

Does Trading Anonymously Enhance Liquidity?

(Internet Appendix (Not For Publication))

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This appendix contains additional descriptive statistics and robustness checks. Table A1 details the breakdown of the members of different Nordic exchange groups, Table A2 shows that the direction and significance of spread results in Table 7 are unchanged without winsorization. Table A3 shows that switching to anonymity improves volume weighted spreads, consistent with the equally weighted spreads in Table 7. Table A4 shows how overall spreads increased with the onset of the financial crisis in 2008 and then began to decrease in 2009. Tables A5 and A6 show that the direction and significance of the price impact results in Tables 8 and 9 are unchanged without winsorization. Table A7 shows an example of what is meant by inside (I), normal (N) and outside (O) price movements in the limit order book. Last, Table A8 provides an empirical summary of the percentage of hypothetical 1% and 2% price movements that are classified as inside, normal or outside.

Table A1: Nordic Exchange Member Market Shares

The table shows the breakdown of members of the different Nordic Exchanges by groups according to whether the group members are members of all four exchanges (HCSR, Helsinki=H, Copenhagen=C, Stockholm=S, and Reykjavik=R) or some combination thereof. The second column contains the number of group members belonging to each combination of exchanges as of September 2008, and the last two columns contain the aggregate market share of each group based on turnover (euro) or the number of trades for the period from January to September 2008.

Exchanges	Number of Members	Aggregate Market Share % (Turnover in Euro)	Aggregate Market Share % (trades)
HCS	36	50.22	56.13
HCSR	11	26.34	22.28
HS	15	15.50	23.50
C	20	3.22	2.90
CSR	2	1.95	1.77
H	2	0.95	1.44
CS	6	0.87	1.28
CR	3	0.43	0.08
S	17	0.37	0.59
R	10	0.11	0.02
HSR	2	0.05	0.01
Total:	124	100.0	100

Table A2: Spreads Before/After Changes In Trading Transparency Without Winsorization

This table shows the average daily quoted spread in basis points, sampled at 15-minute intervals, of those firms that switched to anonymity on 6/2/2008 (panel A) and those firms that switched back to transparency on 4/14/2009 (panel B). The firms that switched are considered the treatment firms. Each treatment firm on 6/2/2008 was matched with a control firm based on propensity scores. T-statistics correspond to a difference-in-difference test that the difference in spreads between treatment and control firms is the same before and after anonymity. Standard errors used to compute the t-statistics are clustered by both firm and time as in Peterson (2009). Statistical significance at the 1% (5%) level is indicated by “***” (“**”).

Panel A: Change to Anonymity on 6/2/2008			
	Treatment firms (<i>t</i>)	Control firms (<i>c</i>)	Difference (<i>t</i> - <i>c</i>)
All Firms - Before (<i>b</i>)	134	131	3
All Firms - After (<i>a</i>)	172	241	-69
Difference (<i>a</i> - <i>b</i>)	38	109	-72**
	<i>N</i> = 7,661	<i>N</i> = 7,661	t-stat = -6.37
Small Firms - Before (<i>b</i>)	266	189	77
Small Firms - After (<i>a</i>)	335	355	-21
Difference (<i>a</i> - <i>b</i>)	69	166	-97**
	<i>N</i> = 1,855	<i>N</i> = 1,855	t-stat = -4.44
Medium Firms - Before (<i>b</i>)	157	138	20
Medium Firms - After (<i>a</i>)	207	267	-60
Difference (<i>a</i> - <i>b</i>)	50	129	-79**
	<i>N</i> = 2,220	<i>N</i> = 2,220	t-stat = -4.79
Large Firms - Before (<i>b</i>)	52	98	-46
Large Firms - After (<i>a</i>)	65	165	-99
Difference (<i>a</i> - <i>b</i>)	13	67	-54**
	<i>N</i> = 3,586	<i>N</i> = 3,586	t-stat = -7.58
Panel B: Change from Anonymity on 4/14/2009			
All Firms - Before (<i>b</i>)	246	327	-81
All Firms - After (<i>a</i>)	181	249	-68
Difference (<i>a</i> - <i>b</i>)	-65	-78	13
	<i>N</i> = 11,552	<i>N</i> = 11,552	t-stat = 1.00
Small Firms - Before (<i>b</i>)	458	467	-9
Small Firms - After (<i>a</i>)	342	365	-22
Difference (<i>a</i> - <i>b</i>)	-116	-102	-13
	<i>N</i> = 3,025	<i>N</i> = 3,025	t-stat = -0.49
Medium Firms - Before (<i>b</i>)	288	355	-67
Medium Firms - After (<i>a</i>)	211	272	-61
Difference (<i>a</i> - <i>b</i>)	-76	-83	7
	<i>N</i> = 3,459	<i>N</i> = 3,459	t-stat = 0.39
Large Firms - Before (<i>b</i>)	86	221	-135
Large Firms - After (<i>a</i>)	68	166	-99
Difference (<i>a</i> - <i>b</i>)	-18	-54	36**
	<i>N</i> = 5,068	<i>N</i> = 5,068	t-stat = 5.07

