

Do Limit Orders Alter Inferences about Investor Performance and Behavior?

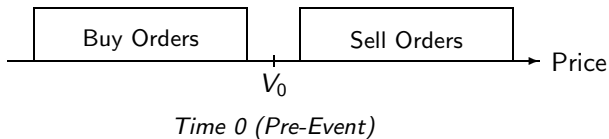
Linnainmaa, Juhani T., 2010, Do Limit Orders Alter Inferences about Investor Performance and Behavior? *Journal of Finance* 65(4), 1473–1506

Note: These slides pre-date the published version by two years

- Two common findings in the empirical behavioral finance literature:
 - ① Individual investors are very sensitive to news and short-term price movements
 - ② Individual investors tend to react and trade in the “wrong direction,” losing money even before transaction costs
 - Odean (1999), Grinblatt and Keloharju (2000), Barber and Odean (2002), Hirshleifer, Myers, Myers, and Teoh (2003), Seasholes and Wu (2005)
- “What is more certain is that these [individual] investors do have useful information which they are somehow misinterpreting.” (Odean 1999, pp. 1296)

- These findings are troubling:
 - ① Imply a curious form of market inefficiency
 - Can we earn superior profits by reverse engineering individuals' trading strategies?
 - ② Imply that individual investors monitor the market closely
 - ③ Contradict theoretical predictions: individuals would be expected to be trend-followers in response to news ([Brennan and Cao 1997](#))
- Could individual investors use of *limit orders* explain some of the more puzzling behavioral finance findings?

- 1 Suppose that there are individual investors who are not constrained to trade immediately
 - Some investors place limit orders
- 2 Suppose the company now announces something unexpected and the intrinsic value moves
- 3 Investors who monitor the market closely react to the news
 - ⇒ Submit market orders to take advantage of “mispriced” limit orders between the old and new valuations



- 4 “Mispriced” limit orders execute!

- ⑤ A researcher infers the following about liquidity (= limit order) traders:
- they reacted to news
 - they traded in the wrong direction and lost money
 - many individuals *simultaneously* made the same mistake

The problem

Condition on something happening in the market \Leftrightarrow condition on a *realization of the adverse-selection risk*

Misleading inferences about

- ① what motivates investors to trade and
- ② investors' stock-picking skills and timing abilities

Behavioral finance and limit orders

- Adverse selection risk understood since [Treynor \(1971\)](#), [Copeland and Galai \(1983\)](#), [Glosten and Milgrom \(1985\)](#), ..
 - ... but ignored in behavioral finance
- The market vs. limit order trade-off:
 - limit order gives better price
 - limit order may not execute
 - limit orders free options to other market participants
 - liquidity vs. information shock (e.g., [Handa and Schwartz 1996](#))
- Limit orders are
 - ① Contrarian: at some horizon the price has to move against the order
 - ② more likely to execute when there are news or asymmetric information
 - ③ lose money when new information arrives information

Behavioral finance and limit orders (cont')

- The “mechanical” features of limit orders carry over to investor behavior
- Limit order use may contribute to the following findings about individual investors:
 - Tendency to trade against news (Hirshleifer, Myers, Myers, and Teoh 2003)
 - Disposition effect (Odean 1998)
 - Contrarian behavior (Grinblatt and Keloharju 2000, 2001)
 - Attention-grabbing behavior and herding (Barber and Odean 2002; Barber, Odean, and Zhu 2003)
 - including the underperformance of “attention-grabbing” trades
 - Poor stock-picking abilities (Odean 1999)

Question

Do limit orders bias inferences about investor behavior and performance?

Result: limit orders *significantly* bias inferences

- The limit order mechanism must play a role—the question is its economic significance
- I do not argue that limit order use is necessarily rational
 - Even if use irrational, inferences very different
 - For example: no “irrational information processing”

- ① Institutional setting and data sets
- ② How individuals and institutions use limit and market orders?
- ③ Misinterpreting new information
 - Do individuals trade against news (and lose) only because sometimes their limit orders suddenly turn stale?
- ④ Disposition effect
- ⑤ Contrarian behavior
- ⑥ Negative stock-picking skills
 - Uninformed investors must lose in equilibrium; may look like negative stock picking skills ([Harris 2003](#))

The Helsinki Stock Exchange

- The data are from the Helsinki Stock Exchange
 - Studied also in a set of [Grinblatt and Keloharju](#) papers
 - Sample period: Sep. 18, 1998—Oct. 23, 2001
- The market consists of 158 companies with a total market capitalization of EUR 383 billion
- Households' participation in trading ranges from a low of 15% to a high of 72% among the 30 most traded stocks
- A limit order driven market
 - Similar to, e.g., Paris ([Biais, Hillion, and Spatt](#) 1995) but without “special” orders
 - No market makers, specialists

- ① Investor trading records
 - Holdings and trades of the entire population (households and institutions); 1.1+ million accounts
 - ② Limit order book data
 - Information on every order submitted into the system
 - Reconstruct the entire limit order book for **every second** of **every trading day** for **every stock**
- Match trading records against the limit order book data:
 - Both data sets contain trades: use all common elements to create a match
 - Discard trades with ambiguity about order type
 - 60.6% of the $N = 14,818,819$ trades good

Limit Order Use

Question

Do individuals and institutions use limit and market orders differently?

