

# Trading Strategies Around Earnings Announcements

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**T**rading in stocks has become fragmented, with more than 195 venues where investors' orders to buy and sell shares are executed. These venues differ from each other in terms of the quality of trade execution and the degree of anonymity they offer to investors. Simultaneously, a proliferation of order types has allowed investors to customize their orders to fit their trading strategies. For instance, the intermarket sweep order (ISO) is a complex order that allows a large order to be executed expeditiously with little market impact. The trading infrastructure in the United States thus allows investors to tailor their choice of venue and order type to maximize the profitability of their trading strategy.

This article investigates how investors exploit differences in the speed of execution, market depth, and the level of anonymity offered by various trading venues and order types to trade around an earnings announcement. Kaniel et al. [2010] and Cho [2007] show that trading volume increases around these announcements as informed traders respond to greater information asymmetry (Frazzini and Lamont [2007]). Liquidity and anonymity offered by the trading infrastructure are important considerations that affect the profitability of informed trades (Sadka and Scherbina [2007] and Sadka [2006]). We compare the choice of venue and order type before and after the earnings announcement

in order to determine the trade-offs that investors make between liquidity, speed of execution, and anonymity.

We analyzed a real-time data feed from the Nasdaq provided to Telemet America, a commercial consolidator of financial services data. Our subscription to the Telemet service provided access to trades and quotes for individual stocks on a real-time basis. In addition, we had access to five days worth of archived data. We handcollected data beyond the five-day period by downloading from Telemet intraday trades and quotes. Due to the difficulty of handcollecting data, we confined our study to 12 Nasdaq stocks that came out with an earnings announcement on December 1, 2010. We followed trading activity in these stocks on each of days -10 through +10, with day 0 being the earnings announcement date. We documented and analyzed the frequency of venue and order type on each day for each stock.

Our evidence shows that informed traders who seek quick execution in order to profit from short-lived information accomplish their objectives in two ways: submit an order to an electronic communication network (ECN) or as an ISO. In choosing between these two alternatives, investors appear to be forced to choose between anonymity and liquidity. Large orders for 1,000 shares or more choose to submit regular orders to an ECN. Small orders for fewer than

1,000 shares choose to submit ISOs to the Nasdaq. An ECN offers the benefit of fast execution of orders while preserving the anonymity of the investor. However, due to its inability to offer sufficient liquidity, an order that is submitted to an ECN is a regular order rather than an ISO. An ISO needs sufficient counterparty depth to avert the risk of liquidity depletion before the order is executed. We find that ISOs are almost always submitted to the Nasdaq. The Nasdaq market offers the benefits of quote stability and the counterparty depth needed to avert the risk of liquidity depletion.

As further confirmation that the trade-off between anonymity and liquidity is binding, we find that ECN-ISO and Nasdaq-regular order combinations are indeed rare. The ECN-ISO combination combines an illiquid market venue with an order type that demands liquidity. The second combination exposes a regular order to a lack of anonymity on the Nasdaq. Within this highly specialized market structure, investors have some flexibility. They can tailor their order size to maximize the profitability of their trades. We find evidence that large orders are being submitted to the Nasdaq disguised as small orders during the crucial day 0 and day +1. We observe a jump in the number of small orders submitted as regular orders to an ECN on days 0 and +1, when the typical small order is submitted to the Nasdaq as an ISO order.

There are several studies of investor trading strategies. Harris [1998], Glosten [1994], and Holden and Subrahmanyam [1992] study the choice between limit and market orders. Market and limit order imbalances are studied by Kelley and Tetlock [2013] and Dorn et al. [2008]. Ours is the first to study the choice of venue and order type and the trade-off between anonymity and liquidity implicit in that choice. A closely related article by Chakravarty et al. [2011] studies the supply of liquidity and its effect on trading activity around earnings announcements. They find that the supply of liquidity shrinks around the announcement, forcing uninformed investors to resort to aggressive ISO orders. In addition, they find that ISO usage continues to increase even after the earnings announcement improves market breadth. They attribute this increase to informed traders relying on ISO orders to reduce the price impact of their trades. Our study differs from these studies in finding that investors can profit from their information not only through submission of ISOs, but also through a judicious choice of venue and order type.

The rest of the article is organized as follows. First, we describe the trading infrastructure and data and analyze the patterns in venues and types of orders submitted. We then examine the joint choice of venue and order type and sort the evidence by the sign of the earnings surprise—negative, positive, or neutral. The final section presents our conclusions.

## DESCRIPTION OF THE TRADING INFRASTRUCTURE

### Multiple Venues and Reg NMS

Trading on U.S. stock exchanges has become increasingly fragmented. There are currently 196 trading venues for U.S. stocks, bonds, and options, of which only 16 are formal securities exchanges. Some of the larger trading venues are listed in Appendix A. The venues not listed in Appendix A are dark pools, ECNs, or broker/dealers who internalize order flow.<sup>1</sup> The migration of trading to electronic venues and the resulting fragmentation forced the U.S. Securities and Exchange Commission (SEC) to promulgate Regulation National Market System (Reg NMS) on April 6, 2005. The Order Protection Rule (OPR) under Reg NMS, also known as Rule 611, requires submitted orders to be checked against prices quoted at other trading centers to verify that the submitted price is not inferior to those quoted elsewhere. Stated differently, the OPR requires that every customer order receive the best price prevalent across all trading venues at the time of the receipt of the order. The Access Rule of Reg NMS complements the OPR by requiring trading centers to gain access to quotations across all trading centers, and to prevent members of such trading centers from predatory practices such as blocking or locking automated quotes. High-frequency trading emerged to facilitate the implementation of the best price rule by routing the order almost instantaneously to the trading venue offering the best price. With the recent controversy surrounding high-frequency trading, there has been intense interest in the finance literature to ascertain whether investors have benefited from Reg NMS.

Goldstein et al. [2008] compare the benefits of trading on ECNs to trading on Nasdaq's now defunct order display and execution platform called the Super-Montage. They find that in the most-liquid stocks, orders can be executed cheaply, anonymously, and with

greater speed on an ECN. In the less-liquid, infrequently traded stocks, they find that traders prefer the Nasdaq SuperMontage. The quotes posted on SuperMontage are stable and are less likely to be withdrawn during periods of high volatility. Hasbrouck and Saar [2009] show that ECNs suffer from flickering quotes, which are quotes that are withdrawn during periods of high volatility. Goldstein et al. [2008] analyze the conditions under which investors are willing to trade off liquidity on Nasdaq against the anonymity offered by ECNs. They argue that when traders have time-sensitive information, they prefer to execute their trades on an exchange that provides immediacy, rather than on a venue that offers anonymity, at the cost of being illiquid.

