't really be competitive for our sort of trading just using the SIP. They need to have the full depth of book. We depend on them to slice up our orders and trade them over time. We need them to have a full view of the market, not just the top of the book.” See, “Roundtable on Market Data Products, Market Access Services, and Their Associated Fees,” U.S. Securities and Exchange Commission, October 25, 2018, p. 136.

¹⁸ Glosten Report, p. 4. The full quote is “as far as brokers having a choice of whether or not they can use the SIP or direct feeds, that doesn't exist. There is no choice there. If a broker is routing using SIP data, they are not routing my flow.” See, “Roundtable on Market Data Products, Market Access Services, and Their Associated Fees,” U.S. Securities and Exchange Commission, October 25, 2018, p. 65.

reasonably be expected to lead to a decrease in the demand for strawberries and a related increase in the demand for blueberries, both by consumers and the restaurants that serve them. In a market with a single restaurant, the restaurant might offer a parfait with either strawberries or blueberries, whichever happened to have the lowest cost at that moment. However, in a market with several restaurants, they may offer parfaits with both strawberries and blueberries because, although they would have a higher cost, they might be preferred by many patrons and help the restaurant attract clients. In this case, it is competition that drives restaurants to offer both options, but they are still substitutes, not complements, as a higher price of one leads to overall higher demand for the other.

25. Purchasers of proprietary data products are subject to a similar dynamic. For example, large brokerage houses compete to offer their clients high quality execution services. In a world with a single broker, it may minimize its costs and maximize its profits by subscribing only to the SIP, or choose to supplement this with proprietary data products from one or two of the most prominent exchanges. But competition among brokers can drive them to offer higher quality execution services and, to this end, to purchase proprietary data from more exchanges than they might otherwise have chosen to subscribe to, even though those data products deliver decreasing marginal returns in creating trading opportunities (i.e., each additional data product enables the broker to improve execution by a decreasing amount).

26. Similarly, proprietary traders compete to identify and take advantage of profitable trading opportunities. In a world with a single proprietary trading firm, the firm might choose to maximize its profits by focusing on the most easily identifiable and highest return trading strategies, which might require only limited proprietary data from exchanges. But in a world with intense competition among proprietary traders, they may be driven to invest in gaining an edge over their peers, possibly by purchasing more of the data products offered by exchanges.¹⁹

27. In Cournot's model of complements, the buyer must purchase all available complements in order to derive any benefit, a property which derives from the ways in which the complements can be used. Cournot motivates his presentation with the example of copper and zinc, which he assumes can be used only to produce brass.²⁰ In that restricted setting, the observation that brass producers purchase both copper and zinc to make brass springs directly from the complementarity of these inputs.

28. But this "perfect complements" setup does not apply to the case of exchange proprietary data products. As I show in Section 3.3, these sources of data can be and are used separately

¹⁹ I provide further discussion regarding this in Section 4.3.

²⁰ Cournot, Antoine Augustin. 1897. *Researches into the Mathematical Principles of the Theory of Wealth*. London: Macmillan & Co., pp. 99–100.

(i.e., most firms subscribe to some but not all proprietary data products). Any argument that exchange proprietary data products are complements must therefore explain how and why this complementarity arises, and provide empirical support for it. Additional explanation would also be required to show that the “Cournot complements” result would hold in such a setting, which would differ from the traditional setup in important ways. Market outcomes in situations that depart from Cournot’s model of monopolist suppliers of complements can be complex and vary according to the particulars of demand for the products, the nature of product differentiation, and market structure.²¹

3.3. Most firms do not purchase data from all exchanges

29. The premise that most large trading firms purchase proprietary data from all (or even most) exchanges is simply not accurate. Empirically, most firms do not purchase all proprietary data products from one exchange or from all exchanges. I explore this question with data available to me on the proprietary data purchases of firms that traded on NYSE. This is a small group of large trading firms. I limit my attention to four NYSE Group exchanges: NYSE, NYSE Arca, NYSE National, and NYSE American.²² I also limit attention to three prominent proprietary data products: BBO, depth-of-book, and integrated feeds. The tables below present information for December 2018 and June 2020.

30. Table 1 looks at firms’ purchases of proprietary data across NYSE Group exchanges. In this table, I count the purchase of any of the proprietary data products I focus on as a purchase of proprietary data by the account in question. For example, if a firm purchased BBO data from NYSE Arca and American, and NYSE IF from NYSE, it would count as a firm that purchased proprietary data from all three of these exchanges. I find that only 26.2% (in December 2018) and 33.0% (in June 2020) of firms purchased proprietary data from all four NYSE Group exchanges. Notably, of the firms analyzed, 14.6% of them in December 2018 and 12.8% of them in June 2020 did not purchase any of these proprietary data products from any of the four NYSE Group exchanges. In both December 2018 and June 2020, only about a third of firms purchased at least one of these proprietary data products from each of Arca, NYSE, and American.

²¹ For examples of research generalizing Cournot’s result to specific sets of circumstances, see, Economides, Nicholas, and Steven C. Salop. 1992. “Competition and Integration among Complements, and Network Market Structure.” *The Journal of Industrial Economics* 40(1): 105–123; Quint, Daniel. 2014. “Imperfect Competition with Complements and Substitutes.” *Journal of Economic Theory* 152: 266–290.

²² The data does not cover the NYSE Chicago exchange.

TABLE 1
Data Product Purchases Across Exchanges by Firms That Traded on NYSE in December 2018 or June 2020

Subscriptions	Proportion of Firms	
	December 2018	June 2020
Arca Only	3.9%	3.2%
NYSE Only	2.9%	4.3%
American Only	0.0%	0.0%
National Only	0.0%	0.0%
Arca and NYSE	11.7%	7.4%
Arca, NYSE, and American	35.0%	33.0%
Arca, NYSE, American, and National	26.2%	33.0%
Arca, NYSE, and National	1.9%	2.1%
Arca, American, and National	0.0%	0.0%
Arca and American	1.9%	1.1%
Arca and National	0.0%	1.1%
NYSE and American	1.9%	2.1%
NYSE and National	0.0%	0.0%
NYSE, American, and National	0.0%	0.0%
American and National	0.0%	0.0%
No NYSE Group Data Purchases	14.6%	12.8%

Source: NYSE

Note: Proportion of firms that subscribed to data products from each combination of exchanges is calculated as the number of firms that traded on NYSE and subscribed to either a depth-of-book, integrated feed, or BBO product from each of the exchanges in that unique combination of exchanges in December 2018 or June 2020 divided by the total number of firms that had traded on NYSE in December 2018 or June 2020, respectively.

31. Next, I look at purchases of integrated feed products across exchanges. More than half of the firms that traded on NYSE (59.6%) did not subscribe to any of the four NYSE Group exchanges' integrated feed products in June 2020. In December 2018, 66.0% of firms that traded on NYSE did not subscribe to any of the four NYSE Group exchanges' integrated feed products. Less than a fifth of firms (14.6% in December 2018 and 19.1% in June 2020) subscribed to integrated feed data from all four NYSE Group exchanges. Notably, most of the firms that subscribed to an integrated feed product in June 2020 subscribed to NYSE National Integrated Feed (81.7% of firms subscribing to an integrated feed product), which was offered free of charge.²³

²³ On February 3, 2020, NYSE National, Inc. filed with the SEC a proposed rule change to establish fees for the NYSE National Integrated Feed. The proposed rule change became effective on the day of filing but was temporarily suspended by the SEC on April 1, 2020. See, "Notice of Filing and Immediate Effectiveness of Proposed Rule Change to Establish Fees for the NYSE National Integrated Feed," Release No. 34-88211; File No. SR-NYSENAT-2020-05, U.S. Securities and Exchange Commission, February 14, 2020; "Suspension of and Order Instituting Proceedings To Determine Whether To Approve or Disapprove a Proposed Rule Change To Establish Fees for the NYSE National

TABLE 2
Integrated Feed Purchases Across Exchanges by Firms That Traded on NYSE in December 2018 or June 2020

Integrated Feed Subscriptions	Proportion of Firms	
	December 2018	June 2020
Arca Only	1.0%	3.2%
NYSE Only	0.0%	0.0%
American Only	1.9%	1.1%
National Only	2.9%	4.3%
Arca and NYSE	1.0%	1.1%
Arca, NYSE, and American	2.9%	2.1%
Arca, NYSE, American, and National	14.6%	19.1%
Arca, NYSE, and National	3.9%	4.3%
Arca, American, and National	1.9%	1.1%
Arca and American	0.0%	0.0%
Arca and National	2.9%	2.1%
NYSE and American	0.0%	0.0%
NYSE and National	0.0%	0.0%
NYSE, American, and National	0.0%	0.0%
American and National	1.0%	2.1%
No NYSE Group Integrated Feed Purchases	66.0%	59.6%

Source: NYSE

Note: Proportion of firms that subscribed to an integrated feed product from each combination of exchanges is calculated as the number of firms that traded on NYSE and subscribed to an integrated feed product from each of the exchanges in that unique combination of exchanges in December 2018 or June 2020 divided by the total number of firms that traded on NYSE in December 2018 or June 2020, respectively.

32. Although this analysis is limited to four NYSE Group Exchanges, I see no reason why my conclusions would not extend to other exchanges. The data is clear: most firms, even the select set of large firms trading on NYSE, did not purchase all proprietary data products from all exchanges.

33. Although the statistics I present are for firms that trade on NYSE, it appears the same is true for another class of data purchasers: ATS. Prof. Glosten references his own research that finds substantial heterogeneity in how many data products different ATS subscribe to, with about a third relying only on the SIP, some using proprietary data from some but not all exchanges, and others purchasing proprietary data from all exchanges.²⁴

34. Information provided by NYSE Group in response to the SEC’s Request for Information further confirms that firms need not purchase all proprietary data from all exchanges. I

Integrated Feed,” Release No. 34–88538; File No. SR– NYSENAT–2020–05, U.S. Securities and Exchange Commission, April 7, 2020.

²⁴ Glosten Report, fn 13.

understand that eight firms that subscribed to NYSE National Integrated Feed threatened to cancel their subscriptions once fees were announced, and six of these firms followed through and cancelled their subscriptions. One of the firms that cancelled its subscription to NYSE National Integrated Feed is a large global bank, the sort of large broker-dealer that Prof. Glosten portrays as requiring all exchange proprietary data. This is consistent with exchange proprietary data being substitutes and inconsistent with Prof. Glosten's depiction of a market where all firms must purchase all proprietary data.

4. SIMPLE EXAMPLES OF THE USES OF EXCHANGE PROPRIETARY DATA SUGGEST THAT THEY ARE SUBSTITUTES, NOT COMPLEMENTS

35. An assessment of the motivations that purchasers of exchange proprietary data have for acquiring these data suggests that exchange proprietary data products are substitutes, not complements. To make this point, I develop simple examples of the impact that purchasing proprietary data products can have on traders' profits. As I explain in Section 3, proprietary data products are complements if the demand for one is greater when the trader has purchased the other than when it has not. In the case of trading firms, the demand for data products is driven by the additional profits that they would generate. As I will show in a simple and intuitive example, purchasing proprietary data products from several exchanges has decreasing marginal returns, not increasing marginal returns for the trading firms that purchase the data. The incremental profits of purchasing additional proprietary data products are lower when the trader has already purchased other proprietary data, suggesting that exchanges' proprietary data products are not complements.

36. To focus the discussion and keep my examples as simple as possible, my examples will illustrate the use and properties of exchange proprietary depth-of-book data products. Throughout, I assume that traders have access to the consolidated data feed or SIP, so that they have full information about top-of-book prices and quantities available.²⁵ For simplicity, I also restrict the trader in my example to using market orders.²⁶

37. The examples I present use the simplest framework possible to capture the features that I consider most important for understanding whether exchange proprietary data products are complements in some of the most common applications.²⁷ I am not attempting to show that proprietary data feeds can never be complements for specific customers pursuing particular business models. A more general point is that understanding whether exchange

²⁵ Consolidated feed data are assembled by the SIPs, which aggregate data from all exchanges to provide (1) last sale reports, including the price and amount of the latest sale of a security and the exchange where it took place; and (2) best bid and best offer (also known as *top of book*) price quote information across all exchanges. The best bid and offer information reported by the SIPs is limited to "round lots," which for most stocks means orders for blocks with multiples of 100 shares; the consolidated feeds do not report "odd lot" quotes of less than 100 shares. SIP data services collect the required data from each stock exchange and distribute it to subscribers for a fee. By regulation, exchanges must supply the necessary data to the SIP no later than they distribute the data to their proprietary data customers. See, "Self-Regulatory Organizations; NYSE Arca, Inc.; Order Setting Aside Action by Delegated Authority and Approving Proposed Rule Change Relating to NYSE Arca Data," Securities Act Release No. 34-59039, December 2, 2008, p. 4.

²⁶ A version of the example in Section 4.1 that allows for the trader to use limit orders leads to the same conclusion, that exchange proprietary data products are not complements.

²⁷ These may differ somewhat from the set of features needed to understand other questions about exchanges' proprietary data. For example, in other work focused on the linkages between data and trading, modeling routing delay was important. See, Rysman Platforms Paper, pp. 15-17. I abstract from routing delay here, but the example I present can be extended to include routing delay and thereby highlight how access to proprietary data from an exchange can drive a trader to direct order flow to that exchange without changing my conclusion that exchange proprietary data products are not complements.

proprietary data products are complements or not requires careful analysis of the sort that neither Prof. Glosten nor others have provided.

4.1. A simple example showing that depth-of-book data from different exchanges are substitutes, not complements

38. To begin with, suppose there is a single exchange. Assume a buyer is looking to buy 200 shares. The buyer believes it can profit from purchases of these shares if it can acquire them at a price below \$21; I refer to this as the buyer's "reservation price."²⁸ If the buyer does not purchase a depth-of-book data feed, it sees only the top of the book. Suppose it sees that 100 shares are being offered for sale for \$19 – this is the top of book offer price. There is another block of 100 shares behind the first, offered at a higher price. For simplicity, let us assume that the price of this block of shares may be either \$20 or \$25, but the buyer does not know which. I assume these two possibilities are equally likely. Of course, in reality, there is a whole distribution of possible values that this block could take on, but we keep things simple to illustrate my point.

39. Thus, if the buyer submits an order for 200 shares, it will purchase the first 100 at \$19. In what follows, we ignore this element of the purchase and focus on the second set of 100 shares. These 100 shares have a 50% chance of transacting at \$20 and a 50% chance of transacting at \$25. Thus, the expected cost to the buyer is \$22.50. The buyer will choose not to purchase at this price, which would be higher than its reservation price. Thus, it will not submit the order for the second set of 100 shares.

40. Suppose now that the buyer subscribes to a depth-of-book data feed and thus knows the order that stands behind the top-of-book order. If the buyer knew that the next offer was \$20, the buyer would buy at \$20. Thus, the buyer's profit would be $(\$21 - \$20) \times 100 = \$100$. If the buyer knew that the next offer was \$25, it would choose not to buy. Thus, with a depth-of-book data subscription, the buyer has an increase in expected profit of \$50 (that is, $\$100 \times 50\%$).

41. In order to study the question of whether depth-of-book data from different exchanges are complements, suppose that there are two exchanges, A and B, with identical situations. Both have top-of-book offers of 100 shares for \$19, with offers behind those of \$20 or \$25 with equal probability.²⁹ For these purposes, assume the buyer would like to purchase up to

²⁸ The example can be extended to other reservation prices. For most ranges of reservation prices, the conclusion that the data products are not complements holds.

²⁹ For simplicity, I assume that these probabilities are independent. That is, that the probability that the second level price on Exchange B is \$20 does not depend on the second level price on Exchange A (and vice-versa). In Section 4.2, I discuss how relaxing this artificial simplifying assumption strengthens the conclusion that depth-of-data products from different exchanges are not complements.

300 shares at a price below \$21. Thus, the buyer will buy the first 100 shares from each exchange, but faces a question about whether to purchase the third lot of 100 shares.

42. If the buyer does not have any depth-of-book data subscriptions, the buyer's only decision is whether to submit an order for 100 shares to one of the two exchanges. There is a 50% chance that the second offer at Exchange A is for \$20, and then the buyer will purchase at that price. If the second offer at A is \$25, Exchange A will query Exchange B to see if it has a better price.³⁰ In this case, there is a 50% chance that the second offer at Exchange B will be for \$20, and the buyer will obtain the lot for \$20. However, if the level 2 offer at Exchange B also has a price of \$25, the buyer will pay \$25 for the third lot. Thus, the expected cost for the third lot is: $(0.5 \times 20) + (0.5 \times 0.5 \times 20) + (0.5 \times 0.5 \times 25) = \21.25 . The buyer will not submit the order for the third lot of 100 shares, and will make zero profit on those shares.³¹

43. Suppose the buyer has a depth-of-book data subscription to Exchange A but not Exchange B. The buyer will know if the second offer at Exchange A is \$20 or \$25. If the second offer is \$20, then the buyer will submit the order for 300 shares. On the third lot, it will buy at \$20, and make profits of \$100.

44. If it sees that the second order at Exchange A is at \$25, then the buyer faces a 50% chance of obtaining a price of \$20 at Exchange B and a 50% chance of paying \$25. Thus, it faces an expected price of \$22.50. The buyer will not submit an order in this case. Thus, with a depth-of-book data feed, the buyer has a 50% of earning \$100 and a 50% chance of earning zero on the third lot, for an expected payoff of \$50. Subscribing to depth-of-book data from one exchange raises the buyer's expected payoff by \$50.

45. Now suppose the buyer has a depth-of-book data subscription for both exchanges. The buyer knows the second order at each exchange. If it sees a price of \$20 at either exchange, it

³⁰ Exchange A may do this in observance of the Order Protection Rule. Alternatively, it could reject the order. The Order Protection Rule simply prevents the exchange from executing the order at any price worse than what is available at top-of-book on other exchanges. See, "Concept Release on Equity Market Structure," U.S. Securities and Exchange Commission, Release No. 34-61358, January 14, 2010, pp. 26-27 ("Another important type of linkage in the current market structure is the protection against trade-throughs provided by Rule 611 of Regulation NMS. A trade-through is the execution of a trade at a price inferior to a protected quotation for an NMS stock. A protected quotation ... must be an automated quotation that is the best bid or best offer of an exchange or FINRA. Importantly, Rule 611 applies to all trading centers, not just those that display protected quotations. Trading center is defined broadly in Rule 600(b)(78) to include, among others, all exchanges, all ATSS (including ECNs and dark pools), all OTC market makers, and any other broker-dealer that executes orders internally, whether as agent or principal ... Rule 611 also helps promote linkages among trading centers by encouraging them, when they do not have available trading interest at the best price, to route marketable orders to a trading center that is displaying the best price. Although Rule 611 does not directly require such routing services (a trading center can, for example, cancel and return an order when it does not have the best price), competitive factors have led many trading centers to offer routing services to their customers.").

³¹ I describe which exchange the buyer uses, but in this example, it does not matter. The payoff to the buyer is the same regardless of which exchange it submits any orders to.

will submit an order and earn \$100 on the third lot. If it sees a second price of \$25 at both exchanges, it will not submit. This latter outcome has a 25% chance. Thus, the buyer's expected payoff on the third lot is \$75.

46. Thus, having the depth-of-book data subscription for one exchange increases the expected payoff to the buyer by \$50 relative to having no subscriptions to depth-of-book data. Having depth-of-book data subscriptions for both exchanges raises the buyer's expected payoff by another \$25 to \$75. Per the definition of complements that I gave in Section 3.1 above, depth-of-book data from Exchanges A and B would be complements if the sum of the incremental values of subscribing to each without subscribing to the other (here $\$50 + \$50 = \$100$) were less than the value of subscribing to both (here \$75). However, the opposite is true here ($\$50 + \$50 > \$75$), so depth-of-book data from Exchanges A and B are substitutes, not complements.

4.2. Correlation of information across exchanges strengthens the conclusion that exchanges' data products are not complements

47. Note that I have made an important assumption that biases the above model *in favor of* finding that proprietary data feeds are complements. Implicitly, I have assumed that the orders behind the top-of-book at the two exchanges are uncorrelated. In practice, available liquidity is likely to be correlated across exchanges.³² If the second order at Exchange A is for \$25, then it is more likely that the second order at Exchange B is \$25 rather than \$20. If that is the case, then the additional value of data at the second exchange is even lower, because the buyer can use information from the first exchange to infer the order book at the second exchange. As an extreme example, suppose the two order books were perfectly correlated, so that if the second order at Exchange A is \$25, then the second order at Exchange B is also \$25. In that case, subscribing to depth-of-book data from the second exchange provides literally no incremental value at all.³³

48. The demand and supply of liquidity is likely to be correlated across exchanges because some traders monitor developments and submit orders to several exchanges. For instance, market makers may monitor developments across exchanges and modify or cancel their limit orders on all exchanges as their views about a stock's fundamental value or market trends

³² Van Kervel, Vincent. 2015. "Competition for Order Flow with Fast and Slow Traders." *The Review of Financial Studies* 28(7): 2094–2127.

³³ It is worth noting that even if the order books are negatively correlated, the marginal value of subscribing to depth-of-book data from both exchanges is reduced. The marginal value of data for the second exchange over the first is maximized with respect to this issue in the case of zero correlation, the case I consider in my example above.

evolve.³⁴ Similarly, traders seeking immediate execution may route their orders to several exchanges depending on the liquidity available on each.³⁵

4.3. Arbitrage strategies do not imply that data from all exchanges are complements

49. We sometimes hear that data products are complements for proprietary traders that employ arbitrage strategies that profit from discrepancies in prices across exchanges.³⁶ The argument is that such traders need data from multiple exchanges in order to identify arbitrage opportunities; data from one exchange generates no value for such traders, but data from two or more exchanges enables them to identify profitable trading opportunities.

50. My example can be used to assess this claim and show that proprietary data subscriptions for all exchanges are not necessarily complements. The reservation price in my example is \$21, but I remain agnostic about where it comes from. One possibility is that it comes from an arbitrage strategy that relies on trading across multiple exchanges from which proprietary market data is critical. To think about this, suppose the price of \$21 comes from some Exchange C from which the buyer subscribes to proprietary data. Then, the model above can be seen as an analysis of value from subscribing to depth-of-book data from one or two more exchanges, in addition to Exchange C. The implication of the model is then that, even if an arbitrage strategy leads a firm to subscribe to depth-of-book data across multiple exchanges, the incremental value is not necessarily increasing in the number of exchanges, and subscriptions for all exchanges are not necessarily complements.

51. In this example, depth-of-book data products are complements for arbitrageurs across some but not all exchanges. Cournot's result leading to supracompetitive pricing of complements does not apply to environments with multiple products and complementarities only in the purchase of the first two. Market outcomes in situations that depart from Cournot's simple model of two monopolist suppliers of perfect complements can be complex and vary according to the particulars of demand for the products, the nature of product differentiation, and market structure.³⁷

³⁴ Van Kervel, Vincent. 2015. "Competition for Order Flow with Fast and Slow Traders." *The Review of Financial Studies* 28(7): 2094–2127, pp. 2094–2095.

³⁵ Van Kervel, Vincent. 2015. "Competition for Order Flow with Fast and Slow Traders." *The Review of Financial Studies* 28(7): 2094–2127, p. 2098.

³⁶ Glosten Report, p. 5. ("[Proprietary traders] 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.")

³⁷ For examples of research generalizing Cournot's result to specific sets of circumstances, see, Economides, Nicholas, and Steven C. Salop. 1992. "Competition and Integration among Complements, and Network Market Structure." *The*

52. Even if one group of consumers views products as complements, products can still be substitutes in the sense of overall demand, and it is overall demand that determines pricing strategy as predicted by the Cournot model. In particular, even if exchanges' proprietary data products are complements in this limited sense for traders that rely on arbitrage strategies, that does not imply that such data products are complements in terms of the overall demand for these products or that these products will be priced at supracompetitive levels. Arbitrage trading is only one example of the trading strategies that proprietary traders may use, and proprietary traders are only one of several group of purchasers of these data products.³⁸ Therefore, overall demand for exchanges' proprietary data is unlikely to mirror exactly the particular economics of data use for arbitrage trading.

Journal of Industrial Economics 40(1): 105–123; Quint, Daniel. 2014. "Imperfect Competition with Complements and Substitutes." *Journal of Economic Theory* 152: 266–290.

³⁸ Prof. Glosten asserts that proprietary traders are the second most prominent purchasers of data products, after brokers. See, Glosten Report, pp. 4–5.

5. FURTHER CLARIFICATIONS TO PROF. GLOSTEN'S REPORT

53. The Glosten Report introduces terminology used by economists without providing definitions or explanations of how they apply to the sale of exchanges' proprietary data products. In this section, I set out to fill some of the most prominent of these gaps.

54. Putting aside the question of whether exchange proprietary data products are complements, Prof. Glosten's explanation of the economics of firms' decisions to purchase data seems incomplete. He asserts that, if data products are complements, firms are concerned only with the total cost of purchasing data from all exchanges, not with their individual and relative prices.³⁹ This is true only in the extreme case of perfect complements, such as left and right shoes, where one good is useless without the other.⁴⁰ For example, although peanut butter and jelly are complements and typically consumed together, a large spike in the price of peanut butter would likely lead many households to reduce the amount of peanut butter they use relative to jelly. In the same way, one would expect purchasers of exchange proprietary data to react to the relative prices of these products, even if they were complements. Prof. Glosten does not address this issue at all, let alone empirically.

55. Prof. Glosten characterizes "the industrial organization of the proprietary data market" as "monopolistic competition" but does not provide a definition of this term.⁴¹ The monopolistic competition framework used by economists has the following key features: "(a) The products sold are differentiated; (b) Firms themselves set the price of these goods; (c) The number of sellers is large and each firm disregards the effects of its price decisions on the actions of its competitors; (d) Entry is unrestricted and proceeds until profits are reduced to zero or the smallest possible number consistent with the fact that the number of firms is an integer."⁴² A widely used textbook summarizes: "the monopolistic competition

³⁹ Glosten Report, p. 2 ("The decision to purchase data is driven by the price of all data because the exchanges' proprietary market data are complements."). *See also*, Glosten Report, p. 14 ("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.").

⁴⁰ Note that Cournot proved his result only for the case of perfect complements: "[t]o proceed systematically, from the simple to the complex, we will imagine two commodities, (a) and (b), which have no other use beyond that of being jointly consumed in the production of the composite commodity (ab)." Cournot, Antoine Augustin. 1897. *Researches into the Mathematical Principles of the Theory of Wealth*. London: Macmillan, & Co., p. 99.

⁴¹ Glosten Report, p. 8. His explanation that firms producing goods that are not "perfect substitutes" are "monopolistic competitors" leaves out important classes of competition, such as oligopoly. It is common in industrial organization to study markets for products that are substitutes but not perfect substitutes, and that do not conform to the definition of monopolistic competition. Oligopoly models are often appropriate when the number of competitors are relatively small.

⁴² Benassy, Jean-Pascal. 1991. "Monopolistic Competition." In *Handbook of Mathematical Economics*, vol. 4, edited by Werner Hildenbrand and Hugo Sonnenschein, 1997-2045. Amsterdam: North-Holland, p. 1999.

model maintains all of the assumptions of perfect competition except that of product homogeneity.”⁴³

56. The recent history of entry into and fragmentation of equity trading is consistent with the free entry condition of monopolistic competition. Trading of U.S. equities today takes place on 13 registered exchanges and a plethora of ATSS, dark pools, and broker-dealer internalizers. As of February 2020, there were more than 50 dark pools registered with the SEC.⁴⁴ Three new exchanges plan to start operations as early as this year: the Members Exchange (“MEMX”), Long-Term Stock Exchange (“LTSE”), and Miami International Holdings (“MIAX PEARL”).⁴⁵ MEMX and MIAX PEARL have declared their intention to offer proprietary data products.⁴⁶

57. However, Prof. Glosten’s evocation of the monopolistic competition framework is puzzling because he does not engage with one of its key characteristics, that there is free entry and that producers make zero profits. Prof. Glosten’s discussion of exchanges’ pricing of proprietary data products emphasizes strategic pricing incentives and not free entry, and thus seems at odds with concept of monopolistic competition.⁴⁷

58. Prof. Glosten’s assertion that “platform competition” is not a helpful framework for understanding the pricing of exchange proprietary data products is also unsupported.⁴⁸ He bases this assessment on a claim that the linkages between exchange proprietary data and trading are not likely to be important, so that firms’ choices regarding their purchases of

⁴³ Cabral, Luis. 2000. *Introduction to Industrial Organization*. Cambridge, Massachusetts: MIT Press, p. 92.

