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Prior to 2007, CTA revenues were allocated in proportion to the number of trades reported by each exchange. The SEC established a new revenue allocation formula in 2005 when it adopted Reg NMS. The new formula, which went into effect on April 1, 2007, first allocates revenues across stocks in proportion to the square root of dollar volume, then within each stock allocates 25% of the revenue to plan participants in proportion to the participant's number of trades, 25% in proportion to the participant's share volume, and 50% in proportion to a measure of how often the exchange is offering liquidity in that stock at the NBBO.<sup>30</sup>

Although the fee schedules described in the previous section have always been public, financial information about the CTA and UTP Plans, including the total amount of fees collected and revenue distributed to participants, has historically not been in the public record, with a few isolated exceptions.<sup>31</sup>

This changed in March 2018, when the CTA and UTP Plans disclosed historical information about the annual revenue distributed to participants going back to 2007, including a decomposition of these distributions for the trade and quote components of the allocation formula. However, it is important to note that this data does not disclose how individual participants share tape revenues with broker-dealers and others. Thus, this data set shows the maximum revenue per participant, not necessarily the amount each participant keeps for itself. In this section, I provide an analysis of this new data set.

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<sup>30</sup> SEC Release No. 34-51808.

<sup>31</sup> SEC Release Nos. 34-49325, 34-51808, and 34-61358.







