
Equity trading by Institutional Investors. Evidence on Order Submission Strategies

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Objective of study

- Concern that off-market trading venues:
 - “cream skim” primary market order-flow
 - “free ride” the price discovery process
 - however, may also supplement the primary market

We want to examine:

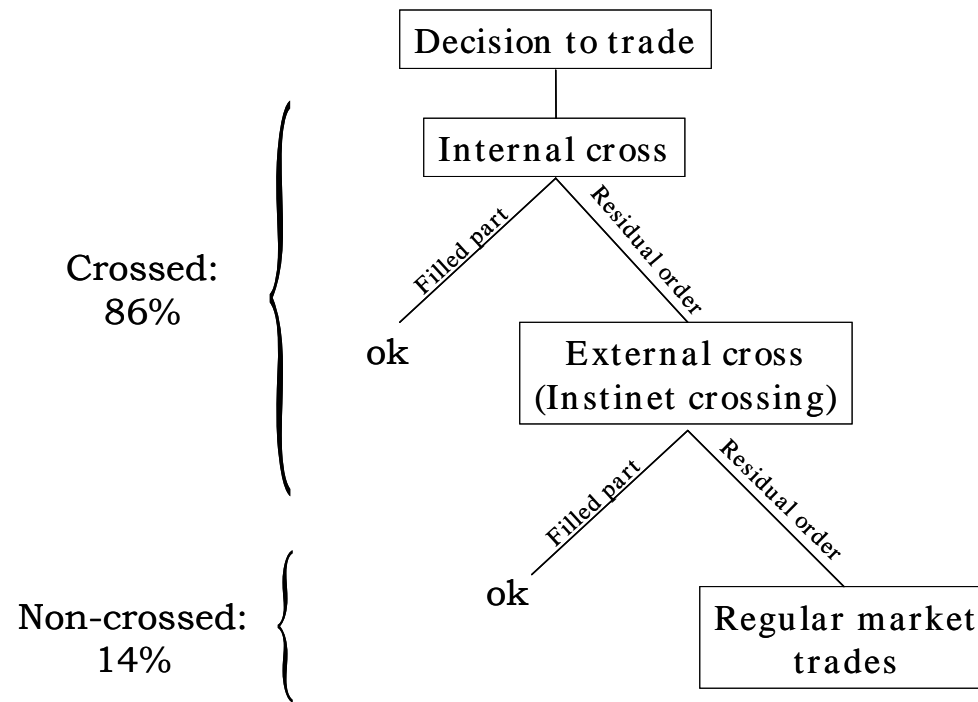
- In which type of stocks are the competition from crossing networks the strongest?
- What is the cost of an “opportunistic” crossing strategy vs. alternative order-submission strategies in the primary market
- Differences in execution costs in the primary market between stocks supplied/not-supplied in the crossing networks?

Crossing Networks

- System where participants enter unpriced orders to buy and sell securities, periodic matching of orders
- Low commissions (about 1-2 cents per share)
- No price discovery \Rightarrow no price impact costs
- No guaranteed execution \Rightarrow potential opportunity costs
- Different types of crossing
 - **external crossing** \Rightarrow electronic crossing networks (e.g. POSIT, Instinet Crossing, NYSE)
 - **internal crossing** \Rightarrow fund managers match customers internally or set up a private network of several fund managers

Background and motivation

- Transactions data from the Norwegian Oil Fund
- purchased a portfolio worth USD 1.76 billion of US equity in 1998
- Strategy: “cross as much as possible and buy the rest in the market the next day”



- Unique dataset:
 - Know the “ex-ante” trading strategy behind all orders
 - Know the identity of orders that was difficult/impossible to cross

Relevant research

- *Recent theoretical papers:*
 - **Hendershott/Mendelson[2000]:** competition from crossing networks have ambiguous effects on the underlying market with respect to liquidity and spreads
 - **Dönges/Heinemann[2001]:** stocks with low price volatility and large turnovers are traded in the crossing network