⁴⁴ “Alternative Trading Systems with Form ATS on File with the SEC as of February 29, 2020,” U.S. Securities and Exchange Commission, available at https://www.sec.gov/files/node/add/data_distribution/atstlist022920.pdf.

⁴⁵ MEMX is planning to launch September 2020. See, Khalil, Kiays, “New US Stock exchange MEMX will go live in September,” *The TRADE*, May 29, 2020, <https://www.thetradenews.com/new-us-stock-exchange-memx-will-go-live-in-september/>. MIAX also plans to launch in September 2020, though this launch date is pending SEC approval. See, “MIAX PEARL Equities Announces Upcoming Testing Dates Exchange Reaffirms September 2020 Launch Date,” *CISION*, May 13, 2020, <https://www.prnewswire.com/news-releases/miax-pearl-equities-announces-upcoming-testing-dates-exchange-reaffirms-september-2020-launch-date-301058484.html>. LTSE planned to launch in Q1 2020, though COVID-19 concerns delayed the launch. See, Harty, Declan, “Long-Term Stock Exchange delays launch with coronavirus weighing on Wall Street,” *S&P Global Market Intelligence*, March 27, 2020, <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/long-term-stock-exchange-delays-launch-with-coronavirus-weighing-on-wall-street-57793626>.

⁴⁶ “Members Exchange FAQ,” MEMX, February 5, 2020, <https://memxtrading.com/faq>; see also, “MIAX PEARL Equities FAQ,” MIAX PEARL, https://www.miaxoptions.com/sites/default/files/knowledge-center/2020-04/MIAX_PEARL_Equities_FAQ_04082020.pdf.

⁴⁷ Cabral, Luis. 2000. *Introduction to Industrial Organization*. Cambridge, Massachusetts: MIT Press, p. 92 (“The monopolistic competition model assumes that there is a large number of firms, so that the impact of each firm upon its rivals is negligible (as in the perfect competition model).”). The model of monopolistic competition was developed “not to study strategic aspects between products (such as product positioning and price competition), but rather to abstract from them to simplify the analysis and study other issues, such as the number of products offered by a market economy.” Tirole, Jean. 1988. *The Theory of Industrial Organization*. Cambridge, Massachusetts: MIT Press, p. 288.

⁴⁸ Glosten Report, pp. 3, 12–14.

exchange proprietary data products have no impact on firms' order routing decisions.⁴⁹ Prof. Glosten does not engage with my research on this question in the Rysman Platforms Paper, which provides conceptual and empirical support for the relevance of the linkages he calls into question. Instead, he offers two conceptual arguments.

59. First, Prof. Glosten points to a disconnect in the time scale at which trading and data purchase decisions are made, trading being “on the order of milliseconds” while data purchases are made “on a monthly or longer basis.”⁵⁰ However, this kind of mismatch in time scales is common on platforms. For example, credit card users decide on a payment method every time they make a purchase, but merchants decide whether to accept Visa or American Express cards over much longer time scales. If data is useful for deciding what exchange to route orders to (as Prof. Glosten agrees is the case),⁵¹ the data subscription decisions made each month can impact the order routing decisions made at high frequencies. Moreover, as Prof. Glosten notes, having additional trading on an exchange makes its data more valuable, so that a trader should be more willing to pay for it.⁵² Therefore, there are reasons to expect linkages running in both directions, from trading to data and from data to trading, despite the difference in time frames.

60. Second, Prof. Glosten argues that traders require proprietary data from all exchanges, so the price of an exchanges' proprietary data does not affect trade volume on that exchange.⁵³ But, as I have shown empirically in Section 3.3, most firms do not buy data from all exchanges, so it cannot be that data from all exchanges are necessary. If firms subscribe to proprietary data from some exchanges but not others, that should impact their decisions on where to route their orders, as I have shown in the Rysman Platforms Paper.

⁴⁹ Glosten Report, pp. 12–14.

⁵⁰ Glosten Report, p. 13.

⁵¹ *See, e.g.*, Glosten Report, pp. 4–5.

⁵² Glosten Report, p. 14 (“this increase in volume may well make NYSE Arca data more valuable.”).

⁵³ Glosten Report, p. 14.

6. OBSERVATIONS ON THE SEC'S REQUEST FOR ADDITIONAL INFORMATION

61. In this section, I comment on two issues raised by the SEC in its request for additional information. First, I note that the size of a platform does not alter the conclusion that all sides of the platform must be considered when evaluating competition and pricing. Second, I comment on the limitations of using accounting measures of profitability to evaluate competition and pricing.

62. First, the SEC asks NYSE to clarify “whether platform-based competition functions differently for an exchange with a smaller market share (e.g., NYSE National) as compared to an exchange with a larger market share (e.g., NYSE).”⁵⁴ The central implication of platform theory for the assessment of exchange proprietary data fees, that they cannot be considered independently of competition for order flow, does not depend on the size of a platform.

63. The size of a platform may be relevant for evaluating that platform’s market power. However, the market structure and dynamics of the equity trading ecosystem suggests that no exchange or exchange group has substantial market power. As already mentioned in Section 5 above, there are 13 registered exchanges and dozens of ATSS, dark pools, and broker-dealer internalizers competing for order flow. Three new stock exchanges are slated to begin operations in 2020, suggesting that barriers to entry are low.⁵⁵ The SEC has observed that “[s]ince the adoption of Regulation NMS in 2005, the market for trading services has become more fragmented and competitive.”⁵⁶

64. NYSE Group’s market share and measures of concentration such as the Herfindahl-Hirschman Index (“HHI”) suggest that NYSE Group is not “large” in any sense that would suggest substantial market power.⁵⁷ Table 3 presents market shares for each public exchange, their aggregation into the four currently active groups of exchanges (NYSE,

⁵⁴ SEC Request for Information, at 37127.

⁵⁵ MEMX is planning to launch September 2020. See, Khalil, Kiays, “New US Stock exchange MEMX will go live in September,” *The TRADE*, May 29, 2020, <https://www.thetradenews.com/new-us-stock-exchange-memx-will-go-live-in-september/>. MIAX also plans to launch in September 2020, though this launch date is pending SEC approval. See, “MIAX PEARL Equities Announces Upcoming Testing Dates Exchange Reaffirms September 2020 Launch Date,” *CISION*, May 13, 2020, <https://www.prnewswire.com/news-releases/miax-pearl-equities-announces-upcoming-testing-dates-exchange-reaffirms-september-2020-launch-date-301058484.html>. LTSE planned to launch in Q1 2020, though COVID-19 concerns delayed the launch. See, Harty, Declan, “Long-Term Stock Exchange delays launch with coronavirus weighing on Wall Street,” *S&P Global Market Intelligence*, March 27, 2020, <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/long-term-stock-exchange-delays-launch-with-coronavirus-weighing-on-wall-street-57793626>.

⁵⁶ “Transaction Fee Pilot for NMS Stocks Final Rule,” Securities Exchange Act Release No. 51808, 84 FR 5202, February 20, 2019, p. 5253.

⁵⁷ A formal antitrust analysis of market shares would follow a market definition analysis, which I have not conducted. The market shares and concentration statistics I present here are nonetheless informative as they put NYSE Group’s size relative to other trading centers in context.

NASDAQ, CBOE, and IEX), and the HHI implied by these shares. NYSE Group’s share of trading is 22%, well below the levels that economists consider dominant.⁵⁸ The HHI I calculate is very conservative: because data on trading volume for each ATS and dark pool is not available individually, I take each trade reporting facility (“TRF”), where many such trading venues report their trades, as unitary actors. With this, I calculate an upper bound HHI of 2,140. This is below the threshold of 2,500, above which the Federal Trade Commission and the Department of Justice consider markets to be “highly concentrated.”⁵⁹

TABLE 3
Market Shares in U.S. Equity Trading Volume, by Number of Shares Traded, June 2020

	Shares Traded	Market Share
Public Exchanges		
NYSE	34,583,389,595	11.28%
NYSE American	1,381,993,716	0.45%
NYSE Arca	26,637,707,910	8.69%
NYSE Chicago	648,860,370	0.21%
NYSE National	4,464,562,476	1.46%
NYSE Total	67,716,514,067	22.08%
NASDAQ	54,905,155,704	17.90%
NASDAQ BX	2,608,086,911	0.85%
NASDAQ PSX	1,646,975,767	0.54%
NASDAQ Total	59,160,218,382	19.29%
BYX Equities	5,262,903,080	1.72%
BZX Equities	16,945,504,908	5.53%
EDGA Equities	4,636,640,952	1.51%
EDGX Equities	19,739,075,839	6.44%
Cboe Total	46,584,124,779	15.19%
IEX	5,617,745,414	1.83%
Trade Reporting Facilities		
NASDAQ TRF Carteret	93,259,396,905	30.41%
NASDAQ TRF Chicago	576,489,276	0.19%
NYSE TRF	33,779,670,063	11.01%
TRF Total	127,615,556,244	41.61%
All Trading	306,694,158,886	

Source: Cboe Global Markets

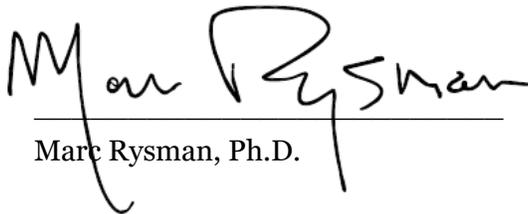
Note: Statistics shown include trading activity for the period 5/29/20 through 6/30/20.

⁵⁸ Motta, Massimo. 2004. *Competition Policy: Theory and Practice*. Cambridge: Cambridge University Press, p. 118 (surveying market share thresholds used to evaluate monopolization conduct, none of which suggest a market share below 40% is cause for concern). “Competition and Monopoly: Single-Firm Conduct Under Section 2 of the Sherman Act,” U.S. Department of Justice, September 2008, p. 22 (The Department of Justice “is not aware ... of any court that has found that a defendant possessed monopoly power when its market share was less than fifty percent. Thus, as a practical matter, a market share of greater than fifty percent has been necessary for courts to find the existence of monopoly power.”). Substantial market power could exist with lower market shares in markets where consumers tend to use a single provider (single-homing). See, Armstrong, Mark. 2006. “Competition in Two-Sided Markets.” *The RAND Journal of Economics*, 37 (3): 668–691. That issue is likely unimportant in the case where traders tend to access multiple trading venues.

⁵⁹ United States Department of Justice and the Federal Trade Commission, “Horizontal Merger Guidelines,” August 19, 2010, p. 19.

65. Second, the SEC has requested information on NYSE National’s profit margins, returns on assets, or other metrics” that could be used to assess “the presence of competition.”⁶⁰ The SEC requests this information “for the entirety of NYSE National and for each of its business lines (including proprietary market data products, consolidated market data products, market connectivity services, and transaction services).”⁶¹ Although competition among platforms would limit the overall profitability of platforms as a whole, economists have long recognized that accounting data do not always reliably reflect economic profitability and therefore can be unreliable for evaluating the competitiveness of an industry.⁶² For example, economists have found that accounting measures of profitability can deviate from the analogous economic concepts due to accounting procedures over which firms have some discretion or the way some costs are recorded.⁶³ These difficulties are even more pronounced for measures of profitability for units within a firm, as the allocation of costs necessarily introduces an element of arbitrariness.

Executed August 13, 2020



Marc Rysman, Ph.D.

⁶⁰ SEC Request for Information, at 37127.

⁶¹ SEC Request for Information, at 37127.

⁶² Fisher, Franklin and John McGowan. 1983. “On the Misuse of Accounting Rates of Return to Infer Monopoly Profits.” *American Economic Review*, 73 (1): 82–97; Baker, Jonathan B. and Timothy F. Bresnahan. 2008. “Economic Evidence in Antitrust: Defining Markets and Measuring Market Power.” In *Handbook of Antitrust Economics*, edited by Paolo Buccirossi, 1–42. Cambridge, MA: The MIT Press, p. 19 (“The Lerner Index can be difficult to measure because of well-known problems in the measurement of marginal cost. These include conceptual difficulties in relating accounting measures to economic concepts. For example, accountants define cost categories for audit purposes that do not necessarily track economist’s concepts; that present difficulties in the accounting treatment of depreciation, that may not capture opportunity costs in accounting data, and that show average variable costs not equal to marginal cost where the marginal cost curve is not horizontal. Indeed the academic literature in empirical industrial organization economics commonly treats the level of marginal cost as unobservable even when some of its determinants, like input prices and scale, can be observed.”).

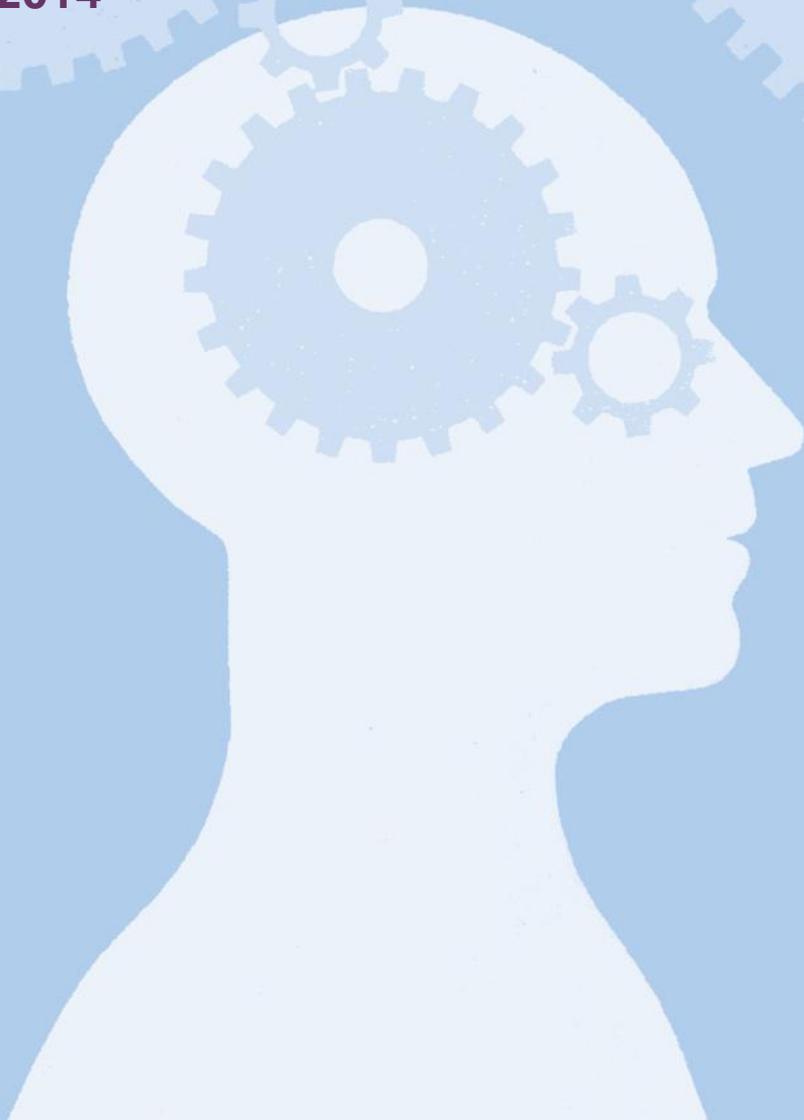
⁶³ Schmalensee, Richard. 1989. “Inter-industry Studies of Structure and Performance.” *Handbook of Industrial Organization* vol. 2, edited by Richard Schmalensee and Robert Willig, 951–1009. Amsterdam: North Holland, pp. 960–966.

Attachment E

Pricing of market data services

An economic analysis

February 2014



How to read this report

This is quite a technical report and is best to read from beginning to end. If you don't have sufficient time then you may want to read the executive summary and perhaps section 4. Although each section builds on the analysis in the preceding sections, each section can also be read on its own.

Section 1 provides the context and sets out the objectives. If you are familiar with the debate on market data services and the European Commission MiFID II proposals then you can probably skip this section.¹

Section 2 describes the value chain and the role of market data in the trading of European equities. It provides a detailed description (with further detail provided in Appendix 1), but the main points can be summarised as follows.

- Trading venues offer market data, but this is only one element in the value chain for market data services. Other services include the value-added services offered by data vendors, software applications, IT infrastructure and in-house market data expertise. Some would say that this point is often overlooked in the debate on the pricing of trading venues' market data.
- The value chain for market data services is, in turn, part of the larger value chain for trading in European equities. This value chain is quite complex but has been analysed in detail in previous Oxera reports for the European Commission.
- Brokers, fund managers, institutional and retail investors, academics and other researchers all use market data but tend to value it (very) differently. For example, high-frequency traders typically need very fast access to market data at the maximum level of detail, while retail investors and some researchers are more likely to be content with delayed, and much less detailed, data that is offered for free. It is useful to know this—the different valuations also explain why trading venues have different pricing schedules for different types of user. From an economics perspective, this can be an efficient outcome, providing benefits to all stakeholders.

Importantly, section 2 also provides a framework within which the pricing of market data can be analysed. It explains that trade execution and market data services are joint products and have joint costs. We explain in section 2 (and in more detail in Appendix 2) what this means. The main implication for our analysis is that the pricing of market data services cannot be analysed in isolation from the pricing of trade execution services. Trading venues can recover their costs through fees for trade execution services and/or fees for market data services, and these two services therefore need to be analysed together. This is done in sections 3 and 4.

Section 2 also explains some of the other key economic characteristics of trading venues and the implications for the pricing of their services.

Section 3 contains the main empirical analysis of the costs of trade execution and market data services. It is based on new data (provided by the four exchanges that participated in this study) and consists of two important parts.

¹ At the time of publication of this report, the European Parliament and the European Council had reached an agreement regarding the European Commission's proposals to amend the Markets in Financial Instrument Directive (MiFID), but the final text had not yet been published.

The first part focuses on the costs of market data services to brokers. It shows that the order of magnitude of these costs, compared with trade execution costs, can vary significantly by broker. This is not surprising and is driven by the pricing schedules as well as the fact that different brokers have different needs, particularly in how market-data-intensive their investment or trading strategies are.

In terms of the revenue data from trading venues, the market data services revenues as a proportion of the total core revenues of exchanges (ie, combined revenues from trade execution and market data services provided by trading venues) range between 19% and 35% in Europe. This range is quite similar to that observed in the USA, and these ratios have been relatively stable in the past few years.

The main policy debate in Europe has focused on the costs of market data services to brokers. However, brokers are intermediaries and pass on the market data costs they incur to end-investors. To really understand the impact of the pricing of market data services on the functioning of the market for trading, it is important to look at how these costs affect end-investors.

This is the focus of the second part of section 3, which assesses the significance of the market data costs compared with other costs in relation to trading that are incurred by end-investors. It shows that the costs of market data services to investors are quite small—less than 2% of the total annual costs of the trading in, and the holding of, securities.

This is an important finding. If the market data costs are relatively small compared with other costs of trading and holding, it would seem unlikely that, at a general level, changes in the fees for market data services would significantly affect the overall level of activity of trading.

In other words, changing how trading platforms recover their costs by, for example, making market data services free—and, therefore, increasing the fees of trade execution services—would be unlikely to radically change the motivations of end-investors to undertake particular trades or adopt particular investment strategies. It is, therefore, very unlikely that changing the balance of prices between market data and transactions can significantly change the overall performance of the (equity) capital markets. More detail on how this conclusion is reached is set out in section 4.

Interestingly, one conclusion is that radically reducing market data prices could actually increase the total that brokers would pay to trading venues, as they would now cover more of the costs of these venues—while other, non-trading stakeholders (eg, fund managers) who currently buy market data would pay less (section 4.1.1 explains why this is).

Finally, in section 5, we compare the costs of market data services in Europe with those in the USA. It is often argued that European market data is far too expensive. The analysis shows that, at first sight, Europe indeed looks more expensive than the USA. However, a more detailed analysis shows that this is driven by large differences in economies of scale, and a number of other factors such as the complexity of the European markets, the specifics of the regulatory requirements around Reg NMS, and the consolidated tape. It is well known that trading fees in the USA are lower than in Europe and that this is driven partly by differences in economies of scale (see section 2.1.1 in Appendix 2)—similarly, data fees are lower in the USA, and this is also driven partly by the same differences in economies of scale.

This leads us to conclude that, from a public policy perspective, there is no real justification for regulating trading venues' pricing of market data services. Trading venues can recover their costs through fees for trade execution services and/or fees for market data services (and various access and membership fees), but how they actually do this is unlikely to have a significant impact on the functioning of the trading market for end-investors.

It is also clear that regulating the pricing of market data services would be far from straightforward. It would not be practicable to impose regulation and there would be a risk that it would actually distort the functioning of the market. On the other hand, it may be beneficial to offer more transparency and provide everyone with a better understanding of how trading venues recover their costs. Some of the metrics presented in section 3 could be used for this.

We use some technical economics terms (joint products, network externalities, etc), but explain most of these in the report itself. We also use some technical language (level 1 and level 2, best-bid-offers, etc), and provide a list of terminology in section 1.5.

There is a certain amount of new and interesting data analysis in this report. The analysis and the conceptual framework build on previous analysis of the securities trading and post-trading value chain undertaken by Oxera for the European Commission.²

For any questions about this report, please contact Oxera: enquiries@oxera.com

² Oxera (2007), 'Methodology for monitoring prices, costs and volumes of trading and post-trading activities', prepared for European Commission and DG Internal Market and Services, July; Oxera (2009), 'Monitoring prices, costs and volumes of trading and post-trading services (MARKT/2007/02/G)', report prepared for European Commission DG Internal Market and Services, July; and Oxera (2011), 'Monitoring prices, costs and volumes of trading and post-trading services', report prepared for European Commission, DG Internal Market and Services, May.

Executive summary

Context

Over the past ten years, there have been some considerable changes in terms of market structure and trading techniques in European capital markets.

Where once only one, or possibly two, exchanges offered trading in a particular equity, for most European equities multiple trading venues now compete for liquidity due to the full implementation of the Markets in Financial Instruments Directive (MiFID) in 2007. One effect of introducing competition has been the fragmentation of trading data on particular stocks across a number of venues. This, together with the creation of new trading strategies (such as algorithmic and high-frequency trading), has generated demand for market data and faster access to the full order books for a wider coverage of markets.

In response to the growing variety of market data needs, exchanges and multilateral trading facilities (MTFs) have introduced new types of data licences, such as non-display licences that cover the whole institution's use of market data for algorithmic trading, post-trade data separated from pre-trade data in order to support the planned EU post-trade consolidated tape, and a harmonised delay period of 15 minutes for data free of licence fees.

Data vendors, independent software vendors, MTFs and exchanges provide products to meet the demand for market data from different types of market participants. While trading venues make their data available, as wholesalers, it is typically offered to market participants by market data vendors, acting here as the retailers. Brokers sometimes also offer data services themselves—for example, when they provide the relevant trading venue's data to retail customers via their web-based offerings.

Market data vendors such as Bloomberg and Thomson Reuters offer market data from more than 500 trading venues across Europe, the USA and Asia via one desktop terminal in a single format. Data sources can be chosen separately or, where relevant, in a consolidated form. The data is usually presented in additional applications (analytics and news services etc.).

After the introduction of MiFID I, the industry (under the lead of the Federation of European Stock Exchanges (FESE)) decided to standardise market data across multiple markets within the EU through projects like the Market Model Typology. The aim of this project is to ensure a more efficient consolidation of data from different trading venues.

The current European Commission proposals to amend MiFID include a number of provisions in relation to trading venues' market data.³ Trading venues will be required to unbundle pre- and post-trade data, provide post-trade data (published with a 15-minute delay) free of data licence fees, and provide pre-trade and post-trade data on a reasonable commercial basis.

Although most of these requirements have already been implemented by most of the trading venues ahead of the adoption of MiFID II, there has been some debate over whether a definition of 'reasonable commercial basis' would be required, and the way in which it should be interpreted, with some stakeholders advocating the need for detailed rules and others

³ Proposal for a Regulation of the European Parliament and of the Council, Title II, Articles 3, 5, 7, 9, 11, 12 and 18.

promoting a principles-based approach with greater reliance on market forces—and some questioning the necessity of a definition.

The market structure and value chain in which market data is produced and consumed is complex, making it challenging to assess the role of regulation. This report aims to provide an economic framework within which the pricing of market data services can be evaluated. To contribute to the regulatory debate, the report provides economic analysis of the following:

- the role of market data in the value chain for trading in European equities;
- the key economic characteristics of trade execution and market data services;
- the current pricing and costs to users of market data services in Europe, drawing comparisons with the prices and costs to users in the USA;
- the potential impact of different pricing schedules and cost recovery mechanisms on market outcomes for end-investors.

The report is written specifically in the context of European equity trading, and thus all statements refer to European equities unless otherwise specified.

The role of market data in the trading of European equities

The production and consumption of market data is part of a larger value chain that includes the trading of financial instruments and the trading of European equities. The latter is the focus of this report.

The objective of the trading system is to provide an efficient mechanism to transfer the ownership of equities from one party to another. In order for this to take place, market participants require access to the market data that is produced by the trading services provided by the trading venues.

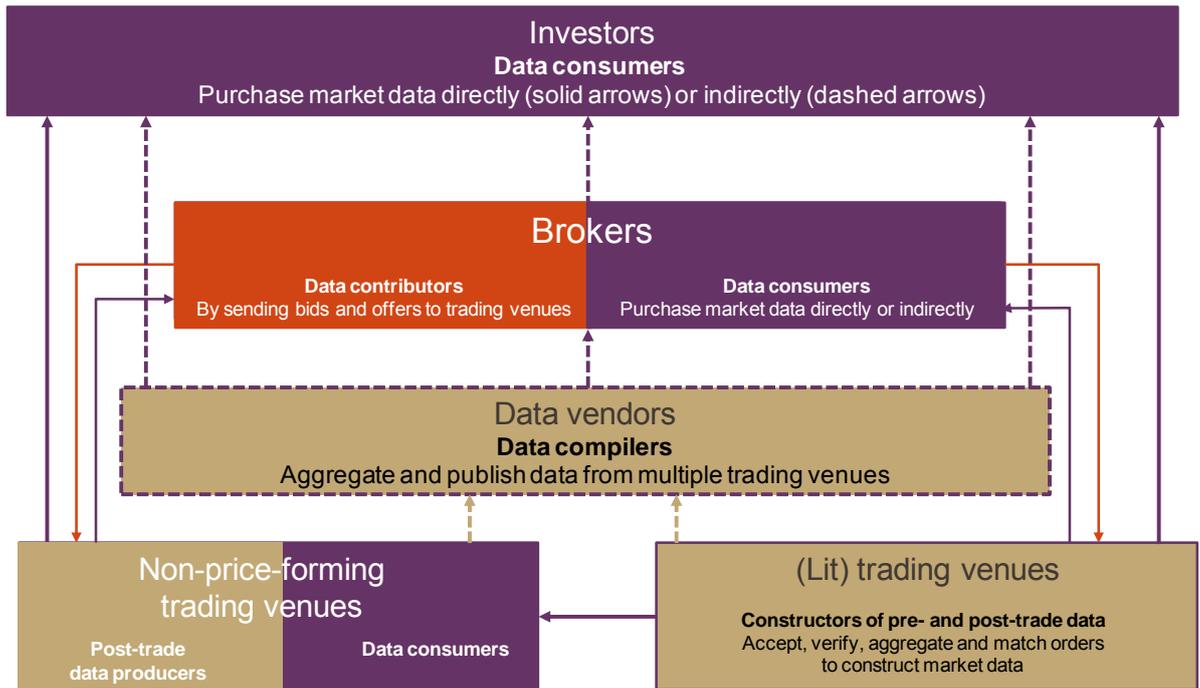
The production and consumption of market data across the trading value chain is complex. Figure 2.2 of the report, repeated below, sets out the main data flows in terms of the contribution of trading data by brokers (red arrows and shading); the consumption of that processed data by investors, brokers and other market participants (purple arrows and shading); the production of market data by trading venues (through the provision of trade execution services); and the further processing of market data by data vendors (brown shading), including value-added services offered by data vendors, software applications, and IT infrastructure providers.

