

The Present and Future of
High-Frequency Trading

THE SPEED

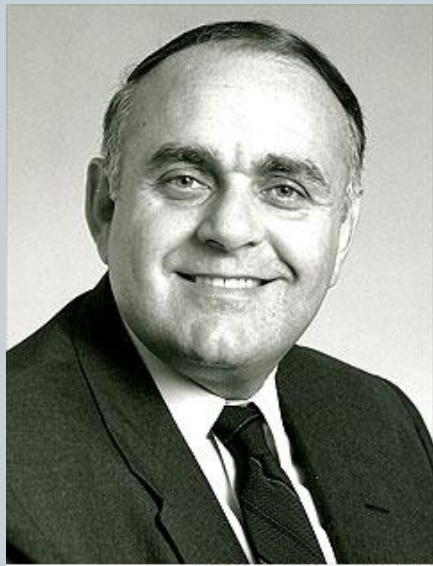
TRADERS

FIXGlobal Face2Face Electronic Trading Forum

The Present and Future of High-Frequency Trading

- **High-Frequency Trading is a set of tools that encompasses a rather diverse number of strategies that prioritize speed, low-latency, volume, liquid instruments and short timeframes**
- High-Frequency Trading has been referred to as the natural progression of technology applied to the investing and trading worlds
- In the process, High-Frequency Trading has unmasked structural issues in the U.S. equity markets that are currently being examined by legislators and regulators
- Speed traders will continue finding alpha-generating opportunities by trading new asset classes in new geographies employing more sophisticated tools than ever

What is it about High-Frequency Trading that makes prominent investors speak up?



COURTESY: OMEGA ADVISORS

“High-frequency trading is destructive!”



“It doesn't raise fundamental questions.”



“It doesn't benefit the financial system and should be taxed.”

Defining High-Frequency Trading

- Professional traders acting in a proprietary capacity that engage in strategies that generate a large number of trades on a daily basis
- Organized as proprietary trading firm, as the proprietary trading desk of a multi-service broker-dealer, or as a hedge fund
- Main characteristics:
 - Usage of extraordinarily high-speed and sophisticated computer programs for generating, routing, and executing orders
 - Co-location services and individual data feeds offered by exchanges and others to minimize network and other types of latencies
 - Very short time-frames for establishing and liquidating positions
 - Submission of numerous orders that are cancelled shortly after submission
 - Ending the trading day in as close to a flat position as possible (that is, not carrying significant, un-hedged positions overnight)
 - Focus on highly liquid instruments (e.g., Citi, Bank of America)

Understanding High-Frequency Trading

- At a recent investment management event, 66% of managers didn't have an opinion about High-Frequency Trading
- A recent poll by Greenwich Associates found that 20% of institutional investors don't fully understand the practice of High-Frequency Trading
- Algorithmic trading is broader, encompassing the automation of alpha-seeking and potentially execution trading decision making
- High-Frequency Trading specifically monitors the market for patterns that indicate alpha-making trading opportunities; then places orders to take instant advantage of those opportunities
- As market data is coming in fast, and conditions are changing by the millisecond, the firms that leverage High-Frequency Trading are able to jump on opportunities faster than the competition

A Primer of High-Frequency Trading Strategies

- **Electronic Market Making:**
 - Continuously buying at the bid and selling at the ask side
- **Trend Following:**
 - Constantly analyzing the order book for signs of order imbalances
- **Relative Value Arbitrage:**
 - Pairs trading, cross market arbitrage, and volatility arbitrage
- **Liquidity Detection:**
 - Capturing spread differentials across markets of related assets
- **News-Based Trading:**
 - Analyzing news faster than others and trading ahead of the crowd
- **Fund of Funds Approach:**
 - Selectively investing in managers with proven track record (UltraHF Capital)

