

How Profitable Day Traders Trade: An Examination of Trading Profits

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Abstract:

This paper investigates how profitable day trading occurs and how it impacts trading on Nasdaq stocks. Our paper analyzes a unique data set on 96,323 trades from the proprietary stock trading team of an U.S. day trading firm. We find profitable day traders trade when and where liquidity traders are present. That is, they prefer and are more profitable trading in the morning, on higher volatility days, on higher volume days, on large capitalization Nasdaq stocks, and in an anonymous dealer capacity over the Island ECN. In addition, we find profitable day traders precede most market makers in updating their quotes. This latter finding is surprising considering day traders have an informational disadvantage to competing Nasdaq dealers. The ability of profitable day traders to rapidly update their quotes and subsequently capture liquidity trader order flow reduces market-making profits, lowers spreads, and leads to efficient price discovery.

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The National Association of Security Dealers (NASD) recently defined a day trader as “an individual who conducts intra-day trading in a focused and consistent manner, with the primary goal of earning a living through the profits derived from this trading strategy” (SEC 2000). Day traders look to profit by executing many intra-day trades taking advantage of small price movements in stocks (e.g. \$.10, \$.05, etc.). Their profit per closing trade is often small, yet because of the frequent trading, their end-of-day profit can be sizeable. The orders of day traders are placed through direct access trading systems at brokerage houses that specifically cater to high volume trading¹.

There has been little comprehensive research conducted on day traders, thus most individuals are unaware of their trading practices. Despite their relative anonymity, they have emerged as a “powerful force” on U.S. markets according to Bear Stearns (2001). Bear Stearns defines a day trader as an individual who typically trades between 25 and 40 times per day. Using exchange data provided by Nasdaq and the NYSE, they estimate 50,000-day traders accounted for over 28% of Nasdaq/NYSE trading volume, in the year 2000.

The day trading industry is divided between traders who trade their own capital (retail day trader) and traders who trade a firm’s capital (proprietary day trader). Many direct access brokers have both retail and proprietary clients using their software. Proprietary day trader’s account for a majority of the day trading industry volume (Bear Stearns 2001), and are thus the focus of our study. Retail day traders will often opt for a proprietary trading program to increase their trading capital and lower their commissions. Although proprietary traders incur lower or no commissions, in return they only receive a percentage of their trading profits. While U.S. margin laws govern retail day traders, proprietary day trading programs can

often receive preferential margin treatment, which is subject to the firm's agreement with the clearing broker, provided minimal net capital requirements are adhered to². Many proprietary trading programs are formed as partnerships or limited liability companies (L.L.C.). They openly recruit and advertise their benefits to public retail day traders. The partnerships have effectively lowered the barriers of entry to conduct profitable day trading.

The purpose of our paper is to examine how profitable intra-day trading occurs and how these trading strategies impact trading on Nasdaq stocks. By selecting proprietary traders, we expect to enhance our chances of finding consistently profitable intra-day traders. Our analysis reveals two defining traits for profitable day trading. First, we find profitable day traders trade when and where liquidity traders are present. That is, they prefer and are more profitable trading in the morning, on higher volatility days, on higher volume days, on large capitalization Nasdaq stocks, and in an anonymous dealer capacity over the Island ECN. These findings are consistent with past theoretical work developed on informed traders. Second, we find day traders are able to profit because they precede most market makers in updating their quotes. This finding is surprising considering day traders have an informational disadvantage to competing Nasdaq dealers. When profitable day traders rapidly update their quotes and subsequently capture liquidity trader order flow this reduces market-making profits, lowers spreads, and leads to efficient price discovery. Because the day traders send a majority of their orders to the Island ECN, we also examine overall quoting activity on Island in relation to other market participants. We find Island quotes to be both rapid and dominant at the inside for our selected large capitalization Nasdaq stocks. In addition, we find these quote updates are informed, as they are well positioned to profit from developing momentum trends.

Our examination of day traders is of interest to academics, practitioners, and regulators alike for several reasons. First, although the day trading industry continues to grow and represents a sizeable portion of trading volume, we know very little about the trading strategies of day traders. Barber and Odean (2001) cite the reluctance of day trading firms to provide access to the trading records of their clients as the main reason for this. To our knowledge we do not know of any modern studies (post 1997 SEC Order Handling Rules) that use proprietary data to analyze how profitable day trading occurs. Thus, our results are the first to provide insight into a growing yet undiscovered area. The day trading industry has been created by increased market volatility, technological advancements in trading software and connections to the financial markets (direct access), and the development and growth of alternative trading venues, such as ECN's. Intra-day trading is not a new concept yet it has never been as widely available to the average individual as it is today. This has resulted in the surge of new traders seeking to profit at the expense of existing market participants.

A second reason for the interest in day trading is that the trading profits we document raise questions about the efficiency of dealer markets. Day traders have less information than Nasdaq market makers, yet experienced day traders, such as the ones we observe, consistently profit from market maker quote updates. Market makers have private information on the large orders they are working for themselves, their clients, and other market participants based on the trading requests they receive. Day traders do not have this private order flow information. This results in day traders basing their trading decisions on the quote updates of market makers while gauging the supply and demand levels of the market. In a Wall Street Journal article (IP 2000), Kenneth Pasternack, former CEO of Knight Securities, Nasdaq's largest

market maker, acknowledged Knight's ability to see order flow as an "informational advantage". "We're smarter than the market in aggregate and we're able therefore to make a determination whether the stock will go up or down." To take advantage of this order flow information, Knight was employing approximately 393 traders (or market maker day traders) when our data sample was obtained. In an effort to curb the information that can be construed from market maker quotes, Nasdaq has recently allowed market makers the option to hide their identity on its new trading platform Supermontage³.

If a day trader consistently profits in a dealer capacity, which we find occurs, it implies they are able to extract information from market maker(s) quotes and update their own quotes faster than many market makers can or choose too themselves. The day traders are setting the national inside spread on over 85% of their Island trades. Their trading is concentrated on the most highly transparent Nasdaq stocks. In addition, our evidence suggests they clearly anticipate profitable momentum trends ahead of most dealers. The trading profits we observe come at the expense of market makers for not acting on their informational advantage to post competitive quotes and entice liquidity traders to trade with them rather than the day trader. When a day trader executes profitable order flow, this not only causes market makers to loose spread revenue, but they loose the information content from each trade the day trader executes. Nasdaq dealers "take advantage of the profit opportunities represented by each trade" according to Knight/Trimark's CEO. When profitable day traders are able to overcome their informational disadvantage and rapidly update their own quotes ahead of better informed dealers, this leads to more efficient price discovery on Nasdaq stocks.

A third reason for the interest in day trading is that day trader's reveal how prices interact between alternative trading systems and Nasdaq market makers. Alternative trading systems, such as Electronic Communication Networks (ECN's), are anonymous marketplaces where limit orders are matched internally without the services of a market maker. This avoids the costs of bid-ask spreads and is thus conducive to liquidity traders. The best bid-ask price on an ECN is forwarded to the Nasdaq quote montage to compete for execution on the national market. ECN quotes can and will often set the inside spread. Traders who observe an ECN quote setting the inside spread can execute against the quotes by using SelectNet, which routes the order directly to the ECN, or matching the order internally on the ECN. The SEC (2000a) reports ECN volume averages 30% of all Nasdaq volume.

We find profitable day traders send a majority of their orders to the Island ECN. Huang (2002) examines the quote setting behavior of market makers and ECN's on Nasdaq's quote montage. The analysis is based on a sample of the 30 most active Nasdaq stocks (stocks we find profitable day trading occurs on) during two time periods, July 1998 and November 1999 (3 months prior to our data collection). Overall, the results indicate Island quotes are more strongly associated with the timely submission of informative quotes than any other market participant. The study does not identify trade data by participant, thus we use proprietary data to show where these quotes come from. In addition, we examine the quote-setting behavior of market participants on our selected stocks and find Island quotes are rapidly updated, dominant at the inside, and well positioned to profit from intra-day momentum trends.

Finally, day traders are interesting to study because they continue to come under increased regulatory pressures without any comprehensive research into their trading practices. The NYSE and the NASD, with the approval of the SEC, have

recently increased the initial margin account balance required to open up a retail day trading account. On September 28, 2001 retail day traders were required to maintain an equity account balance of \$25,000. The previous required balance was \$2,000. The SEC definition of a day trading account (for margin purposes) is any account that executes four or more day trades (open and close a position in the same day) within five business days, provided the number of trades is more than 6% of the account value for the five day period. Accounts that meet this definition are deemed pattern day traders and are subject to the new rules. Proprietary day traders are not subject to this rule but they have come under their own pressures. On February 24, 2000 firms engaging in joint back office arrangements with clearing brokers were subject to net capital requirements. Also, on February 25, 2000 proprietary day traders were required to meet Series 7 licensing requirements. The implications of more stringent regulatory requirements will most likely reduce the number of existing day traders.

The rest of this paper is organized in the following way. Section I describes previous literature in this field, section II describes our unique dataset, section III analyzes how profitable day trading occurs, section IV discusses how this trading strategy impacts market maker profitability, and section V concludes.

I. Previous Work

This paper serves two main areas of interest in the finance literature. First, it provides empirical evidence on how informed traders trade. Theoretical work on informed trading, developed in Easley and O'Hara (1987) and (1992), Admati and Pfleiderer (1988), and Diamond and Verrecchia (1987) is indicative of how we find the day traders trade and subsequently profit. Second, our paper extends the brief

academic literature to date that has been conducted on day traders, who use the Small Order Execution System (SOES)⁴ for their trading strategies.