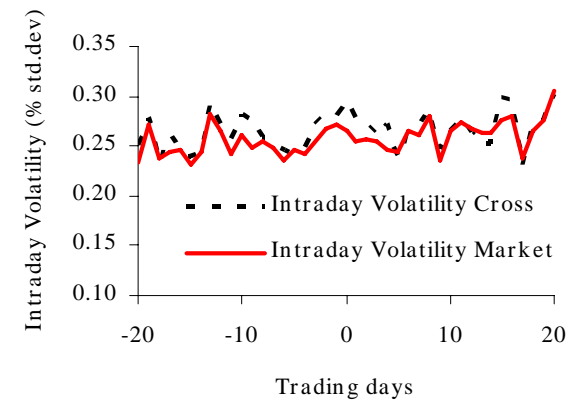
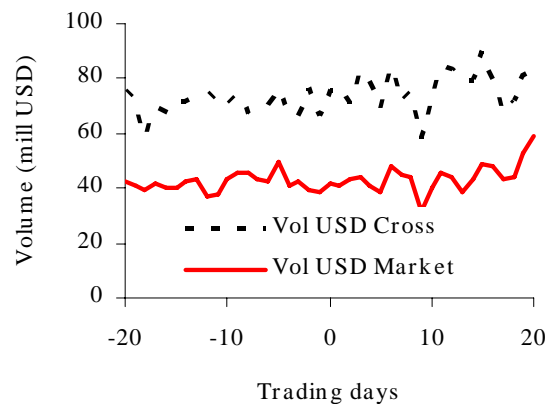
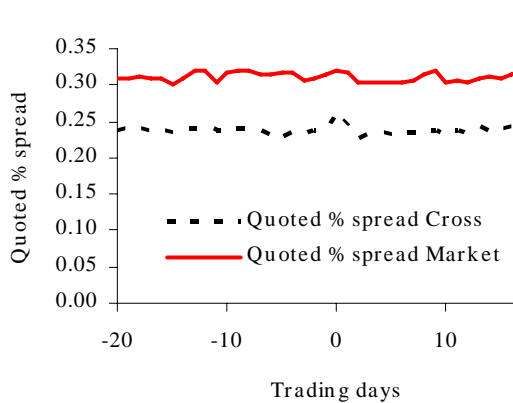
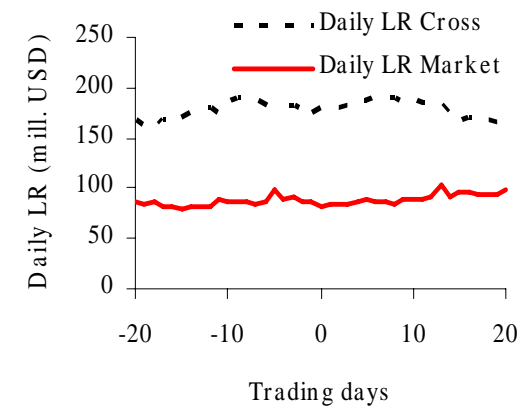
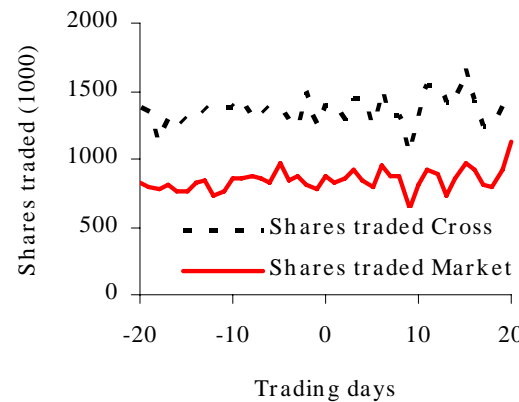
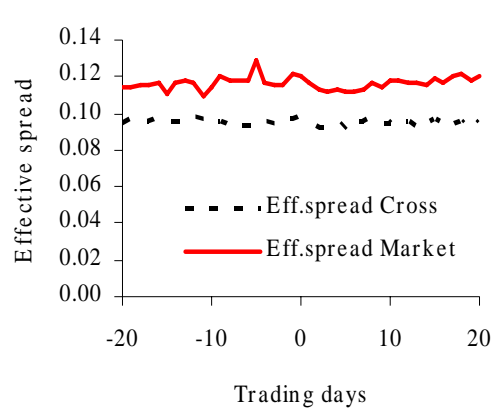
- *Recent empirical papers:*
 - **Conrad/Johnson/Wahal [2001]:** total execution costs are substantially lower on alternative trading systems
 - **Fong/Madhaven/Wahal[2001]:** there is significant competition in highly liquid securities. ATS' supplement the primary market for certain traders.
 - **Næs/Ødegaard[2001]:** find evidence of informed trading in crossing networks