### Order Types and Reg NMS

Reg NMS makes exceptions and exemptions to the OPR to accommodate traders who demand immediacy. These exceptions, and the types of orders that qualify for these exceptions, are described in detail in Appendix B. Of the order-types listed in Appendix B, the ISO is among the most popular. An ISO is a limit order that designates a market center for trade execution. The order executes at the designated market center even when another market center is publishing a better quotation. The ISO first executes at the designated market center at the best price, after which it sweeps down the limit order book until all the orders in the ISO are filled, or the limit price, or liquidity replenishment point (LRP), is reached. The advantage of an ISO is its speed of execution since it can avoid the time-consuming task of searching for the best price. Its disadvantage is the risk that the LRP is reached before all orders can be executed, or the risk that market prices move against the limit price. Regular orders are not subject to this risk as they are filled sequentially with each order being filled at the best available price.

Chakravarty et al. [2011] find that ISOs account for 41% of the 146 billion shares that are traded in their sample. They find that informed institutional traders take advantage of the speed of execution of ISOs and minimize the price impact of their trades by breaking up large orders into smaller ISO trades. Lei and Li [2012] study investor order strategies in response to erroneous information about a stock that is corrected shortly thereafter. They find that regular trades account for the majority of trades in the non-event period, but ISO

trades account for a majority in the mistake and correction stage. They conclude that investors with short-lived information use ISOs to exploit their information advantage.

Our motivation in this article is to study the choice of venue and order type around an earnings announcement. The choice reveals the trade-offs that investors make between liquidity, speed of execution, and anonymity around an earnings announcement and whether these trade-offs change from before, to after, the announcement.

### DATA

Trading data on NASDAQ are obtained from Telemet-Orion, which is a third-party distributor of real-time consolidated data. The distributor maintains a five-day history of time and sales and time and quotes. In addition, they report the value-weighted average price, bid/ask, size, trade size, last, net change, trade times, open, high, low, volume, and close on the real-time composite NYSE, ASE, and NASDAQ indexes. A snapshot of the “time and quotes” data on Telemet for Apple Inc. (ticker symbol AAPL) time-stamped to the millisecond is in Appendix C. For quotes, the exchange where the bid and ask originated and the sizes of the quotes are reported. For the trades, the exchange where the trade originated, the price and size of the trade, and the condition code that specifies the type of order are reported. NASDAQ does not permit identification of the specific quote against which a transaction was executed, so we cannot align transactions with quotes. Quotes listed against the trades are the best bid and offer (BBO). They are Nasdaq’s best bid and offer, and not necessarily the national best bid and offer (NBBO), which explains why some trades indicate price improvement. Our subscription to the data also did not give us access to identities of the buyers and sellers, so we are limited to drawing inferences about the motives of traders from observing unusual patterns in trading.

We collect intraday data for 12 Nasdaq stocks that released their earnings on December 1, 2010. We collected “time and quotes” data for each of these stocks during a 21-day period consisting of 10 trading days prior to the earnings announcement (day -10 to day -1), the day of the announcement (day 0), and the 10 days following the announcement (days +1 to +10). For companies that released their earnings after hours, we

treated the day following the earnings release as day 0. Financial firms are excluded from the analysis. Exhibit 1 has a list of tickers, the earnings announcement date, the reported earnings per share (EPS), and the consensus analyst estimate of EPS. Analyst estimates are obtained from IBES. Eight companies had positive earnings surprises, two were neutral, and two were negative. Four

firms are in retail (SIC code 5120 and 5600), three in electric and electronic equipment (SIC 3500 and 3600), two in business services (7300), and one each in textiles (2300), sewage systems (4900), and transportation (4200).

In Exhibit 2, we report the mean and median volume traded per day, calculated by averaging the

## EXHIBIT 1

### List of Nasdaq-Listed Companies That Announced Their Earnings on December 1, 2010

Company Name	Tickert	IBES Consensus	SIC	Share Price (\$)	Market Value (\$ millions)	Reported EPS	EPS Surprise
G-III Apparel Group, LTD.	GIII	2.09	2380	27.85	537	2.16	0.07
Finisar Corporation	FNSR	0.38	7371	19.77	1526	0.44	0.06
Dynamex, Inc.	DDMX	0.31	4215	24.31	237	0.36	0.05
Sigma Designs, Inc.	SIGM	0.37	3570	12.12	381	0.41	0.04
Casella Waste Systems, Inc.	CWST	-0.08	4950	4.4	112	-0.04	0.04
Zumiez Inc.	ZUMZ	0.37	5600	31.57	968	0.4	0.03
rue21, Inc.	RUE	0.27	5600	30.97	753	0.29	0.02
Semtech Corporation	SMTC	0.46	3670	24.03	1522	0.48	0.02
Synopsys, Inc.	SNPS	0.39	7370	26.51	3936	0.39	0.00
Synovis Life Technologies, Inc.	SYNO	0.13	5120	16.21	182	0.13	0.00
Charming Shoppes, Inc.	CHRS	-0.09	5621	3.79	437	-0.13	-0.04
Sycamore Networks, Inc.	SCMR	-0.04	3660	25.25	720	-0.2	-0.16

## EXHIBIT 2

### Distribution of Volume and Number of Trades Around the Earnings Announcement

The mean and median volume and number of trades on each day across all tickers are presented. % vol and % trades are the proportions of total volume and the total number of trades in the 21-day period. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	% Volume	Mean Volume	Median Volume	% Trades	Mean # Trades	Median # Trades
-10	4.39	615,543.17	229,666.00	4.72	3,390.42	1,362.00
-9	2.50	350,328.17	126,681.00	2.97	2,130.83	880.50
-8	2.97	416,801.25	170,750.00	3.15	2,258.67	952.50
-7	3.14	440,109.83	268,018.00	3.05	2,191.67	1,492.00
-6	3.12	437,085.50	155,617.50	3.61	2,590.17	965.00
-5	2.94	411,973.58	144,616.00	3.34	2,394.75	893.50
-4	3.55	498,031.17	333,280.50	3.57	2,560.33	1,382.50
-3	1.26	176,085.00	66,229.50	1.39	1,000.25	420.00
-2	2.85	400,070.33	252,471.50	3.51	2,516.67	1,198.50
-1	6.58	923,139.25	509,529.00	4.78	3,433.67	1,771.50
0	7.45	1,044,768.92	779,423.50	7.26	5,215.00	4,391.00
+1	12.13	1,701,146.25	773,206.00	11.90	8,541.33	3,977.00
+2	6.92	970,094.67	370,771.50	6.96	4,998.00	2,483.50
+3	4.74	665,044.42	248,885.00	4.81	3,450.17	1,670.50
+4	4.59	643,108.83	376,021.00	4.64	3,333.33	2,182.50
+5	3.81	533,779.50	389,037.00	3.92	2,812.67	1,893.50
+6	4.63	648,597.83	282,099.00	4.46	3,204.33	1,562.50
+7	4.07	571,046.83	304,294.50	4.20	3,014.67	1,842.50
+8	5.38	754,591.67	350,356.00	5.67	4,071.50	2,409.50
+9	4.95	694,078.75	282,966.50	5.07	3,636.00	1,852.50
+10	8.02	1,125,034.33	504,690.00	7.02	5,039.00	2,328.00
Average pre-vol (%)	33%			34%		
Average post-vol (%)	67%			66%		
Days -1, 0 and +1	26%			24%		