The market data offered by trading venues is only one element in the value chain for market data. Other services include the value-added services offered by data vendors, software applications, IT infrastructure and in-house market data expertise. According to research in 2010,⁴ exchange market data licence fees were estimated to account for 8% to 15% of customer market data expenditure; IT infrastructure was estimated to account for 10% to 16%; and data vendor services were estimated to account for the remaining 65% to 80%.

Market data is often complemented by other sources of information and data to which market participants may have different levels of access, and which they may interpret in different ways. For example, investment decisions typically draw on a broad mix of information sources in addition to market data such as annual reports, financial statements and more general news services.

⁴ Atradia (2010), 'The cost of access to real time pre & post-trade order book data in Europe', August, p. 21.

Information flows in the trading of European equities



Source: Oxera.

There is significant variation in the use of market data by market participants, which is analysed in more detail in the report. Users can choose between several types of data products, and whether they purchase the data directly from trading venues (usually reducing latency) or indirectly via data vendors or brokers (which may also provide analysis software, and combine market data from multiple trading venues). Market data products vary according to depth (ie, how much information about the demand and supply of a particular stock is included in the data product); the speed at which data is received by the market data recipient; and coverage of the types of stocks or asset classes captured in the data product.

In addition to anonymised market data sets for publication, trading venues generate non-anonymised data for surveillance purposes. This data is used only by the trading venues' market surveillance, and by regulators. The confidential nature of the information included in such data, such as trader IDs or Algo Trading IDs, means that it is not suitable for public dissemination.

An economic framework to assess the pricing of market data services in Europe

Market data and trade execution are linked not only at the level of consumption (ie, market data is required in order for traders to take decisions on trading), but also at the level of production.

Market data is a by-product of the overall operation of the trading system. Given the general structure of electronic order books and electronic order matching, it is not possible to provide transaction services without generating market data, and it is not possible to generate trade transaction—or market depth—data without also supplying a trade execution service. In economic terms, trade execution and market data are joint products.

The joint product nature of trade execution and market data has two important implications.

- With joint products, the production costs of the outputs cannot be separated—ie, they are joint costs. This has been well established in the economic literature and regulatory practice. Joint costs are incurred when production facilities simultaneously produce two or more products in fixed proportions, such that an increase in the output of one product will necessarily mean a corresponding increase in the output of the other product.

This means that the recovery of costs by a trading venue cannot be assessed effectively by the independent analysis of either trade execution services or market data services. The appropriate frame of reference for the economically efficient recovery of the costs of the secondary market activities of trading venues is at the level of combined transaction revenues and data revenues.

- This, in turn, means that the economic characteristics of the production of the trade execution service are also relevant. Trading venues are characterised by high fixed costs and low marginal costs, and significant economies of scale. In industries with these characteristics, the pure competitive outcome—where prices are set at forward-looking marginal costs—may not be economically efficient. Marginal cost pricing would not be sufficient to recover the total cost of production, and therefore trading venues would exit the market. Furthermore, charging the same price to all customers would not account for the different valuations that different types of customers may have. Different market participants often have very different valuations of what is essentially the same information. This suggests that a single price for all users may not be efficient.

With this framework in mind, this report analyses the way in which trading venues in Europe currently recover their costs through fees for both trade execution and market data services, and assesses the implications of the current (and potentially different) cost recovery mechanisms for the functioning of the equity markets, and their impact on end-investors.

Analysis of the current pattern of cost recovery by trading venues

The current pattern of cost recovery has been analysed on the basis of a number of specific metrics using data from the participating exchanges and that available in the public domain (in annual reports and pricing schedules). These metrics are as follows.

- **The revenues from market data services as a proportion of combined revenues from market data and trade execution services, including membership fees**
 - This analysis shows that, within both Europe and the USA, there is a certain amount of variation in the relative importance of market data revenues. In 2012, market data revenues accounted for about 19–35% of market data and trade execution revenues combined for the European markets of the participating exchanges. For the US markets (of the participating exchanges) the range was fairly similar, at about 14% to 29%.
 - Over the past four to seven years, the proportion of revenue accounted for by market data services by each exchange appears to have been relatively stable. Analysis of historical data licence pricing schedules from European exchanges suggests that this is because licence fees have not generally increased. While faster or more detailed market data products have been introduced, for which higher fees are charged, licence fees have not been frequently increased. There are some exceptions to this general trend, and some trading venues have increased their fees for market data services at a time when revenues from trade execution services have been falling (due to lower trading volumes).
- **The fees incurred by brokerage firms (hereafter referred to as brokers) to purchase market data services, compared with the fees incurred for trade execution services**

- This analysis was undertaken by designing user profiles and applying these to the pricing schedules for trade execution and market data services. The analysis shows that the relative importance of data licence fees can vary significantly between brokers according to their business model.
- Large brokers generally pay exchanges between 0.05bp and 0.15bp of their value of trading in market data licence fees, compared to around 0.08bp and 0.55bp in trade execution fees and less than 0.01bp in membership fees—ie, as a proportion of total fees for trade execution and market data services paid to exchanges, market data fees are usually in the range of 10% to 30%. The breadth of this range reflects the observed differences in the use of market data products by different brokers transacting similar volumes. Large brokers are here defined as executing around 50,000 trades a day, or around €100 billion a year (assuming an average trade size of €8,000), at a particular trading venue.
- In terms of a ‘mid-active broker’ at a trading venue, market data fees cover a broader range as market data needs can vary more widely, but they are typically in the range of 15% to 40% of total fees paid to exchanges. A mid-active broker is here defined as a brokerage firm that executes around 1,000 trades a day, or around €2 billion a year (assuming the same average trade size of €8,000).
- There is some variation in pricing schedules for market data services across trading venues. For example, most but not all trading venues in Europe offer market data for free to registered traders for trading on that venue.
- **The cost of consolidated tapes in Europe and the USA**
 - When expressed in absolute amounts, European trading venues are typically more expensive for both data and transaction services than those in the USA. However, a more detailed analysis shows that this is driven by large differences in economies of scale, and a number of other factors such as the complexity of the European markets, and the specifics of the regulatory requirements around Reg NMS. It is well known that trading fees in the USA are lower than in Europe and that this is driven partly by differences in economies of scale—similarly, data fees are lower in the USA, and this is also driven partly by the same differences in economies of scale.
- **Market data costs as a proportion of the total costs (in relation to trading and holding securities) incurred by end-investors**
 - The relative importance of market data fees compared to other costs incurred by end-investors (ie, the cost of trading and post-trading and the costs of fund management) can be estimated in two ways.
 - The ‘top-down’ approach compares market data revenues of an exchange (as a proxy for the market data fees incurred indirectly and directly by end-investors) against the domestic market capitalisation of stocks traded on the exchange (as a proxy for the value of investments held by the end-investors in the local market). This suggests that annual market data costs represent less than 0.01% of the value of an investor’s assets under management.
 - The ‘bottom-up’ approach considers all the services provided to an end-investor, from fund management, brokerage and trading, to clearing and custody); estimates the expenditure by each intermediary on market data; and compares this to the total costs of these services charged to the end-investor. This approach estimates that annual market data costs represent less than 0.02% of the value of an investor’s assets under management.

The precise relationship between market data fees and the total costs incurred in making a transaction will vary depending on the investment style (and other factors) adopted by the end-investor or fund manager. However, taking both a top-down and a bottom-up approach, the annual market data fees received by trading venues are likely to account for less than 2% of the total annual costs associated with trading and holding securities incurred by institutional investors.⁵ This is typically equivalent to less than 0.02% of assets under management.⁶ (The significance of market data fees charged by trading venues for retail investors in Europe is even smaller, as many European trading venues offer market data to retail investors for licence fees of €1 a month or for free.)

This shows that the market data costs (in relation to the market data provided by stock exchanges) are relatively small compared with the total costs that investors incur in relation to trading and post-trading.

Competition in the markets for fund management, market making and brokerage services keeps the fees charged by intermediaries for such services close to the costs incurred in providing them. This means that any change in the cost of providing such services—for example, an increase in market data licence fees—would be expected to be passed on to end-users in the form of higher fees charged by intermediaries for them.

Changes in fees for market data and trading services may affect the demand for them. However, given the relatively small proportion of the total costs represented by market data fees, it would seem unlikely that, at a general level, changes in the licence fees for market data would significantly affect the overall level of activity of trading.

This is not to say that a different balance between market data service fees and the fees for trade execution services provided by trading venues would have no impact on either end-users or other intermediaries. The next section looks at what would happen were trading venues to implement different pricing structures.

Potential impact of different pricing structures on market outcomes

Changing the pricing schedules for trade execution and market data services may have a number of potential effects on market participants and market outcomes for end-investors, which are analysed in detail in the report. These effects can be summarised as follows.

Distributional effects—changing the balance of cost recovery may create winners and losers among market participants. Shifting costs from market data services to trading services, for example, would improve the competitive position of those brokerage firms with the highest data needs given their trading activity.

However, the number of customers purchasing data services tends to be higher than the number purchasing transaction services—it is likely that anyone who purchases trading services will also purchase market data services, while there are a number of customer groups who will purchase market data services but not directly purchase trading services or other related services for which an exchange charges a fee (for example, fund managers).

This means that the general pattern would be that those purchasing both transaction services and market data services would be worse off, while those purchasing only market data would be better off. It should be noted that market data is free for some brokers—so

⁵ The services considered are: fund management services; trade execution services provided by brokerage firms and trading platforms; market impact costs experienced by funds; clearing services provided by clearing firms and CCPs; and custody services provided by custodians and CSDs.

⁶ This cost is based on a fund with a turnover ratio of 50%—ie, a fund in which 50% of the assets held are changed each year, such that the value of assets under management is the same as the value of trading each year.

such brokers will not benefit from lower data fees, and experience only the higher trading fees.

From an end-investor perspective, this may not matter so much. If trading fees were increased and market data fees reduced, the fund management fee would reduce but commissions paid to brokers (often directly by the funds) would increase.

Impact on market efficiency—although there is some assessment in the economic literature of the impact of charging or not charging for market data services on market efficiency, there is not sufficient evidence from these models to draw a conclusion on the relationship between the efficiency of markets and the pricing of market data. In theory, charging for market data services could reduce the demand for data and therefore potentially have a negative effect on the price discovery process. However, if there are multiple trading platforms, individual platforms have incentives to ensure that they are attractive both in terms of fees (for trade execution and market data services) and non-fee elements (such as price discovery and liquidity).

Impact of different pricing schedules on volume of trading—trading platforms can recover their costs in a number of ways and design different types of pricing schedules.

In the report, two extreme scenarios are analysed: a scenario where all costs were recovered through market data fees (and trade execution fees were set at zero), and a scenario where all costs were recovered through trading fees (and market data fees were set at zero).

The analysis shows that the effect is not clear-cut. In the first scenario, the volume of trading may go up (since transaction fees are set at zero), but the volume of trading may go down as a result of the increase in market data costs leading to a reduction in the consumption of market data by fund managers, and this in turn could lead to a reduction in the demand for trading services (ie, decisions are made not to trade when, with access to the data, the decision would be to trade). The overall net effect is an empirical question—in the first scenario, the net effect is likely to be more marginal transactions, and in the second scenario it is likely to be fewer marginal transactions.

Furthermore, the first scenario is likely to encourage consolidation among brokerage firms, as the largest brokers are likely to find it easier to increase the average value/volume of trading per data user. Niche brokers that trade smaller amounts per trader would be disadvantaged. However, this increase in concentration is unlikely to result in a significant reduction in the degree of competition, and is therefore unlikely to affect the end-investors.

In sum, the analysis shows that, even in extreme scenarios of recovering all costs through trade execution fees or market data services fees, there is no evidence that the impact on market outcomes in terms of efficiency and volume of trading would be detrimental to end-investors.

Conclusions

As explained, market data and trade execution services are joint products. Therefore, from an economic perspective, an assessment of the pricing of market data services requires an analysis of the revenues from both trade execution and market data services. Furthermore, both services are intermediate products, which means that the analysis needs to focus on the market outcomes in terms of the efficiency of the market, the volume of trading, and the total costs of trading for the end-users—ie, investors.

The analysis in this report shows that the current cost of market data as a percentage of total costs to end-investors is low, at less than 2% of the total annual costs associated with trading and holding securities incurred by institutional investors. This is typically equivalent to less than 0.02% of assets under management. This indicates that a change in market data fees is

unlikely to have a significant effect on behaviour in terms of—for example—the volume of trading.

The conceptual analysis also shows that, even if the pricing of market data services were changed significantly, there would be unlikely to be a significant detrimental effect on market outcomes for end-investors.

This suggests that there is no justification for regulating the pricing of market data services. Although this report has not analysed potential options for the regulation of the pricing of market data services, it is clear that it would be very challenging to design a framework that is practicable and there would be a risk that it would actually distort the functioning of the market—defining the relevant services and regulating the prices would be far from straightforward.

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1 Introduction

Deutsche Börse, Nasdaq OMX, NYSE Euronext and SIX Swiss Exchange (the participating exchanges) have commissioned Oxera to undertake independent economic analysis into the pricing of market data services. This report presents the findings of this analysis. At the time of publication, the European Parliament and the European Council had reached an agreement regarding the European Commission's proposals to amend the Markets in Financial Instrument Directive (MiFID), but the final text had not yet been published.⁷

1.1 Context

Over the past ten years, there have been some considerable changes in terms of market structure and trading techniques in European capital markets.

In 2004, the European Commission introduced the Markets in Financial Instruments Directive (MiFID),⁸ with the objective of increasing competition and consumer protection in investment services. MiFID included pre- and post-trade transparency requirements but, with the break-up of the monopoly of national exchanges, trading and—therefore—market data has become fragmented across a number trading venues. Where once only one, or possibly two, exchanges offered trading in a particular equity, for most European equities multiple trading venues have competed for liquidity since the full implementation of MiFID in late 2007.

In addition to the fragmentation of trading, technology has revolutionised the data and order execution business. Automation of processes has been introduced throughout the trading and post-trading value chain, facilitating new trading strategies (such as algorithmic and high-frequency trading), and generating demand for new types of data.

The European Commission proposals to amend MiFID include a number of provisions in relation to market data.⁹ Trading venues will be required to make pre- and post-trade data available on reasonable commercial terms, unbundle pre- and post-trade data, and provide post-trade data published with a 15-minute delay free of data licence fees.

Furthermore, currently most European exchanges offer data with a 15-minute delay without a data licence fee. Both changes have been applied to European exchanges ahead of the introduction of MiFIR/MiFID II. Some of the initiatives are already reflected in data vendors' product offerings, which typically include the provision of delayed data from all venues for no additional licence fee other than the cost of the terminal itself.

However, there has been some debate over the way in which a 'reasonable commercial basis' should be interpreted, with some parties advocating the need for detailed rules and others promoting a principles-based approach with greater reliance on market forces.

What characterises reasonable commercial terms for the provision of market data is not a simple question. The (very wide) range in the value of the market data between different market participants suggests that a single price is unlikely to be considered reasonable for all users. For example, technological advances have facilitated the development of new high-frequency trading strategies, increasing the value of very low-latency trading data. At the

⁷ According to the following press release, the European Parliament and the European Council reached an agreement on 14 January 2014: http://europa.eu/rapid/press-release_MEMO-14-15_en.htm?locale=en.

⁸ The European Commission's MiFID directive, implementing regulations and other documents can be found at http://ec.europa.eu/internal_market/securities/isd/mifid/index_en.htm.

⁹ Title II, Chapter 3, Articles 3, 5, 7, 9, 11 and 12.

same time, retail investors would probably not be able to take full advantage of low-latency direct feeds. Usually, the retail customer accesses market data via their broker, who displays market data from those markets covered by their best execution policy.

1.2 Objectives of this report

The market structure and value chain in which market data is produced and consumed is complex, making it challenging to assess the role of regulation. This report aims to provide an economic framework within which the pricing of market data services can be evaluated. To contribute to the regulatory debate, this report provides economic analysis of the following:

- the role of market data in the value chain for trading in European equities;
- the key economic characteristics of trade execution and market data services;
- the current pricing and costs to users of market data services in Europe, drawing comparisons with the prices and costs to users in the USA;
- the potential impact of different pricing schedules and cost recovery mechanisms on market outcomes. The report is written specifically in the context of European equity trading, and thus all statements refer to European equities unless otherwise specified.

1.3 Information sources

Oxera has gathered and analysed information from a number of sources, as follows.

- Interviews were held with various parties including data vendors, investors, brokerage firms, and stock exchanges and MTFs. These discussions were used to inform Oxera's understanding of the data needs and uses of different market participants, the interactions between different market participants seeking to consume or distribute market data, and general views of the potential role for regulation.
- Publicly available pricing schedules for trade execution and market data services provided by a selection of US and European trading venues were analysed to assess the costs of these services for different types of brokerage and fund management firms. The stylised user profiles in the analysis were informed by confidential information provided by the participating exchanges.
- Confidential information on revenues received from market data, trade execution and listing services was provided by the participating exchanges and analysed to further assess the current pricing of market data in Europe. This was combined with (publicly available) information on the volume and value of trading at each exchange in order to consider the effects of economies of scale.

1.4 Terminology

Throughout this report, the terminology below has been adopted.

- **Access fee:** this refers to the 'per-firm' market data licence fee, charged by some trading venues, for a firm wishing to license market data and distribute internally only. Where such access fees are charged, user and device fees are typically not.
- **Best bid and offer (BBO):** the lowest ask price and the highest bid price offered for a security.

- **Data aggregators (aggregators) and data vendors (vendors):** organisations that take market data from one or more trading venues and re-sell that information to data users. This service is often combined with an enhanced ability to analyse that information and to display information from more than one venue in an integrated manner.
- **(Market) depth:** bids and offers below BBO. Trading venues often offer different market data products that vary in the depth of market data provided.
- **Full order book:** the complete list of orders to buy or sell a particular security on a trading venue.
- **Last price:** price information on the last executed trade per instrument.
- **Latency:** the time delay with which the data is available to the data user. In terms of market data provision, 'low-latency' is commonly used to refer to speeds in the range of milliseconds or nanoseconds.
- **Level 1 data:** information on the BBO for each security as well as all executed trades.
- **Level 2 data:** as per level 1 data, but including market depth data to various degrees.
- **Multilateral trading facility (MTF):** MTFs provide similar or competing trading services to stock exchanges and can have similar structures, such as rulebooks and market surveillance departments, but do not have listing processes and cannot change the regulatory status of a security.
- **Post-trade data:** executed trades per security.
- **Pre-trade data:** quotes and orders per security. This can vary in depth from including only BBO to including various levels of market depth.
- **Regulated market (RM):** as defined by MiFID, this is a multilateral system operated and/or managed by a market operator, which brings together—or facilitates the bringing together of—multiple third-party buying and selling interests in financial instruments in a way that results in a contract, in respect of the financial instruments admitted to trading under its rules and/or systems, and which is authorised and functions regularly and in accordance with the provisions of Title III of Directive 2004/39/EC. One example is a stock exchange.
- **Trading venue:** an RM or MTF.

2 Economic analysis of the pricing of market data services

2.1 Role of market data in the trading of European equities

This section identifies the key economic characteristics of market data services, and provides a description of the value chain in which market data services are provided. Further detail is provided in Appendix 1.

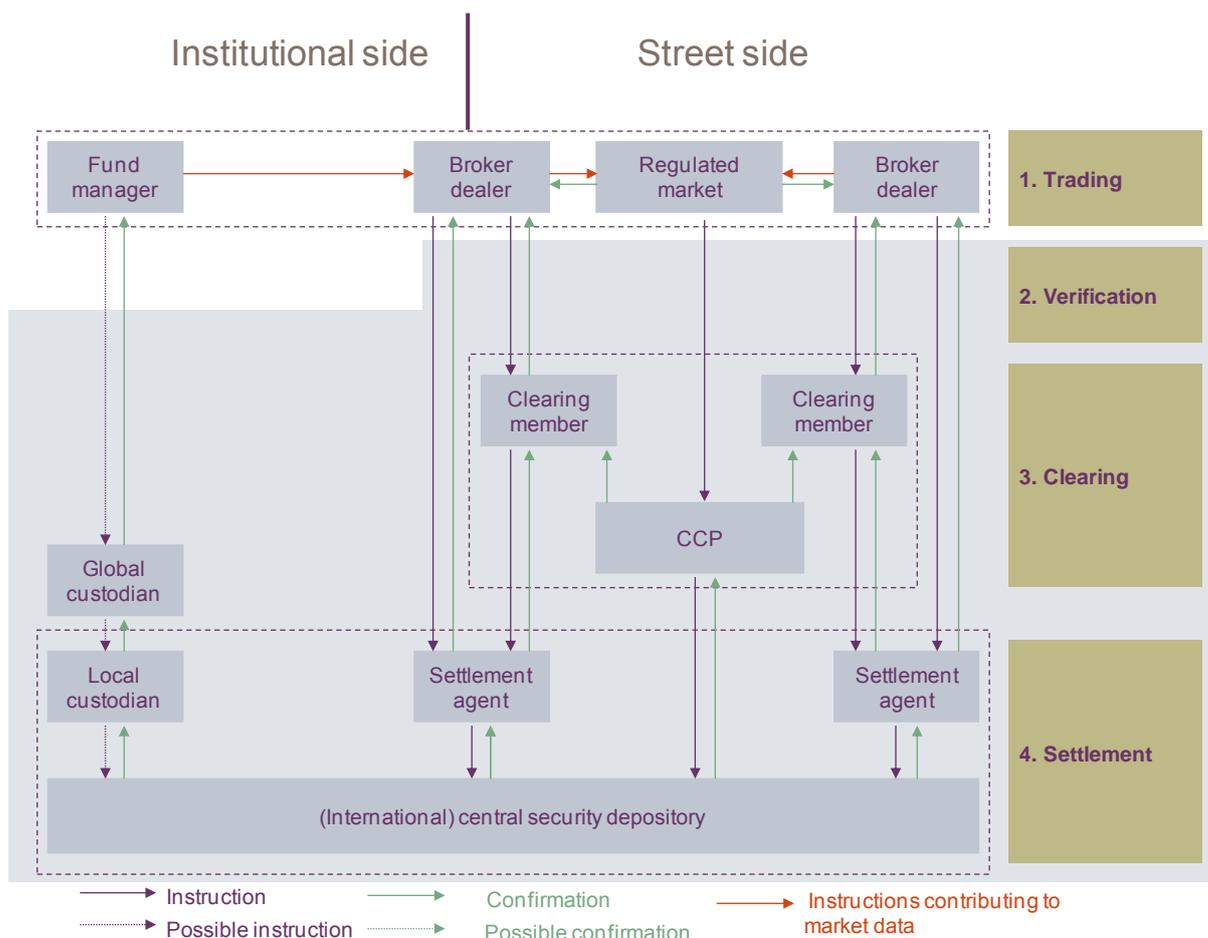
2.1.1 Market data within the value chain for the trading of European equities

The production and licensing of exchange market data is part of a larger industry value chain that includes the trading of financial instruments such as European equities, which is the focus of this report.

The objective of the trading system is to provide an efficient mechanism to transfer the ownership of equities from one party to another. In order for this to take place, market participants require access to the data that is an output from the operation of the relevant trading venues. In few, if any, circumstances is the use (or consumption) of market data the end objective of those using/consuming that data. Consumption of market data is, therefore, an intermediary activity, or a means to an end, rather than an end in itself.

Figure 2.1 below illustrates the complex value chain for equity trading services, through which market data is jointly produced. Post-trading services, shaded in grey, are a further necessary component for the transfer of ownership of equities from one party to another. A further function of regulated markets, not included in Figure 2.1, are the listing and issuance services provided to companies seeking to raise finance.

Figure 2.1 Trading and post-trading services



Source: Adapted from Oxera (2011), 'Monitoring prices, costs and volumes of trading and post-trading services', prepared for European Commission DG Internal Markets, available at: http://ec.europa.eu/internal_market/financial-markets/docs/clearing/2011_oxera_study_en.pdf.

2.1.2 Information flows in the trading of European equities

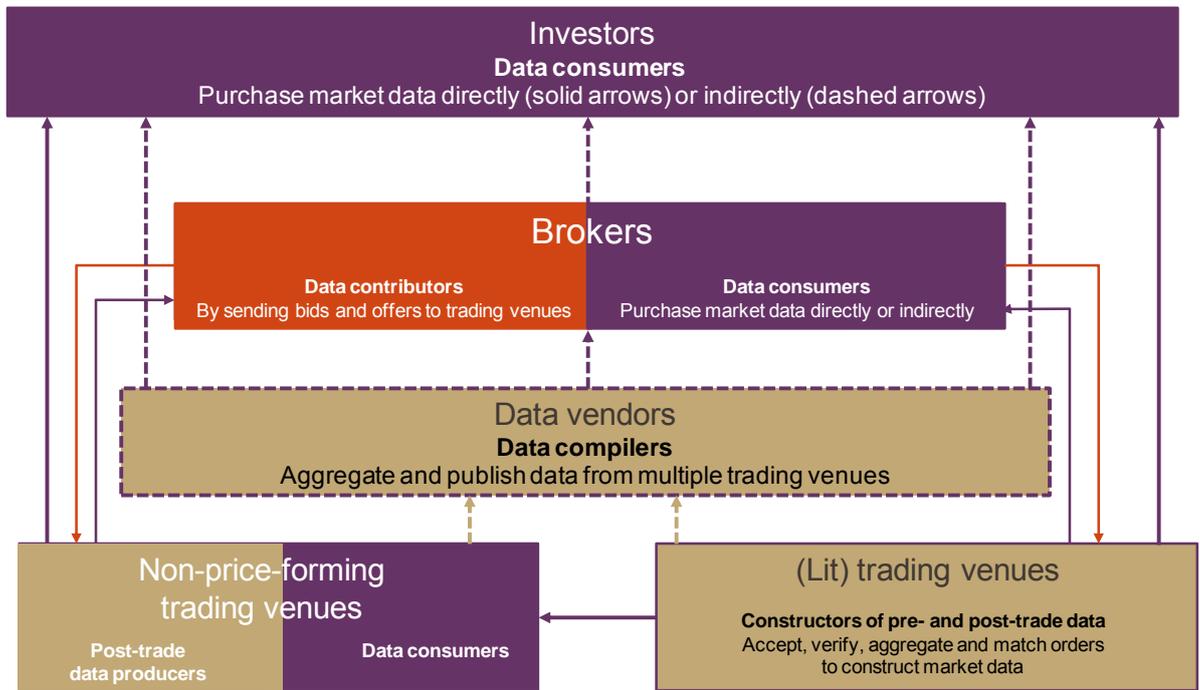
The production and consumption of market data across the trading value chain is complex. Figure 2.2 below sets out the main data flows in terms of the trading instructions sent by investors and brokers (red arrows and shading); the consumption of that data by investors, brokers and other market participants (purple arrows and shading); and the construction of market data by trading venues (through the provision of trade execution services, involving the confirmation and cleansing of bids and offers, matching of bids and offers, and market supervision and surveillance); and the further processing of market data by data vendors (brown shading).

The market data offered by trading venues is only one element in the value chain for market data. Other services include the value-added services offered by data vendors, software applications, and IT infrastructure costs. According to research in 2010,¹⁰ expenditure on IT infrastructure costs (including telecommunications, hardware, network infrastructure and software) accounted for roughly the same amount as expenditure on exchange market data licence fees for sell-side and buy-side firms—exchange market data licence fees were estimated to account for 8% to 15% of customer market data expenditure; IT infrastructure was estimated to account for 10% to 16%; and data vendor services were estimated to account for the remaining 65% to 80%.

¹⁰ Atradia (2010), 'The cost of access to real time pre & post-trade order book data in Europe', August, p. 21.

Market data is often complemented by other sources of information and data to which market participants may have different access, and which they may interpret in different ways. For example, investment decisions typically draw on a broad mix of information sources in addition to market data such as annual reports, financial statements and more general news services.

Figure 2.2 Information flows in the trading of European equities



Source: Oxera.

