Internet Appendix for
"Price Discovery without Trading: Evidence from Limit Orders"

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Table IAI Trader Type Statistics

The table reports stock-day-participant (HFT and nonHFT) median trading, orders, and positions for individual HFTs and nonHFTs for the 15 noncross-listed stocks in the TSX 60. The sample period is from 10/15/2012 to 06/28/2013. *Number of Messages* is the number of orders, order cancels, and order amends that a trader places. *Number of Trades* is the number of trades (marketable orders) conducted by a trader. *Number of Shares Traded* is the number of shares traded by a trader. *Dollar Volume (DV) Traded* is the number of shares traded by a trader multiplied by the share price. *Message-to-Trade Ratio* is the number of messages deployed for each trade by a trader. *DV Traded / Total DV Traded* is the dollar volume traded by a trader scaled by the total dollar volume traded on that stock-day. *Abs(EoD Inv.) / DV Traded* is the absolute value of a trader's end-of-day dollar volume inventory scaled by that trader's dollar volume traded. *Abs(Max Intra. Inv.)/DV Traded* is the trader's absolute value of the maximum intraday dollar volume inventory position scaled by that trader's dollar volume traded. *% of days with Abs(EoD Inv) / DV Traded < 3%* is the percent of stock-day-trader observations with *Abs(EoD Inv.) / DV Traded* less than 3%. *Average DV Trade Size* is the average dollar volume size of a trade. *Number of Participants* is the number of traders in each stock-day.

	HFT (1)	NonHFT (2)
Number of Orders (thousand)	0.74	0.02
Number of Trades	104.00	8.00
Number of Shares Traded (thousand)	14.00	1.40
Dollar Volume (DV) Traded ($million)	$0.51	$0.05
Order to Trade ratio	10.00	2.30
Number of Orders / Total Orders	0.53%	0.01%
DV Traded / Total DV Traded	0.92%	0.08%
Abs(EoD Inv) / DV Traded	3.00%	94.90%
Abs(Max Intra. Inv.) / DV Traded	10.20%	100.00%
% of days with Abs(EoD Inv)/DV Traded < 3%	100.00%	0.00%
Average DV Trade Size	$4,802.39	$4,449.85
Number of Participants	13.00	189.00

Table IAII Return Impulse Response Function, 2013 Only

The table reports stock-day average return impulse response functions (IRFs) from a vector autoregression (VAR) for the 15 noncross-listed stocks in the TSX 60. The sample period is from 01/01/2013 to 06/28/2013. There is one equation for each of the variables listed in the table, for each HFT and nonHFT, and the midpoint NBBO midpoint return. The VAR is in event time where every message is an observation. *Trade - Change Price* takes the value of +1 for buy-initiated trades (sell-initiated trades, -1, are defined analogously) that consume all depth at the NBO. *Trade - Same Price* takes the value of +1 for buy-initiated trades that do not consume all depth at the NBO. *Improving Order* takes +1 (-1) for bids (offers) placed inside the NBB (NBO). *Order* take the value of +1 for bids placed at the NBB, -1 for offers placed at the NBO, and 0 otherwise. *Order 1 tick from NBBO* takes the value of +1 for bids placed at one cent from the NBB, -1 for offers placed at one cent from the NBO, and 0 otherwise. *Order more than one tick from NBBO* take the value of +1 for bids placed more than one cent from the NBB, -1 for offers placed at more than one cent from the NBO, and 0 otherwise. For cancels, the analogous definition apply with the sign such that cancels at the bid take the value -1 and cancels at the offer take the value of +1. Observations include all displayed messages between 9:45 a.m. EST and 3:45 p.m. EST. The IRF is cumulative over 20 events. For HFTs and nonHFTs, a * (**) next to the coefficient indicates that the coefficient is statistically different from zero at the 5% (1%) significance level using standard errors clustered by stock and by day. In the "Difference" column, * (**) next to the coefficient indicates that the HFTs and nonHFTs coefficients are statistically different from each other at the 5% (1%) significance level using standard errors clustered by stock and by day.