- If they differ in how often they are informed and in their reasons to trade \Rightarrow **yes**
- Classification of orders:
 - ① market order
 - ② inside the spread limit order
 - ③ at the spread limit order
 - ④ outside the spread limit order
 - ⑤ pre-open / stale limit order
 - pre-open = submitted into the system before trading begins
 - stale = carried over from the previous trading day

Frequencies (for executed orders)

Order Type	Individual Investors ($N = 3,230,735$)	Institutional Investors ($N = 5,750,824$)
Market Orders	44.0%	52.7%
Limit Orders		
Inside	30.0	55.4
At	9.9	20.1
Outside	34.5	20.2
Pre-Open	19.6	3.6
Stale	5.9	0.8

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Observation 1: Individuals use more limit orders than institutions: 56% vs. 47%. ([Glosten](#) 1994, [Rosu](#) 2006, etc. \Rightarrow individuals more patient?)

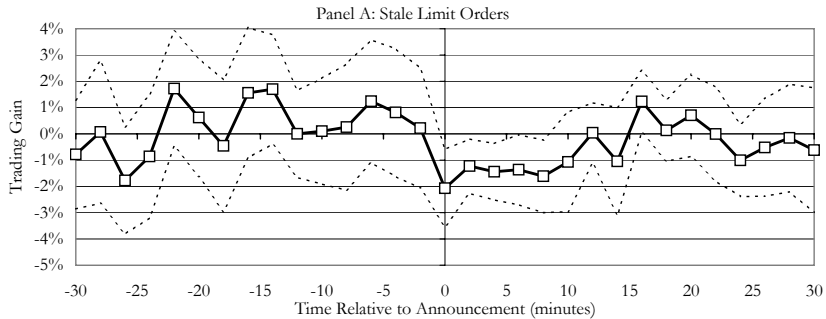
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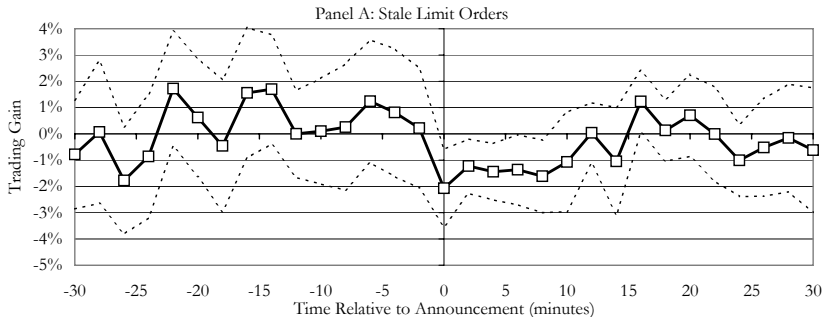
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Observation 2: Individuals place their limit orders farther away from the spread: > 60% outside the spread or “worse!”

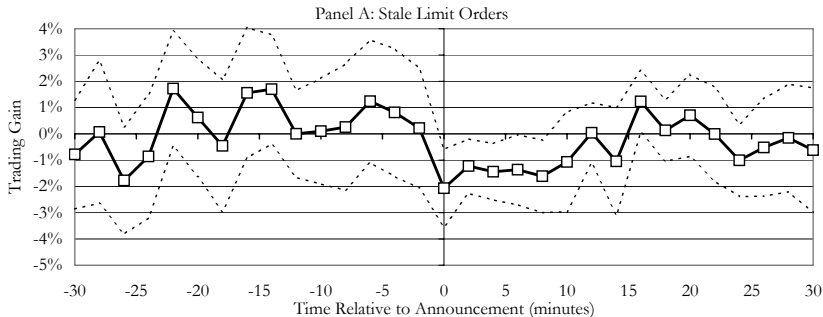
Misinterpreting New Information

- How announcements affect inferences about investor behavior?
 - Hirshleifer, Myers, Myers, and Teoh (2003): individuals trade against earnings surprises
- Form a sample of scheduled (“not a surprise”) and unscheduled earnings announcements released when the market is open
 - $N = 586 + 117$ earnings announcements
 - Cross-sectional analysis around the event (conservative)
- What should happen?
 - If the announcement contains new information, the market could endogenously shut down (for an *instant*) as everyone flees
 - Why not? Monitoring costs? Some investors have very precise private signals? Overconfidence?