total volume of all trades reported during each day for each ticker. Volume of a transaction is the product of the number of trades and the size of each transaction. Since a few large orders can affect volume, we also report the average number of trades per day, which is calculated by summing for each ticker, the number of trades executed each day, and averaging across all tickers. The table shows that day +1 experiences the highest trading activity, accounting for 12.31% of total mean volume, and for 11.90% of the total mean number of trades during the 21-day period. The announcement window consisting of days -1, 0, and +1 collectively accounts for 26% of total mean volume and 24% of the total mean number of trades. There is greater trading activity in the post-announcement period. Volume in the post-announcement period is twice (67%) that in the pre-announcement period (33%). Elevated levels of trading indicate that investors are spurred to trade by information released by the earnings announcement,

which is consistent with the evidence in Frazzini and Lamont [2006].

In Exhibit 3, we report statistics on volume and number of trades by the size of the order. Large orders are transactions for 1,000 shares or more. Although Campbell et al. [2008] classify orders for \$2,000 or less as small orders and those for over \$30,000 as large orders, we stick to our definition since only two stocks in our sample, Zumiez and rue21, would qualify as large orders as per the Campbell et al. definition. Even with our definition, Exhibit 3 shows marked differences between large and small orders in their trading activity. Mean volume for large orders peaks on day -1, while the mean number of trades peaks on day +1, suggesting that a few very large orders are being traded ahead of the announcement, either because these are informed orders (Easley et al. [2008]) or the result of arbitrageurs who are trading to eliminate mispricing caused by irrational traders. Baker et al. [2004] and Frazzini and Lamont

### EXHIBIT 3 Volume and Number of Trades Sorted by Order Size

The mean and median volume and number of trades on each day across all tickers are presented. % vol and % trades are the proportions of total volume and the total number of trades in the 21-day period. Large orders are for greater than or equal to 1,000 shares, and small orders are for fewer than 1,000 shares. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Large Orders				Small Orders			
	% Volume	Mean Volume	% Trades	Mean Trades	% Volume	Mean Volume	% Trades	Mean Trades
-10	3.84	141,396.50	3.42	30.58	4.59	474,146.67	4.74	3,359.83
-9	1.82	66,995.00	2.09	18.75	2.74	283,333.17	2.98	2,112.08
-8	2.94	108,334.58	3.52	31.50	2.99	308,466.67	3.14	2,227.17
-7	3.41	125,625.42	3.97	35.50	3.04	314,484.42	3.04	2,156.17
-6	2.27	83,590.17	2.38	21.33	3.42	353,495.33	3.62	2,568.83
-5	2.37	87,302.33	2.70	24.17	3.14	324,671.25	3.34	2,370.58
-4	3.72	137,038.83	3.80	34.00	3.49	360,992.33	3.56	2,526.25
-3	1.05	38,562.08	1.70	15.25	1.33	137,522.92	1.39	984.92
-2	1.64	60,441.67	2.34	20.92	3.29	339,628.67	3.52	2,495.75
-1	11.99	442,162.75	4.30	38.50	4.65	480,976.50	4.79	3,395.17
0	7.38	272,207.17	8.43	75.42	7.48	772,561.75	7.25	5,139.58
+1	10.17	374,894.92	13.75	123.08	12.83	1,326,251.33	11.88	8,418.25
+2	6.48	238,745.75	6.79	60.75	7.08	731,348.92	6.96	4,937.25
+3	4.97	183,197.08	4.27	38.25	4.66	481,847.33	4.81	3,411.83
+4	4.91	181,036.33	5.20	46.50	4.47	462,072.50	4.64	3,286.83
+5	3.72	137,177.58	3.75	33.58	3.84	396,601.92	3.92	2,779.08
+6	5.12	188,766.25	4.72	42.25	4.45	459,831.58	4.46	3,162.08
+7	4.09	150,916.25	4.12	36.83	4.07	420,130.58	4.20	2,977.75
+8	4.21	155,107.67	6.01	53.83	5.80	599,484.00	5.67	4,017.58
+9	4.62	170,466.17	5.29	47.33	5.07	523,612.58	5.06	3,588.67
+10	9.30	343,004.92	7.46	66.75	7.57	782,029.42	7.01	4,972.25
Average pre (%)	35%		30%		33%		34%	
Average post (%)	65%		70%		67%		66%	
Days -1, 0 and +1	30%		26%		25%		24%	

[2006] show that there is heavy buying by large investors prior to the announcement that reverses on the day of the announcement. Collectively, the three-day window of day -1, day 0, and day +1 accounts for a higher proportion (30%) of total volume and a higher proportion (26%) of total trades than did the corresponding period for the entire sample reported earlier in Exhibit 2. For small orders, volume and the number of trades peak on the same day, namely, day +1. The peak on day +1 after the announcement is made suggests that trading in small orders is not due to information asymmetry, but rather a difference of opinion among traders (Kandel and Pearson [1995]) about the meaning of the earnings announcement.

## CHOICE OF MARKET VENUE

In Exhibit 4, we present mean and median volume by the market identified by Telemet as the originating source of a transaction. Since there are more than a dozen markets on which U.S. equities trade, we include

in this table only those venues that account for at least 5% of total volume on any single day. Six markets meet this criterion: Nasdaq, ADF, PAC, BATS, DEA, and DEB. We lump all other venues into a catch-all category called OTHERS. We calculate the mean volume of trades across the 12 tickers in each market on each trading day and report the percentage of total volume accounted for by each market. Nasdaq has the highest mean volume (34%) during every single day in the 21-day period. The preference for Nasdaq can be explained by the evidence in Goldstein et al. [2008], that Nasdaq offers greater liquidity than do the ECNs. Greater liquidity should be more valuable for the small-cap stocks that compose this study.