	HFT (1)	NonHFT (2)	Difference (3)
Trade - Change Price	3.12**	2.95**	0.17**
Trade - Same Price	0.99**	0.73**	0.26**
Improving Order	1.52**	1.10**	0.42**
Worsening Cancel	2.02**	2.17**	-0.15**
Order Placement at NBBO	0.14**	0.15**	-0.01**
Order Cancel at NBBO	0.02**	-0.03**	0.05**
Order 1 tick from NBBO	0.01**	0.03**	-0.02**
Cancel 1 tick from NBBO	0.01**	-0.01**	0.02**
Order > 1 tick from NBBO	-0.09**	-0.00**	-0.09**
Cancel > 1 tick from NBBO	0.02**	0.01**	0.01**

Table IAIII Variance Decomposition, 2013 Only

The table reports the stock-day average variance decomposition from the vector autoregression (VAR) used in Table IV for the 15 noncross-listed stocks in the TSX 60. The sample period is from 01/01/2013 to 06/28/2013.

	HFT (1)	NonHFT (2)
Trade - Change Price	9.18%	11.97%
Trade - Same Price	3.33%	7.51%
Improving Order	18.36%	8.95%
Worsening Cancel	9.10%	4.79%
at NBBO Order	1.10%	1.15%
at NBBO Cancel	0.19%	0.12%
Order 1 tick from NBBO	0.11%	0.04%
Cancel 1 tick from NBBO	0.06%	0.05%
Order > 1 tick from NBBO	0.52%	0.03%
Cancel > 1 tick from NBBO	0.08%	0.04%

Table IAIV Stock Volatility and Message Frequency by HFT and nonHFT and by Order Type, 2013 Only

The table reports coefficients from pooled OLS regressions on daily message frequencies (as Table III) for the 15 noncross-listed stocks in the TSX 60. The sample period is from 01/01/2013 to 06/28/2013. *% by Limit Order* is the percent of messages by limit order book submissions and cancellations. *% HFT by Limit Order* is the percent of limit order book submissions and cancellations by HFTs. *% HFT by Limit Order / % HFT* is the percent of HFT limit orders and cancellations by total HFT. *% HFT by Limit Order / % by Limit Order* is the % HFT limit orders normalized by the percent of total limit orders. *% HFT by Limit Order / % by Market Order* is the percent of HFT limit orders normalized by the percent of market orders. *% nonHFT by Limit Order* is the percent of nonHFT limit orders. *% nonHFT by Limit Order / % nonHFT* is the percent of nonHFT limit orders normalized by the percent total nonHFT. The dependent variables are in percent. *Stock Volatility (t-1)* is the daily absolute return from the previous trading day, in percent. *Market Cap* is the market capitalization of the stock, in billions, and *1/ Price* is the reciprocal of the stock price. * (**) next to the coefficient indicates that the coefficient is statistically different from zero at the 5% (1%) significance level using standard errors clustered by stock and by day.

	% by Limit Order (1)	% by HFT Limit Order (2)	% by HFT Limit Order / % HFT (3)	% by HFT Limit Order / % by Limit Order (4)	% by HFT Market Order / % Market Order (5)	% by NonHFT Limit Order (6)	% by NonHFT Limit Order / % NonHFT (7)
Intercept	95.00**	40.98**	95.72**	42.87**	25.91**	54.02**	93.51**
	(0.19)	(0.80)	(0.20)	(0.84)	(0.84)	(0.79)	(0.38)
Stock Volatility (t-1)	-1.05**	-2.21*	-0.74**	-1.81	1.02*	1.16	-0.86
	(0.19)	(0.80)	(0.20)	(0.87)	(0.43)	(0.82)	(0.43)
Market Cap	-0.08**	0.60**	0.07**	0.69**	-0.25**	-0.68**	-0.29**
	(0.01)	(0.03)	(0.01)	(0.03)	(0.03)	(0.03)	(0.02)
1 / Price	-46.02**	43.37**	-3.21	76.43**	-41.12**	-89.39**	-95.94**
	(1.31)	(4.32)	(1.77)	(4.47)	(6.44)	(3.86)	(2.67)

Table IAV: Stock Volatility and Percentage of Price Discovery by HFT and NonHFT and by Order Type, 2013 Only