Observation 1: Individuals do not systematically lose money with limit orders before the announcement.



Observation 2: Limit orders that trigger during the first ten minutes after announcements suffer significant losses.

Panel A: Scheduled Earnings Announcements						
Period	Trading Gains (%), Horizon					
	Same-Day		One Week		Two Weeks	
	Mean	SE	Mean	SE	Mean	SE
<i>Stale Limit Orders</i>						
Before	0.53	0.20	0.67	0.34	0.44	0.41
During	-1.49	0.44	-2.82	0.81	-3.80	1.18
After	-0.31	0.19	-0.84	0.46	-1.41	0.76
<i>Market Orders</i>						
Before	-0.22	0.26	-0.29	0.44	0.31	0.63
During	0.77	0.43	1.60	0.78	2.20	1.08
After	-0.16	0.10	-0.53	0.25	0.07	0.44

Note: Before = all trades before the announcement; During = a five-minute window after the announcement; After = all trades after the window.

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Observation 1: The performance of limit orders triggered after the announcement worsens with the horizon—PEAD.

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Observation 2: Individuals make money with their market orders during the first five minutes after announcements.

Panel B: Unscheduled Earnings Announcements						
Trading Gains (%), Horizon						
Period	Same-Day		One Week		Two Weeks)	
	Mean	SE	Mean	SE	Mean	SE
<i>Stale Limit Orders</i>						
Before	1.10	0.98	0.86	1.35	-0.04	1.40
During	-5.99	1.46	-9.69	2.25	-10.28	2.47
After	-1.27	0.84	-1.72	1.54	1.05	1.99
<i>Market Orders</i>						
Before	-1.90	1.15	-1.32	1.43	-2.09	1.80
During	4.32	1.24	7.38	2.07	7.09	2.07
After	-0.14	0.33	0.20	0.78	-0.15	1.12

Observation: The results are stronger for unexpected announcements.

- “What happens around earnings announcements?”
 - ① Institutions start to withdraw their orders before the announcement, individuals do not
 - ② Institutions react by submitting market orders
 - ③ Individuals *appear* to react to announcements
 - ④ Executed limit orders suffer significant losses
- Individuals who actively react to information make money
- The money made with market orders is (to some extent) compensation for risks and costs:
 - monitoring the market; processing and reacting to information; private signal noisy
- Very strong results given the setup—most “news” unexpected or unknown even after the fact (Roll 1988)

Disposition Effect

- Disposition effect: Individuals hold on to losers and sell winners too early
- How could limit orders affect inferences?
 - Suppose an investor buys 10 stocks, needs to sell one of them
 - Indifferent in terms of what to sell—investor places sell orders for all holdings
 - Investors might also use “hypothetical” limit orders like this
⇒ if so, we could not observe this mechanism in the data
 - Withdraw other orders as one of them executes
 - A “winner” is sold

- Run [Grinblatt and Keloharju \(2000\)](#) capital-gain indicator variable regressions conditional on order type
 - Data consist of actual sales and “shadow sales” —holdings that are not sold when something else is sold
 - Dependent variable is an actual-sale indicator variable
 - If the actual trade is completed with a limit order, classify all “shadow sales” as limit order trades as well
 - Idea: what variables predict which stock an investor actually sells from his or her portfolio?
- Stock-by-stock regressions with controls, examine average coefficients
- Do results differ between the samples?

Sample	Capital Gain Coefficients				% -Chg
	All	Market	Limit	Pre-Open	
Full	0.902 (0.040)	0.491 (0.038)	1.179 (0.042)	1.248 (0.048)	-45.6%
Small Trades	0.783 (0.052)	0.303 (0.056)	1.061 (0.054)	1.067 (0.060)	-61.3%
Large Trades	0.883 (0.056)	0.589 (0.069)	1.154 (0.059)	1.496 (0.131)	-33.4%

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Observation 1: Disposition effect significantly weaker in the “market orders only” sample; the strongest in the “pre-open limit orders” sample

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Observation 2: The role of limit orders greater in the small trades-sample, but not limited to it

- Do investors use limit orders because they *want* to display the disposition effect?
 - The decision to use limit orders may not be independent of the disposition effect
- Even if so, a very different type of disposition effect:
 - The investor does not sell the stock with the highest gain
 - He commits to selling the one that appreciates the most
- This “caveat” about behavioral-based preferences should be kept in mind when interpreting the results