A SOES order is a market order that attempts to execute against market maker quotes setting the inside spread. If an ECN is setting the inside spread, or if there is heavy traffic in the SOES system, the orders are held up in a queue often resulting in a different execution price than when the trader sent the order⁵. As a result, SOES orders are seen as more risky than limit or marketable limit orders, which are commonly used by day traders today. Before the implementation of the SEC Order Handling Rules day traders had few order routing options. The SOES order was the preferred method of choice and thus day traders became known as the SOES bandits.

The information content of day traders, who use the SOES order routing system, has been examined in two previous papers. Harris and Schultz (1997) examine SOES trading around the time of rule change. The maximum sized SOES order was reduced from 1,000 to 500 shares. Battalio et al. (1997) examine SOES trading and volatility. Both studies conclude that day traders are informed in that their trading leads to efficient price discovery.

Our paper focuses on the trading profits of day traders and is more closely related to Harris and Schultz (1998) examination of SOES Bandits trading profits. Using two weeks of proprietary data, Harris and Schultz (1998) find retail day traders are generally profitable. They attribute profitable day trading to market maker agency costs. Day traders trade their own account, which gives them a greater incentive to seek out intra-day profitable opportunities rather than traders who work for market makers. The compensation of traders working for market makers is not as closely tied to performance, thus they may not trade with the same level of focus or intensity which allows day traders to overcome their informational disadvantage and realize

trading profits. Do market makers suffer from agency costs today? It would be difficult to definitively answer this question. Many traders working for market maker now have equal compensation schemes to that of a day trader. For example, almost all of Knight/Trimark's 393 traders mentioned above are paid solely on the basis of profits they are able to earn for the firm (IP 2000). The only difference in Knight/Trimark's traders and the day traders we observe is that the former group of traders uses Knight/Trimark's order flow information to generate trading profits.

Our study differs from Harris and Schultz (1998) in that it is more recent and on a larger dataset, it is on highly profitable day traders, and most importantly it is conducted after the implementation of the SEC Order Handling Rules. These rule changes drastically impacted the trading structure of Nasdaq stocks and how profitable day trading occurs. Day traders do not seek to profit by trading with market makers; they attempt to profit by taking away their order flow. The increased competition for order flow will inevitably lower market-maker profitability and reduce Nasdaq spreads. Several studies, including Wahal (1997) and Klock and McCormick (1998) show Nasdaq spreads are lower on stocks with more competing dealers.

II. Data and Profit Calculation

The data for this study is obtained from the proprietary trading team of a U.S. direct access broker from March 8, 2000 through June 13, 2000. The data is a transaction database, which for each trade lists the trader identification, the time the order was filled on the relevant exchange, the order type (limit order, stop limit order, etc.), the action taken (buy, sell, short, or cover), the volume, the price, the location of

the trade, the contra party on the trade, and the number of parties on the other side of the trade. Our selection of proprietary day traders eliminates any complications with transaction costs, fees, etc. We analyze all trades on all traders. Fifteen proprietary day traders were trading for the firm during this time period, but not all traders traded for the whole time period (see table I for days traded). There were 68 days in which the U.S. markets were open and there were 2 market holidays. In total the data consists of 96,323 trades or 118,967,894 traded shares segregated by trader account. The 15 traders accounted for 0.10% of Nasdaq share volume and 0.09% of Nasdaq dollar volume. The data was obtained on site directly from the brokerage house database, ensuring data completeness, and eliminating any possibilities of data tampering. The firm is a member of the National Association of Security Dealers (NASD) and caters to retail as well as proprietary day traders through direct access trading. They are one of the larger direct access brokers in the United States. The 15 proprietary day traders traded in an on site location with retail day traders in the New York City area.

To aid our understanding on how the day trader's profit we also use the Nasdaq data set provided by the NASD. Nasdaq contains trade data, inside quote data, and individual quote data for each market participant during the intra day. Because we have the execution time for each day trader's trade we are then able to compare this with the actual market conditions (inside spread, depth, each market participant's quote, etc.) that existed during the time of the trade.

The average trader in our study trades 115 times per day with an average volume of 1,235 per trade. Trades are executed at an average price of \$42.12. The mean dollar transaction per trade is \$51,373.51. Open trades are closed out with an average absolute price change of \$0.08 in 3 minutes and 17 seconds. The traders

primarily trade Nasdaq stocks through limit order trading via the Island ECN. Figure 1 reveals that 64% of the traders volume is executed by placing bid/offers through the Island ECN, 32% is executed by routing marketable limit orders to a market maker/ECN based on their level II quotes (via SelectNet), 3% is sent to the floor of the NYSE/AMEX, and 1% is executed by placing bid/offers on another ECN rather than Island. Nine ECN's were registered to trade Nasdaq stocks at the time of this study. Island and Instinet were by far the two most active ECN's in terms of share volume. During the year 2000, 53 billion shares were executed over the Island ECN resulting in approximately 12% of Nasdaq trades and 6% of Nasdaq share volume. Over 600 market makers, broker dealers, institutions, etc. subscribe to Island⁶.

To determine where the day trader's quotes on Island are in relation to other market participants, we match the price on the Island trade (recall we have the intra-day execution time) with a one second lag to the prevailing inside quotes on the Nasdaq dataset⁷. We conduct this analysis for the 20 most heavily traded stocks from 9:30 a.m. – 4:00 p.m. In total, we analyze 55,808 trades or 89% of the Island trades. Figure 2 shows the day traders were setting the national inside spread on 47% (27,102) of their trades, they traded within the national inside spread on 37% (20,543) of their trades⁸, and they traded outside of the national inside spread on 15% (8,163) of their trades. The ability of ECN's to set the national inside spread came about with the final phases of the SEC Order Handling Rules. Barclay et al. (1998) show this had a dramatic effect on trading costs, as spreads declined approximately 30%. Although the day traders are frequently at the inside on Island, contributing to lower spreads, it does not necessarily mean they are contributing to price discovery. However, in the next section we show the information content behind the day trader's quotes, by examining their quotes relevant to competing dealers.

The trader's intra-day volume is consistent with market volume trading patterns. Trading is heavy at the open, light during midday, and picks back up again towards the end of the day. Figure 3 graphically displays their trading volume segregated by half-hour trading increments. The day traders only chose to trade outside of the main trading hours on 258 trades, or less than 0.03% of their total trades. Trading outside of the main trading hours is more risky due to reduced participation among market participants.

To determine the profit or loss on a round-trip transaction we match the opening trade for each stock in each traders account with the subsequent trade of the opposite sign each day. Day traders do not always open and close positions with two trades. A day trader may lay off part of an open position or they may combine a closing transaction with an opening transaction. Regardless of whether trades opened, closed, or open and closed a position simultaneously, we search forward in a time sequence each day keeping track of accumulated inventory levels with each corresponding price the trader paid. Thus, round-trip calculations are based on a last in first out inventory method for each day. Day trading firms calculate intra-day trading profits in the same manner. We were able to match all but 115 of the 96,323 trades (over 99.88% of trading activity). Day traders rarely hold positions overnight due to the increased price risk. These 115 unmatched trades could be long-term investments or alternatively the day traders could be purchasing stock to hedge against future short sale constraints. Day traders typically hold large block shares in the stocks they day trade the most to avoid restrictions on short selling. Thus a trader would be in a defacto short sale during the intra-day, yet the trade is labelled as a sell due to their overall inventory position.

III. Trading Strategies

A. Profitable day trading occurs incrementally on large capitalization Nasdaq stocks

Table I gives the profit distribution for all round-trip transactions. The trading profits on the 58,835 round-trip trades are relatively small. Approximately 30% of round-trips were for \$50 or less while only 8% were above \$150. The day traders were right 62% of the time (trading profit above zero) with a \$0.09 average price change per round-trip and wrong (trading profit below zero) just 28% of the time with a \$0.10 average absolute price change per round trip. Approximately 10% of round-trip trades were realized for neither a gain nor a loss. The day traders were right more than wrong, and their average price change when they are right is greater than the prevailing spread (large Nasdaq stocks typically quoted in 1/16th spreads when our data was collected) indicating that they do have short-term information and they are not just profiting by adding depth to the existing spread. Occasionally the day traders realize large trading profits (the largest was \$3,206.25) but more often than not they seek to earn incremental trading profits, trading frequently throughout the day. The frequency of trading and large block trades leads to a sizeable profit at the end of the day.

Table II segregates trading profit by stock on the twenty most heavily traded equities. These stocks accounted for over 90% of the day trader's volume. The day traders are primarily profiting on large capitalization Nasdaq stocks. Fifteen of the top twenty traded stocks were members of the Nasdaq 100 composite index during our time period. Dell and WorldCom were by far the two most heavily traded issues. Over 55% of all round-trip transactions occurred on these two stocks. Mean profit per round-trip trade is significantly different from zero in nineteen out of the twenty

stocks. The only stock that the day traders did not have a statistically significant informational advantage on was Cisco, although they were still able to generate \$6,769.24 in overall trading profits. Cisco was down 2% for our time period. The day traders were most profitable on Dell, where twelve traders earned \$423,336.48 despite Dell decreasing 4% in value over the 68 days. Techniclone Corporation had the highest mean profit per round-trip trade at \$65.86. The stock was down 68% in value over the 68 days. Techniclone, a member of the Nasdaq SmallCap market, is a biopharmaceutical company engaged in research, development, and commercialization of targeted cancer therapeutics⁹.

