Dealers' Incentives to Reveal their Names*

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Abstract

This research investigates dealers' motivation to disclose their names when quoting on the NASDAQ over the years. NASDAQ enables dealers to quote limit orders either anonymously or with a feature that reveals their names. Results are consistent with dealers advertising by revealing their identities so as to develop and maintain their reputation for reliable pricing. Dealers strategically choose to reveal their identities when order flow is profitable. Post-name disclosure analysis further suggests that named quotations are likely to be driven by informational considerations. This research contributes to our understanding of the use of non-anonymity in electronic trading.

Keywords: Name disclosure, dealers' identity, advertising, reputation.

JEL Classification: G10, G20, L10.

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1. Introduction

Major dealer-based exchanges offer name disclosure on their limit order books (e.g., the Toronto Stock Exchange, the SETSmm system of London Stock Exchange, and the NASDAQ). The study of why market-makers[1] reveal their names while quoting on the electronic limit order book interests both practitioners and academics. This paper examines the use of named quotations by NASDAQ market-makers, and in particular, investigates whether informed or uninformed market-makers choose to reveal their names on the quoting system.

For over 30 years, the NASDAQ has enabled registered market-makers to quote limit orders either anonymously under the NSDQ feature (previously named SIZE) or with a feature that reveals their names. The identities of market-makers can be price-relevant if they offer insight into the reasons why market-makers want to trade, and whether they possess private information about the asset value[2]. In such instances, name disclosure by dealers can engage market participants in a leader-follower type of behavior, resulting in an increasing price impact similar to the signaling game in Kyle (1985). Despite the signalling risk, market-makers might be strategically revealing their names in order to communicate with the market. Market-makers would then be interested in developing and maintaining a reputation for accurate pricing so that their quotations lead the market, which can increase their payoffs in the long run. In the industrial organization literature,

[1]The terms ”dealers” and ”market-makers” are used interchangeably throughout the paper.

[2]Traditional theory in market microstructure assumes that market-makers are uninformed and only react to potentially informed customer orders, as in Glosten and Milgrom (1985) among others. More recent models relax this assumption and assume that dealers can be asymmetrically informed (Calcagno and Lovo, 2006; Foucault, Moinas, and Theissen, 2007), and this theory is supported by many empirical papers (Davies, 2003; Madureira and Underwood, 2008) among others.

Milgrom and Roberts (1986) introduce the notion that asymmetric information can provide such a mechanism in highly competitive markets. This paper tests this rationale using a large sample of stocks from two different time periods, namely 24 days from 2004 and 24 days from 2018. The breadth of the cross-section allows for general conclusions to be drawn, and recent data are important because significant changes have been made in the US market structures over the last 15 years.

This research focuses on three primary economic concerns related to the usage of named quotations by market-makers for advertising purposes. First, it examines whether name disclosure has been frequently used by market-makers. It documents that a non negligible proportion of quotes are frequently submitted by market-makers under their names. Second, it investigates the informational content of named quotations relative to their anonymous counterparts. It shows that named quotations are more informative relative to their anonymous counterparts over the years. Named quotations are associated with higher effective spreads than anonymous quotations, and they have also significantly higher realized spreads after 5 minutes. Finally, it examines whether named quotations represent a dealer's attempt to attract large traders interested in automated executions in today's markets that trade at millisecond speeds.

Overall, the results suggest that market-makers use their names strategically to attract profitable order flow, which is consistent with the advertising hypothesis. Market-makers, at least those who have survived in the RegNMS environment, seem to still generate higher revenues while revealing their names. They seem to be selectively revealing themselves when the amount of protected liquidity at the National Bid and Best Offer (NBBO) prices, provided by other National Market System (NMS) market centers, narrows. Named quo-

tations may have gained so much popularity that market-makers use their identity as a screening device so that large traders can call them directly, which also allow them to find liquidity in size in today's markets, which trade at millisecond speeds.

It is, of course, possible that named quotations have been used simultaneously by market-makers in an attempt to control their inventory risk. So, it is possible that market-makers tactically use their identity to monitor their inventories and keep them from diverging to arbitrarily large or short positions, as predicted by the theory (Grossman and Miller, 1988). If this is the case, named quotations might be associated with distorted pricing. However, the results show the opposite, i.e., named quotations are associated with price improvements. I use the Lo and MacKinlay (1989) variance ratio measure defined as the ratio of long to short price variance to assess the effect of name disclosure on the price process. I find that named quotations are associated with variance ratio closer to 1.0, suggesting that most of the named quotations are used as tools for advertising purposes.

I test another motive behind the choice of dealers to reveal their names although is it one for which I have no support. Market-makers might announce their trading motives in advance, a practice called sunshine trading (Admati and Pfleiderer, 1991) to avoid exacerbating any adverse selection. In such instances, dealers would be recognized as uninformed because they reveal their lack of information via a sunshine trading announcement. If they are recognized as such, there would be a decrease in adverse selection costs post name disclosure. However, I find the opposite. I compute the difference between the realized and effective spreads, known in the market microstructure as a viable measure of adverse selection costs faced by market-makers. The results suggest that there is an increase in adverse selection costs post name disclosure, further corroborating that

market-maker identity conveys information.

This paper contributes to our understanding of the use of non-anonymity in securities trading. Though a number of studies examine the value of the identity of the intermediary with conflicting results, none has addressed the use of name disclosure on a dealer-based limit order book. Unlike the fragmented setting I analyze here, Comerton-Forde, Putniņš, and Tang (2011) examine anonymity in a centralized limit order book with designated market-makers whose operation is completely different from that of NASDAQ market-makers. Other papers either compare trading on separate anonymous and non-anonymous platforms (Barclay, Hendershott, and McCormick, 2003; Reiss and Werner, 2005); or compare trading before and after a regulatory change regarding identity disclosure requirements (Foucault, Moinas, and Theissen, 2007). I contribute to this literature in several ways. By showing that name disclosure facilitates price discovery, I underscore the importance of market maker identity in the increasingly fragmented and anonymous electronic markets, which can be of use to policy-makers and market regulators i.e., the MiFiD II in Europe and the RegNMS in the United States. The search for liquidity by large traders is one of the main reasons why market-makers frequently advertise their quotations on a limit order book. It is a way for market-makers to identify themselves as the market leader in a particular stock, so large potential clients use this signal as a screening device to call them directly.

The rest of the paper is structured as follows: section 2 discusses the hypotheses to be tested; section 3 describes the sample periods and discusses the effect of changes in the market structure on named quotations; section 4 presents the results of the analysis; section 5 concludes.

2. Hypotheses development

Theories as to why dealers might choose to reveal their identities when placing their orders on electronic books tend to flow into one of these four hypotheses.