The ADF market has the next-highest volume (18%) in Exhibit 4. As noted previously, several ECNs and dark pools route their trades through ADF and the PAC. ECNs offer anonymity to traders while providing faster speeds of execution. These benefits are particularly valuable during the crucial announcement window comprising of days -1 through day +1. During this three-day

## EXHIBIT 4 Distribution of Volume by Trading Venue

The proportion of total volume in the 21-day period represented by average volume transacted on each trading venue on each day in the 21-day period is presented. Average daily volume is calculated as the average across all tickers. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Nasdaq	ADF	PAC	BATS	DEA	DEB	Other
-10	32.97	14.66	16.20	10.96	5.49	5.21	14.5
-9	31.73	16.02	18.93	12.47	5.51	4.35	10.98
-8	37.50	16.62	17.98	9.47	6.89	5.68	5.86
-7	37.95	18.15	15.27	9.24	4.89	4.40	10.09
-6	35.97	14.15	18.05	10.17	4.77	5.78	11.12
-5	34.56	16.95	15.96	11.15	4.57	4.13	12.68
-4	33.24	21.56	17.28	10.27	6.14	3.46	8.05
-3	35.12	13.71	18.10	12.12	5.76	4.53	10.67
-2	37.43	17.11	16.96	9.39	6.40	5.41	7.3
-1	32.39	19.48	18.38	11.56	6.76	4.11	7.34
0	37.68	22.92	15.13	9.87	7.33	2.90	4.17
+1	31.73	21.28	19.84	9.43	7.40	2.76	7.56
+2	32.56	21.73	19.76	10.69	6.76	3.37	5.14
+3	30.66	18.46	15.33	13.94	8.69	4.57	8.34
+4	36.21	19.41	17.37	12.59	7.40	3.22	3.8
+5	32.40	23.53	16.10	11.27	7.18	4.86	4.66
+6	33.91	16.55	17.07	13.04	5.14	3.20	11.1
+7	31.19	14.57	17.07	12.69	7.09	2.79	14.6
+8	34.51	17.73	16.75	12.38	7.52	3.68	7.43
+9	33.81	17.14	15.24	11.99	7.53	3.61	10.68
+10	31.53	18.48	17.80	14.87	8.72	3.82	4.79
Average pre volume (%)	35	17	17	11	6	5	10
Average post volume (%)	33	19	17	12	7	4	7
Average on days -1, 0 and +1 (%)	34	21	18	10	7	3	6

window, a greater volume of trades is routed through ADF and PAC combined (39%) than through Nasdaq (34%). Outside this crucial window, Nasdaq remains the favored venue.

In Exhibit 5, we report the mean and median number of trades at each market venue. As in Exhibit 4, we include only venues with at least 5% of the total number of trades on any single day. Five venues met this criterion: Nasdaq, ADF, PAC, BATS, and DEA. The table shows that Nasdaq continues to be the largest single originating venue, with an average share of 29% of the total number of trades. Comparing Exhibits 4 and 5 shows that Nasdaq accounts for a smaller share of trades than it did of volume, which suggests that a few very large orders are routed through Nasdaq. ADF and PAC combined account for a much larger number of trades than they did of volume. In the crucial three-day announcement window, ADF and PAC combined account for 42% of the total number of trades compared to Nasdaq's share of 26%.

In Exhibit 6, we relate the choice of trading venue to the size of the order. These orders were previously defined as large orders—1,000 or more shares—and small orders—fewer than 1,000 shares. We report the average number of trades in each market on each day across all tickers for each of the two size categories.<sup>2</sup> The table shows that large orders originate primarily on the ADF. The preference for ADF becomes even stronger in the post-announcement period, with 41% of the total number of trades originating through the ADF, and is the strongest during the three-day announcement window surrounding the earnings announcement, when it accounts for 47% of all trades. Its closest competitor, Nasdaq, accounts for only 16% of all trades during the three-day announcement window. The preference for ADF among large orders can be explained by the evidence in Goldstein et al. [2008], who show that ECNs that report their trades to ADF provide immediacy and anonymity. Informed investors with short-lived information prefer to trade on a venue that preserves their anonymity while ensuring their orders are executed quickly.

## EXHIBIT 5 Distribution of Trades by Trading Venue

The proportion of the total number of trades represented by the average number of trades transacted on each trading venue on each day in the 21-day period is presented. Average daily number of trades is calculated as the average across all tickers. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Nasdaq	ADF	PAC	BATS	DEA	Other
-10	29.57	18.90	10.91	8.13	5.13	27.37
-9	26.19	22.73	17.28	9.71	3.93	20.15
-8	34.54	20.66	13.56	7.38	4.41	19.44
-7	36.94	24.93	11.61	5.85	3.32	17.35
-6	33.38	23.59	14.87	7.00	3.91	17.26
-5	26.40	23.50	11.03	8.42	4.31	26.34
-4	26.67	30.30	10.48	6.10	3.46	22.97
-3	31.51	25.40	14.02	9.23	4.85	14.99
-2	33.20	20.58	11.44	6.20	4.94	23.65
-1	23.70	27.47	7.70	5.80	3.41	31.93
0	29.83	35.00	9.95	6.85	5.74	12.64
+1	24.25	30.01	14.05	5.60	6.03	20.06
+2	28.13	31.53	15.11	6.90	6.20	12.13
+3	25.82	27.49	12.24	10.41	5.52	18.53
+4	31.98	26.12	11.31	7.27	5.21	18.11
+5	27.06	24.86	11.58	6.75	6.36	23.38
+6	26.41	19.45	11.92	7.26	3.77	31.18
+7	29.15	24.65	11.26	7.98	5.04	21.92
+8	30.62	27.95	12.30	8.34	5.89	14.89
+9	30.50	26.25	11.11	8.66	6.01	17.47
+10	23.14	30.16	8.54	8.07	4.26	25.83
Average pre # of trades (%)	30	24	12	7	4	21
Average post # of trades (%)	28	28	12	8	5	20
Average on days -1, 0 and +1(%)	26	31	11	6	5	22