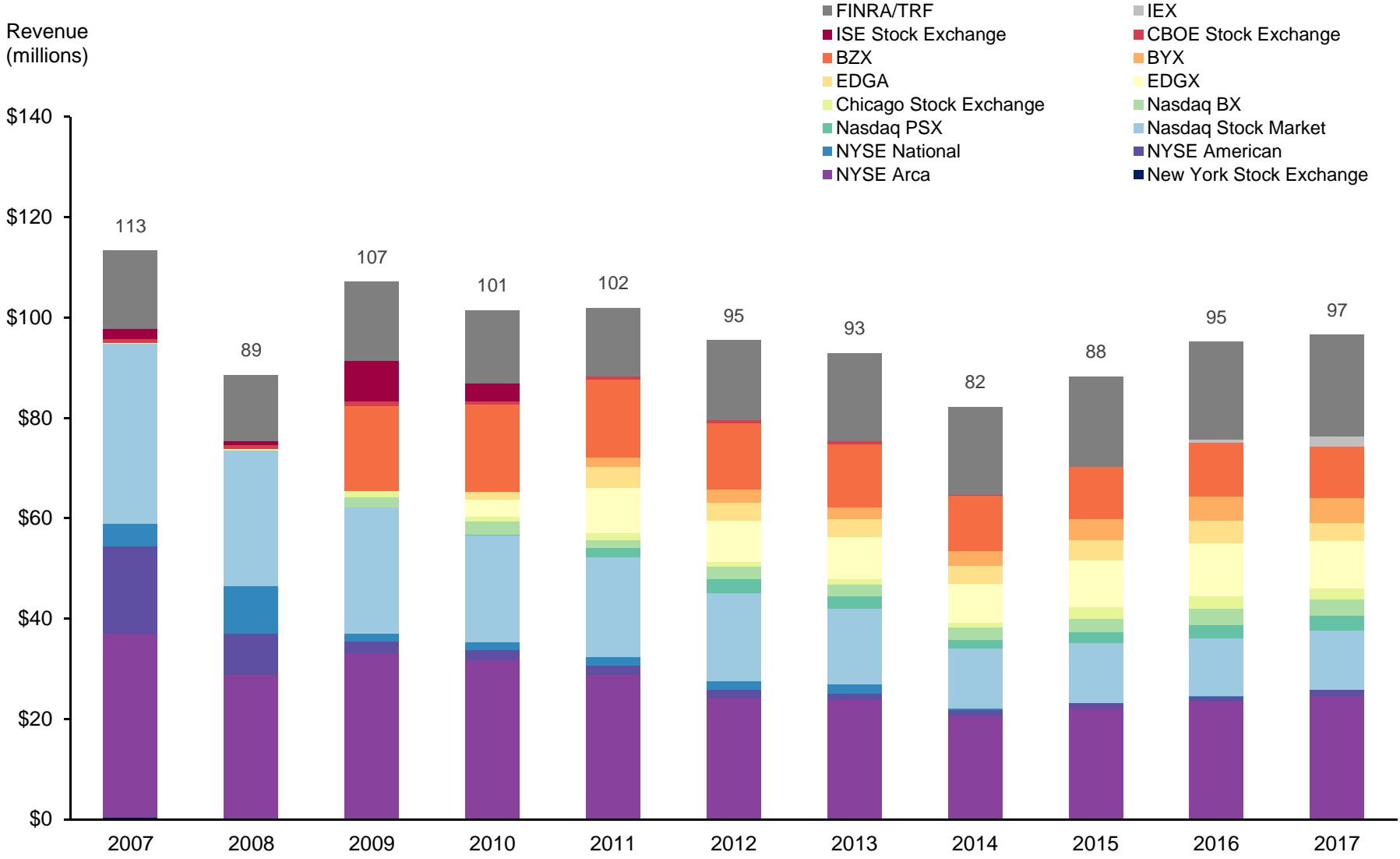






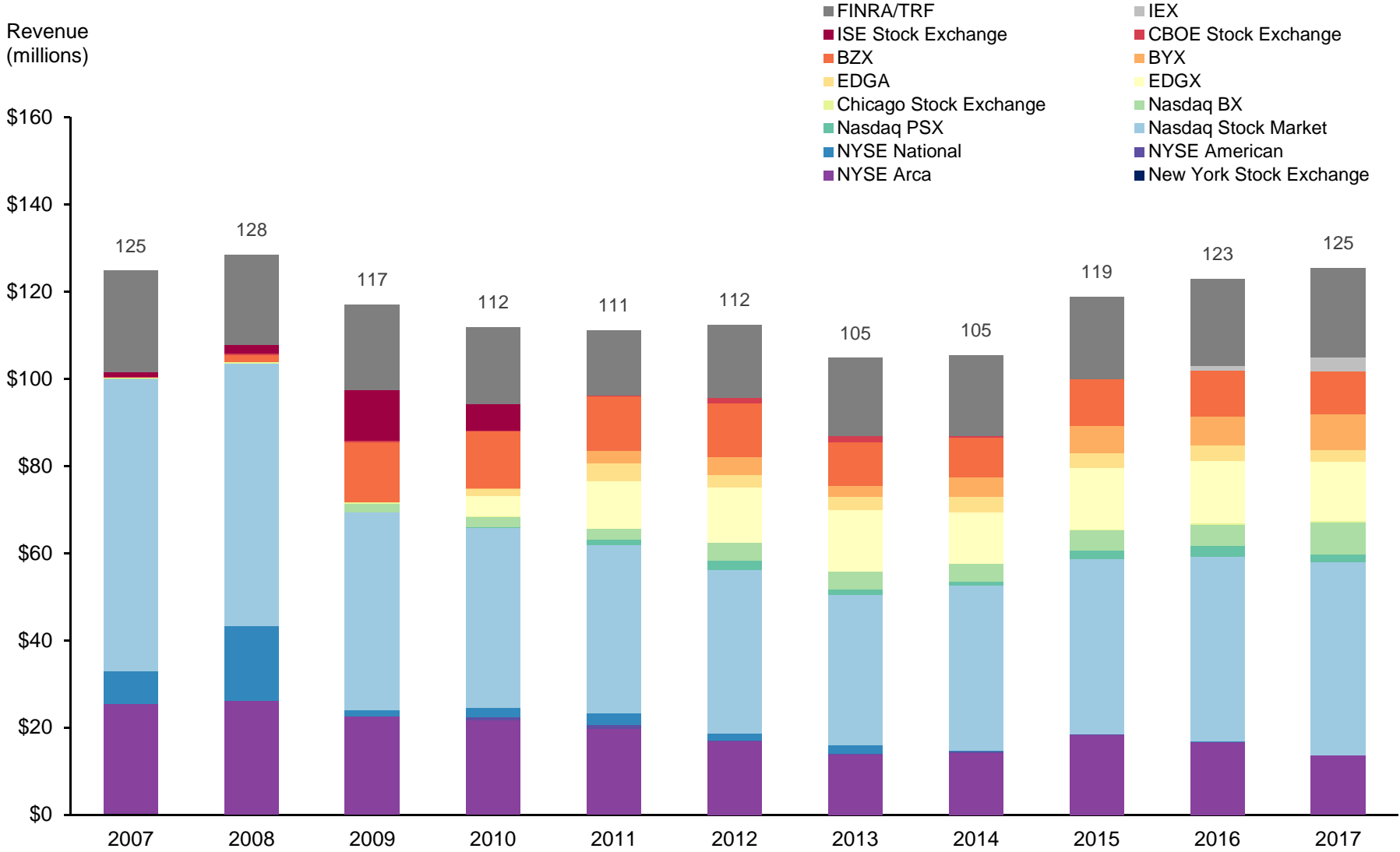
Figure 3

# Annual Consolidated (SIP) Equity Market Data Revenue: Tape B



Source: CTA Financial Disclosure on 3/1/18: Tape B Trade & Quote Revenue Distributed to Participants

# Annual Consolidated (SIP) Equity Market Data Revenue: Tape C



Source: UTP Plan Revenue Disclosure Q42017: Trade & Quote Revenue Distributed to Participants

Figure 3 shows the evolution of revenue allocation for Tape B (securities with primary listing on exchanges other than NYSE or Nasdaq). In 2007, a significant portion of Tape B revenues was earned by NYSE Arca and the American Stock Exchange. The combined Tape B revenue for current NYSE exchanges has decreased since then, as have Tape B revenues for the three current Nasdaq exchanges. Bats/Direct Edge exchanges and FINRA have gained market share over this interval and have seen an increase in Tape B revenues since 2007.

Figure 4 provides a similar chart for Tape C, which consists of securities with primary listing on Nasdaq. In 2007, Tape C revenue was mostly shared by Nasdaq, NYSE Arca, and FINRA. Since that time, the revenue earned by the Nasdaq exchanges has decreased, offset by increases in revenues by the Bats/Direct Edge exchanges and FINRA.