As explained above, there is significant variation in the use of market data by market participants. Based on Oxera’s interviews with various parties, the main entities producing and/or consuming market data—and their rationale for doing so—can be summarised as follows.

- **End-investors (‘long-term’)**: end-investors with (relatively) long holding periods, such as pension funds, and their agents (eg, fund managers), typically consume market data in the form of transaction data relating to the (execution) price and, possibly, volume. Immediate access (ie, within seconds) to current data is unimportant for most long-term investors. Non-trading data (eg, information about the fundamental characteristics of the entity being invested in) is also likely to be important. Although their actions do not produce market data directly, the instructions that they send to brokers underpin the bids/offers that contribute to market data.
- **End-investors (‘short-term’)**: investors with more emphasis on short-term trading strategies (eg, hedge funds) are likely to need access to more immediate transaction data. As the trading time horizon shortens, the minimum profitable price movement falls, all else being equal.¹¹ The short-term volatility of prices (ie, minute to minute, second to second, and much shorter time periods) observed in the market is, therefore, more important in successful trading strategies executed over a short term than in those executed over a longer time period. This means that the value of access to immediate market data will be higher for this group than for long-term investors. As with long-term

¹¹ As one of the costs of investing is the time cost of capital, the absolute value of profit required to deliver a particular rate of return reduces the quicker that profit can be generated. With no transaction or other costs, buying at 100 and selling at 101 makes an annual return on capital of 240% if it is done every working day, but only 2% if it is undertaken only every six months.

investors, unless this group has direct market access to trading venues it is unlikely that their trading decisions contribute to the production of market data directly. Rather, the instructions they send to brokers underpin the bids/offers that contribute to market data.

- **Brokers:** long-term and, often, short-term investors will interact with a trading venue through one or more agency brokers. The broker takes instructions from the investor (or fund manager) and translates these into instructions and messages (bids, offers and cancellations) to be sent to the venue. This submission of bids, offers and cancellations by brokers to trading venues contributes to the production of market data.

Brokers in Europe have an obligation to provide clients with a 'best execution' policy, an important element of which can be achieving the best possible trade price (lowest, if buying; highest, if selling).¹² Short-term price fluctuations, and knowledge about the availability and volume of counterparties' offers, affect the broker's ability to achieve the best price. This means that not only is immediate market data valuable from a commercial perspective, but immediate market data from (and membership at) multiple trading venues can also be important from a regulatory point of view. Within the EU, except at London Stock Exchange, registered traders at a trading venue can access the trading venue's market data direct from the trading venue, free of licence fees.

- **Principal traders and market makers:** the provision of services that involve traders being counterparties to investors will generally involve short holding periods (or, in the case of high-frequency traders, very short holding periods). In light of the short-term price volatility, immediate access to market data is important to the economics of their activities. In addition, access to market data (and, indeed, non-market data) that allows participants to make successful predictions in relation to short-term price movements enables short- and very short-term trading strategies to be successful. The limited nature of the availability for any particular transaction at a particular (good) price makes the relative time delay between the supply of market data and the receipt of that data by a user also important.¹³ That is, because an order or bid can be filled only once, delayed information can be of less use as, by the time the information is received, the trading opportunity may have passed. The economic value of market data may, therefore, depend on the speed at which it can be obtained and processed relative to the speed at which those competing for the same transaction can obtain and transact it, and being the fastest can have a significant economic value.¹⁴

Like brokers, those sending bid, offer and cancellation messages to the trading venue are contributing to the production of market data.

- **Trading venues:** through the provision of trade execution services, trading venues construct post-trade market data and, in the case of lit trading venues (those with observable price formation), pre-trade market data.
- The process of producing market data is as follows:
 - orders and quotes are submitted by (or under the sponsorship of) registered traders under the rules of the trading venue;
 - trading instructions are accepted in the form of orders (usually detailing price, volume and other characteristics);

¹² Other elements of best execution in Europe may include minimising the total cost of execution (including post-trading fees), likelihood of execution and time of execution.

¹³ The speed with which the recipient can process the data and implement a decision based on that information also affects the value of the information received.

¹⁴ For a description of high-frequency traders (HFT) and high-frequency trading strategies, see Oxera (2012), 'What is the Economic Impact of the MiFID Rules aimed at Regulating High-Frequency Trading?', available at: <http://www.bis.gov.uk/assets/foresight/docs/computer-trading/12-1080-eia21-economic-impact-mifid-rules-high-frequency-trading.pdf>.

- order data is organised, disseminated and displayed to trading participants;
 - order data is matched under the rules of the venue by its matching algorithm and under market surveillance;
 - the anonymised data of the resulting trades is published to the market;
 - personal and enriched data may also be provided to regulators for surveillance purposes, and to post-trade service providers for clearing and settlement purposes.
- **Data aggregators and vendors:** an additional economic activity exists in the aggregation of information from different trading venues into formats that provide enhanced ease of use for market data users—for example, via a vendor terminal or a trader’s front end trading system. In addition, data vendors and independent software vendors (ISVs) may incorporate non-market transaction data (eg, news) into the services they sell and/or additional analytical tools. The services offered by data vendors and ISVs provide market data users with choice over the format and scope of information they wish to receive. In addition to providing consolidated data direct to data users, some vendors also sub-vend consolidated data to smaller vendors to display to their customers.
 - **Non-price-forming trading venues and off-exchange trading:** market data provides a reference price that can be used by other trading venues as an input to the trade execution service they provide (or by traders trading off-exchange). Where a venue is not, itself, price-forming, the reference price is a necessary input to the provision of their trade execution service. The value of immediate data is, therefore, very high for this group.

A number of other individuals and institutions interested in market data are not included in Figure 2.2. From a public policy perspective, companies seeking capital and considering issuance are perhaps most important. Such companies require information on the prevailing stock price and the volatility of stock prices, to establish the potential capital to raise from issuance, for which post-trade information is commonly sufficient.

2.1.3 Different types of market data

An end-user can choose between several types of data and product, and whether they purchase the data directly from trading venues (usually reducing latency) or indirectly via data vendors or brokers (which may also provide analysis software, and combine market data from multiple trading venues but adding latency).¹⁵

The dimensions along which market data products can vary include the following.

- **Depth**—ie, how much information about demand and supply of a particular stock is included in the data product.

The first distinction in terms of depth is between pre-trade data and post-trade data. The former provides information on execution prices and volumes, while the latter includes information on unfilled quotes and orders. Trading venues often provide multiple pre-trade data products that vary in the volume of bids and offers for a particular stock available at a particular time that information is being provided for. Level 1 data products commonly provide information on the last execution price and the BBO available, while level 2 data products also provide information on bids and offers lower down the order book.

- The **speed** at which data is received by the market data recipient.

¹⁵ Legally speaking, the brokers do not purchase market data but purchase a licence to use the market data. In this report, this is referred to as brokers purchasing market data.

'Delayed' data refers to data that is published 15 minutes or more after the publication of the transaction. In line with the MiFID guidelines discussed in sections 1.1 and 5.1, this data is normally provided free of charge by trading venues. Real-time data usually requires payment of data licence fees and can be subdivided into the 'standard' real-time product (which is fast enough for a human user to experience it as real-time) and 'low-latency' connections. The latter are more bespoke and can involve on-site computer location to achieve connections with low millisecond or even micro-second speeds.

- **Coverage** of the number and types of stocks or asset classes captured in the data product.

Market data can be consolidated (or split) in a number of ways, including consolidating information on all equities traded on a trading venue versus splitting out stocks according to (for example) market or listing rules; consolidating market data provided by different trading venues (for example, as provided in Europe by data vendors or via the consolidated tape administrators in the USA); and consolidating across different asset classes (eg, equity and exchange-traded fund data are often provided together by European stock exchanges).

Endogenous to the decision about the data product is the choice of provider. One advantage of purchasing data directly from trading venues can be the speed of delivery, and an advantage of purchasing data indirectly from data vendors can be the consolidation of market data from multiple venues within one analytical interface.

In addition to commercial data products, trading venues also provide surveillance data that is able to identify participants and analyse trading behaviour. This is used internally and by regulators for regulatory and surveillance purposes only. The confidential nature of the information included in such data, such as trader ID information, means that it is not suitable for public dissemination.

2.1.4 Data requirements for different users

Table 2.1 below summarises the typical data requirements of the different market data users, based on the views expressed by market participants, data vendors and data providers who were interviewed during the course of the study.

Depending on the price of data products, some users may, of course, choose to purchase data offering a greater level of detail or coverage than strictly required. For example, since exchanges offer substantial discounts on pre-trade data to retail investors, some may choose to purchase level 1 or level 2 data rather than rely on delayed data that is (generally) free. For example, Euronext offers level 1 and level 2 data to non-professional users for the same price of €1 per user.

Data licensed from a trading venue is not always used to inform trading on that particular platform. For example, a trader on BATS Chi-X Europe may use London Stock Exchange data feeds to inform their strategy when buying and selling, even when the trader does not use the London Stock Exchange platform for trade execution.

Table 2.1 Typical data requirements for different users

User		Purpose (use) of data	Type of data required
Trader—broker, prop trader, HFT, etc	Front office	To execute trades	Real-time (often low-latency) level 2 ¹
	Middle office	Risk, credit and strategy management, including forecasts and some modelling	Generally delayed or real-time level 1, but some activities (eg, testing strategies) can require level 2
	Back office	To monitor and administer settlement and clearing obligations, regulatory compliance (including evaluation of best execution), and reconciliation of trades	Delayed
Market maker		Observing the liquidity and depth in the market to fulfil quoting obligations, generate prices and calculate risk	Real-time (often low-latency) level 2 ¹
Fund manager		Research and strategy, including forecasts and modelling, assessment of brokers and other service providers	Dependent on individual manager. Often, delayed data is sufficient. Some managers may choose to receive real-time data at level 1 or 2 according to their strategy
Retail investor		To assess investment prospects and strategy	Dependent on individual investor. Often post-trade is sufficient
Issuer		To form a correct pricing and demand estimation at issuance; to assess listing venues	Delayed post-trade
Competitor trading venue (MTF, organised trading facility, Dark Pool, Systematic Internaliser)		To inform traders/market makers of pricing on other venues	Real-time level 1 or level 2
		To provide a reference price when the venue does not have its own price discovery mechanism	
		To provide order pegging services—ie, where a trader enters an order that does not contain a price, but the instruction to execute only at a price better than available on other venues	
Indexing (CDS, benchmarks)		To analyse and group companies' risk profiles to form CDS indexes or to form and manage an index	Real-time level 1 or level 2
Market surveillance, regulators and governments		Identify illegal behaviour of participants	Non-public, private information (including Member ID per trade). Not part of the MiFID commercial requirements
Other research/academic		To model markets and market mechanisms, and investigate specific relationships between economic variables	Historical data

Note: ¹ At several European stock exchanges, registered members of the exchange are entitled to free data for trading on the exchange.

Source: Oxera analysis, based on views expressed by market participants, data vendors and data providers.

2.2 Economic framework to assess the pricing of market data services

This section summarises some of the key economic characteristics of the value chain for market data, in particular the role of market data within the broader context of the trading of

European equities, to identify the implications for an economic analysis of the pricing of market data services.

2.2.1 Key economic characteristics of market data services

As set out in section 2.1, the licensing of market data is only one part of a more complex industry that exists to enable companies to raise finance and investors to earn a return on their capital—ie, the European capital markets.

Many consumers of market data are market intermediaries of some sort, and for most of them their main objective is to participate in trading/transactions. As intermediaries, their costs of operation will need to be covered if they are to remain in business and, either directly or indirectly, these costs will have to be (largely) recovered from end-investors and paid out of the returns available to those end-investors.

In addition to often being consumed in combination with trade execution services, market data is produced as part of the trade execution process—a process with high fixed costs, low marginal costs and significant economies of scale.

Exchanges, MTFs and other trading venues have a number of mechanisms by which they can recover their costs (as do other intermediaries in the value chain). In particular, they provide a number of services that are potentially valuable to their customers (and hence will provide a means of raising revenue), including trade execution and market data.

Another characteristic of market data is that different market participants often have very different valuations of what is essentially the same information. For example, a trader wishing to execute a large order in a particular stock will value real-time information on the current depth of liquidity for such a stock across a number of trading venues more highly than a fund manager in the process of developing a long-term investment strategy, or a back-office department tasked with reconciling trades, orders and instructions for which post-trade information may be sufficient.

Market data, like all (digital) information, is also non-rivalrous in consumption. In comparison to (for example) ice cream, one person's consumption of market data does not stop someone else from consuming the same information.¹⁶

2.2.2 Implications for an economic efficiency assessment

The key economic characteristics of market data services, as identified above, have a number of implications.

First, the recovery of costs by a trading venue cannot be assessed effectively by the independent analysis of either trading services or data services. Given the general structure of electronic order books and electronic order matching, it is not possible to provide transaction services without generating market (transaction) data, and it is not possible to generate transaction or bid and offer data without also supplying a transaction service. From an economic perspective, trade execution and market data are joint products and this means that the appropriate frame of reference for the economically efficient recovery of trading venues' costs is at the level of combined transaction revenues and data revenues.

In turn, this means that the economic characteristics of the production of the trade execution service itself is also relevant. Trading venues are characterised by high fixed costs and low marginal costs, and significant economies of scale (see Appendix 2).

¹⁶ However, the economic use of trading data, unlike other types of information, is often limited—this is because the information relates to something that itself has a limited supply. For example, for many purposes, market data on the price and volume of an offer to sell or buy a particular security reduces in value once the offer has been removed or met.

The implication is that the pure competitive outcome—where prices are set at forward looking marginal costs—may not be economically efficient. First, marginal cost pricing would not be sufficient to recover the total cost of production, and therefore trading venues would exit the market. Second, charging the same price to all customers does not account for the different needs and valuations that different types of customers may have.

The next section analyses the way trading venues in Europe currently recover their costs through fees for both trade execution and market data services, and assesses the implications of the current recovery mechanisms for the functioning of the equity markets, and their impact on end-investors.

3 Analysis of the current pattern of cost recovery

This section analyses the current pattern of recovery of costs by trading venues through fees for market data services and fees for trade execution services, on the basis of a number of metrics:

- the fees paid by brokers to license market data services compared with the fees incurred for trade execution services. These calculations are based on an analysis of the pricing schedules of various European exchanges (section 3.1);
- the revenues from market data services as a proportion of combined revenues from market data and trade execution services. These calculations are based on data collected from the participating exchanges and annual reports, and include both European and US markets (section 3.1);
- market data per-user and per-subscriber licence fees, drawing comparisons between fees in Europe and the USA (section 3.2);
- the revenues from market data services as a proportion of combined revenues from market data and trade execution services *over time*, based on an analysis of revenue data and an analysis of fee schedules (section 3.3);
- market data costs as a proportion of the total costs of providing trade execution services (section 3.4).

3.1 The brokers' perspective: exchange market data fees as a proportion of trade execution and market data fees

Most trading venues around the world recover their costs through both trading fees and data licence fees and, if relevant, fees for listing and post-trade services. These fees can be applied on a variable basis (eg, transaction services often attract a fee per transaction or a fee according to the value of the transaction), or on a fixed basis (eg, brokerage firms are often charged monthly or annual membership fees to access the trading services). An exception to this pattern is seen particularly in the process of market entry by new trading venues (for example, the entry of BATS and Chi-X in Europe, and BATS in the USA, where proprietary market data services were initially offered for free).¹⁷

The costs of market data and trade execution services to brokers can be measured based on a user-profile analysis (section 3.1.1) and revenues received by trading venues (section 3.1.2).

3.1.1 User-profile analysis

To analyse the pattern of cost recovery, a user-profile approach can be used, in which illustrative user profiles (in relation to both trade execution and market data services) are designed and subsequently applied to the pricing schedules of different trading venues to give an estimate of the total charges that each user pays.¹⁸

¹⁷ As reported by Inside Market Data (2013), 'BATS Takes Swing at US Market Data Access Fees', April 19th, available at: <http://www.waterstechnology.com/inside-market-data/news/2262915/bats-takes-swing-at-us-market-data-access-fees>, accessed October 18th 2013. Since entry, BATS has received revenues for market data contributed to the US consolidated tapes.

¹⁸ This is a standard approach for estimating the costs of services when the costs incurred depend on the profile of the user, and has been used by Oxera and infrastructure providers in studies of securities trading and post-trading, as well as in studies in other sectors. See, for example, Oxera (2013), 'The Oxera Trading and Post-trading Monitor', note prepared for ASX Group,

Table 3.1 below describes six stylised profiles of brokerage firms active in the European equities market, for which the relative and absolute amount paid in membership, trading and market data licence fees to various European and US trading venues is presented in Figures 3.1–3.4 below.

The average transaction size on SIX Swiss Exchange is considerably higher than on other European stock markets, at about €16,000 in 2012 compared to around €8,000 elsewhere. As SIX Swiss Exchange imposes a minimum fee per transaction, which binds for transactions smaller in value than around €13,000 and €17,000 (according to the monthly value of transactions undertaken by the broker), the analysis presented for SIX Swiss Exchange in Figures 3.1–3.4 below represents the fees paid by brokers, assuming an average trade size of €16,000. This adjustment has been adopted to generate results for SIX Swiss Exchange that are more representative of the fees paid by brokers in this market, as observed from revenue data provided by SIX Swiss Exchange. All other user characteristics are as set out in Table 3.1.¹⁹

Table 3.1 Summary of stylised user profiles active in the European equities market

	'Very active' brokerage firm			'Mid-active' brokerage firm		
Average trade size	€8,000			€8,000		
Number of trades a year	12,500,000			250,000		
Number of level 2 data user licences in a typical month ¹	1,000	650	500	45	25	15

Note: ¹ The number of level 2 data user licences purchased in a typical month has been informed by considering total fees paid for data licences by the top 20 brokers at the participating exchanges, and therefore also includes other data products licensed for the local market.

Source: Oxera analysis of confidential information on the top 20 brokerage firms (by trading volumes), provided by participating exchanges. Brokerage firms trading European equities are a heterogeneous group. These profiles have been informed by confidential data provided by the participating exchanges for a random selection of their top 20 brokers (by trading volumes), with information on the top ten brokers informing the 'very active' profile, and information on the next ten informing the 'mid-active' profile. These profiles should be considered illustrative rather than directly representative, as the core ratio for this analysis (the number of data terminals paid for relative to trading activity) varies widely between different firms and within firms (eg, for different markets) according to their trading strategies and middle office data needs. The range of market data use considered in this analysis has been selected to cover the majority of brokers active within the markets operated by the participating exchanges, but is not intended to be comprehensive.

Figures 3.1 and 3.2 show that there is considerable variation in both trade execution fees and market data fees between different trading venues, with the US trading venues typically offering lower fees than trading venues in Europe. In terms of market data fees, since this analysis does not take into account the cost of purchasing the consolidated tape, total market data costs incurred by brokers may be understated in the USA compared with the EU. Under RegNMS, the consolidated tapes are necessary inputs for any broker who is dealing in NYSE-, Nasdaq- or AMEX-listed equities regardless of whether Level 2 market data products covering the same markets are also purchased. As brokers in Europe are not required to license market data from multiple venues, in both absolute and relative terms, total market data costs incurred by brokers may be understated in the USA compared with the EU.

April; Oxera (2012), 'What would be the costs and benefits of changing the competitive structure of the market for trading and post-trading services in Brazil?', Prepared for Comissão de Valores Mobiliários, June; Oxera (2010), 'Costs of securities trading and post-trading—UK equities', prepared for Euroclear, February 26th; and EuroCCP (2008), 'The Clearing Industry in Europe: Cost Comparison'. For an example of the user-profile approach outside the area of securities trading and post-trading, see Oxera (2006), 'The price of banking: an international comparison—a study prepared for the British Bankers' Association', November.

¹⁹ The average transaction size on Deutsche Börse is around €12,000 and Deutsche Börse also imposes a minimum fee. However the results of the user profile analysis for Deutsche Börse presented in Figures 3.1–3.4 are robust to this smaller change in average transaction size.

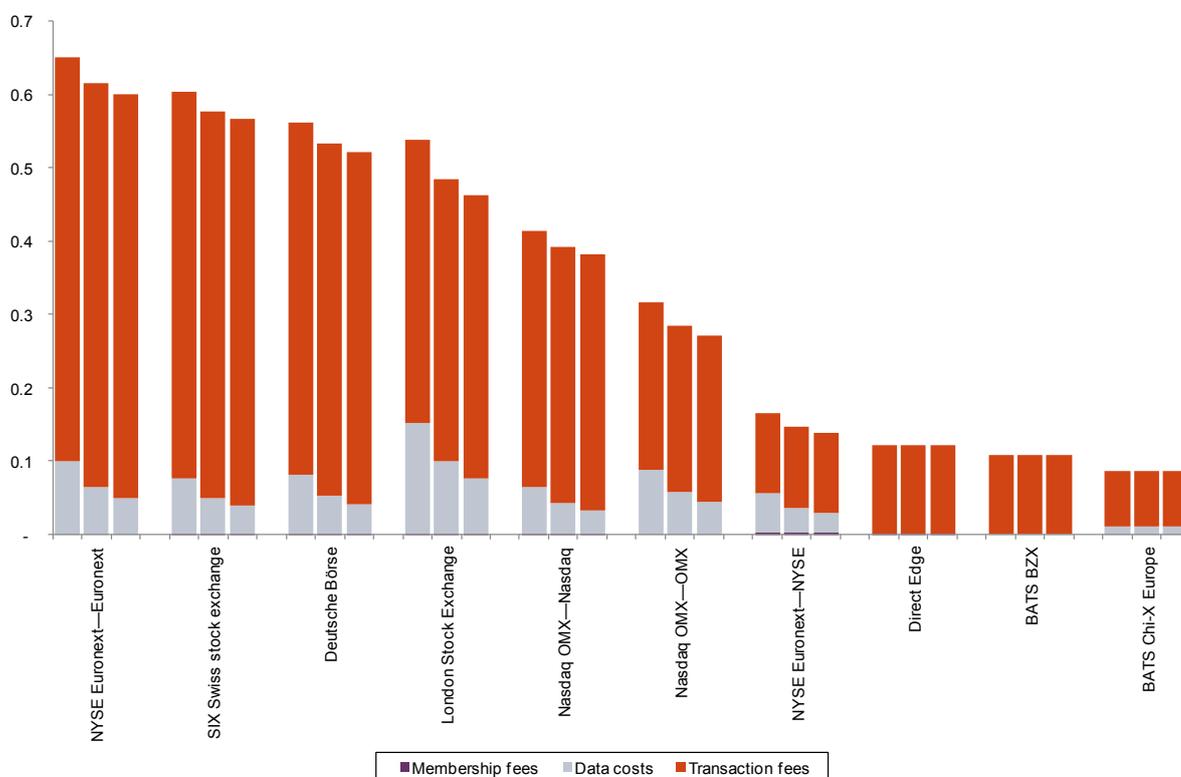
In terms of market data licence fees, as shown in Figure 3.1, large brokers generally pay exchanges between 0.05bp and 0.15bp (of their value of trading) in market data licence fees, compared to between 0.08bp and 0.55bp on trade execution fees and less than 0.01bp on membership fees. Or, as shown in Figure 3.2, market data fees are usually in the range of 10% to 30% of total fees paid to exchanges for trade execution and market data services.

The analysis of the ‘mid-active’ broker presented in Figures 3.3 and 3.4 shows much more variation in both trade execution fees and data fees paid to different exchanges. At some exchanges on both sides of the Atlantic, for this activity of trading (250,000 trades a year, equivalent to an annual value of trading of €2 billion), data fees can account for more than 30% of trade execution, membership and market data fees combined. This is not surprising given the fixed-cost nature of market data fees: the relative importance (but not absolute level) of data fees increases for brokers executing fewer trades. This is particularly evident for trading venues that charge on a per-firm rather than a per-user or per-device basis, for example, BATS Global Markets, Direct Edge and Bats Chi-X Europe.

In sum, market data costs as a proportion of total costs (in relation to trade execution and market data services) clearly vary and will depend on the profile and needs of the individual broker. Generally speaking, large brokers will pay a lower unit price for market data services than medium brokers—however, due to the very substantial discounts often available to retail investors, retail investors typically pay a much lower unit price for market data services than institutional investors.

The next section looks at the *average* ratio of market data costs to total costs (ie, in relation to trade execution and market data services) across the market, based on revenue data from exchanges.

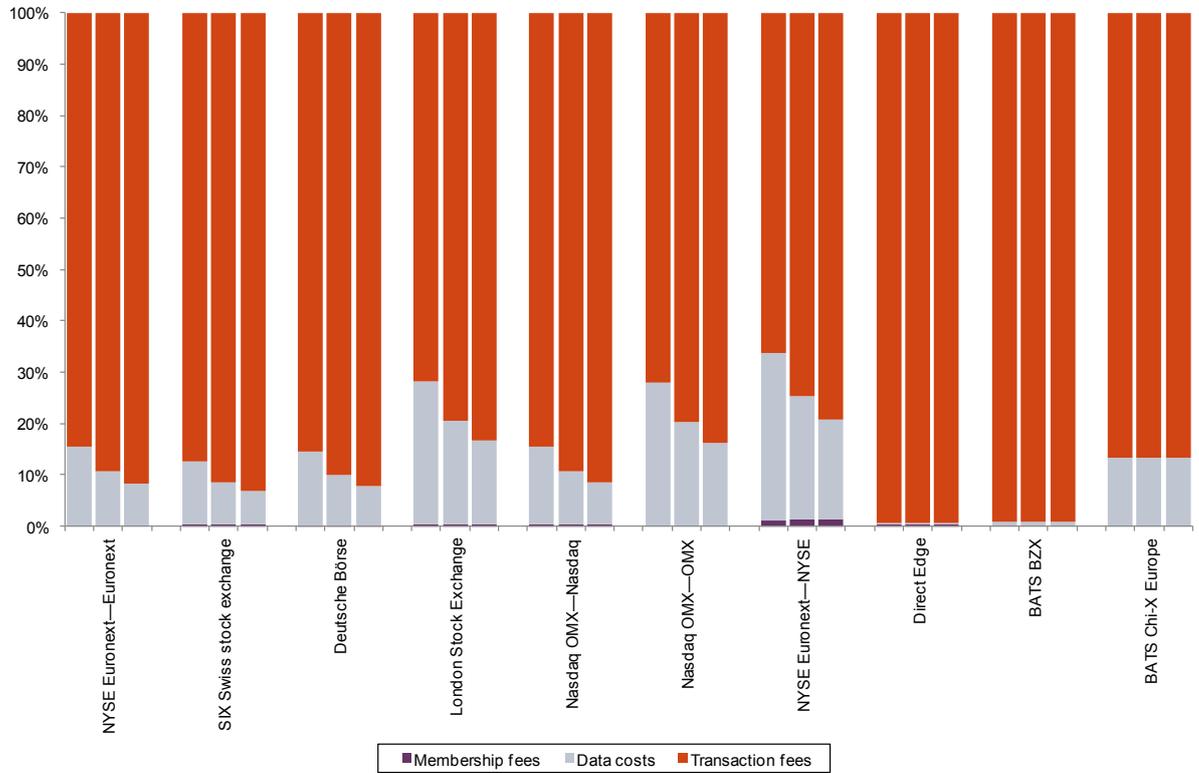
Figure 3.1 Membership, trading and data licence fees as a proportion of transaction value, for an illustrative ‘very active’ brokerage firm (basis points)



Note: The three columns presented for each stock exchange represent the fees paid by the ‘very active’ brokerage firm with decreasing data needs. The first column corresponds to the first profile in Table 3.1, in which the firm is assumed to purchase 1,000 level 2 data user subscriptions a month; the second column corresponds to 650 level 2 data user subscriptions a month; and the third column corresponds to 500 level 2 data user

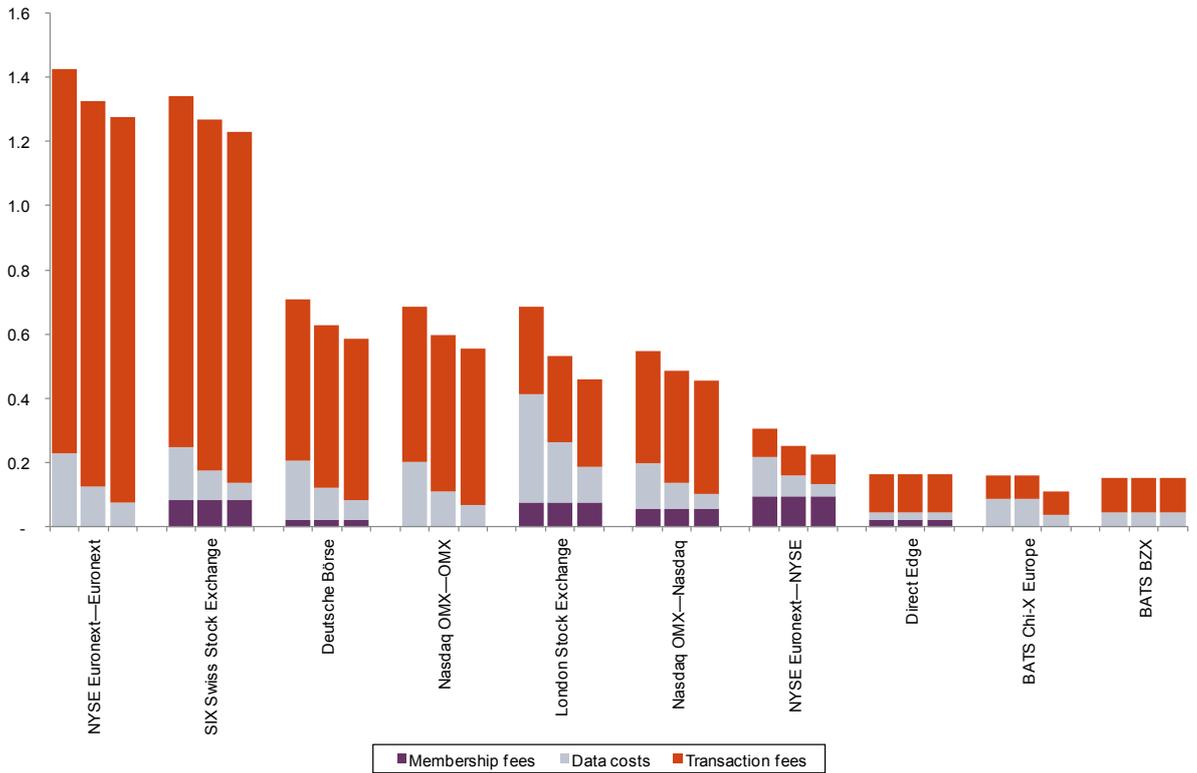
subscriptions a month. Market data fees are based on the per-user or per-device fees charged. Transaction fees include fees charged on a per-transaction or per-value-of-a-transaction basis. Fees paid are estimated for a typical month, such that annual membership and access fees are divided by 12, and trading fees are calculated assuming there are 21 trading days per month. For Deutsche Börse, a market data product that offers BBO 10 is used. For all the other exchanges a full order book product is used.
 Source: Oxera analysis of stock exchange pricing schedules.

