Make and Take Fees in the U.S. Equity Market

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Abstract

We study make and take fees on the U.S. stock exchanges, documenting that exchange trading volume depends on the net fee relative to that of other exchanges. This result implies that traders do not fully adjust their quoted prices to offset the exchange's fees. In addition, we show that the allocation of the net fee to makers and takers has an effect on trading activity, specifically, an increase in the take fee decreases trading volume more than an increase in the make fee. We do not find an association between the fee structure and changes in quoted spreads.

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Abstract

We study make and take fees on the U.S. stock exchanges, documenting that exchange trading volume depends on the net fee relative to that of other exchanges. This result implies that traders do not fully adjust their quoted prices to offset the exchange's fees. In addition, we show that the allocation of the net fee to makers and takers has an effect on trading activity, specifically, an increase in the take fee decreases trading volume more than an increase in the make fee. We do not find an association between the fee structure and changes in quoted spreads.

I. Introduction

In recent years, stock exchanges have adopted the "make-and-take" fee pricing model to compete for order flow, trading volume, and ultimately, revenue. As of 2010, all 14 registered equity exchanges in the United States employed make-and-take fees. The structure involves separate fees for orders that take liquidity (i.e., marketable orders) and for orders that provide liquidity (i.e., orders that are nonmarketable when posted).[1] The fees are levied on a per-share basis when trades are completed, and can be negative; that is, comprise a rebate from the exchange. Figure 1 presents a graphical representation of the relationship between the exchange, customers' orders adding liquidity, and customers' orders taking liquidity in the make-and-take fee pricing model. The sum of the make fee and take fee is the net fee (the total fee charged by an exchange), where a positive net fee provides revenue for the exchange when trades are completed.

The use of make and take fees by U.S. exchanges is a relatively recent phenomenon, having become widespread only after 2007. As a consequence, the effects of these fees on market outcomes have been little studied to date. This paper explores the effects of make-and-take fees on trading volume, market share, and quoted prices across exchanges. In particular, we assess the following economic issues.

First, we study whether traders alter quoted prices so as to neutralize the effects of fees. The reasoning of Angel, Harris, and Spatt (2011) implies that, holding the total fee constant, an increase in the make fee will have a positive effect on the quoted spread while an increase in the take fee will have a negative effect on the quoted spread, such that true (net-of-fees) spreads are unchanged. On the flip side, in the presence of frictions such as nonzero tick size, traders cannot fully neutralize the fees and consequently the fee structure; that is, the allocation of the total fee to makers and takers, matters (Foucault, Kadan, and Kandel, 2013).

Second, we explore whether exchanges' trading volume and market share depend on an exchange's net fees relative to other exchanges. A downward-sloping demand curve for trading implies that each exchange's trading activity should be negatively related to the total fee, unless

[1] Marketable orders are either market orders or buy (sell) limit orders whose limit is at or above (below) the current market. Nonmarketable orders are buy (sell) limit orders in which the limit price is below (above) the current market.

traders change their quotes such that the effect of the fee is completely offset. Alternatively, Colliard and Foucault (2012) show that an increase in the total fee can be associated with increased trading activity due to heterogeneous patience across investors. With a fee increase, patient investors submit more aggressive quotes, increasing the likelihood of a transaction. We assess empirically which of these hypotheses holds.

Third, we evaluate whether market outcomes are equally sensitive to changes in make versus take fees. Outcomes potentially depend on discrepancies in participation rates between traders making liquidity and traders taking liquidity. Exchanges may elect to subsidize one side in order to balance any discrepancies in participation rates between makers and takers of liquidity. Empirically, the make fee is most often negative, implying rebates for orders that add liquidity, and the take fee is positive. The idea is that exchanges pay rebates to liquidity makers to increase the number of non-marketable orders, thus, increasing liquidity, which in turn attracts marketable orders (Foucault, Kadan, and Kandel, 2013). The increased number of executed transactions generates revenue for the platform and increases its market share with respect to its competitors. Alternatively, if an exchange were to observe many nonmarketable orders but few transactions, it can choose to reduce fees or provide rebates to liquidity takers. Negative take fees have also been observed. For example, in 2010, BATS-Y advertised that they offered a rebate of \$0.02 per 100 shares for traders removing liquidity.[2]

To our knowledge, this study is the first to formally assess relations of make, take, and net fees with trading activity and spreads. These issues are of increasing importance due to the changing structure of the trading environment. In recent years, the listing and trading functions of exchanges have been decoupled, and trading has fragmented across trading venues as new entrants such as BATS-X, BATS-Y, Direct Edge, and the like, have gained significant market share. Fees are an important source of revenue for the exchanges.[3] Nasdaq reports 2010 revenue from take fees of \$1.600 billion and rebates to the make side of \$1.094 billion, which combined amounts to a net fee revenue of \$0.506 billion (2010 10K Report). By comparison, Nasdaq's net income in 2010 is \$0.395 billion. Further, exchanges potentially earn significant revenue from

[2]Nasdaq OMX BX, Direct Edge's EDGA, and CBSX exchanges have operated similar pricing structures.

[3]Exchanges have gone through "demutualization" where a nonprofit member-owned mutual organization is transformed into a for-profit shareholder corporation, and if publicly traded like Nasdaq, must file a 10K Report (Macey and O'Hara, 2005).

the sale of trade and quote data, which magnifies the importance of optimizing the fee structure.

To assess relations between make-and-take fees, trading volume, market share, and quoted and net-of-fees spreads, we construct a sample that includes data from January 2008 to December 2010 across all registered exchanges in the U.S.[4] The fee data are hand-collected from the SEC filings and press announcements and include total fees, make fees, and take fees. Exchanges have different fees for securities listed on three "Tapes." Tape A securities are listed on the NYSE exchange, Tape B securities are listed on the NYSE-Arca-, Amex-, and regional exchanges, and Tape C securities are Nasdaq listed. We record the fee for each tape and exchange and conduct our analysis at the tape-exchange level. The sample includes 108 tape-exchange fee-change events.

We find evidence that an increase in the level of an exchange's net fee is associated with a reduction in trading volume and market share relative to other exchanges and is associated with an increase in the quoted and net-of-fees spreads. We further find that an increase in the take fee decreases trading activity more than an increase in the make fee. We do not find an association between the fee structure and changes in quoted and net-of-fees spreads. Our results imply that, contrary to the conjecture of Angel, Harris, and Spatt (2011), traders do not fully neutralize the fees by systematically changing their quotes in response to fee changes.

Our evidence is relevant to the current debate regarding the desirability of imposing a transaction tax. Proponents argue that such a tax could stabilize financial markets (Keynes, 1936), while the opponents' view is that it could adversely affect market liquidity in terms of wider spreads and lower trading activity and, consequently, increase the cost of capital (Amihud and Mendelson, 1992, 1986). Our results are relevant since they imply that the effect of higher exchange fees, which are not fully offset by changes in quotes, are likely to be similar to a transaction tax on shares traded. Our study contributes to the debate by showing that a higher total fee reduces trading activity and market liquidity.

[4]The list of registered exchanges is available at `http://www.sec.gov/divisions/marketreg/mrexchanges.shtml`. Our sample includes the NYSE Amex LLC (formerly the American Stock Exchange), BATS Exchange Inc., BATS Y-Exchange Inc., NASDAQ OMX BX Inc. (formerly the Boston Stock Exchange), Chicago Board Options Exchange Incorporated (CBOE Stock Exchange [CBSX]), Chicago Stock Exchange Inc., EDGA Exchange, Inc., EDGX Exchange, Inc., International Securities Exchange LLC (ISE), the Nasdaq Stock Market LLC, National Stock Exchange Inc. (formerly the Cincinnati Stock Exchange), New York Stock Exchange LLC, NYSE Arca Inc., and NASDAQ OMX PHLX Inc. (formerly Philadelphia Stock Exchange).

In related work, Malinova and Park (2011) study the effects of a single fee-change event, an introduction of a negative make fee, for a subsample of stocks on the Toronto Stock Exchange. They find that the liquidity rebate structure leads to decreased spreads, increased depth, increased volume, and intensified competition in liquidity provision. We assess relations between fees, trading activity, and quoted and economic spreads across many exchanges. Recently, the make-and-take fee pricing model has been introduced on the options markets as well. Battalio, Shkilko, and Van Ness (2011) and Anand, McCormick, and Serban (2012) explore the make-and-take fee pricing model and the payment-for-order flow model in application to equity options exchanges and show that evaluations of market quality that ignore taker fees can be misleading and that neither structure dominates on all dimensions.

The next section introduces the data and the variables of interest and provides summary statistics. The details of the empirical methodology and results are reported in Section III. Section IV concludes.

II. Data

A. Variables

We use SEC filings and press announcements made by the registered exchanges to hand-collect data on the make and take fees for the period January 1, 2008 – December 31, 2010.[5] We record the make fee as well as the take fee per 100 shares for Tape A, Tape B, and Tape C on every registered U.S. equity exchange. These fees can be either positive or negative (when negative, they are rebates from the exchange to the traders). The exchange earns the sum of the make fee and the take fee, i.e., the total (net) fee. Exchanges have adopted multiple levels

[5]It is important to note that Regulation NMS, which is a structural change affecting order execution and fees, was implemented by the end of December 2007. The regulation consists of four main parts, one of which is Rule 611, the Order Protection Rule (also known as the trade-through rule). This rule requires that exchanges route marketable orders to other exchanges that provide better prices; however, the rule does not take access fees or rebates into consideration in determining the best price. There are, however, exceptions to this rule – e.g., the Intermarket Sweep Orders (ISO), which allows the initiator of an order to designate the market that the order executes on. Chakravarty, Jain, Upson, and Wood (2012) show in a sample of 120 stocks that ISO orders represent 47% of trades and 42% of volume. Thus, we do not believe that Rule 611 "caused" the make-and-take fees per se, although Regulation NMS "cleared regulatory impediments to electronic trading and thereby led to increased competition between market centers" (p.4, Angel, Harris, and Spatt, 2011). This is not the focus of the current manuscript.

of fees, "tiers," based on volume and liquidity provision. Exchanges offer high-tier pricing to high-volume market participants (minimum total executed volume per month) who also provide high levels of liquidity (minimum limit order volume per month), while other traders who do not meet these thresholds are charged the less attractive basic-tier pricing.

