Two Stock-Trading Agents: Market Making and Technical Analysis

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Motivation

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- Now ECNs (e.g. Island) make **order books** available
- **Penn-Lehman Automated Trading** (PLAT) Simulator mixes agent and real-world bids (Kearns, 2003)
- Permits direct comparison of agent strategies
  - Like TAC, but in a realistic stock-market scenario

Outline

- Motivation
- PLAT
- Reverse Strategy
- Market Making Strategy
- Results

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- For any profitable situation, there's one that loses
- Match strategies to market conditions
- Encourage people to use PLAT

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- Matches agents' orders and Island order books

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- Cash and holdings start at 0; can borrow.
- Agent **value** = cash + holdings * current Price

Differences from Real Trading

- Some **time lag**
- Market price can **diverge** from reality
- No **commission** or **tax charges**
- Fully automated strategies with **no human intervention**

Basic Strategy

while time permits:
lastPrice $\leftarrow$ getLastPrice();
currentPrice $\leftarrow$ getCurrentPrice();
if currentPrice $>$ lastPrice
    placeOrder(**BUY**, currentPrice, volume);
elseif currentPrice $<$ lastPrice
    placeOrder(**SELL**, currentPrice, volume);

Basic Strategy

while time permits:
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Favors days with price of consistent slope

Reverse Strategy

while time permits:
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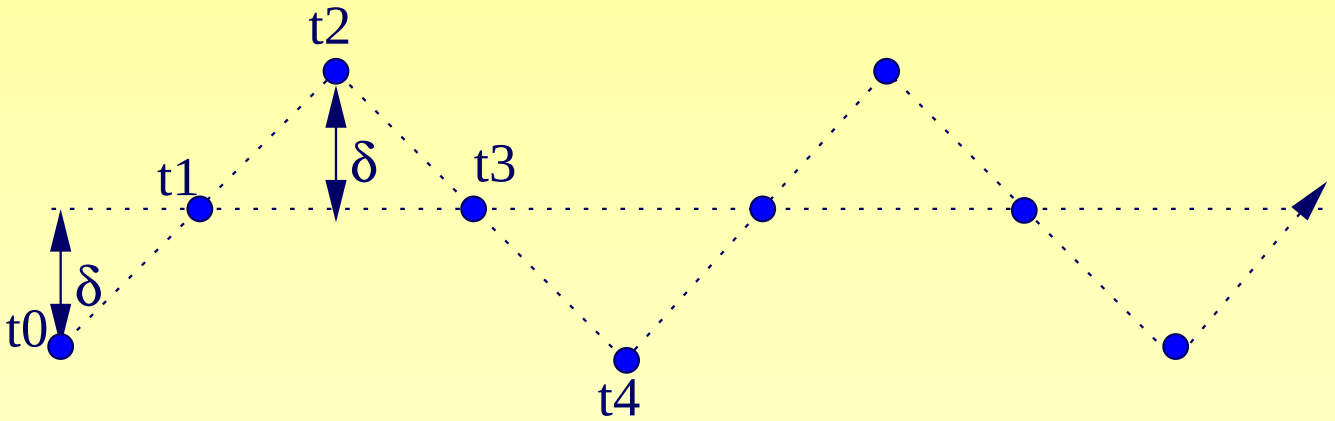
Analysis