Electronic Market Making

- This strategy strives to earn all or at least part of the difference between bid and ask by continuously buying at the bid and selling at the ask side
- The target is to have ideally no position at all at the end of a trading day. Positions are kept very small and are turned quickly and in very high frequency
- On average, the strategy buys as many times as it sells and buys and sells in equal risk adjusted nominal amounts, each time earning a spread. The risk of losses is further minimized by maximum diversification across underlyings and by keeping quote and position sizes small
- In some European and Asian markets, additional fee rebates and even stipends are offered for liquidity providers, further increasing profit potential

Trend Following

- This strategy analyses the order book in a large number of securities for signs of order imbalances
- If, for example, a large sell order is detected, the strategy attempts to sell before the bulk of the sell order enters the market and tries to buy back the initially sold amounts from the final balance of the large sell order at a then most likely lower price
- Indications for selling pressure can, for example, be repeated hits of the bid price or a significantly larger total number and volume of sell orders than buy orders
- The real time analysis of the order book is not possible for a human, as changes are too fast for the human eye and brain to capture

Relative Value Arbitrage

- Pairs trading is analyzing the very short-term relationship of two correlated securities. If one of the securities in a pair moves away, on average, there is an expectancy that the related security will follow and close the gap
- Cross-market arbitrage is looking at identical or closely linked securities listed on different markets and in different time zones and takes advantage of non synchronous moves on the different markets
- Volatility arbitrage is observing the relationships between as many listed derivatives contracts as possible on a specific underlying and takes advantage of fluctuations and mean reversion of stable relative relationships between different strikes and expirations within and across underlyings

Liquidity Detection

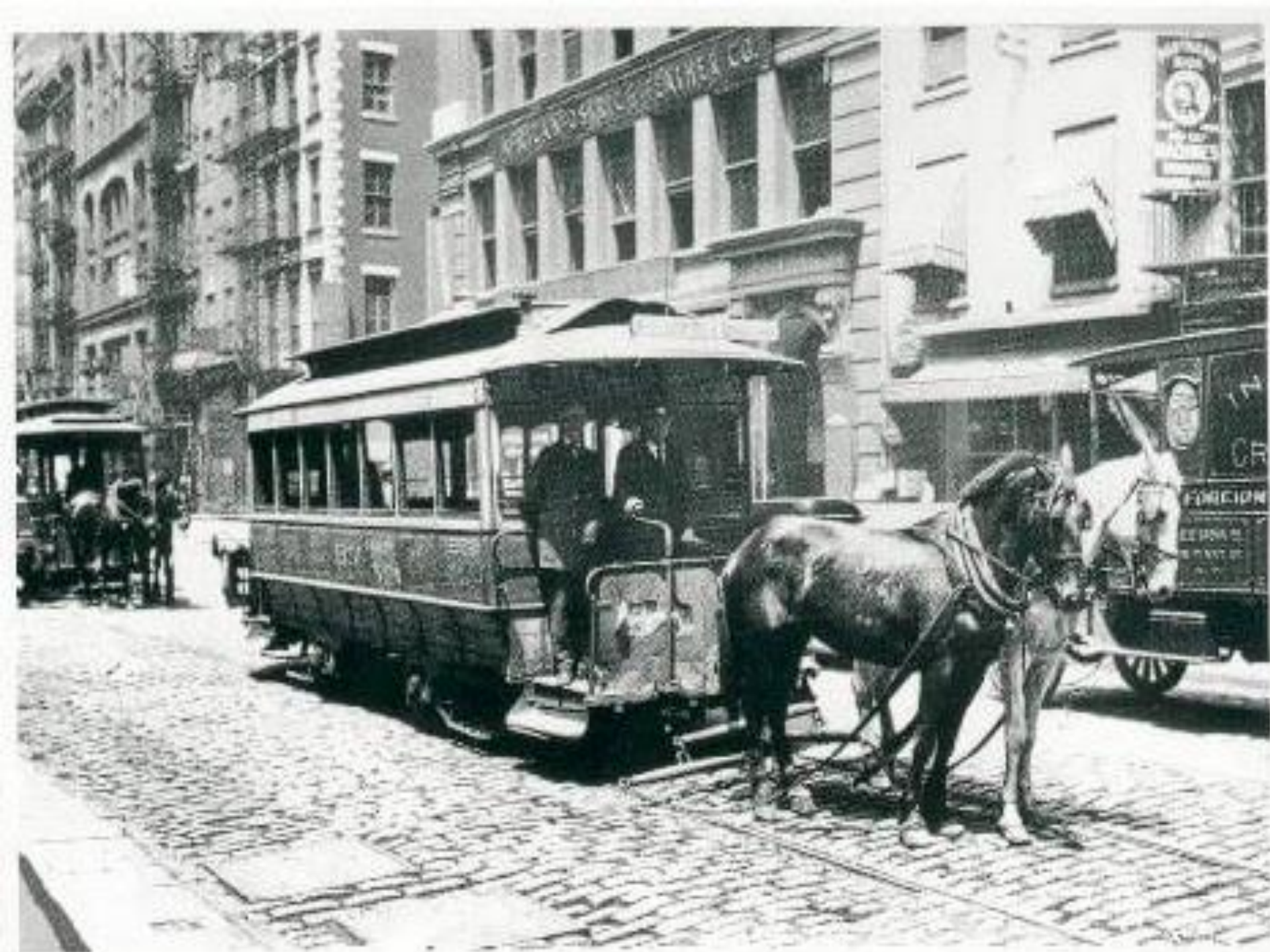
- This strategy is a combination of first three strategies. The differential liquidity and speed of movement of related products and markets is exploited
- By providing liquidity at certain times and taking liquidity at other times, one can create opportunities to gain relative premiums and spread deviations
- Profits come from spread differentials across markets of related underlyings or assets, including currency conversions as well as liquidity lead-lag relationships between faster and slower markets. This is exploitable not only within asset classes but also across asset classes
- The more statistical nature of this strategy requires significant diversification across underlyings, markets, and asset classes