Liquidity and activity 1

ALL TRADES	Crossed stocks	Crossed/ Market	Market stocks
<i>Spread measures</i>			
Effective spread	0.0982	0.1034	0.1201**
Quoted \$ spread	0.1222	0.1312*	0.1478**
Quoted % spread (midp.)	0.2629	0.3068**	0.3197**
<i>Volume measures</i>			
Trades	890	911	621*
Shares traded (1000)	1404	1181	871**
Volume (mill. USD)	76	68	42**
Tradesize (1000 USD)	83	68**	67**
<i>Liquidity ratios and depth</i>			
Daily LR (mill.USD)	179.70	143.74	82.28**
Intraday LR (mill.USD)	17.68	13.92	8.34**
Depth at quotes (shares)	1805	1596	1601
<i>Volatility and return</i>			
Daily volatility (10 day std.dev)	0.0241	0.0266**	0.0269**
Intraday volatility (15 min. % std.dev)	0.2960	0.3128	0.2662**

Liquidity and activity 2

- The crossed stocks are systematically more liquid and active over time



Liquidity and activity 3

- The probability of cross given primary market liquidity and activity
- Estimate a probit model:

$$y = \Pr(\text{cross}) = F(\beta_0 + \beta_1 \text{eff_spread}_i + \beta_2 \text{depth}_i + \beta_3 \text{LR}_i + \beta_4 \text{volume}_i + \beta_5 \text{vola}_i + \varepsilon_i)$$

	coeff	std	pvalue	dy/dx
β_0 : constant	0.0888	0.1887	0.6380	
β_1 : eff_spread	-4.8483	1.4834	0.0010	-1.7173
β_2 : depth	-0.0002	0.0314	0.9940	-0.0001
β_3 : LR	0.1926	0.0528	0.0000	0.0682
β_4 : volume	0.2424	0.5630	0.0000	0.0858
β_5 : vola	-1.4638	3.3163	0.6590	-0.5185

n	646.0000
Wald $\chi^2(5)$	27.9400
Prob > χ^2	0.0000
Log likelihood	-389.0788
pseudo R^2	0.0516

Execution costs

- the most liquid and active stocks should also be the cheapest to buy in the regular market
- would it have been cheaper for the fund to buy the stocks in the primary market immediately instead?
- differences in alternative execution costs across groups of crossed/non-crossed stocks?

Execution costs

- Strategies we evaluate (Hendershott/Mendelson[2001]):
 - Pure crossing strategy (assume everything crossed after 10 days, 1/10 of the original order each day)
 - Opportunistic crossing (actual data from fund's transactions)
 - Limit order strategies (3 different limit order simulations)
- US market is represented by the NYSE TAQ database
- Compare implicit trading costs across strategies by implementation shortfall approach (Treynor[1981], Perold[1988])

Execution costs

Implicit costs	Opport. Cross	Pure Cross	LO1	LO2	LO3
EW					
All orders	0.0879	0.1443	0.0603	0.1281	0.2470**
Crossed orders	0.0553	0.0553	-0.0147**	0.0520	0.1729**
Non-crossed orders	0.2536	0.5867	0.4317**	0.5048**	0.6143**

- Even the most simple limit order simulation (LO1) is not significantly cheaper than the opportunistic crossing strategy
- Non-crossed stocks are most expensive
- Do not take into account explicit costs (commissions etc.)

Summary

- crossing networks compete for orderflow in the most liquid and active companies in the US
- stocks with the lowest spreads, highest volumes and highest liquidity ratios have a higher crossing probability
- the “opportunistic” crossing strategy is relatively cheap compared to alternative order submission strategies

Limit Order Simulations

- The US market is represented by the NYSE TAQ database

- **Limit order simulation (LO3):**
 - 1) split the original order into suborders equal to the mean tradesize in the stock at t-1 (the decision date)

 - 2) “submit” a limit order at the opening bid for the same number of shares as in the suborder (“at the quote” limit order)

 - 3) if a **larger order** is executed during the day, at a **lower price** than our limit order price, our order is assumed filled at the limit price

 - 4) (a) if order execution, “submit” next suborder at the following bid quote
 (b) if no execution, we assume that the unfilled portion of the total order is bought at the NYSE opening price the next day