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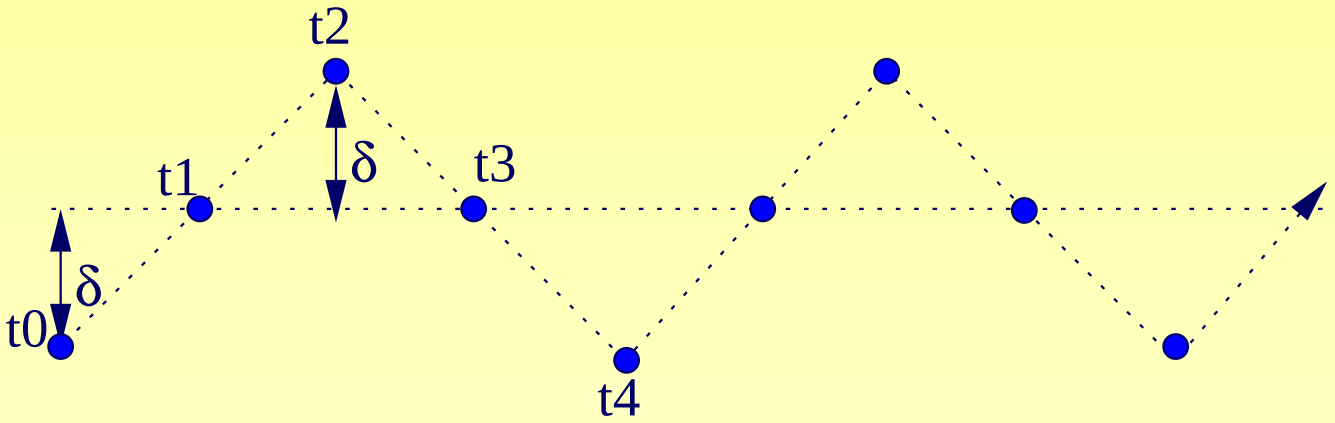
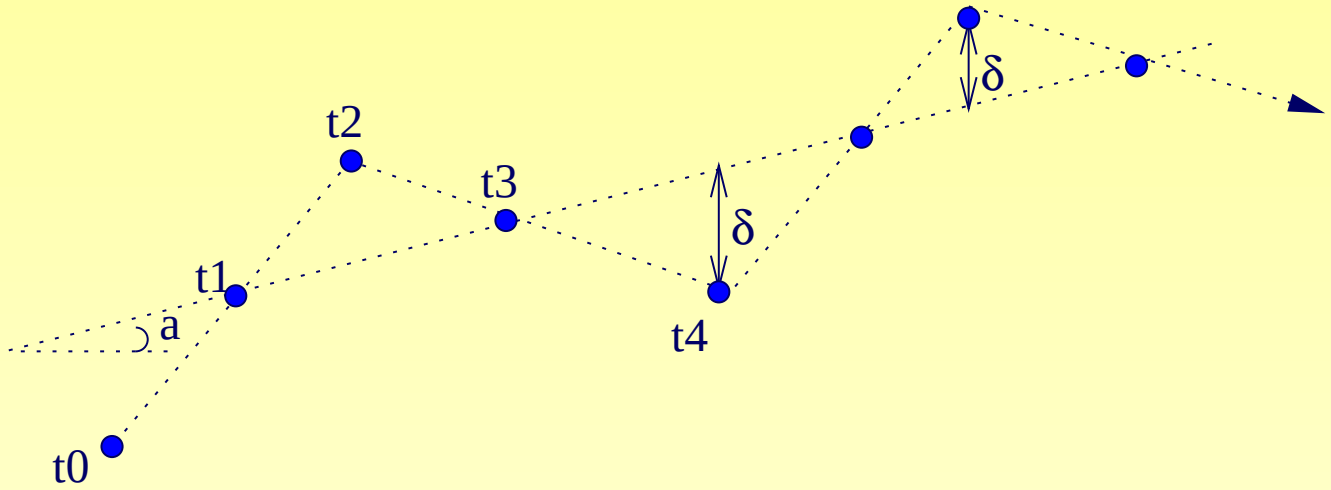


time	price	action	holding	cash	value
t_0	$p - \delta$	—	0	0	0
t_1	p	sell	$-v$	vp	0
t_2	$p + \delta$	sell	$-2v$	$2vp + v\delta$	$-v\delta$
t_3	p	buy	$-v$	$vp + v\delta$	$v\delta$
t_4	$p - \delta$	buy	0	$2v\delta$	$2v\delta$

Further Analysis



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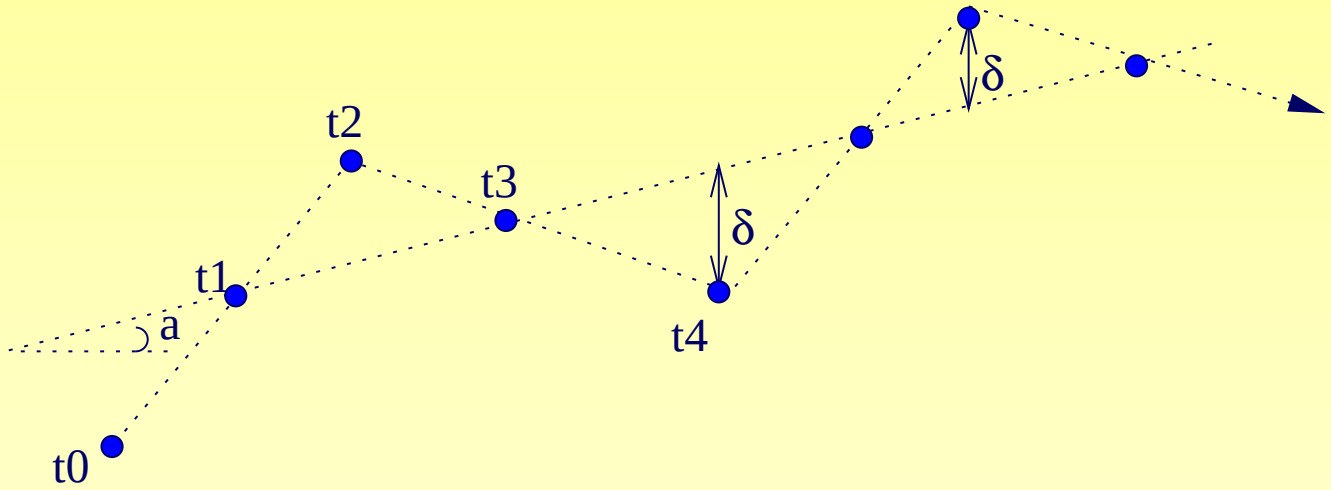