## EXHIBIT 6

### Distribution of Trades by Trading Venue Sorted by Order Size

The proportion of the total number of trades transacted on each trading venue on each day in the 21-day period is presented. Daily number of trades is calculated as the average across all tickers. Large orders are for greater than 1,000 shares, and small orders are for fewer than 1,000 shares. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Large Orders					Small Orders					
	Nasdaq	ADF	PAC	SYS	Other	Nasdaq	ADF	PAC	BATS	DEB	Other
-10	22.11	22.58	1.23	39.85	14.23	32.72	20.96	15.64	11.10	4.25	15.33
-9	11.40	41.62	0.00	29.99	16.99	28.38	21.84	19.89	10.83	4.32	14.75
-8	19.80	45.06	0.00	33.11	2.03	36.76	18.80	17.23	8.61	5.50	13.10
-7	48.80	36.46	0.00	0.00	14.74	34.50	24.64	14.14	7.91	3.82	14.99
-6	23.35	33.60	0.00	9.79	33.26	34.00	18.05	17.46	8.40	4.19	17.89
-5	16.99	25.33	0.00	50.11	7.57	30.63	23.43	13.82	10.69	3.82	17.61
-4	17.39	45.22	0.00	32.20	5.19	29.99	25.39	14.61	8.33	4.66	17.02
-3	12.17	56.15	0.00	0.00	31.69	34.83	18.64	17.77	9.98	5.37	13.41
-2	22.68	30.91	0.68	9.52	36.22	35.71	19.74	14.15	8.20	5.28	16.93
-1	16.47	31.82	0.00	36.10	15.61	30.90	27.09	16.30	9.66	6.18	9.88
0	17.18	60.06	4.26	11.15	7.35	35.99	29.31	13.31	8.17	7.16	6.05
+1	15.43	48.44	2.47	22.14	11.52	29.19	28.58	17.60	7.25	6.19	11.19
+2	24.60	44.43	3.26	6.48	21.22	30.33	27.88	17.43	8.75	5.89	9.71
+3	23.18	46.37	1.54	0.00	28.91	28.85	22.41	13.97	12.17	6.77	15.83
+4	19.16	33.34	1.08	46.31	0.11	35.23	24.91	15.16	9.70	5.71	9.30
+5	16.46	29.37	2.80	36.12	15.24	30.42	27.40	14.63	9.60	6.50	11.46
+6	18.68	19.62	0.00	60.08	1.62	32.39	25.12	16.57	10.39	4.53	11.00
+7	20.91	45.42	0.00	18.73	14.94	30.04	22.23	16.02	11.55	6.25	13.92
+8	25.96	51.42	3.77	1.48	17.37	31.83	22.25	14.37	10.56	6.19	14.80
+9	27.32	29.46	0.26	31.57	11.39	32.49	22.41	13.85	10.74	6.53	13.99
+10	16.42	40.98	0.75	36.36	5.49	30.92	23.84	16.05	13.40	7.20	8.61
Average pre-# of trades (%)	21	37	0	24	18	33	22	16	9	5	15
Average post-# of trades (%)	20	41	2	25	12	32	25	15	10	6	11
Average on days -1, 0 and +1(%)	16	47	2	23	11	32	28	16	8	7	9

Small orders in Exhibit 6 originate mostly on Nasdaq, which accounts, on average, for 32% of the total number of trades on any given day in the 21-day period. Smaller orders, which are more likely to be retail and uninformed orders do not require the immediacy and anonymity offered by ECNs. These orders prefer the Nasdaq for the liquidity it provides in small infrequently traded stocks, which fits the description of the stocks included in this study. Nonetheless, the ADF and PAC combined account for a larger proportion of trades than does the Nasdaq. These orders are perhaps the retail-informed trades in Kelley and Tetlock [2013] or large informed trades disguised as small orders (Chakravarty [2001]).

#### CHOICE OF ORDER TYPES

In addition to the choice of venue, Lei and Li [2012] and Chakravarty et al. [2011] show that traders can select the order type that best satisfies their trading objective.

We examine order types in the 21-day trading period to determine if there is a preference for a particular order type and if there is any change in this preference around the earnings announcement. In Exhibit 7, we report the mean volume and mean number of trades across all tickers on each trading day sorted by the type of order. We include order types that account for at least 5% of total volume, or 5% of the total number of trades on any given day. The results in the table show that two types of orders dominate trading: regular orders and ISOs. Regular orders account for 51% of volume, and 57% of the number of trades, while ISOs account for 31% of volume and 40% of the number of trades on any given day. ISOs increase in popularity during the three-day announcement window when trading activity is measured by the number of trades. ISOs account for 43% of all trades during this three-day window, but account for a smaller (30%) proportion of volume during that same period. The difference between the number of trades and volume suggests that ISOs tend to be smaller orders,



## EXHIBIT 7

### Distribution of Volume and Trades by Order Type

The proportion of total volume and total number of trades by type of order on each day in the 21-day period is presented. Average daily volume and daily number of trades are calculated as the averages across all tickers. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Large Orders				Small Orders			
	ISO	Regular	Form T	Other	ISO	Regular	Form T	Other
-10	32.49	44.34	0.36	22.81	43.76	54.43	0.20	1.61
-9	32.59	56.79	0.20	10.41	39.98	57.82	0.02	2.18
-8	27.69	50.07	0.44	21.80	37.85	59.21	0.23	2.70
-7	32.60	51.72	0.22	15.46	38.74	59.12	0.28	1.85
-6	33.90	50.42	0.16	15.52	42.63	55.03	0.08	2.26
-5	28.89	51.21	0.99	18.92	40.28	56.34	0.76	2.62
-4	28.45	51.41	0.67	19.47	40.12	57.69	0.15	2.03
-3	33.07	51.86	1.45	13.62	40.93	52.23	1.00	5.85
-2	33.06	57.65	0.57	8.72	38.69	58.54	0.48	2.28
-1	24.16	38.18	0.40	37.26	45.47	52.59	0.37	1.56
0	32.93	55.24	1.23	10.60	42.06	56.31	0.72	0.91
+1	32.79	54.52	0.27	12.42	40.67	57.37	0.20	1.76
+2	33.92	54.53	1.86	9.70	39.14	59.71	0.13	1.02
+3	33.48	56.30	0.09	10.14	40.22	58.47	0.06	1.26
+4	30.15	51.01	0.36	18.48	40.56	57.74	0.14	1.56
+5	27.70	54.37	0.09	17.84	37.21	61.66	0.04	1.08
+6	28.20	42.93	0.23	28.65	42.01	56.10	0.14	1.75
+7	31.27	54.87	0.14	13.73	38.67	59.75	0.06	1.52
+8	33.70	54.55	0.08	11.67	40.19	57.71	0.06	2.04
+9	33.01	48.86	3.22	14.92	42.30	54.65	1.50	1.55
+10	25.23	43.61	0.68	30.48	42.02	56.58	0.03	1.38
Average pre-(%)	31	50	1	18	41	56	0.36	2
Average post-(%)	31	52	1	16	40	58	0.28	1
Average on days -1, 0 and +1 (%)	30	49	1	20	43	55	0.43	1

which is consistent with the evidence in Chakravarty et al. [2011] and Lei and Li [2012].

In Exhibit 8, we sort on the size of the order and report the proportion of the number of trades represented by each order type on each day. The striking difference between large and small orders is in their preference for ISOs. ISOs account for 41% of all trades among small orders and for 43% during the three-day announcement window. ISOs account for only about 13% of all trades for large orders, increasing only to 17% during the three-day announcement window. Regular orders continue to be the dominant order type for both large and small orders, accounting for 49% of the trades in large orders and for 58% of the trades in small orders in the post-announcement period.

### CHOICE OF VENUE AND ORDER TYPE

The evidence thus far has considered the choice of trading venue separately from the choice of order type.

In this section, we consider the joint choice of venue and order type. We narrow down the list of all possible combinations of trading venue and order type by considering only those that feature one of the four dominant venues in Exhibit 6 and one of the two dominant order types in Exhibit 7. The dominant venues are Nasdaq, ADF, PAC, and BATS, and the dominant order types are regular and ISO orders. Combining the two yields eight different combinations of venue and order type. For each of these combinations, we calculate the mean number of trades averaged across all tickers for each trading day. We report these averages in Exhibit 9 for those combinations that account for at least 1% of the total number of trades in a given day. All other combinations are reported in a catch-all category called “other.”