Hypothesis 1: Dealers reveal themselves to the market when they are informed about the asset value. Market microstructure theory assumes that intermediaries value anonymity because it allows them to conceal their trading motives or hide their trading strategies.[3][4] Empirical evidence tends to confirm that some NASDAQ market-makers can be asymmetrically informed, either by knowing the costs of trading a particular stock (Schultz, 2003), or through developing a reputation for trading in advance of news (Madureira and Underwood, 2008). To test whether dealers choose to reveal their names when informed, I disentangle spreads attributable to execution costs (effective spreads) and market-making (realized spreads) associated with named quotations as opposed to anonymous quotations. If the difference between the realized and effective spreads is positively significant, this result would indicate that adverse selection costs become more of a problem when dealers make their orders public. According to the market microstructure, this difference is a viable measure of the adverse selection costs faced by market-makers. Also, I measure the informational content of named quotations relative to their anonymous counterparts. If named quotations are indeed more informative, I should observe that they tend to be asso-

[3]Röell (1990), Fishman and Longstaff (1992), Forster and George (1992) and Foucault, Moinas, and Theissen (2007) among others.

[4]The literature provides mixed empirical results on the usage of anonymity by traders in the market, e.g., (Barclay, Hendershott, and McCormick, 2003; Grammig, Schiereck, and Theissen, 2001; Goldstein, Shkilko, Van Ness, and Van Ness, 2008; Perotti and Rindi, 2006; Reiss and Werner, 2005). The mixed results can be explained based on fundamental differences in market design, and accessibility across different trading systems. Further, most of these papers focus on customer anonymity. Few empirical papers, however, examine the usage of anonymity by intermediaries, (Simaan, Weaver, and Whitcomb, 2003; Reiss and Werner, 2005; Comerton-Forde, Putniņš, and Tang, 2011).

ciated with higher execution costs and that the informational content of trades associated with these quotations is higher relative to the anonymous ones.

Hypothesis 2: Dealers advertise themselves frequently through their public quotations on the order book in order to gain/maintain a reputation for more accurate and more reliable pricing in competitive markets. After establishing whether market-makers reveal themselves when they are informed, I test the strategic properties of named quotations. I conjecture that advertising through named quotations conveys information about a reputable dealer in a market to potential clients, in line with the industrial organization literature (Milgrom and Roberts, 1986). In that sense, dealers who repeatedly advertise their public quotations more than their competitors in a given stock acquire such a market reputation and are more likely to attract a large part of the order flow. The primary test of this hypothesis is that named quotations are strategically submitted when the profitability of attracting order flow is high.

Hypothesis 3: Dealers reveal themselves to the market when they are uninformed about the asset value in order to reduce the adverse selection costs a practice known as sunshine trading. No further tests are required to draw these conclusions. I simply reinterpret the results of testing hypotheses 1 and 2 to rule out the sunshine hypothesis. If the informational content of named quotations is higher than the informational content of anonymous quotes, then this difference would indicate that dealers' identity is perceived by market participants as a signal consistent with the advertising hypothesis. Furthermore, if the difference between the realized and effective spreads is positively significant, this result would indicate that adverse selection costs become more of a problem when dealers make their orders public.

Hypothesis 4: Dealers reveal their identities to manage their inventory. Strategic market-makers might simultaneously use their named quotations to monitor their inventories and to keep them from diverging to arbitrarily large or short positions. Previous empirical evidence on foreign exchange markets find evidence of this mechanism, in that dealers inventory positions are managed by their public quotes (Cao, Lyons, and Evans, 2003; Reiss and Werner, 1998). In such instances, systematic price reversals could be observed if order flows temporarily push prices beyond their long term equilibrium. One would expect named quotations to be accompanied by an increase in short-term price volatility. The ratio of long-term to short-term variance, i.e., variance ratio, is expected to deviate from 1.0. In contrast, if named quotations facilitate price discovery, consistent with the advertising hypothesis, short-term volatility is lower, and thus variance ratio is expected to be closer to one. I compute variance ratios from quote midpoint returns to test for intraday price reversals after name disclosure.

3. Institutional details

Thirty years ago, NASDAQ introduced the Level II pricing data, known as the order book, which provides only the best bids and asks from every market participant in the NASDAQ execution system. The Level II was initially designed for broker/dealers firms to collect all the individual quotes in the market at any point of time rather than relying on the Security Information Processor (SIP) for quotes, which only contains the best bid and the best ask without the granularity of individual market maker quotes (Level I). When orders are placed through different market-makers and other market participants, Level II shows

a ranked list of the best bid and best ask prices for each market participant identified by their respective market participant identifier (MPID). For example, a market participant, such SBSH (market maker Citigroup) representing the number of shares to buy may have consolidated orders for their clients and for their own account at the same limit price. The multiple orders at the same limit price are time-stamped (the exact date and time, right down to the milliseconds are recorded with the order) as they are entered, and the oldest orders are executed first. Level II also displays the best quotations among the anonymous displayed orders resting on the exchange book. The anonymous orders are aggregated under the NSDQ quoting feature, previously named SIZE. All the limit orders to sell (buy) are arranged from the lowest (highest) price at the top. This display is commonly used in most securities markets, including commodities and foreign exchange markets.

Up until 2005, market-makers were frequently competing for order flow for NASDAQ securities with the two major Electronic Communication Networks of that era, namely INET and ArcaEX. Back then, there was no trade-through rule on the NASDAQ market to ensure that the order must be sent to the trading venue that offers the best prices for NASDAQ stocks. Market-makers were required to fill in bids and asks on the limit order book queue, particularly at stressful times. They mainly established the majority of the bids and asks for the less liquids stocks. In such a trading environment, they maintained a large and fluctuating inventory for stocks they had decided to follow regularly.

Between 2005 and the present time, dealers have found themselves competing in an environment that has changed drastically, as documented by Egginton (2014). Since the implementation of RegNMS, they have been increasingly facing competition from high-speed traders that preform much like them by providing liquidity on both sides of the

markets but on a much larger scale. Unlike dealers, high-speed traders have no obligation to make the market in times of distress. In such an environment, dealers, at least those who had survived, were no longer able to trade in the same high-risk reward markets as they once were, and they were forced to adjust to the current environment accordingly. They are now all using automated programs to seek the spreads between bids and asks for the stocks they decide to follow. Still, many of dealers internalize the order flow and execute orders outside exchanges in their own dark pools. The publicly displayed quotations on all exchanges are now protected based on the new Rule 611, which ensures that customer orders will be executed at the NBBO prices in the market. Further, dark pools, which are subsidiaries of large dealers and brokerage companies, have to execute orders at the NBBO, and they are required to report their executions data to Financial Industry Regulatory Authority (FINRA).[5]

In the past few years, Level II has become widely available to all market-makers/exchanges that specialize in electronic trading[6]. The quotes submitted will appear only on the level II if only it is the best price submitted by each MPID. A large portion of orders posted on the multiple order books is now done so anonymously, which therefore, are displayed on the level II under the NSDQ identifier. In such an increasingly anonymous market, named quotations submitted by market-makers provide additional trading information that might be used by traders that follow the order flow to piggyback the momentum. In that case, the dominant market makers in a given stock, once identified through their quoting activity on Level II, could become the legitimate market leaders in that stock.