Table A3: Volume Weighted Spreads Before/After Changes in Trading Transparency

This table shows the average daily volume weighted spread in basis points of those firms that switched to anonymity on 6/2/2008 (panel A) and those firms that switched back to transparency on 4/14/2009 (panel B). The firms that switched are considered the treatment firms. Each treatment firm on 6/2/2008 was matched with a control firm based on propensity scores. T-statistics correspond to a difference-in-difference test that the difference in spreads between treatment and control firms is the same before and after anonymity. Standard errors used to compute the t-statistics are clustered by both firm and time as in Peterson (2009). Statistical significance at the 1% (5%) level is indicated by "***" ("**").

Panel A: Change To Anonymity On 6/2/2008			
	Treatment firms (<i>t</i>)	Control firms (<i>c</i>)	Difference (<i>t</i> - <i>c</i>)
All Firms - Before (<i>b</i>)	131	125	5
All Firms - After (<i>a</i>)	163	212	-49
Difference (<i>a</i> - <i>b</i>)	32	87	-54**
	<i>N</i> = 7,432	<i>N</i> = 7,277	t-stat = -4.66
Small Firms - Before (<i>b</i>)	285	190	95
Small Firms - After (<i>a</i>)	343	337	5
Difference (<i>a</i> - <i>b</i>)	57	147	-89**
	<i>N</i> = 1,722	<i>N</i> = 1,713	t-stat = -3.44
Medium Firms - Before (<i>b</i>)	151	130	21
Medium Firms - After (<i>a</i>)	199	228	-29
Difference (<i>a</i> - <i>b</i>)	48	98	-50**
	<i>N</i> = 2,147	<i>N</i> = 2,108	t-stat = -3.05
Large Firms - Before (<i>b</i>)	43	90	-48
Large Firms - After (<i>a</i>)	55	140	-84
Difference (<i>a</i> - <i>b</i>)	13	49	-36**
	<i>N</i> = 3,563	<i>N</i> = 3,456	t-stat = -5.39
Panel B: Change From Anonymity On 4/14/2009			
All Firms - Before (<i>b</i>)	215	239	-24
All Firms - After (<i>a</i>)	168	202	-34
Difference (<i>a</i> - <i>b</i>)	-47	-36	-10
	<i>N</i> = 10,201	<i>N</i> = 10,445	t-stat = -1.26
Small Firms - Before (<i>b</i>)	441	351	90
Small Firms - After (<i>a</i>)	358	306	52
Difference (<i>a</i> - <i>b</i>)	-83	-45	-38**
	<i>N</i> = 2,275	<i>N</i> = 2,543	t-stat = -2.72
Medium Firms - Before (<i>b</i>)	273	251	22
Medium Firms - After (<i>a</i>)	200	213	-13
Difference (<i>a</i> - <i>b</i>)	-73	-38	-35
	<i>N</i> = 2,959	<i>N</i> = 3,095	t-stat = -1.62
Large Firms - Before (<i>b</i>)	75	171	-95
Large Firms - After (<i>a</i>)	64	141	-77
Difference (<i>a</i> - <i>b</i>)	-11	-30	18**
	<i>N</i> = 4,967	<i>N</i> = 4,807	t-stat = 2.60