For each tape-exchange, we construct two distinct fee variables to capture the different degrees of pricing attractiveness. The first one we refer to as "basic fee" (make or take), which is the fee charged to market participants who do not qualify for any volume or liquidity thresholds. The second one we refer to as "competitive fee" (make or take), which is the fee charged to market participants who qualify for the highest tier offered on an exchange. In the case there are no volume tiers, we record the fee that is offered to all market participants. The following are the fee variables we consider:

- *Nom_Make_Basic* and *Nom_Take_Basic* (*Nom* stands for nominal) are the make fee and the take fee, respectively, offered to traders who do not qualify for higher volume-based tiers. *Nom_Total_Basic* is the sum of *Nom_Make_Basic* and *Nom_Take_Basic*.
- *Nom_Make_Competitive* and *Nom_Take_Competitive* are the make fee and the take fee, respectively, offered to traders who qualify for the high volume-based tier and thus capture the most favorable pricing available on an exchange. *Nom_Total_Competitive* is the sum of *Nom_Make_Competitive* and *Nom_Take_Competitive*.

We would like to also capture the attractiveness of an exchange's fees compared with fees on rival exchanges. The nominal fees do not capture the exact position of an exchange in terms of the fee it charges relative to its rivals' fees. A natural approach would be to take the distance from the cross-sectional mean or median, but this approach does not capture the dispersion or clustering of exchanges' fees. We design a measure, a relative-to-rivals fee, that captures the full distribution and, specifically, the distance of an exchange's fees from each of its rivals' fees. At each point in time, the exchanges are ordered from the lowest to highest nominal fee – i.e., Fee_1, Fee_2, $\ldots Fee_n$, then the relative fee measure for exchange i is defined as:

$$\text{Relative Fee Measure}_i = \sum_{k=1,k<i}^{i} |Fee_i - Fee_k| - \sum_{k=i,k>i}^{n} |Fee_i - Fee_k|. \tag{1}$$

The relative-to-rivals fee for exchange i is measured as the sum of all distances from Fee_i to Fee_k for each rival k where $k < i$ minus the sum of all distances from Fee_i to Fee_k for each rival k where $k > i$. If a rival increases its fee, the nominal fee remains unchanged while the relative-to-rivals fee on an exchange decreases, since its fee has become increasingly more attractive compared to its rivals' fee. Analogously, if a rival decreases its fee, the relative-to-rivals fee on an exchange increases, since its fee has become increasingly less attractive than before the change.[6] We denote the relative-to-rivals fee measure with *Rel* – e.g., *Rel_Make_Basic*.

Data are also collected from NYSE's Trade and Quote (TAQ) database.[7] In order to test the relationship between fees and trading activity, we need proxies for trading activity. Given that the fees are applied per share and the same fee is applied to all securities in a tape, we aggregate the individual security volume to the tape-exchange level. Thus, our measure of volume, Vol, is the volume in billions of shares traded on an exchange in a tape. We construct a corresponding market share measure, MS, which is the number of shares traded on an exchange in a tape divided by the sum of shares traded in that tape across all exchanges.[8]

We also test the relationship between fees and quoted prices.[9] On every exchange, for each individual security, we calculate the daily time-weighted average quoted bid-ask spread in dollars per share and in percentage of the bid-ask midpoint. We then take the median each day across all time-weighted individual-security quoted spreads within each tape on an exchange as our measure of typical quoted spread at the tape-exchange level (the best bid and offer [BBO] in

[6]The following is intended to illustrate the construction of the relative-to-rivals fee. Suppose there are a total of four exchanges: E, F, G, and H. Each exchange has a total fee per 100 shares: 0.01, 0.02, 0.03, 0.04, respectively (the mean level of total fee for the basic tier reported in Table I is 0.033). Consider the relative-to-rivals fee for exchange F. This is calculated as the sum of the distance to exchange E, the negative distance to exchange G, and the negative distance to exchange H. Thus, (0.02-0.01)-(0.03-0.02)-(0.04-0.02)= -0.02. In this sense, should the total fee on exchange, E, G, or H change, the relative-to-rivals fee on exchange F will adjust to reflect this change. For example, if exchange H were to increase its fee, to 0.05, the relative-to-rivals fee on exchange F would decrease to -0.03 to reflect that fact that exchange F's fee is now more attractive. Similarly, if exchange H decreased its fee to 0.03, the relative-to-rivals fee on exchange F would now be -0.01 to reflect the fact that its relative attractiveness has decreased.

[7]The Appendix discusses the Consolidated Quotes (CQ) and Consolidated Trades (CT) files with regard to what the data encompass, data management, and how to merge these databases with CRSP. We use CRSP to identify the tape of a security.

[8]The SEC requires that as of March 2, 2007, all nonexchanges must report to a trade reporting facility, which in turn reports to the consolidated tape (footnote 3, O'Hara and Ye, 2011). TAQ reports the aggregated volume combined for all TRF/ADFs. Thus, in estimating our market share measure from TAQ, we take into account the trades reported as TRF/ADFs as well.

[9]As explained in the Appendix, the Consolidated Quotes Files in TAQ report quote updates from all registered exchanges, and this updated quote will be the best bid and offer (BBO) prevailing at the market center.

each tape at the market center).[10] We denote the tape-exchange BBO in dollars as *$BBO* and in percentage as *%BBO*. For each tape-exchange, we also calculate the corresponding true economic net-of-fees spread, which is the spread that an investor pays on a liquidity-demanding round-trip transaction in the presence of fees. The net-of-fees spread in dollars per share is equal to *$BBO* plus twice the take fee per share (for the basic or the competitive tier) and is denoted with *$AdjBBO_Basic* and *$AdjBBO_Competitive*. Correspondigly, the net-of-fees spread in percentage of the bid-ask midpoint is denoted with *%AdjBBO_Basic* and *%AdjBBO_Competitive*.

B. Summary Statistics

Table I reports summary statistics, including mean, median, and standard deviation for the fee measures, volume, market share, and spreads across daily tape-exchange observations for the period from January 1, 2008, to December 31, 2010, across all tapes. We start with 32,801,938 daily security-exchange observations for our sample period that get aggregated to 18,362 daily tape-exchange observations for the trading activity and fee variables and to 18,282 daily tape-exchange observations for the spread variables.[11]

Panel A in Table I shows that the fee variables exhibit variation. On average, the make fee charged to all market participants is -$0.199 per 100 shares, which is negative and thus a rebate. The make fee charged to high-volume-high-liquidity market participants is -$0.229 per 100 shares, which represents a larger rebate on average. The take fee for the high-volume and high-liquidity market participants is $0.240 per 100 shares, which is less than the mean take fee charged to all market participants, $0.249 per 100 shares.[12] Not surprisingly, on average, the pricing menu offered to customers that qualify for the most competitive pricing is more attractive than the fees offered to all market participants. The fact that, on average, exchanges choose to subsidize one side of the market, in particular the make side, first suggests that exchanges are trying to balance discrepancies in participation rates between the two sides and second,

[10] The distribution of the time-weighted individual-security quoted spreads is positively skewed, and in this case, the median better represents the typical spread compared to the average at the tape-exchange level.

[11] After the filtering procedure described in the Appendix, we lose some spread observations.

[12] The SEC adopted Rule 610(c) of Regulation NMS to cap access fees on equity markets to 30 cents for 100 shares. Therefore, it is possible that the optimal take fee is beyond the imposed cap. The median value for the *Nom_Take_Basic* shown in the second column is 30 cents per 100 shares, which is the maximum allowed take fee by the SEC. The median for the *Nom_Take_Competitive* is 28 cents per 100 shares, which is 2 cents less than the imposed cap on the take fee.

exchanges are trying to increase the number of nonmarketable orders to increase liquidity.

Panel A in Table I also provides summary statistics on the net fee, or the total fee, charged by an exchange. *Nom_Total_Basic*, which is the sum of the make and take fees charged to all market participants, has a mean of \$0.050 per 100 shares.[13] *Nom_Total_Competitive*, which is the total fee catered for traders that meet certain volume/liquidity thresholds, has a mean of \$0.011 per 100 shares. In terms of revenue, a given tape-exchange earns roughly only 1 cent from the competitive pricing level, while it earns 5 cents from the basic pricing level per 100 shares. In fact, focusing on the median values reveals that a tape-exchange typically earns nothing from the traders transacting at the competitive pricing menu since the median *Nom_Total_Competitive* is zero. The median of the *Nom_Total_Basic* is 4 cents per 100 shares.

Panel B reports the relative-to-rivals fees, which captures the exact position, and not just the level, of an exchange's fees relative to the fees charged by its industry rivals. These variables are zero on average by construction for each daily cross-section. The median values show that there is fee clustering. For example, the medians for the relative make fee variables, *Rel_Make_Basic* and *Rel_Make_Competitive*, are negative (-0.260 and -0.235, respectively), which indicates that there are some tape-exchanges that offer much greater make fees or alternatively offer smaller rebates than most other tape-exchanges. The medians for the relative take fee variables, *Rel_Take_Basic* and *Rel_Take_Competitive*, are positive (0.220 and 0.190, respectively), which demonstrates that there are a few tape-exchanges that offer much lower take fees than other tape-exchanges.

Panel C in Table I reports the trading activity variables used in the later analysis. Across all tape-exchange observations in our sample, there are on average 0.182 billion shares traded in a tape on an exchange. Aggregating the volume in a tape across exchanges, the average daily tape volume is 2.338 billion shares and ranges from 0.230 billion shares to 9.803 billions shares (untabulated). The average market share of an exchange in tape-level trading volume is 7.574% and the median is 1.507%.

Panel D shows that the average tape-exchange *\$BBO* is \$0.197. Across all registered exchanges, the lowest tape-exchange dollar spread (untabulated) occurred on BATS Y-Exchange for all three tapes (ranging from \$0.016 to \$0.018). The highest tape-exchange dollar spreads in

[13]Interestingly, a negative total fee has also been employed by exchanges for some periods of time (e.g., Direct Edge, NYSE Amex).

Tape A, Tape B, and Tape C occurred on CBOE Stock Exchange, Chicago Stock Exchange, and CBOE Stock Exchange, respectively (ranging from \$0.250 to \$0.655). When we adjust *\$BBO* for fees, we add twice the take fee per share. The net-of-fee spreads variables, *\$AdjBBO_Basic* and *\$AdjBBO_Competitive*, are both greater than the quoted spread, *\$BBO*. The average *\$AdjBBO_Basic* is only slightly greater than *\$AdjBBO_Competitive*, but the medians are the same. While appearing similar, these variables are estimated differently due to the difference between the take fee offered on the basic and competitive tier pricing on a per-share basis of \$0.009 per 100 shares (\$0.2490-\$0.2400).