Figure 3.2 Relative amounts spent on membership, trading and data licence fees, for an illustrative ‘very active’ institutional brokerage firm



Note: See note to Figure 3.1.
 Source: Oxera analysis of stock exchange pricing schedules.

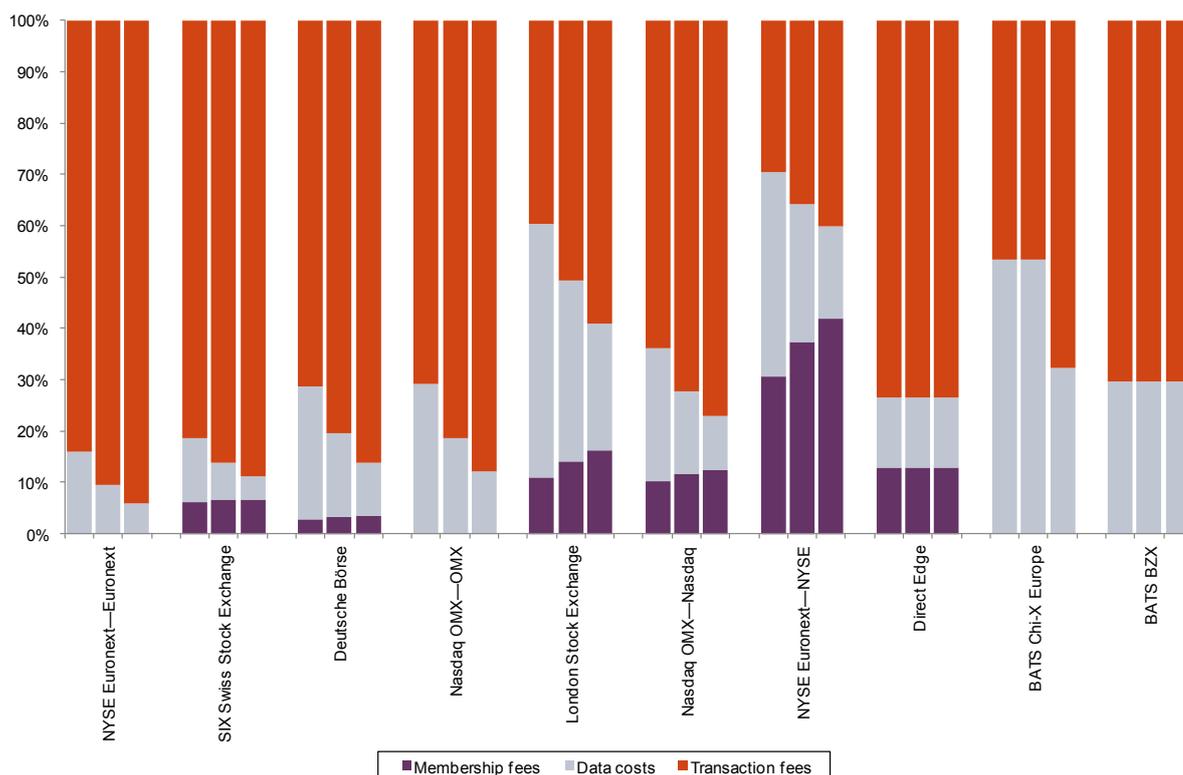
Figure 3.3 Membership, trading and data licence fees as a proportion of transaction value, for an illustrative ‘mid-active’ brokerage firm (basis points)



Note: The three columns presented for each stock exchange represent the fees paid by the ‘mid-active’ brokerage firm with decreasing data needs. The first column corresponds to the fourth profile in Table 3.1, in which the firm is assumed to purchase 45 level 2 data user subscriptions a month; the second column corresponds to 25 level 2 data user subscriptions a month; and the third column corresponds to 15 level 2 data user subscriptions a month. For other notes, see note to Figure 3.1.

Source: Oxera analysis of stock exchange pricing schedules.

Figure 3.4 Relative amounts spent on membership, trading and data licence fees, for an illustrative ‘mid-active’ brokerage firm



Note: See note to Figure 3.3.

Source: Oxera analysis of stock exchange pricing schedules.

3.1.2 Relationship between market data service revenue and trade execution service revenue

Table 3.2 sets out the relationship between revenues generated directly from trading services and revenue from the provision of market data services for a number of large US and European trading venues, based on data collected from the participating exchanges. It shows that revenues from market data services account for between 15% and 35% of total revenues (where total revenues is the sum of revenues from data services and trade execution services).

Table 3.2 Relationship between market data service revenue and trade execution service revenue (2012)

Trading venue	Market data revenues as a proportion of total revenues (ie, market data and trade execution revenues)
Deutsche Börse	35%
Nasdaq OMX—OMX market	28%
NYSE Euronext—Euronext market	20%
SIX Swiss Exchange	19%
Nasdaq OMX—Nasdaq market	23–29%
NYSE Euronext—NYSE market	14%

Note: The US exchanges are highlighted by shading. The market data revenues reported focus on the revenues from the sale of equity market data, and in general exclude revenues from technology services, index licensing, sales of non-equity data products, and the sales of news and other non-market data-type information. In the case of SIX Swiss Exchange and Deutsche Börse (where equity, ETFs and fixed income market data are sold as an overall cash market product) and Nasdaq OMX (where revenue data was sourced from the annual report), market data revenues include revenues from the sales of non-equity data products. Trade execution revenues include trading fees and membership fees and are net of transaction-based rebates (eg, where the trading venue offers

rebates to liquidity providers). In the case of SIX Swiss Exchange, Deutsche Börse and Nasdaq OMX, where market data revenues include revenues from non-equity data sales, transaction revenues from the relevant asset classes were also included.

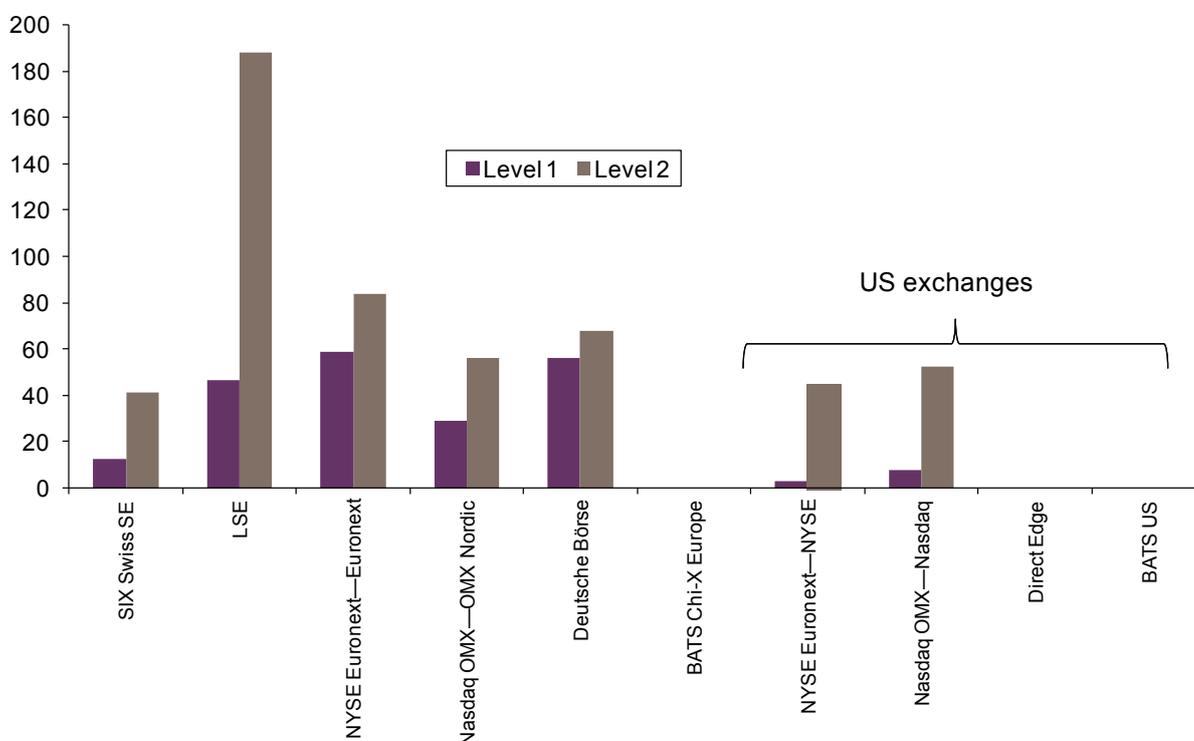
Source: For the following exchanges, market data revenues and trade execution revenues were provided directly by the exchange and verified against annual reports: Deutsche Börse, NYSE Euronext and SIX Swiss Exchange. Data for Nasdaq OMX was sourced from annual reports.

3.2 Comparing the EU with the USA—economies of scale

When expressed in *absolute* amounts, another pattern is clear—European trading venues are typically more expensive for both trading services and data services. This is shown in Figures 3.1 and 3.3, which order the exchanges according to total fees paid by brokers—only BATS Chi-X Europe falls within the range of fees charged by US exchanges.

Figure 3.5 below sets out the licence user (device) fees for a selection of European and US exchanges' level 1 and level 2 market data products, further illustrating the difference in licence fees between the USA and the EU. This finding is not particularly surprising, given the economies of scale present in trading venue operation (see Appendix 2).

Figure 3.5 User (device) fees for direct licensing of level 1 and level 2 products (€)



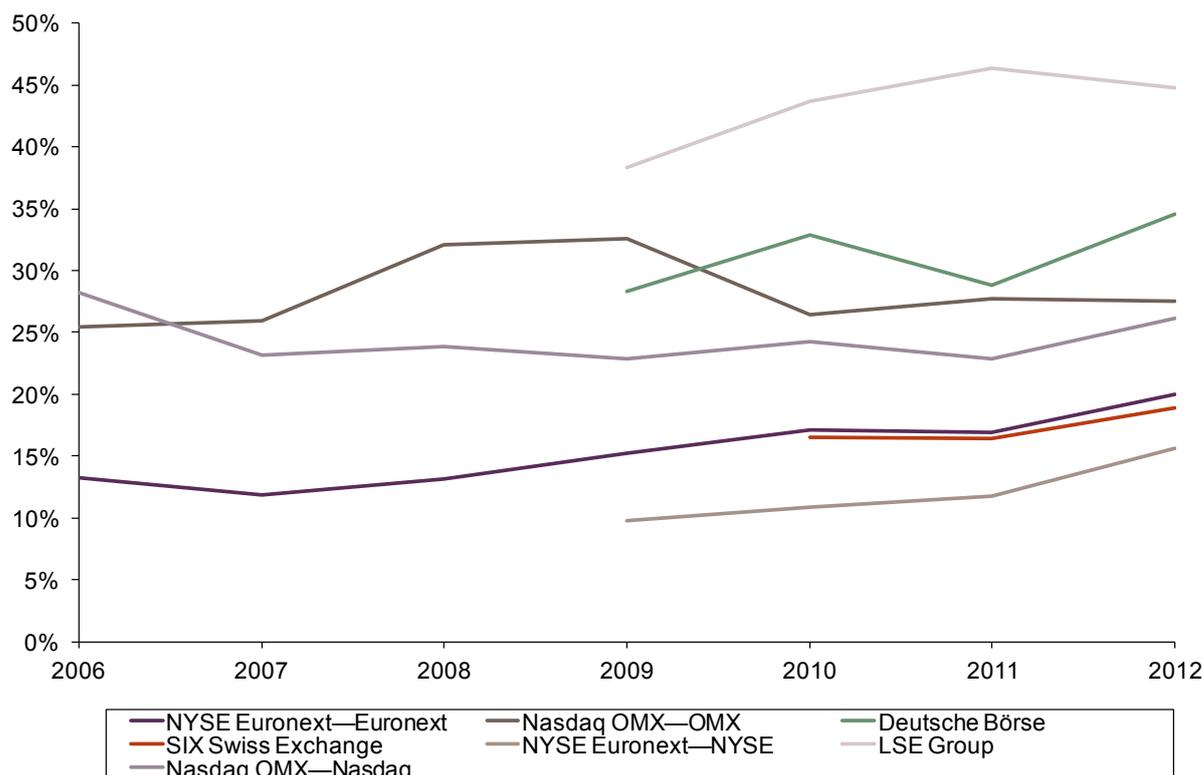
Note: The level 1 product includes the BBO. The level 2 product includes the best ten bids and offers. NYSE Euronext and London Stock Exchange currently do not offer a level 2 product as defined here (BBO 10), so the fee for the full order book product is used instead. For Nasdaq OMX—Nasdaq, the full order book product (Nasdaq Totalview) is used, as the level 2 product is market maker prices only. For SIX Swiss Exchange and Deutsche Börse, the fees reflect the fees for the overall cash market data products. The licence fees reported are as charged for non-members for local equities data. For the following exchanges, the chart depicts the per-user fee: SIX Swiss Exchange, NYSE Euronext—Euronext, and NYSE Euronext—NYSE; and for London Stock Exchange and Deutsche Börse the chart depicts the per-device fees. Nasdaq OMX charges on a per-subscriber basis. Data access fees are not included and are charged by the following exchanges as follows: Direct Edge (€375 for level 2 data), and BATS US (€750 for level 2 data). For BATS Chi-X Europe, access fees increase with the number of users in a firm, from €149 to €9,545 for level 2 data.

Source: Oxera analysis of the most recent available stock exchange pricing schedules.

3.3 Revenues from market data services over time

Figure 3.6 presents the revenues earned from market data services as a proportion of combined revenues from market data and trading services (including membership and access fees). This shows that, over the last four to seven years in both the USA and Europe, market data revenue has been between around 10% and 45% of trading and market data revenues combined. This is consistent with previous research on market data revenues in the USA, which found that, in 2004, market data revenues constituted 10% to 20% of total revenues (ie, more than just trading and market data revenues combined) for US exchanges.²⁰

Figure 3.6 Proportion of trading and market data revenue attributed to market data revenues



Note: For the following exchanges, market data revenues and trade execution revenues were provided directly by the exchange: Deutsche Börse, NYSE Euronext, and SIX Swiss Exchange. Data for Nasdaq OMX and London Stock Exchange Group, which includes London Stock Exchange and Borsa Italiana, has been sourced from their annual reports and, in the case of Nasdaq OMX, includes revenues from derivative trade execution services and market data.

Source: Oxera analysis of data provided directly by participating exchanges, and annual report data.

Figures 3.7–3.9 summarise how licence fees for different types of market data products have changed since 2005, and show that, in general, fees have not increased significantly (particularly once inflation is taken into account). Faster or more detailed market data products have been introduced for which higher fees are charged, and this may have resulted in an increase in costs to some brokers and/or other data users.

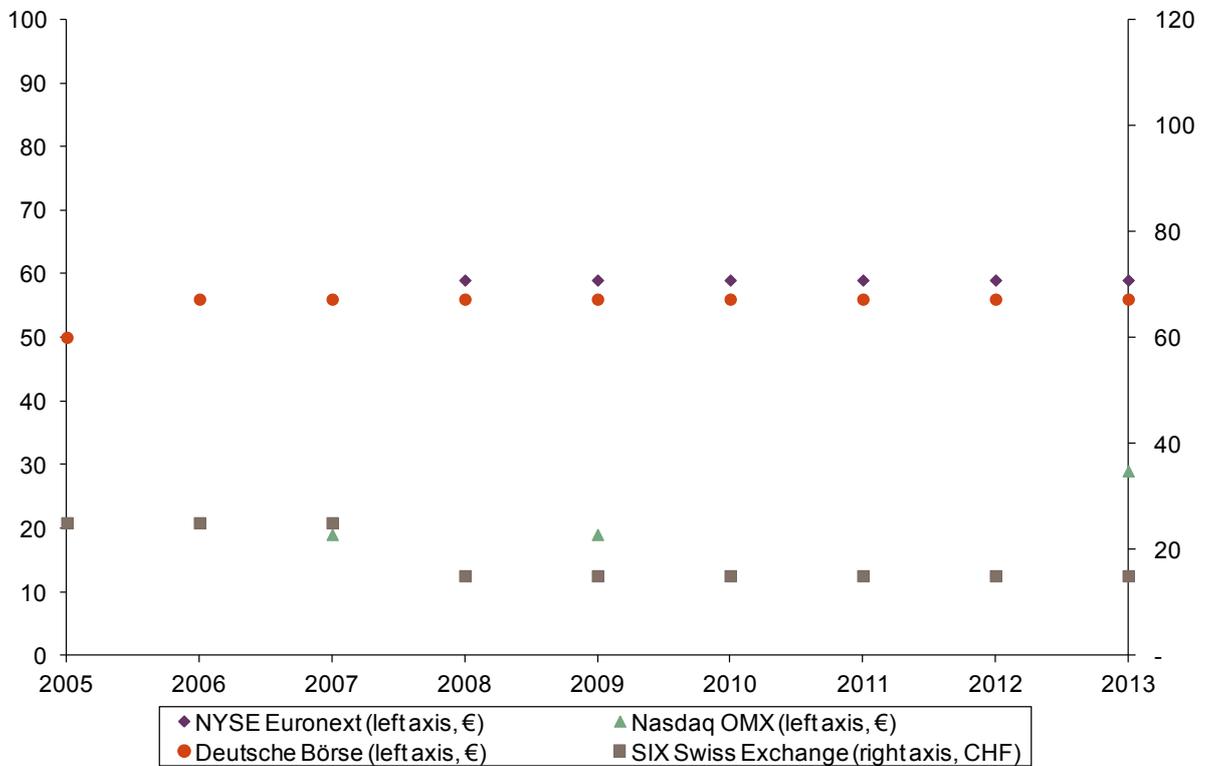
There are some exceptions to this general trend, and some trading venues have increased their fees for market data services at a time where revenues from trade execution services

²⁰ Caglio, C. and Mayhew, S. (2008), 'Equity Trading and the Allocation of Market Data Revenue', Feds Working Papers 2012-65, Federal Reserve Board.

have been falling (due to lower trading volumes). At such exchanges, the proportion of revenue accounted for by market data services can be expected to increase.

Figure 3.7 considers a benchmark level 1 product, defined to include the last price and BBO available, and shows a mixture of trends: one exchange charges the same fees as in 2008 when the product was introduced; two exchanges have increased their fees, one significantly from €19 to €29; and the fourth has reduced its fees from CHF25 to CHF15.

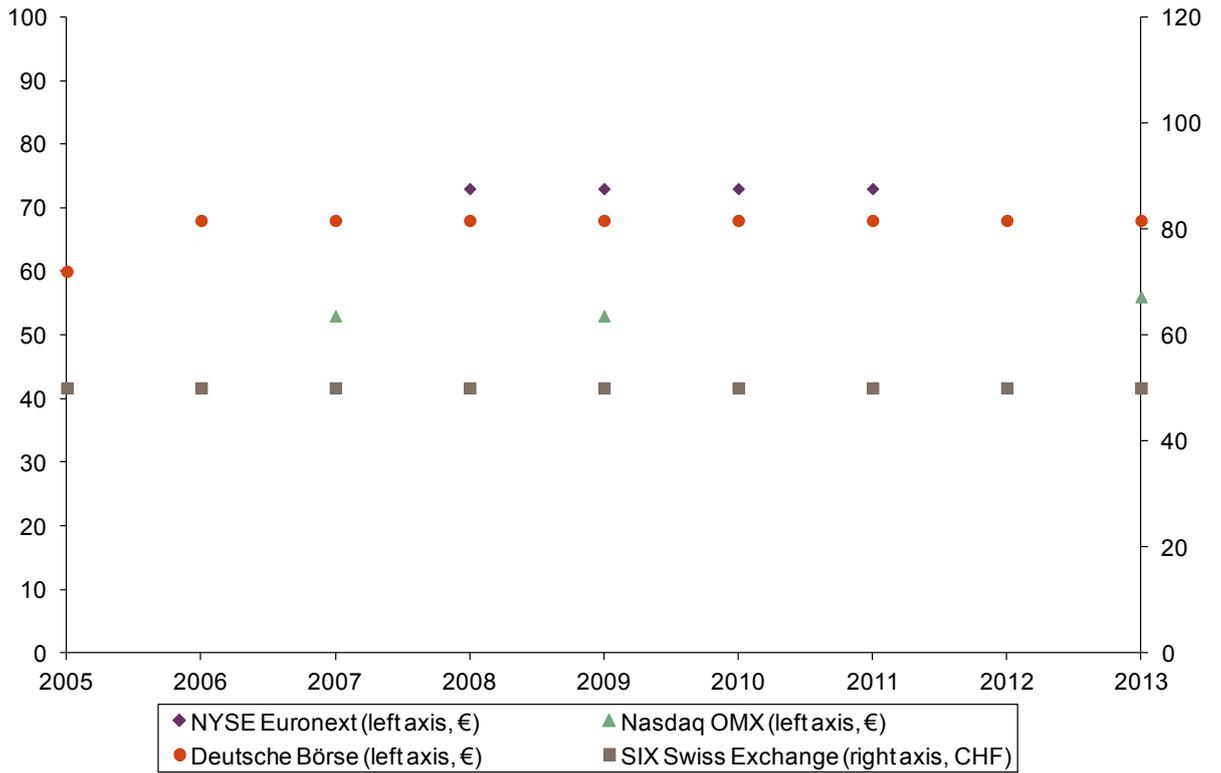
Figure 3.7 Fees for a level 1 data product (local currencies)



Note: The fees are in nominal terms, in the local currency. The left vertical axis is in euros (€), the right vertical axis is in Swiss Francs (CHF). The scale of the left and right vertical axis have been chosen to approximately reflect the 2013 €-CHF exchange rate and held constant across Figures 3.7 to 3.9.
Source: Data provided by the participating exchanges.

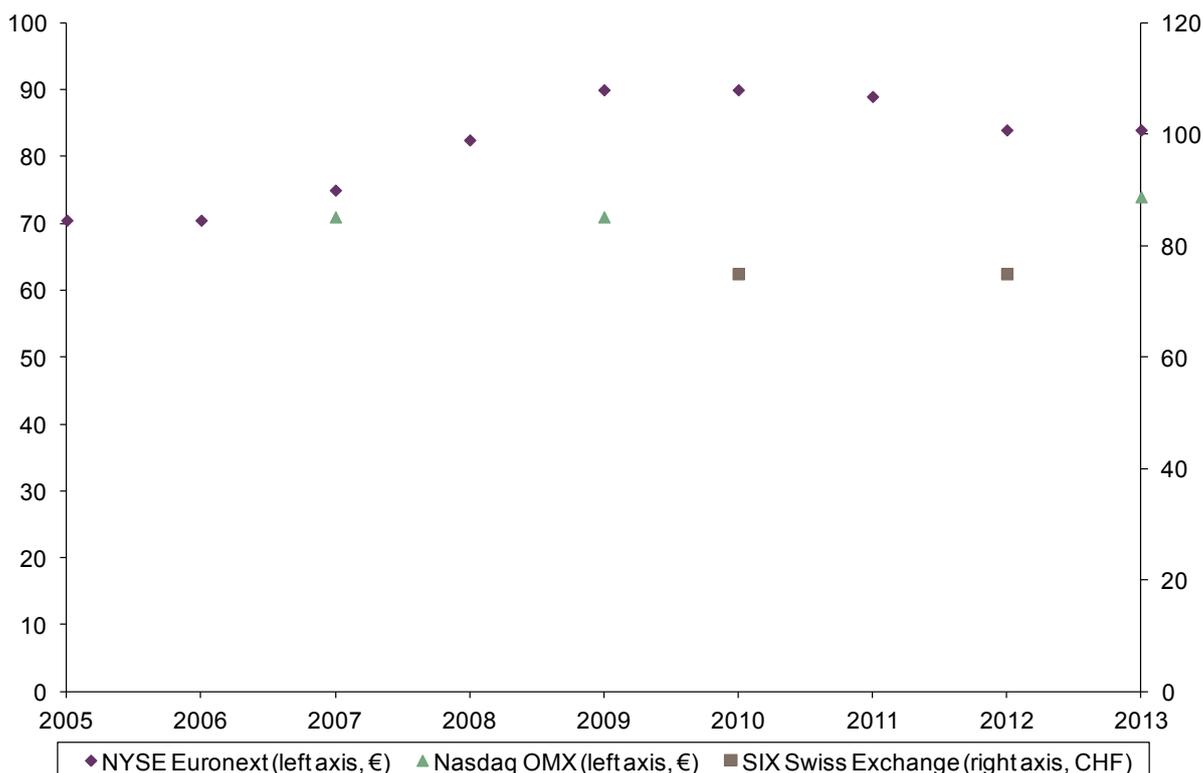
Figure 3.8 presents the fee changes for a benchmark level 2 product, defined to include the last price and best ten or five bids and offers, and Figure 3.9 presents the fee changes for the full order book. Except for a small increase in 2006 by one exchange, the price of the benchmark level 2 market data products considered here have not changed, as shown in Figure 3.8. Figure 3.9 shows that more detailed, and more expensive, market data products have been introduced, the fees for which have, in some cases, varied over time.

Figure 3.8 Fees for a level 2 data product (local currencies)



Note: Due to the differences in the range of data products offered by the participating exchanges, for NYSE Euronext, SIX Swiss Exchange and Deutsche Börse the level 2 product includes the last price and the best ten bids and offers, while for Nasdaq OMX the level 2 product includes the last price and the best five bids and offers. After 2011, NYSE Euronext removed its partial level 2 data product, so the data series ends. The fees are in nominal terms, in the local currency (the left axis is in €, the right in CHF).
 Source: Data provided by the participating exchanges.