The first noteworthy result in Exhibit 9 is that across both small and large orders, ISO orders originate mostly on Nasdaq. The Nasdaq-ISO combination accounts for an average of 8% of total trades in large orders and for about 19% of total trades in small orders.

## EXHIBIT 8

### Distribution of the Number of Trades by Order Type and Size

The proportion of the total number of trades by type of order on each day in the 21-day period is presented. The daily number of trades is calculated as the averages across all tickers. Large orders are for greater than 1,000 shares, and small orders are for fewer than 1,000 shares. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Large Orders				Small Orders			
	ISO	Regular	Form T	Other	ISO	Regular	Form T	Other
-10	13.69	35.79	0.99	49.53	44.14	54.95	0.20	0.72
-9	9.17	42.39	0.91	47.53	40.35	57.99	0.02	1.64
-8	6.79	30.63	0.49	62.09	38.58	60.32	0.24	0.86
-7	18.59	46.42	0.08	34.92	38.79	59.61	0.28	1.32
-6	10.06	50.36	0.00	39.57	43.11	55.09	0.08	1.72
-5	5.62	35.65	1.60	57.13	41.15	57.16	0.75	0.93
-4	13.78	46.61	1.50	38.11	40.79	58.14	0.14	0.93
-3	11.49	60.35	0.13	28.03	41.46	52.47	1.02	5.05
-2	15.13	48.72	0.57	35.58	38.98	58.55	0.49	1.98
-1	11.69	40.62	0.96	46.72	46.13	52.86	0.37	0.64
0	21.69	50.89	2.10	25.32	42.42	56.47	0.70	0.41
+1	16.80	54.35	0.52	28.34	41.17	57.87	0.20	0.77
+2	12.30	51.96	0.92	34.82	39.54	59.81	0.12	0.53
+3	19.07	46.38	0.06	34.49	40.45	58.76	0.06	0.74
+4	12.70	39.82	0.99	46.49	41.10	58.22	0.12	0.55
+5	12.83	50.31	0.44	36.42	37.52	62.04	0.04	0.40
+6	5.33	45.37	1.80	47.51	42.79	56.47	0.12	0.62
+7	15.72	50.91	0.08	33.30	39.08	60.38	0.05	0.48
+8	19.91	55.33	0.05	24.72	40.48	58.12	0.05	1.34
+9	14.01	37.94	0.20	47.84	42.68	55.04	1.51	0.77
+10	17.77	51.89	0.67	29.68	42.57	57.02	0.02	0.38
Average pre-(%)	12	44	1	44	41	57	0.36	2
Average post(%)	15	49	1	35	41	58	0.27	1
Average on days -1, 0 and +1 (%)	17	49	1	33	43	56	0.42	1

ISO orders rarely originate on the ADF; the ADF-ISO combination accounts for only 1% of total trades in both large and small orders throughout the 21-day period. It appears that Nasdaq provides both the liquidity and depth sought by investors placing ISO orders. ISO orders are subject to the risk that prices can move against a trader between when the order is submitted and when it hits the targeted market center. In a rapidly evolving market, ISO orders may execute at the targeted market at a possibly inferior price. ISO orders can also suffer the risk of liquidity depletion at the targeted market center, leaving their order unfilled. ISO orders therefore appear to be routed to the Nasdaq, a market with sufficient depth so as to minimize this risk of a sudden change in prices. Regular orders are not subject to the risk of receiving an inferior price in a fast-moving market, as these orders are automatically re-routed to a market center posting the best price.

The second noteworthy result in Exhibit 9 is the stark difference between large and small orders in their preference for a venue-order type combination. Among large orders, the dominant combination is regular orders submitted to the ADF, which accounts for 33% of the total number of trades on an average day and for 38% during the three-day announcement window. In these large orders, the Nasdaq-ISO order combination comes in a distant second with only 8% of the total number of trades, on average, and slightly more (10%) during the three-day announcement window. The catch-all "other" category accounts for most (53%) of the trades in these large orders.

Among small orders, Exhibit 9 shows that the Nasdaq-ISO combination has a slight edge, accounting for an average of 19.5% of the total trades, while the ADF-regular combination accounts for an average of 17%. The Nasdaq-ISO combination accounts for

## EXHIBIT 9

### Distribution of the Number of Trades by Trading Venue, Order Type, and Size

The proportion of the total number of trades of each order type transacted on each market venue on each day in the 21-day period is presented. The average daily number of trades is calculated as the average across all tickers. Large orders are for greater than 1,000 shares, and small orders are for fewer than 1,000 shares. The pre-period includes days -10 through -1, and the post-period includes days 0 through +10.

Day	Large Orders					Small Orders				
	Nasdaq & ISO	Nasdaq & Reg	ADF & ISO	ADF & Reg	Other	Nasdaq & ISO	Nasdaq & Reg	ADF & ISO	ADF & Reg	Other
-10	8.64	5.17	0.05	24.15	61.98	21.75	12.31	1.02	15.88	49.05
-9	6.75	2.99	0.96	28.36	60.94	16.47	14.02	1.10	15.93	52.47
-8	4.43	3.17	0.09	23.51	68.80	19.28	18.06	1.25	15.65	45.76
-7	13.55	6.31	1.09	34.21	44.84	21.04	16.07	1.16	18.22	43.50
-6	6.12	10.82	1.56	32.00	49.51	19.40	14.55	0.94	12.75	52.36
-5	3.42	1.67	0.43	29.77	64.72	19.00	15.19	0.85	16.83	48.13
-4	9.83	4.72	0.08	38.43	46.94	19.30	14.88	0.99	17.91	46.92
-3	6.13	5.56	1.56	42.17	44.57	17.82	13.63	1.55	14.05	52.94
-2	8.10	2.89	0.38	31.31	57.31	19.99	17.67	1.32	16.12	44.91
-1	10.41	8.39	0.31	28.98	51.91	21.44	11.35	1.73	17.35	48.14
0	10.93	3.99	3.87	1.60	32.02	58.04	16.51	14.12	1.01	19.44
+3	11.79	5.38	0.47	30.38	51.97	17.30	12.68	1.01	18.01	51.00
+4	6.45	4.99	1.18	28.35	59.04	19.04	15.23	1.31	16.32	48.09
+5	6.99	9.63	2.42	29.91	51.04	18.17	14.80	1.58	21.71	43.74
+6	2.60	5.16	0.19	32.47	59.57	19.17	13.97	1.54	16.89	48.42
+7	8.23	4.22	2.04	40.77	44.74	16.73	15.36	0.98	14.92	52.00
+8	8.71	5.62	0.88	37.32	47.46	18.73	13.33	1.06	16.09	50.79
+9	7.74	5.28	0.72	28.26	57.99	19.43	13.98	1.03	16.98	48.59
+10	10.81	3.55	0.82	39.43	45.39	19.53	11.34	0.81	17.56	50.76
Mean pre-(%)	8	5	1	31	55	20	14.77	1	16	48
mean post-(%)	8	5	1	35	51	19	13.68	1	18	48
Mean on days 0, -1, +1	10	6	1	38	46	21	12.35	1	20	45

more trades than does the ADF-regular combination on every single day in the pre-announcement window except during days 0, +1 and +2. During these three post-announcement days, the share of the ADF-regular combination jumps to 21% of the total number of trades, while the Nasdaq-ISO combination accounts for 19%. We surmise that the ADF-regular combination offers the twin benefits of speed of execution and anonymity, which are valuable to a trader who wishes to profit from short-lived information. The ADF offers the benefit of anonymity and speed, while a regular order doesn't run the risk of poor price execution, or even non-execution, which can adversely affect ISO orders in a fast-moving market.