The data released by CTA and UTP also provides a breakdown between revenue distributed for the quote and trade components of the allocation formula. Based on the allocation formula that became effective in 2007, 50% of distributed revenues is allocated based on trading activity (number of trades and number of shares) and 50% based on quoting activity. Thus, across the entire industry, the amount of revenues distributed from the quote component equals the amount distributed from the trade component.

However, FINRA is not often used as a channel for displaying quotes, so its revenues are derived almost exclusively from trades.<sup>32</sup> Consequently, FINRA's share of the overall market revenues, reflected in the charts above, does not reflect its market share of trade reports. For example, in 2017, FINRA captured 16.6% of all consolidated market data revenue and 33.2% of

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<sup>32</sup> When market participants use FINRA's Alternative Display Facility ("ADF") for quoting, FINRA does earn quote credit. In recent years, however, FINRA has not received any allocation of quote revenue. FINRA's share of quote revenue across all networks was approximately 2.14% in 2014, 0.14% in 2015, and zero in 2016 and 2017.



the trade revenue. Because the exchanges are competing with FINRA for trade revenue but not for quote revenues, the exchanges derive more than half their SIP revenues from the quote component. This is an important distinction, because it reflects the value of a key aspect of the price discovery process.

In summary, Figures 2–4 show that while total consolidated revenues distributed have stayed roughly constant since 2007, primary listing exchanges NYSE, Nasdaq, and AMEX/NYSE American have experienced reduced allocations, in large part due to new trading venue entrants. New ECNs would successfully capture market share in trading and then become registered exchanges through mergers or through exchange registration. This happened with Archipelago in the early 2000s, which gained access to tape revenue by affiliating with and then acquiring the Pacific Stock Exchange (although in this case the NYSE Group ultimately recaptured that portion of the market data allocation when it acquired Arca Ex in 2006). This happened again with the development of the Bats ECN, which became a registered exchange in 2008 and launched a second exchange in 2010, and two Direct Edge ECNs, which became registered exchanges in 2010.

Off-exchange trading also provides a significant source of competition for consolidated market data revenues. FINRA’s competing TRFs—the FINRA/Nasdaq TRF and the FINRA/NYSE TRF—pass through the majority of their market data revenue from the CTA and UTP Plans to broker-dealer market centers that report trades to the TRFs. ATSS and broker-dealers trading as principal (including internalizers and wholesale purchasers of retail order flow) report their trades in this way. Thus, it is not just exchanges that receive revenue from consolidated feeds, but also dark pools, ATSS, and internalizers (who collectively receive tens of

millions of dollars annually in market data revenue rebates).<sup>33</sup> In fact, the total dollar amount of market data distributed to FINRA members who report off-exchange trades to a TRF has increased over time as the off-exchange share of trading has increased.

Market data rebates to broker-dealers reporting off-exchange trades serve two important disciplining roles. First, they effectively reduce the net amounts that off-exchange market centers pay for market data. Second, these rebates create an additional form of competition. In competing vigorously for order flow, exchanges can and do recognize that they must offer a trading product that is attractively priced relative to an alternative that may include market data rebates.

### **C. Exchange Market Data Revenues**

Exchanges receive equity market data revenue from the sale of proprietary data and from the sale of SIP data. Although the exchanges do not provide itemized details of their exchange market data revenues, total market data revenues (which include market data revenues from securities exchanges and other sources as well) are reported in the financial disclosures of exchanges' parent companies. These disclosures indicate that total market data revenue is a small portion of overall reported revenue, and has remained roughly constant over time as a percentage of those total revenues.

Table 2 provides data on total market data revenues (across all asset classes and all geographies) of exchange groups as a percentage of total revenues over time for the three major ownership groups, as reflected in their financial disclosures. Market data revenue reported by

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<sup>33</sup> In 2017, the TRFs collected over \$64 million in revenues from Tapes A, B, and C. According to FINRA Rule 7610B, 85% or more of revenues are shared with FINRA members whose market share is at least 0.1%. See [http://finra.complinet.com/en/display/display\\_main.html?rbid=2403&element\\_id=7355](http://finra.complinet.com/en/display/display_main.html?rbid=2403&element_id=7355).

ICE (and its predecessor NYSE Euronext), which includes market data for equity and non-equity products, both inside and outside the United States, has remained between 8% and 10% of total revenue from 2008 to 2017. Likewise, Nasdaq's market data revenue has remained between 9% and 12% over the same time period. For Bats, market data revenue accounted for 7% to 8% of revenues from 2015 to 2017.

From these financial disclosures, it is also possible to place a strong upper bound on the revenues from the sale of equity securities exchange proprietary data. Table 2 also shows that proprietary data accounts for at most \$65 million of 2017 revenue at Bats, which is 3% of its overall revenue that year. For Bats, it is clear that proprietary data is a significantly smaller source of revenue compared to consolidated data. For NYSE and Nasdaq, equity securities exchange proprietary data revenues have been discussed in recent earnings calls. During the 3Q17 ICE earnings call, for example, ICE management stated that “the sales of NYSE real-time equity data products [i.e., proprietary market data products] are expected to be less than \$90 million in annual revenue to us and their growth has been relatively stagnant. These products account for approximately 2% of ICE's annual revenue.” For the same quarter, Nasdaq provided a slide in its earnings presentation noting that U.S. equity proprietary depth products generated \$101 million in trailing 12-month revenue, compared to \$120 million for its share of consolidated data fees. Thus, it appears that for all three major U.S. stock exchange groups, proprietary equity market data actually provides less revenue to these firms than consolidated data.