Why do profitable day traders prefer trading large capitalization Nasdaq stocks and why do consistently profitable day trading opportunities exist? Day traders are attracted to large capitalization Nasdaq stocks for several reasons. Although the companies are large cap stocks they are technology companies, which indicate that they tend to have greater price volatility than many of the large capitalization stocks that list on the specialist exchanges. Price volatility is an indicator of higher profitability as will be subsequently shown. Also, the size of the companies will ensure there are many market makers in the stock. This provides three notable benefits. First, the multiple market participants will provide information. Day traders base their trading decisions on the quote updates of market makers. Large cap stocks will have the biggest and most influential market makers making a market providing information. Second, more market makers in a stock will foster competition tightening spreads than on less frequently traded stocks. When a day trader enters a trade by trading with a market maker at their posted quotes (36% of trades were opened with marketable limit orders against dealer quotes), they have already occurred a loss. A day trader must first cover the spread and the cost of execution

before they can earn a profit. The large cap stocks tend to have tight spreads. A third reason day traders prefer multiple market participants is the liquidity it brings. Liquidity is defined as the ability to buy or sell an asset quickly and in large volume without substantially affecting the asset's price. Profitable day traders trade in block shares moving in and out of stocks in seconds. Multiple dealers providing adequate liquidity are essential for their strategy to work.

The continuous large block trading of day traders can allow them to substantially contribute to overall share volume on highly transparent Nasdaq equities. We examine the trading records of only 15-day traders, yet we find their market share to be somewhat surprising. Table III shows what percentage of overall share volume they accounted for on the twenty most heavily traded equities. On Dell and WorldCom they accounted for 2% of share volume over the 68-days. The other 18 equities were traded less frequently but when they concentrated trading on these stocks (largest percentage of volume indicates their most active day) their contribution to share volume is significant. Individual day traders will often trade more shares than many competing Nasdaq market makers who are registered to make a market in the stock.

Table IV displays trading profitability segregated by trader account. The number of days traded reveals that only trader 4 traded every day in our sample period. On March 8th 11 traders were trading while on June 13th 13 traders were trading. The number of round-trip trades per trader indicates differences in the way trading profits are realized. Trader 3 and trader 13 both traded 65 days yet trader 3 closed out 6,785 more trades. Trader 1 traded one more day than trader 2 yet he closed out 3,283 more trades. Some day traders will often prefer trading large block

trades every few seconds (often referred to as a grinding strategy), while some prefer trading less shares every few minutes (often referred to as spread or range trading).

Mean profit per round-trip trade is significantly different from zero in 13 out of the 15-day traders exclusive of execution costs. A sign rank test indicates the median round-trip profit per trader is statistically different from zero in 14 out of the 15-day traders exclusive of execution costs. The large differences in average profit per round-trip and total trading profits indicate that some day traders are more skilled at day trading than others. Clearly not all day traders are profitable, yet we find consistencies with the way profitable day trading occurs.

The day traders are highly profitable but do their trading profits under perform benchmark indices? We do not have information on the trading capital the firm was required to put up for each day trader nor do we have beginning inventory levels for each trading account. This causes difficulties in estimating an abnormal return. However, the trading profits were obtained during a bearish market. Nearly all stocks the day traders traded were down in value over our sample period. The Nasdaq composite index was down 23% and the Nasdaq 100 composite index (the stocks the day traders trade the most) was down 14% for the 68-day trading period.

Is it possible that the day traders profit by taking advantage of more stringent exchange requirements that other market participants have? For instance, Nasdaq market makers must register in a stock they wish to make a market and post both a bid and a ask quote at all times. In contrast, day traders are not required to meet either of these obligations. We find this theory unlikely because these requirements for market makers are neither expensive nor risky. Nasdaq makes it very easy and costless for entering and exiting market makers. A market maker can register in a stock following a one-day registration period and exit from a stock with a half-hour notice. A market

maker is required to post both a bid and an ask but this does not mean they are required to trade. In fact, Ellis et al. (2002) find most registered market makers are there only in name. Whether a market maker trades depends on the aggressiveness of his quotes, and on his involvement in such practices as preferencing. Preferencing is when a smaller dealer pays a larger dealer cash or service for the privilege of executing the order.

If profitable day trading is not the result of an upward trending market or differences in exchange requirements, how than can a less informed day trader trade profitability among better informed market makers? Recall market makers have an informational advantage due to existing Nasdaq order flow arrangements. From our discussion with traders at the firm¹⁰, we are told day traders base their trading decisions on information derived from market maker quotes while gauging the supply and demand of the market. This strategy is also consistent with Harris and Schultz's (1998) investigation of SOES bandits. Day traders observe all market maker quotes through their direct access trading system, and take advantage of incremental profit opportunities in real time. The quote updates of market makers are watched simultaneously with a ticker tape that displays all real time executions. The real time ticker allows the day traders to gauge supply and demand levels. In essence, day traders conduct technical analysis in real time and attempt to profit. Day traders may base trading decisions on the quote updates of a single influential market marker or a group. Ellis et al. (2002) find that one dealer will often dominate trading in Nasdaq stocks when that stock has reached its equilibrium-trading environment. Profitable day traders know which dealer quotes to watch while monitoring overall order flow.

To consider how a day trader might make a decision to enter a trade, consider a scenario where the number of market makers posting competitive bids begins to

expand, the number of market makers posting competitive offers begins to contract, and the majority of trades are going off at the offer. A day trader may then look to enter a stock by bidding in front of competing dealers if they feel the price is upward trending and not reflective of its fundamental value. The reverse of this would hold true if a stock were decreasing in price. ECN quote updates are anonymous; therefore their movements are difficult to interpret because the day trader does not know who is behind the quote. The quote could be becoming from a dominant dealer, who has information on a large order (and subsequent price change) they are working for a client, or a day trader who may be interpreting information incorrectly. We feel consistently profitable day traders are simply faster or more skilled than many competing dealers which allows them to overcome their informational disadvantage. We suspect there are wide differences in skill levels among active day traders today, although our study seeks to identify defining characteristics that can lead to consistently profitable day trading.

To measure the information content of the day trader's trades we examine where their Island quotes were placed in relation to other dealers. Using the Nasdaq inside quote file we match the number of dealers and size that correspond with the inside quote on the market participant quote file. We do this for all twenty stocks for each second during the 68 days of our study. For each of the day traders 55,808 Island trades, which occur from 9:30 a.m. to 4:00 p.m. on the twenty most heavily traded equities; we match each trade with a one second lag to the Nasdaq data set. This reveals the number of dealers and size on both the inside bid and the inside ask subsequent to the day traders execution. The t-statistic tests the null hypothesis that there is no difference between the average number of dealers and average size on the bid versus the average number of dealers and average size on the ask. Because the

information content of day traders is short lived, a long-run econometric specification of price, subsequent to a trade, will most likely misrepresent the true information content behind each trade. The results of our analysis are displayed in tables V and VI.

When the day traders bid better than the national best bid, the market is clearly upward trending and they are preceding most dealers in updating their quotes. There are on average 6.78 dealers setting the national best bid with a size of 11,237 shares as opposed to an average of 4.45 dealers on the offer posting a size of 5,644 shares. The difference between the average number of dealers and average size on the bid versus the average number of dealers and average size on the ask is positive and highly significant with t-statistics of 41.08 and 25.76 respectively.

When the day traders are setting the national best bid, there are more dealers and size on the ask. This finding is consistent with Harris and Schultz (1998), who found when SOES bandits opened a trade with a buy (market order at the ask as opposed to bidding) there were more dealers on the ask. The day traders are preceding most dealers in updating their quotes. Finally, when the day traders place their bid below the best bid, the market is clearly downward trending and they are again ahead of most dealers to efficiently update their quote and ensure execution. When the day traders place their bid below the national inside bid there is on average 2.84 dealers on the inside bid posting an average size of 2,963 shares as opposed to on average 5.69 dealers on the inside ask posting an average size of 8,571 shares. The differences between the average number of dealers and size on the bid versus the average number of dealers and size on the ask is negative and the t-statistic is highly significant. The t-statistic for the difference in dealers and size is -35.90 and -33.34 respectively. When we examine offers placed on Island in table VI we find the same results, with a

high level of significance, indicating the day traders are on average preceding most dealers in updating their offer quotes. The day traders ability to precede most market makers and get executed is not only allowing them to realize sizeable trading profits, but also, their rapid quote updates lead to efficient price discovery as information is incorporated into quotes more quickly in their presence.

B. Profitable day trading occurs when liquidity traders are increasingly present

To examine questions such as when and where higher levels of profitable day trading occur we analyze the 58,835 round trip trading profits at time t based on six variables. Summary statistics on these variables are listed in table V, while table VI gives the results of a cross sectional regression. For our regression analysis we use a profit per share derivation $((\text{Profit}/\text{Quantity}) * 100)$ as opposed to the summary statistics (table VII), which calculate an actual trading profit per trade exclusive of execution costs. The cross sectional regression is:

$$\begin{aligned} \text{Round-trip profit per share}_t = & \beta_0 + \beta_1 \text{time}_t + \beta_2 \text{volume}_t + \beta_3 \text{volatility}_t + \beta_4 \text{volume}_t \\ & + \beta_5 \text{trade size}_t + \beta_6 \text{trade position}_t + \beta_7 \text{order routing method}_t \end{aligned} \quad (1)$$

where the 58,835 round-trip trading profits per share are regressed on the time of day (time), whether the trade occurred on a high or low volume day (volume), whether the trade occurred on a high or low volatility day (volatility), the size of the round-trip trade (closing trade size), whether the trade closed out a long or short position (trade position), and where the trade occurred (order routing method).