Dataset: Descriptive statistics

	Order size				Liquidity			<i>n</i>
	Dollar value		No shares		Market cap		Listed	
	mean	median	mean	median	mean	median	%	
<i>Our study</i>								
All orders	386	174	6 898	3 800	16.9	7.5	100	4 200
- Cross	396	177	7 013	3 800	17.6	7.8	100	3 494
- Market order	339	157	6 329	3 550	13.6	6.1	100	706
<i>KM [1995,1997]</i>								
All orders		138		4 800		1.1	82.6	36 590
<i>Conrad et al. [2001]</i>								
All orders								723 998
- External cross	187	45			12.8		> 90.0	112 159
- ECN's	194	53			3.0			51 127
- Broker filled	1474	137			11.1			560 712

- The orders were large compared to orders submitted by institutional traders in other studies (using Plexus Group data)
- The fund was trading in the larger companies in the US

Fill rates across strategies and groups

(a) Fill rates for submission strategies

	Opport. Cross	Pure Cross	LO1	LO2	LO3
Orders					
Filled (%)	83.2%	100.0%	85.6%	71.9%	65.1%
Not-filled (%)	16.8%	0.0%	14.4%	28.1%	34.9%
Submitted orders	3909	3909	3909	11864	11289
Filled orders	3316	3909	3346	8528	7347
Unfilled orders	594	0	563	3336	3942
Shares					
Filled (%)	84.8%	100.0%	88.5%	49.7%	42.5%
Not-filled (%)	15.2%	0.0%	11.5%	50.3%	57.5%
Shares in submitted orders	26776710	26776710	26776710	26776710	26776710
Shares in filled orders	22714683	26776710	23693158	13303893	11372729
Shares in unfilled orders	4070060	0	3083552	13472817	15403981

(b) Fill rates across groups

	Opport. Cross	Pure Cross	LO1	LO2	LO3
Orders					
Cross group:					
Filled (%)	83.2%	100.0%	84.8%	70.9%	64.0%
Not-filled (%)	16.8%	0.0%	15.2%	29.1%	36.0%
Non-crossed group:					
Filled (%)	100%	-	89.7%	76.3%	70.2%
Not-filled (%)	0	-	10.3%	23.7%	29.9%
Shares					
Cross group:					
Filled (%)	84.8%	100.0%	88.1%	48.9%	41.5%
Not-filled (%)	15.2%	0.0%	11.9%	51.1%	58.5%
Non-crossed group:					
Filled (%)	100%	-	90.5%	53.6%	47.7%
Not-filled (%)	0	-	9.6%	46.4%	52.3%