The dollar quoted bid-ask spreads are usually increasing in share price, so the quoted bid-ask spread measured in percentage could provide a more accurate picture than the dollar spread. The percentage spread measures the round-trip trading cost of a \$1000 position in an asset. The average tape-exchange level spread measured in percentage, *%BBO*, is 1.271% (reported in Panel D). The lowest tape-exchange level spreads in percentage (untabulated) occurred on BATS Y-Exchange for Tape A and Tape B securities (0.093% and 0.082%) and on NASDAQ OMX PHLX Inc. Exchange (formerly Philadelphia Stock Exchange) for Tape C securities (0.157%). The highest spreads in Tape A, Tape B, and Tape C occurred on CBOE Stock Exchange, Chicago Stock Exchange, and CBOE Stock Exchange, respectively (ranging from 2.149% to 4.407%). As is the case when spreads are measured in dollar terms, now again when the spreads are measured in percentage terms, the net-of-fees spreads variables (basic and competitive) are both greater that the quoted spread variable. However, now in percentage terms, the net-of-fees spread for the competitive pricing level and the net-of-fees spread for the pricing menu offered to all market participants are quite different. The mean and the median for the *%AdjBBO_Basic* are 1.320% and 1.318%, while the mean and the median for the *%AdjBBO_Competitive* are 0.716% and 0.714%, respectively.

C. Money Transfer

Note that Table I reports summary statistics of the variables of interest on a *tape-exchange* level. Now, we are interested in obtaining upper and lower boundaries of money transfer due to make-and-take fees among *exchanges*, makers, and takers. We use our hand-collected data

and calculate a range of how much money is transferred among makers, takers, and exchanges in aggregate for 2008 through 2010 and report results in Table II.

Recall that the "basic fee" measure offers the least competitive pricing, while the "competitive fee" measure offers most favorable pricing for market participants. Assuming the "basic fee" is applied to all transacted shares provides us with the upper bound of money transfer. On average, an exchange is paid \$1.168 million per day by takers and rebates \$0.708 million to makers, thus an exchange retains \$0.459 million (Panel A, Column (1)). Assuming that all transacted shares are subject to the "competitive fee" pricing level gives us the lower bound of average daily money transfer for an exchange. In this case, an exchange makes much less on average, \$0.132 million per day (Panel B, Column (1)). The money that all exchanges retain in aggregate for the whole sample period ranges from \$885 million (approximately 12% of the aggregate amount paid by takers, Panel B, Column (3)) to \$3,086 million (approximately 40% of the aggregate amount paid by takers, Panel A, Column (3)). Therefore, the exchanges retain as little as 12% and as much as 40% from the fees that takers paid, and the other 88% to 60% are paid as rebates to makers of liquidity.

III. Methodology and Results

A. Methodology

We perform regression analysis in changes of variables using the full sample of tape-exchange observations in daily frequency during the period January 1, 2008 through December 31, 2010. In our sample, we have 108 tape-exchange fee change events.[14]

In order to test the relationship between trading activity and fees, we perform tests in which our dependent variable is volume in billions of shares in a tape on an exchange, *Vol*, or the corresponding market share measure in percentage, *MS*. The independent variables of interest are the nominal and the relative fee measures as explained in Section II. To control for changes in overall tape volume, unrelated to fees, we include the following variables in the regression

[14]Out of the 108 events, there are 12 cases in which the total fee charged on a tape-exchange decreased from a positive total fee to a negative total fee. There are 85 cases that included a change in make fee on either the basic or high tier and 84 cases of a change in the take fee on either the basic or high tier.

specifications: *Number*, the number of exchanges each day, and *Tape_Vol*, the total volume measured in billions of shares across all exchanges in a tape each day.

We also perform tests to explore the relationship between spreads and the fees, where our dependent variables are the quoted and net-of-fees spreads in dollars and in percentage and the independent variables of interest are again the nominal and the relative fee measures. It is well known that quoted spreads differ significantly across securities not only because of characteristics such as stock price and variance but also because of volume of trading (Stoll (1989), among others). Therefore, besides *Number*, we also include two other control variables – *Log_Exchange_dVol*, which is the logarithm of daily dollar volume in millions on a certain exchange in a certain tape and *Log_Rivals_dVol*, the logarithm of daily dollar volume in millions on the rival exchanges in the same tape. We also include year dummies in all regression specifications.

B. Volume and Market Share

Total Fee

Table III reports results when the dependent variable is ΔVol (Columns (1) through (4)) and ΔMS (Columns (5) through (8)). For all regression specifications in Columns (1) through (4), the coefficient on the control variable $\Delta Tape\_Vol$ is positive and significant, which shows that as the volume across all exchanges increases, the volume on a tape-exchange also increases on average. Interestingly, the coefficient on this control variable is also positive and significant in Columns (5) through (8) when the dependent variable is *MS*. This is likely attributed to the fact that during our sample period, there were a number of new registered exchanges that consistently gained market share. We find that the coefficient on $\Delta Number$, the change in the number of exchanges, is positive but insignificant in all regression specifications in Table III.

In Panel A, our independent variable of interest is total (net) fee. Column (1) reports results from a regression specification where the dependent variable is a change in volume, ΔVol, and the independent variable of interest is ΔNom_Total_Basic, which is the change in the total fee offered to market participants that do not meet volume/liquidity thresholds. The coefficient is negative (-0.193) and statistically significantly different from zero. In Column (2), we report results

from regressing changes in volume, ΔVol, on $\Delta Nom\_Total\_Competitive$, which is the change in the total fee offered to market participants that meet higher volume/liquidity thresholds. The point estimate is -0.197 (p-value of 0.00). The observed negative association between changes in volume and changes in total fee indicates that the volume on a tape-exchange increases when the total fee decreases. This finding is consistent with predictions that the trading rate on an exchange is affected by changes in its total fee (Colliard and Foucault, 2012). In Columns (3) and (4), we regress changes in volume on changes in the relative-to-rivals basic fee measure and changes in the relative-to-rivals competitive fee measure, respectively. The point estimates are -0.018 (p-value of 0.01) and -0.016 (p-value of 0.02). Thus, if an exchange offers a low nominal fee compared to its rivals, decreasing its fee further – i.e., increasing the distance to rivals offering higher nominal total fees, also has a positive effect on its own volume. For example, in the extreme case when an exchange offers the lowest nominal total fee, reducing that fee further can incentivize some market participants to utilize that exchange.

We also explore the relationship between market share and total fee, where an exchange's market share is the percentage of traded shares in a tape. Results are reported in Panel A, Columns (5) through (8), of Table III. In Column (5), the coefficient associated with ΔNom_Total_Basic is negative and significant (-2.515, p-value of 0.00), and in Column (6), the coefficient associated with $\Delta Nom\_Total\_Competitive$ is also negative -1.431 and marginally significant (p-value = 0.06). The results indicate that on average, when an exchange decreases its total fee, the market share of the exchange increases. Columns (7) and (8) show the results from estimating a regression where the dependent variable is again ΔMS, but now the independent variable of interest is the corresponding relative-to-rivals transformation of the nominal fee measures for the basic and competitive pricing, respectively. The coefficients are -0.186 (p-value of 0.04) and -0.179 (p-value of 0.06), respectively. Therefore, decreasing the total fee has a positive effect on market share, and this relationship is more pronounced for the basic fee pricing measure vs. the competitive fee pricing measure.

One reason changes in tape-exchange market share are more sensitive to "basic" fee changes than "competitive" fee changes could be that switching costs are higher for the market

participants that qualify for the more competitive pricing menu.[15] Further, the fact that exchanges offer two pricing menus is consistent with second-degree price discrimination, in which exchanges offer better prices to large-quantity clients and effectively capture more consumer's surplus. Exchanges are not able to differentiate between different types of customers in terms of volume and liquidity preferences. As a result, they provide incentives for customers to essentially self-select into either the basic or competitive fee scheme based on their volume and liquidity preferences. Hence, the market participants who qualify for the more competitive pricing are the ones that, on average, have higher gains from trade (due to potentially large amounts of shares to trade or informational advantages). Therefore, small changes in their transaction costs do not affect their high willingness to trade. On the contrary, for lower-volume-liquidity traders who transact at the basic tier pricing, the gains from trade are less and, therefore, these traders are more sensitive to small changes in transaction costs.

Due to heterogeneous patience across investors, an increase in total fee can be associated with an increase in trading activity (Colliard and Foucault, 2012). Also, if traders fully offset the changes in the total fee by appropriately adjusting their quotes, we should observe no effect of changes in the total fee on changes in trading activity. We find that on average, total fee is negatively related to exchange's trading activity as measured by volume and market share. First, our results are consistent with a downward-sloping demand curve for trading, and second, traders do not fully offset the effect of changes in the total fee.

Allocation of Total Fee between Makers and Takers

Next, we empirically investigate whether the make/take breakdown, i.e., the allocation of total fee to the two sides of the market, affects trading volume and market share. The regression results are reported in Panels B and C in Table III.

To study the effect of the allocation of the total fee between makers and takers on trading activity, we separately regress changes in trading activity (volume and market share) on changes in make fees and take fees and test whether the difference between the two coefficients is different

[15]For example, if a trading firm places its servers and computers within the same facility as the exchange's matching engine in order to get faster access to market data (known as "co-location"), it will experience higher switching costs in the event it has to move.("Not so fast!" by John D'Antona Jr. and Peter Chapman, Traders Magazine, August 28th, 2010.)

from zero. If this difference is zero, we can infer that a unit change in the make fee has the same effect on trading activity as a unit change in the take fee. Consequently, in these circumstances, what mattes is the sum of the make fee and take fee – i.e., the total fee, and an exchange cannot affect its trading activity by changing the allocation of the total fee between the two sides of the market. Panel B of Table III follows the methodology in Panel A, where instead of total fee, we include both the make fee and take fee as separate independent variables in the same regression specification. Panel C reports the estimates of the difference between the parameters of the corresponding make fee and take fee in Panel B.