Figure 3.9 Fees for the full order book (local currencies)



Note: Deutsche Börse does not provide a complete full order book product for all equities listed on its exchange, and is therefore excluded from the chart. The fees are in nominal terms, in the local currency (the left axis is in €, the right in CHF).

Source: Data provided by the participating exchanges.

This analysis suggests that the pattern of cost recovery from market data services and transaction services has not changed significantly over time in the financial centres analysed in this report.

To understand the potential impact of any increases in costs on the functioning of the market for equity trading, the market data costs need to be compared with the total costs of trade execution services. This is covered in the next section.

3.4 The end-investors' perspective: exchange market data fees as a proportion of total costs associated with trading and holding securities

Nearly all trading and market data services will, in the end, be paid for by end-investors. This is because intermediaries that supply trading services to their clients will consider trading and market data services as inputs, and will need to recover the cost of such inputs from their customers if the activity is to remain economically viable. Ultimately, the cost of market data will thus be passed on to end-investors.

One way to generate a rough estimate of the significance of data costs to end-investors is to compare the total revenues earned by a stock exchange from equity market data services to the total market capitalisation of stock traded on such an exchange. The main end-

consumers of a particular stock exchange's market data are likely to be those investors holding the market capitalisation of stocks traded on the exchange.²¹

Table 3.3 below summarises the results for a selection of European and US exchanges, and suggests that market data costs represent less than 0.01% of the value of an investor's assets under management.

Table 3.3 Market data revenue as a proportion of market capitalisation

Trading venue	Market data revenue as a proportion of market capitalisation of stocks traded on the exchange (%)
Deutsche Börse	0.005
NYSE Euronext—Euronext	0.003
SIX Swiss Exchange	0.003
London Stock Exchange Group	0.005
NYSE Euronext—NYSE	0.001

Note: Nasdaq OMX has been excluded due to unavailability of data. London Stock Exchange Group includes London Stock Exchange and Borsa Italiana.

Source: World Federation of Exchanges statistics; data provided directly by Deutsche Börse, NYSE Euronext and SIX Swiss Exchange; and London Stock Exchange Group 2012 annual report.

Another approach to estimating the significance of market data costs to end-investors is to consider the amount spent on market data by each of the intermediaries supplying trading and investment services to a typical (institutional) end-investor, and compare this to the total cost of the services charged to the fund by each intermediary.

There are three types of intermediary providing services to end-investors that are likely to incur relatively material market data costs:

- **fund managers**—who determine the investment strategy on behalf of the end-investor and require market data to inform these decisions;
- **brokers**—who execute the trading decisions on behalf of the fund and require market data to identify where and when to submit bids and offers to achieve best execution;
- **market makers**—who are often counterparties of end-investors and require market data in order to make successful predictions in relation to short-term price movements, in order for their short-term trading strategies to be successful.

The following bullets consider the significance of market data fees to the total cost of services provided to end-investors by each of these intermediaries.

Proportion of fund management costs accounted for by market data costs

- Fund management fees vary significantly, but management fees for pension funds (for example) are typically in the range of 0.3% to 1.5% of assets under management per annum.²²
- As set out in section 2.1, according to whether the end-investor has a short or longer holding period, the market data requirements of their fund managers may vary.

²¹ This can be considered to be an upper bound, because some of the data purchased from an exchange will have been used to inform the decision *not* to purchase the listed equities, and thus be borne by investors whose assets are not included within this particular stock exchange's market capitalisation.

²² ABI (2006), 'How to evaluate alternative proposals for personal pension accounts', report prepared by Oxera, October.

However, generally speaking only (real-time) level 1 data is required, and sometimes delayed data (which is often available free of charge) is sufficient, such that market data costs are unlikely to account for a significant proportion of the total management charge.

- A rough estimate of the cost of market data to fund managers can be calculated by comparing the revenues that exchanges earn from sales of level 1 data products to professional users against the market capitalisation of the stocks traded on such exchanges. Although this excludes the fees incurred by fund managers for level 2 data licences, not all level 1 data fees will relate to fund managers managing the assets included within the exchange's market capitalisation, and therefore this approach is expected to give a fair indication overall of the order of magnitude of data costs to fund managers. Based on data provided by the participating exchanges, this approach estimates that the annual market data costs to fund managers are less than 0.001% of the funds under management.

Proportion of brokerage and market maker costs accounted for by market data costs

- An execution-only brokerage service in Europe was in the region of 2bp in 2010,²³ and in 2012 the (implicit) cost of market makers to end-investors was in the order of 30–40bp of the end-investors' transaction values.²⁴
- The proportion of the brokerage commission and market maker costs accounted for by market data fees can be estimated by comparing the market data licence fees associated with an individual trader within a brokerage or market maker firm against other significant costs associated with employing each trader, such as salaries, bonuses, tax, rent and IT equipment. In the case of market makers, there will also be the costs associated with the use of the firms' capital to provide the market making service.
- In terms of market data costs, as reported in Table 5.2, the per-user (device) licence fees for level 2 data from the five largest European stock exchanges total €474 per month. This implies that the total data licence cost per trader employed is around €5,700 per annum.
- According to various recruitment company surveys, typical salaries for traders with three to seven years' experience are around €55,000 to €120,000 per annum, with the potential for bonuses of 30–100%.²⁵ Salaries at this level suggest that €150,000 is a conservative estimate for the total non-market data costs associated with employing each typical trader (ie, non-market data costs associated with each trader could be much higher), which in turn implies that market data costs account for approximately 1–5% of the total costs of operating as a broker. Taking account of other costs incurred by market makers, in particular the costs associated with the use of the firms' capital to provide market marking services, the proportion of their costs represented by market data services will be lower (in the order of 1–3%).

Table 3.4 below summarises this analysis of the breakdown of charges passed on to end-investors, and shows that annual market data fees are unlikely to account for more than 5% of any of the fees imposed on a fund.

²³ Oxera (2011), 'Monitoring prices, costs and volumes of trading and post-trading services', report prepared for European Commission DG Internal Market and Services, May. These services do not include research or 'working-on-the-trade'.

²⁴ ITG (2013), 'ITG's Global Cost Review: Q1 2013', available at: <http://www.itg.com/2013/07/30/itg%E2%80%99s-global-cost-review-q1-2013/>.

²⁵ See, for example, Robert Half Financial Services (2012), '2013 salary guide: your business and recruitment handbook'; and Michael Page Financial Services (2013), 'Financial services salary survey 2013: front office banking, markets & asset management'.

Table 3.4 Overview of the significance of market data costs to other costs incurred by end-investors

Service provider	Activity provided	Typical fees (or impact) ultimately charged to (or paid by) end-investors	Proportion of fee attributed to market data
Fund manager	Management of fund	0.3% to 1.5% of assets under management	<0.001%
Broker	Execution of trades	2bp of value of trading	3–5%
Market maker	Counterparty to (some) trades	30bp to 40bp of value of trading	1–3%
Trading venue	Matching of trades	0.5bp of value of trading	0%
Clearing member and custodian	Clearing and settlement of trades, and management of assets	3bp of assets under management	0%
CCP	Clearing of trades	0.12bp of value of trading	0%
CSD	Settlement and custody of assets	0.17bp of assets under management	0%

Source: Oxera analysis.

To draw all these cost estimates together and compute an estimate of the significance of total market data costs imposed on a fund by each service provider requires an assumption about the turnover of the end-investor’s fund. Suppose this is 50%—ie, that the end-investor changes 50% of the assets it holds in a year, and therefore has the same value of trading each year as the value of its assets under management. In this case, fees charged based on the value of trading and assets under management are of equal significance and, based on the typical fees set out in Table 3.4, total costs incurred by a fund are in the range of 0.6% to 2% of assets under management (or the annual value of trading), of which 0.2–1.5% are accounted for by annual market data fees received by trading venues (or less than 0.01% of assets under management or annual value of trading).

The precise relationship between market data fees and the total costs incurred in making a transaction will vary depending on the investment style (and other factors) adopted by the end-investor or fund manager. However, taking both a top-down (see Table 3.3) and bottom up approach (as described directly above Table 3.4), the annual market data fees received by trading venues are likely to account for less than 2% of the total annual costs of trading in, and holding of, securities incurred by investors.

3.5 Conclusion: impact of current pricing schedules on market outcomes for end-investors

Competition in the markets for fund management, market making and brokerage services keeps the fees charged by intermediaries for such services in line with the costs incurred in providing these services. This means that any change in the cost of providing such services—for example, an increase in market data licence fees—will be passed on to end-users in the form of higher fees charged by intermediaries for these services.

Changes in fees for market data and trading services may affect the demand for these services. However, given the relatively small proportion of the total costs represented by market data charges (as shown in the analysis above), it would seem unlikely that, at a general level, changes in the licence fees for market data will significantly affect the overall level of activity of trading.

However, this is not to say that a different balance between market data service fees and the fees for trade execution services provided by trading venues would have no impact on either

end-users or other intermediaries. The next section looks at what would happen were trading venues to implement different pricing structures.

4 Potential impact of different pricing structures

The analysis presented in section 3 shows that the current pricing pattern observed in Europe and the USA is for trading venues to recover around 15–35% of their total trading venue costs through fees for market data. The analysis in this section considers the potential impact of different pricing structures on market outcomes.

4.1 Conceptual framework

Since the full implementation of MiFID in late 2007, and the breaking up of the monopoly of national exchanges, the provision of trading services for European equities has become a competitive market. For most European equities, multiple markets are competing for liquidity. Even where only one provider currently exists, the low barriers to entry as evidenced by the successful entry of a number of new trading venues (eg, Chi-X, BATS Global, Turquoise), and thus the credible threat of new entry, imposes competitive constraints on the incumbent (see Appendix 2.2 for a summary of the recent competition authority findings in this regard).

The competitive pressure in the market means that any reduction in market data fees by trading venues can be expected to result in higher fees for some of the other services they provide (or a worsening in quality of service). In the absence of any 'super-normal' profits, total revenue cannot be reduced and therefore any reduction in market data fees will result in a compensatory increase in other services provided by trading venues.

The other services that trading venues provide, for which fees could potentially be increased to compensate for a reduction in market data fee revenues, can be categorised into:

- services that **are not** closely related to the provision of trading—eg, the provision of exchange software to other trading venues, or the provision of broker software services; and
- services that **are** closely related to the provision of trading—eg, trading fees, membership fees, and co-location fees.

If the services not closely related to the provision of trading are provided in competitive markets, with a significant number of suppliers that are not also trading venues, then trading venues will not be able to increase their fees and continue to compete in the markets for these services. This is because consumers would simply switch to the non-trading venue providers, which are able to offer lower fees.

This, in turn, means that the impact of any change in the price of market data services will be felt in the market for trade execution services, since in this market all suppliers are trading venues and therefore all will experience the same cost shock should (for example) market data fees be artificially lowered.

In this context, when considering whether to restrict the price of market data fees, it becomes relevant to focus on assessing the welfare implications of a system-wide re-focusing of recovering the costs of trading away from market data fees and towards trading fees. The impact of such a re-balancing of trading venue fees can be analysed in relation to the following aspects:

- the potential direct effect on the purchasers of market data and trading services (considered in section 4.1.1);

- the potential indirect effect on price efficiency (considered in section 4.2) and trading volumes (considered in section 4.3).

4.1.1 **The potential direct impact on purchasers of market data and trading services**

One general feature is that the number of customers purchasing market data services will tend to be higher than the number purchasing transaction services. This is because it is likely that anyone who purchases trading services will also purchase market data services, while there are a number of customer groups who will purchase market data services but who do not directly purchase trading services or other related services for which an exchange charges a fee—such as fund managers and middle office staff.

As a result of there being a higher number of customers purchasing market data services than trading services, reducing market data fees and increasing trade execution fees will tend to leave those paying for both services (eg, primarily brokers) paying, in aggregate, more to trading venues, while those who use only market data services will pay less. This is because a larger proportion of costs are now being recovered through trading fees, for which there is a smaller consumer base. This distributional effect is particularly the case for direct members of an exchange, for whom registered traders are entitled to level 2 market data free of licence fees when accessed via the trading platform.

The change in the structure of trading venue prices is also likely to have a differential relative effect within different customer groups. For example, a shift to lower market data fees can be expected to put firms that use a lot of market data but make relatively few transactions (ie, traders who focus on identifying trading opportunities with particularly expected returns) at a potential cost advantage compared to the status quo.

Ultimately, different patterns of consumption of different services provided by the trading venues will mean that a shift to lower data fees and higher trading fees will create both winners and losers, in terms of the total fees paid to those venues. However, the general pattern will be that those purchasing both transaction services and market data services will be worse off, while those purchasing just market data will be better off.

4.2 **The impact on market efficiency of charging for market data**

Another potential context in which to consider market data is the possibility that it brings wider benefits to financial markets as a whole, and that wider and/or cheaper dissemination of market data would further fulfil the transparency and efficiency objectives of MiFID.

There is some economic literature about the impact of charging or not charging for market data services on market efficiency. Easley, O'Hara and Yang (2013) find that, within their model, charging for market data can increase the cost of capital and volatility, worsen market efficiency and liquidity, and discourage the production of fundamental information relative to a world in which all traders freely observe prices.²⁶

This conclusion is sensitive to the assumptions in their model. Using a different structure for the release of information to the market, Cespa and Foucault (forthcoming) find the opposite conclusion—namely, that market data is over-consumed when offered free of charge, and average welfare is maximised when investors pay for data.²⁷ They show that this efficient outcome is achieved by a for-profit exchange charging for data. The authors allow a group of homogeneous investors to receive a private signal of the value of an asset and pay to receive real-time price data, or to receive a delayed price data free of charge. In contrast,

²⁶ Easley, D., O'Hara, M. and Yang, L. (2013), 'Differential Access to Price Information in Financial Markets', Johnson School Research Paper Series no. 11-2011.

²⁷ Cespa, G. and Foucault, T. (forthcoming), 'Sale of Price Information by Exchanges: Does it Promote Price Discovery?', *Management Science*, available at: <http://www.esrc.ac.uk/my-esrc/grants/RES-000-22-4653/outputs/Download/bb740b1f-acd6-4586-8f7e-14c08ef24730>.

Easley, O'Hara and Yang's model relies on two groups—'rational' traders and 'liquidity' traders—interacting in a market where they must choose to pay for price data to submit orders conditional on the market price, or must trade based on their private value signal alone.

The contrasting conclusions of these two studies characterise the general theme of the relevant literature: that there is not sufficient evidence to draw a conclusion on the relationship between the efficiency of markets and the pricing of market data from these models.

Both academic papers discussed above consider a single monopolistic exchange. While this increases the simplicity and tractability of the models, information efficiency can also be analysed in the context of competitive markets—see, for example, Reisinger (2011)²⁸—which can result in different efficiency implications.

The two papers assume that the quality of the price-discovery process is something generated by the participants' actions, without allowing participants to choose between venues of different quality. Allowing such a choice results in an important insight: because participants will prefer the market with the best price discovery, if data fees harm or reduce this price discovery, any venue charging such fees will become less attractive and therefore less competitive. This is analogous to the aforementioned competition over the 'total cost of trading' on a particular venue, in which market data licence fees, trading fees and spread costs are all taken into account by users when choosing where to trade. This means that the competition between venues can ensure that if price discovery is poor (and therefore spread costs are high), the trading venue will need to offer lower data fees and/or trading fees in order to remain an attractive venue. Indeed, when new platforms enter the market and initially have low liquidity, their data and/or trading fees tend to be low, while often having higher spread/liquidity costs.

4.3 Distributional effects and impact on volume of trading

The analysis set out above suggests that there may not be a unique optimal cost recovery pattern for trading venues—re-balancing fees between variable fees (eg, trading fees) away from fixed fees (eg, market data licence fees) will generate both winners and losers.

However, it is still useful to consider simple stylised examples that can indicate if there are obvious benefits, or costs, of moving to a significantly different cost recovery pattern from the one that has been generated without regulatory intervention.

Boxes 4.1 and 4.2 analyse whether the current pricing schedules are likely to have negative consequences on the economy, based on two extreme examples, both using a scenario with a monopolist trading venue and a fee structure imposed on two participant types: traders/brokers (who charge a commission fee per trade), and fund managers (who consume data and send trade orders to brokers).

Assuming that the only relevant costs are a fixed data fee and a per-unit trading fee, the balance of data and execution fees results in different unit costs for users with different volumes of activity and different marginal costs for each trade.

Box 4.1 Case 1: high fees for market data and low fees for trade execution

In the extreme, if the exchange charges a high data fee and a zero trade execution fee, participants are incentivised to maximise their volume of transactions per data user in order to spread their fixed cost of market data across as many trades (for which they receive commission revenue) as possible.

²⁸ Reisinger, M. (2011), 'Unique Equilibrium in Two-Part Tariff Competition between Two-Sided Platforms', University of Munich Publications, January.

This is likely to encourage consolidation among brokerage firms, as the largest brokers are likely to find it easier to increase the average trading per data user. Niche brokers that trade fewer amounts per trader would be disadvantaged. There is also likely to be an advantage to those brokers who are continuously in the market (for example, market makers), so the sell side may be advantaged relative to the buy side.

As marginal transaction costs would be lower, spreads would tend to narrow, although this would also be offset by the need for the spread to still pay for market makers' (now higher) data fees.

- **Impact on brokers:** purely from a brokers' perspective, more trading could be expected, with improved liquidity.
- **Impact on fund managers:** those further back in the production chain (ie, fund managers) would be paying more for their data services. If they continued to purchase the same quantity of data then the increased price should *not* affect their own trading activity, as their own marginal costs of trading (in terms of fees paid to brokers) will have remained the same. However, if the increase in data costs leads to a reduction in the consumption of market data, and this in turn leads to a reduction in the demand for trading services (ie, decisions are made *not* to trade when, with access to the data, the decision would be to trade) then trading volumes would tend to decrease.

There are, therefore, two potentially opposing dynamics in terms of trading volumes. The marginal cost of trading would fall, but the costs for fund managers of developing their trading strategy would rise.

However, the current cost of market data to fund managers is likely to be a very small proportion of their total costs. As set out in section 3.4, currently annual market data is likely to account for less than 2% of total costs incurred by end-investors—ie, less than 0.01% of assets under management.

Conclusion

Although there are clearly two mechanisms working in opposite directions in terms of the impact on total levels of trading, the relative insignificance of market data fees to fund managers suggests that, even in the case of relatively extreme changes in the pricing structure, the potential negative impact on trading would be small, and would in any case be (at least partially, if not completely) balanced by an increase in trading as a result of the reduction in marginal trading costs.

Overall, high data fees combined with low trade fees can therefore be expected to result in fewer traders and/or brokerage firms, and more marginal transactions.

Box 4.2 Case 2: low fees for market data and high fees for trade execution

In this scenario, market data is offered for free but trading venues now have to recover their total costs from trade execution fees (or other fee levels such as membership fees).

The fixed costs of providing brokerage services reduces, but the variable (ie, per transaction) costs increase. Traders with lower volumes per data device are relatively advantaged, while brokers with high volumes per screen are relatively disadvantaged.

The total costs to be recovered from traders would also rise, as those not directly involved in trade execution but currently paying market data fees (eg, fund managers) would no longer contribute directly to covering the costs of trading venues.

Conclusion

The same two dynamics in relation to trading volumes (as analysed in the scenario in Box 4.1) will be in play. To the extent that fund managers have greater access to market data, they may identify more trading opportunities, but those trading opportunities would now need to be more profitable in order to cover the higher costs of each transaction (ie, the higher trade execution fees).

Overall, low data fees combined with high trade fees can therefore be expected to result in more traders and/or brokerage firms, and fewer marginal transactions.

In this simplified example, the main drivers of transaction volumes are subject to conflicting pressures. The balance of the outcome will depend on how strong each dynamic is. From an economics perspective, overall consumer welfare (in this case, investor welfare) will be maximised when the fixed joint costs of a number of services are recovered more from the

service(s) with the least elastic demand.²⁹ So if transaction services are generally more price sensitive than data services, welfare will be maximised by recovering more of the fixed costs from data services and less of the fixed costs from transaction services.

This is also the pattern of cost recovery that would be expected where there are competing suppliers, who will respond to the relative price elasticities they face when setting their own pricing levels.³⁰

4.4 Conclusion: potential impact of different pricing structures

The extent to which trading venues recover the joint costs of trading and market data services through transaction-based fees, membership-based fees and data-based fees may have an effect on their customers.

First, reducing market data fees and increasing trade execution fees will tend to leave those buying both services paying more in aggregate terms. This is because the number of customers purchasing data services from any trading venue is generally greater than the number purchasing transaction services (because market data is a necessary input for trading, but not all who purchase market data also directly trade on an exchange—eg, fund managers, middle office staff and index providers).

Second, any shift in the balance of trading and market data fees is likely to have distributional impacts within the brokerage and fund management industry. This is because within the brokerage and fund management industries, the relationship between the value of trading or assets managed, and the type and number of data terminals used, can vary. Those with business models that are relatively data-intensive will find their competitive position improve relative to their peers should data fees fall and trading fees rise.

This section also considered whether the balance between transaction-based fees and market data fees would affect the volume of trading and the efficiency of price formation. In both cases the effect is not clear-cut. In terms of volume of trading, lower transaction-based fees can be expected to result in more marginal transactions, but higher data costs could mitigate this effect if it results in reduced participation in the industry. In terms of the efficiency of price formation, the emerging academic literature has mixed findings, suggesting that there is not yet a robust conclusion on the relationship between the pricing of market data and the efficiency of capital markets.

²⁹ The elasticities referred to here are industry elasticities.

³⁰ Although a sub-optimal outcome may arise if the pattern of firm elasticities is very different to the overall product elasticities. For example, supermarkets will tend to have quite different gross margins on different products and will also flex these in response to local market conditions. One dimension of this pricing is the price elasticity they face, and the results can be that supermarkets will sell some goods below cost, and make up for the loss by raising margins on other goods that they sell to the customers attracted by the that loss leader. See Competition Commission (2008), 'The supply of groceries in the UK', Market Investigation, April, para 5.69.

5 Regulatory context and the consolidated tape

The analysis in this section builds on the empirical analysis of the costs of market data services in section 3 and considers different regulatory contexts for market data services in Europe and the USA. It also assesses whether there are alternative justifications for the regulation of market data services.

5.1 Comparison between the USA and Europe

The regulatory requirement to use a consolidated tape of bids and offers and transactions for securities listed on NYSE, Nasdaq and AMEX creates a contrast between the market structure for the provision and use of market data between the USA and the EU. The information in the (bid and offer) consolidated tape is required by trading venues in order to operationalise the regulatory requirement for one trading venue to pass on to another any (protected) marketable orders it receives that can be immediately executed at the prevailing BBO if that order cannot be fully executed at the BBO at the recipient trading venue. This regulatory structure is known as rule 611 of Reg NMS (Order Protection or Trade Through Rule)—see Box 5.1 below.

There are currently 12 trading venues in the USA that are required by regulation to ensure that their relevant market data is supplied to the aggregators, who then create the consolidated tape that is then supplied to market participants.³¹ As a result of regulatory requirement, the consolidated tape is a necessary input for any broker who is dealing in NYSE-, Nasdaq- or AMEX-listed equities. One implication of this requirement is that brokers that purchase level 2 data in the USA pay twice for level 1 information, because it is included in both the consolidated tape they are required to purchase, and the level 2 market data they are choosing to purchase.

Although market data is regulated under MiFID (see Box 5.2 below) and national regulation, there are no equivalent regulatory requirements of Reg NMS in Europe. Each trading venue is free to execute (if possible) all orders sent to it, without reference to the prevailing price and/or availability of the same security at an alternative execution venue. However, brokers and market vendors in Europe can—and many do—aggregate the market data from trading venues to create a single ‘consolidated’ tape relating to any particular security.

Therefore, although the regulatory structures are very different in the USA and the EU, consolidated tapes are available in both. Table 5.1 below sets out the constituent parts of the regulated consolidated tape available in the USA, and compares them to one form of the consolidated tape available in Europe—a tape consolidating level 1 data from the ten largest (by value/volume of trading) trading venues in Europe.

³¹ The 12 trading venues are: BATS, Chicago Board Options Exchange, Chicago Stock Exchange, Direct Edge, International Securities Exchange, Nasdaq OMX BX, Nasdaq OMX PHLX, National Stock Exchange, NYSE, NYSE AMEX, NYSE Arca and the Nasdaq Stock Market.

Table 5.1 Comparison of real-time, level 1, consolidated tapes available in the USA and the EU

	US consolidated tape (tapes A, B and C)	EU ‘consolidated’ tape (as provided by data vendors)	Notes
Trading venues covered	BATS, Chicago Board Options Exchange, Chicago Stock Exchange, Direct Edge, International Securities Exchange, Nasdaq OMX BX, Nasdaq OMX PHLX, National Stock Exchange, NYSE, NYSE AMEX, NYSE Arca and the Nasdaq Stock Market	Deutsche Börse, BATS Chi-X Europe, NYSE Euronext, London Stock Exchange, Borsa Italiana, Madrid Stock Exchange, Nasdaq OMX Nordic, Oslo Stock Exchange, SIX Swiss Exchange, Warsaw SE	European trading venues reflect all the European trading venues that, in 2012, executed at least as much as the smallest annual value of trading executed in 2012 by each of the US exchanges that contribute to one of the US consolidated tapes
Price per month—level 1 data	\$74 (€58)	Bloomberg: \$555 (€430) Thomson Reuters: \$430 (€340)	Tape A offers volume discounts for the user profile. This analysis includes the price for tape A, assuming that the number of devices per entity is between 3 and 999
Number of trading venues in tape	12	10	
Total value of transactions (per annum 2012) (trillion)	\$53 (€41)	\$9.5 (€7.5)	Includes all participants (except ISE in USA)
Number of listed companies	5,000	6,500–7,000	
Number of connections to US consolidated tape	At least 370,000	n/a	In each quarter of 2012 there were between 250,000 and 370,000 professional subscriptions to tapes A, B and C. Most professional subscribers to one tape will also consume another tape, and therefore the numbers of subscribers to each tape are not mutually exclusive. However, as some subscribers will subscribe to only one tape, 370,000 can be considered to be a lower bound
Estimated number of potential users for EU consolidated tape	n/a	At most around 80,000	In 2012 there were 10,000 professional users of SIX Swiss Exchange level 1 data, 24,000 users of Euronext level 1 data, and 90,000 level 1 and level 2 terminals for London Stock Exchange data. As in the USA, there is likely to be an overlap between these users, such that the total number of professional users of level 1 European market data is likely to be at most 80,000

Source: Data from the Consolidated Tape Association, Nasdaq Price List – UTP/FINRA, Bloomberg pricing list, Thomson Reuters pricing list, U.S. Stock Exchanges Market Summary (available at: www.batstrading.com/market_summary), Pan-European Stock Markets Market Data (available at: www.batstrading.co.uk/market_data/market_share/market/all/), World Federation of Exchanges statistics, data provided by the participating exchanges, and London Stock Exchange Group annual reports.