News-Based Trading

- This strategy electronically subscribes to news feeds and analyzes them for potentially market moving news, such as earnings disappointments or surprisingly bad or good general economic news such as employment data or inflation numbers
- It takes the computer under a second to read and interpret the news story. The computer can already trade on the news, while a human is still reading the first word of a story
- Very few markets and securities are yet traded this way. So, the lag of markets that are not traded this way compared to those markets that are traded this way is substantial. If one analyzes the news faster than others and how they impact the market, one can trade ahead of the crowd

The Present and Future of High-Frequency Trading

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- **High-Frequency Trading has been referred to as the natural progression of technology applied to the investing and trading worlds**
- In the process, High-Frequency Trading has unmasked structural issues in the U.S. equity markets that are currently being examined by legislators and regulators
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What Happened to the Horse Cars?

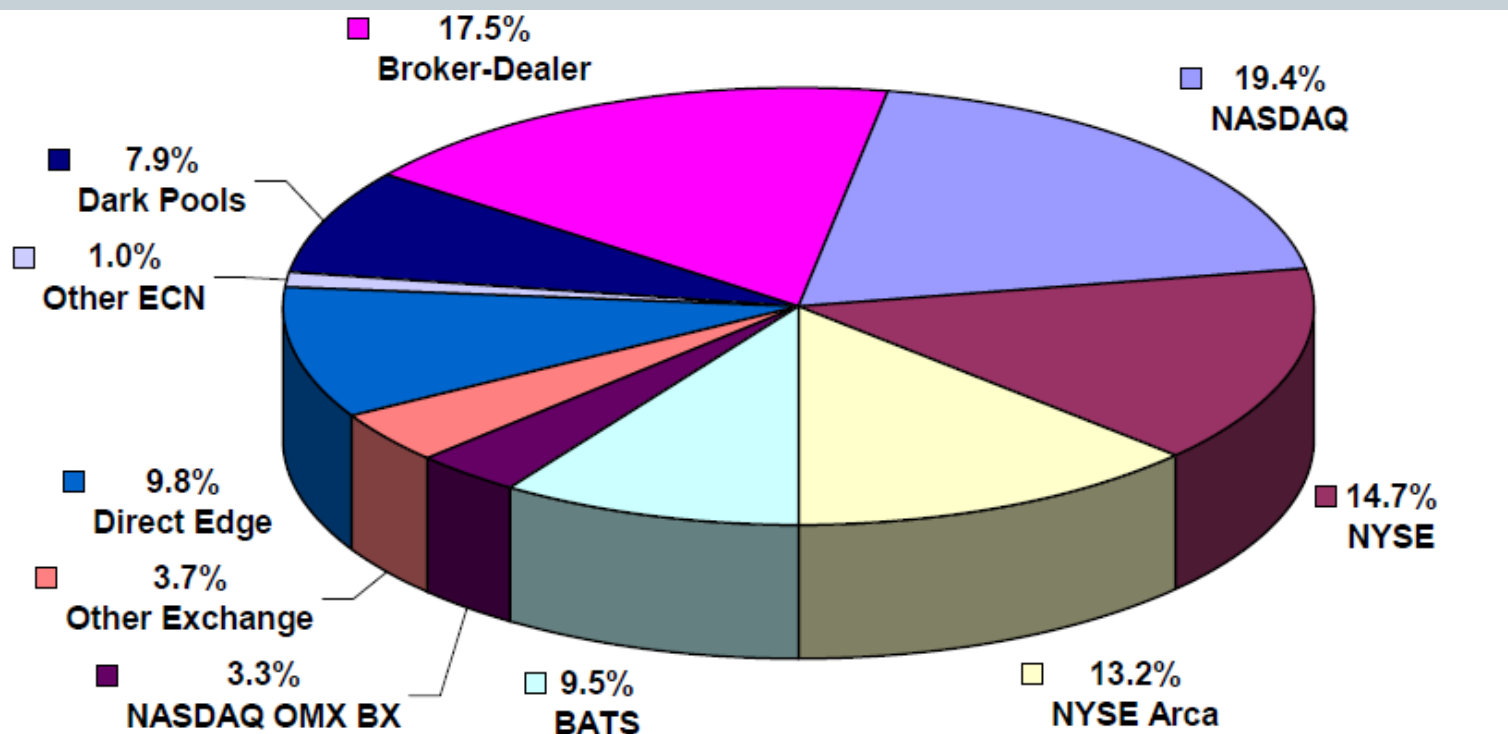
- Horses deposited tons of feces and gallons of urine on the streets every day
- A horse could work only part of the day, but would eat all day
- A horse car could run all day, but it would require many changes of horses
- A line's investment in horses could be wiped out by diseases
- Horses could not pull cars up steep hills

Technology and Changes to Market Structure

Key Enablers

- **Technological innovation:**
 - Faster, cheaper computing power
 - Advancements in the field of complex event processing
 - Increase in availability of low-latency bandwidth
- **Shift to electronic trading**
- **Rise of alternative trading systems**
- **Decimalization**
- **Regulatory changes such as Reg NMS:**
 - Order Protection Rule
 - Access Rule
 - Sub-Penny Rule
 - Market Date Rules (SROs funding)

