A Primer on Fast Electronic Markets

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Agenda

- Introduction
- Some bottom line empirical evidence
- Important issues for buy-side traders

Introduction

Two Aspects of Electronic Trading

1. Electronic exchange and brokerage systems
2. Electronic traders

The widespread adoption of electronic exchange systems led to huge growth in automated order creation and submission systems.

Fast Electronic Exchange Trading Systems

Electronic Exchanges

- Electronic order matching systems are very cheap to operate once built.
- These systems do exactly what they are programmed to do.
  - Hidden orders stay hidden.
  - Precedence rules are precisely enforced.
- They also maintain perfect audit trails.

Efficiency Wins

- The efficiency of electronic trading systems led to great growth.
- Electronic trading systems have largely displaced floor-based trading systems in all instruments for which order-driven markets are viable.

Fast Electronic Traders

Types of Electronic Traders

- Proprietary traders
  - High frequency traders (HFT)
  - Low latency traders
- Buy-side traders
  - Algorithms designed to find liquidity

Three Main Proprietary Strategies

1. Liquidity trading
   - Dealing
   - Arbitrage
2. Order Anticipation
   - Front-running algorithms
   - Quote-matching standing limit orders
3. News trading

Liquidity Trading

- Dealers match buyers and sellers who arrive at a market at different times.
  - HFTs are scalpers.
- Arbitrageurs match buyers and sellers who arrive at different markets at the same time.
- Traders who can implement combined strategies dominate in markets with many thinly traded correlated instruments.
  - Options

Parasitic Low Latency Strategies

- Front-running
  - Traders try to front run orders not yet submitted.
- Quote-matching
  - Traders try to extract order option values.
- News trading
  - Traders try to pick off stale orders when events cause values to change.

Electronic Buy-Side Traders

- Buy-side traders use algorithms to reduce the costs of filling large orders.
- These systems split orders into small parts that they submit to the market over time.
- Buy-side algorithms are designed to reduce the market impact of large orders.
  - Clever traders try to front-run them.

The Three Needs for Speed

1. Take a trading opportunity before others do.
2. Make a market first when time-precedence matters.
3. Cancel an order when you no longer want to trade before someone takes it.
   - Trading when you do not want to trade is rarely profitable.

Being fast is not important. Being faster is.

How To Trade Fast

- Run on fast computer servers.
  - Use fast processors with specialized chips.
  - Keep information in memory instead of on disk.
  - Use simple operating systems and fast code.
  - Preplan information-contingent trades.
- Obtain data directly from exchanges.
- Co-locate servers to avoid router and speed-of-light communication delays.

Why Electronic Traders Are Efficient

- Computers have infinite attention spans.
- The scope of their attention is very wide.
  - They can watch and respond to information from many securities simultaneously.
- Computers respond to new information and trading opportunities almost instantaneously.
- Computers are disciplined.
  - They do only what they are instructed to do.