First, we regress the change in volume on both the change in nominal make fees and the change in nominal take fees for the basic-level pricing and report results in Column (1) of Panel B. The coefficient on ΔNom_Make_Basic is -0.165 and the coefficient on ΔNom_Take_Basic is -0.287; both are statistically significant. The difference between the two coefficients is positive and statistically significant, as reported in Panel C, Column (1) (the difference is 0.122 and the p-value is 0.02). This indicates that a unit increase in the take fee, on average, is associated with a larger decrease in volume than a unit increase in the make fee. Namely, an increase in the take fee by \$0.10 per 100 shares (one standard deviation reported in Table I) will reduce the trading volume by 0.0287 billion shares (to put this number in perspective, recall that the median tape-exchange volume is 0.0283 billion shares reported in Table I). An increase of the make fee by \$0.10 per 100 shares (approximately one standard deviation reported in Table I) will reduce the trading volume by only 0.0165 billion shares.

Column (2) in Panel B shows the results of regressing changes in volume on changes in the make and take fees for the most competitive pricing offered on an exchange. The coefficient on $\Delta Nom\_Make\_Competitive$ is -0.168 and on $\Delta Nom\_Take\_Competitive$ is -0.283. Both coefficients are significant, and the difference in the coefficients reported in Panel C is positive and significant (the difference is 0.114 and the p-value is 0.03). Thus, also for the competitive-tier pricing level, a change in the take fee is associated with a greater change in volume than a change in the make fee at the tape-exchange level.

Next, we also report findings for changes in volume regressed on changes in relative-to-rivals fees in Columns (3) and (4), which confirm our results reported for the nominal fee measures in

Columns (1) and (2). The coefficients associated with the relative-to-rivals fee measures are all negative and statistically significant (Panel B), and the differences between the corresponding coefficients on the make fee and the take fee variables are significant and positive (Panel C). Even if an exchange does not change its nominal fees, if other exchanges do, the attractiveness of its fee relative to other exchanges' fees changes. The results therefore indicate that a change in the relative take fee is also associated with a greater change in volume than a change in the relative make fee.

The results for both the basic fee and the competitive fee, regardless of whether the fees are nominal or in their relative-to-rivals transformation, show the negative effect of an increase in the make fee and the take fee on volume. These findings provide empirical evidence that the breakdown of the total fee between makers and takers – i.e., the fee structure, matters for trading activity (Foucault, Kadan, and Kandel, 2013).

Columns (5) through (8) of Panel B report results for the effect of changes in make and take fees on changes in market share. We first examine the effect of changes in the make and take fees in nominal terms (Columns (5) and (6)) and then in their relative-to-rivals transformation (Columns (7) and (8)). The results reported in Panel C, Columns (5) and (6), show that the breakdown of the total fee does not affect market share since the differences between the coefficients on make and take fees are insignificant (p-values of 0.37 and 0.25).

We would expect relative prices to matter more than absolute prices specifically in terms of market share. The results of a regression in which the dependent variable is market share and the independent variables are relative-to-rivals fee measures is more informative. For example, if the objective of an exchange is to maximize long-term profits by increasing market share, one strategy is to charge its customers a price based on the effective value of customers' alternatives. The relative-to-rivals fee variables capture the attractiveness of an exchange's fee compared to fees on all rival exchanges, specifically the distance (proximity of fees across exchanges) and not just the absolute level of the fee. Notably, in Panel C, Columns (7) and (8), when the fees are measured as relative-to-rivals analogues, the difference between the coefficients associated with changes in the make fee and the take fee is positive and significant for both the basic and the competitive pricing (-0.149 and 0.139 with corresponding p-values of 0.04 and 0.06).

Consequently, in a relative sense, a decrease in the take fee increases the market share of a tape-exchange more than a decrease in the make fee.

Our tape-exchange level analysis provides evidence that in the U.S. equity market, the volume of transactions as well as exchange's market share in trading volume depends not only on the overall level of net fees charged by the platform but also on the structure of these fees. Theory suggests that in the presence of frictions, like nonzero tick size, the breakdown of the total fee affects the equilibrium outcomes (Foucault, Kadan, and Kandel, 2013), and in the absence of any friction, only a change in total fee and not the breakdown of this total fee to the two sides of the market matters (Colliard and Foucault, 2012). Our results suggest that on average, an exchange could change its volume and market share in a tape by changing the allocation of the total fee between makers and takers. For example, should an exchange decide to increase its total fee in a tape by one unit, our results thus far indicate it would be better for the exchange to increase its make fee (or provide less rebate in the case the make fee is negative), as this would lead to a smaller reduction in volume than an increase in the take fee. These results are generally not consistent with the conjecture that on average, on a tape-exchange level, market participants fully neutralize a change in the make fee or the take fee by adjusting their quoted prices.[16] If the traders fully neutralize changes in these fees, we would have observed no effect on volume when changing allocation of the total fee between makers and takers. In the following subsection, we specifically explore the relationship between quoted and net-of-fees spread and the make-and-take fees, to study whether, on average, market participants do indeed adjust their prices.

C. Quoted Spread

Total Fee

If traders fully neutralize a net fee change by adjusting their quoted prices, we should observe an effect of the fee change on quoted prices but not on trading activity. In the previous section, we showed that an increase in the total fee leads to a reduction in trading activity at the

[16] On a separate note, while beyond the analysis of this study, we acknowledge that for some particular securities or for some subgroup of securities, market participants may neutralize changes in the make-and-take fees by changing their quoted prices (Foucault, Kadan, and Kandel, 2013).

tape-exchange level. The fact that an exchange's net fees affect trading activity is evidence that changes in the net fee are not completely offset by changes in quotes. We now turn our attention to specifically test whether there is association between changes in quoted spreads and changes in the net fee.

Table IV reports results when the dependent variable is the best bid and offer (BBO) quoted spread in dollars and in percentage of the bid-ask midquote. As previously defined in Section II, the dependent variables *$BBO* and *%BBO* are estimated at the tape-exchange level as the median of security-level time-weighted BBOs. Generally, in all regression specifications in Table IV, the coefficient on the control variable Δ*Log_Exchange_dVol*, which is the logarithm of daily dollar volume in millions on a tape-exchange, is negative and significant. This negative association between volume and spread is consistent with prior literature (Demsetz (1968), Copeland and Galai (1983)). The coefficient on the control variable Δ*Log_Rivals_dVol*, which is the logarithm of the daily dollar volume in millions on all rival exchanges, is positive and significant in all regression specifications. This shows that the quoted spread of an exchange is wider when rival exchanges exhibit higher trading activity. Taken together, the observed relationship among quoted spreads, an exchange's volume, and its rivals' volume provides some indication of the extent to which the market environment has changed in the stock exchange industry since the decoupling of the trading and listing functions and the impact on the competition among exchanges (see footnote (5)). The coefficient on Δ*Number* is positive but insignificant in the regression specifications reported in Columns (1) through (4) where the dependent variable is *$BBO*. However, the coefficient on Δ*Number* is negative and significant in the regression specifications reported in Columns (5) through (8) where the dependent variable is *%BBO*. This result provides evidence that as the number of registered exchanges increases, there is a reduction in the tape-exchange quoted spreads measured in percentage of the midquote – i.e., increased competition from other market centers leads to a reduction in transaction costs on average.

In Panel A, our independent variable of interest is the total fee. In Columns (1) through (4), we report results from performing regressions where the dependent variable is Δ*$BBO*, while in Columns (5) through (8), we report results from performing regressions where the

dependent variable is $\Delta\%BBO$. In Columns (1) and (2), when the dependent variable is $\Delta\$BBO$, the coefficients associated with the total fee (basic and competitive) in nominal terms are positive and significant at 10% level (p-values of 0.07 and 0.08). In Columns (5) and (6), when the dependent variable is $\Delta\%BBO$, the coefficients associated with the total fee (basic and competitive) in nominal terms are positive (point estimates of 1.278 and 1.817) and highly significant (p-values of 0.04 and 0.00). This result provides evidence that there is a positive association between total fee and quoted spreads. Recall that the results in the previous section show that an increase in the total fee reduces trading activity. Taken together, these results illustrate that an increase in the total fee is associated with a reduction in trading activity and an increase in the quoted spread at the tape-exchange level. For example, with regard to the competitive pricing level, the point estimate of -1.431 reported in Column (6) in Table III and the point estimate of 1.817 in Column (6) in Table IV together show that a one-cent increase in the net fee per 100 shares decreases the market share of an exchange by 1.4% and increases the quoted percentage spread per share at the tape-exchange level by almost 2%.

Thus far, the results can be summarized as follows. First, the fact that an increase in the total fee is associated with a reduction in trading activity and an increase in the quoted spread shows that the effect of changes in the total fee is not completely offset by changes in quoted prices, since if it were, a change in total fee should not affect the trading activity. Second, this fact implies that the effect of higher exchange fees, which are not fully offset by changes in quotes, is likely to be similar to a transaction tax on shares traded (a higher total fee reduces trading activity and market liquidity). With a transaction tax in place, "...some cost components may increase because of the 'thinner' market caused by the reduction in trading" (Amihud and Mendelson, 1992). Thus, an increase in the overall transaction costs leads to larger spreads. Third, this result also relates to studies that document an inverse relationship between spreads and trading activity (Demsetz (1968), Copeland and Galai (1983); McInish and Wood (1992)).

Interestingly, when the total fee is measured in relative terms, none of the coefficients are significant (Panel A, Columns (3), (4), (7), and (8)). Recall that if an exchange does not change its total fee in nominal terms but other exchanges do implement a change, the exchange's total fee in relative terms is also changed. That is, the exchange's total fee is relatively less competitive

compared to the total fee offered by the rest of the exchanges. The reported result above, namely, a change in the total fee measured in relative terms is not associated with changes in quotes, indicates that a reduction in the relative total fee will not have an effect on the exchange's quoted spread, even though it negatively affects its trading activity (Table III).

Allocation of Total Fee between Makers and Takers

Now we assess whether changes in quoted spreads are equally sensitive to changes in make versus take fees. Panel B of Table IV shows regression results when the dependent variable again is quoted spread and the independent variables of interest are the make fee and take fee, and Panel C reports the difference between the estimated regression coefficients on the make and take fee. Results in Panel B reveal that there is no significant relationship between quoted spreads and make and take fees. More importantly, Panel C demonstrates that none of the differences between the parameters for make and take fees reported in Panel B are significant. This leads to the conclusion that only the level of the total fee and not its allocation to the make and take sides affects the quoted spread.