#### **D. Third-Party Vendors**

Industry research reports, such as those by Burton-Taylor and Atradia,<sup>34</sup> provide detailed information about the costs of market data and related services to investors. For example, Burton-Taylor reports that in 2016, the total revenue earned by third-party vendors for market data–related services was over \$12 billion.<sup>35</sup> To put this number into perspective, this is over 10 times as much revenue as all the major exchanges combined earned for both proprietary and consolidated data during the same period. Exchange market data revenues across all asset classes and geographies (which is much more than market data revenue from just U.S. equity markets) total about \$1.1 billion in 2016—a small fraction of the over \$12 billion paid by market participants for real-time and trading data–related services during that time period.<sup>36</sup>

#### **E. Market Data Revenues as a Friction in Investment Performance**

Retail and other equity investors might look at these market data revenues and conclude that they are significant costs that could contribute to higher brokerage commissions, greater mutual fund fees, and other drags on an investor’s overall investment performance. However,

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<sup>34</sup> Burton-Taylor provides an annual report called “Financial Market Data/Analysis: Global Share & Segment Sizing.” Atradia published a research study in August 2010 called “The Cost of Access to Real Time Pre & Post Trade Order Book Data in Europe.”

<sup>35</sup> “Financial Market Data/Analysis: Global Share & Segment Sizing,” Burton-Taylor, 2017, p. 139. Note that this figure does not include exchange market data fees, and only includes fees paid to vendors themselves, denoted as “Real-Time & Trading Data.”

<sup>36</sup> Note that these three exchange groups operate a variety of financial markets, including options markets, futures markets, and others. Their financial statements do not separately break out U.S. equity market data fees, so the 2016 total U.S. *equity* market data fees are below \$1.108 billion, and probably substantially so. Similarly, the \$12.465 billion revenue number for third-party vendors applies to all financial markets, not just U.S. equity markets.

the data does not bear this out: the aggregate cost of equity market data is very tiny compared to the amounts invested in the stock market.

To see this, consider the \$1.1 billion of revenue reported by the three major exchange groups under the market data category (which includes all asset classes and geographies) in 2016 relative to the overall size of the U.S. equity market, which was \$30.15 trillion at the end of 2016.<sup>37</sup> Recall that this figure applies to all financial assets and jurisdictions where NYSE, Nasdaq, and Cboe operate, so it overstates U.S. equity market data revenue (likely by a substantial amount), whereas the size figure for the U.S. equity market is in fact limited to U.S. equities. Even so, this market data revenue figure represents less than 0.004% of the market capitalization of U.S. stocks, and the true ratio is probably substantially lower than 0.004% considering that the market data revenue figure (the numerator) includes data revenues from non-U.S. and non-equities markets. Equity market data has considerable value, as noted above, but even if its cost were considered as a simple drag on investment performance, the cost of equity market data would subtract far less than one basis point from overall investor performance each year.

This figure is also minimal compared to other standard sources of “drag” in investment performance: the overall amount charged in commissions, fees charged by investment managers, and so on. For example, I collected data on commissions charged by the retail brokerage sector. Together, the six firms in the Bloomberg Intelligence U.S. Retail Brokerage Competitive Peers Index reported \$10.0 billion in commission and related revenue in 2016. These firms alone take about 10 times as much in commissions from the subset of investors who use them as all market

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<sup>37</sup> Center for Research in Security Prices (CRSP) database total value of listed equity securities as of December 30, 2016.

data generates from *all* market participants. By making this comparison, I do not mean to suggest that these brokerage firms have inappropriate commission levels. In fact, these broker-dealers also seem to engage in robust competition for customers, constantly improving their technological infrastructures and service delivery, while providing value in the form of equity transactions in return for small fees. My only point in drawing these comparisons is that market data costs are quite modest in comparison to other costs incurred by equity market participants.

Exchange market data costs are also small relative to overall broker-dealer equity trading revenues. For example, in the first nine months of 2015 the nine largest investment banks earned a total of \$35.9 billion from their equities trading operations.<sup>38</sup> This amounts to an annualized total of \$47.9 billion, assuming that the banks generated revenues at the same rate.<sup>39</sup> In contrast, in 2015 the total market data revenue earned by NYSE, Nasdaq, and Cboe (for all asset classes and geographies) was \$1.1 billion. Thus, total exchange market data revenues were less than 2.3% of equities trading revenues for just these nine investment banks. Since the numerator includes non-equity market data revenue, and the denominator includes only nine firms, this 2.3% percentage overstates (and probably substantially so) the fraction of equity trading revenues spent on equity market data by broker-dealers in aggregate. In short, exchange equity market data is a very small cost for the securities industry overall.