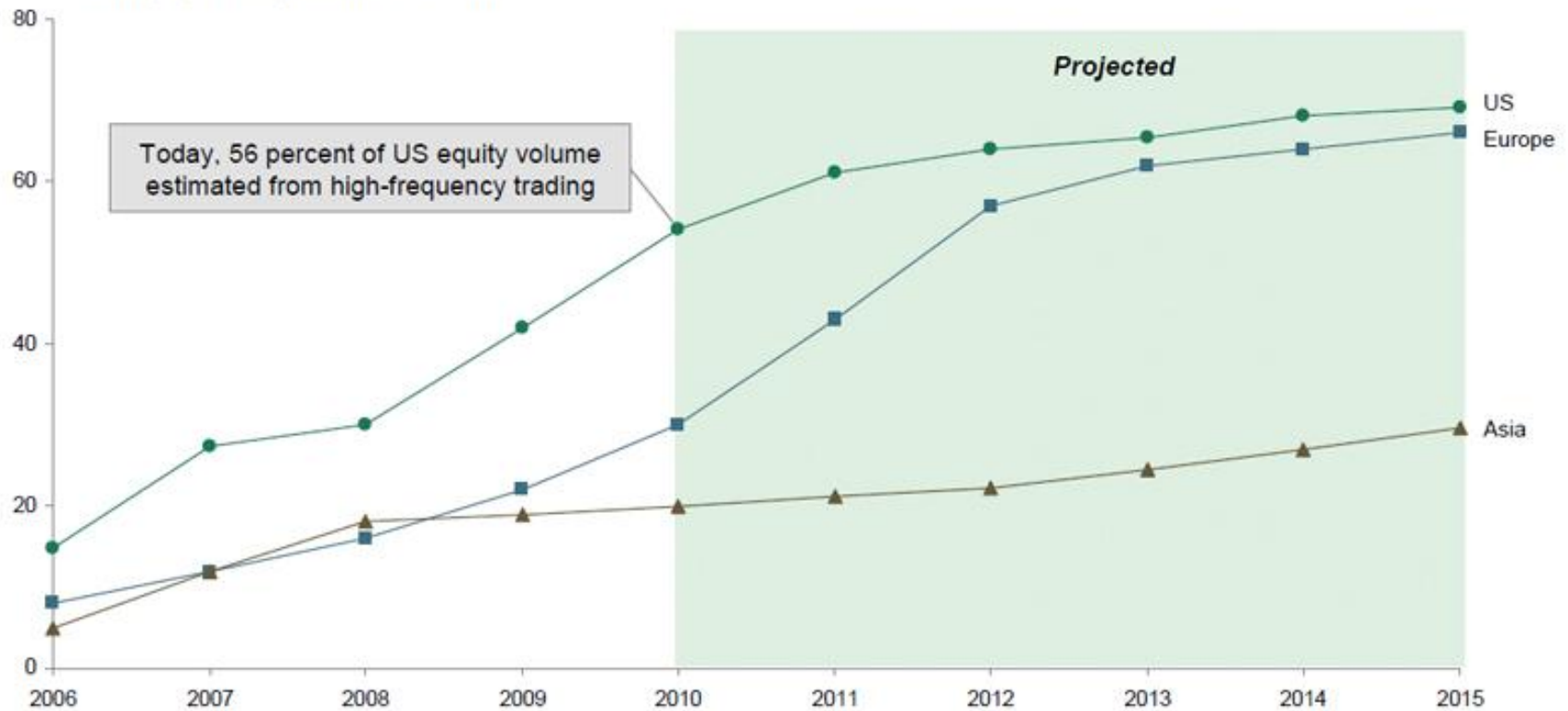
Trading Centers and Estimated % of Share Volume in NMS Stocks (September 2009)



NASDAQ	NYSE	NYSE Arca
BATS	NASDAQ OMX BX	Other Registered Exchange
ECN: 2 Direct Edge	ECN: 3 Others	Dark Pools Approximately 32
Broker-Dealer Internalization More than 200		

Significant Growth in High-Frequency Trading

% of total equity trading volume from HFT



Source: TABB Group, BCG analysis

High-Frequency Trading a Natural Evolution of the Securities Markets

- There is a clear evolutionary process in the adoption of new technologies triggered by competition, innovation and regulation
- Like all other technologies, High-Frequency Trading enables sophisticated market participants to profit on their investments – especially in technology – and compensation for their market, counterparty and operational risk exposures

