

Bibliography

Introduction

This document is a bibliography of resources on the capital markets, particularly on some of the negative effects of high frequency trading (HFT). It contains a wide variety of evidence-based academic, government, and industry research.

Research noted here also discusses how the most common business model employed by today's high frequency traders (unregulated market making or "scalping") can be disruptive - several of these studies even predate automation.

Along with evidence-based research, this bibliography includes press editorials, op-eds, other commentary, and a variety of statements from government bodies and government officials from around the world about high frequency trading.

- R. T. Leuchtkafer, December 2012

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High frequency trading defined

Definitions of "high frequency trading" (HFT) can vary, but every definition published to date includes one common attribute: High frequency trading includes any business model or trading strategy where positions in the market are bought and sold quickly, often hundreds or even thousands of times a day. High frequency traders rarely hold on to a position overnight, and usually close a position within minutes or even within seconds.

Industry participants

"The main innovation that separates high-frequency from low-frequency trading is a high turnover of capital in rapid computer-driven responses to changing market conditions."

-Irene Aldridge, *High-Frequency Trading: A Practical Guide to Algorithmic Strategies and Trading Systems* (2009).

"While traditional buy-side trading strategies hold positions for weeks or even months, HFT is characterized by fast turnover of capital. Instead of capturing large price changes over extended periods of time, HFT aims to book multiple small gains over short periods of time. An overwhelming 86% [of survey respondents] believe that the term 'high-frequency trading' referred strictly to holding periods of only one day or less."

-Irene Aldridge, "FINalternatives Survey: High-Frequency Trading has a Bright Future," (2009).

"High frequency trading is best understood as a subset of algorithmic trading that is characterized by high levels of messaging deployed in a very low latency infrastructure as well as high turnover with short holding periods."

CME Group letter, "Public Comment on Consultation Report: Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency," (2011).

"High-frequency trading is a method of trading that involves frequent turnover of positions, not a strategy in itself."

FIA Principal Traders Group / European Principal Traders Association, "FIA Principal Traders Group and FIA European Principal Traders Association Response to the IOSCO Consultation Report: Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency," (2011).

Academics

"HFTs are identified as those firms with high volume, low intraday inventory, and low overnight inventory...The categorization of traders used in this paper is based on capturing the common characteristics of a high frequency trader: a market participant who trades a large number of contracts, consistently maintains a low inventory level, and ends the day at or near a zero inventory position."

Baron, Brogaard, Kirilenko, "The Trading Profits of High Frequency Traders" (2012).

"HFT is a type of investment strategy whereby stocks are rapidly bought and sold by a computer algorithm and held for a very short period, usually seconds or milliseconds."

Jonathan Brogaard, "The Activity of High Frequency Traders", (2011).

"High frequency traders submit and cancel a massive number of orders and execute a large number of trades, trade in and out of positions very quickly, and finish each trading day without a significant open position."

Cvitanic, Kirilenko, "High Frequency Traders and Asset Prices" (2010).

"Indeed, the typical high frequency market maker turns over his or her inventory 5 or more times a day, explaining how high frequency firms have come to have such a high share of trading volume. These market makers also seek to hold very small or even zero inventory positions at the end of the session. "

Easley, Lopez de Prado, O'Hara, "The Microstructure of the 'Flash Crash'", (2010).

"Like traditional intermediaries HFTs are central to the trading process, have short holding periods, and trade frequently."

Hendershott, Riordan, "High Frequency Trading and Price Discovery", (2011).

Regulators

"[H]F traders execute trades in matters of milliseconds on electronic order books and hold new equity positions possibly down to a 'sub-second.' HFT generally involves getting in and out of positions throughout the day with a 'flat' position at the end of the day."

Committee of European Securities Regulators, "Micro-structural issues of the European equity markets" (2010) .

"Trading activities that employ sophisticated, algorithmic technologies to interpret signals from the market and, in response, implement trading strategies that generally involve the high frequency generation of orders and a low latency transmission of these orders to the market. Related trading strategies mostly consist of either quasi market making or arbitraging within very short time horizons. They usually involve the execution of trades on own account (rather than for a client) and positions usually being closed out at the end of the day."

European Securities and Markets Authority, "Final Report: Guidelines on systems and controls in an automated trading environment for trading platforms, investment firms and competent authorities." (2011) .

"We generally characterise HFT as automatically generating large numbers of orders based on price movements and market information, holding positions for a very short time, and ending the day with a zero position."

Greg Medcraft, Chairman, Australian Securities and Investments Commission (2012).