[5]See the FINRA "ATS Transparency Data Quartely Statistics," at http://www.finra.org/industry/otc/ats-transparency-data-quarterlystatistics.

[6]For a reliable source of all MPIDs, see http://www.level2stockquotes.com/market-makers-a-list.html.

4. Data and sample

For 2004, I use the 500 most active NASDAQ stocks by the total dollar volume reported by Center for Research on Security Prices (CRSP). The sample period is 24 days during the second quarter of 2004. A large number of stocks is selected to highlight aspects related to liquidity, inventory, and competition from other liquidity providers. I use the NASDAQ Trade and Quote dataset (Nastraq) collected from NASDAQ,[7] which contains all trades and detailed quotations for the Nasdaq listed securities. The Nastraq provides two quote datasets: (1) the inside file, which gives the inside or NBBO quotes across all markets; and (2) the quote file, which provides the top of file quotes displayed by market-makers. I also use the Trade and Quote (TAQ) database to identify trades and quotes of the two major ECNs of that era. I aggregate the sample stocks into activity quintiles, by ranking the 500 stocks by the total dollar volume during 2004 as reported by CRSP. For instance, Q1 contains the 100 most active stocks while Q5 contains the 100 least active stocks. Sample statistics on the quintiles are provided in Table 1. On average, the most active stocks exhibit a higher volume (11.58 million shares), higher trade size, higher market capitalization, and higher prices than the less active stocks.

For the 2018 tests, I use Thomson Reuters Tick History (TRTH) supplied by Refinitiv and complement these data with firm characteristics from CRSP. The sample period is 24 days from the second quarter of 2018. The stocks must exist in the intersection between TRTH and CRSP databases. The 500 most active stocks are then grouped by activity quintiles based on market capitalization on the last trading day of May 2018. The top 50 stocks from the largest and the smallest quintiles are considered for the 2018 tests,

[7] The service ended in 2006.

resulting in a sample of 100 stocks. All the stocks are listed on the NASDAQ. The TRTH database is not commonly used to study U.S. equity markets, but it is comparable to the data used by Holden and Jacobsen (2014)[8]. I use three files: (1) the one that includes all the updates to the official NBBO as well as (2) trade file, time-stamped to the microsecond with separate sequence numbers for quotes and trades, and (3) market-makers' individual best quotations from the NASDAQ level II. Each NBBO update contains price, size, and time priority, and is assigned to an exchange. Each trade record indicates the executing venue, price and volume. Each market maker quotation contains price, number of shares, and most importantly MPID. The TRTH raw data come from the Security Information Processor (SIP), which is different from NASDAQ (UTP) and include a very large number of qualifiers for quotes and for trades. Following Rindi and Werner (2019) analysis, I retain the trades marked as regular, odd lots, opening, closing, agency crosses, derivatively priced, or due to intermarket sweep orders. I also retain the quotes flagged as regular, opening, closing, or coinciding with changes in the limit up-limit down price bands. I clean the raw data by removing the following observations: trades flagged as corrected, time stamp missing, negative ask size or bid size, and bid price or ask price or bid size or ask size equal to 0. I include trades and quotes that are time-stamped between 9:35 AM and 3:44 PM to avoid opening and closing effects. Retained trades are matched with quote observations in force in the preceding millisecond, as recommended by Holden and Jacobsen (2014). To infer the buy or sell direction of each trade, I use the Ellis, Michaely, and O'Hara (2000) algorithm, which classifies all trades executed at ask quote as buy and all trades executed at bids as sells. For the remaining trades, I use the tick rule which

[8]TRTH contains consolidated instruments that merge trades from the consolidated tape and quotes taken from the official NBBO feed; see Hagstromer (2017) for comparison between DTAQ database and TRTH.

classifies buy (sell) every transaction above (below) the previous price.

5. Results

5.1 Name disclosure and trade size

I first examine to what degree named quotations were used in 2004. The descriptive statistics shown in Table 2 suggest that named quotations contributed to a lower proportion compared to the anonymous quotations. Named quotations contribute to almost 12% for the most active stocks, and this value increases to 22% for the least active stocks. It seems that dealers selectively quote under their names, and this practice might be for additional market share (Panel C). Their presence is important in the less active stocks, in which the competition with ECNs was low. As reported in Panel D of Table 2, dealers tend to execute large orders under their names across all quintiles. Their anonymous quotations tend to be smaller in particular for the less active stocks. With the ECNs' competition, dealers used to advertise their prices on the NASDAQ system by submitting large orders (Panel D) and greater depth (Panel E) in attempt to attract large orders. It is possible they supplement this strategy by using the anonymous option with lower quantities to reduce their order exposure risk when they are uncertain about the value of the asset.

5.2 Decomposition of spreads

To assess whether named quotations are informed or uninformed, I compute effective half-spreads as the signed difference between the trade price and the corresponding NBBO midpoint. The realized half-spread is the prevailing posted-NBBO quote midpoint 5 min-

utes after the trade. The effective spread measures the real price paid by investors while the realized spreads measures the profits of the market-makers.

Table 3 presents the transaction cost results for the 2004 sample for each quoting category by trade size (Panels A and B) and activity quintiles (Panels C and D). Using a paired *t*-test, I test whether the daily averages of the spreads are statistically and significantly different for named and anonymous quotations. The effective half-spread for named quotations is 2.62 cents for the full sample while for anonymous quotations it is 2.38 cents, for giving a significant difference of 0.24 per share. The results for realized spreads show that they are much higher for named quotations for every trade size category, and they increase with size. The difference between the executions of large orders can be attributed to the fact that dealers execute a higher proportion of them under their names. I perform additional analysis and find that the majority of these large orders executed by dealers were in the less liquid stocks. This result might partially explain the higher execution costs associated with named quotations. Effective and realized spreads by activity quintiles further show that trading costs decrease with trading activity. The realized spreads show that revenues are highest when named quotations are submitted by market-makers. This result reflects the ability of NASDAQ market-makers to attract less informed investors and thus a more profitable order flow.

5.3 Information shares and variance ratios

The higher spreads on named quotations may also imply that, following the submission of named quotations, there is an information provided to the market. In essence, if traders react to the signal perceived from the identity of the dealer, then trades have a higher

contribution to the price discovery process. Then I should expect to see greater price discovery between named and anonymous quotations. To address the issue of relative price discovery associated with trades, I turn to the Information Shares method developed by Hasbrouck (1995). In particular, Hasbrouck's method uses a vector autoregressive error correction model (VECM) to decompose the random walk contribution from each price vector into the efficient price evolution process. In that context, if the trades executed against named quotations react to the price changes of trades executed against anonymous quotations, then named trades have a higher contribution to price process.