Efficiency Wins Again

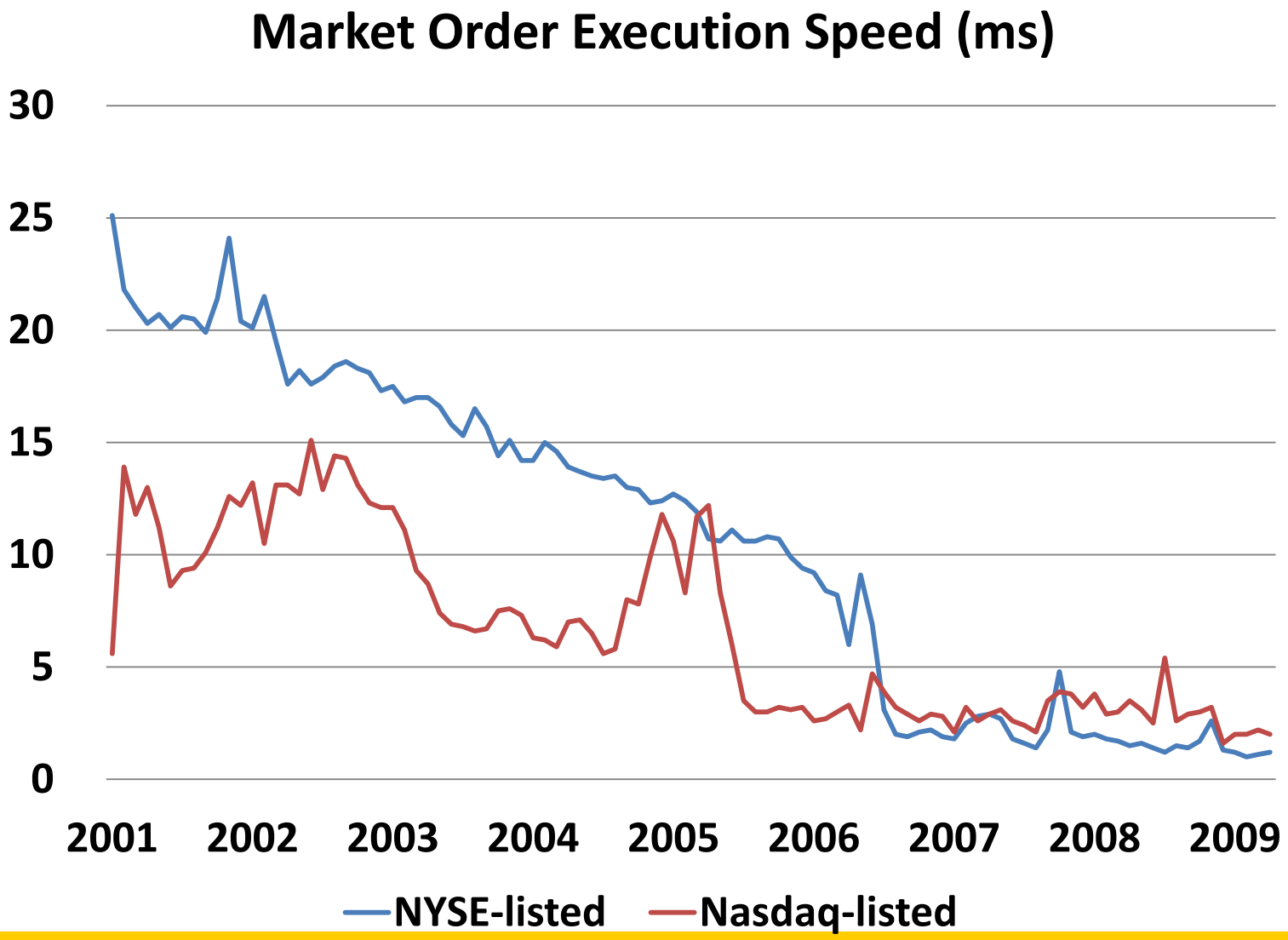
- The efficiency of electronic trading strategies led to their widespread adoption by proprietary traders, buy-side traders, and their brokers.
- Electronic traders have displaced traditional dealers, arbitrageurs, and brokers in electronic order-driven markets.