The day traders are more active and profitable during peak hours of trading during the intra-day. To see this we divide the trading day into 13 equal half-hour

time increments. The 106 round-trip transactions that occur before the open or after the close are included in the 1st and 13th time periods. There were 6,595 round-trip trades in the first period and the average profit is \$40.93. In addition, the morning period coefficient is positive and statistically significant (t-stat of 3.14) at the 1% level for the cross sectional regression. The period immediately following the open is the only period that is positive and statistically significant. Trading profitability steadily decreases during the day to a low of \$18.39 from 1:00 p.m. to 1:30 p.m. and picks back up again towards the end of the day. The results indicate how important the open is for profitable day trading.

If the day traders are more profitable during peak trading times during the intra-day, than their profitability should be higher when daily share volume is higher as well. To test this we obtain Nasdaq share volume for the 68 days in our sample period. We segregate trading profits by whether they occur on a high or low volume day (34 days each). The average round-trip trade is \$29.73 on a high volume day as opposed to \$17.92 on a low volume day. Further, the high volume coefficient is positive and statistically significant (t-stat of 6.94) at the 1% level for the cross sectional regression.

Higher share volume levels often translate into higher price volatility. Therefore, we anticipate finding higher day trading profits when Nasdaq volatility is higher. To see this we obtain the Nasdaq composite index high/low for each of the 68 days and divide it by the index level at the start of the day. Similar to our volume classification we segregate the round-trip trading profits by whether they occur on a high or low volatility day. There were 4,433 more trades on high volatility days and the average trading profit is \$4.26 higher. The high volatility coefficient is positive

and statistically significant (t-stat of 4.19) at the 1% level for the cross sectional regression.

Admati and Pfleiderer (1988) note that informed traders prefer to trade during times when liquidity traders are present in the markets so that their information is not revealed. This will create periods of concentrated trading in which both liquidity and informed traders participate. Our finding that the day traders are more active and profitable during these times of concentrated trading is consistent with informed trading. When there is reduced participation by liquidity traders, the day trader's information is more revealed and thus their profit opportunities are lessened.

C. Profitable day trading occurs on moderate block trades and on both long and short positions

The day traders earn a higher average trading profit when they trade in larger block trades. However, larger block trades result in a lower average trading profit per share. To see this we segregate trading profits based on the size of the round-trip trade. There were 25,419 closing round-trip trades conducted with less than 1,000 shares resulting in an average profit of \$15.40, 25,552 closing round-trip trades were conducted between 1,000 and 2,000 shares resulting in average profit of \$27.32, and 7,864 closing round-trip trades were conducted at or above 2,000 shares resulting in an average profit of \$43.49. The large block trading and frequency of trading is consistent Easley and O'Hara's (1992) predictions. That is, informed traders will trade as quickly as possible and as much as possible once they have received their information.

Easley and O'Hara (1987) also note that informed traders may be quickly distinguished by their large volume trading and hence their profit opportunities will be

lessened. We find when the day traders trade in larger block trades they lessen their profit opportunities, which is again consistent with Easley and O'Hara's predictions. The average profit per share on a closing round trip trade less than 1,000 shares is \$0.036 (median is \$0.047), the average profit per share on a closing round-trip trade between 1,000 and 2,000 shares is \$0.025 (\$0.031), and the average profit per share on a closing round-trip trade at or above 2,000 shares is \$0.019 (\$0.021). Evidence of lower trading profits on higher block trades is also seen with the cross sectional regression. The coefficient on closing round-trip trades below 1,000 shares is positive and statistically significant with a t-stat of 5.30. Closing round trip trades conducted between 1,000 and 2,000 shares also has a positive and statistically significant coefficient, yet the t-stat is lower at 2.61.

The day traders went both long and short during the intra-day. There were 33,230 round-trip intra-day long trades with a mean of \$27.81, a median of \$20.83, and total trading profits of \$923,971.55. In contrast, there were 25,605 round trip intra-day short trades with a mean of \$19.83, a median of \$15.62 and total trading profits of \$507,654.90. The coefficient for a long trade is positive and statistically significant in the cross sectional regression indicating that there is a difference in trading profits between a long and short position. However, the day traders were highly profitable under both scenarios.

The preference of profitable day traders to go long rather than short, even in a downward trending market, may be due to restrictions on short selling. On Nasdaq, a stock may only be sold short if the inside bid is up. Direct access brokers have sophisticated software that prevents day traders from violating this up tick rule. The ability of traders to consistently profit on an intra-day short position is indicative of informed trading. Short selling is costly, thus uninformed traders are less likely to do

so because of these costs, as noted in Diamond and Verrecchia (1987). Despite the costs associated with going short, the day traders chose to do so during the intra-day 25,605 times earning \$507,654.90 in trading profits.

D. Profitable day trading occurs anonymously on the Island ECN

The results clearly indicate the day traders prefer trading and are highly profitable on the Island ECN as opposed to other order routing methods. The average round-trip profit on Island is \$47.88 and the coefficient is positive and statistically significant (t-stat of 1.85) at the 10% level. The 62,987 trades on Island resulted in 43,091 round-trips totalling \$2,063,027.96 in trading profits over 68 trading days.

Why does profitable day trading occur in a dealer capacity through Island as opposed to trading directly with market makers? One reason may be that the day traders are anonymous on ECN's. Anonymity facilitates the mingling of informed traders with liquidity traders, as in Admati and Pfleiderer (1988), resulting in better price discovery as information is incorporated into quotes. Island and Instinet are the two most liquid ECN's on Nasdaq, which allows profitable day traders to find a quick match while not revealing information. The preference for Island is most likely due to who typically trades on the two competing ECN's. Instinet caters to better-informed buy side institutions, such as Fidelity Investments, whereas Island caters to less informed individual traders (liquidity traders) that seek to avoid the costs (the spread) of trading with market makers. Major U.S. on-line brokerage firms often provide their customers with access to Island providing an influx of liquidity. In fact, Datek, a large on-line brokerage firm, is the parent company of the Island ECN. Liquidity traders may be further attracted to Island due to its high transparency. Island displays its limit order book free over the Internet and they also run a series of

television campaigns targeted at individual traders. Another distinctive feature about Island is that it is the only ECN to date that pays for non-marketable limit orders. Thus, a highly active proprietary trading program can generate substantial revenue back by placing their quotes on Island as opposed to other order routing methods.

If profitable day trading occurs where high levels of liquidity traders are present, then we would expect reduced day trading profitability where low levels of liquidity traders are present. We find this when the day traders trade on less liquid ECN's. There were only 1,988 trades routed to ECN's other than Island resulting in 295 round-trip trading profits. Only one of these round-trip trades was placed on Instinet. The average profit on a round-trip trade is less than half of what it is on Island. The coefficient in the cross sectional regression is positive and statistically significant at the 10% level (t-stat of 1.92). Total trading profits were only \$5,982.88.

If profitable day trading occurs against uninformed traders than unprofitable day trading is most likely to occur with informed traders (e.g. large Nasdaq dealers with order flow information). This is clearly evident in our results. The 26,302 trades routed (via SelectNet) to competing Nasdaq participants resulted in 12,912 round-trip trades totalling \$698,739.09 in trading losses. The average loss on a round-trip trade is \$-54.12 and the coefficient in the cross sectional regression is negative and highly significant at the 1% level. An advantage with our data set is that we are able to see the contra-party when the day traders chose to trade against competing dealers quotes (marketable limit orders). In contrast, the contra-party on limit orders placed on ECN's is not revealed. Table VII reveals the top twenty dealers the profitable day traders chose to trade against and the subsequent losses they occurred. The better-informed large buy side institutions, quoting anonymously on Instinet, were able to earn the most trading profits off of the day traders. Larger market maker firms such

as Morgan Stanley, Goldman Sachs, Merrill Lynch, Schwab Capital Markets, and Salomon Smith Barney also frequently traded with the day traders. Although the better-informed dealers profit by trading directly with the day traders, their trading profits are adversely impacted when the day traders rapidly update their quotes in a dealer capacity themselves. Our results indicate that this can be extremely costly.

IV. The Impact of Profitable Day Trading Strategies on Market Participants

Day traders that seek to profit by the methods we document will lower competing dealer profitability in several ways. First, when day traders act quickly on information and rapidly update their quotes on Island, this reduces or eliminates the ability of market makers to profit from order flow. Market making, on average, is profitable and dealers with low trading profits and volume will often exit from market making in that stock, as found in Ellis et al. (2002). When day traders continuously set or are near the inside spread they will inevitably capture a portion of Nasdaq order flow. Large dealers, such as wholesalers, may be impacted the most by profitable day trading strategies. These firms typically make markets in thousands of stocks and generate a substantial portion of their revenues from market making. When day traders are faster to update their quotes and thereby seek to sell liquidity at a more competitive price, this will lower market maker trading profits. In fact, we find this frequently occurs on large capitalization Nasdaq stocks.

To see this we examine the quoting behavior of Nasdaq market participants on the Nasdaq data set. The results are displayed in table X. In total, we analyze 22,822,420 quote updates from 9:30 a.m. to 4:00 p.m. on our twenty most heavily traded stocks over the 68-day trading period. Island accounted for 6,686,018 (29.3%)

of these quote updates. When each market participant updates their quotes, and displays their new bid and ask, we calculate the percentage of time the new bid, ask, and both the bid and ask set the national inside spread. Of the 22,822,420 quote updates 39.5% of the bid updates set or matched the existing best bid, 40.3% of the ask updates set or matched the existing best ask, and 15.0% of the quote updates set or matched both the best bid and best offer price. Our next step is to examine the 6,686,018 Island quote updates and repeat our previous calculation. Of the 22,822,420 quote updates 16.5% of the bid updates set or matched the existing best bid and were attributable to Island, 17.4% of the ask updates set or matched the existing best ask and were attributable to Island, and 8.3% of the quote updates set or matched the existing best bid and best ask and were attributable to Island. Finally, we divide our latter calculation by the former calculation which gives us the percentage of quote updates that matched or set the inside price and were attributable to Island. Of the 9,022,914 bid updates that matched or set the national best bid 41.7% of these quotes were attributable to Island. There were 9,206,401 ask updates that matched or set the national best offer and 43% of these were attributable to Island. Finally, there were 3,429,561 quote updates that matched or set both the best bid and best offer and 55% of these were attributable to Island.