The information shares are determined stock by stock using the VECM of trades executed against named and anonymous quotations. Then, the stocks are divided by quintiles, and maximum, minimum, and mean information shares are determined. The results are reported in Table 4. The named quotation's share of informed trading is high in the most active quintile, confirming that the identified activity tends to be informative. Additionally, the results suggest that the anonymous information share increases as we move to lower activity quintiles. This increase could be explained by the fact that market-makers select to reveal their names on the basis of the cost of liquidity. They anticipate that most active stocks will be sufficiently actively traded to act strategically whereas they selectively choose to reveal their names in illiquid stocks by letting anonymous quotations appear more often.

An alternative test to assess the contribution of named quotations to price process is the variance ratio. I measure variance ratios using returns over 15-second and five minutes interval, and I compute the ratio of the variance in a half-hour. I sort all stocks in each quintile in each category, named versus anonymous. I calculate the cross-sectional average

variance ratio and report the time series mean of these cross-sectional averages in table 5. The average ratio for named quotations is closer to one. This result implies that prices in these groups of updates behave on average, as a random walk. Average cross-sectional standard deviations are also lower for named quotations. These results suggest that named quotations, although more expensive, facilitate price discovery.

5.4 Intraday variations and determinants of name disclosure

Dealers can choose to reveal their names for different reasons. Name disclosure can be a tool used by dealers for advertising to attract order flow, that is, it can facilitate the search for liquidity to large traders in fragmented markets. Another rationale for name disclosure is that it can be used by dealers for signaling to the market that they are uninformed via sunshine trading announcement. Finally, it can be used by dealers to tactically manage their inventory by selecting their trades. Estimating a probit model regression for the choice of non-anonymity helps to examine these different possibilities or to identify the market conditions under which dealers choose to reveal their names. In this section, I combine these factors into a model similar to Bessembinder (2003) and Comerton-Forde, Putniņš, and Tang (2011) to test the validity of the univariate results documented in the earlier sections on the 2004 sample. I estimate the following logistic regressions:

$$\begin{aligned} Disclosure_{i,t} = \beta_0 + \beta_1 FirstHalfHour + \beta_2 LastHalfHour + \beta_3 NBBOSpread_{i,t} \\ +\beta_4 Breadth_{i,t} + \beta_5 StockVolatility_{i,t-5mn} + \beta_6 Momentum_{i,t-5mn} + \\ \beta_7 OrderImbalance_{i,t} + \beta_8 Size1 + \beta_9 Size2 + \beta_{10} Size3 + \alpha_i + \delta_t + \epsilon_{i,t} \end{aligned} \tag{1}$$

The dependent variable *Disclosure* is set to 1 if a named quotation is submitted at the NBBO in stock i and to 0 if the quotation at the NBBO is instead submitted anonymously under SIZE. The event time t is determined by any new quote update made at the top of the order book (inside market) to prices and quantities. I focus on quote updates, i.e., quotes that establish a new NBBO, as market-makers submit these competitive quotes to signal their willingness to trade to ensure price priority in the 2004 NASDAQ-like environment. I relate these inside quotations submitted by dealers to variables that determine name disclosure in order to assess the incentives of dealers to post competitive quotes under their names. I then match the dealers' inside quotations with trades on a second-basis to assess the sign of the order at the time of quote submission. As the decision to reveal names may be driven by liquidity concerns, I conduct the determinant analysis separately for each quintile. Further, I separately report the results for the bid- and ask- quotations since the sign of some estimates are expected to differ.

I examine two types of variables that describe the market conditions at the time of quote submission. The first type is related to the quotes and describes the supply of liquidity at the time of the quote submission. I consider the NBBO spread right before the quote submission to proxy for market competitiveness, measured by *NBBOSpread* as the width of the NBBO spread preceding the quote submission, relative to the average NBBO spread for the stock. To proxy for quote competition from other venues, I include *Breadth* for quote competitiveness as the number of liquidity suppliers on the near side of the book (the bid side for a dealer quoting at the bid side, and the ask side for a dealer quoting at the ask side), relative to the average number of liquidity suppliers for the stock. In addition, I include dummy variables for inside quotations submitted in the first and last half-hour of

the trading day, *FirstHalfHourDummy* and *LastHalfHourDummy* respectively, to control for the intraday effects documented in Figure 1. As shown in Figure 1, dealers' quoting activity is influenced by the openings and the closing days. The activity pattern typically shows a maximum use of named quotations by dealers in the morning of the trading day which is when they are likely to be informed (Cao et al., 2000).

The second group of variables is related to the level of market activity and describes the information environment at the time of the quote submission by dealers. *StockVolatility* during the five minutes prior to the quote submission, based on the absolute percentage change in midpoint returns. The volatility measure is standardized by the sample mean for that stock; *Momentum* is the momentum during the five minutes preceding the quote submission, based on the average midpoint-to-midpoint return over the previous five minutes of the quote submission; *OrderImbalance* is the relative order imbalance. This variable is measured as the difference between the order imbalance measure for the individual venue and the same measure averaged across all three venues. Each relative order imbalance is standardized to allow for the time of the day and trading activity, as in Bessembinder (2003).

The controls also include three trade size variables: *size1*, *size2*, and *size3* with *size4* being base size.[9] In addition to the variables listed above, I include time and stock fixed effects to control for unobservable cross-sectional characteristics: δ_t is a time-specific fixed effect and α_i is a stock-specific fixed effect.

I report the estimated coefficients from the probit regressions in Equation (1) in Table

[9] A number of other variables were also tested: dollar trading volume, stock-return volatility, and stock-price momentum during the previous 15 minutes or 30 minutes of the quote submission; the NBBO spreads and market breadth during the previous 15, or 30 minutes. These variables add little to the explanatory power of the regression and do not affect the coefficients of interest.

6 for bid and ask separately and for each quintile. Wider inside spreads create incentives for dealers to submit named quotations to attract order flow in the two most active quintiles, as such superior quotations attract order flow to the posting quotes. Because market-makers face more quote competition for high-volume stocks, wider spreads will be associated with more aggressive dealer quotations, which will increase the likelihood of dealers' trades. This is confirmed by the positive coefficients on *Breadth*, although the coefficients are small. For the thin traded stocks, the negative coefficients on the spread suggest that dealers seem to be less likely to adjust their competitive quotes under their names. The plausible explanation is that dealers might have less incentives to expose themselves in these stocks for which they face less competition. For all quintiles, the results are more important for the spreads coefficients. To illustrate the magnitude of the results, the marginal effects estimates suggest that an increase in the spread increases the probability that dealers submit their competitive quotations under their names by almost 9% in the most active quintiles, and the spread increase decreases the probability of their submission by almost 12% in the less active quintiles. Additional results are consistent with the intraday patterns documented in Figure 1.