The table reports the coefficient from pooled OLS regressions on the different components of the daily variance decomposition (from Table VII) for the 15 noncross-listed stocks in the TSX 60. The sample period is from 01/01/2013 to 06/28/2013. *% by Limit Order* is the percent of the efficient price explained by limit orders (cancellations and submissions) normalized by the fraction of explained variance from the variance decomposition. *% HFT by Limit Order* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the explained variance. *% HFT by Limit Order / % HFT* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the percent HFT explained. *% HFT by Limit Order / % by Limit Order* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the percent explained by limit orders. *% HFT by Limit Order / % by Market Order* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the percent explained by market orders. *% nonHFT by Limit Order* is the percent of the variance decomposition estimates explained by nonHFT limit orders normalized by the explained variance. *% nonHFT by Limit Order / % nonHFT* is the percent of the variance decomposition estimates explained by nonHFT limit orders normalized by the percent explained by nonHFT. Observations are at the stock-day level. *Stock Volatility (t-1)* is the daily absolute return from the previous trading day, in percent. *Market Cap* is the market capitalization of the stock, in billions, and *1/ Price* is the reciprocal of the stock price. * (**) next to the coefficient indicates that the coefficient is statistically different from zero at the 5% (1%) significance level using standard errors clustered by stock and by day.

	% by Limit Order (1)	% by HFT Limit Order (2)	% by HFT Limit Order / % HFT (3)	% by HFT Limit Order / % by Limit Order (4)	% by HFT Market Order / % Market Order (5)	% by NonHFT Limit Order (6)	% by NonHFT Limit Order / % NonHFT (7)
Intercept	55.89**	16.87**	48.61**	31.52**	48.85**	39.02**	66.57**
	(0.69)	(0.77)	(1.02)	(1.19)	(1.06)	(0.78)	(0.96)
Stock Volatility (t-1)	-1.00**	-1.03*	-0.68	-0.78	-0.62	0.03	-0.52
	(0.28)	(0.39)	(0.44)	(0.53)	(0.40)	(0.30)	(0.45)
Market Cap	1.76**	9.07**	8.27**	13.70**	-3.24**	-7.32**	-9.06**
	(0.29)	(0.31)	(0.36)	(0.43)	(0.36)	(0.30)	(0.38)
1 / Price	-13.22*	41.27**	45.97**	80.62**	-43.83**	-54.50**	-79.59**
	(5.27)	(6.30)	(7.34)	(7.04)	(8.54)	(3.76)	(6.90)

Table IAVI Information Shares

The table reports the average stock-day Hasbrouck (1995) minimum and maximum information shares for the 15 noncross-listed stocks in the TSX 60. The sample period is from 01/01/2013 to 06/28/2013. Panel A evaluates HFT and nonHFT quotes. Panel B evaluates quotes on each exchange. Panel C evaluates HFT and nonHFT quotes on each exchange. * (**) next to the HFT-Min point estimate indicates that the difference between the HFT Min and the nonHFT Max estimates is statistically significant at the 5% (1%) level using standard errors clustered by stock and by day.

Panel A: By HFT

	Min (1)	Max (2)
HFT	.60**	0.81
NonHFT	0.19	0.4

Table B: By Exchange

	Min	Max
Exchange 1	0.27	0.57
Exchange 2	0.22	0.47
Exchange 3	0.15	0.39

Panel C: By HFT and Exchange

	Min (1)	Max (2)
Exchange 1		
HFT	0.75**	0.86
NonHFT	0.14	0.25
Exchange 2		
HFT	0.57**	0.76
NonHFT	0.24	0.43
Exchange 3		
HFT	0.83**	0.93
NonHFT	0.07	0.17

Table IAVII Stock Volatility and Message Frequency by HFT and by NonHFT and Order Type

The table reports coefficients from pooled OLS regressions on daily message frequencies (as Table III) for the 15 noncross-listed stocks in the TSX 60. The sample period is from 10/15/2012 to 06/28/2013. *% by Limit Order* is the percent of messages by limit order book submissions and cancellations. *% HFT by Limit Order* is the percent of the limit order book submissions and cancellation by HFTs. *% HFT by Limit Order / % HFT* is the percent of the HFT limit orders and cancellations by total HFT. *% HFT by Limit Order / % by Limit Order* is the percent HFT limit orders normalized by the percent of total limit orders. *% HFT by Limit Order / % by Market Order* is the percent of HFT limit orders normalized by the percent of market orders. *% nonHFT by Limit Order* is the percent of nonHFT limit orders. *% nonHFT by Limit Order / % nonHFT* is the percent of nonHFT limit orders normalized by the percent total nonHFT. The dependent variables are in percent. *Stock Volatility (t-1)* is the daily absolute return from the previous trading day, in percent. The model includes stock fixed-effects. * (**) next to the coefficient indicates that the coefficient is statistically different from zero at the 5% (1%) significance level using standard errors clustered by stock and by day.