The previous calculations were conducted for each registered market participant for our selected 20 stocks over the 68 trading days. Island quotes are both dominant and rapid at the inside and they are the clear leader for setting the best bid, the best ask, and both the best bid and the best ask for our sample stocks. Instinet is second to Island for each of our three categories¹¹. The rapid quote updates of day traders on Island have clearly captured a portion of order flow at the expense of Nasdaq market makers. Being a price leader is not necessarily indicative of Island's

ability to contribute to price discovery. However, recent economic research, on large capitalization Nasdaq stocks, suggests Island quotes are the leaders at price discovery as well.

A second way dealer profitability is negatively impacted by the presence of day traders is through order flow information. Recall dominant Nasdaq market makers, such as Knight/Trimark, employ hundreds of traders to generate trading profits off of the firms order flow information. Day traders seeking to profit as dealers will capture order flow and will thus limit the informational advantage that larger dealers have. One way to measure the information behind Island quotes is to look at market conditions (e.g. dealers and size at the inside) when the quotes are updated. To do this we focus our analysis on the twenty most heavily traded stocks and the 6,686,018 quote updates that came from Island. For each Island quote update we examine the number of dealers and size at the inside in relation to where the new quote update is placed. We segregate quote updates by whether they are setting or below the inside spread. The results for bid updates are displayed in table XI. When a bid update from Island is setting the best bid, there is on average 5.62 dealers on the bid side and 4.10 dealers on the ask side. The difference of 1.52 dealers on the bid side is statistically different from zero at the 1% level. In addition, there is an aggregate size of 8,284 shares on the bid side and 4,852 shares on the ask side. The mean difference is highly significant for size as well. When day traders are aggressively bidding for a stock the market conditions indicate that the stock is upward trending. However, when there is more pressure on the ask side, Island bid quote updates are positioned to take advantage of a downward trending price. When Island quote updates are updated below the best bid there is on average 2.67 dealers at the inside bid and 4.71 dealers at the inside ask. The difference of 2.04 dealers on the

ask side is highly significant. In addition, there is an aggregate size of 2,542 shares on the bid side and 7,221 shares on the ask side, which is again reflective of downward trending conditions due to pressure on the sell side.

When we examine market conditions for Island ask quote updates we get the same results that occur for Island bid quote updates. The results are displayed in table XII. Day traders seeking to profit will monitor dealer quoting activity and order flow in real time. When they see a trend developing they will rapidly update their quotes on Island to profit from their information. Their ability to do so, will limit the informational advantage that larger dealers have and will thus reduce competing dealer profitability.

A third way market maker profitability is negatively impacted by profitable day trading strategies is through order preferencing arrangements. Payment for order flow is a common practice on Nasdaq where larger dealers pay smaller dealers cash or service for their order flow. The larger dealer will then typically execute the order at the inside spread. When day traders continuously set the inside spread at a more competitive price, large dealers are often required to pay the day trader's quote. In the absence of the day trader, they would pay a less competitive price. Our matching analysis revealed that over 85% of the day trader's quotes on Island were at or within the national inside spread.

V. Conclusion

We examine a unique data set on 96,323 trades from the proprietary stock trading team of a U.S. day trading firm. Our paper provides the first evidence, subsequent to the 1997 SEC Order Handling Rules, on how profitable day trading

occurs and how it impacts trading on Nasdaq stocks. In addition, we provide empirical evidence using proprietary data to support past theoretical work developed on informed traders.

Our analysis reveals two defining traits for profitable day trading. First, we find profitable day traders prefer and are more profitable trading in the morning, on higher volatility days, on higher volume days, on large capitalization Nasdaq stocks, and in an anonymous dealer capacity over the Island ECN. These findings are consistent with past theoretical work on informed traders. Second, we find profitable day traders precede most dealers in updating their quotes. This later finding is of note, considering day traders have an informational disadvantage to competing Nasdaq dealers. When the day traders trade directly with better-informed dealers they are not profitable. However, when they rapidly update their quotes on Island they are able to attract uninformed order flow at the expense of these better-informed dealers. The trading structure of Nasdaq stocks allows day traders to monitor market maker quotes while gauging supply and demand levels. This allows highly skilled day traders to anticipate short-term momentum trends and earn incremental trading profits per round trip. Although the trading profits per round-trip are small, the frequency of trading and large block trades can lead to a sizeable end of day profit. Proprietary trading programs, with their favorable margin requirements, lower the barriers of entry to realize these trading profits.

Because the day traders send a majority of their orders to the Island ECN, we also examine overall quoting activity on Island in relation to other market participants. We find Island quotes to be both rapid and dominant at the inside for our selected large capitalization Nasdaq stocks. In addition, we find these quote updates are well positioned to profit from developing momentum trends. The ability of

profitable day traders to rapidly update their quotes and subsequently capture liquidity trader order flow reduces, market making profits, lowers spreads, and leads to efficient price discovery.

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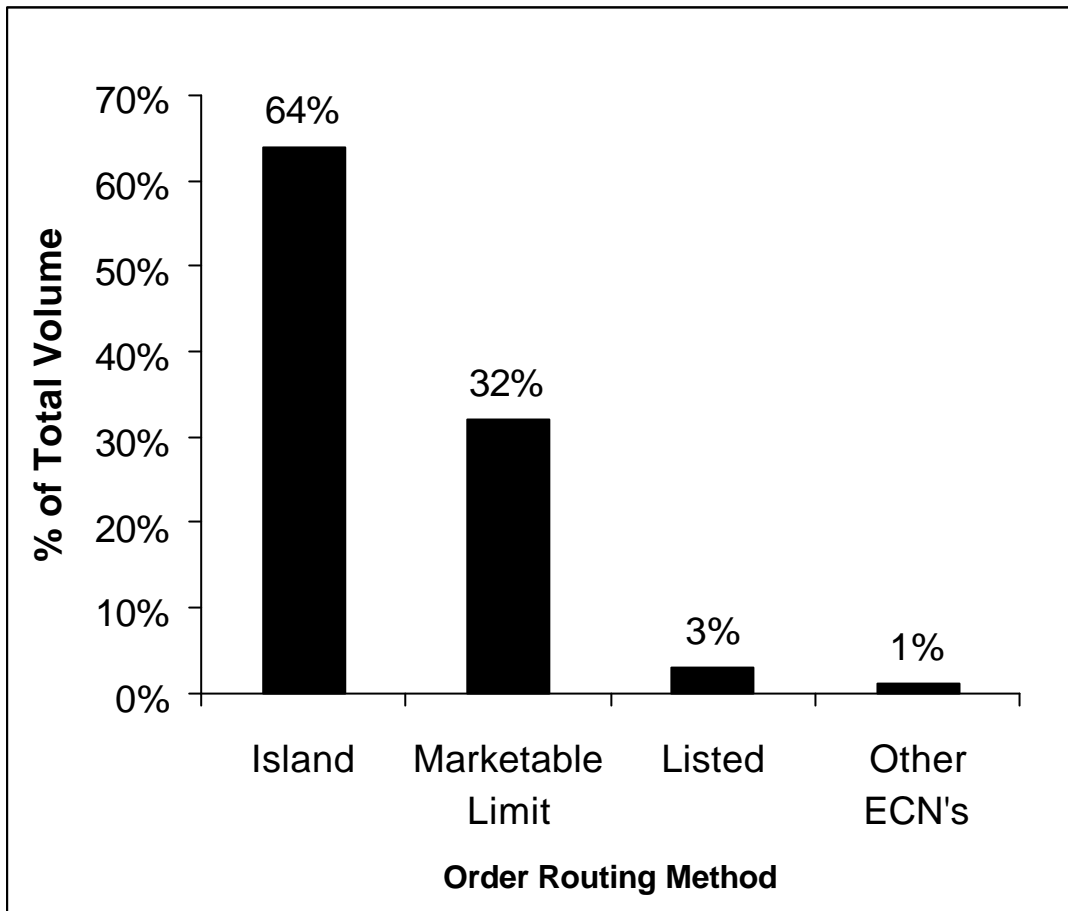


Figure 1 Order Routing Method – The method of order routing on the 118,967,894 (96,323 trades) shares executed by the day traders. Island represents the 75,704,421 shares (62,987 trades) executed by bidding/offering on the Island ECN. Marketable limit represents the 38,644,960 shares (26,302 trades) executed by routing marketable limit orders to Nasdaq market participants based on their displayed quotes. Listed represents the 3,836,600 shares (5,046 trades) executed on the floor of the NYSE or AMEX exchanges. Other ECN's represents the 781,913 shares (1,988 trades) executed by bidding/offering on Electronic Communication Networks exclusive of Island.