Some Simple Evidence

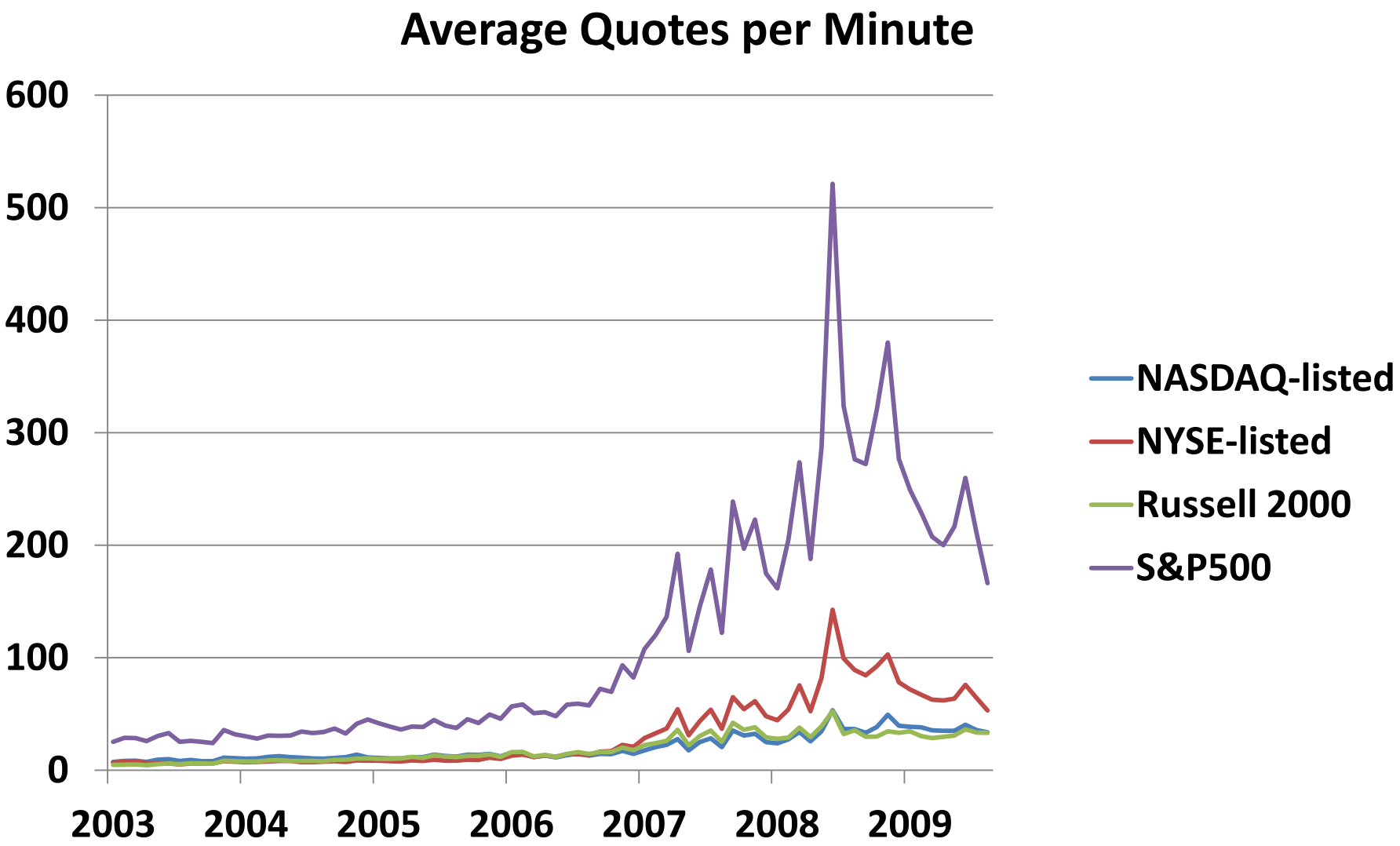
Markets Now Are Much Faster

- Automated systems and traders are extraordinarily fast and active.