"Other characteristics often attributed to proprietary firms engaged in HFT are...(3) very short time-frames for establishing and liquidating positions..."

Mary L. Schapiro, Chairman, U.S. Securities and Exchange Commission, testimony before the Subcommittee on Securities, Insurance, and Investment of the United States Senate Committee on Banking, Housing, and Urban Affairs, May 20, 2010.

"A number of common features and trading characteristics related to HFT can be identified...It is characterized by a high daily portfolio turnover and order to trade ratio (i.e. a large number of orders are cancelled in comparison to trades executed); It usually involves flat or near flat positions at the end of the trading day...Positions are often held for as little as seconds or even fractions of a second."

Technical Committee of the International Organization of Securities Commissions, "Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency: Final Report" (2011) .

"Other characteristics often attributed to proprietary firms engaged in HFT are...(3) very short timeframes for establishing and liquidating positions..."

U.S. Securities and Exchange Commission, "Concept Release of Equity Market Structure" (2010) .

"There is no widely accepted definition of HFT, but it typically exhibits some common characteristics, such as: (1) high volume of trades on a daily basis but low level of profits per trade; (2) extreme short stock holding period (I know of one HFT firm operated out of the west coast of the US that boasts its average holding period for US equities is 11 seconds); (3) submitting numerous orders; and (4) no significant open position overnight."

Martin Wheatley, CEO of the Securities and Futures Commission in Hong Kong, and former deputy chief executive of the London Stock Exchange, (2010).

Evidence-based research papers

Author(s), Title, Year	Evidence	Relevant findings
Anand, Tanggaard, Weaver, " Paying for Market Quality " (2009)	Swedish equities, 2002-2004	Designated market makers with affirmative obligations improve market quality, increase market valuation.
Bank for International Settlements, " High frequency trading in the foreign exchange market " (2011)	Foreign exchange, 2010 and 2011	"HFT has had a marked impact on the functioning of the FX market in ways that could be seen as beneficial in normal times, but also in ways that may be harmful to market functioning, particularly in times of market stress."
Baron, Brogaard, Kirilenko, " The Trading Profits of High Frequency Traders " (2012)	U.S. futures, 2010-2012	"First, HFTs are profitable, especially Aggressive (liquidity-taking) HFTs, and generate high Sharpe ratios. Second, HFTs generate their profits from all other market participants, and do so mainly in the short and medium run (seconds to minutes). Third, firm concentration in the HFT industry is not decreasing over time, nor is its profitability. We conjecture this is tied to our fourth finding that HFTs profits are persistent, new entrants have a higher propensity to underperform and exit, and the fastest firms (in absolute and in relative terms) make up the upper tail of performance."; "While all work done to date considers HFT to be a single type of trading activity, we show the wide heterogeneity of trading strategies, profits, and speed within the E-mini market."
Ben-David, Franzoni, Moussawi, " ETFs, Arbitrage, and Shock Propagation " (2012)	U.S. equities 1998-2011	"[O]ur results also provide support for the claim that high-frequency trading has the potential to rapidly propagate liquidity shocks across markets."; "As much of ETF arbitrage is carried out at high frequencies, the evidence in the paper seems to suggest that HFT adds to the non-fundamental volatility of asset prices, at the very least. In more extreme situations, such as the Flash Crash, HFT can be highly destabilizing as it propagates shocks across markets at very high speed."
Benos, Sagade, " High-frequency trading behaviour and its impact on market quality: evidence from the UK equity market " (2012)	U.K. equities, 2011 or 2012	"It thus appears that the more HFTs trade aggressively the more they contribute to both price discovery and excess volatility."