	% by Limit Order (1)	% by HFT Limit Order (2)	% by HFT Limit Order / % HFT (3)	% by HFT Limit Order / % by Limit Order (4)	% by HFT Market Order / % Market Order (5)	% by NonHFT Limit Order (6)	% by NonHFT Limit Order / % NonHFT (7)
Stock Volatility	-0.57**	-1.10	-0.58**	-0.84	1.41**	0.53	-0.35
	(0.14)	(0.55)	(0.15)	(0.57)	(0.42)	(0.51)	(0.22)
Stock Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table IAVIII Stock Volatility and Percentage of Price Discovery by HFT and NonHFT and by Order Type

The table reports the coefficient from pooled OLS regressions on the different components of the daily variance decomposition (from Table VII) for the 15 noncross-listed stocks in the TSX 60. The sample period is from 10/15/2012 to 06/28/2013. *% by Limit Order* is the percent of the efficient price explained by limit orders (cancellations and submissions) normalized by the fraction of explained variance from the variance decomposition. *% HFT by Limit Order* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the explained variance. *% HFT by Limit Order / % HFT* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the percent HFT explained. *% HFT by Limit Order / % by Limit Order* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the percent explained by limit orders. *% HFT by Limit Order / % by Market Order* is the percent of the variance decomposition estimates explained by HFT limit orders normalized by the percent explained by market orders. *% nonHFT by Limit Order* is the percent of the variance decomposition estimates explained by nonHFT limit orders normalized by the explained variance. *% nonHFT by Limit Order / % nonHFT* is the percent of the variance decomposition estimates explained by nonHFT limit orders normalized by the percent explained by nonHFT. Observations are at stock-day level. *Stock Volatility (t-1)* is the daily absolute return from the previous trading day, in percent. The model includes stock fixed-effects. * (**) next to the coefficient indicates that the coefficient is statistically different from zero at the 5% (1%) significance level using standard errors clustered by stock and by day.

	% by Limit Order (1)	% by HFT Limit Order (2)	% by HFT Limit Order / % HFT (3)	% by HFT Limit Order / % by Limit Order (4)	% by HFT Market Order / % Market Order (5)	% by NonHFT Limit Order (6)	% by NonHFT Limit Order / % NonHFT (7)
Intercept	-0.91**	-1.01**	-0.90*	-0.78*	-0.09	-0.41	0.10
	(0.26)	(0.32)	(0.35)	(0.31)	(0.30)	(0.15)	(0.22)
Stock Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table IAIX Exchange Descriptive Statistics by Exchange

The table reports summary statistics for the exchanges. Column (1) reports statistics summed across the three largest exchanges in Canada. Columns (2) to (4) report statistics for each of the three exchanges separately. *Shares Traded* is the number of shares traded. *Dollar Volume Traded* is the number of shares traded multiplied by the share price. *% of Dollar Volume Traded* is the percent of the dollar volume traded on each exchange. *% HFT* is the double-sided dollar volume percent of trades by a high-frequency trader (HFT). *% HFT Demand* is the dollar volume percent of trades in which an HFT is the liquidity taker. *% HFT Supply* is the dollar volume percent of trades in which an HFT is the liquidity provider. *Quoted Half-Spread* is the calendar time weighted one-half quoted difference between the best bid and the best ask price on each exchange. For *Overall,* it is the calendar time weighted one-half quoted difference between the national best bid and the national best ask price on each exchange. *% of time at both NBBO* is the percent of the calendar time at which an exchange is quoting the national best bid and offer. *% of time at either NBB or NBO* is the percent of the calendar time at which an exchange is quoting either the national best bid or the national best offer, but not both. *% of time at neither NBBO (while quoting)* is the calendar time at which an exchange is quoting but neither its bid nor its offer is at the national best. *% of time with no B or O* is the calendar time at which an exchange has no quotes on at least one side of the order book.