The positive coefficients on trading volume for the two most active quintiles indicate that dealers adjust their quotations under their names when there is higher trading activity. The coefficient estimates are negative and significant for quintiles 3, 4, and 5. The plausible explanation is that dealers might adjust their quotes under their names at times when markets are liquid as well as in the most active stocks. More active trading seems to lower the likelihood that dealers adjust their quotes under their names for the thin traded stocks, for which unwanted positions can be hardly unwounded. The effects range from

7% to 13% across quintiles. The negative association with price volatility in the majority of quintiles further suggests that dealers adjust their quotations under their names when uncertainty about the asset value is lower. However, the marginal effects are too small. Named quotations are not significantly associated with price momentum, suggesting that price momentum is not concentrated in one trading venue on the NASDAQ.

Inventory consideration seems to affect dealers' decision to adjust their quotations under their names in the direction predicted by the theory. For all volume categories, the results suggest that an excess of buy (sell) orders increases (decreases) the likelihood that named quotations are at the inside of the market. An order imbalance alters the probability that named quotation is submitted at the inside of the market by 10% for most active quintiles and 9% for the less active quintiles. Consistent with the summary statistics in Table 2, the negative coefficients on *size1* for quintiles 2,3,4, and 5 indicate that large trades are more likely to occur when dealers submit their competitive quotations under their names.

6. Out-of-sample results

6.1 The changed environment

With the ECN's competition in 2004, market-makers were able to attract profitable order flow by advertising their prices on the NASDAQ order book. With the implementation of RegNMS in 2005, market-makers have been increasingly adjusting to the current environment that has changed drastically. Presently, there are 20 exchanges that now compete for order flow for all US stocks. The publicly displayed quotations are now protected, based on the Rule 611. As of 2018, no exchange dominates the order flow for US stocks.

I first examine to what degree named quotations are used in the RegNMS marketplace. As shown in Table 7, the average percentage of quote updates increases from large to small sample stocks. The magnitude of the increase is notable. In the largest stocks, 4.24% of the updates are under their named quotations while 13% are for the smallest stocks with a maximum of 49%. This result implies the importance of market-makers in providing quote updates for the less liquid stocks. I next examine whether dealers' incentives have changed in the current setting of the markets with the rise of high-speed traders and the ability of using slicing and dicing trading algorithms. From the FINRA data, it is clear that some dark pools, owned by some of large market-makers in the sample, break large orders into small orders. The average trade size reported by most of dark pools is around 200 shares.[10] For the 2018 sample, the average trade size associated with named quotations is 304.6 shares, slightly higher than 200 shares. For the anonymous quotations, the average trade size is 146.9 shares. Across all sample stocks, I find that named quotations are, on average, associated with relatively higher trade size, regardless of the market capitalization of each subsample. I provide the time-weighted average NBBO posted depth (ask+bid) in Table 7 in order to examine whether the relative trade size associated with named quotations are driven by the availability of market depth or are a strategic choice by market-makers. At any given time in the market for large stocks, the median expected value of the market depth is 2,500 shares. The depth is relatively large in comparison to the average trade size associated with named quotations. Therefore, liquidity supply is not a binding constraint for named quotations, and the choice appears to be driven by other strategic considerations in 2018.

[10] https://otctransparency.finra.org/otctransparency/Agreement.

6.2 Results

I compute the transaction cost associated with named quotations as opposed to anonymous quotations for the 2018 sample. Using a paired *t*-test, I test whether the daily averages of the spreads are statistically and significantly different for named and anonymous quotations. Results are reported in Table 8. The effective and the realized half-spreads for named quotations are significantly higher for all stocks. I find that named quotations are profitable for market-makers, increasing the likelihood that market-makers earn high revenues for those securities with a higher speed trading environment.

My interest is in whether name disclosure is associated with changes in the cost of trading and variance ratios in the higher speed trading environment. Because there were substantial changes in the trading environment compared to 2004 and because I wish to focus purely on the effects of name disclosure in the RegNMS environment, I compute execution costs and variance ratios in the 300 seconds interval before and after name disclosure. I report the results for anonymous quotations for comparison. For each security, I calculate changes in spreads, effective and realized, in the 300 seconds before and after name disclosure. Panel A of Table 9 reports the average effective spreads values as well as the average paired changes in effective spreads. I compute realized spreads and price impact, using a variety of horizons as recommended by Conrad, Wahal, and Xiang (2015), but I show only the five minutes results. Panels B and C of Table 9 show realized and price impact results based on midpoints five minutes after a trade. The results show a significant increase in the realized spreads for named quotations, 2.4 basis points for small stocks and 1.10 basis points for large stocks. The increase of effective spread seems to come from an increase of realized spreads, suggesting that market-makers earn revenues

in high-frequency environment. Compared to anonymous quotations, named quotations appear to be also associated with relatively higher price impact. This result implies that dealer's identity is perceived by the markets as a signal. I also calculate variance ratios and average over the 300 seconds pre- and post- name disclosure. Panel D in Table 9 shows the cross-sectional average of these values, along with their differences. Standard deviations of the cross-section of variance ratios are reported between parentheses. For the named quotations, the variance ratios values seem to be closer to one as opposed to the ones for anonymous quotations, and the paired t-statistic confirm that the changes value is different from zero. The direction of the changes suggests further that variance ratios improve slightly post name disclosure. The time series average of cross-sectional standard deviation of variance ratios seems to be lower for named quotations, implying that named quotations is associated with lower variability in deviations from a random walk. Inventory management might be still driving both named quotations updates and variance ratios results. However, it seems that market-makers are able to generate revenues under their activity in the RegNMS environment, with price discovery process also experiencing slight improvements. The implication, consistent with other results, is that named quotations are used strategically by market-makers to attract order flow, consistent with the advertising hypothesis.

Up to this point, I have shown that named quotations are relatively more used for the less liquid stocks in the RegNMS environment, tend to be profitable for market-makers, and have higher impact. I next examine what drives named quotations in the RegNMS marketplace. Mainly, I capture the conditions that allow parallel processing ability of multiple small orders through multiple exchanges in the RegNMS environment. I examine whether

these market conditions can affect dealers' decision to reveal their names. To conduct this analysis, I divide the trading day into 78 five-minutes periods. I use fixed effects model to regress the percentage of named quotations in each period on the following variables: market breadth computed as the time-weighted average of the number of market centers that can quote for the stock; the maximum level of time-weighted quoted depth across all market centers that match the NBBO; time-weighted relative spreads based on the NBBO quotes, and the NBBO quote midpoint volatility.

Results of the regression are reported in Table 10. Named quotations seem to increase as market breadth narrows. When quote competition is lower, the amount of protected liquidity for immediate execution decreases, market markers might signal their willingness to trade outside of protected prices for potential large traders. I find that, as the spreads widen, the use of named quotations increases. As spreads widen, the cost of demanding immediacy also increases, and thus the costs of reaching additional liquidity past the best prices increase even more. Further, named quotations use increases as quote midpoint volatility increases. Market-makers reveal themselves when the market narrows: the coefficient on the maximum depth is negative and significant. This result implies that, when a market center posts a large amount of liquidity, market-makers switch to anonymous orders to compete for order flow, which based on the results convey less information.