For the full sample of all traded securities, aggregated to tape-exchange level, our results demonstrate that the allocation of the total fee between makers and takers is relevant for an exchange's trading activity as measured by volume and market share and that traders do not fully neutralize changes in make and take fees by adjusting quoted prices at the tape-exchange level. Our results are contrary to common perception that market participants fully neutralize changes in make and take fees. These results, however, are not necessarily inconsistent with finding that allocation does or does not matter for certain types of securities since our analysis focuses on the tape-exchange level versus security-exchange level. For example, it is possible that the make/take allocation at the security level is dependent upon different security-level characteristics like, for instance, traders' interest in an asset (an inclusion/deletion of a stock from the S&P 500 index will cause buying/selling pressure from index funds, for instance). That is, it could be the case that factors affecting demand elasticity for the asset in the absence of frictions will affect whether and how make/take fees will matter.

D. Net-of-Fees Spread

Total Fee

Our results so far are consistent with the hypothesis that traders do not fully adjust the effect of the fees in quoted prices. Given these results, we expect to find that total fees have an affect on net-of-fees spreads at the tape-exchange level.

Table V reports results for a regression specification when the dependent variable is the net-of-fees spread at the tape-exchange level, estimated as the difference between the ask price plus the take fee and the bid price minus the take fee or, alternatively, as the quoted bid-ask spread plus twice the take fee. This variable is a proxy for the true economic spread, which is the cost paid on an immediately executed round-trip transaction in the presence of fees. The control variables in Table V are the same as in Table IV. The coefficients on the control variables reported in Table V are similar in magnitude and significance to those in Table IV. Namely, there is a positive relation between net-of-fees spreads and volume on a tape-exchange while there is a negative relation between net-of-fees spread and the volume on rival tape-exchanges.

In Panel A of Table V, Columns (1) and (2) when the dependent variable is $\Delta \$AdjBBO$, the coefficients associated with ΔNom_Total_Basic and $\Delta Nom\_Total\_Competitive$ are both positive and significant at the 10% level (p-values of 0.08 and 0.07). When the dependent variable is $\Delta \%AdjBBO$ (Columns (5) and (6)), the coefficients are positive (point estimates are 1.133 and 1.880) and highly significant (p-values of 0.04 and 0.00). These results show that an increase in the nominal total fee is on average associated with an increase in the net-of-fees spread. Since the net fee is not fully neutralized in the quoted spread and also impacts the true economic spread, this supports the notion that the total fee acts as a transaction tax on shares traded.

The coefficients associated with ΔRel_Total_Basic and $\Delta Rel\_Total\_Competitive$ are positive but insignificant (Columns (3), (4), (7), and (8)). If an exchange does not change its nominal total fee, but all other exchanges reduce their nominal total fees, this increases the distance to rivals offering lower nominal fees. Our results show that any relative fee change has no further effect on the true economic spread but will have an effect on the trading activity (Table III).

Allocation of Total Fee between Makers and Takers

In terms of whether the breakdown of the net fee matters for the net-of-fees spread, the results in Panel C of Table V are of particular interest. Panel C reports the estimates of the difference between the coefficient associated with the make fee and the coefficient associated with the take fee reported in Panel B. Finding that this difference is insignificant indicates that changing the allocation of the total fee between makers and takers is irrelevant to the net-of-fees spread on a tape-exchange. Across all regression specifications in Panel C, we find that the differences between the coefficients associated with the make fee and the take fee are insignificant (p-values range from 0.49 to 0.69). The results provide evidence that a change in the make fee is not significantly different from a change in the take fee in terms of their effect on the true economic spread at the tape-exchange level. This indicates that changing the allocation of the total fee between makers and takers is irrelevant to the spread adjusted for fees on a tape exchange.

Our results in terms of whether allocation matters for the quoted spreads lead to the same conclusion that the breakdown of the total fee between makers and takers is irrelevant. In short, we show that the make/take breakdown is irrelevant for both the quoted spreads and net-of-fees spreads.

IV. Conclusion

Recently, the predominant pricing model on equity exchanges is the so-called make-and-take fee pricing model. The model has been adopted on all registered U.S. equities exchanges. The use of the fees has become widespread as more exchanges employ the model as a tool to gain market share and trading volume. The effect of these fees on the U.S. equity exchange industry is largely undocumented and not well understood. This paper presents evidence to address the following question: How does the total fee and the breakdown of the total fee to the make fee and the take fee affect an exchange's volume, market share, quoted, and true economic net-of-fees spreads? In short, we are interested in whether the fee structure matters – i.e., whether an exchange can change outcomes such as volume and market by changing the allocation of the total fee to makers and takers.

We examine the relationship among fees, volume, market share, quoted, and economic spreads in the United States for the period January 1, 2008 through December 31, 2010, across more than a dozen registered exchanges. Our tape-exchange-level analysis provides evidence that a decrease in the total fee increases an exchange's volume and market share in a tape. We show that an increase in total fee increases both the quoted as well as the true economic spread. The negative association between total fee and trading activity measures is consistent with a downward-sloping demand curve for trading. These results are consistent with the interpretation that the total fee could be viewed as a transaction tax on traded shares.

Moreover, our results show that not only does the level of the total fee matter for volume and market share, but the allocation of the total fee to makers and takers affects volume and market share. We find that a decrease in the take fee increases the trading activity on an exchange more than a decrease in the make fee. Given that generally the fees charged to the takers are positive and the fees charged to makers are negative – i.e., rebates, this result implies that, on average, an exchange is able to increase its volume more by decreasing its take fee by one unit than by increasing its rebate provided to liquidity makers. We do not find that the fee structure has any effect on the quoted prices and the net-of-fees spreads, at least as inferred by median security-level BBO at the tape-exchange level.

We note that our results are based on tape-exchange-level analysis and that the optimal make-and-take fee structure can depend on security-level characteristics (Foucault, Kadan, and Kandel, 2013). Further analysis is needed to address the impact of these fees for different types of securities depending on their characteristics.

Theory suggests that the allocation of total fee to make and take sides is irrelevant if there are no frictions, for example, if routing decisions are based on prices adjusted for fees and if all quotes are feasible – i.e., tick size of zero (Colliard and Foucault, 2012). If any of these assumptions do not hold, the fee structure affects the equilibrium outcomes (Foucault, Kandel,

and Kadan, 2013).[17] Since we find that it is not only the total fee that matters for trading activity and true economic spread, but the fee structure has an effect as well, the next natural question to ask is which trading friction could be the source of fee structure relevance on the market for equities.

This study is an early attempt at determining the overall effect of the make-and-take fee pricing model on exchanges. The way in which the fees affect market participants and the role of regulators are topics beyond the scope of this paper but of great importance. For example, high-frequency trading firms have been known to design strategies directed at capitalizing on make-and-take fee structures across markets.[18] The effects of these activities on the market as a whole and on long-term investors is still under debate.[19] Given our findings that these fees affect trading activity on an exchange, we believe that exploring the avenues through which fees affect trading strategies, behavior, and profitability is an interesting and relevant topic for future research.

[17] In practice, the participant actually placing the order pays the fee and receives the rebate. Dealers are not allowed to charge access fees and are not subject to them. Angel, Harris, and Spatt (2011) explain this issue in detail. "Since brokers route marketable retail orders to internalizing dealers to avoid access fees, the traders who pay the access fees at make-or-take exchanges typically are proprietary and institutional traders whose orders internalizing dealers will not accept. ... The problem results because retail customers usually do not receive the liquidity rebates, and because standards for best representation of limit orders are primitive in comparison to standards for best execution of marketable orders ... The SEC could solve these make-or-take problems by requiring that all brokers pass through access fees and liquidity rebates to their clients. Presently, some brokers do this voluntarily or upon request by their clients. However, the practice is complex and therefore confusing to most customers. Most retail brokers provide single fee commissions because this single fee pricing appeals most to their customers." (p.41-43).

[18] "What's behind high-frequency trading" by Scott Patterson and Geoffrey Rogow, *Wall Street Journal*; "Who's afraid of high-frequency trading?" by Jonathan Spicer and Herbert Lash, *Reuters*; "Serving all, not just the elite few" by Sal Arnuk and Joseph Saluzzi, *The New York Times*.

[19] Regulators are particularly interested in the topic of the maker-taker pricing model. For example, the Securities and Exchange Commission has requested comment with regard to the impact of these make and take pricing models within the marketplace. In a recent filing, they ask, "Are liquidity rebates unfair to long-term investors because they necessarily will be paid primarily to proprietary firms engaging in passive market making strategies? Or do they generally benefit long-term investors by promoting narrower spreads and more immediately accessible liquidity? Do liquidity rebates reward proprietary firms for any particular types of trading that do not benefit long-term investors or market quality?" (SEC 34-61358)

Appendix: Data Management Details

The Consolidated Tape Association (CTA)[20] oversees the dissemination of real-time trade and quote information. Market centers send their trades and quotes to Consolidated Tape System (CTS) and to Consolidated Quotation System (CQS).[21] Market centers are required, as authorizing Self-Regulatory Organizations (SROs) per the CTA Plan, to report their trade activity within 90 seconds of execution time to CTS; otherwise the trade report must be designated as a late report. The current participants of the CTA as of March 18, 2010, include the American Stock Exchange, Boston Stock Exchange, Chicago Board Options Exchange, Chicago Stock Exchange, Financial Industry Regulatory Authority, International Securities Exchange, Nasdaq Stock Market, National Stock Exchange, New York Stock Exchange, NYSE Arca, and Philadelphia Stock Exchange.

The TAQ (Trades and Quotes) database is the primary source of historical trade and quote data for U.S. equities coming from the CQS and CTS. Academicians usually have access to TAQ through Wharton Research Data Services (WRDS).[22] TAQ on WRDS have two components: the Consolidated Quotes Files and the Consolidated Trades Files. We will talk about each one in turn.

Consolidated Quotes Files on TAQ

The Consolidated Quotes Files report quotations, more specifically a quote update (a quote is valid until a new quote comes in), from more than 10 market centers as of January 2010. If a market center would like to cancel its quote, typically it will post an extremely small bid (e.g., \$0.01) or an extremely large offer (e.g., \$201,000) (the so-called stub quote). For most market centers, this updated quote will be the best bid and offer (BBO) prevailing at the market center. The only exception is quotes coming from Nasdaq and the ADFs. From the BBO reported from all market centers, we could establish the prevailing National Best Bid and Offer (NBBO) at any point of time.