Table A4: Time Series Of Nasdaq Nordic Spreads, 2008-2009

The table reports the monthly average closing bid-ask spreads for the period of December 2007 to October 2009 for all large capitalization stocks listed on the Helsinki, Copenhagen, and Stockholm exchanges with 150 or more trades for the month. The switch to anonymity in June 2008 and the switch to transparency in April 2009 are denoted by horizontal lines within the table. This table simply reports stocks deemed “large” by Nasdaq Nordic. This is a smaller group of larger market capitalization firms than our grouping in Table 7, which uses a tercile sort. The data are obtained from the Nasdaq Nordic monthly trading activity reports (www.nasdaqomxnordic.com).

Month	Mean (%)	Median (%)
12-2007	0.55	0.33
01-2008	0.72	0.33
02-2008	0.59	0.33
03-2008	0.54	0.31
04-2008	0.54	0.31
05-2008	0.47	0.30
06-2008	0.67	0.31
07-2008	1.31	0.34
08-2008	0.53	0.32
09-2008	0.69	0.35
10-2008	0.86	0.43
11-2008	1.15	0.46
12-2008	0.91	0.45
01-2009	0.89	0.44
02-2009	0.77	0.42
03-2009	0.74	0.42
04-2009	1.15	0.39
05-2009	0.58	0.35
06-2009	0.51	0.34
07-2009	0.55	0.32
08-2009	0.45	0.31
09-2009	0.44	0.27
10-2009	0.43	0.27

Table A5: Price Impact Of Trades During Switch To Anonymity on 6/2/2008 Without Winsorization

This table shows the average daily price impact in basis points of buyer and seller initiated trades for those firms that switched to anonymity on June 2, 2008 (the treatment group) and those firms that did not switch (the control group) before and after the event date. Each treatment firm is matched with a control firm based on their respective propensity scores. “LB” and “SB” refer to large buys (above the daily median trade size for a firm) and small buys, respectively. “LS” and “SS” are defined similarly for large and small sells. T-statistics correspond to a difference-in-difference test that the price impact difference between treatment and control firms is the same before and after the switch to anonymity. Standard errors used to compute the t-statistics are clustered by both firm and time as in Peterson (2009). Statistical significance at the 1% (5%) level is indicated by “***” (“**”).

Panel A: All Firms												
	Transparent to anonymous (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	8.1	6.4	-6.7	-6.4	9.9	15.1	-8.2	-9.6	-1.7	-8.7	1.5	3.1
After (a)	12.5	8.1	-8.4	-8.2	35.7	42.3	-7.9	-3.9	-23.2	-34.2	-0.4	-4.3
($a - b$)	4.4	1.7	-1.7	-1.7	25.8	27.2	0.3	5.6	-21.4**	-25.5**	-1.9	-7.4
t-statistic									-3.03	-2.23	-0.33	-1.10
N	4,938	4,070	4,880	3,914	4,938	4,070	4,880	3,914				

Panel B: Small Capitalization Firms												
	Transparent to anonymous (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	26.2	19.5	-12.6	-20.5	14.8	28.0	-6.8	-1.3	16.3	-8.5	-5.8	-19.2
After (a)	30.4	31.2	-18.2	-27.8	61.7	71.6	-35.9	-15.8	-5.3	-40.4	17.7	-11.9
($a - b$)	4.2	11.7	-5.6	-7.2	46.9	43.6	-29.1	-14.5	-42.6*	-31.8	23.5	7.2
t-statistic									-2.15	-0.99	1.50	0.34
N	670	471	655	401	670	471	655	401				