Overall, the regression indicates that the selection of named quotations is determined by the liquidity conditions prevailing in the market at the time of name disclosure. When large market depth is available, market-makers reveal less to limit exposure to potentially less profitable order flow. Market-makers choose to reveal their names when transaction costs increase and when markets become narrower, i.e., become more volatile markets.

7. Conclusion

In this paper, I examine the incentives for market-makers to reveal their names on the NASDAQ limit order book in 2004 and 2018 to find evidence of the advertising hypothesis. Name disclosure is a strategy used by dealers to communicate with the markets and thus to encourage large traders to call them directly. Results show that market-makers, at least those who survived in the millisecond environment, still manage to capture profitable order flow in the RegNMS marketplace under their identified activity. I further find that named quotations increases when NBBO spreads widen and when market narrows. The results imply that, when fewer NMS market centers offer competitive prices, market-makers shift to named quotations in order to attract investors interested into liquidity outside of the protected best prices to fill their demand.

This study offers important insights into the usage of named quotations on the limit order book at different time periods with different market designs for general conclusions. In today's increasingly fragmented markets, the search for liquidity by large traders becomes an issue because of fragmentation and higher frequency trading. In the past, market-makers, as some still do, were executing large orders across market centers with well-placed limit orders in the effort to generate profits. One can argue that electronic platforms that do not disclose market-makers' identities may face difficulties in supporting market liquidity for large traders, and this full anonymity will lower the incentives of market-makers to display their liquidity publicly in the first place.

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Table 1. Sample descriptive statistics. Reported are descriptive statistics of stocks in the 2004 sample aggregated into activity quintiles (with quintile 1 being the most active and quintile 5 the least active). Results contain measures that are reported in CRSP: average trade price ($), average number of market-makers, market capitalization.

Activity Quintile	Average price ($)	Number of market-makers	Market capitalization (in billion $)
Q1 (most active stocks)	23.78	73	16.23
Q2	18.01	54	2.36
Q3	17.52	46	1.78
Q4	17.11	40	1.37
Q5 (least active stocks)	12.89	29	1.02

Table 2. Comparison between named and anonymous quotations. Reported are sample means for quotations placed during the 24 days in the second quarter 2004 for the 500 sample stocks, aggregated by activity quintiles (with Q1 being the 100 most active and Q5 the least 100 active stocks). Dealers' named quotations are aggregated under the NAME category, whereas their anonymous quotations are reported under NSDQ. Panel A reports the averages obtained when each quotation is at the inside bid and ask is weighted by the elapsed time. Panel B are averages obtained when each quotation is weighted by the number of trades. Panel C reports the number of trades for the entire sample. Panel D reports the proportion of large trades executed in each category. Panel E reports the average quoted depth displayed at the inside by each category. Superscripts ***, ** and * indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

	NSDQ	NAME	Paired difference
Panel A: Percentage of time at the ask and the bid, time-weighted averages			
Q1 (most active)	15.99	11.69	-4.30***
Q2	20.34	15.13	-5.21 ***
Q3	24.23	14.31	-9.92 ***
Q4	27.42	16.01	-11.41***
Q5 (least active)	33.68	22.27	-11.41***
Panel B: Percentage of sample trades, trade-weighted averages			
Q1 (most active)	16.63	13.05	-3.58***
Q2	20.91	17.42	-3.49***
Q3	24.58	16.81	-7.77***
Q4	27.81	18.33	-9.48***
Q5 (least active)	32.30	24.89	-7.41***
Panel C: Number of trades in million of shares			
Q1 (most active)	4.63	1.61	-3.02***
Q2	0.73	0.57	-0.16***
Q3	0.52	0.34	-0.18***
Q4	0.37	0.23	-0.14***
Q5 (least active)	0.16	0.11	-0.05***
Panel D: Percentage of large trades on each category of quotations			
Q1 (most active)	49.32	50.02	0.70***
Q2	31.46	40.62	9.16***
Q3	23.50	34.50	11.00***
Q4	21.81	38.23	16.42***
Q5 (least active)	23.85	40.56	16.71***
Panel E: Average quoted depth in shares			
Q1 (most active)	83.76	82.41	1.35***
Q2	9.88	17.39	7.51***
Q3	5.43	9.71	4.28***
Q4	5.55	13.36	7.81***
Q5 (least active)	5.73	13.92	8.19***

Table 3. Half-spread analysis of named and anonymous quotations. This table reports results on trading costs and market maker rents, measured respectively by the effective and the realized spreads, between 9:35 a.m. and 3:55 p.m during 24 days in the second quarter in 2004. Effective spreads are calculated as signed differences between the trade price and the corresponding quote midpoint. Realized spreads are calculated as signed difference between the trade price and a quote midpoint 5 minutes after the trade. Results are divided into trade size categories in Panel A and B, and by activity quintiles in Panels C and D, with quintile 1 being the most 100 active stocks and quintile 5 the least 100 active stocks. Trades are designated as buys and sells using the algorithm recommended by Ellis et al. (2000). Superscripts ***, ** and * indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

	NSDQ	NAME	Paired difference
Panel A: Effective half-spread by trade size (cents)			
All trades	2.38	2.62	0.24***
100-499	2.04	2.51	0.47***
500-4,999	2.41	2.13	-0.28***
5,000-9,999	2.55	2.45	-0.10***
10,000 or more	2.52	3.40	0.88***
Panel B: Realized half-spread by trade size (cents)			
All trades	2.11	2.25	0.14***
100-499	1.56	1.63	0.07***
500-4,999	1.67	1.66	-0.01***
5,000-9,999	2.53	2.47	-0.06***
10,000 or more	2.69	3.23	0.54***
Panel C: Effective half-spread by activity quintiles (cents)			
Q1 (most active)	1.49	2.04	0.55***
Q2	1.45	2.34	0.89***
Q3	1.49	2.64	1.15***
Q4	1.88	2.76	0.88***
Q5 (least active)	1.78	3.31	1.53***
Panel D: Realized half-spread by activity quintiles (cents)			
Q1 (most active)	1.40	1.82	0.42***
Q2	1.30	2.04	0.74***
Q3	1.32	2.23	0.91***
Q4	1.66	2.26	0.60***
Q5 (least active)	1.50	2.72	1.22***

Table 4. Information share evaluation in 2004. This table contains the evaluation of named quotation as opposed to anonymous quotations on the price discovery using the information share methodology. Information shares are calculated for each stock using a vector correction model (VECM) described in Hasbrouck (1995). The computed information shares are then collapsed into activity quintiles and mean shares for each venue are reported together with min-max range in square brackets. Superscripts ***, ** and * indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

	NSDQ	NAME	Paired difference
Q1 (most active)	17.50	20.46	-2.96*
	[24.16-9.78]	[31.8-15.78]	
Q2	18.63	18.82	0.19*
	[27.26-7.87]	[39.87-9.53]	
Q3	19.38	18.78	-0.60
	[26.06-10.85]	28.66-10.27	
Q4	19.83	18.74	-1.09
	[30.43-9.64]	32.33-11.55	
Q5 (least active)	19.72	19.18	-0.54*
	[35.35-9.95]	36.65-9.14	

Table 5. Average variance ratios evaluation in 2004. This table reports results on variance ratios for named and anonymous quotations for the sample of stocks during 24 days in the second quarter in 2004, with quintile 1 being the most 100 active stocks and quintile 5 the least 100 active stocks. For each stock, I compute variance ratios based on 15-second and 5 minutes interval for named and anonymous quotations. The table shows time series averages of the variance ratios by size quintile. The time series average of the cross-sectional standard deviations is in parentheses.