Faster Executions



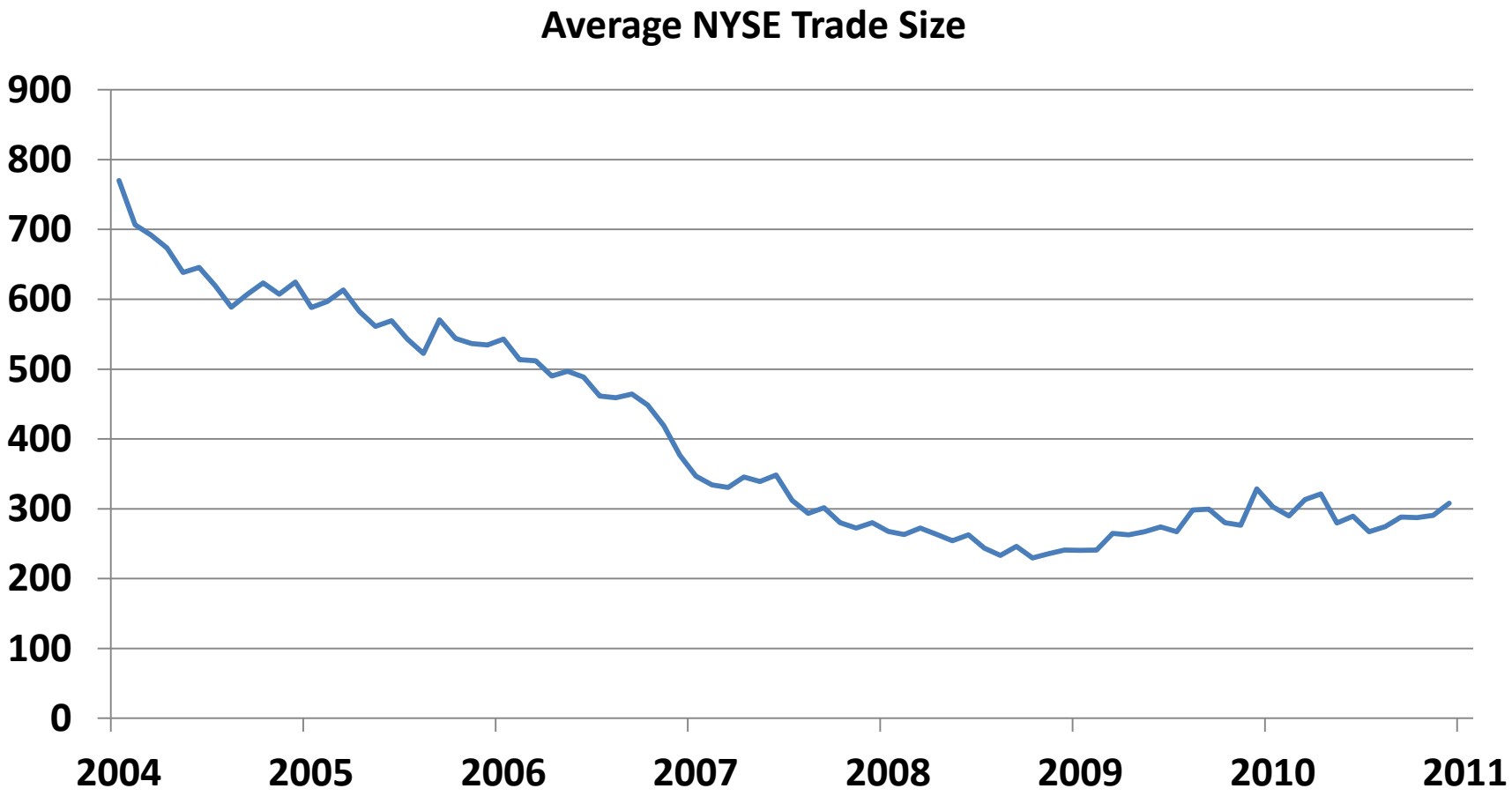
More Quotes per Stock



Trading Strategies Changed

- More orders cancelled
- Smaller more numerous trades

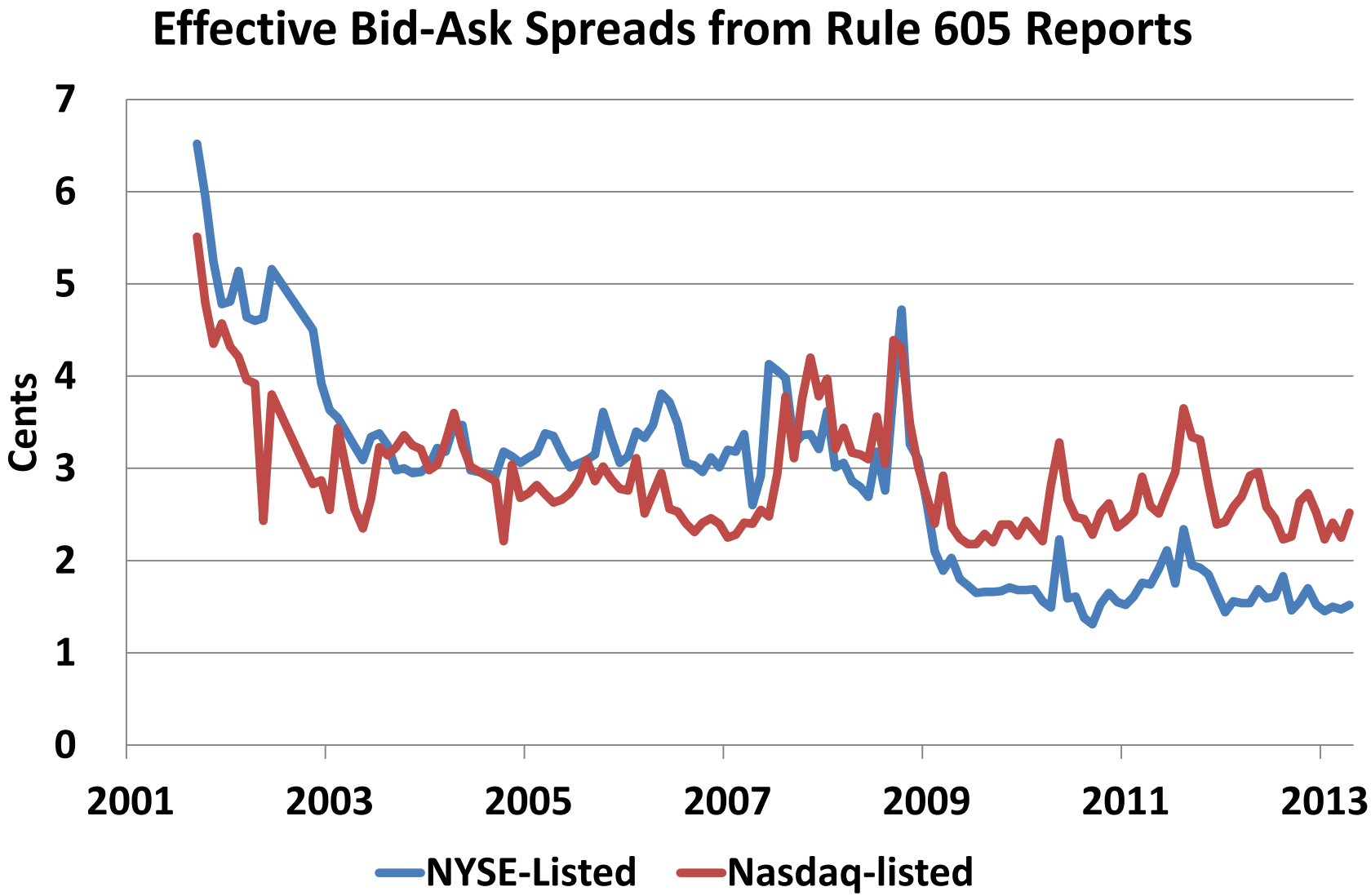