Panel C: Medium Capitalization Firms												
	Transparent to anonymous (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	8.5	8.1	-8.2	-7.0	11.1	17.2	-6.9	-8.5	-1.4	-9.1	-1.3	1.4
After (a)	17.9	8.3	-8.8	-11.6	46.4	60.8	-5.1	-5.7	-17.8	-52.5	-3.7	-6.0
($a - b$)	9.4	0.2	-0.7	-4.6	35.4	43.6	1.8	2.8	-25.9*	-43.4*	-2.4	-7.4
t-statistic									-2.28	-2.53	-0.30	-0.74
N	1,299	1,062	1,293	1,038	1,299	1,062	1,293	1,038				

Panel D: Large Capitalization Firms												
	Transparent to anonymous (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	3.9	2.8	-4.5	-3.4	8.2	11.3	-9.1	-11.7	-6.0	-8.6	4.6	8.2
After (a)	6.1	4.5	-6.3	-4.3	25.2	30.7	-3.6	-1.7	-29.6	-26.2	-2.6	-2.6
($a - b$)	2.2	1.7	-1.7	-0.9	17.0	19.3	5.5	9.9	-14.8**	-17.6*	-7.2	-10.9
t-statistic									-2.70	-2.18	-1.21	-1.94
N	2,969	2,537	2,932	2,475	2,969	2,537	2,932	2,475				

Table A6: Price Impact of Trades During Switch To Transparency On 4/14/2009 Without Winsorization

This table shows the average daily price impact in basis points of buyer and seller initiated trades for those firms that switched to transparency on April 14, 2009 (the treatment group) and those firms that did not switch (the control group) before and after the event date. Each treatment firm is matched with a control firm based on their respective propensity scores. “LB” and “SB” refer to large buys (above the daily median trade size for a firm) and small buys, respectively. “LS” and “SS” are defined similarly for large and small sells. T-statistics correspond to a difference-in-difference test that the price impact difference between treatment and control firms is the same before and after the switch to transparency. Standard errors used to compute the t-statistics are clustered by both firm and time as in Peterson (2009). Statistical significance at the 1% (5%) level is indicated by “***” (“**”).

Panel A: All Firms												
	Anonymous to transparent (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	16.9	10.2	-21.9	-17.1	17.0	12.6	-27.7	-20.3	-0.1	-2.4	5.8	3.3
After (a)	11.8	8.2	-15.1	-13.5	37.0	29.3	-29.3	-18.9	-25.2	-21.1	14.2	5.3
($a - b$)	-5.1	-2.0	6.8	3.5	20.0	16.7	-1.6	1.5	-25.2**	-18.7**	8.5	2.1
t-statistic									-3.93	-3.01	1.45	0.52
N	5,906	5,426	5,977	5,353	5,906	5,426	5,977	5,353				

Panel B: Small Capitalization Firms												
	Anonymous to transparent (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	47.3	37.7	-59.4	-45.6	18.4	13.4	-48.0	-32.0	30.3	24.4	-11.4	-13.6
After (a)	36.8	28.9	-35.9	-32.2	97.3	80.1	-57.4	-27.1	-0.2	-51.1	21.5	-5.1
($a - b$)	-10.5	-8.8	23.6	13.5	78.9	66.7	-9.3	4.9	-89.4**	-75.5*	32.9	8.6
t-statistic									-3.11	-2.52	1.73	0.47
N	717	543	753	555	717	543	753	555				

Panel C: Medium Capitalization Firms												
	Anonymous to transparent (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	31.3	15.7	-33.7	-29.6	13.6	13.5	-28.5	-23.3	14.3	2.2	-5.2	-6.3
After (a)	13.3	8.9	-22.3	-22.4	41.8	31.2	-31.6	-19.1	-23.7	-22.3	9.3	-3.4
($a - b$)	-18.0	-6.8	11.4	7.1	28.2	17.7	-3.1	4.2	-46.2**	-24.5**	14.5	2.9
t-statistic									-4.27	-2.79	1.63	0.34
N	1,412	1,246	1,443	1,257	1,412	1,246	1,443	1,257				