#### SIGN OF EARNINGS SURPRISE AND VENUE-ORDER PREFERENCES

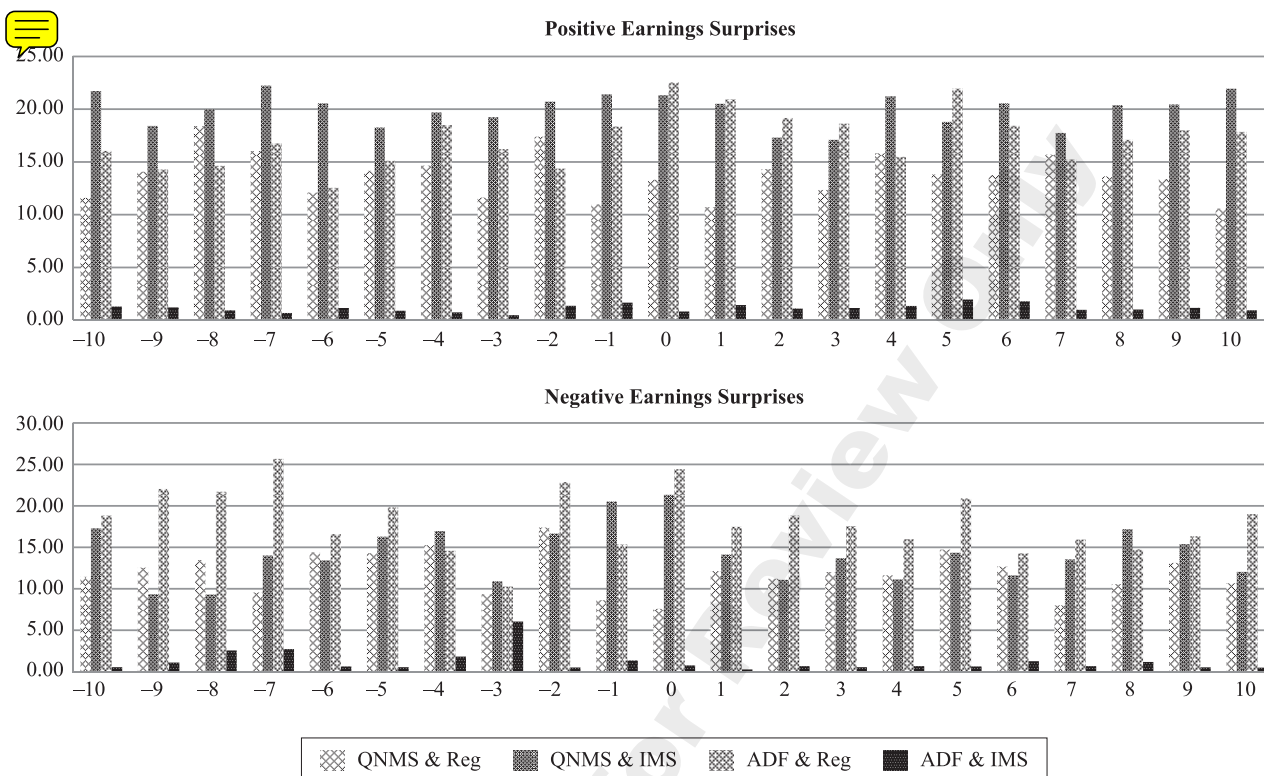
The value of private information is greater when there is an earnings surprise (Hirshleifer et al. [2009]).

We therefore re-examine the choice of venue and order type by sorting firms into two groups based on the sign of the earnings surprise: positive, neutral, or, negative. Eight firms came out with a positive surprise, and two each with a negative and neutral surprise, respectively. We did not include the two firms with a neutral earnings surprise since the earnings surprises provide the greatest opportunity for profits from informed trading. Since the sample sizes are small, we present the venue-order combinations as graphs rather than tables. Exhibit 10 has graphs of the venue-order type combinations for the positive and negative earnings surprise samples. The graphs include only trading activity in small orders, since large orders are dominated by the ADF-regular combination.

Exhibit 10 shows that among firms that released a positive earnings surprise, the Nasdaq-ISO combination dominates trading activity until day -1. The Nasdaq market provides the liquidity needed by possibly informed ISO orders. On day 0 through day +3,

## EXHIBIT 10

### Proportion of Total Number of Trades by Venue and Order Type Among Small Orders



ADF-regular orders account for a large proportion of trading activity, after which, Nasdaq-ISO once again becomes the preferred combination. We surmise that the increase in ADF-regular orders on days 0 through +3 is due to large informed traders disguised as small traders. Earlier, in Exhibit 9, we showed that the ADF-regular combination is the preferred combination among large orders, but is not the overwhelming choice for the small orders that are included in Exhibit 10. So, we suspect that the ADF-regular orders are, in fact, large orders being broken up into small orders. The ECNs that report to the ADF offer the advantage of anonymity, which is valuable to these informed traders. Further, since ISO orders run the risk of inferior price execution in a rapidly changing market, these traders prefer regular orders.

The lower graph in Exhibit 10 shows the venue-order combinations for small orders in firms that released a negative earnings surprise. The graph shows that the ADF-regular combination dominates trading through much of the 21-day trading period. There are fewer trades recorded as Nasdaq-ISO orders, with

an exception on day -1, when there are more Nasdaq-ISO orders than there are ADF-regular orders. In the post-announcement period, when there is likely greater disagreement about the meaning of the earnings announcement, rather than greater information asymmetry, investors are wary of submitting ISO orders that run the risk of inferior price execution. Thus, the shift in the preferences for venue-order types suggests a shift in the objectives of traders before and after the earnings announcement. There is greater information asymmetry in the pre-earnings announcement period when it is advantageous to profit from private information. The ISO order submitted to the Nasdaq enables quick execution of the order with minimal price impact. The ISO order submitted during a period of relative calm also does not run the risk of liquidity depletion. The same does not hold true in the post-announcement period when, because of greater disagreement about the meaning of the earnings announcement, volatility is higher. An ISO order placed by an informed investor runs the risk of liquidity depletion.