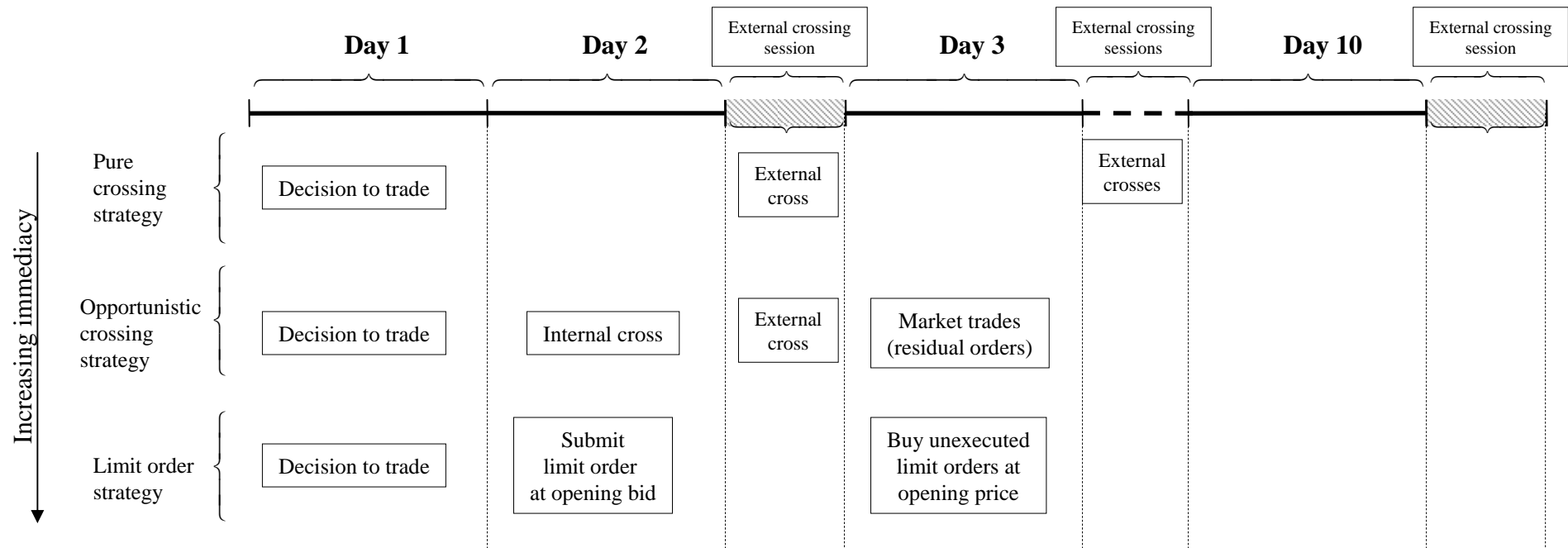
Execution time

(c) Execution time (minutes)

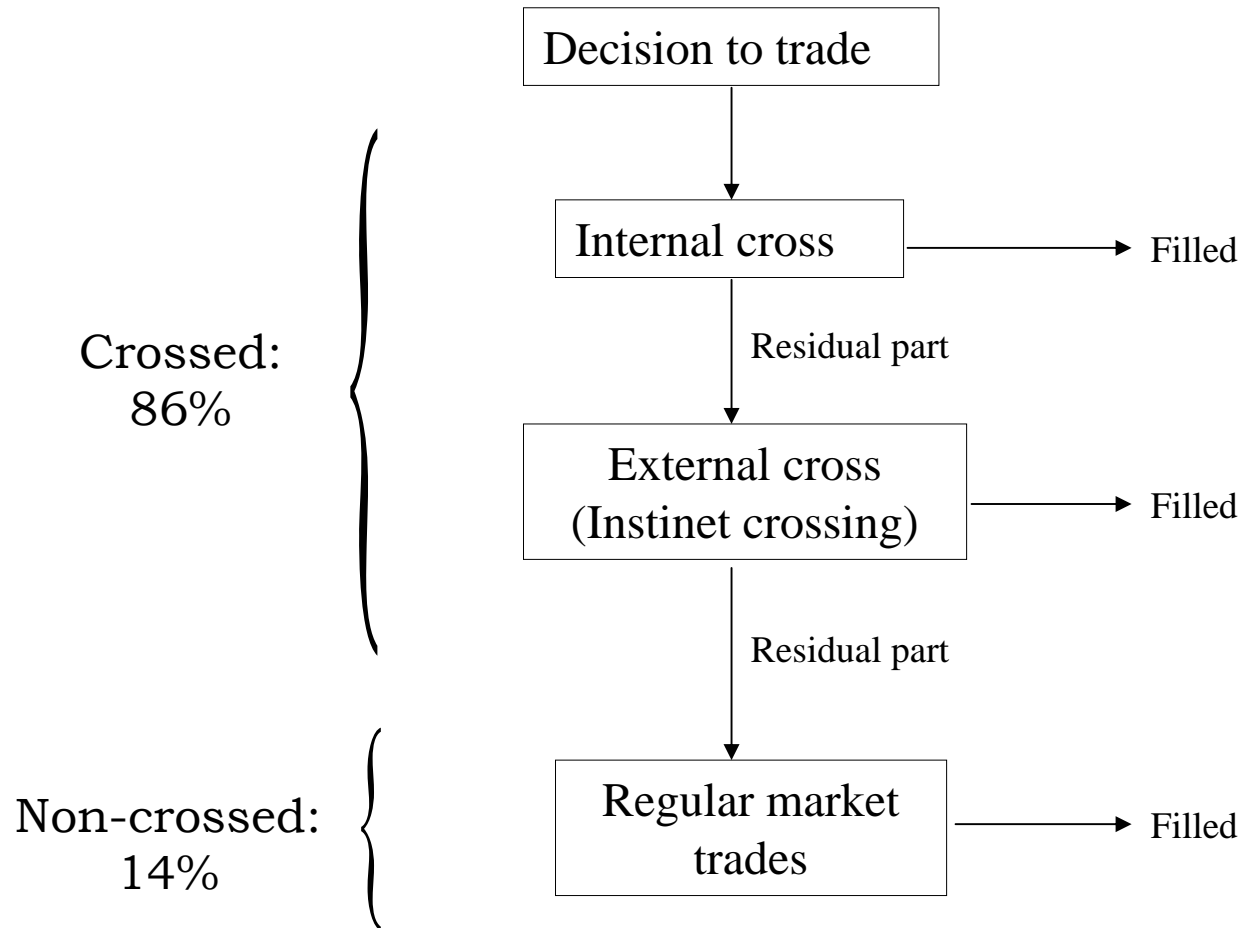
	Opport. Cross	Pure Cross	LO1	LO2	LO3
Mean	-	-	30 (30)	42 (22)	71 (38)
Median	-	-	7 (7)	9 (5)	24 (10)
Minimum	-	-	0 (0)	0 (0)	0 (0)
Maximum	-	-	389 (389)	390 (390)	390 (390)
First quartile	-	-	3 (3)	4 (1)	7 (1)
Third quartile	-	-	19 (19)	31 (14)	80 (34)
Standard deviation	-	-	67 (67)	80 (56)	102 (73)