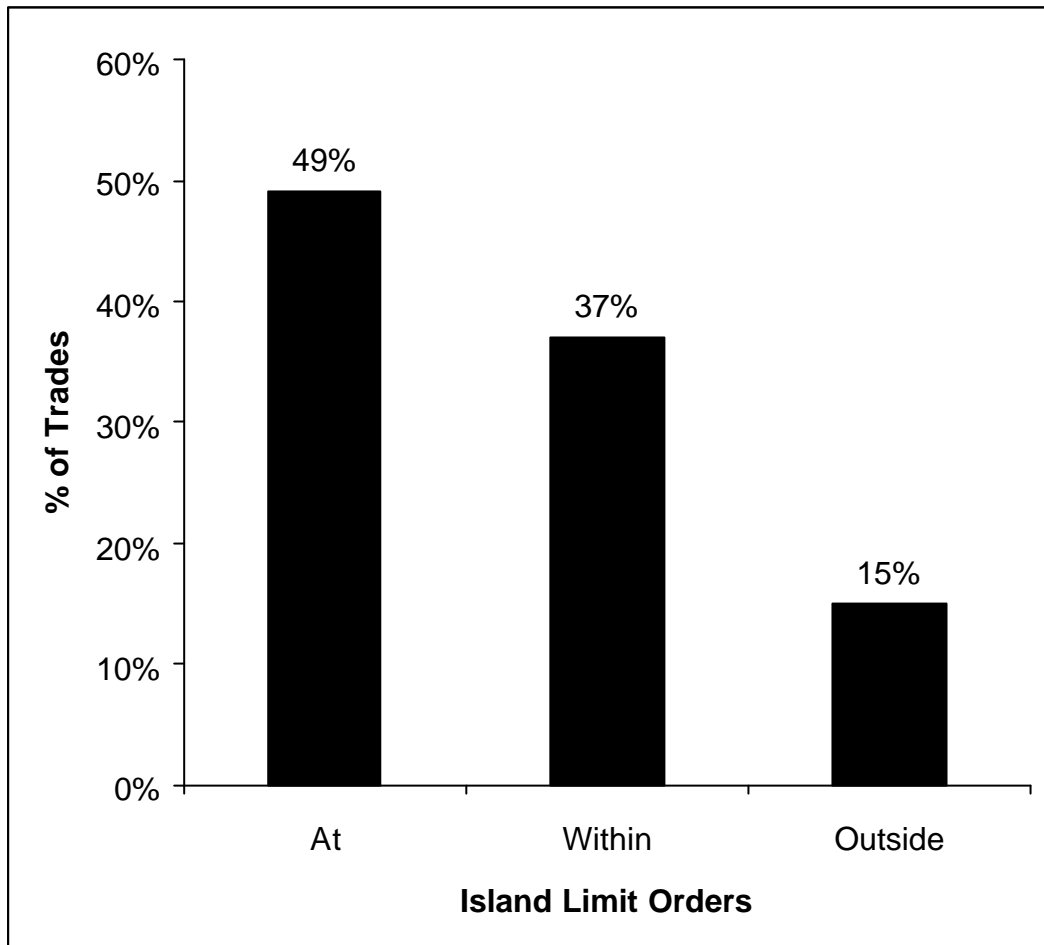


Figure 2 Island Limit Orders. The 55,808 Island limit orders (9:30 am. – 4:00 p.m.) on the twenty most heavily traded equities segregated by whether the trades were executed at, within, or outside the inside spread. The day trader's trade is matched with a one second lag to the Nasdaq dataset to determine the relation of the trade to the national inside spread.

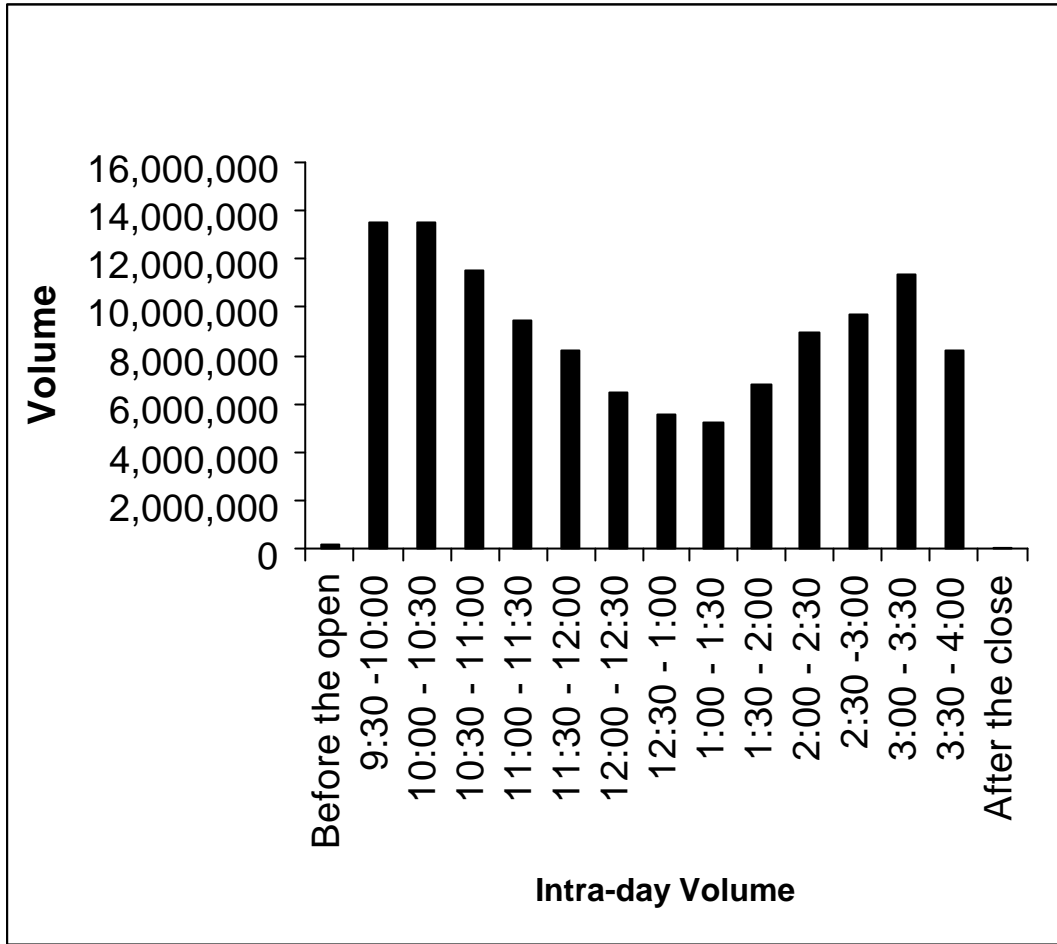


Figure 3 Volume Traded- The intra-day share volume segregated into half-hour time increments. The day traders traded 118,967,894 shares (96,323 trades). There were 216,490 shares (226 trades) traded in the pre-market and 23,810 shares (32 trades) traded in the after-hours market. Trading conducted outside of primary market hours accounted for 0.2% of overall share volume.

Table I
Profit Distribution

Profit distribution for round-trip trading profits exclusive of execution costs. Results are calculated across all trades on all stocks for each day trader during the 68-day trading period. The day traders had 36,285 winning round-trip transactions (profit above zero 62% of the time), and 16,607 losing round-trip transactions (profit below zero 28% of the time). There were 5,943 round-trip transactions with a profit equal to zero (10% of the time). Winning round-trip transactions occurred with an average absolute price change of \$0.09 and losing round-trip transactions occurred with an average absolute price change of \$0.10

	Number of round-trips	% of overall round-trips
<u>Profitable</u>		
Profit more than \$150.00	4,950	8%
\$100.01 - \$150.00	3,932	7%
\$50.01 - \$100.00	9,753	17%
\$00.01 - \$50.00	17,650	30%
 Closing Profit = 0	 5,943	 10%
<u>Unprofitable</u>		
\$-00.01 - \$-50.00	7,320	12%
\$-50.01 - \$-100.00	4,312	7%
\$-100.01 - \$-150.00	1,984	3%
Profit less than \$-150.00	2,991	5%

Table II
Profit by Stock

The number of day traders that day traded the stock, the number of round-trip transactions, mean profit per round-trip, and the total trading profits exclusive of execution costs for the 20 most heavily traded stocks (by share volume). These stocks accounted for over 90% of share volume. A t-test is used to determine if the mean profit is significantly different from zero. A sign rank test is used to determine if the median profit is statistically different from zero.

Stock	Number of day traders	Number of round-trips	Mean profit per round-trip	Median profit per round-trip	Total trading profits
Dell	12	15,628	\$27.09*	\$18.75*	\$423,336.48
WorldCom	14	16,939	\$17.56*	\$18.75*	\$297,479.09
Oracle	8	2,699	\$39.70*	\$12.21*	\$107,137.09
Paging Networks	9	1,632	\$42.10*	\$25.00*	\$68,698.56
Techniclone Corporation	8	1,433	\$65.86*	\$23.44*	\$94,377.01
LM Ericsson	10	2,011	\$26.03*	\$20.53*	\$52,342.90
Global Crossing	11	2,363	\$19.87*	\$21.54*	\$46,942.36
Atmel Corporation	3	1,666	\$35.69*	\$15.63*	\$59,450.56
Microsoft	12	1,753	\$11.04*	\$15.63*	\$19,359.67
Cisco	9	979	\$6.91	\$5.63*	\$6,769.24
3Com	7	997	\$20.53*	\$7.81*	\$20,469.23
Novell	11	969	\$23.54*	\$16.09*	\$22,811.02
ADC Telecommunications	6	806	\$14.57**	\$11.43*	\$11,746.71
Intelect Communications	6	310	\$50.91*	\$14.84*	\$15,780.88
Centura Software	4	328	\$54.31*	\$19.28*	\$17,813.74
Metrocall	3	357	\$33.38*	\$12.50*	\$11,915.28
Parametric Technologies	7	361	\$25.17*	\$23.44*	\$9,087.51
Informix Corporation	10	367	\$19.18*	\$23.13*	\$7,039.93
Etrade	8	557	\$15.36*	\$14.06*	\$8,553.73
Internet Capital Group	3	287	\$38.64*	\$23.33*	\$11,089.29
All Others	15	6,393	\$18.68*	\$12.50*	\$119,426.18

*, **, Significantly different from zero at the 1%, 5% levels respectively.