<p>Bichetti, Maystre, "The synchronized and long-lasting structural change on commodity markets: evidence from high frequency data" (2012)</p>	<p>U.S. futures and equities, 1997-2011</p>	<p>"This paper documented striking similarities in the evolution of the rolling correlations between the returns on several commodity futures and the ones on the US stock market, computed at high frequencies...we think that HFT strategies, in particular the trend-following ones, are playing a key role...commodity markets are more and more prone to events in global financial markets and likely to deviate from their fundamentals."</p>
<p>Boehmer, Fong, Wu, "International Evidence on Algorithmic Trading" (2012)</p>	<p>Equities in 37 countries (excluding U.S.), 2001-2009</p>	<p>"Overall, our results show that algorithmic trading often improves liquidity, but this effect is smaller when market making is difficult and for low-priced or high-volatility stocks. It reverses for small cap stocks, where AT is associated with a decrease in liquidity. AT usually improves efficiency. The main costs associated with AT appear to be elevated levels of volatility. This effect prevails even for large market cap, high price, or low volatility stocks, but it is more pronounced in smaller, low price, or high volatility stocks."</p>
<p>Boehmer, Fong, Wu, "Algorithmic Trading and Changes in Firms' Equity Capital" (2012)</p>	<p>Equities in 37 countries (excluding U.S.), 2001-2009</p>	<p>"Our findings suggest that the activity of algorithmic traders can have impact beyond the immediate trading environment and potentially affect the more fundamental functions of capital markets, such as the allocation of capital to firms."; "We find that greater AT intensity is, on average, associated with declines in equity capital in the next year. This result is only partly driven by a decline in new securities issues; rather, greater AT intensity is associated with an increase in repurchase activity. These results control for market capitalization, book-to-market, volatility, liquidity, and information asymmetry at the firm level, and for secular trends at the market level..."</p>
<p>Boni, Brown, Leach, "Dark Pool Exclusivity Matters" (2012)</p>	<p>U.S. equities, 2011</p>	<p>Excluding HFT from a market center results in lower volatility, less front-running, and higher execution quality for institutional traders.</p>
<p>Boulton, Braga-Alves, Kulchania, "The Flash Crash: Effects on Shareholder Wealth and Market Quality" (2012)</p>	<p>U.S. equities, 2010</p>	<p>"We show that the flash crash was not just a 20 minute glitch as it has been described in [the] popular press. Overall, the flash crash is a significant event that affected shareholder wealth, trading costs, and volatility of stocks."; "Our results suggest that seemingly fleeting events, such as the flash crash, can have dramatic and lingering effects on shareholder wealth and market quality."</p>
<p>CFA Institute, "Dark Pools, Internalization, and Equity Market Quality" (2012)</p>	<p>U.S. equities, 2009-2011</p>	<p>"The results from this study suggest that if a majority of trading in a given stock takes place in undisplayed venues, spreads</p>

		will likely increase and market quality will deteriorate. If the majority of order flow is filled away from pre-trade transparent markets, investors could withdraw quotes because of the reduced likelihood of those orders being filled. As investors become disincentivized from displaying orders, bid–offer spreads are likely to widen. Therefore, competition should be maintained to encourage aggressive quoting in displayed order books and a predominance of dark trading should be avoided.”
Chae, Wang, " Determinants of Trading Profits: The Liquidity Provision Decision " (2009)	Taiwanese equities, 1997-2002	Absent mandatory obligations, market maker privileges don't induce market makers to provide liquidity; privileged but unconstrained market makers make profits when demanding liquidity in their own informed trades; unconstrained market makers are informed traders rather than liquidity providers in most scenarios.
Chung, Chuwonganant, " Uncertainty, Fear, and Liquidity " (2012)	U.S. equities, 1997, 2001, 2007-2009	"Based on this result, we conjecture that higher volatility in asset prices and larger fluctuations in liquidity in recent years may be due, at least in part, to the reduced role of [traditional, regulated] market makers and the increased role of high-frequency traders who do not have the affirmative obligation of the traditional market makers. These findings should prove useful to market regulators who are interested in devising a more robust market structure."
Dichev, Huang, Zhou, " The Dark Side of Trading " (2011)	U.S. equities, 1926-2009	"Our main finding is that, controlling for other factors, there is a reliable and economically substantial positive relation between volume of trading and stock volatility. The conclusion is that stock trading produces its own volatility above and beyond that based on fundamentals..."; "The combined impression from these results is that stock trading injects an economically substantial layer of volatility above and beyond that based on fundamentals, especially at high levels of trading."
Easley, Lopez del Prado, O'Hara, " The Microstructure of the Flash Crash " (2011)	U.S. futures, 2010	Unregulated or unconstrained HFT market makers can exacerbate price volatility when they dump inventory and withdraw, flash crashes will recur because of structural issues.
Egginton, Van Ness, Van Ness, " Quote Stuffing " (2012)	U.S. equities, 2010	"We find that quote stuffing is pervasive with several hundred events occurring each trading day and that quote stuffing impacts over 74% of US listed equities during our sample period. Our results show that, in periods of intense quoting activity, stocks