Quintile	NSDQ	NAME
Q1 (Most active)	0.871	1.011
	(0.60)	(0.56)
Q2	0.859	1.023
	(0.68)	(0.70)
Q3	0.848	1.047
	(0.56)	(0.54)
Q4	0.839	1.053
	(0.67)	(0.82)
Q5 (Least active)	0.837	1.037
	(0.67)	(0.45)

Figure 1 - Intraday proportion of named quotations by quintiles in 2004. Each graph depicts the proportion of named quotations at the inside relative to total quotations for each of the 13 half-an-hour trading intervals (from 9:35 a.m. to 3:55 p.m.). The values are averaged across sample stocks aggregated by activity quintiles (with quintile 1 being the 100 most active and quintile 5 the least active stocks) during the 24 days in the second quarter of 2004.

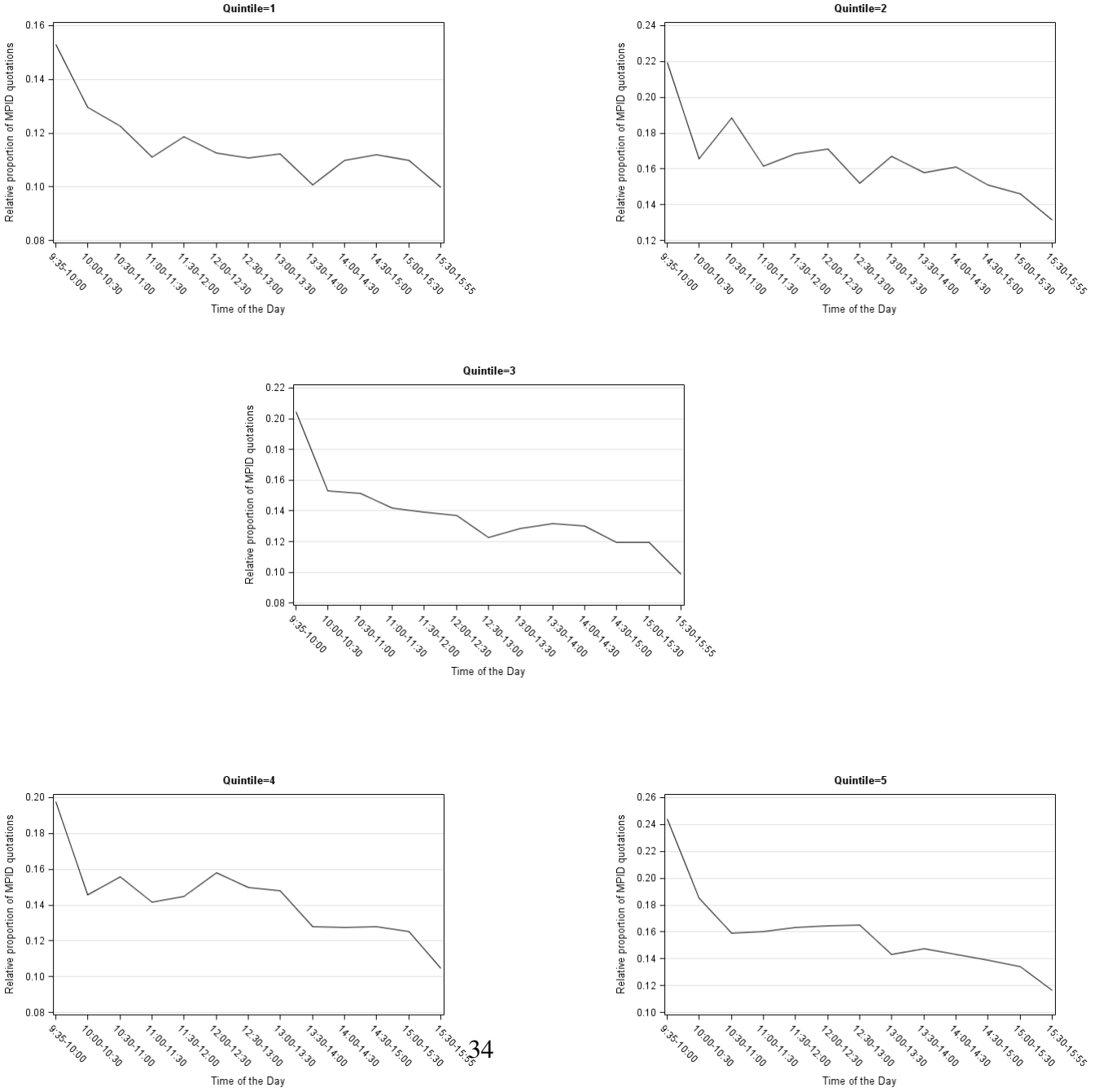

Table 6. Determinants of named quotations in 2004. Reported are results of estimating logistic regressions for each of the five trading quintiles, with the dependent variables equal to 1 if named quotation is at the inside of the market, between 9:35 a.m and 3:55 p.m. during the 24 days in the second quarter of 2004. Stock volatility in the prior 5 minutes is standardized by the average 5 minutes volatility in that stock. Trading volume and Momentum in the prior 5 minutes of quote submission are included. The width of NBBO Spread preceding to the quote is averaged by the average NBBO spread in the stock. Breadth is the number of liquidity suppliers at the inside of the market relative to the average number for the stock. The relative order imbalance is scaled by the average trading activity in that stock. The models control for trade size. Two indicator variables are included: (1) Dummy equals to one for the quote submitted at the first half-an-hour of the trading day, (2) a dummy equals to one for the quote submitted at the last half-an-hour of the trading day. The models control for stock-specified fixed effects and non-spherical errors by allowing the procedure to assume clustering across stocks and times by using Huber-White estimator.