The variable EX in TAQ contains data for the exchange on which the quote occurred. More

[20] http://www.nyxdata.com/cta

[21] http://sec.gov/divisions/marketreg/marketinfo/appendixq.pdf

[22] http://wrds.wharton.upenn.edu/

specifically, EX = A for Amex,[23] EX = B for Boston, EX = C for NSX (National Stock Exchange, formerly the Cincinnati Stock Exchange[24]), EX = D for NASD ADF and NASD, EX = N for NYSE, EX = P for Arca,[25] EX = T for NASDAQ,[26] EX = X for Philadelphia, EX = I for ISE,[27] EX = M for Chicago, EX = W for CBOE, EX = Z for BATS. The Consolidated Quotes File contains information about the bid price and the size of it, the offer price and the size of it, quote condition and that Nasdaq market marker for each NASD Quote (variable "MMID" in TAQ[28]), and the symbol of the security.

There are some specifics about the way Nasdaq reports its quotes in the CQ files in TAQ, during the process of becoming a regular market participant as a stock exchange. There are three important dates on TAQ CQ files: November 25, 2002, May 15, 2006, and February 12, 2007. Further, we take into account whether a security is (1) NYSE listed, AMEX listed, and Arca listed or (2) Nasdaq listed. Thus, we have the following case scenarios:

- The security is NYSE listed, AMEX listed, and Arca listed and the period is
  - *Case A. Before Friday, May 12, 2006*: Nasdaq quotes have EX = T identifier on TAQ with the MMIDs reported, i.e., individual dealer quotes. There are no quotes with EX = D identifier.
  - *Case B. Monday, May 15, 2006 - Friday, February 9, 2007*: Nasdaq quotes have EX = D identifier on TAQ with MMIDs reported. There are no quotes with EX = T identifier.

[23]NYSE Euronext acquired American Stock exchange on October 1, 2008. More details about the history of American Stock Exchange could be found at `http://www.nyse.com/pdfs/AmexTimeline.pdf` and about NYSE Euronext at `http://www.nyse.com/pdfs/NYSEEuronextTimeline-web.pdf`.

[24]The Cincinnati Stock Exchange moved to Chicago in 1995 and changed its name to National Stock Exchange in 2003.

[25]The Pacific Stock Exchange used to be a floor-based market, but it merged with Archipelago (an ECN) and later NYSE and Archipelago merged to form NYSE Group Inc. More details could be found at: `http://www.nyse.com/pdfs/nysegrouptimeline.pdf` and `http://www.nyse.com/pdfs/NYSEEuronextTimeline-web.pdf`.

[26]EX = Q only in the CT files. See next section.

[27]As of December 23, 2008, Direct Edge Holdings (Direct Edge), the parent company of Direct Edge ECN, and the International Securities Exchange (ISE) completed the transaction through which the ISE Stock Exchange has become a wholly owned subsidiary of Direct Edge Holdings. Upon completion of the transaction, ISE also gained a significant equity stake in Direct Edge. For more information, go to `http://www.directedge.com/AboutDirectEdge/Announcements/ViewNewsletterDetail.aspx?NewsletterID=51`.

[28]The market maker identification (MMID) data field provides an additional classification layer among NASDAQ dealers and ECNs. For example, TRIM denotes Trimark, a NASDAQ dealer, while BRUT denotes the BRUT ECN. The National Securities Clearing Corporation provides a listing of NASDAQ market makers and their MMIDs in the Member Directory at `www.nscc.com` and `http://www.dtcc.com/customer/directories/nscc.php`. (see footnote 13, p. 90 from GAO report).

- *Case C. After Monday, February 12, 2007*: Nasdaq quotes have EX = T identifier with no MMIDs reported or the "CAES" MMID reported,[29] i.e., Nasdaq reported quotes are treated as standard market participant. ADF quotes have EX = D identifier with MMIDs reported.[30]

- The security is Nasdaq listed and the period is

  - *Case D. Before Friday, November 22, 2002*: Nasdaq quotes have EX = T identifier on TAQ with no MMIDs reported – i.e., best Nasdaq dealer quotes for Nasdaq stocks. There are no quotes with EX = D identifier. In the cases when MMIDs are not reported, we could consider that this is the Nasdaq BBO quote for Nasdaq-listed securities.

  - *Case E. After Monday, November 25, 2002*: Nasdaq quotes are identified with EX = T while NASD ADF quotes are identified with EX = D. MMIDs are not reported for both cases[31].

[29] CAES (Computer Assisted Execution System) is an NASD interdealer automated execution system for listed 19c-3 securities. CAES is the NASD link to ITS (Intermarket Trading System). If an NASD dealer wishes to make markets in listed securities, he or she must register as an ITS/CAES market maker for those securities. CAES is a NASDAQ system that allows its members to quote NYSE-listed stocks. For details, go to `http://www.sec.gov/rules/sro/nd9975o.htm` and `http://www.sec.gov/rules/sro/nd9953/frucher1.htm`. "NAQS" stands for NASD Alternative Quotation System. "NAQS" replaced "CAES" as of May 15, 2006.

[30] The TAQ manual notes that "As of Monday, May 15, 2006, through Friday, March 2, 2007, Nasdaq quotes in NYSE-listed, AMEX-listed and Arca listed stocks will appear on TAQ with an exchange code of D only." We download CQ data for GM, which is a NYSE-listed stock for the period May 1, 2006, through March 15, 2007. We observe that on Friday, May 12, 2006, the Nasdaq quotes are identified with EX = T and the MMIDs are reported including MMID = CAES and that there are no quotes with EX = D identifier. We also observe that on Monday, May 15, 2006 the Nasdaq quotes are identified with EX = D and the MMIDs are reported and that there are no quotes with EX = T identifier. This is consistent with the TAQ Manual. However, as of Monday, February 12, 2007 (not Friday, March 2, 2007, as noted in TAQ Manual), Nasdaq quotes of NYSE-, Amex-, and Arca-listed securities have an exchange code of T (the MMIDs are not reported consistent with the fact that this is the time when Nasdaq quotes are treated as a regular market participant), while ADF quotes have a code of D with MMIDs reported. We contacted WRDS and they agreed that the data are not consistent with the TAQ Manual at this point.

[31] EX = D was added for NASD on Friday, May 31, 2002 according to the CQS Revision #19. We downloaded CQ data from TAQ for MSFT, which is a Nasdaq-listed stock for the period May 1, 2002 through Dec 31, 2002. We observe that on Friday, November 22, 2002, we have quotes with EX = T (no MMIDs reported and no quote with EX = D). We observe that on Monday, November 25, 2002, we have both quotes with EX = T and quotes with EX = D. MMIDs are not reported for both cases. Thus, TAQ reflects the CQS change on Monday, November 25, 2002.

Consolidated Trades Files on TAQ

The Consolidated Trades files report transactions with the time[32] they got recorded, the symbol of the security (variable *Symbol*), number of shares traded (variable *Size*), actual trade price per share (variable *Price*), the market center on which the trade occurred (variable *EX*)[33], correction indicator (variable *CORR*), sale condition (variable *COND*) and combined "G" Rule 127, and stopped stock trade indicator (variable *G127*). We eliminate from the sample trades with a correction code greater than 1 – i.e., corr in (0,1) following Bessembinder (1999) and Kyle, Obizhaeva, and Tuzun (2010).

We use only trades for which TAQs CORR field is equal to zero or one and for which the COND field is either blank or equal to *, @, E, F, I, J, or K. We only include trades with positive prices or quantities. We eliminate trades with prices more than (less than) 150% (50%) of the previous trade price if the prior price is more than $2 per share. We do not delete observations for which price is less or equal to $2.

As of May 15, 2006, Monday through March 2, 2007, Friday Nasdaq trades in NYSE-listed, AMEX-listed, and Pacific- (Arca-) listed stocks will appear on TAQ with an exchange code of D only. As of March 5, 2007, Monday, Nasdaq trades of NYSE-, Amex-, and Arca-listed stocks will have an exchange code of T, while ADF and TRF trades will have a code of D. T will no longer appear for trades in Nasdaq stocks as of June 28, 2006 (T will not appear until Nasdaq becomes an exchange.). These trades will have an exchange identifier of "Q". When Nasdaq became an exchange, Nasdaq executions are represented with a "Q," while "D" will include Trade Reporting Facility(TRF) prints and ADF trades.

As of May 15, 2006, through March 2, 2007, Nasdaq trades and quotes in NYSE-listed, AMEX-listed, and Arca-listed (formerly Pacific Stock Exchange) stocks will appear on TAQ

[32]Variable *TTIM* is trade time and reflects the time at which the trade entered CTS. The TAQ Manual says "Beginning in June 1995, the trade time for NYSE and AMEX issues is the Consolidated Trade System (CTS) time stamp. Beginning in March 1997, the trade time for Nasdaq issues is the NTDS time stamp. Previously, the time shown for all trades was the time the message was received by IGS, which is approximately 3 seconds later than the CTS time stamp."

[33]More specifically, EX = A for AMEX, EX = N for NYSE, EX = B Boston, EX = P for Arca, EX = C for NSX, EX = T/Q NASDAQ, EX = D for NASD ADF and TRF, EX = X for Philadelphia, EX = I for ISE, EX = M for Chicago, EX = W for CBOE, EX = Z for BATS, and EX = 1 for Nasdaq prints in Nasdaq stocks Aug/Sep 2006 only. For some observations, EX = 8 and there is no information for it in the TAQ Manual. We find, however, that for the period 2005 through 2008 less than 1% of the trades have exchange code equal to 8, so we exclude this data.)

with an exchange code of D only. As of March 5, 2007, Nasdaq trades of NYSE-, Amex-, and Arca-listed stocks will have an exchange code of T, while ADF and TRF trades will have a code of D. T will no longer appear for trades in Nasdaq stocks as of June 28, 2006. These trades will have an exchange identifier of Q.

As of May 15, 2006, Nasdaq trades and quotes in NYSE-listed, AMEX-listed, and Arca-listed stocks will appear on TAQ with an exchange code of D only. T will not appear again when Nasdaq became an exchange.

Merging TAQ and CRSP

The CRSP "NCUSIP" variable has correct historical values (unlike "CUSIP," which is a header variable that contains current data only), and the first eight characters of the TAQ Master File variable "CUSIP" can be used to match with CRSP's NCUSIP. Thus we (1) get SYMBOL-CUSIP links from TAQ master files, (2) get PERMNO-NCUSIP- ticker links from CRSP, and (3) merge above two by using the common variable of CUSIP. Comerton-Forde, Hendershott, Jones, Moulton, and Seasholes (2010) note that the symbol in TAQ and ticker in CRSP match only 90% of the time in their CUSIP matched sample, suggesting that using the TAQ master file to obtain CUSIPs is constructive.