		experience decreased liquidity, higher trading costs, and increased short-term volatility. Our results suggest that the HFT strategy of quote stuffing may exhibit some features that are criticized in the media."
Ferguson, Mann, " Execution Costs and Their Intraday Variation in Futures Markets " (2001)	U.S. futures, 1992	Unregulated or unconstrained market makers in the futures market have much more rapid inventory cycles than (regulated) equity market makers, are active rather than passive traders, and "actively trade for their own accounts, profiting from their privileged access..."
Frino, Forrest, Duffy, " Life in the pits: competitive market making and inventory control-further Australian evidence " (1999)	Australian futures, 1997	Unregulated or unconstrained market makers are not passive liquidity providers, they behave aggressively like informed traders.
Frino, Jarnećić, " An empirical analysis of the supply of liquidity by locals in futures markets: Evidence from the Sydney Futures Exchange " (2000)	Australian futures, 1997	Unregulated or unconstrained market makers demand liquidity to profit from information advantages of privileged access, less likely to supply liquidity in volatile markets, almost as likely to demand as to supply liquidity.
Frino, Jarnećić, Feletto, " Local Trader Profitability in Futures Markets: Liquidity and Position Taking Profits " (2009)	Australian futures, 1997	Unregulated or unconstrained market makers are active and informed traders.
Golub, Keane, " Mini Flash Crashes " (2011)	U.S. equities, 2006-2010	"As soon as the [HFT] market maker's risk management limits are breached...the market maker has to stop providing liquidity and start to aggressively take liquidity, by selling back the shares bought moments earlier. This way they push the price further down and thus exaggerate the downward movement."
Golub, Keane, Poon, " High Frequency Trading and Mini Flash Crashes " (2012)	U.S. equities, 2006-2011	"We find strong evidence that Mini Flash Crashes have an adverse impact on market liquidity and are associated with Fleeting Liquidity."; "Given the speed and the magnitude of the crashes, it appears likely that Mini Flash Crashes are caused by HFT activity."
Government Office for Science, " Foresight: The Future of Computer Trading in Financial Markets. Final Project Report: Executive Summary " (2012)	Varied data; literature reviews	"A key message: despite commonly held negative perceptions, the available evidence indicates that high frequency trading (HFT) and algorithmic trading (AT) may have several beneficial effects on markets. However, HFT/AT may cause instabilities in financial markets in specific circumstances."

<p>Hautsch, Huang, "On the Dark Side of the Market: Identifying and Analyzing Hidden Order Placements" (2012)</p>	<p>U.S. equities, 2010</p>	<p>A frequent criticism of the proprietary data feeds exchanges sell to HFT firms is that the feeds reveal information investors reasonably believe is confidential; "Using data from the NASDAQ TotalView message stream allows us to retrieve information on hidden depth from one of the largest equity markets in the world."</p>
<p>Hirschey, "Do High-Frequency Traders Anticipate Buying and Selling Pressure?" (2011)</p>	<p>U.S. equities, 2009</p>	<p>"HFTs' aggressive purchases predict future aggressive buying by non-HFTs, and their aggressive sales predict future aggressive selling by non-HFTs"; "These findings suggest HFTs trade on forecasted price changes caused by buying and selling pressure from traditional asset managers."</p> <p>Note that while the author writes that "On net, it is probable HFTs have a positive impact on market quality" because of tighter spreads, investment managers might disagree.</p>
<p>Johnson, Zhao, Hunsader, Meng, Ravindar, Carran, Tivnan, "Financial black swans driven by ultrafast machine ecology" (2012)</p>	<p>U.S. equities, 2006-2011</p>	<p>The authors study "18,520 ultrafast black swan events that we have uncovered in stock-price movements between 2006 and 2011" and find "an abrupt system-wide transition from a mixed human-machine phase to a new all-machine phase characterized by frequent black swan events with ultrafast durations."</p>
<p>Joint CFTC-SEC Advisory Committee on Emerging Regulatory Issues, "Recommendations Regarding Regulatory Responses to the Market Events of May 6, 2010" (2011)</p>	<p>U.S. futures and equities, 2010</p>	<p>"In the present environment, where high frequency and algorithmic trading predominate and where exchange competition has essentially eliminated rule-based market maker obligations, liquidity problems are an inherent difficulty that must be addressed. Indeed, even in the absence of extraordinary market events, limit order books can quickly empty and prices can crash simply due to the speed and numbers of orders flowing into the market and due to the ability to instantly cancel orders."</p>
<p>Kang, Shin, "The Role of High Frequency Traders in Electronic Limit Order Markets" (2012)</p>	<p>Korea futures, 2007</p>	<p>"We find that when high frequency traders make use of fleeting orders actively, the level of informativeness in the limit order book declines. This evidence suggests, albeit indirectly, that massive use of limit orders including revision and cancellation by high frequency traders may potentially have negative effects on the market."</p>
<p>Kim, Murphy, "The Impact of High-Frequency Trading on Stock Market Liquidity Measures" (2011)</p>	<p>U.S. equities, 1997-2009</p>	<p>Traditional market microstructure models have significantly underestimated market spreads in recent years. This is because of how trade sizes have decreased with the recent dominance of high frequency trading. When the authors correct for this they find</p>