Average Trade Sizes Decreased



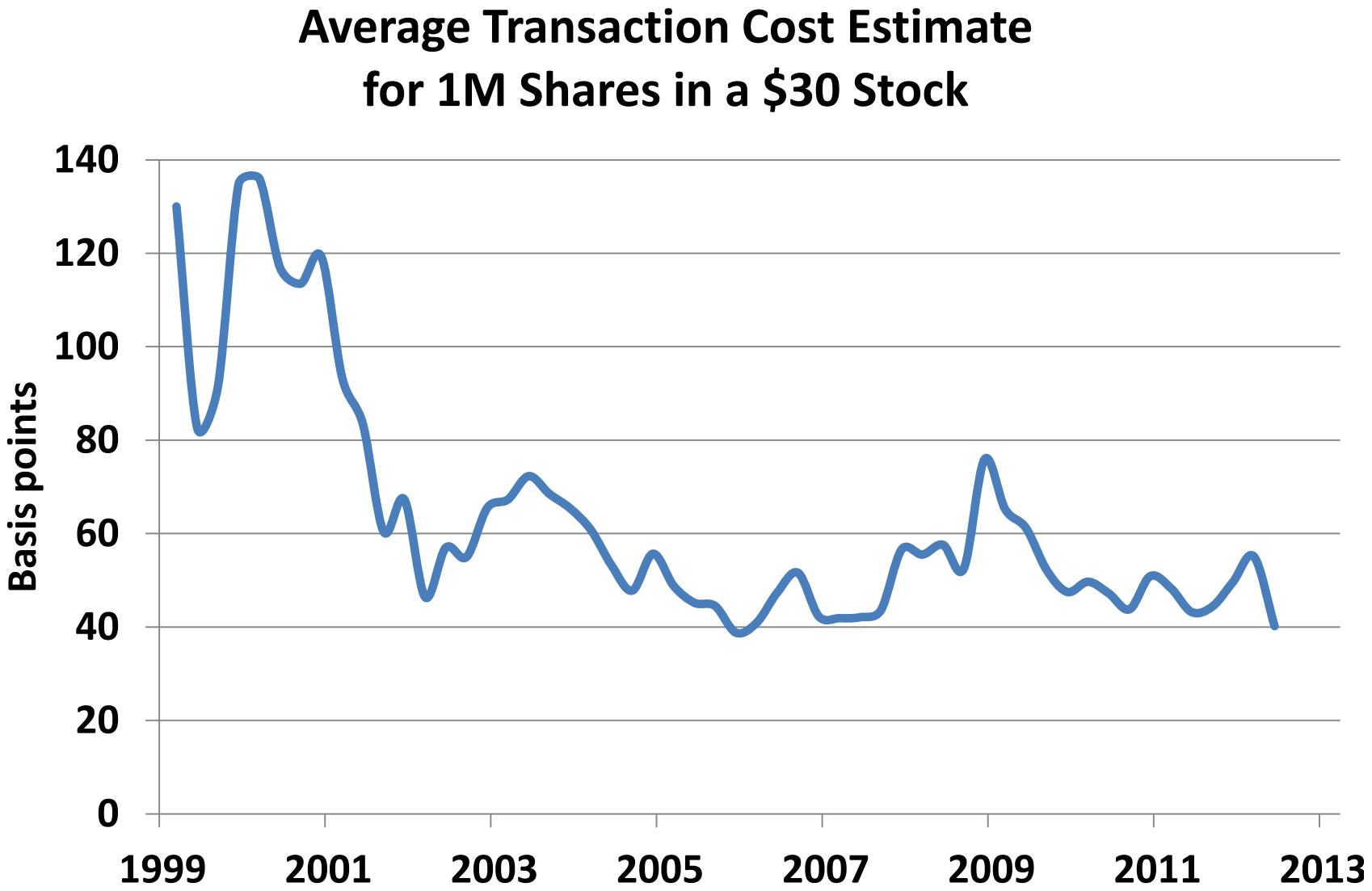
Markets Are More Liquid

- Greater volumes
- Smaller spreads benefit small orders
- Smaller large trade transaction costs
- Greater quoted sizes