Trends in Trading Activity, Partly Driven by High-Frequency Trading

Average daily trades

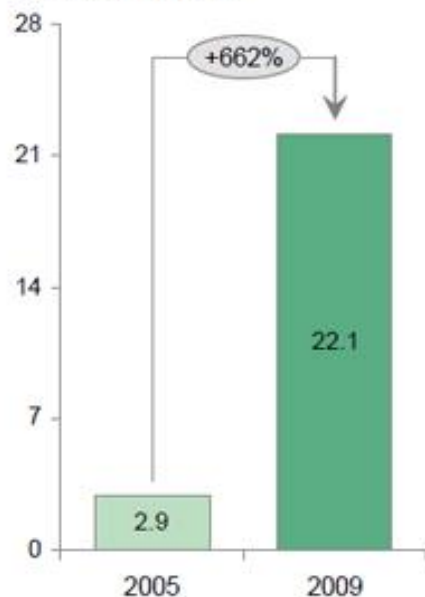
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Average trade size

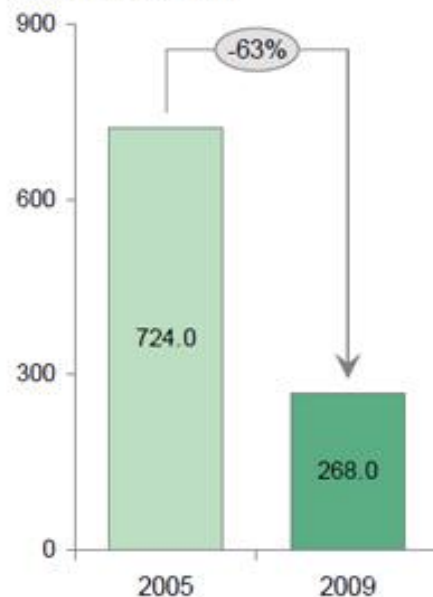
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Average daily volume

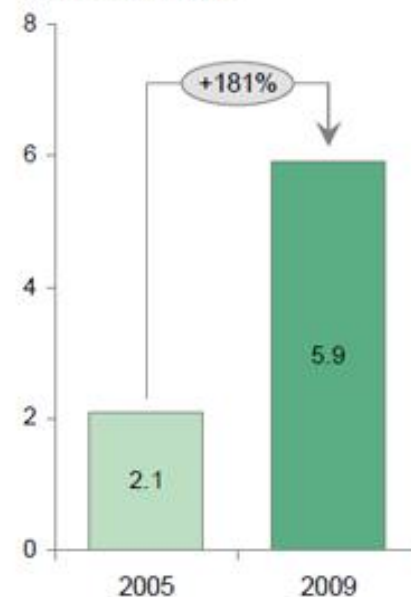
Trades (millions)



Shares per trade



Shares (billions)



Note: All data is consolidated NYSE-listed

Source: US Securities and Exchange Commission, "Concept Release on Equity Market Structure," 1/14/2010 [Release 34-61358; File S7-02-10], BCG analysis.

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The Flash Crash According to David Cummings

- “Wow! Who puts in a \$4.1 billion order without a limit price?”
- “This was a human mistake. The trader could have easily put a price limit on the order, but recklessly chose not to. The Sell Algorithm performed exactly as it was designed. It angers me when people blame technology for what are clearly lapses in human judgment.”
- “Now that the regulators know what happened, what are they going to do? Is there any penalty for massively disrupting the market? Are we going to let people throw around billion-dollar orders with no understanding of market impact?”

What do Warren Buffett and James Simons Have to Say About the Flash Crash?