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<sup>38</sup> Christina Rexrode, “The New Kid on the Stock-Trading Block: Citigroup,” *Wall Street Journal*, January 10, 2016.

<sup>39</sup> This value is calculated by dividing the reported values of equities trading revenue found in the *Wall Street Journal* article by 0.75 to estimate annual revenue. Although each of the banks does not report a separate value for equities trading revenue in their financial statements, the extrapolated number appears to be in the right ballpark based on relevant reported categories.

## VII. Conclusion

The data on equity market data revenues is clear. Revenues from the consolidated feed are modest, totaling \$387 million in 2017. These revenues are lower than they were 10 years ago, while the consolidated feed has gotten considerably faster. Scaled by the over 1.5 trillion U.S. shares that changed hands in 2017, consolidated feed revenues amount to at most two hundredths of a cent per traded share. Exchanges are selling their own proprietary market data, but their overall market data revenues are relatively small, and they have remained approximately constant as a percentage of overall exchange revenues. Finally, market data revenues are small compared to some of the other costs that market participants face. Third-party vendors have overall real-time and trading data revenues that are over 10 times exchange market data revenues. Broker-dealer commission revenue is similarly much larger than exchange market data revenue. When aggregated together, annual exchange market data revenues are at most 0.4 basis points of the U.S. equity market capitalization, so they are truly a rounding error when it comes to calculating overall investment performance.

The economics of equity market data are also clear. Market data is clearly valuable to a wide variety of market participants for a wide variety of reasons, and basic economic principles dictate that the producers of that market data should be compensated for that value, which the existing regulatory system accomplishes. Although most broker-dealers are required to subscribe to it, consolidated market data also has public good aspects, and like other public goods, consolidated market data might be underpriced without regulatory oversight. The SEC is capable of taking into account all of these considerations.

For proprietary exchange data feeds, the main question is whether there is a competitive market for proprietary market data. More than 40 active exchanges and alternative trading

systems compete vigorously in both the market for order flow and in the market for market data. The two are closely linked: an exchange needs to consider the negative impact on its order flow if it raises the price of its market data. Furthermore, new entrants have been frequent over the past 10 years or so, and these venues often give market data away for free, serving as a check on pricing by more established exchanges. These are all the standard hallmarks of a competitive market.



## Appendix — More Details on Market Data

There is a long history of stock exchanges and vendors selling market data. After stock ticker technology was introduced in 1867, ticker companies sold access to equity market data. For example, New York Quotation Co. and Gold and Stock Telegraph both disseminated quotation data from the NYSE. New York Quotation Co. became owned and controlled by the NYSE in 1890, and was given the exclusive right to provide equity market data to NYSE members.<sup>40</sup>

The modern era of equity market data began with the overhaul of securities market regulation in the early 1970s. This was a time of intense legislative and regulatory action, including a focus on the fragmentation of trading across primary exchanges, regional exchanges, and third-market (off-exchange) trading. A series of studies, reports, and hearings involving the SEC, the exchanges, advisory committees, and congressional committees culminated in a new regulatory framework built around the core principles of the legislatively mandated National Market System.<sup>41</sup>

An important component of this new regulatory framework was the development of a system for channeling trade and quote data from each trading venue into consolidated feeds. This was accomplished by creating joint industry plans (“NMS Plans”),<sup>42</sup> including the

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<sup>40</sup> For a description of the mechanics of how the tickers worked in the early twentieth century, see Sereno Pratt “The Work of Wall Street,” (1912), pp. 182–184.

<sup>41</sup> See Section 11(a) of the Securities Exchange Act of 1934. For a detailed summary of the regulatory activity at that time, see Robert Colby et al., “The National Market System: A Selective Outline of Significant Events,” 1985.

<sup>42</sup> An NMS Plan is a consortium of self-regulatory organizations (including registered securities exchanges and FINRA) that come together as “participants” under the plan’s governing documents as a mechanism for coordinating compliance with a particular regulatory mandate. The plans themselves are advised by various committees of market participants and are governed by committees made up of the plan members.

Consolidated Tape Association Plan, the Consolidated Quotation Plan, and the UTP Plan, described below.

Interestingly, consolidated equity market data is not mandated in many other jurisdictions around the world. For example, many European stocks are traded on multiple stock exchanges in the European Union, but each stock exchange there distributes its data as it sees fit and is not required to channel trade and quote data into consolidated feeds. In these jurisdictions, third-party vendors are typically the consolidators, aggregating individual exchange feeds together for use by market participants.

## **A. Consolidated Data**

### **1. National Market System Plans**

Under the U.S. regulatory framework developed in the early 1970s, certain trade and quote data must be disseminated through consolidated data feeds administered by NMS Plans regulated by the SEC.<sup>43</sup> Market participants, media outlets, and others subscribe to the consolidated data feeds to obtain data on current market quotes and trade reports. The NMS Plans collect fees from sales of consolidated data and distribute the revenues, net of certain expenses, back to the plan participants. Since 2007, revenues have been allocated among participants based on a formula established by the SEC in connection with the adoption of Reg

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<sup>43</sup> This requirement is laid out in Rule 603(b) (17 CFR 242.603(b)).