time	price	action	holding	cash	value
t_0	$b - \delta$	—	0	0	0
t_1	$a + b$	sell	$-v$	$v(a + b)$	0
t_2	$2a + b + \delta$	sell	$-2v$	$v(3a + 2b + \delta)$	$v(-\delta + a)$
t_3	$3a + b$	buy	$-v$	$v(b + \delta)$	$v(\delta - 3a)$
t_4	$4a + b - \delta$	buy	0	$2v(\delta - 2a)$	$2v(\delta - 2a)$

Market Making Strategy

while time permits:
buyReferencePrice ← getBuyOrderPrice(n) + 0.0001;
placeOrder(BUY, buyReferencePrice, volume);
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- **Fixed price gaps** have problems
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- Use the **order book**

Market Making Strategy

Example

Buy Order Book		Sell Order Book	
Price	Volume	Price	Volume
24.0360	500	24.0700	350
24.0061	**1000**	**24.0889**	**1000**
24.0060	1500	24.0890	600
24.0010	800	24.0950	2000
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- If not, positions can accumulate - high **risk**!
- Can **reduce position** by altering price and/or volume

Results

- Live competition
- Controlled experiments on historical data

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  - Lost money in the last round!

The last 2 days for Reverse

MSFT Mar 17; Finals, Day 4

Figure 1: Profit and Loss of Client

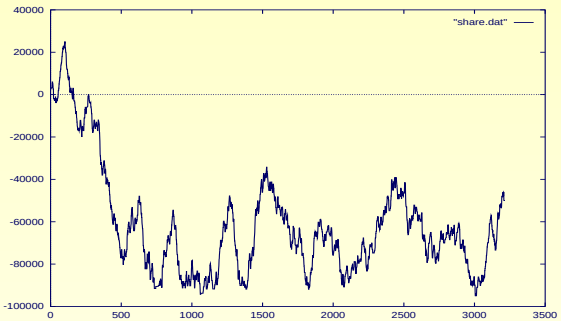
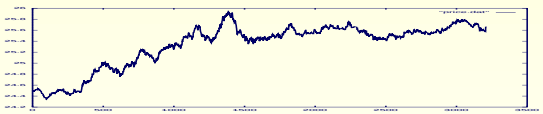


Figure 2: Shares Position of the Client



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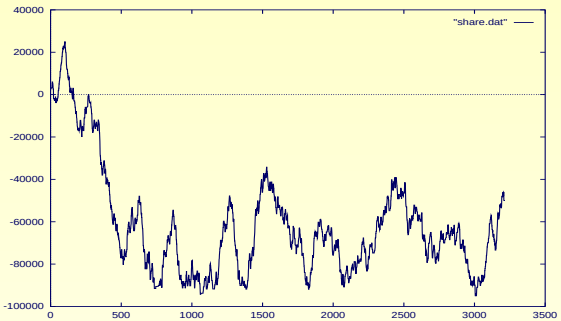

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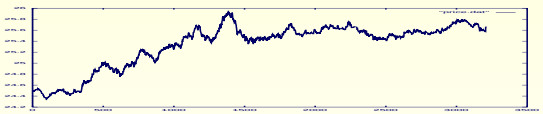

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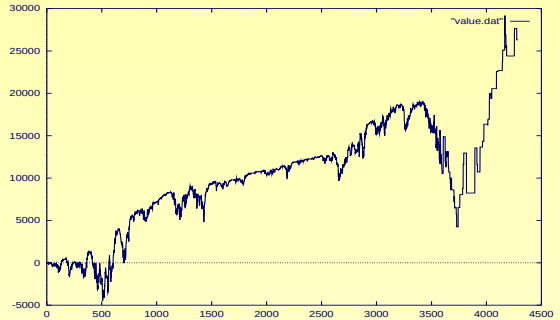
MSFT Mar 18; Finals, Day 5