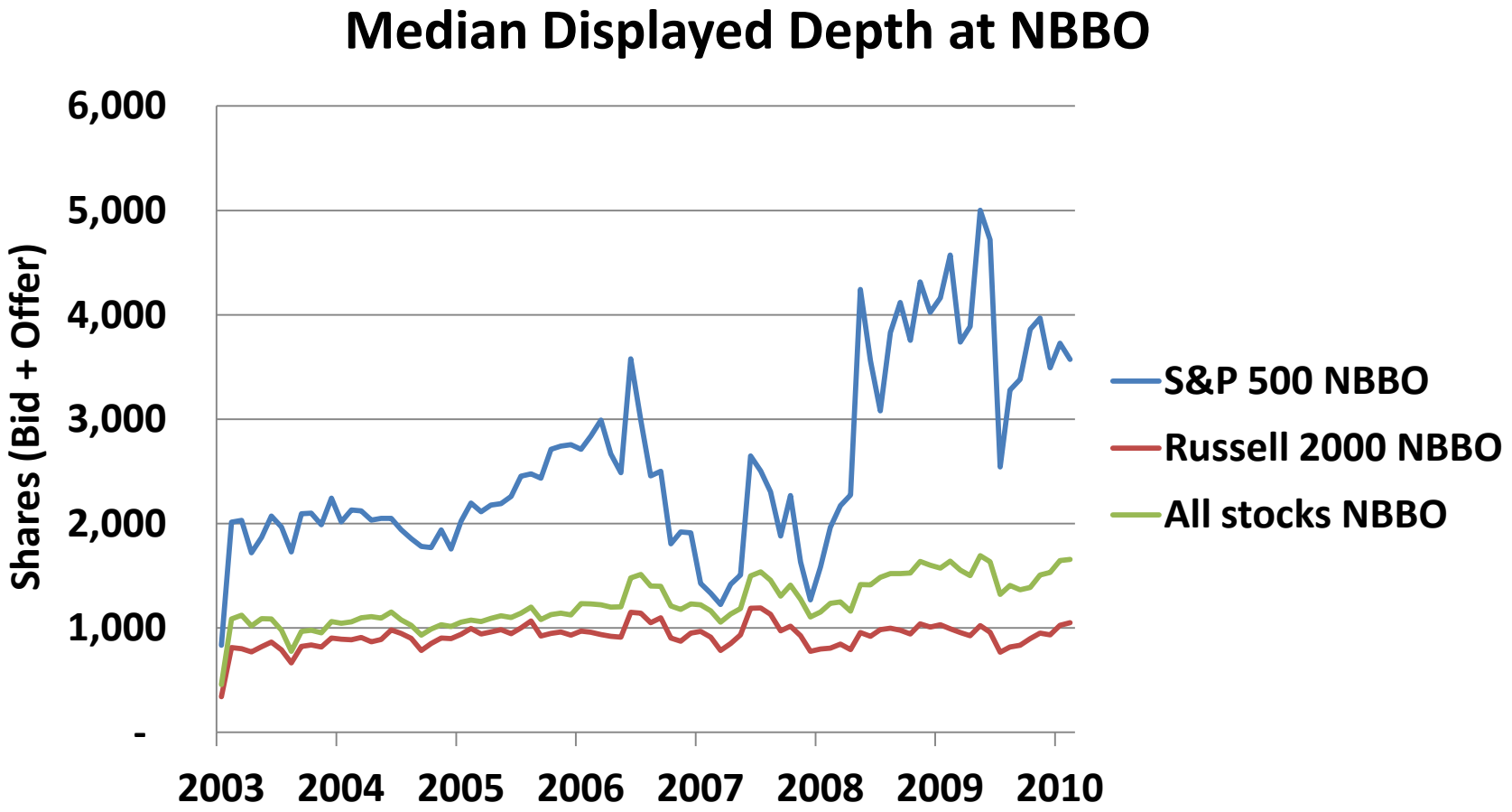
Bid/Ask Spreads Dropped



Large Trade Costs Dropped



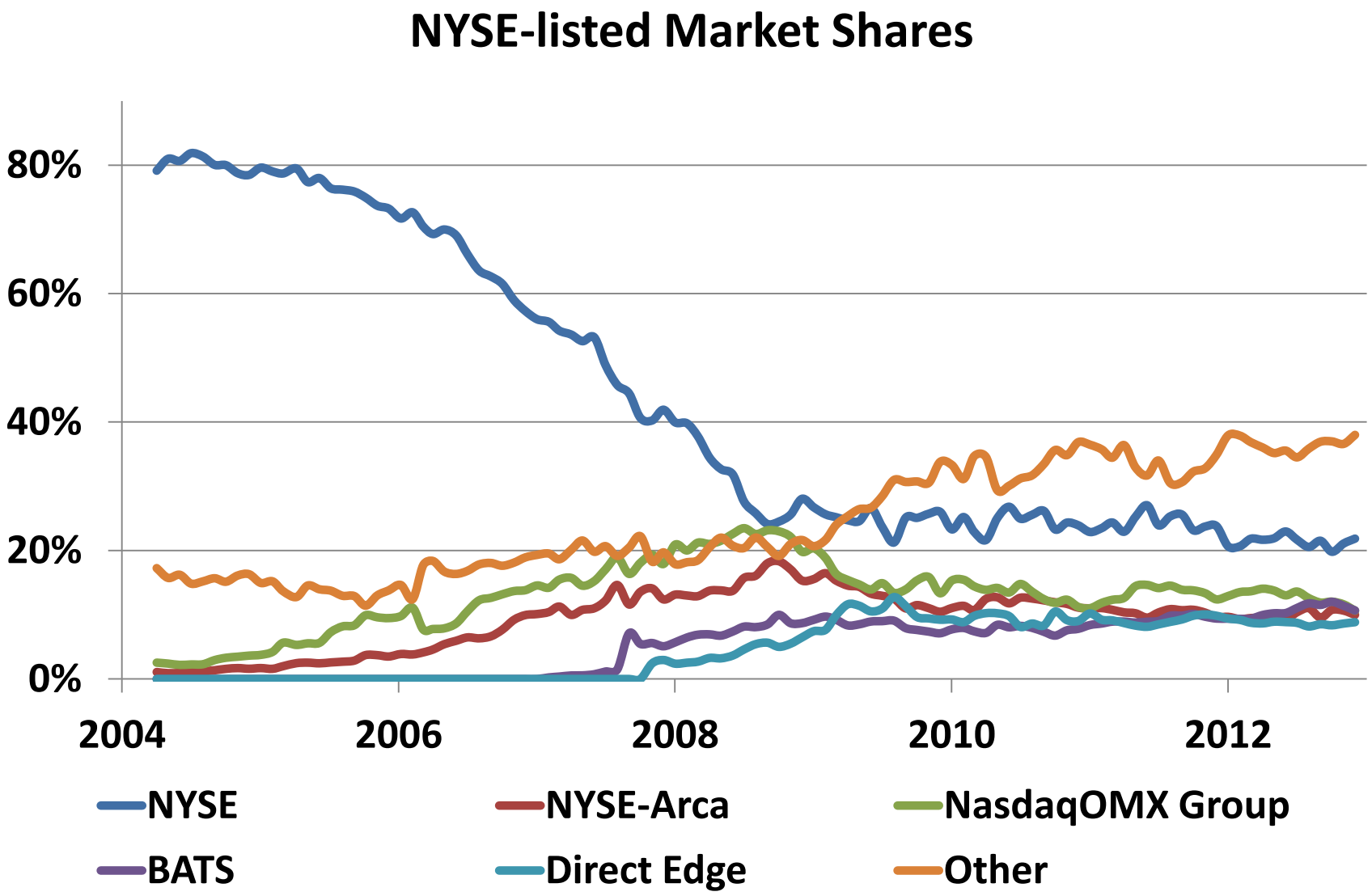
Quotation Sizes Increased



Effect on Market Shares

- NASDAQ, NYSE, and Amex all failed to quickly adopt the technologies and business models that traders wanted.
- They lost market share to new competitors.

Slow Technology Adopters Lost



Practitioner and Regulatory Issues Associated with Fast Electronic Markets

Does Speed Help Capital Formation?

- No one makes capital allocation decisions in milliseconds.
- But the costs of primary market capital depend on secondary market liquidity.
- HFTs provide liquidity in electronic markets.

Is Electronic Trading Fair?

- Some traders have always had superior access to markets.
  - Anyone can be fast by investing in the necessary technologies or by trading through a broker who offers fast trading tools.
- Competition among fast traders limits their profits.
  - Of little consolation to traders exploited by parasitic traders.

Systemic Risks of Electronic Trading

- Systemic risks involve failures that have large negative impacts on others for which contingent contracting is impossible, too expensive, or unlikely.
- Examples of fast trading systemic risks:
  - Runaway algorithms
  - Electronic exchange trading system failures
  - “Fat fingers” and other overlarge trades

Unintended and Malevolent Orders

- Risks
  - Programmers sometimes make mistakes.
  - Denial-of-service attacks can hurt competitors.
  - Terrorists may try to deliberately disrupt markets.