Contrarian behavior

- Individual investors follow contrarian trading strategies
 - Huddart, and Lang (1999), Nofsinger and Sias (1999), Choe, Kho, and Stulz (1999), Grinblatt and Keloharju (2000, 2001), Richards (2004)
- Limit orders are always contrarian at some horizon:
 - They execute only when the stock price moves against the order
- It could be that all active investors follow momentum strategies
 - Limit order investors “forced” into (ex-post) contrarian trades

- Replicate the [Grinblatt and Keloharju \(2000\)](#) analysis:
 - Logistic regression in a sample that contains all purchases and sales
 - Dependent variable set to one for sales
 - Explanatory variables are returns over different horizons:
 - From the same-day return (i.e., from previous day's close to today's close) up to three months before the trade
 - Use *market-adjusted* returns
 - This is a conservative approach for my purposes: limit prices themselves do not adjust as the market moves

Return	Order Type						%Chg
	All		Market		Limit		
	Mean	SE	Mean	SE	Mean	SE	
r_t	8.21	0.71	-5.13	0.75	20.11	1.28	-100.0%
r_{t-1}	4.03	0.52	-0.10	0.51	7.84	0.77	-100.0%
r_{t-2}	3.06	0.44	1.44	0.45	4.65	0.54	-52.8%
r_{t-3}	3.11	0.41	1.60	0.43	4.54	0.51	-48.5%
r_{t-4}	2.47	0.32	1.25	0.36	3.69	0.41	-49.5%
$r_{[t-19,t-5]}$	1.59	0.23	1.20	0.24	1.93	0.23	-24.4%
$r_{[t-39,t-20]}$	1.00	0.12	0.76	0.14	1.24	0.13	-24.6%
$r_{[t-60,t-40]}$	0.56	0.11	0.30	0.13	0.77	0.12	-46.1%

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Observation 1: “All orders” results similar to [Grinblatt and Keloharju](#) results: individuals follow contrarian strategies—the contingency on returns is the strongest when the horizon is short

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r_{t-3}	3.11	0.41	1.60	0.43	4.54	0.51	-48.5%
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$r_{[t-60,t-40]}$	0.56	0.11	0.30	0.13	0.77	0.12	-46.1%

Observation 2: Limit orders play a major role: the “conclusion” about contrarian behavior reversed for the same-day return and for the previous day’s return

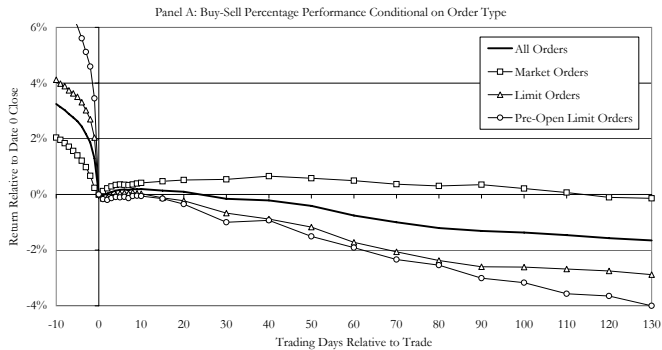
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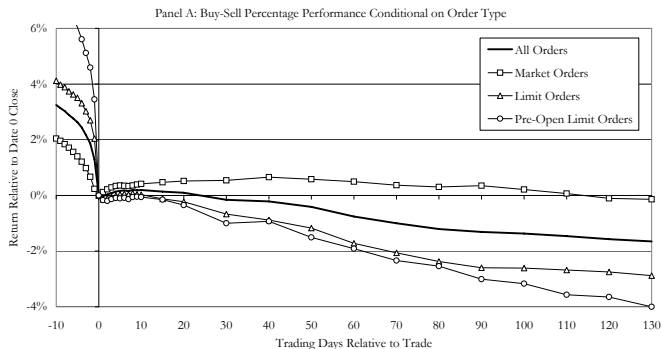
Observation 3: The effect is economically significant up to three months.