Table III
Trading Volume

This table provides summary statistics on the twenty most heavily traded stocks. These stocks accounted for over 90% of the day trader's volume. Overall volume on each stock is aggregated from those days in which the day traders executed at least one transaction on the stock.

Stock	Days traded	Total trades	Total volume	% of stock volume	Largest daily % of volume
Dell ⁺	68	24,599	34,794,452	1.81%	3.46% 3/27/00
WorldCom ⁺	68	26,965	31,739,554	1.97%	3.49% 4/18/00
Oracle ⁺	54	4,260	6,313,254	0.39%	1.29% 4/19/00
Paging Networks	27	2,750	4,939,346	2.79%	5.86% 3/13/00
Techniclone Corporation	47	2,406	4,433,024	2.67%	5.69% 3/22/00
LM Ericsson ⁺	28	3,234	3,787,246	0.72%	2.07% 6/12/00
Global Crossing ⁺	50	3,939	3,646,400	0.52%	1.65% 5/17/00
Atmel Corporation ⁺	26	2,743	3,134,530	1.80%	4.74% 6/6/00
Microsoft ⁺	39	2,842	2,825,202	0.17%	0.98% 4/27/00
Cisco ⁺	49	1,585	2,253,228	0.08%	0.25% 4/24/00
3Com ⁺	54	1,655	2,078,186	0.42%	1.74% 6/13/00
Novell ⁺	23	1,607	2,018,482	0.70%	2.48% 5/11/00
ADC Telecommunications ⁺	24	1,396	1,325,644	1.03%	2.60% 5/31/00
Intellect Communications ⁺	33	543	912,046	0.75%	2.87% 4/11/00
Centura Software ⁺	28	563	850,220	1.73%	4.58% 3/31/00
Metrocall ⁺	45	668	739,346	1.26%	3.41% 4/5/00
Parametric Technologies ⁺	11	615	697,562	0.34%	1.47% 4/10/00
Informix Corporation	28	617	687,942	0.31%	1.32% 4/20/00
Etrade	32	1,016	686,656	0.22%	1.13% 3/15/00
Internet Capital Group	26	486	492,502	0.44%	0.98% 4/24/00

⁺ Denotes stocks that comprised the Nasdaq 100 index on June 13, 2000.

Table IV
Profit by Trader

The number of days traded, number of round-trip transactions, mean profit per round-trip, and total trading profits exclusive of execution costs for each day trader that day traded the firms' capital during the 68-day trading period. A t-test is used to determine if the mean profit is significantly different from zero. A sign rank test is used to determine if the median profit is significantly different from zero.

Trader number	Days traded	Number of round-trips	Mean profit per round-trip	Median profit per round-trip	Total trading profits
1	67	9,402	\$32.59*	\$20.54*	\$306,382.51
2	66	6,216	\$37.55*	\$13.25*	\$233,435.34
3	65	7,681	\$29.86*	\$12.50*	\$229,342.34
4	68	5,777	\$26.96*	\$24.91*	\$155,741.49
5	67	4,807	\$24.31*	\$20.53*	\$116,833.21
6	60	3,859	\$26.81*	\$23.44*	\$103,461.06
7	66	7,734	\$14.94*	\$20.25*	\$115,567.22
8	24	703	\$36.65*	\$31.25*	\$25,761.84
9	54	2,283	\$25.79*	\$0.00	\$58,868.76
10	65	1,136	\$27.45*	\$23.44*	\$31,178.82
11	44	3,326	\$9.25*	\$16.60*	\$30,750.41
12	24	572	\$7.59*	\$18.75*	\$4,338.36
13	65	1,700	\$3.87	\$7.81*	\$6,581.82
14	54	1,193	\$2.19	\$14.06*	\$2,609.98
15	47	2,446	\$4.40*	\$9.00*	\$10,773.30
Total	836	58,835	\$24.33*	\$18.75*	\$1,431,626.46

* Significantly different from zero at the 1% level.

Table V
Information Content of Bids Placed on Island

The number of dealers and size at the inside when the day traders had their Island bids executed on the 20 most heavily traded equities. The execution time on each of the 25,781 bids placed on Island (9:30 a.m. – 4:00 p.m.) is matched with a one second lag to the Nastroq data set to determine the numbers of dealers and size at the inside. The day traders had 11,812 bids executed at the inside, 10,295 bids executed within the inside, and 3,674 bids executed outside of the inside. A t-test is used to determine if the difference in the numbers of dealers and size is significantly different from zero.

	Average # of dealers	Average size
<u>Island bids placed within the inside</u>		
Dealers and size at the inside bid	6.78	11,237
Dealers and size at the inside ask	4.45	5,644
Difference	2.33	5,593
T-statistic	41.08	25.76
 <u>Island bids placed at the inside</u>		
Dealers and size at the inside bid	5.29	5,894
Dealers and size at the inside ask	5.78	7,740
Difference	-0.51	-1,846
T-statistic	-9.94	-15.57
 <u>Island bids placed outside the inside</u>		
Dealers and size at the inside bid	2.84	2,963
Dealers and size at the inside ask	5.69	8,571
Difference	-2.85	-5,608
T-statistic	-35.90	-33.34

Table VI
Information Content of Offers Placed on Island

The number of dealers and size at the inside when the day traders had their Island offers executed on the 20 most heavily traded equities. The execution time on each of the 30,027 offers placed on Island (9:30 am. – 4:00 p.m.) is matched with a one second lag to the Nastraq data set to determine the numbers of dealers and size at the inside. The day traders had 15,290 offers executed at the inside, 10,248 offers executed within the inside, and 4,489 offers executed outside of the inside. A t-test is used to determine if the difference in the numbers of dealers and size is significantly different from zero.

	Mean number of dealers	Mean size
<u>Island offers placed within the inside</u>		
Dealers and size at the inside bid	4.67	6,676
Dealers and size at the inside ask	6.37	9,336
Difference	-1.70	-2,660
T-statistic	-29.15	-14.82
<u>Island offers placed at the inside</u>		
Dealers and size at the inside bid	5.88	8,551
Dealers and size at the inside ask	4.99	6,223
Difference	0.89	2,328
T-statistic	20.77	17.61
<u>Island offers placed outside the inside</u>		
Dealers and size at the inside bid	6.46	12,321
Dealers and size at the inside ask	2.60	3,025
Difference	3.86	9,296
T-statistic	53.76	38.03

Table VII
Trading Profit by Market Conditions

The 58,835 round-trips trading profits are segregated between Time of Day, High/Low Volume Days, High/Low Volatility Days, Trade Size, Position, and Order Routing Method. Time is based on round-trips realized during each intra-day half-hour. Volume is calculated by taking the total share volume traded on Nasdaq each day and then segregating round trips into 34 high/low volume days. Volatility is calculated by taking the difference in the Nasdaq composite high/low divided by the beginning index level each day. Round-trips are then segregated into 34 high/low volatility days. Closing trade size is based on round-trips that occurred with a closing trade size under 1,000 shares, a closing trade size inclusive of 1,000 shares and less than 2,000 shares, or a closing trade size of 2,000 shares or greater. Position is based on round-trips that occurred on an intra-day long or short position. Order routing is based on round-trips that occurred on the Island ECN, on a ECN other than Island, on marketable limit orders, or on the specialist exchanges.

	Number of round-trips	Mean	Median	Total trading profits
<u>Time</u>				
Before the open	80	\$32.51	\$20.88	\$2,600.29
10:00 AM	6,515	\$41.03	\$31.25	\$267,323.70
10:30 AM	6,674	\$27.18	\$21.88	\$181,380.41
11:00 AM	5,651	\$20.43	\$18.17	\$115,465.34
11:30 AM	4,752	\$20.14	\$18.00	\$95,695.05
12:00 PM	4,094	\$22.06	\$18.06	\$90,291.83
12:30 PM	3,231	\$21.78	\$13.28	\$70,324.63
1:00 PM	2,838	\$18.39	\$13.38	\$52,201.13
1:30 PM	2,705	\$27.81	\$14.53	\$75,235.67
2:00 PM	3,523	\$21.77	\$13.20	\$76,692.69
2:30 PM	4,417	\$19.70	\$15.63	\$87,021.82
3:00 PM	4,830	\$17.11	\$15.18	\$82,649.90
3:30 PM	5,471	\$24.77	\$16.88	\$135,486.18
4:00 PM	4,028	\$24.73	\$18.75	\$99,602.78
After the close	26	-\$13.27	\$0.00	-\$344.97
<u>Volume</u>				
High (34 Days)	31,953	\$29.73	\$20.83	\$949,989.18
Low (34 Days)	26,882	\$17.92	\$15.33	\$481,637.28
<u>Volatility</u>				
High (34 Days)	31,634	\$26.30	\$18.75	\$832,027.50
Low (34 Days)	27,201	\$22.04	\$15.75	\$599,598.96
<u>Closing Trade Size</u>				
Trade < 1,000	25,419	\$15.40	\$11.72	\$391,530.84
1,000 ≤ Trade < 2,000	25,552	\$27.32	\$31.25	\$698,056.35
Trade ≥ 2,000	7,864	\$43.49	\$46.88	\$342,039.26
<u>Position</u>				
Long	33,230	\$27.81	\$20.83	\$923,971.55
Short	25,605	\$19.83	\$15.62	\$507,654.90
<u>Order Routing Method</u>				
Island	43,091	\$47.88	\$31.25	\$2,063,027.96
Marketable Limit	12,912	-\$54.12	-\$31.25	-\$698,739.09
Listed	2,537	\$24.20	\$0.00	\$61,354.70
Other ECN's	295	\$20.21	\$6.25	\$5,982.88

Table VIII
Regression Results

A cross-sectional regression is estimated using the 58,835 round-trip trading profits per share ((profit/quantity)*100) as the dependent variable. A dummy variable equal to one is used for each indicated category and serves as the independent variable.