- Runaway algorithms impose costs on everyone.

Runaway Algorithm Solutions

- Brokers must be responsible for all order flows that they introduce.
  - No naked sponsored access.
- Exchanges must meter incoming order flows to ensure that they are appropriate.

Mindless Electronic Exchanges

- Extreme prices changes will occur in electronic markets when market orders arrive and no liquidity is present if the markets do not have price limits or trade halt rules.
  - Flash Crash

The Causes of the Flash Crash

- The stock market was down about three percent on concerns about Greek debt.
- A large institutional trader tried to sell $4B S&P 500 e-Mini futures contracts using an algorithm.
  - The algorithm timing parameters were too aggressive.
  - The trader lost approximately $140M of his clients' capital.

The Flash Crash Causes (2)

- Index arbitrageurs moved the selling pressure to the cash markets where order books on the buy-side were already weak.
- Price decreases triggered stop sell orders, especially in ETFs.
- Market sell orders and market stop loss sell orders exhausted all liquidity and prices fell.

The Flash Crash Causes (3)

- Some dealers quit making markets, but mostly day traders and not the largest HFTs.
- Market buy orders in a few stocks pushed prices to extremely high levels.

The Flash Crash Recovery

- A CME rule halted e-mini trading for five seconds and cleared the order book.
- When trading resumed, prices rose quickly.
- The entire event occurred over less than 20 minutes.