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Figure 1: Make-and-Take Fee Pricing Model

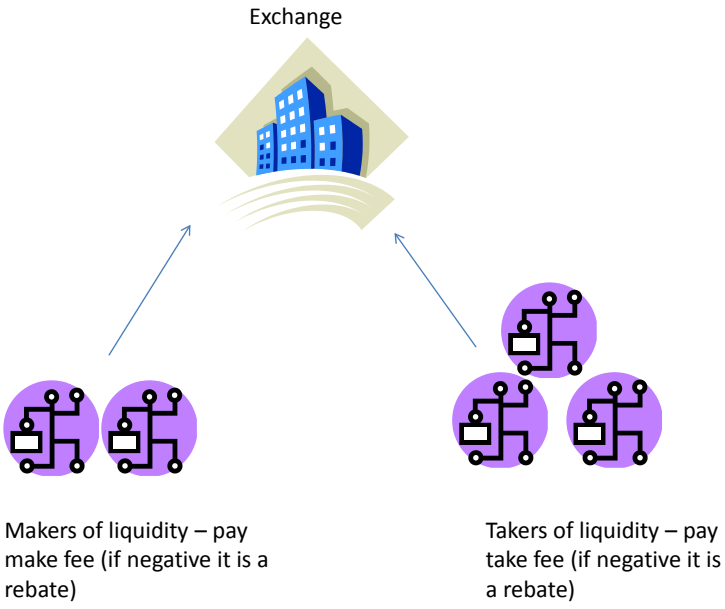

Table I. Summary Statistics, January 2008 – December 2010

This table reports mean, median, and standard deviation for fee, trading activity, and quoted spread measures. *Nom_Make_Basic* and *Nom_Take_Basic* are the nominal make fee and the nominal take fee, respectively, offered to traders that do not qualify for higher volume-based tiers. *Nom_Total_Basic* is the sum of *Nom_Make_Basic* and *Nom_Take_Basic*. *Nom_Make_Competitive* and *Nom_Take_Competitive* are the nominal make fee and the nominal take fee, respectively, offered to traders that qualify for the high volume-based tier and thus capture the most favorable pricing available on an exchange. *Nom_Total_Competitive* is the sum of *Nom_Make_Competitive* and *Nom_Take_Competitive*. *Rel* stands for "relative-to-rivals" and is estimated as per Eq.(1). All fee measures are in dollars per 100 shares. The variable *Vol* is the trading volume on an exchange in a tape in billions of shares. Correspondingly, the variable *MS* is the market share of an exchange in percentage of all traded shares in a tape. The variable *Tape_Vol* is the daily trading volume in a tape aggregated across exchanges in billions of shares. The variable *$BBO* is the dollar quoted spread calculated for each tape on each exchange as the daily median across individual securities' time-weighted average dollar quoted spreads. *$AdjBBO_Basic* and *$AdjBBO_Competitive* are the dollar net-of-fees quoted spreads estimated as *$BBO* plus twice the take (basic or competitive) fee per share. Calculated in the same manner, *%BBO* is the corresponding percentage quoted spread while *%AdjBBO_Basic* and *%AdjBBO_Competitive* are the corresponding percentage net-of-fees quoted spreads. There are 18,362 daily tape-exchange observations for the trading activity and fee variables and 18,282 for the spread variables.

Variable	Mean	Median	St.Dev.
Panel A: Nominal Make, Take, and Total Fees			
Nom_Make_Basic	-0.1992	-0.2500	0.1078
Nom_Take_Basic	0.2490	0.3000	0.1022
Nom_Total_Basic	0.0498	0.0400	0.0768
Nom_Make_Competitive	-0.2288	-0.2700	0.1137
Nom_Take_Competitive	0.2400	0.2800	0.0993
Nom_Total_Competitive	0.0112	0.0000	0.0647
Panel B: Relative Make, Take, and Total Fees			
Rel_Make_Basic	0.0000	-0.2600	0.9243
Rel_Take_Basic	0.0000	0.2200	0.9097
Rel_Total_Basic	0.0000	-0.1000	0.6746
Rel_Make_Competitive	0.0000	-0.2350	0.9997
Rel_Take_Competitive	0.0000	0.1900	0.8861
Rel_Total_Competitive	0.0000	-0.0450	0.6106
Panel C: Trading Activity			
Vol	0.1818	0.0283	0.2970
MS	7.5737	1.5075	9.7527
Tape_Vol	2.3375	1.3742	1.6863
Panel D: Quoted and Net-of-Fees Spreads			
$BBO	0.1972	0.1069	0.2564
$AdjBBO_Basic	0.2022	0.1124	0.2564
$AdjBBO_Competitive	0.2020	0.1124	0.2565
%BBO	1.2707	0.6464	1.7069
%AdjBBO_Basic	1.3200	0.7157	1.7173
%AdjBBO_Competitive	1.3183	0.7138	1.7174

Table II. Money Transfer in Millions of Dollars Among Exchanges, Makers and Takers, January 2008 – December 2010

This table reports upper and lower boundaries of money transfer in millions of dollars among exchanges, makers, and takers. Panel A reports the upper boundary of money transfer, while Panel B reports the lower boundary of money transfer. Specifically, we first multiply the nominal make fee per share, the nominal take fee per share, and the nominal total fee per share for the basic tier by the number of shares traded each day for each tape-exchange – i.e., we assume that all shares are transacted at the basic tier pricing level, which provides us with the upper boundary on money transfer among parties. Similarly, we next multiply the nominal make fee per share, the nominal take fee per share, and the nominal total fee per share for the competitive tier by the number of shares traded each day for each tape-exchange – i.e., we assume that all shares are transacted at the competitive tier pricing level, which provides us with the lower boundary on money transfer among parties. Then we aggregate the data across tapes within each exchange. The observations are exchange-day observations in millions of dollars. The number of the exchange-day observations is 6,727. Column (1) reports the average across all exchange-day observations. Next, for each exchange we aggregate across days and report the average across exchanges in Column (2). The sum across exchanges and all days is reported in Column (3).

	Average Money Transfer in an Exchange on a Day	Average Money Transfer in an Exchange	Total Money Transfer Across Exchanges and Days
	(1)	(2)	(3)
Panel A: Upper Boundary — All Shares Transacted at the Basic Tier			
Takers paid	1.171	562.505	7,875.074
Makers paid	-0.710	-341.410	-4,779.742
Exchanges earned	0.460	221.095	3,095.332
Panel B: Lower Boundary — All Shares Transacted at the Competitive Tier			
Takers paid	1.124	540.389	7,565.454
Makers paid	-0.992	-476.849	-6,675.882
Exchanges earned	0.132	63.541	889.571

Table III. Volume and Market Share

This table reports regression results when the dependent variable is a proxy for trading activity. Panel A reports results when the independent variable of interest is the total fee (the sum of the make fee and take fee), and Panel B reports results when the independent variables of interest are the make fee and take fee. Panel C reports estimates of the difference between the parameters of the corresponding make fee and take fee in Panel B. All fee measures are in dollars per 100 shares and are explained in Table I. *Nom* stands for "nominal" and *Rel* stands for "relative-to-rivals." *Vol* is the volume in billions of shares on a tape-exchange. *MS* is the market share of an exchange in percentage of all traded shares in a certain tape. Columns (1) through (4) report results when the dependent variable is volume in billions of shares, while Columns (5) through (8) report results when the dependent variable is market share in percentage. *Tape_Vol* is the volume in billions of shares in a tape across all exchanges. *Number* is the number of exchanges. All specifications include year dummies. The *p*-values are shown in parentheses. There are 18,324 daily tape-exchange observations. Δ denotes the change in a variable.

Independent Variables	ΔVol				ΔMS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Total Fee								
Δ*Nom_Total_Basic*	-0.193	–	–	–	-2.515	–	–	–
	(0.00)				(0.00)			
Δ*Nom_Total_Competitive*	–	-0.197	–	–	–	-1.431	–	–
		(0.00)				(0.06)		
Δ*Rel_Total_Basic*	–	–	-0.018	–	–	–	-0.186	–
			(0.01)				(0.04)	
Δ*Rel_Total_Competitive*	–	–	–	-0.016	–	–	–	-0.179
				(0.02)				(0.06)
Δ*Number*	0.000	0.000	-0.001	-0.001	-0.010	-0.010	-0.021	-0.025
	(0.91)	(0.91)	(0.67)	(0.61)	(0.79)	(0.77)	(0.50)	(0.45)
Δ*Tape_Vol*	0.083	0.083	0.083	0.083	0.117	0.117	0.117	0.117
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.3942	0.3942	0.3941	0.3940	0.0071	0.0066	0.0067	0.0067
Panel B: Make Fee and Take Fee								
Δ*Nom_Make_Basic*	-0.165	–	–	–	-2.361	–	–	–
	(0.00)				(0.00)			
Δ*Nom_Take_Basic*	-0.287	–	–	–	-3.019	–	–	–
	(0.00)				(0.00)			
Δ*Nom_Make_Competitive*	–	-0.168	–	–	–	-1.226	–	–
		(0.00)				(0.12)		
Δ*Nom_Take_Competitive*	–	-0.283	–	–	–	-2.058	–	–
		(0.00)				(0.03)		
Δ*Rel_Make_Basic*	–	–	-0.016	–	–	–	-0.152	–
			(0.02)				(0.11)	
Δ*Rel_Take_Basic*	–	–	-0.027	–	–	–	-0.301	–
			(0.00)				(0.01)	
Δ*Rel_Make_Competitive*	–	–	–	-0.014	–	–	–	-0.145
				(0.05)				(0.13)
Δ*Rel_Take_Competitive*	–	–	–	-0.024	–	–	–	-0.284
				(0.00)				(0.01)
Δ*Number*	0.000	0.000	-0.001	-0.001	-0.010	-0.010	-0.018	-0.021
	(0.94)	(0.94)	(0.76)	(0.71)	(0.76)	(0.76)	(0.59	(0.53)
Δ*Tape_Vol*	0.083	0.083	0.083	0.083	0.117	0.118	0.117	0.117
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.3944	0.3944	0.3942	0.3942	0.0071	0.0067	0.0069	0.0069
Panel C: Estimating Differences Between the Parameters for Make Fee and Take Fee in Panel B								
Δ*Nom_Make_Basic*-Δ*Nom_Take_Basic*	0.122	–	–	–	0.658	–	–	–
	(0.02)				(0.37)			
Δ*Nom_Make_Competitive*-Δ*Nom_Take_Competitive*	–	0.114	–	–	–	0.833	–	–
		(0.03)				(0.25)		
Δ*Rel_Make_Basic*-Δ*Rel_Take_Basic*	–	–	0.012	–	–	–	0.149	–
			(0.03)				(0.04)	
Δ*Rel_Make_Competitive*-Δ*Rel_Take_Competitive*	–	–	–	0.011	–	–	–	0.139
				(0.04)				(0.06)