## CONCLUSIONS

We present novel evidence on a trader's choice of trading venue and order type around earnings announcements. With regard to venue, the Nasdaq and ADF are equally popular, with the Nasdaq accounting for a larger proportion of volume, and the ADF accounting for a larger proportion of trades. With regard to order type, regular orders are the dominant order type. It is when we sort the sample by the size of the order that we observe clearly the trade-offs made by investors between liquidity and anonymity. Even in our sample of 12 small-cap stocks, we find that the size of the order affects venue and order choice. Large orders for 1,000 shares or more are overwhelmingly directed to the ADF as regular orders, while small orders for fewer than 1,000 shares are directed to the Nasdaq as ISO orders. The

ADF-regular combination offers traders the dual benefits of anonymity and faster execution speeds. The illiquidity of ADF means that regular orders are preferred to ISO orders that demand liquidity. Higher liquidity offered by the Nasdaq makes it the preferred destination for ISO orders. Stable quotes and greater depth on the Nasdaq alleviate the risk that an ISO order will not be executed before liquidity depletion occurs. It is perhaps because of this risk of liquidity depletion that ISOs are rarely submitted when a firm comes out with a negative earnings surprise. Finally, we find some evidence of stealth trading, when we observe a sudden jump in small orders being submitted to the ADF as regular orders during days 0 and +1. Collectively, our evidence underscores the importance of the trade-off between anonymity and liquidity that underlies the choice of venue and order type.

## APPENDIX A

### Exchanges<sup>3</sup>

Market Center	Complete Name
AMEX	American Stock Exchange
ADF	Alternative Display Facility
QNMS	Nasdaq Stock Exchange
PAC	Pacific Stock Exchange
NYSE Arca	Formerly the Archipelago Exchange
CBSX	CBOE Stock Exchange
CHX	Chicago Stock Exchange
NSX/CINC	National Stock Exchange
EDGA	DirectEdge
EDGX	DirectEdge
ISE	International Securities Exchange Holdings
LavaFlow	Citigroup and Credit Suisse ECN
NYSE	New York Stock Exchange
PHLX/PHIL	Philadelphia Stock Exchange
BATS	BATS Global Markets
COMP	U.S. Composite Exchange
BOST	Boston Stock Exchange
DQNA	NAqcess Top of File and Dealer Quotes
LCQS	Nasdaq Controlled, CQS exchange listed (non-U.S. session)
NOTC	Non-Bulletin Board
OTC	Bulletin Board

## APPENDIX B

### Types of Markets

Type of Order	Description, Advantages, and Disadvantages
Intermarket Sweep (ISO)	Large quantity limit order sent to multiple exchanges simultaneously. Trades must be marked as ISO and must comply with Reg NMS by sending orders of sufficient quantity to exchanges with better prices. Advantage: Faster execution and the ability to capture larger counterparty depth. Disadvantage: Risk of liquidity depletion; risk of price movements, which can result in no execution.
Self-Help	Bypass protected orders of a trading center that is experiencing systems problems. Advantage: Allows orders to be filled at prices worse than best prices when there is likely to be a technical delay. Disadvantage: One-second delay is enough to set off this exception, which is not always necessary.
Benchmark Trades	A single order in a single security seeking to match the performance of a selected benchmark over a pre-determined period of time. Advantage: Reduces price impact of large order executions. Disadvantage: Exempt from OPR.
Stopped Orders	Establishes boundaries and stability. Allows the institution to know the maximum amount they could pay for the order and the minimum they will be able to collect from a sale.
Flickering Quotes	If a quote is displayed for less than one second, the trading center can consider it a flickering quote, and thus gain the right to trade at the next "least aggressive" best bid. Advantage: The speed of these orders makes them easy to identify and disregard for exception purposes.
Not "Regular Way"	Trades that were posted after hours, late prints, opening and closing trades, prior and next day trades, and trades with any special terms.
Single-Price Reopening	Only relevant in case of a trading halt. After reopening, single-price can be assigned to a security to establish a fair starting point.
Crossed Market	An order to buy and sell the same security at a price better than the NBBO.
Contingent Trades	Complex trades that contain a security or a derivative in addition to the stock.
Sub-Penny Trades	If the price of the trade is less than one cent, or if the difference in protected and quoted price is less than one cent; prevents minute price differences from slowing down processing.
Error-Correction	Brokers are allowed to correct previous errors by posting inferior quotes; error tolerance allows for small mistakes to be corrected without accumulating overtime.
Print Protection	Brokers are allowed to post inferior prints, if the order has been traded through and is currently not at the top of the book. Price improvements can be made without removing prior quotes, thus saving time.

## APPENDIX C

### Sample Telemet Display

Quote for Apple Inc. (AAPL) on November 4, 2010, between 14:50:02 and 14:50:10

Time	Original	Price	VWAP	Size	Bid	B × A size	Ask		\$ Flow	Code
14:50:10					279.04	28 × 4	279.08	C × Q		
14:50:10					279.05	1 × 7	279.08	C × Q		
14:50:10					279.05	1 × 4	279.08	C × Q		
14:50:10					279.04	28 × 1	279.08	C × Q		
14:50:09	PAC	279.07	279.9309	100	279.04	28 × 2	279.07	C × P	0.0553	Inter-market Sweep
14:50:09	PAC	279.07	279.9309	100	279.04	28 × 2	279.07	C × P	0.0277	Inter-market Sweep
14:50:09					279.04	28 × 2	279.07	C × P		
14:50:08	PAC	279.06	279.9309	100	279.05	1 × 1	279.07	K × P	0.0277	Inter-market Sweep
14:50:08	PAC	279.08	279.9309	144	279.05	1 × 1	279.07	K × P	0.0461	Inter-market Sweep
14:50:08	PAC	279.07	279.9309	100	279.05	1 × 1	279.07	K × P	0.0987	Inter-market Sweep
14:50:08	PAC	279.07	279.9309	100	279.05	1 × 1	279.07	K × P	0.0628	Inter-market Sweep
14:50:08	PAC	279.07	279.9309	100	279.05	1 × 1	279.07	K × P	0.0628	Inter-market Sweep
14:50:08	PAC	279.06	279.931	100	279.05	1 × 1	279.07	K × P	0.0628	Inter-market Sweep
14:50:08	PAC	279.06	279.931	100	279.05	1 × 1	279.07	K × P	0.0264	Inter-market Sweep
14:50:08	ADF	279.06	279.931	200	279.05	1 × 1	279.07	K × P	-0.0086	Regular Sale
14:50:08					279.05	1 × 1	279.07	K × P		

### ENDNOTES

<sup>1</sup>This information is from sec.gov and www.swift.com/customforms/downloads/ISO10383\_MIC.xls.

<sup>2</sup>We repeated the analysis with trading volume. The results are qualitatively similar to those in Exhibit 6 and are omitted for brevity.

<sup>3</sup>Information on exchanges and types of orders is from www.advancedtrading.com.

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