Negative stock-picking skills

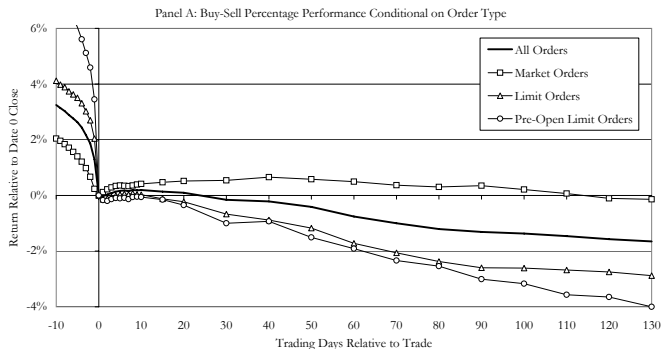
- A common way of measuring individual investors' performance: construct “buy” and “sell” portfolios
- Do investors shift towards future winners?
- **Literature:** No. . . they shift towards future losers, away from future winners
 - Barber and Odean (1999), Odean (1999), Grinblatt and Keloharju (2000, 2006), Barber, Lee, Liu, and Odean (2005)
- Uninformed investors—possibly using limit orders—**must** lose to the informed investors
- If private information is long-lived, the adverse selection losses accumulate over a period of time

- Construct “buy” and “sell” portfolios each day based on what stocks individual investors buy and sell
- Compute cumulative returns on these portfolios—equal- and value-weighted—up to six months after the trade
- Use the “buy” versus “sell” as a metric of investor performance
- Repeat the computations separately for market- and limit order-initiated trades
 - Do the results differ between the samples?
- (Overlapping observations not a significant problem, portfolio weights reset every day.)





Observation 1: “All orders” results resemble the results in the literature. Odean (1999), for example, finds a -1.5% drift in six months.



Observation 2: The results are very different depending on the type of the order that generates the trade: pre-open limit orders lose the most, market orders break even

Results (cont'd)

Order Type	Number of Trading Days after Trade					
	1	5	10	20	60	130
	<i>Value-Weighted Returns (%)</i>					
All	-0.03 (0.03)	0.17 (0.09)	0.20 (0.16)	0.10 (0.21)	-0.76 (0.47)	-1.65 (0.70)
Market	0.12 (0.03)	0.36 (0.09)	0.41 (0.15)	0.52 (0.21)	0.50 (0.45)	-0.14 (0.66)
Limit	-0.14 (0.04)	0.03 (0.11)	0.03 (0.19)	-0.22 (0.24)	-1.72 (0.54)	-2.88 (0.79)
Pre-Open	-0.17 (0.06)	-0.10 (0.19)	-0.06 (0.31)	-0.35 (0.41)	-1.91 (0.89)	-4.00 (1.30)
Market-Limit	0.26 (0.04)	0.33 (0.09)	0.38 (0.15)	0.74 (0.20)	2.22 (0.39)	2.74 (0.52)

Conclusions and discussion

- Because limit orders are price-contingent, they have mechanical features:
 - Always contrarian
 - Exposed to the adverse selection risk ([Treyner 1971](#))

Problem: consequences (so far) ignored in behavioral finance

- These features carry over to the investor behavior we observe in the trading data
 - Many results in behavioral finance could be artifacts of individuals' use of limit orders. . .
 - . . . *even* if order strategies are optimal
 - False inferences about
 - ① what motivates investors to trade (attention-grabbing behavior, coordinated trading, contrarian strategies)
 - ② investor performance (trade systematically in the wrong direction)

- Some of the puzzling (troubling?) findings in behavioral finance may be explained by the use of limit orders
 - Results positive news to those who believe in any notion of market efficiency:

No machine to reverse engineer and exploit individuals' trading strategies

- Individuals use of limit orders not optimal?
 - Individuals' limit orders far away from the spread suffer severely from adverse selection
 - However: we do not know investors' reason for trading
 - **Harris and Hasbrouck** (1996) results similar
 - **Campbell** (2006): *most* individuals make only minor mistakes

- Limit orders likely to affect US results:
 - Limit orders account for 45% of the total orders on the NYSE (Lo, Mackinlay, and Zhang 2002)
 - Good-till-canceled orders more popular in US: 14.4% in TORQ data (Bae, Jang, and Park 2002)
- Collaborating evidence from other markets:
 - Richards (2004): "... it is therefore likely that order-submission effects are a substantial cause of the finding that domestic individual investors in Asian equity markets appear to be contrarian investors."
 - Dorn, Huberman, and Sengmueller (2005): limit orders are important in explaining coordinated trading in German data

The magnitude of the effect?

- Informed traders must earn their profits from other market participants; Harris (2003):

“Uninformed traders do not lose because they systematically want to trade on the wrong side. Even if they flip a coin to decide on which side to trade, uninformed traders tend to lose.”

- Asymmetric information is one of the most fundamental issues in finance (Grossman and Stiglitz 1980; Diamond and Verrechia 1981; Kyle 1985)
 - Limited understanding of the “mechanical” effects that the adding-up constraints have on investor behavior
 - Someone gains → someone must lose, someone buys → someone must sell, . . .