Panel D: Large Capitalization Firms												
	Anonymous to transparent (treatment, t)				Remained transparent (control, c)				Difference ($t - c$)			
	LB	SB	LS	SS	LB	SB	LS	SS	LB	SB	LS	SS
Before (b)	6.4	4.7	-10.8	-9.1	17.9	12.1	-23.7	-17.8	-10.6	-7.5	12.9	8.7
After (a)	6.2	4.5	-7.7	-6.8	23.1	20.2	-22.4	-17.3	-30.8	-15.8	14.7	10.5
($a - b$)	-0.2	-0.2	3.1	2.3	5.2	8.1	1.3	0.5	-5.4	-8.3	1.8	1.9
t-statistic									-1.31	-2.15	0.46	0.58
N	3,777	3,637	3,781	3,541	3,777	3,637	3,781	3,541				

Table A7: Book Depth Scenarios

This table shows three cases determining what volume it would take to move the price up at least 1% from the quote midpoint to $1.01 \times 30 = 30.30$. In case *I* the inside ask is 30.40, so a 1% price movement occurs inside the bid-ask spread. In case *N* it takes $100 + 300$ of volume to move the inside ask to 30.30 or higher, and, since there was not a limit order at 30.30, the new inside ask would be 30.40. Since these wind up in the middle of the book these are the “normal” cases. In case *O* a 1% price movement lies outside the highest level of the order book.

	Price	Limit Order Book		
		Case <i>I</i>	Case <i>N</i>	Case <i>O</i>
	30.50	200	100	
	30.40	100	300	
	30.30			
	30.20		300	
Inside Ask:	30.10		100	400
Midpoint:	30.00			
Inside Bid:	29.90			

Table A8: Relative Frequencies Of Limit Order Book Movements

This table shows the percentage of 1% and 2% price movements from the bid-ask midpoint (P) that consume liquidity and result in the marginal trade being in the middle of the book (N), outside all existing liquidity in the book (O), or insufficient to move the price to the lowest ask or highest bid (I) as described in Table A7. All trades for a given price movement ($N + O + I$) in each row sum to 100%.

Panel A: Switch To Anonymity On 6/2/2008

	From Transparent to Anonymous (Treatment, t)						Remained Transparent (Control, c)					
	$\frac{\Delta P}{P} = 1\%$			$\frac{\Delta P}{P} = 2\%$			$\frac{\Delta P}{P} = 1\%$			$\frac{\Delta P}{P} = 2\%$		
	N	O	I	N	O	I	N	O	I	N	O	I
Ask Before	83.0	10.4	6.5	68.4	29.0	2.6	90.4	6.6	3.0	83.0	16.5	0.5
Ask After	86.1	5.5	8.4	75.2	22.1	2.6	84.1	5.1	10.8	84.1	13.1	2.8
Bid Before	85.7	7.8	6.5	72.9	24.5	2.6	97.1	0.0	2.9	98.2	1.3	0.5
Bid After	86.6	5.1	8.4	75.5	21.9	2.6	89.3	0.0	10.7	94.6	2.6	2.8

Panel B: Switch To Transparency On 4/14/2009

	From Anonymous to Transparent (Treatment, t)						Remained Transparent (Control, c)					
	$\frac{\Delta P}{P} = 1\%$			$\frac{\Delta P}{P} = 2\%$			$\frac{\Delta P}{P} = 1\%$			$\frac{\Delta P}{P} = 2\%$		
	N	O	I	N	O	I	N	O	I	N	O	I
Ask Before	84.8	2.1	13.2	80.6	14.1	5.3	84.6	3.1	12.3	85.6	10.0	4.4
Ask After	83.5	5.5	11.0	75.9	20.6	3.5	89.4	2.5	8.1	87.3	9.9	2.8
Bid Before	85.3	1.5	13.1	80.0	14.8	5.3	87.7	0.0	12.3	93.8	1.9	4.3
Bid After	84.3	4.8	10.9	77.9	18.7	3.4	92.0	0.0	8.0	93.3	4.1	2.6

Table A9: Standardized Book Depth Before/After Changes in Trading Transparency

This table shows the average daily standardized book depth for those firms that switched to anonymity on 6/2/2008 (panel A) and those firms that switched back to transparency on 4/14/2009 (panel B). Standardized book depth is computed as average daily book depth in euro within 1% of the inside bid-ask midpoint divided by daily volume in euro and is shown for small, medium and large firms. T-statistics correspond to a difference-in-difference test that the turnover between treatment and control firms is the same before and after anonymity. Standard errors used to compute the t-statistics are clustered by both firm and time as in Peterson (2009). Statistical significance at the 1% (5%) level is indicated by “**” (“*”).