As indicated by Table 5.1, the US system differs from the EU financial markets in three significant ways:

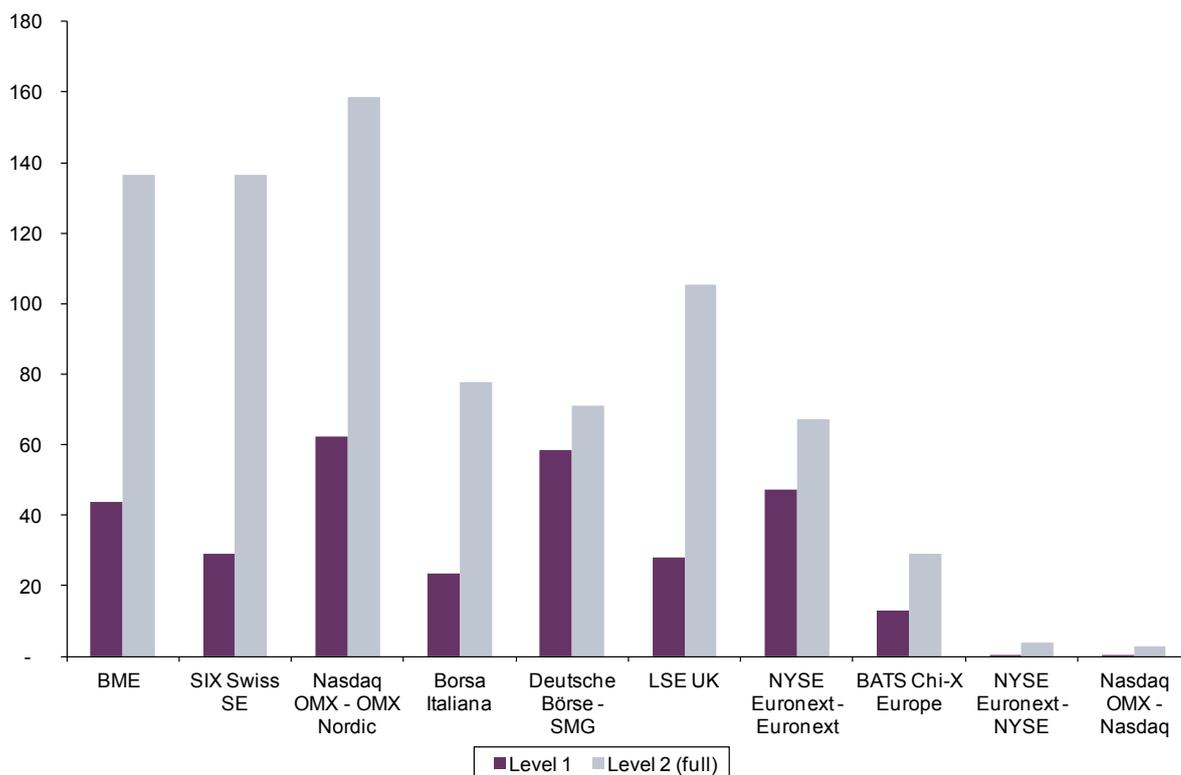
- trading venues in Europe are much smaller than in the USA. There are only ten European trading venues that execute the same annual value of trading as the smallest US exchange that contributes to one of the consolidated tapes. The combined total value of transactions for these ten exchanges is less than one-fifth of the total executed by the US exchanges contributing to the consolidated tapes;

- there are many more users of the USA consolidated tapes than of a comparable European consolidated tape. As a result of the regulatory requirement, any broker dealing in NYSE-, Nasdaq- or AMEX-listed equities is required to license the USA consolidated tapes. This results in a much greater base (of around 370,000 users) to recover the cost of provision compared to the estimated 80,000 users of a comparable European consolidated tape;
- the USA has a smaller number of stocks traded on the regulated system than the equivalent EU number of stocks—there are around 5,000 companies listed on the exchanges contributing to the US consolidated tape, versus 6,500–7,000 listed on the ten largest European exchanges.

Given the economies of scale that trading venues benefit from, it is not unexpected that the cost of a consolidated tape on a per-user basis is greater in Europe than in the USA. It is not clear to what extent the different regulatory framework in the USA has further reduced the costs of a consolidated market data tape in the USA compared to what would otherwise occur, particularly given that the trading venues in both the USA and Europe recover about 15–30% of their joint costs of trading and market data services from market data services (see Table 3.2).

Figure 5.1 below presents the per-user data fees charged by seven European exchanges and two large US exchanges (Nasdaq and NYSE), as a proportion of the value of trading executed by each exchange (multiplied by 10^9 to improve readability). Although the sample is limited, the decrease in the bars from left to right shows that, as exchanges transact significantly higher volumes, the data cost element per transaction falls.

Figure 5.1 Scaled data fees per unit value traded (per professional user per month)



Note: The vertical scale represents data fee divided by notional traded amount in 2012 scaled by 10^9 . The market data products from the European exchanges encompass a wider set of instruments (including, for example, index data and/or fixed income data) than the market data products from the US exchanges.

Source: Oxera, fee schedules of exchanges and MTFs, and World Federation of exchanges and BATS Chi-X Europe data on trading volumes.

The analysis set out above compares the US consolidated tape with an equivalent European product made available by two data vendors. However, as set out earlier, for brokers and other market participants that require depth of book information, and/or are concerned about the delay in the messaging they receive from trading venues, the consolidated tape in the USA is unlikely to provide the level of detail (and speed) they require. To purchase level 2 market data from the 12 US trading venues that contribute to the regulated consolidated tape would cost significantly more than receiving consolidated tape data.

Table 5.2 compares the cost of purchasing level 2 data from the five largest US and European exchanges, and shows that the difference in cost is much less marked.

Table 5.2 Costs comparison between USA and Europe, level 2 data for five largest exchanges

	US exchanges	European exchanges
Sum of user (device) fees	€132	€447
Sum of access fees¹	€1,125 (€1,500) ²	€0
Exchanges included	Nasdaq, NYSE Arca, NYSE, BATS BZX, Direct Edge, (BATS BYX)	BATS Chi-X Europe, NYSE Euronext—Euronext, London Stock Exchange, Deutsche Börse, Borsa Italiana

Note: ¹ The access fees included are the fees charged by some trading venues for internal distribution within a firm, external distribution fees are not included. The total US per-user fee is based on the following fees: Nasdaq (€57), NYSE (€45) and NYSE Arca (€30); BATS and Direct Edge do not charge a per-user fee. The total US access fee is based on the following fees: BATS BZX (€750) and Direct Edge (€375); Nasdaq, NYSE and NYSE Arca do not charge access fees in addition to the user fees. ² Including the access fee for BATS BYX of €375, increases the estimate of the total US access fee to €1,500. BATS Chi-X Europe fees are based on the vendor distribution model which includes only a per-user fee, therefore the total access fees for the European exchanges considered is zero. The total European per-user fee is based on the following fees: BATS Chi-X Europe (€45), NYSE Euronext (€84), LSE (€210 which includes the UK and European order books), Deutsche Börse (€68) and Borsa Italiana (€40). The level 2 data product includes BBO 10 for Deutsche Börse and full order book for the other exchanges.

Source: The most recent available pricing schedules of the exchanges (as at November 2013).

Furthermore, arguably, in the EU, the relevance of pricing information on different stocks to each participant is likely to vary more widely than in the USA. For example, a small Bulgarian firm is unlikely to be of any interest to a UK-based large cap investor, whereas most of the Reg NMS stocks are frequently traded on all the venues and relevant to all investors in the US equity market.

5.2 Current regulatory context

The following sub-sections provide a short overview of the key aspects of the prevailing regulations encompassing market data services in the EU and USA.

5.2.1 MiFID and the regulation of market data in the EU

In the EU market data is regulated by MiFID, the EU regulation for financial markets.³² Recently, the European Commission proposed an update to MiFID, with the main aims of providing a 'level playing field' in financial markets (in line with the EU objective of fostering a single market), improving investor protection, and enhancing the efficiency of financial markets in the EU.³³

³² The European Commission's MiFID directive, implementing regulations and other documents, can be found at: http://ec.europa.eu/internal_market/securities/isd/mifid/index_en.htm.

³³ European Commission (2011), 'New rules for more efficient, resilient and transparent financial markets in Europe', press release, IP/11/1219, October 20th, available at: http://europa.eu/rapid/press-release_IP-11-1219_en.htm?locale=en.

The proposed regulation amending MiFID sets out requirements in relation to the disclosure of trade transparency data to the public.³⁴ Regulated markets, MTFs and organised trading facilities (OTFs) will be required to:

- unbundle pre- and post-trade data:³⁵
 1. Regulated markets and market operators and investment firms operating MTFs and OTFs shall make the information published in accordance with Articles 3 to 10 available to the public by offering pre- and post-trade transparency data separately
 2. The Commission may adopt, by means of delegated acts in accordance with Article 41, measures specifying the offering pre- and post-trade transparency data, including the level of disaggregation of the data to be made available to the public as referred to in paragraph 1. (Title II, Chapter 3, Article 11)³⁶
- provide pre- and post-trade data separately on ‘reasonable commercial terms and on a non-discriminatory basis’ (Title II, Chapter 3, Articles: 3, 5, 7, and 9)
 1. Regulated markets, MTFs and OTFs shall make the information published in accordance with Articles 3 to 10 available to the public on a reasonable commercial basis. The information shall be made available free of charge 15 minutes after the publication of a transaction.
 2. The Commission may adopt, by means of delegated acts in accordance with Article 41, measures clarifying what constitutes a reasonable commercial basis to make information public as referred to in paragraph 1. (Title II, Chapter 3, Article 12)³⁷

Although the regulation is focused more generally on the availability of data and efficiency of markets, a key applied concern relating to market data is best execution by brokers and other agents. Although specific conditions vary by country within the EU, brokers are generally required to have a best execution policy, make clients aware of this policy, and monitor the attractiveness of venues in improving their execution (which can be done on delayed data or analytics provided directly by the trading venues).³⁸ The regulation does not require brokers to be active participants in all markets within the EU, or even all markets trading a certain security, and brokers have adopted a variety of methods and strategies to achieve best execution—while some will enlist to many venues, others may specialise in particular markets, resulting in different data usage.

³⁴ European Commission (2011), ‘Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on markets in financial instruments and amending Regulation [EMIR] on OTC derivatives, central counterparties and trade repositories’, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0652:FIN:EN:PDF>.

³⁵ Although many exchanges have already unbundled these products.

³⁶ European Commission (2011), ‘Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on markets in financial instruments and amending Regulation [EMIR] on OTC derivatives, central counterparties and trade repositories’, p. 34, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0652:FIN:EN:PDF>.

³⁷ European Commission (2011), ‘Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on markets in financial instruments and amending Regulation [EMIR] on OTC derivatives, central counterparties and trade repositories’, p. 34, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0652:FIN:EN:PDF>.

³⁸ For example, the Financial Services Authority (FSA; now the Financial Conduct Authority, FCA) provides guidance in a section of its website: <http://www.fsa.gov.uk/about/what/international/mifid/background/key-topics/best-execution>. The key document is Financial Services Authority (2006), ‘DP06/3: Implementing MiFID’s best execution requirements’, May, available at: http://www.fsa.gov.uk/pages/library/policy/dp/2006/06_03.shtml. This states: ‘Under MiFID Article 21, a firm must take all reasonable steps to obtain the best possible result, taking into account price, costs, speed, likelihood of execution and settlement, size, nature or any other consideration relevant to the execution of the order. In support of this process-based approach, a firm is also required to: have effective arrangements for complying with Article 21; have an ‘execution policy’ explaining the factors the firm will consider; when executing orders and providing information about the ‘execution venues’ it will use; inform clients about its execution policy and obtain their consent; assess the execution venues in its execution policy at least yearly and consider including other execution venues; monitor the effectiveness of its execution arrangements; and if requested, show that a client’s order has been executed in line with the firm’s execution policy.’

5.2.2 Reg NMS and the regulatory framework encompassing market data in the USA

The regulatory framework in the USA is often used as a benchmark in discussions of data dissemination and pricing. The USA does not actively regulate the price of data and data products, but instead mandates that all trades on a number of venues must be included on the 'consolidated tape system' (CTS), and all quotes on these venues must be included on the 'consolidated quote system' (CQS). These two systems are run by the Consolidated Tape Association, which states:

Since the late 1970s, all SEC-registered exchanges and market centres that trade Network A or Network B securities send their trades and quotes to a central consolidator where the Consolidated Tape System (CTS) and Consolidated Quote System (CQS) data streams are produced and distributed worldwide.³⁹

The CTS and CQS include volume and price information, and, in the case of the consolidated quote system, a 'national best bid-offer' (NBBO) is calculated. In many ways, this broadly corresponds to the level 1 data package discussed above. The system does not preclude the selling of other data products, and many market participants purchase additional data packages or pay to minimise their latency or to receive more detailed data.

In addition to the CTS and CQS, which govern quote and trade data dissemination for exchange-listed securities and therefore the provision of tape A (NYSE-listed stocks) and tape B (AMEX-listed stocks), the 'OTC/UTP Plan' governs quote and trade data dissemination for Nasdaq-listed securities (tape C).

This system is combined with the 'regulated national market system', which relates to best execution. Although the USA and EU have similar standards in requiring brokers to have and publish best execution policies and monitor execution, the USA has an additional order routing requirement. The essence of this process is best illustrated using a simple example. If a broker sends an order to buy 200 Citi shares to the NYSE, and the best offer price on NYSE is \$40.00 per share, but on Nasdaq the best offer is \$39.99, NYSE must route the buy order to Nasdaq for execution. However, this requirement covers only the best offer, so if the order arrives at NYSE and the disposition of the resting offers (of 100 shares each) is NYSE \$40.00 and \$40.01, and Nasdaq \$39.98 and \$39.99, the actual execution would be 100 shares at \$39.98 on Nasdaq and 100 shares on NYSE at \$40.00, notwithstanding the availability of 100 shares at \$39.99 on Nasdaq.

The USA is an example of close interaction between trading regulations and data regulations—without the CTS, the Reg NMS system could not be properly implemented. EU market infrastructure participants compete for volume in a more open, commercial fashion than the direct intervention of a system like Reg NMS.⁴⁰ Indeed, as shown by Caglio and Mayhew (2008),⁴¹ the exact particulars of the regulatory system have substantial effects on behaviour in the US market. Any EU regulatory system should therefore be considered with the awareness that market participants are highly sophisticated and will rationally attempt to profit from any arbitrage opportunity in the system, potentially at a cost to investors. In contrast, a market-based data and trading system may be able to internalise such problems as part of the attractiveness of a venue in a way that direct intervention would exclude.

³⁹ See <http://www.nyxdata.com/cta>.

⁴⁰ Section 2.2 discusses how exchange data is part of a joint product, including trading and data, and that operators compete on this 'overall' or 'joint' level.

⁴¹ Caglio, C. and Mayhew, S. (2008), 'Equity Trading and the Allocation of Market Data Revenue', Feds Working Papers 2012-65, Federal Reserve Board.

5.3 Are there alternative justifications for the regulation of market data services in Europe?

Sections 2, 3 and 4 provide a framework within which the pricing of market data services can be assessed, and an empirical and conceptual analysis, and conclude that there is no justification for regulating the pricing of market data services. Although this report has not analysed potential alternatives for the regulation of the pricing of market data services, it is clear that it would be very challenging to design a framework that is practical, and there would be a risk that it would actually distort the functioning of the market—defining the relevant services and regulating the prices would be far from straightforward.

Various market participants have suggested, both in public discourse and to Oxera in the course of carrying out this research, a number of specific justifications for the regulation of market data services:

- request that all trading venues offer market data for free in order to reduce barriers to entry for new trading venues;
- request that trading venues unbundle market data relating to market opening and closing auctions from market data relating to the continuous trading sessions, in order to create more competition in the provision of the market data relating to continuous trading;
- request that trading venues further unbundle market data by reference to the security or security type in order to improve the ability of users to access (ie, pay for) only that information which they require.

Price of market data services and cost of entry by new trading venues

New entry of trading venues is characterised by the entrant charging low, or no, market data fees. This makes economic sense in a market with economies of scale and network effects, as the economics of entry will be helped by a rapid build-up of use to a sustainable market share, and minimising the fixed costs to potential customers of using the new trading facility (eg, offering market data free of licence fees) will help to attract new customers.

In comparison, trading venues that can offer customers greater liquidity may be able to recover a greater proportion of their joint costs of providing trading and market data services, through market data fees. This is particularly the case for trading venues whose market data customers also trade large volumes on the trading venue, as for such customers market data fees will have a smaller effect on the overall average and marginal costs of trading on this venue.

In this context, some market participants have suggested that requiring market data services to be provided free of licence fees would reduce the barriers to entry for new trading venues. The following observations can be made.

First, market data fees are only one type of trading venue fee that has a fixed fee characteristic: membership and connection fees also have this characteristic. Therefore, any impact of requiring market data to be provided free of licence fees may be muted by subsequent changes in other elements of trading venues' pricing structures.

Second, although initial market entry may be marginally easier, some new entrants may find that a restriction on fees for market data services inhibits their ability to further establish themselves. For example, new trading venues that successfully attract a critical mass of trading in certain stocks may find it more difficult to expand further (as well as into less liquid shares) if they are not allowed to recover any of their joint costs of providing trading and market data services from market data fees, and therefore cannot offer as competitive trading fees as they otherwise could. This means that there is a potential trade-off between

allowing competition to have a focus on reducing transaction fees and thereby potentially fostering growth in trading volumes, and constraining market data costs and potentially increasing the ease of initial entry by new trading venues.

Third, given the level of market fragmentation currently observed both in the USA and in Europe (where, for many equity securities, there are at least three significant trading venues), there does not seem to be an indication that the pricing of market data fees has indeed prevented firms from entering the market for trade execution services. Furthermore, given decisions to clear a number of trading venue mergers by competition authorities, it is far from clear that further fragmentation would result in significant benefits from a competition policy perspective.

In sum, this justification for regulating the pricing of market data services does not seem to be supported by existing evidence.

Competition in the provision of ‘continuous trading’ data

Although the continuous trading elements of trading equity securities are reproduced in a number of trading venues, the opening and, in particular the closing price auctions are still almost entirely confined to one trading venue per security (usually the trading venue on which the security has its primary listing). Trading venues with the opening and closing auction do not tend to split out market data relating to these auctions from market data relating to the continuous trading, and instead provide market data for the full trading day.

Some stakeholders have argued that requiring auction data to be provided separately from continuous trading data would intensify competition between providers of continuous trading data, and thereby reduce market data fees. However, both the economic characteristics of the production of data and trading services, and the demand characteristics for market data, suggest that this theoretical improvement in market dynamics might not materialise and/or be significant. In particular:

- enhanced competition in the provision of continuous trading data can develop only if there are a significant number of customers for whom both of the following conditions apply:
 - they require real-time access to auction data;
 - they do **not** require real-time access to **complete** continuous trading data.
- the number of market participants to whom both conditions apply appears to be very limited. Although clearly this demand pattern cannot be ruled out, if it is indeed limited, it will pose limited (if any) additional competitive pressure on trading venues forced to split out auction data from their continuous trading data, and it is likely that the overall price structure offered will remain broadly the same;
- if the group of market participants that do require real-time access to auction data, but only real-time access to continuous trading data from a subset of trading venues, is material, the impact on competition for continuous trading data may still be very limited (or non-existent). Trading venues that are forced to split auction data from continuous trading data are likely to reduce the price of continuous trading data (compared to the price for the original comprehensive market data product) and increase the price of auction data. A trading venue without auction data that wished to address this part of the continuous trading data market would therefore have to ensure that its price was below this new (lower) price, and unless it could price-discriminate between those who require full market data and those that require only partial market data, it might be uneconomic for the trading venue to actually compete for this niche market.

The market dynamics described above suggest that, at best, the overall impact of requiring auction and continuous trading data to be provided separately would be minimal. The

potential group of market participants that would benefit is unlikely to be large, and even they may not benefit because of the underlying market dynamics.

With an inherent danger of unintended consequences of regulation and there being some costs for any regulatory intervention, intervention of this sort runs the distinct risk of not achieving any overall net benefit to end-users. Further, much more detailed analysis would be required to be able to finally conclude that there would, indeed, be a net benefit for the (likely to be) small group of affected end-users.

Unbundling individual security market data

The main market data services offered by trading venues in Europe tend to encompass all instruments traded on each of their cash markets. Market participants may trade only a subset of the instruments available in each market and, therefore, may be interested only in a subset of the market data provided. Splitting market data into its constituent securities would enable market participants to purchase less market data and still meet their needs. In addition, providing market data in this way would enable different trading venues to match more closely the market data products provided by their competitor trading venues, potentially enhancing competition in the provision of specific market data services.

The underlying economics of the provision of market data relating to individual securities are similar to those of the provision of market data services more generally. The marginal cost of supplying an additional customer with data relating to an additional security traded on the same platform to data already being provided in relation to other securities will be very low. Put another way, the cost saving to a trading platform of not supplying data that relates to a specific security traded on that platform to a specific customer will be very low, if not zero. The cost of supplying data relating to a subset of securities traded is, therefore, virtually the same as the cost of providing the complete set of data, once the decision has been made to supply the relevant data at all.

Under these circumstances the same market dynamics arise in relation to the split of the recovery of total costs from data and trading services. Prices will tend to reflect relative demand conditions, and not (relative) marginal costs. As a result, the prices for (and volume of demand for) market data for the heavily traded securities would be expected to recover the vast majority of market data revenue, while the market data relating to less traded securities would recover little of the revenue. Although this could result in marginally lower costs for those trading and investing only in the high-volume securities, a potential negative impact arises in relation to the low-volume securities as the number of brokers, fund managers and investors with access to information on these securities could fall. This could exacerbate differences in liquidity between the most- and least-traded securities, with a potential negative consequence in the provision of capital to the small and/or growing companies listed.

Splitting market data may also result in higher costs of market data services for end-users. Market participants requiring market data on a broad array of securities may incur higher transactional costs when handling a higher number of market data subscriptions with each trading venue/data vendor. Trading venues are also likely to incur additional costs, splitting their prevailing market data packages into smaller groups.

Ultimately, for this type of unbundling to improve competition in the provision of market data there must be a material demand for market data that covers only part of the market for a particular security. Unless this condition applies, market data that covers the same security from different trading venues is complimentary and not substitutable, and the same dynamics apply as described in the subsection above.

5.3.1 Summary

The underlying economics of the production of market data, combined with the demand conditions, mean that regulatory interventions designed to intensify competition between market data providers (such as those considered above) do not have a clear justification and

may have little, or no, overall positive impact on end-users. Furthermore, such interventions may increase overall transaction and regulatory costs, which would ultimately have to be paid for by end-investors (or companies raising capital). To be absolutely definitive on any net benefits (or disbenefits) to end-users, a much more detailed analysis would be required. However, the fundamental economic characteristics of both the joint product and very low/zero incremental costs of market data, and the economies of scale in transactions, mean that interventions to address apparent market anomalies (eg, prices not set at forward marginal costs, services sold in large bundles) may have negative outcomes and/or not achieve benefits for end-users.

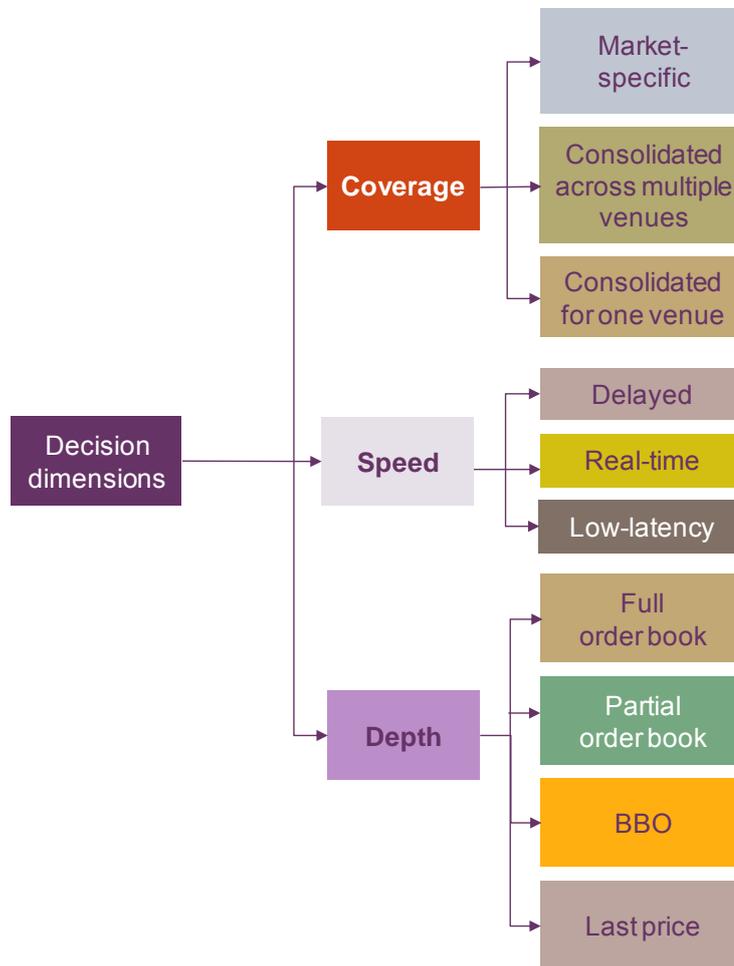
A1 Analysis of the value chain

Exchanges, as well as MTFs, publish pre- and post-trade market data generated on their markets to brokerage and fund management firms, investors and other parties, typically via data vendors. This appendix elaborates on the multiple products and methods of accessing the data, and describes the processes by which the data reaches the end-user.

A1.1 Different types of data

An end-user can choose between several types of data products. Figure A1.1 illustrates the three main dimensions along which market data products can vary—coverage, speed and depth—and provides some examples of the variation in data products along each.

Figure A1.1 Data product choices



Source: Oxera.

These dimensions are of differing importance to different clients. For example, an academic researcher building a model may require historical data with wide coverage and large amounts of detail from a vendor, whereas a high-frequency trader may require low-latency, full-detail data charged per device directly from the exchange.

A1.2 Provider

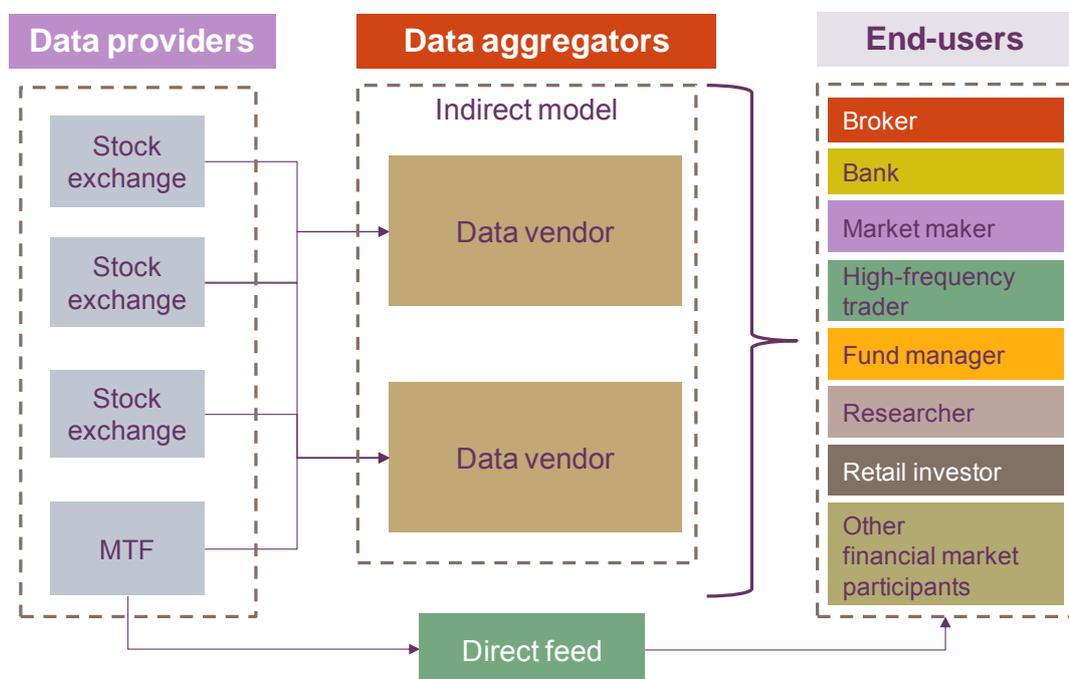
The choice of provider is endogenous to the decision about the data product. In general, exchanges make their data available for licensing on a 'wholesale' basis to data vendors and software providers, such as Bloomberg and Thomson Reuters.⁴²

These vendors normally offer a platform that combines various data subscriptions, and the users of these platforms can purchase data from multiple exchanges and other data sources in a common format. Customers accessing market data through data vendors may also choose to purchase some of the analysis packages vendors offer, such as pre-trade analysis.

However, certain users, such as high-frequency traders, will often interact directly with the exchange to manage their data connection.

In the indirect model, the user pays the vendor for the access (which often includes a value-added/mark-up component), and then the vendor requests a subscription from the data provider on behalf of the user, as shown in Figure A1.2 below.