Implications for Traders

- Market orders are incompatible with electronic order matching systems.
  - All traders should price their orders.
- Institutional traders using algorithms need to be more careful.
  - The $140M market-based penalty will be more than adequate to discipline buy-side traders.

Regulatory Responses

- New market structures
  - Trade halts
  - Price limits
- Stock-by-stock implementation will create a new fear index.
  - Percentage of stocks now halted.
  - Complexity can create systemic risks in closely-coupled systems.

The HFT Arms Race

- HFT technologies have become very expensive so that new entry is very costly.
- These barriers to entry can create natural monopolies.
- A simple solution: Randomize instruction processing over 5ms intervals.

Parasitic Trading Strategies

Market structures than can protect slower traders from electronic parasitic traders:

- Delayed trade reporting can frustrate front-running of buy-side algorithms.
- Larger ticks make quote-matching expensive.
- Hidden orders also can protect buy-side traders.
- Delayed processing of market orders can protect HFT liquidity suppliers from news traders.

Who Owns the Data?

- Exchanges make lots of money selling high speed proprietary data feeds to HFTs.
- Traders with slower access are disadvantaged.
- Is this fair?

The sale of proprietary data allows exchanges to extract some of the rents from HFT.

Special Order Types

- Special order types used by HFT can disadvantage slower traders.
- Example of the conflict between floating market-making orders used by HFTs and marketable limit orders used by buy-side traders.

Maker-Taker Pricing

- Exchanges traditionally have charged the buyer and seller for arranging trades.
- Exchange systems using make-or-take pricing charge the taker an access fee and provide a liquidity rebate to the maker.
  - For US equities, the access fee is typically 0.3¢/share and the liquidity rebate is 0.25¢ so that the exchange makes 0.05¢/share.

Broker Routing Decisions

- Suppose the best bid and offer at two exchanges are the same.
  - One uses traditional pricing and the other uses make-or-take pricing.
- Brokers will route marketable orders to the traditional exchange and limit orders to the make-or-take exchange.
  - Their clients' limit orders trade only after all orders at the traditional exchange are filled.

Maker/Taker Regulatory Issues

- Maker/taker pricing simply narrows equilibrium bid/ask spreads.
  - If the tick binds bid/ask spreads, displayed sizes increase.
- Maker/taker pricing creates transparency and agency problems.
  - Needlessly complicates market structure.

Taker-Maker Pricing

- Some exchanges operate subsidiary exchanges where the
  - Maker pays an access fee.
  - The taker receives a rebate.
- Taker-maker pricing effectively creates new ½-tick prices that cheapen front-running.

Nominal and Net Spreads

Nominal market: 20 bid, offered at 21

- At maker-taker exchange, the net market is 20-0.3=19.7 bid, offered at 21.3=20+0.3
- At taker-maker exchange, the net market is 20+0.3=20.3 bid, offered at 20.7=21-0.3
- The market will tick up by alternating between exchanges.
  - 19.7 at M-T, then 20.3 at T-M, then 20.7 at M-T, …

Exchange Pricing Problems

- At best, taker-maker coupled with maker-taker is a convoluted system for price competition.
- How large should the tick be?
    - Buy-side traders need to be aware.
- Agency problems arise when access fees and liquidity rebates are not passed through to the beneficial account.
  - Algorithms and buy-side trade desks may game their customers.

Dark Pools

Dark pools are off-exchange systems that match buyers to sellers.

- They may provide special services to a clientele.
  - Large institutions use LiquidNet to arrange low impact trades.
- They also may facilitate exploitation of agency problems among brokers and their clients.
  - Internalization and order preferencing to favored dealers.

Dark Pool Fears

- The growth of dark pools has raised fears about the quality of the lit exchange markets.
  - Not surprisingly, the exchange markets and those who use them are most concerned.
- The concerns are theoretically well-founded but current evidence does not indicate that the issue is now material.
- Arbitrage holds the markets together.
  - At some cost.

Conclusion

Final Comments

- Electronic markets and electronic trading have changed how people trade.
- The sell-side has reacted and so must the buy-side.
- These new systems pose some regulatory problems, but overall, the markets are working well.

What Should Regulators Do?

- Maximize the private benefits of utilitarian traders without which the markets would not exist.
- Maximize the externalities that markets produce for everyone by facilitating better
  - Primary capital accumulation and allocation
  - Allocation of secondary (seasoned) capital to corporate managers
  - Risk sharing

Topics We Could Discuss Further

- Internalization, order preferencing, and payments for order flow
- Subsidization schemes for designated dealers and market-makers
- Regulation of best representation for limit orders
- Transaction taxes
- The costs of communications bandwidth

More Potential Topics

- Free rider problems involving the provision of regulatory services by exchanges
- Why buy-side traders always complain about market structure
- Front running of orders in correlated securities and contracts
- Exchange governance
- Fixed income market structure