Panel A: Change to anonymity on 6/2/2008						
	Treatment firms (<i>t</i>)		Control firms (<i>c</i>)		Difference (<i>t</i> - <i>c</i>)	
	Bid	Ask	Bid	Ask	Bid	Ask
Small - before (<i>b</i>)	0.240	0.499	0.260	0.492	-0.020	0.007
Small - after (<i>a</i>)	0.239	0.489	0.110	0.176	0.130	0.312
Difference (<i>a</i> - <i>b</i>)	-0.001	-0.011	-0.151	-0.316	0.150**	0.305*
	<i>N</i> = 2,434	<i>N</i> = 2,434	<i>N</i> = 2,099	<i>N</i> = 2,099	t-stat = 2.9	t-stat = 2.4
Medium - before (<i>b</i>)	0.296	0.414	0.200	0.280	0.096	0.134
Medium - after (<i>a</i>)	0.300	0.426	0.072	0.090	0.229	0.336
Difference (<i>a</i> - <i>b</i>)	0.005	0.012	-0.128	-0.190	0.133**	0.202**
	<i>N</i> = 2,660	<i>N</i> = 2,660	<i>N</i> = 2,421	<i>N</i> = 2,421	t-stat = 3.2	t-stat = 3.8
Large - before (<i>b</i>)	0.075	0.087	0.335	0.311	-0.260	-0.225
Large - after (<i>a</i>)	0.070	0.075	0.198	0.180	-0.127	-0.104
Difference (<i>a</i> - <i>b</i>)	-0.004	-0.011	-0.137	-0.132	0.133**	0.120**
	<i>N</i> = 3,870	<i>N</i> = 3,870	<i>N</i> = 3,619	<i>N</i> = 3,619	t-stat = 4.9	t-stat = 4.7
Panel B: Change from anonymity on 4/14/2009						
	Treatment firms (<i>t</i>)		Control firms (<i>c</i>)		Difference (<i>t</i> - <i>c</i>)	
	Bid	Ask	Bid	Ask	Bid	Ask
Small - before (<i>b</i>)	0.113	0.210	0.051	0.126	0.062	0.083
Small - after (<i>a</i>)	0.129	0.218	0.075	0.177	0.053	0.041
Difference (<i>a</i> - <i>b</i>)	0.016	0.008	0.025	0.050	-0.009	-0.042
	<i>N</i> = 3,604	<i>N</i> = 3,604	<i>N</i> = 3,387	<i>N</i> = 3,387	t-stat = -0.0	t-stat = -0.6
Medium - before (<i>b</i>)	0.249	0.371	0.029	0.054	0.219	0.317
Medium - after (<i>a</i>)	0.588	0.450	0.049	0.074	0.539	0.376
Difference (<i>a</i> - <i>b</i>)	0.340	0.079	0.020	0.020	0.320**	0.059
	<i>N</i> = 3,909	<i>N</i> = 3,909	<i>N</i> = 3,771	<i>N</i> = 3,771	t-stat = 6.4	t-stat = 1.4
Large - before (<i>b</i>)	0.054	0.081	0.090	0.117	-0.036	-0.035
Large - after (<i>a</i>)	0.075	0.085	0.117	0.133	-0.042	-0.048
Difference (<i>a</i> - <i>b</i>)	0.021	0.003	0.027	0.016	-0.006	-0.013
	<i>N</i> = 5,383	<i>N</i> = 5,383	<i>N</i> = 5,091	<i>N</i> = 5,091	t-stat = -0.8	t-stat = -0.9