	Overall (1)	Exchange 1 (2)	Exchange 2 (3)	Exchange 3 (4)
Shares Traded (thousand)	1,701.22	271.69	1,016.64	412.90
Dollar Volume Traded ($million)	$32.70	$3.55	$20.61	$8.54
% of Dollar Volume Traded		10.9%	63.0%	26.1%
% HFT Demand	18.1%	23.1%	19.6%	14.4%
% HFT Supply	23.2%	34.6%	17.6%	45.3%
% HFT	20.7%	28.8%	18.6%	29.9%
Quoted Half-Spread (bps)	3.78	8.29	4.06	7.83
% of time at both NBBO		38.5%	86.8%	40.3%
% of time at either NBB or NBO		40.9%	12.1%	38.3%
% of time at neither NBBO (while quoting)		20.5%	1.1%	20.4%
% of time with no B or O		0.1%	0.0%	1.1%

Table IAX Return Impulse Response Function by Exchange

The table reports stock-day average return impulse response functions (IRFs) from a vector autoregression (VAR) for the 15 noncross-listed stocks in the TSX 60 for each exchange. The sample period is from 10/15/2012 to 06/28/2013. There is one equation for each of the variables listed in the table, for each HFT and nonHFT, and the midpoint NBBO midpoint return. The VAR is in event time, where every message is an observation. *Trade - Change Price* takes the value of +1 for buy-initiated trades (sell-initiated trades, -1, are defined analogously) that consume all depth at the NBO. *Trade - Same Price* takes the value of +1 for buy-initiated trades that do not consume all depth at the NBO. *Improving Order* takes the value of +1 (-1) for bids (offers) placed inside the NBB (NBO). For cancels, the analogous definitions apply with signs such that cancels at the bid take the value -1 and cancels at the offer take the value +1. Observations include all displayed messages between 9:45 a.m. EST and 3:45 p.m. EST. The IRF is cumulative over 20 events. For HFTs and nonHFTs, a * (**) next to the coefficient indicates that the coefficient is statistically different from zero at the 5% (1%) significance level using standard errors clustered by stock and by day. In the Difference column, * (**) next to the coefficient indicates that the HFT and nonHFT coefficients statistically different from each other at the 5% (1%) significance level using standard errors clustered by stock and by day.

	HFT (1)	NonHFT (2)	Difference (3)
Exchange 1			
Trade - Change price	2.44**	2.23**	0.21**
Trade - Same Price	0.53**	0.32**	0.21**
Improving Order	0.85**	0.98**	-0.13**
Worsening Cancel	1.54**	1.59**	-0.05*
Order Placement at NBBO	0.08**	0.08**	-0.00
Order Cancel at NBBO	0.06**	0.03**	0.03**
Exchange 2			
Trade - Change price	2.75**	2.66**	0.09**
Trade - Same Price	1.04**	0.75**	0.31**
Improving Order	0.54**	1.08**	-0.54**
Worsening Cancel	1.45**	1.67**	-0.22**
Order Placement at NBBO	0.10**	0.14**	-0.04**
Order Cancel at NBBO	0.12**	-0.04**	0.16**
Exchange 3			
Trade - Change price	2.42**	2.14**	0.28**
Trade - Same Price	1.21**	0.75**	0.46**
Improving Order	1.45**	0.96**	0.51**
Worsening Cancel	1.27**	1.62**	-0.35**
Order Placement at NBBO	0.26**	0.19**	0.07**
Order Cancel at NBBO	-0.08**	-0.03**	-0.05**

Table IAXI Cross-Exchange Price Change Sequences

The table reports the frequencies of price change sequences on Exchange 1 and Exchange 3 for the 15 noncross-listed stocks in the TSX 60. The sample period is from 10/15/2012 to 06/28/2013. The sequences capture all events in which Exchanges 1 and 3 start with the same bid or ask price, followed by one of the exchange's best bid or ask price changing, and subsequently the other exchange updating its quote in the same direction. The deviation and resolution must persist at least one millisecond. The statistics are calculated using data from 10/15/2012 to 06/28/2013. This analysis evaluates the joint probability of a HFT/nonHFT and Trade/Order/Cancel opening a sequence and an HFT/nonHFT and Trade/Order/ Cancel subsequently updating the second exchange's quotes. The average stock-day has 1,021 sequences that persist at least one millisecond.