- Execution time is measured in minutes from open for the entire order
- Numbers in parenthesis is the average execution time from submission

Methodology: Simulations



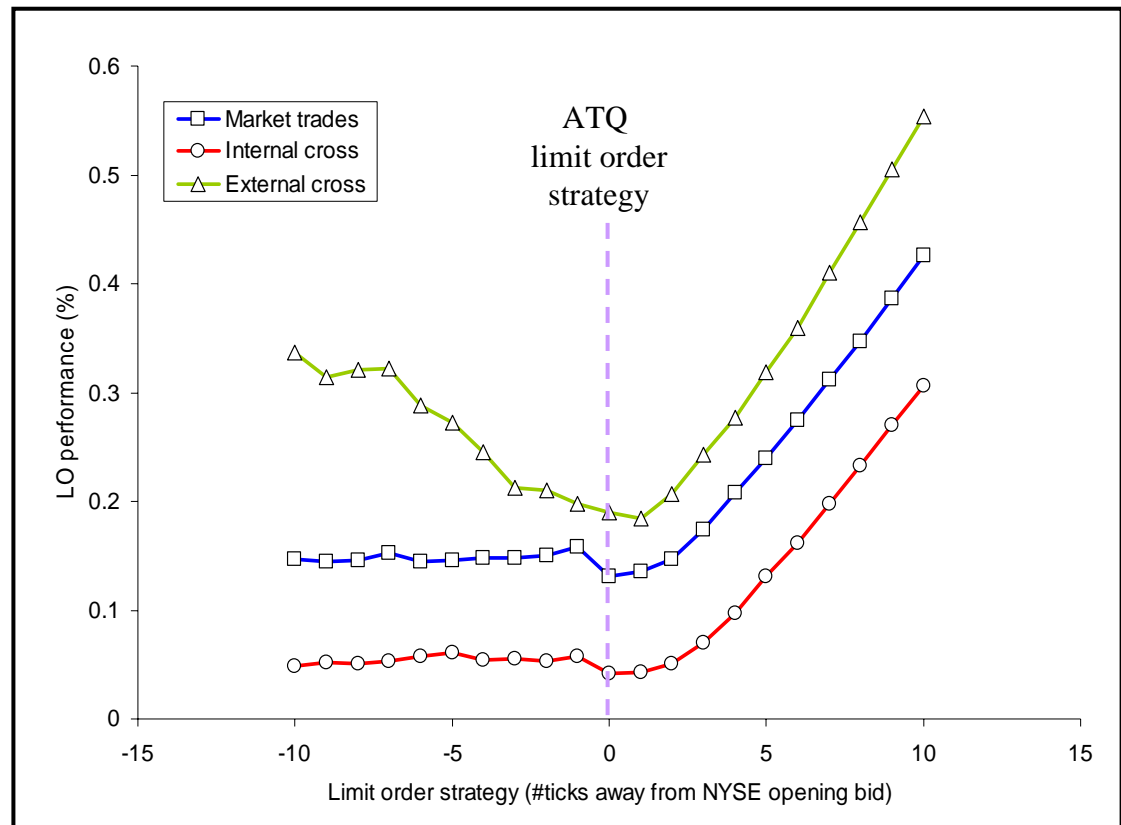
The submission strategy



Results from limit order simulations

- The simulated limit order strategies versus crossing strategy for different groups of trades (implementation shortfall approach)

- There are significant differences in the relative execution costs between the different groups of trades in the crossing strategy
- The internal crosses performs worst relative to the limit order strategies
- The external crosses were the most profitable compared to the limit order strategy



- Same pattern accross groups of stocks with minimum at BID + 1 tick