Quintile	Q1		Q2		Q3		Q4		Q5	
	Bid	Ask	Bid	Ask	Bid	Ask	Bid	Ask	Bid	Ask
Volatility during prior 5 min										
Regression coefficient	-0.010***	-0.016***	-0.003	-0.002	-0.007	-0.015***	-0.030***	-0.010	-0.007	-0.001
Volume during prior 5 min										
Regression coefficient	1.056***	0.934***	-0.567***	-0.935***	-0.432***	-0.743***	-1.210***	-1.567***	-0.432***	-1.076***
Momentum during prior 5 min										
Regression coefficient	0.002	0.001	-0.019***	-0.023***	-0.025***	-0.057***	-0.078***	-0.034***	-0.008	-0.004
NBBO Spread										
Regression coefficient	0.937***	0.973***	0.298***	0.194***	-0.025	-0.388***	-0.352***	-0.756***	-0.967***	-0.764***
Breadth										
Regression coefficient	0.012***	0.001	0.023***	0.045***	0.067***	0.097***	0.017***	0.045***	0.004	0.038***
Relative order imbalance										
Regression coefficient	1.122***	-0.946***	0.661***	-0.905***	0.528***	-0.619***	1.075***	-1.186***	0.852***	-0.922***
size1										
Regression coefficient	0.039***	0.062***	-0.315***	-0.261***	-0.648***	-0.694***	-0.740***	-0.831***	-0.789***	-0.533***
size2										
Regression coefficient	0.115***	0.132***	0.125***	0.118***	0.251***	0.243***	0.519***	0.497***	0.305***	0.525***
size3										
Regression coefficient	-0.114***	-0.086***	0.166***	0.104***	0.571***	0.631***	1.054***	0.782***	0.478***	0.812***
First-Half Dummy										
Regression coefficient	0.251***	0.299***	0.485***	0.390***	0.547***	0.453***	0.463***	0.0431***	0.652***	0.739***
Last-Half Dummy										
Regression coefficient	-0.199***	-0.218***	-0.34***	-0.281***	-0.546***	-0.468***	-0.433***	-0.540***	-0.321***	-0.564***
Number of Observations	3,228,390	3,333,303	1,093,128	1,142,241	735,113	771,633	501,070	523,584	204,055	213,545

Table 7. Named quotations in the RegNMS marketplace. The sample period consists of 24 trading days during the second quarter of 2018. Sample stocks are selected based on the following criteria. The 500 most active NASDAQ listed stocks are selected, and grouped into quintiles based on trading activity. The top 50 stocks from the quintile 1 (Large) and the 50 stocks from the quintile 5 (Small) are considered for the out-of-sample analysis. Named quotations are identified in the market maker file of the TRTH database which provided directly from the exchange. I report the average proportion of named quotations displayed under MPID of market-makers, relative to anonymous quotations aggregated under NSDQ feature on the level II. I report the minimum and the maximum proportion across stocks between brackets. I also report the average trade size associated with named quotations, and the median market depth at the NBBO.

Sample	No. firms	% of Named quotations	Named trade size	Median market depth at NBBO
Large	50	4.24% [0.86-19.89]	239.1	2,500
Small	50	13.17% [15.70-49.03]	304.6	700

Table 8. Half-spread analysis of named and anonymous quotations in 2018. The table reports the average effective half-spreads in Panel A, and the average realized spreads 5 minutes after the trade in Panel B, associated with named and anonymous quotations respectively for 2018 sample stocks. The sample consists of 50 most active NASDAQ listed stocks and 50 less active NASDAQ listed stocks during 24 days in the second quarter of 2018. I compute the time-weighted effective and realized spreads for each stock in the sample and then conduct a paired *t*-test between named and anonymous quotations. The results of the paired difference are shown in the Paired difference columns. Superscripts ***, ** and * indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

Sample	NSDQ	NAME	Paired difference
Panel A: Effective half-spread (in cents)			
Large stocks	0.89	1.32	0.43**
Small stocks	1.71	3.35	1.64*
Panel B: Realized half-spread (in cents)			
Large stocks	0.32	1.02	0.70**
Small stocks	1.51	2.85	1.34*

Table 9. Average effective spreads, realized spreads, price impact and variance ratios before and after three hundred seconds of the quote submission. The sample consists of 50 most active NASDAQ listed stocks and 50 less active NASDAQ listed stocks during 24 days in the second quarter of 2018. I compute the time-weighted effective spreads, and realized spreads in each stock, and average these in three hundred seconds before and after submission of named and anonymous quotations. Price impact is simply the difference between effective and realized spreads. Panels A, B, and C report the averages of the effective, realized spreads and price impact respectively, and the paired difference between the post- and the pre-submission spreads. The results of the paired difference are shown in the Difference columns. Differences in pre-/ post spreads are in basis points. I also calculate variance ratios in the three hundred seconds before and after the submission of named quotations and anonymous quotations. Panel D reports averages of variance ratios for the largest stocks and for the smallest stocks, as well as the difference between pre/post variance ratios. The time series average of the cross-sectional standard deviations is in parentheses. Superscripts ***, ** and * indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

	NSDQ			NAME		
	Pre-	Post-	Difference	Pre-	Post-	Difference
Panel A: Effective half-spread (in cents)						
Large stocks	0.91	0.94	3.00*	1.07	1.11	3.74**
	(0.60)	(0.70)		(0.50)	(0.40)	
Small stocks	1.94	1.97	1.68**	2.64	2.73	3.52**
	(1.57)	(1.54)		(0.83)	(0.84)	
Panel B: Realized half-spread (in cents)						
Large stocks	0.52	0.53	0.66**	0.84	0.85	0.93*
	(0.30)	(0.35)		(0.35)	(0.30)	
Small stocks	1.75	1.77	0.94***	2.18	2.24	2.44**
	(1.08)	(1.09)		(0.70)	(0.60)	
Panel C: Impact half-spread (in cents)						
Large stocks	0.39	0.41	2.34**	0.23	0.26	2.80**
	(0.20)	(0.40)		(0.05)	(0.08)	
Small stocks	0.19	0.20	0.74**	0.46	0.49	1.09*
	(0.13)	(0.10)		(0.10)	(0.20)	
Panel D: Variance ratios						
Large stocks	1.03	1.08	0.05**	0.93	0.94	0.01**
	(0.50)	(0.67)		(0.20)	(0.40)	
Small stocks	0.99	1.26	0.27*	0.97	0.99	0.02**
	(0.61)	(0.50)		(0.34)	(0.31)	

Table 10. Fixed effects regressions of named quotations usage in 2018 I estimate the fixed effects regression of named quotations usage in 2018. Each trading day is divided into 78 five-minutes periods. The percentage of named quotations is the current percentage for the period. Midquote volatility is the NBBO midquote volatility. The NBBO spread is the time-weighted spread. Maximum depth is the maximum time-weighted quoted depth from all market centers. Breadth is the market breadth. The sample period consists of 24 trading days during the second quarter of 2018. Superscripts ***, ** and * indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.

Variable	% Named Quotations
Intercept	-0.048
Midquote volatility	2.374**
NBBO spread	22.643**
Maximum depth at the NBBO	-0.009**
Market breadth	-0.033***
Adj. R2	0.26