Figure A1.2 Value chain



Note: Retail investors are unlikely to ever source a direct feed from a trading venue.
Source: Oxera.

A1.3 Nature and detail

Data generated by exchanges and MTFs can be grouped into the following three main categories:

- pre-trade data concerning quotes and orders and respective volumes;
- post-trade data concerning execution prices and volumes;

⁴² As also explained by the European Commission in Deutsche Börse/NYSE Euronext: 'overall, the majority of the Notifying Parties' [Deutsche Börse and NYSE Euronext] revenues from proprietary market data are derived from sales through third party data vendors, with a smaller portion of sales made directly to end-users'. See European Commission (2012), *Case No COMP/M.6166 – Deutsche Börse / NYSE Euronext*, February, pp. 31–2.

- surveillance data for identifying participants and analysing behaviour for regulatory and legal reasons.

Reflecting the different purposes of each data category, different levels of detail are provided for each. In the case of market surveillance and market supervision data, the detail of the data limits the scope of distribution. Whereas anonymised pre- and post-trade data is available to the public, market surveillance data generally contains sensitive private information (eg, trader IDs) that would not be appropriate for public distribution.

Product divisions as regards pre- and post-trade data often vary between exchange operators. For example, while some operators offer only a distinction between a ‘level 1’ product (including post-trade and BBO) and a ‘level 2’ product (including level 1 plus a number of levels in the order book), others have more nuanced distinctions.

A1.4 Speed

Market data products may vary in speed. Normally, ‘delayed’ data refers to data that is published 15 minutes or more after the publication of the transaction. In line with the MiFID guidelines discussed in section **Error! Reference source not found.**, this data is normally free of data licence fees or at very low cost.⁴³ Real-time data is more expensive and can be subdivided into the ‘standard’ real-time product (which is fast enough for a human user to experience it as real time) and ‘low-latency’ connections. The latter are more bespoke and can involve more technical optimisation of the connection, such as on-site computer location, and are mainly of interest to fast high-frequency traders who require connections with low millisecond or even micro-second speeds (see Figure A1.3).

Figure A1.3 Data speed and detail

Speed/depth	Post-trade	(Pre-trade) BBO	(Pre-trade) Top of order book	(Pre-trade) Full order book
Delayed	Normally free of charge/low-cost			
Real-time				
Real-time— low-latency				

Source: Oxera analysis.

The above discussion has already suggested the purpose of this data—broadly, those directly involved in trading on the platform are more likely to be interested in the more detailed and faster products, while retail investors and researchers are more likely to be content with delayed data (at least most of the time).

A1.5 Coverage of data

Some exchanges bundle multiple data products (ie, data covering different venues and asset classes is offered in a bundle), while others provide data separately by asset, venue or other typologies. For example, Euronext offers some single-venue data products (eg, reference prices for Amsterdam) as well as asset classes (eg, cash equities, equity indices). In

⁴³ European Commission (2011), ‘Proposal for a Regulation of the European Parliament and of the Council on markets in financial instruments and amending Regulation [EMIR] on OTC derivatives, central counterparties and trade repositories’, p. 9, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0652:FIN:EN:PDF>.

contrast, SIX Swiss Exchange offers a single-data product only, covering all equity and fixed-income data from SIX.

Data vendors do not always follow the exchange's bundling choices. It is not uncommon for vendors to offer a subset of the products offered by the data provider. For example, Bloomberg offers only three of BME's five levels of equity data, and Borsa Italiana's more comprehensive division of products according to the number of order book levels is compressed by Bloomberg into only level 1 and full order book level 2.

Oxera's discussions with operators revealed that the structure of these data divisions often stems from the underlying system used by the exchange, enabling the exchange operator to split the data without high cost.

A1.6 Pricing structure

The structure of pricing across exchanges varies along several dimensions:

- 'unit' of data—eg, per user/device, per data request;
- type of user—eg, professional, private, display/non-display;
- number of users (as there are sometimes volume discounts);
- coverage of venues (as above);
- product detail (as above);
- product speed (as above).

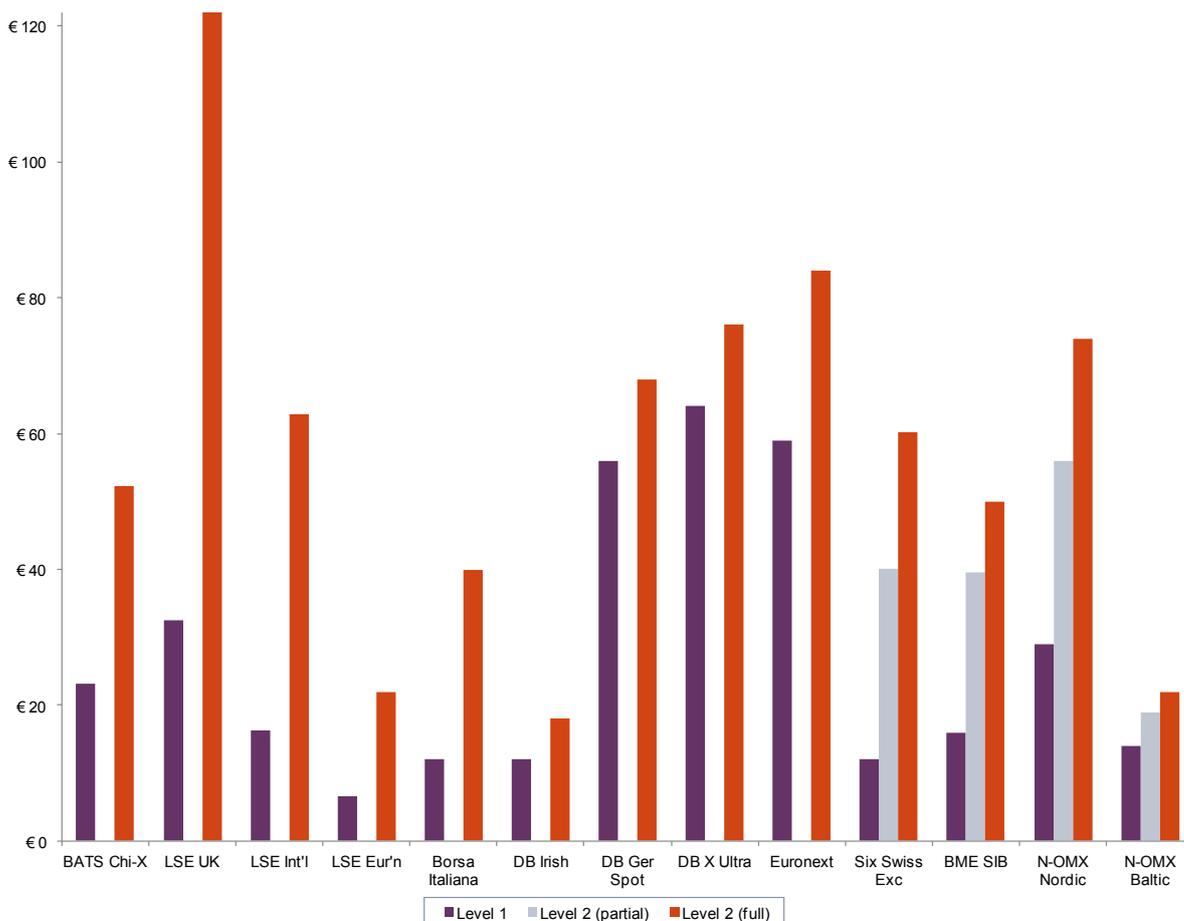
As noted above, while some exchanges offer a single product of a certain depth/speed encompassing multiple venues, others split data products by venue or asset class. Thus, 'NYSE Euronext Cash Level 1' would be a typical product, referring to level 1 real-time data for Euronext cash equity markets. These products are often sold at a per-user, per-month fee through a data vendor. However, this is only one possible fee structure. There is a wider flexibility in the 'unit' of data, which can be per user, per device, per data request or simply per annum. Moreover, the market is divided by user type, as there are also substantial discounts for non-professional users of the data. In addition, exchanges offer volume discounts for a variety of the data products. Similarly, registered traders of several European exchanges are entitled to use data free of charge for trading purposes on that particular venue.

Some price structures are more suited to certain client types than others. For example, a proportion of users want to access market data only infrequently, and do not require a constant feed. An example of such a user could be a retail investor who monitors the daily delayed price free of charge, but may require a different speed or depth of data during a certain period (perhaps in anticipation of buying/selling). For this type of usage, several exchanges offer a per-request fee structure, rather than a monthly subscription. Data vendors, including retail brokers, often use this option in order to service a wide number of infrequent clients.

Figure A1.4 below shows the professional user licence fees for data feeds from a variety of exchanges. The products are not entirely comparable, owing to different venue scope and slightly different depth and timing features. Nonetheless, it can be observed that all feeds are within an order of magnitude or so of each other. Several features deserve further mention:

- broadly, venues executing a smaller volume/value of trades have lower data fees—for example, data fees are much lower for the Irish Stock Exchange and the Baltic part of the Nasdaq OMX market than those of the London Stock Exchange;
- universally, increasing the depth of data raises the price—in price terms, level 1 is cheaper than level 2 (partial), which is cheaper than level 2 (full).

Figure A1.4 Data subscription fees across venues by data type (per professional user per month)



Note: London Stock Exchange member fees are used for this figure; comparable non-member fees for LSE UK-only market data are €45 for level 1 data and €183 for level 2 data. The figures avoid any level of volume discount—ie, they are for a single user applying for a single feed.
Source: Oxera analysis of fee schedules of exchanges and MTFs.

A large number of users use data vendors, who charge their own (different) fees. Data vendors typically charge users separate fees to access real-time market data from different trading platforms. The fees charged by data vendors are generally higher than the license fees charged by trading platforms for direct access, reflecting cost recovery by the data vendor of their formatting, system provision system and add-on products. Data vendor fees (and the associated service) are also under pressure from competitor data vendors. Analysis by Atradia in 2010 suggested that the mark-up is approximately 5–30%, and varies by product.⁴⁴ Oxera's own analysis of comparable prices confirms this to be the case,⁴⁵ but as Bloomberg's fees are exclusively in US dollars the mark-up will vary according to exchange-rate fluctuations.

⁴⁴ Atradia (2010), 'The cost of access to real time pre & post-trade order book data in Europe', August.

⁴⁵ Oxera's analysis is not presented as is based on privately provided price lists from Bloomberg and Thomson Reuters, that are not in the public domain.

A2 Competitive dynamics in capital markets

A2.1 Key economic characteristics of trading venues

The key economic characteristics of exchanges and other trading platforms can be grouped into the following four categories:

- cost structure;
- joint products;
- network externalities;
- potential buyer power.

These characteristics determine the nature of competition and are described in the following sub-sections.

A2.1.1 Cost structure and economies of scale

Exchanges and MTFs are characterised by high fixed costs and low marginal costs.⁴⁶ A large proportion of exchange costs revolve around technology and attracting order flow to the platform,⁴⁷ whereas the cost of the marginal product (an extra trade) is very low, as it is simply utilisation of the existing infrastructure built to handle such trades. There are some costs that raise the marginal impact, such as increased surveillance data-gathering and potential administration tasks relating to an additional trade, bringing the marginal cost above zero.

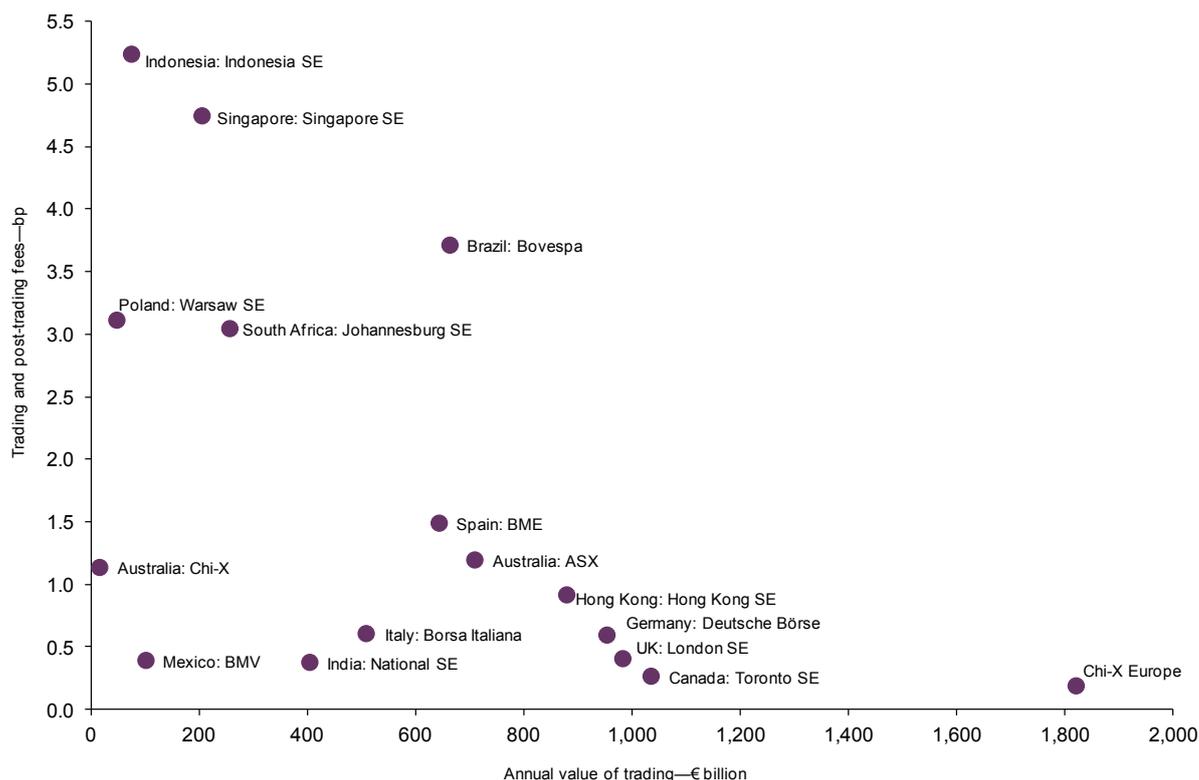
Often, markets with high fixed costs have non-standard pricing structures—ie, not simply a single per-unit fee—to enable efficient recovery of fixed costs. Common structures include two-part tariffs (a fixed entry/access fee plus a variable unit fee), volume discounting, fixed fees for unlimited usage (eg, broadband subscription), and price differentiation between different customer types (eg, students and pensioners and, in the case of trading venues, liquidator takers and liquidity providers).

As a result of the high fixed costs and low marginal costs, trading venues are characterised by economies of scale. This is shown in Figure A2.1, which shows the relationship between the cost of trading (and post-trading) and the value of trading.

⁴⁶ This has been widely recognised. See, for example, Office of Fair Trading (2013), 'Anticipated Acquisition by London Stock Exchange Group of Control of LCH.Clearnet Limited', January, p. 42, available at: http://www.of.gov.uk/shared_of/mergers_ea02/2013/LSEG.pdf.

⁴⁷ According to an earlier study by Lee and Kwong, approximately 20% of exchange costs are due to systems, and another 9% are due to premises. See Lee, J. and Kwong, L. (2002), 'Revenue and Cost Trends of Global Stock Exchanges and HKEx', November, available at: <http://www.sfc.hk/web/doc/EN/research/research/rs%20paper%202002.pdf>. The World Federation of Exchanges also provides a detailed breakdown of historical revenues and costs. See World Federation of Exchanges (2010), 'Cost and Revenue Survey', available at: http://www.world-exchanges.org/files/statistics/excel/2010%20Cost%20%26%20Revenue%20Survey_Final.pdf.

Figure A2.1 The relationship between the cost and value of trading and post-trading for selected exchanges



Note: The costs of trading and post-trading in this figure are for institutional investors using large intermediaries, based on the analysis in Oxera (2013), 'The Oxera Trading and Post-trading Monitor', note prepared for ASX Group, April. The institutional investor has assets of €100m, a trading velocity of 200%, and an average order size of €125,000. The large intermediary is assumed to trade (on average) 100,000 times a day, with an average trade size of €10,000, and to hold a CSD account of €39 billion. For an overview of the infrastructures considered in each financial centre, see Oxera (2013), 'The Oxera Trading and Post-trading Monitor', note prepared for ASX Group, April. For each of the financial centres considered, the value of electronic order book (EOB) trading on the relevant trading venue during the 12-month period ending January 2013 (the latest period for which data is consistently available) is reported.

Source: Oxera (2013), 'The Oxera Trading and Post-trading Monitor', note prepared for ASX Group, April.

A2.1.2 Joint products and cost allocation

Joint products are an economic concept designed to explain the situation where the production of one product simultaneously involves the production of one or more other products. A textbook examples is cattle livestock, which results in the production of beef and leather.

In the case of joint products, the production costs of the outputs of two or more products cannot be separated—they are joint costs. In other words, they are incurred when production facilities simultaneously produce two or more products in fixed proportions, such that an increase in the output of one product will necessarily mean a corresponding increase in the output of the other product.

In the case of trading, there are two levels of joint product. First, the trade execution is a service for the buyer and seller simultaneously, as the production of any trade requires both sides to be present. As financial market participants both buy and sell on the exchange, it is difficult to apportion the costs between 'buyers' and 'sellers'.

In the second sense of 'joint product', the exchange or trading platform actually produces two products at the same time using the same inputs—'trade execution' and 'market data services'—as each transaction is necessarily linked to the production of data.

The joint product nature can have implications for the pricing of the individual products. The total costs incurred by an exchange and trading platform can, in principle, be recovered from the fees for trade execution services or from fees for data services, or from a combination of fees for these two services. Since the costs are jointly incurred and cannot be separated, the costs of production cannot be allocated based on input drivers and are often allocated based on demand factors, such as the prices, revenues or consumers' willingness to pay.⁴⁸ One variant is to allocate costs using the Ramsey pricing principle, which states that it is economically efficient to recover a relatively larger part of costs from those customers whose demand is relatively more inelastic (ie, less sensitive to price).⁴⁹

A2.1.3 Network externalities

Trading platforms are characterised by network effects (or network externalities). From an economic perspective, network effects mean that an individual's demand depends not only on the individual's own preferences—as in normal markets—but also on the demand of other individuals.

Network effects generally represent positive externalities, in which case an individual's demand for a good increases not only as the price of that good falls (the 'normal' relationship), but also with the demand for that good by other individuals. In some cases network effects can represent negative externalities—for example, congestion on a road network. These effects can be between the same group of users or between different classes of users. For example, in a telephone network, externalities arise among the class of 'people wanting to make and receive phone calls', whereas a PC operating system becomes more valuable to PC users as the number of programmers that write applications for the operating system increases; moreover, it becomes more valuable to programmers as the number of users of the system increases.

Various network effects characterise the operation of stock exchanges.⁵⁰ These effects arise in both the primary market—where companies list their shares on the exchange—and the secondary market—where shares are traded among investors (normally through brokerage firms):

- in the primary market, network effects arise between companies and investors (through pools of capital). Companies will seek to list (or be admitted to trading) at the exchange that offers them access to the greatest pool of capital. Pools of capital will be attracted to those exchanges where most companies are listed;
- network effects arise in the secondary market between companies and brokers (through liquidity)—the more a security is traded on a given exchange, the more attractive that exchange is to issuers;
- network effects also arise in the secondary market between brokers as a class (through liquidity)—the more brokers there are that use a trading platform (or rather, a price-formation umbrella) in order to trade a certain security, the more attractive that platform is to any individual broker wishing to trade in that security.

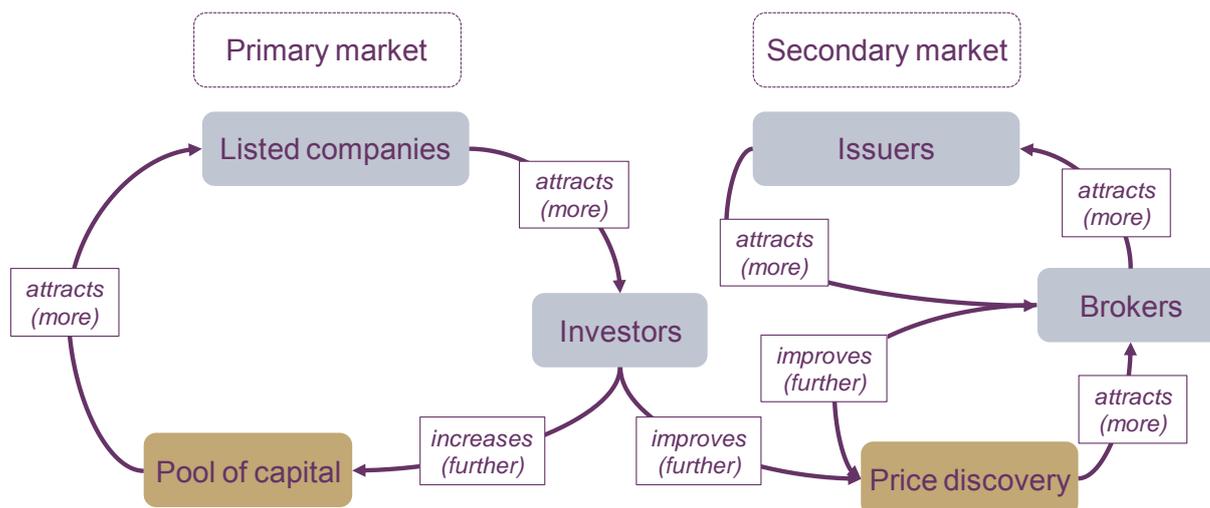
Network externalities are illustrated in Figure A2.2 below.

⁴⁸ As was already recognised in Marshall, A. (1920), *Principles of Economics*, Book V, Chapter VI.

⁴⁹ The efficiency of Ramsey pricing lies in the fact that it generally leads to higher total output, and hence generates higher surpluses for consumers.

⁵⁰ For example, as identified by the UK Office of Fair Trading in its investigation of the BATS/Chi-X merger. See Competition Commission (2011), 'A report on the anticipated acquisition by BATS Global Market, Inc of Chi-X Europe Limited', November. Section 10 of the same report describes competition and network effects extensively.

Figure A2.2 Network externalities in stock markets



Source: Oxera.

Markets with network externalities may be prone to ‘tipping’, where a network that has obtained a critical mass of users may have a competitive advantage over rival networks. In stock markets this is particularly relevant for liquidity: trading in a specific security may tip towards the trading platform where most market participants already trade that security, and hence where liquidity is greatest. Liquidity is the key network effect in trading and is of great importance to traders choosing a lit venue (one with observable price formation), as it represents the ease and cost with which they can build and liquidate their positions. A highly liquid platform will suffer relatively little price change from a trade of a given size compared with a venue with lower liquidity. This is because there are relatively more traders in the former wishing to buy or sell at or near the current price, which lowers the spread between the bid and offer and thus the cost of trading.

A2.1.4 Potential buyer power

Users of exchanges are often quite large, including global brokerage firms, banks and dealers. Such customers act as gatekeepers for investors, supplying trading and post-trading services to end-users and providing these services in exchange for a commission fee when a client wishes to trade. These users have been identified in competition cases as an important constraint on exchanges, through their incentive to reduce the cost of their trading and their ability to move large volumes and/or to sponsor entry of a rival provider.⁵¹

A2.2 Competition between trading platforms in Europe

Competition in the EU exchange market has been studied in a number of reports and competition investigations.⁵² In general, the following three conclusions are drawn:

- exchanges compete on a platform or combined product level (ie, not at the level of specific fees);
- liquidity and other network effects are a key part of a venue’s attractiveness and are thus important to its maintenance of market share and business; and

⁵¹ See, for example, Competition Commission (2011), ‘A report on the anticipated acquisition by BATS Global Market, Inc of Chi-X Europe Limited’, November, p. 5. During the BATS/Chi-X merger the Competition Commission found that ‘customer consortia’ had previously sponsored the entry of MTFs into the exchange sector and had overcome the barriers to entry (predominantly network effects and regulatory barriers), and considered that this would continue to be feasible in the future, thus acting as a constraint on incumbents’ behaviour and ensuring that the quality of offerings would remain high, and prices would remain low.

⁵² For further general discussion of competition in the exchange sector, see Oxera (2012), ‘What would be the costs and benefits of changing the competitive structure of the market for trading and post-trading services in Brazil?’, section 2.

- potential entry into the market is an important constraint on an exchange's behaviour.

After regulatory reforms, EU-wide trading in a particular product was not limited to the platform on which it was listed, giving rise to venues that competed for the order flow from incumbent exchanges, such as BATS, Chi-X, Turquoise and Burgundy. These operators have garnered a strong market share (BATS Chi-X Europe holds approximately 20% of European lit equity trading on either a volume or value basis) and compete for liquidity.⁵³

Many domestic stock exchanges nowadays face competition in the secondary market from a number of other trading venues, including alternative trading systems, crossing networks, direct broker-to-broker trades, and in-house matching (internalisation of trades) by brokers, as well as other stock exchanges. For any particular trade in a security that is listed on the 'central' exchange, market participants often have a choice among these different execution venues, of which the central exchange's own trading platform is only one. The choice of venue normally depends on the type and size of the trade, and is guided by factors such as the spread, trading fees, market impact costs, and transparency requirements. Prices for trading and post-trading services have generally fallen since the introduction of platform competition in 2007.⁵⁴

Exchanges and MTFs compete for trades on the basis of gaining both additional revenue and more liquidity, offering volume discounts and incentive programmes to keep volume high. As discussed, this competition may result in 'tipping points', whereby large numbers of traders will switch venue in order to benefit from increased liquidity elsewhere.⁵⁵ There are various examples of successful entry and competition, such as the rise of BATS Chi-X Europe and Turquoise in equities, the successful entry by Intercontinental Exchange (ICE) into Dutch natural gas trading, and fierce competition between Chicago Mercantile Exchange (CME), NYSE, Deutsche Börse and ICE over interest rate, commodity and foreign exchange contracts. As set out in section A2.1.4, the credible threat of potential entry is a key constraint and a major part of competition in exchange markets.

As an alternative to exchanges, traders can also use dark pools and OTC venues. These exist mainly to facilitate large trades that would have a significant impact on the market, providing an off-market option that does not influence the traded price. Typically, a participant wishing to make a particular trade will evaluate their on- and off-market options before choosing which venue(s) to execute on.⁵⁶

As a trader, one considers the overall cost of trading in order to get the best execution outcome, and this cost has a number of components—ie, the direct cost of trading, the trade and clearing fees, and the bid–offer spread on the venue; as well as data fees, membership fees, and other features such as overall latency, counterparty risk and trading hours. This is described by the UK Office of Fair Trading in two decisions (BATS/Chi-X⁵⁷ and London Stock Exchange/LCH.Clearnet⁵⁸), and by the Competition Commission for BATS/Chi-X.⁵⁹

⁵³ BATS Chi-X Europe publishes its daily market share of European equity trades online at: http://www.batstrading.co.uk/market_data/market_share/market/.

⁵⁴ European Commission (2012), 'Case No COMP/M.6166 – Deutsche Börse / NYSE Euronext', February, p. 22. For a discussion of the fall in trading and post-trading costs, see Oxera (2011), 'Monitoring prices, costs and volumes of trading and post-trading services', prepared for European Commission DG Internal Markets, available at: http://ec.europa.eu/internal_market/financial-markets/docs/clearing/2011_oxera_study_en.pdf.

⁵⁵ Competition Commission (2011), 'A report on the anticipated acquisition by BATS Global Market, Inc of Chi-X Europe Limited', November, p. 5.

⁵⁶ European Commission (2012), 'Case No COMP/M.6166 – Deutsche Börse / NYSE Euronext', February, p. 15.

⁵⁷ Office of Fair Trading (2013), 'Anticipated Acquisition by London Stock Exchange Group of Control of LCH.Clearnet Limited', January, p. 26, available at: http://www.of.gov.uk/shared_of/mergers_ea02/2013/LSEG.pdf.

⁵⁸ Office of Fair Trading, (2011), 'Anticipated Acquisition by BATS Trading Limited of Chi-X Europe Limited', July, p. 28.

⁵⁹ Competition Commission (2011), 'A report on the anticipated acquisition by BATS Global Market, Inc of Chi-X Europe Limited', November, p. 15.

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