NMS.<sup>44</sup> In some cases, NMS Plan participants then pass a portion of these revenues on to other market participants through rebate programs.<sup>45</sup>

The two organizations responsible for overseeing the dissemination and sales of consolidated data for U.S. equity markets are the Consolidated Tape Association (“CTA”) and the UTP Plan.<sup>46</sup> They oversee the process under which trade and quote information is collected from the NMS Plan participants, consolidated, and disseminated to subscribers.

The CTA oversees the operations of the Consolidated Tape System (“CTS”), launched in 1974, and the Consolidated Quote System (“CQS”), launched in 1978.<sup>47</sup> The members or “participants” of the CTA Plan and CQ Plan include every registered stock exchange and FINRA.<sup>48</sup> (See Appendix Table A).

Trade and quote data for securities with a primary listing on the NYSE are distributed through CTA’s Network A (also known as Tape A), and trade and quote data for securities with primary listing on another non-Nasdaq exchange are distributed through CTA’s Network B (Tape B).<sup>49</sup> Historically, Network B consisted of securities listed on the American Stock Exchange (now known as NYSE American). After Archipelago Exchange became part of the

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<sup>44</sup> For a description of the current formula, see SEC Release No. 34-51808.

<sup>45</sup> For a description of the history of market data rebate programs, see Cecilia Caglio and Stewart Mayhew, “Equity Trading and the Allocation of Market Data Revenue,” *Journal of Banking & Finance* 62 (2016), pp. 97–111.

<sup>46</sup> More information about these plans, including governing documents, is available on their websites, [www.ctaplan.com](http://www.ctaplan.com) and [www.utpplan.com](http://www.utpplan.com). For information about the NMS Plan tasked with overseeing collection and distribution of data in the options market, see [www.opradata.com](http://www.opradata.com).

<sup>47</sup> For governing documents, see the Consolidated Tape Association Plan and the Consolidated Quotation Plan (“CQ Plan”).

<sup>48</sup> As of March 2018, there are 16 participants: New York Stock Exchange, NYSE Arca, NYSE American, NYSE National, Nasdaq Stock Market, Nasdaq BX, NASDAQ PSX, ISE Stock Exchange, CBOE Stock Exchange, BZX Equities, BYX Equities, EDGA Equities, EDGX Equities, the Chicago Stock Exchange, the Investors’ Exchange, and FINRA.

<sup>49</sup> Note that it is the primary listing venue, not the trade or quote venue, that determines the reporting network. Thus, trades and quotes on securities with a primary listing on the NYSE are distributed through Network A, even if the trade or quote occurred on another exchange.

NYSE Group in 2006, NYSE Arca became a popular listing venue for exchange-traded funds and structured products. More recently, Cboe's BZX exchange has adopted a similar listing strategy, and as of 2018, Network B includes securities with primary listings on NYSE Arca, NYSE American, and BZX. When the CTA was developed in the early 1970s, FINRA's predecessor, the National Association of Securities Dealers, operated a nascent system called NASDAQ for dealers to post quotes for stocks not listed on any exchange. The data distributed by the CTA did not include these stocks. The UTP Plan was developed to oversee the dissemination and sales of market data for stocks listed on Nasdaq, through a data channel known as Network C (Tape C).<sup>50</sup> Today, trade and quote data for securities with a primary listing on the Nasdaq exchange are distributed through Network C.

The 1975 regulatory framework also created the concept of a Securities Information Processor, or SIP, an entity registered with the SEC that is responsible for handling the mechanics of disseminating consolidated market data.<sup>51</sup> Accordingly, consolidated data is sometimes referred to as "SIP data." The SIP for the CTA is the Securities Industry Automation Corporation ("SIAC"), now a subsidiary of NYSE Group, and the SIP for the UTP Plan is Nasdaq.

## **2. Trade and Quote Data**

The CTA and UTP Plans govern the collection and initial distribution of consolidated market data. Subscribers (including third-party vendors) to the consolidated data feeds have

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<sup>50</sup> Note that the CTA and UTP feeds do not provide trade or quote data for securities that are quoted on the OTC Markets (formerly known as the "Pink Sheets") or FINRA's OTC Bulletin Board. Market data feeds are available for such stocks from OTC Markets, but these are not considered NMS Securities, and OTC market data distribution is not governed by an NMS Plan. See [www.otcmarkets.com](http://www.otcmarkets.com).

<sup>51</sup> See Section 11(a) of the Securities Exchange Act of 1934.

contractual limitations on their ability to redistribute consolidated market data for a period of 15 minutes. Data more than 15 minutes old is considered “historical data” and subscribers, including third-party vendors, can use that data as they wish, including redistributing or reselling the data without any payments to the CTA and UTP Plans. Databases of historical consolidated trade and quote data are widely used by market participants, academics, and regulators for research purposes and forensic analysis, in the form of the NYSE’s TAQ database and analogous products sold by other vendors such as Thomson Reuters Tick History.