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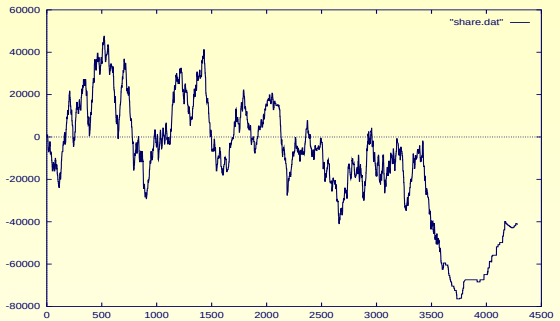

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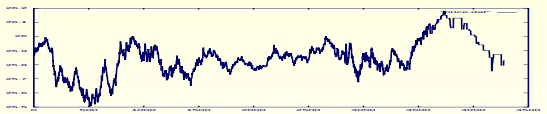

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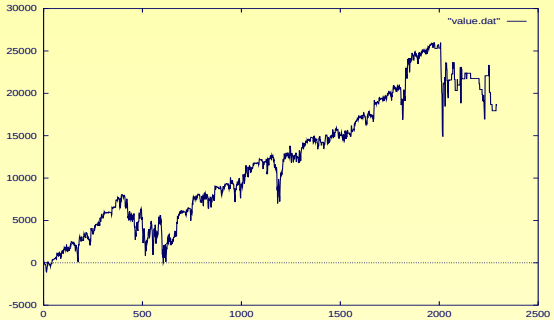
Good and Bad Days for Market Making

MSFT Mar 6; Round 2, Day 2



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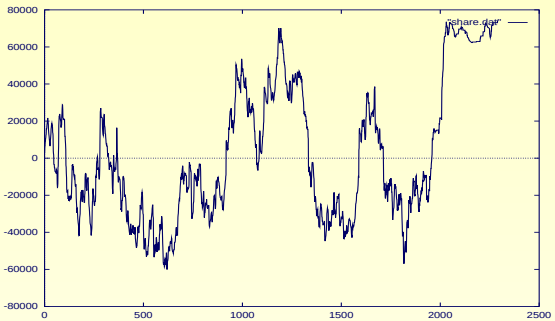

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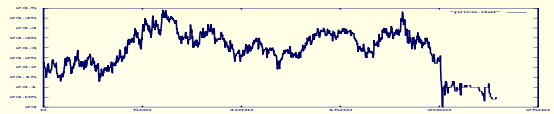

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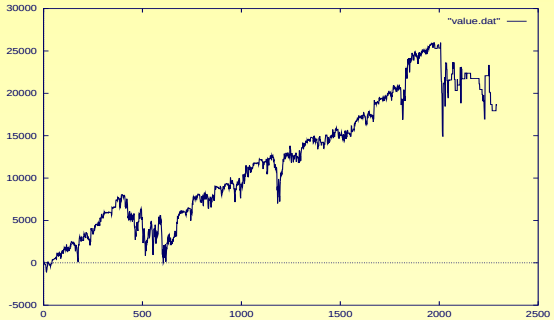

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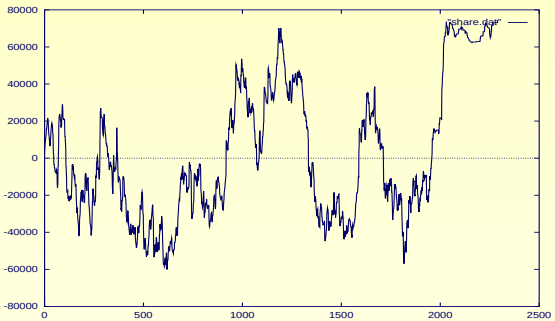

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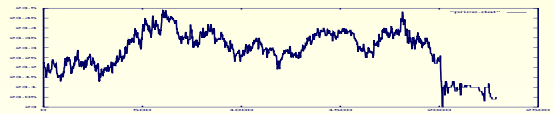

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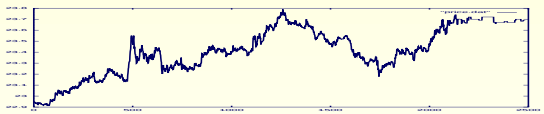

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Historical Experiments

DATE	Market Making	Reverse
Mar21, 2003	25557	7730
Mar24, 2003	-30845	-21602
Mar25, 2003	-4742	-4504
Mar26, 2003	28453	-5525
Mar27, 2003	5856	-21932
Mar28, 2003	13174	-7146
Mar31, 2003	8520	-3489
Apr01, 2003	31144	6500
Apr02, 2003	-34444	6087
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- Experimented with market making **volume control methods**

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