- Buffett: “I didn’t know what was going on for 15, 20 minutes, but it didn’t make any difference. There’s probably some mechanical aspect that I don’t understand that needs some work, but it didn’t raise fundamental questions in my mind about either the economy or the markets.”
- Simons: “The crash of ’87, the market went straight down 22, 23 percent, in a few hours. Nobody stepped in to stop it. And everybody was selling, and it ended up flat on its back where it stayed for, you know, weeks and months, and— gradually crawled back. Flash crash lasted seven minutes, maybe. There was enough action, enough people came back, and the whole thing was reversed. In my opinion, the system worked beautifully compared to the way it worked in October of 1987, 23 years earlier”

What is the Securities and Exchange Commission to Do?

- **Circuit breakers:** adopted in May 2010 for 404 NYSE listed S&P 500 stocks and widened in September for Russell 1000 stocks to halt or slow down trades of a particular stock if the price moves 10% or more in a five-minute period
- **Limit up, limit down:** it would require that trades in all listed stocks be executed within a range tied to the recent prices for that security. It would impose a five-minute pause if trading is unable to occur within the price band for more than 15 seconds
- **Consolidated audit trail:** trade tagging and data collection system that would help the SEC track information about trading orders so it can better understand the fast-paced markets
- **Same responsibilities as traditional market makers:** as specialists at NYSE or Nasdaq, to have both a bid and an offer when they want to publish a quote

Is a Tax on Automated Transactions the Way to Go?

- French Senate has approved plans to establish a tax on automated transactions in France.
- This new initiative proposes to impose from January 1, 2012, a tax on certain investment service providers in cases where daily cancellation rates for orders for buying and selling financial instruments on public markets exceed 50%.
- The Senate Finance committee had warned that the many potentially very harmful effects associated with high frequency trading posed a systemic risk, notably in terms of operational risk, permanent instability of orders, distortions of competition, and market abuse and manipulation.
- A financial tax in the US? In Europe? Both? To be continued.

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The Potential for High-Frequency Trading

- **High-Frequency Trading firms:**
 - Move away from the stock market as there has been lower volatility and volume
 - Now increasingly active in markets like futures and currencies, where volatility remains high
- **The volatility debate**
 - “High frequency trading reduces volatility in stock markets rather than exacerbates it”, Professor Alex Frino, University of Sydney Business School
 - "It's not high-frequency traders that are catalysts for the volatility", Seth Merrin, CEO, Liquidnet
- **What comes next:**
 - New asset classes
 - New geographies
 - More sophisticated tools than ever

New Asset Classes

- In U.S. equity markets, High-Frequency Trading has decreased to 53% of stock-market trading volume, from 61% in 2009
- In U.S. futures markets, High-Frequency Trading accounts for 28% of the total volume, an increase from 22% in 2009
- Of all foreign-exchange flows, High-Frequency Trading accounted for roughly 30%, as of 2010, compared with 13% in 2004
- Cross-asset trading:
 - Real-time position monitoring and efficient collateral management
 - Will enable participants to hide their strategy from competitors

New Geographies

- The U.S. and European capital markets have been through a number of developments from the implementation of sophisticated trading technology to the evolution of their regulatory frameworks, which have fostered the emergence of High-Frequency Trading strategies
- High-Frequency Trading activity has so far been focused on the equity markets, and here it has ensured consistency in a fragmented European market
- Speed traders now account for around 15% of Asia-Pacific equity trading volumes
- Japan is the leading venue for High-Frequency Trading, accounting for nearly half of all activity in Asia-Pacific, with 45% penetration. Singapore and Hong Kong following closely
- High-Frequency Trading now accounts for 6% of Brazil's BM&Fbovespa's total volume and 25% of orders in India's Bombay Stock Exchange

More Sophisticated Tools Than Ever

- GPUs (Graphical Processing Units): Recent developments in high performance computing provide strong evidence that graphic cards can be successfully used as high-performance many-core processors. Usually provide advantageous scalability in terms of calculations that can be done in parallel, plus savings in terms of electric power consumption, computing power and heat emission
- FPGA (Field Programmable Gate Arrays): Acceleration using hardware. Really good at doing bit-level manipulation, which makes them particularly well suited for certain types of signal processing

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