Trade data in the consolidated feed includes the ticker symbol, time stamp, execution price, number of shares executed, information about the reporting venue, and various condition codes indicating special circumstances. Trades must be reported regardless of whether they are executed on an exchange, executed on an ATS (i.e., a dark pool or ECN), or executed by an internalizer (a broker that fills a client’s order using its own inventory) or wholesale market maker. Prior to October 31, 2013, trades for fewer than 100 shares (known as odd-lot trades) were not reportable.<sup>52</sup>

Trades executed on an exchange are reported with an exchange identifier. Trades executed off-exchange are reported to FINRA, typically through a Trade Reporting Facility, or TRF. These trades are identified on the consolidated feed as having been reported through a TRF, but the execution venue is not identified.<sup>53</sup> Thus, it is possible to identify which trades were executed off-exchange, but not whether the off-exchange trades were internalized, routed to a wholesaler, or executed on an ATS or dark pool.

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<sup>52</sup> SEC Release Nos. 34-70793 and 34-70794.

<sup>53</sup> SEC Release No. 34-61358.

Quote data included in the consolidated feed includes time-stamped “top-of-book” quotes from each exchange, including exchange best (lowest) offer price, number of round lots available at the best offer, best (highest) bid price, number of round lots available at the best bid, and various condition codes indicating special circumstances. The consolidated feed also contains quotes displayed by off-exchange market makers or ATSS on FINRA’s ADF and information about market conditions such as limit up/limit down events and trading halts.

#### **B. Exchange Proprietary Market Data Products**

Exchanges have also developed various market data products that they sell directly to subscribers. These data products generally differ from the SIP feeds. Data products sold by the exchanges include data feeds containing trades and quotes, depth-of-book information, and messages related to price discovery around the opening and closing auctions. Other data products sold by the exchanges include historical trade, quote, and order book data at all price levels, daily data summarizing trading activity by security, and reference data including information about securities, corporate actions, and indices.

Different market data products offered by the exchanges are designed for different types of market participants with different needs:

- Some market participants find that the consolidated feeds are sufficient; these participants have little or no need to purchase data directly from exchanges.
- Institutional brokers and proprietary trading desks may subscribe to some or all exchanges’ depth-of-book data feeds as inputs to their order routing algorithms or to help them work large orders. For example, an executing broker might break up a large order into smaller pieces submitted to multiple venues. Depth-of-book feeds could help that broker decide which venues to send the orders to and the prices at

which it should submit each order. These feeds would also help the broker readjust the pricing or venue for those orders based on evolving market conditions. For this purpose, “level data,” which summarizes the total amount of liquidity displayed at each price, may be sufficient.

- Other market participants, such as high-frequency trading firms, may be implementing market making operations or other trading strategies that rely on having low-latency access to order book information, or more granular information about the orders in an exchange’s book. For these market participants, the exchanges offer proprietary feeds with order-level data.
- Finally, some market participants may be interested in back-testing trading strategies or order submission strategies, for which highly granular historical data products can be useful.

### **1. Exchange Trade and Quote Feeds**

Prior to 2005, SEC rules prohibited exchanges from distributing trade reports through channels other than the consolidated feed.<sup>54</sup> The reforms adopted as part of Reg NMS in 2005 permitted exchanges to distribute trade reports through direct feeds, and more generally provided a regulatory framework for all sales of data through direct feeds.<sup>55</sup> Shortly after Reg NMS was adopted, there was an increase in the use of proprietary data feeds by market participants to get access to trades and top-of-book quote information faster than they could get it through SIPs. As

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<sup>54</sup> See SEC Rules 11Aa3-1(c)(2) and 11Aa3-1(c)(3), which were rescinded with the passage of Reg NMS in 2005 (see SEC Final Rule Release No. 34-51808).

<sup>55</sup> See Rule 603 of Reg NMS. For a discussion of this change, see SEC Release No. 34-49325.

described below, SIP latencies have decreased substantially in recent years due to technological improvements.

When it proposed and adopted Rule 603, the SEC stated that the rule meant that exchanges are prohibited from distributing data through direct channels “on a more timely basis” than they make the same data available to the SIPs. The SEC also clarified explicitly that this does not mean that an exchange must delay dissemination of its direct feeds in an attempt to synchronize the arrival of the feeds to end users. Rather, the SEC interprets Rule 603 as prohibiting an exchange from “transmitting data to a vendor or user any sooner than it transmits the data to a Network processor.”<sup>56</sup> There is no rule governing the timing of when any data purchaser receives data.

In the last decade, there have been dramatic improvements in the latency for both quotes and trades. In February 2018, for example, the average latency for quotes reported through the SIPs was 0.09 milliseconds for Tape A and Tape B securities and 0.017 milliseconds for Tape C securities. These quote latencies represent a significant reduction since the first quarter of 2010, when the average latency was 4.04 milliseconds for Tape A and Tape B securities and 5.42 milliseconds for Tape C securities. There have been similar improvements in trade-reporting times. The average latency for trades reported through the SIPs fell from 6.46 milliseconds in the first quarter of 2010 to 0.15 milliseconds in February 2018 for Tape A and Tape B securities, and from 6.06 milliseconds to 0.017 milliseconds for Tape C securities over the same period.<sup>57</sup>

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<sup>56</sup> SEC Release No. 34-51808, pp. 269–271.