Table IV. Quoted Spreads

This table reports regressions results when the dependent variable is the best bid and offer quoted spread in dollars per share and in percentage of the bid-ask midpoint. The variable *$BBO* is the dollar quoted spreads calculated for each tape on each exchange as the daily median across the individual securities' time-weighted average dollar quoted spreads. *%BBO* is the corresponding quoted spread in percentage of the bid-ask midpoint. Panel A reports results when the independent variable of interest is the total fee (the sum of the make fee and the take fee), and Panel B reports results when the independent variables of interest are the make fee and take fee. Panel C reports estimates of the difference between the parameters of the corresponding make fee and take fee in Panel B. All fee measures are in dollars per 100 shares. *Nom* stands for "nominal" and *Rel* stands for "relative-to-rivals." Columns (1) through (4) report results when the dependent variable is *$BBO*, while Columns (5) through (8) report results when the dependent variable is *%BBO*. *Number* is the number of exchanges. *Log_Exchange_dVol* is the logarithm of daily dollar volume in millions on a tape-exchange and *Log_Rivals_dVol* is the logarithm of the total daily dollar volume in millions on rival exchanges. All specifications include year dummies. The *p*-values are shown in parentheses. There are 18,244 daily tape-exchange observations. Δ denotes the change in a variable.

Independent Variables	Δ*$BBO*				Δ*%BBO*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Total Fee								
Δ*Nom_Total_Basic*	0.170	–	–	–	1.278	–	–	–
	(0.07)				(0.04)			
Δ*Nom_Total_Competitive*	–	0.170	–	–	–	1.817	–	–
		(0.08)				(0.00)		
Δ*Rel_Total_Basic*	–	–	0.005	–	–	–	0.025	–
			(0.64)				(0.74)	
Δ*Rel_Total_Competitive*	–	–	–	0.005	–	–	–	0.065
				(0.63)				(0.40)
Δ*Number*	0.001	0.001	0.001	0.001	-0.070	-0.071	-0.067	-0.064
	(0.85)	(0.85)	(0.75)	(0.74)	(0.01)	(0.01)	(0.01)	(0.01)
Δ*Log_Exchange_dVol*	-0.007	-0.007	-0.007	-0.007	-0.068	-0.068	-0.068	-0.068
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Δ*Log_Rivals_dVol*	0.027	0.027	0.027	0.027	0.259	0.259	0.259	0.259
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.0029	0.0029	0.0027	0.0027	0.0061	0.0062	0.0059	0.0059
Panel B: Make Fee and Take Fee								
Δ*Nom_Make_Basic*	0.162	–	–	–	1.403	–	–	–
	(0.10)				(0.03)			
Δ*Nom_Take_Basic*	0.197	–	–	–	0.871	–	–	–
	(0.10)				(0.27)			
Δ*Nom_Make_Competitive*	–	0.159	–	–	–	1.923	–	–
		(0.12)				(0.00)		
Δ*Nom_Take_Competitive*	–	0.202	–	–	–	1.496	–	–
		(0.09)				(0.06)		
Δ*Rel_Make_Basic*	–	–	0.005	–	–	–	0.035	–
			(0.69)				(0.65)	
Δ*Rel_Take_Basic*	–	–	0.007	–	–	–	-0.008	–
			(0.57)				(0.93)	
Δ*Rel_Make_Competitive*	–	–	–	0.005	–	–	–	0.077
				(0.67)				(0.933)
Δ*Rel_Take_Competitive*	–	–	–	0.007	–	–	–	0.033
				(0.61)				(0.72)
Δ*Number*	0.001	0.001	0.001	0.001	-0.070	-0.072	-0.066	-0.062
	(0.84)	(0.85)	(0.77)	(0.75)	(0.01)	(0.01)	(0.01)	(0.03)
Δ*Log_Exchange_dVol*	-0.007	-0.007	-0.007	-0.007	-0.068	-0.069	-0.068	-0.069
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Δ*Log_Rivals_dVol*	0.027	0.027	0.027	0.027	0.260	0.260	0.259	0.259
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.0029	0.0029	0.0027	0.0027	0.0061	0.0062	0.0059	0.0059
Panel C: Estimating Differences Between the Parameters for Make Fee and Take Fee in Panel B								
Δ*Nom_Make_Basic*-Δ*Nom_Take_Basic*	-0.034	–	–	–	0.531	–	–	–
	(0.71)				(0.40)			
Δ*Nom_Make_Competitive*-Δ*Nom_Take_Competitive*	–	-0.043	–	–	–	0.426	–	–
		(0.64)				(0.49)		
Δ*Rel_Make_Basic*-Δ*Rel_Take_Basic*	–	–	-0.002	–	–	–	0.044	–
			(0.76)				(0.49)	
Δ*Rel_Make_Competitive*-Δ*Rel_Take_Competitive*	–	–	–	-0.002	–	–	–	0.044
				(0.84)				(0.48)

Table V. Net-of-Fees Spreads

This table reports regressions results when the dependent variable is the best bid and offer quoted spread in dollars per share and in percentage of the bid-ask midpoint net of fees. The variable *$AdjBBO* equals *$BBO*, plus twice the take fee (basic or competitive) per share. The variable *%AdjBBO* is the percentage of the bid-ask midpoint net of fees. Columns (1) through (4) report results when the dependent variable is *$AdjBBO*, while Columns (5) through (8) report results when the dependent variable is *%AdjBBO*. Panel A reports results when the independent variable of interest is the total fee (the sum of the make fee and the take fee), and Panel B reports results when the independent variables of interest are the make fee and take fee. Panel C reports estimates of the difference between the parameters of the corresponding make fee and take fee in Panel B. All fee measures are in dollars per 100 shares. *Nom* stands for "nominal" and *Rel* stands for "relative-to-rivals." *Number* is the number of exchanges. *Log_Exchange_dVol* is the logarithm of daily dollar volume in millions on a tape-exchange and *Log_Rivals_dVol* is the logarithm of the total daily dollar volume in millions on rival exchanges. All specifications include year dummies. The *p*-values are shown in parentheses. There are 18,244 daily tape-exchange observations. Δ denotes the change in a variable.

Independent Variables	Δ*$AdjBBO*				Δ*%AdjBBO*			
	Basic	*Competitive*	*Basic*	*Competitive*	*Basic*	*Competitive*	*Basic*	*Competitive*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Total Fee								
Δ*Nom_Total_Basic*	0.175	–	–	–	1.333	–	–	–
	(0.08)				(0.04)			
Δ*Nom_Total_Competitive*	–	0.175	–	–	–	1.880	–	–
		(0.07)				(0.00)		
Δ*Rel_Total_Basic*	–	–	0.006	–	–	–	0.011	–
			(0.62)				(0.86)	
Δ*Rel_Total_Competitive*	–	–	–	0.006	–	–	–	0.053
				(0.61)				(0.50)
Δ*Number*	0.001	0.001	0.001	0.001	-0.073	-0.074	-0.071	-0.068
	(0.85)	(0.85)	(0.76)	(0.74)	(0.01)	(0.01)	(0.01)	(0.01)
Δ*Log_Exchange_dVol*	-0.007	-0.007	-0.007	-0.007	-0.070	-0.070	-0.069	-0.070
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Δ*Log_Rivals_dVol*	0.028	0.028	0.028	0.028	0.261	0.262	0.261	0.262
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.0029	0.0029	0.0027	0.0027	0.0061	0.0064	0.0059	0.0060
Panel B: Make Fee and Take Fee								
Δ*Nom_Make_Basic*	0.162	–	–	–	1.425	–	–	–
	(0.10)				(0.03)			
Δ*Nom_Take_Basic*	0.217	–	–	–	1.032	–	–	–
	(0.07)				(0.20)			
Δ*Nom_Make_Competitive*	–	0.159	–	–	–	1.947	–	–
		(0.12)				(0.00)		
Δ*Nom_Take_Competitive*	–	0.223	–	–	–	1.670	–	–
		(0.07)				(0.04)		
Δ*Rel_Make_Basic*	–	–	0.005	–	–	–	0.019	–
			(0.70)				(0.81)	
Δ*Rel_Take_Basic*	–	–	0.009	–	–	–	-0.016	–
			(0.50)				(0.86)	
Δ*Rel_Make_Competitive*	–	–	–	0.005	–	–	–	0.061
				(0.68)				(0.44)
Δ*Rel_Take_Competitive*	–	–	–	0.010	–	–	–	0.027
				(0.52)				(0.77)
Δ*Number*	0.001	0.001	0.001	0.001	-0.073	-0.075	-0.070	-0.067
	(0.84)	(0.86)	(0.78)	(0.76)	(0.01)	(0.01)	(0.01)	(0.02)
Δ*Log_Exchange_dVol*	-0.007	-0.007	-0.007	-0.007	-0.070	-0.070	-0.069	-0.070
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Δ*Log_Rivals_dVol*	0.028	0.028	0.028	0.028	0.262	0.262	0.261	0.262
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.0029	0.0029	0.0027	0.0027	0.0061	0.0064	0.0059	0.0060
Panel C: Estimating Differences Between the Parameters for Make Fee and Take Fee in Panel B								
Δ*Nom_Make_Basic*-Δ*Nom_Take_Basic*	-0.055	–	–	–	0.393	–	–	–
	(0.56)				(0.53)			
Δ*Nom_Make_Competitive*-Δ*Nom_Take_Competitive*	–	-0.064	–	–	–	0.277	–	–
		(0.49)				(0.66)		
Δ*Rel_Make_Basic*-Δ*Rel_Take_Basic*	–	–	-0.005	–	–	–	0.035	–
			(0.62)				(0.58)	
Δ*Rel_Make_Competitive*-Δ*Rel_Take_Competitive*	–	–	–	-0.004	–	–	–	0.035
				(0.69)				(0.58)