Independent variable	Coefficient	Standard Error	T-Stat
Intercept	2.843	0.722	3.940
<u>Time</u>			
10:00 AM	1.056	0.336	3.139
10:30 AM	-0.081	0.312	-0.261
11:00 AM	-0.808	0.297	-2.725
11:30 AM	-0.925	0.308	-3.006
12:00 PM	-0.978	0.412	-2.372
12:30 PM	-0.609	0.324	-1.879
1:00 PM	-0.746	0.346	-2.157
1:30 PM	-0.201	0.461	-0.436
2:00 PM	-0.443	0.329	-1.347
2:30 PM	-0.677	0.314	-2.153
3:00 PM	-0.698	0.313	-2.230
3:30 PM	-0.483	0.315	-1.535
<u>Volume</u>			
High Volume	0.794	0.115	6.938
<u>Volatility</u>			
High Volatility	0.476	0.113	4.191
<u>Closing Trade Size</u>			
Trade Size < 1,000	0.858	0.162	5.296
1,000 ≤ Trade Size < 2,000	0.368	0.141	2.609
<u>Position</u>			
Long Positions	0.214	0.123	1.744
<u>Order Routing Method</u>			
Island	1.177	0.637	1.847
Marketable Limit Order	-8.177	0.648	-12.619
Other ECN's	1.634	0.852	1.916

Table IX
Contra – Party on Marketable Limit Orders

Trading profitability against Nasdaq market participants for marketable limit orders. Trading profits are exclusive of execution costs. The market participant identification code is revealed for non-ECN orders only. There were 26,302 trades (32% of the 96,323 trades) that were routed to Nasdaq market participants based on their displayed quotes. Marketable limit orders were used 36% of the time to open a position and 22% of the time to close a position.

	Market participant	# of trades sent	Average profit per trade	Total trading profits
1.	Instinet ⁺	2,500	\$-32.44*	\$-81,086.46
2.	Morgan Stanley	2,293	\$-25.41*	\$-58,268.23
3.	Goldman Sachs	1,996	\$-27.24*	\$-54,362.25
4.	Merrill Lynch	1,573	\$-27.18*	\$-42,760.62
5.	Schwab Capital Markets	1,542	\$-32.68*	\$-50,391.73
6.	Salomon Smith Barney	1,373	\$-27.76*	\$-38,107.17
7.	Robert Stephens	855	\$-31.07*	\$-26,657.23
8.	Knight Securities	836	\$-17.40*	\$-14,543.55
9.	Archipelago ⁺	758	\$-26.90*	\$-20,390.97
10.	Spear, Leeds, & Kellogg	680	\$-22.32*	\$-15,175.29
11.	Brass Utility ⁺	659	\$-37.99*	\$-25,035.81
12.	Credit Suisse First Boston	650	\$-22.72*	\$-14,765.38
13.	Donaldson, Lufkin, & Jenrette	633	\$-21.00*	\$-13,293.67
14.	Bear Stearns	628	\$-25.80*	\$-16,202.43
15.	Herzog, Heine, Geduld	593	\$-24.85*	\$-14,733.92
16.	Redibook ⁺	557	\$-41.38*	\$-23,048.51
17.	B-Trade Services ⁺	487	\$-18.62*	\$-9,069.89
18.	Island ⁺	463	\$-42.99*	\$-19,903.80
19.	UBS Warburg	453	\$-24.35*	\$-11,032.31
20.	JP Morgan	444	\$-36.30*	\$-16,117.40

⁺ Denotes an Electronic Communication Network

* Indicates significantly different from zero at the 1% level.

Table X
Quote Updates for Market Participants

This table examines quoting activity on the twenty most heavily traded stocks from March 8, 2000 through June 13, 2000. There were 22,822,420 quote updates from 9:30 a.m. to 4:00 p.m. over the 68 trading days. Information on each market participant's intra-day quotes is obtained from the Nastroq data set. The Island ECN accounted for 6,686,018 (29.3%) of the 22,822,420 quote updates. All quotes indicates the percentage of time a market participants quote update set the inside bid, ask, or both. Island quotes indicates the percentage of time an Island quote update set the inside bid, ask or both. Island quotes divided by all quotes indicates the percentage of quote updates, at the inside, that were attributable to Island.

	Inside Bid	Inside Ask	Inside Bid and Ask
All Quotes	39.5%	40.3%	15.0%
Island Quotes	16.5%	17.4%	8.3%
Island Quotes / All Quotes	41.7%	43.2%	55.3%

Table XI
Information Content of Bid Updates on Island

The number of dealers and size at the inside when Island bids were updated on the twenty most heavily traded stocks from March 8, 2000 through June 13, 2000 (68 trading days). There were 3,798,666 Island quotes updates setting the best bid and there were 2,887,352 Island quote updates below the best bid. Information on each market participant's intra-day quotes is obtained from the Nastroq data set. A t-test is used to determine if the difference in the numbers of dealers and size is significantly different from zero.

	Mean number of dealers	Mean size
<u>Island bid updates setting the inside bid</u>		
Dealers and size at the inside bid	5.62	8,284
Dealers and size at the inside ask	4.10	4,852
Difference	1.52*	3,432*
<u>Island bid updates outside the inside bid</u>		
Dealers and size at the inside bid	2.67	2,542
Dealers and size at the inside ask	4.71	7,221
Difference	-2.04*	-4,679*

*Significantly different from zero at the 1% level.

Table XII
Information Content of Offer Updates on Island

The number of dealers and size at the inside when Island offers were updated on the twenty most heavily traded stocks from March 8, 2000 through June 13, 2000 (68 trading days). There were 3,997,760 Island quotes updates setting the best offer and there were 2,688,258 Island quote updates below the best offer. Information on each market participant's intra-day quotes is obtained from the Nasdaq data set. A t-test is used to determine if the difference in the numbers of dealers and size is significantly different from zero.

	Mean number of dealers	Mean size
<u>Island offer updates setting the inside offer</u>		
Dealers and size at the inside bid	3.90	4,520
Dealers and size at the inside ask	5.26	6,826
Difference	-1.36*	-2,306*
<u>Island offer updates outside the inside offer</u>		
Dealers and size at the inside bid	4.42	5,717
Dealers and size at the inside ask	2.44	2,377
Difference	1.98*	3,340*

*Significantly different from zero at the 1% level.

Footnotes:

¹Direct Access is a software platform that allows the user instantaneous access to the financial markets, thereby bypassing the middleman. Direct access users have access to Nasdaq's Level II quotes (all market maker quotes in Nasdaq equities displayed on a quote montage) and are able to interact directly with specific execution destinations such as market makers, exchanges, and electronic communication networks (ECN's). The SEC (2000) has identified 133 direct access brokers in the United States, while Keefe, Bruyette, & Woods (2001) estimate 75,000 users of this system.

² Firms typically engage in a joint back office (JBO) arrangement with the clearing broker. A discussion of these privileges can be found in SEC (2000). Readers wanting further information can reference the NASD Manual under section 17 C.F.R. 240.15c3-1.

³ Trading on Supermontage began July 29, 2002.

⁴ When we obtained our data, proprietary day traders were required to use SelectNet to reach market maker quotes at the inside spread. Market makers are required to honor their posted quotes and size. SelectNet can also be used to trade with market makers outside the NBBO. The implementation of SuperSoes on July 30, 2001 enabled proprietary day traders to use the SOES order routing system.

⁵ A SOES limit order only executes at the inside price when the order was sent. If the inside quotes change unfavorably the order is cancelled.

⁶ Island's contribution to Nasdaq share volume and total trades comes from a discussion with Tim McCormick of the NASD.

⁷We conducted the analysis with a 1 to 5 second lag and got very similar results for each lag. The results can be obtained from the authors.

⁸Our data was obtained before the April 9, 2001 conversion to decimalization. Large capitalization Nasdaq stocks typically quoted in $1/16^{\text{th}}$ spreads before this. If a day trader quoted within the $1/16^{\text{th}}$ spread on an ECN their quotes would still be displayed on the national quote montage at a $1/16^{\text{th}}$. For example, suppose a stock had an inside bid of $50 \frac{1}{16}$ and an inside ask $50 \frac{1}{8}$. If Island had bids on its book for \$50.07 at 1,000 shares and \$50.08 at 2,000 shares, then the national quote montage would show the aggregate of these for Island or $50 \frac{1}{16}$ and 3,000 shares.

⁹ Techniclone Corporation has changed its name since our study. They are now called Peregrine Pharmaceuticals and their ticker symbol is PPHM.

¹⁰ Time was spent training on the firms direct access software and interviewing day traders.

¹¹ Results on each market participants ranking can be obtained from either author.