<sup>57</sup> “Key Operating Metrics of Tape A&B U.S. Equities Securities Information Processor (CTA SIP),” *Consolidated Tape Association*, Q4 2017; “UTP Q1 2018 - February TAPE C QUOTE METRICS,” *Unlisted Trading Privileges*, February 2018; U.S. Equities Securities Information Processor (UTP SIP) Key Quarterly Operating Metrics of Tape C,” *Unlisted Trading Privileges*, Q4 2015.



## 2. Depth of Book Data

The market data products sold directly by exchanges include real-time limit order book information. Although SIP data contains quotes displaying the number of shares available at each exchange's best bid and offer (top-of-book quotes), the direct data feeds available from exchanges include "depth-of-book" information about displayed liquidity at other price levels below the exchange's best bid and above the exchange's best offer.

Some depth-of-book data products include only aggregate information about the number of shares available at each price point, whereas others provide more granular information on individual orders. Some depth-of-book products provide an updated view of the limit order book at fixed time intervals, whereas others are updated in event time.

Historically, limit order book information for NYSE-listed stocks was available only at the specialist's post on the floor of the exchange. The introduction of NYSE's OpenBook in 2002 was the first time that market participants off the trading floor could see the number of shares available in the NYSE's order book at price levels outside the NYSE's best bid and offer quotes.

When it was originally launched, OpenBook was distributed only through third-party vendors, included the aggregate number of shares available at each bid and offer price provided, and was updated every 10 seconds.<sup>58</sup> Over time, the OpenBook product has improved markedly both in terms of speed and granularity. Today, NYSE offers OpenBook Aggregated, a feed similar to the original OpenBook product but updated every second, and OpenBook Ultra, which is updated with every limit order event in real time.

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<sup>58</sup> SEC Release No. 34-45138.

For Nasdaq stocks, market data feeds summarizing the top-of-book liquidity (Level 1) and quotes from individual dealers at all prices (Level 2) have long been available to market participants. Level 2 quotes first became broadly available to public market participants with the development of the Nasdaq Quotation Dissemination Service in 1983.<sup>59</sup> Currently, Nasdaq's main depth-of-book product is TotalView, which shows full depth at each price level for any security that can be traded at Nasdaq. TotalView also shows odd-lot orders, as well as order imbalance information for opening and closing auctions each day, for IPOs, and for the reopening of trading after trading halts.

Cboe has similar real-time product offerings which include top-of-book and depth-of-book data for the BZX, BYX, EDGA, and EDGX exchanges. Customers can purchase trade and quote data, last sale data, or a composite product that offers both, along with aggregated depth-of-book data. Cboe also offers historical market data for its quote, trade, and depth products.

### **C. Third-Party Vendors**

Market data is widely available from third-party vendors. These vendors provide integrated access to a wide variety of services to assist their clients in their trading activities. The vendors' services include access to the real-time market data that SIPs and exchanges provide, as well as reference and valuation data, analytics, news, independent research, and trading platforms. Investment professionals rely on the technology from third-party vendors to not only access market data, but to interact with it and to trade. There is a large market for these services, and they generate substantial revenues. As detailed elsewhere in the paper, the revenues generated by third-party vendors from selling their services are an order of magnitude

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<sup>59</sup> SEC Release No. 34-79863.

larger than the revenues generated by SIPs and exchanges through sales of consolidated and proprietary data.

## CTA and UTP Plan Participants

Participant	Predecessors	Reporting Code
New York Stock Exchange		N
NYSE Arca	Pacific Exchange/Archipelago Exchange (–2006)	P
NYSE American	American Stock Exchange (–2008); NYSE Alternext US/NYSE Amex/NYSE MKT (2008–2017)	A
NYSE National	Cincinnati Stock Exchange (–2003); National Stock Exchange (2003–2011)	C
Nasdaq Stock Market		T/Q
Nasdaq BX	Boston Stock Exchange (–2008)	B
Nasdaq PSX	Philadelphia Stock Exchange (–2008)	X
BZX	BATS Z/Bats BZX (2005–2017)	Z
BYX	BATS Y/Bats BYX (2005–2017)	Y
EDGA	EDGA/Bats EDGA (1998–2017)	J
EDGX	EDGX/Bats EDGX (1998–2017)	K
Chicago Stock Exchange	Midwest Stock Exchange (–1993)	M
The Investors Exchange		V
FINRA	NASD (–2007)	D

Source: CQ Plan - Composite as of May 3, 2018; CTA Plan - Composite as of May 3, 2018; UTP Plan Effective as of January 9, 2018; SEC Self-Regulatory Organization Rulemaking Website: <https://www.sec.gov/rules/sro.shtml>

Note: Participants currently receiving Plan revenues are included. The list of predecessors is not exhaustive. The Chicago Board Options Exchange (Cboe) and the International Securities Exchange (ISE) are also listed as participants in the CTA and UTP Plans. Cboe and ISE are active options exchanges. At one time they operated stock exchanges, known as the Cboe Stock Exchange and the ISE Stock Exchange, respectively, but these exchanges are no longer operational: Cboe Stock Exchange has not generated any market data revenues since 2014, and ISE Stock Exchange has not generated any market data revenues since 2010.