Conditional on Open/Close Order Type and HFT, ≥ 1 Millisecond

	Second							
	HFT			NonHFT				
First	Trade (1)	Order (2)	Cancel (3)	Trade (4)	Order (5)	Cancel (6)	% Open by Trader-Order	% Open by Trader
HFT								
Trade	0.2%	---	0.6%	0.1%	---	0.1%	1.0%	
Order	---	23.2%	---	---	8.5%	---	31.7%	71.1%
Cancel	0.7%	---	24.5%	1.7%	---	11.6%	38.4%	
NonHFT								
Trade	0.2%	---	1.8%	0.9%	---	1.7%	4.5%	
Order	---	5.4%	---	---	5.6%	---	11.0%	28.9%
Cancel	0.2%	---	5.8%	0.7%	---	6.6%	13.3%	
% Close by Trader-Order	1.3%	28.6%	32.7%	3.3%	14.1%	20.0%		
% Close by Trader		62.6%			37.4%			

Table IAXII Cross Exchange Price Change Sequences

The table reports the frequencies of price change sequences on Exchanges 1 and 2 for the 15 noncross-listed stocks in the TSX 60. The sample period is from 10/15/2012 to 06/28/2013. The sequences capture all events in which Exchanges 1 and 3 start with the same bid or ask price, followed by one of the exchange's best bid or ask price changing, and subsequently the other exchange updating its quote in the same direction. The deviation and resolution must persist at least one millisecond. The statistics are calculated using data from 10/15/2012 to 06/28/2013. This analysis evaluates the joint probability of a HFT/nonHFT and Trade/Order/Cancel opening a sequence and an HFT/nonHFT and Trade/Order/ Cancel subsequently updating the second exchange's quotes. The average stock-day has 1,021 sequences that persist at least one millisecond.

Conditional on Open/Close Order Type and HFT, ≥ 1 Millisecond

	Second							
	HFT			NonHFT				
First	Trade (1)	Order (2)	Cancel (3)	Trade (4)	Order (5)	Cancel (6)	% Open by Trader-Order	% Open by Trader
HFT								
Trade	0.5%	---	1.1%	0.1%	---	0.4%	2.1%	
Order	---	16.0%	---	---	9.8%	---	25.9%	59.8%
Cancel	1.5%	---	12.6%	2.3%	---	15.5%	31.9%	
NonHFT								
Trade	0.7%	---	2.5%	1.1%	---	2.4%	6.7%	
Order	---	6.7%	---	---	10.7%	---	17.4%	40.2%
Cancel	0.7%	---	4.5%	1.8%	---	9.0%	16.1%	
% Close by Trader-Order	3.4%	22.8%	20.7%	5.3%	20.5%	27.4%		
% Close by Trader		46.8%			53.2%			

Table IAXIII: Duration of Cross Exchange Price Change Sequences

The table reports the average length of time, in seconds, of price change sequences on Exchanges 2 and 3. The sequences capture all events in which Exchanges 2 and 3 start with the same bid or ask price, followed by one of the exchange's best bid or ask price changing, and subsequently the other exchange updating its quote in the same direction. The sequences must take at least one millisecond. The average stock-day has 1,009 sequences. The average durations are calculated using data from 10/15/2012 to 06/28/2013. Panel A evaluates the joint probability of a HFT/nonHFT and Trade/Order/ Cancel opening a sequence and an HFT/nonHFT and Trade/Order/ Cancel subsequently updating the second exchange's quotes. Panel B repeats the joint probability analysis for the 164 sequences by the same trader.

Panel A: Conditional on Open/Close Order Type and HFT

	Second					
	HFT			NonHFT		
First	Trade (1)	Order (2)	Cancel (3)	Trade (4)	Order (5)	Cancel (6)
HFT						
Trade	0.24	---	0.35	1.02	---	1.23
Order	---	0.45	---	---	1.02	---
Cancel	3.49	---	0.84	3.87	---	1.92
NonHFT						
Trade	1.61	---	0.69	1.48	---	1.33
Order	---	1.17	---	---	1.19	---
Cancel	3.66	---	1.33	2.79	---	1.21

Panel B: Conditional on Open/Close Order Type and HFT by Same Trader ID

	Second					
	HFT			NonHFT		
First	Trade (1)	Order (2)	Cancel (3)	Trade (4)	Order (5)	Cancel (6)
HFT						
Trade	0.10	---	0.14	---	---	---
Order	---	0.26	---	---	---	---
Cancel	1.13	---	0.36	---	---	---
NonHFT						
Trade	---	---	---	0.38	---	0.24
Order	---	---	---	---	0.45	---
Cancel	---	---	---	0.10	---	0.29

REFERENCES

Hasbrouck, Joel, 1995, One security, many markets: Determining the contributions to price discovery, *Journal of Finance* 50, 1175–1199.