		that spreads have not decreased as much as HFT proponents believe.
Kirilenko, Samadi, Kyle, Tuzun, " The Flash Crash: The Impact of High Frequency Trading on an Electronic Market " (2010)	U.S. futures, 2010	Unregulated or unconstrained HFT market makers exacerbated price volatility in the Flash Crash, hot potato trading, two minute market maker inventory half-life; "[H]igh Frequency Traders exhibit trading patterns inconsistent with the traditional definition of market making. Specifically, High Frequency Traders aggressively trade in the direction of price changes...when rebalancing their positions, High Frequency Traders may compete for liquidity and amplify price volatility."
Kurov, Lasser, " Price Dynamics in the Regular and E-Mini Futures Markets " (2004)	U.S. futures, 2001	Unregulated or unconstrained market makers demand liquidity to profit from information advantages of privileged access.
Linton, O'Hara, " The impact of computer trading on liquidity, price efficiency/ discovery and transaction costs " (2011)	Literature review and survey	"The nature of market making has changed, shifting from designated providers to opportunistic traders. High frequency traders now provide the bulk of liquidity, but their use of limited capital combined with ultra-fast speed creates the potential for periodic illiquidity"; in "regular market conditions," liquidity has improved and transaction costs are lower.
Locke, Sarajoti, " Interdealer Trading in Futures Markets " (2004)	U.S. futures, 1995	Unregulated or unconstrained market makers demand liquidity to manage inventories.
Lyons, " A Simultaneous Trade Model of the Foreign Exchange Hot Potato " (1997)	Model derived from empirical studies of 1992 U.S. foreign exchange market.	Demonstrates hot potato trading among unregulated or unconstrained market makers. "Hot potato trading" means cascading inventory imbalances from market maker to market maker in response to a large order. Hot potato trading explains most of the volume in foreign exchange markets. Hot potato trading is not innocuous - it makes prices less informative. <i>See also</i> Kirilenko, Samadi, Kyle, Tuzun, " The Flash Crash: The Impact of High Frequency Trading on an Electronic Market ".
Lyons, " Foreign exchange volume: Sound and fury signifying nothing? " (1996)	U.S. foreign exchange, 1992	Unregulated or unconstrained market makers cascade inventory imbalances from one to another, as "...trading begets trading. The

		<p>trading begotten is relatively uninformative, arising from repeated passage of inventory imbalances among dealers...this could not arise under a specialist microstructure."</p> <p>See <i>also</i> Kirilenko, Samadi, Kyle, Tuzun, "The Flash Crash: The Impact of High Frequency Trading on an Electronic Market".</p>
Manaster, Mann, " Life in the pits: competitive market making and inventory control " (1996)	U.S. futures, 1992	Unregulated or unconstrained market makers aggressively manage inventory, are "active profit-seeking," have much shorter inventory cycles than equities market makers.
Manaster, Mann, " Sources of Market Making Profits: Man Does Not Live by Spread Alone " (1999)	U.S. futures, 1992	Unregulated or unconstrained market makers demand liquidity to profit from information advantages of privileged access, are "predominant" informed traders.
Madhavan, " Exchange-Traded Funds, Market Structure and the Flash Crash " (2011)	U.S. equities, 1994-2011	"We show that the impact of the Flash Crash across stocks is systematically related to prior market fragmentation."; "Using intraday trade data from January 1994-September 2011, we find that fragmentation now is at the highest level recorded."; "The link to higher frequency quotation activity and the current high levels of fragmentation help explain why a Flash Crash did not occur before and offers a counterpoint to the view that the Flash Crash stemmed from an unlikely confluence of events."
McInish, Upson " Strategic Liquidity Supply in a Market with Fast and Slow Traders " (2012)	U.S. equities, 2008	"We model and show empirically that latency differences allow fast liquidity suppliers to pick off slow liquidity demanders at prices inferior to the NBBO. This trading strategy is highly profitable for the fast traders."; "[O]ur research focuses on the ability of fast liquidity suppliers to use their speed advantage to the detriment of slow liquidity demanders, which we believe unambiguously lowers market quality. The ability of fast traders to take advantage of slow traders is exacerbated in the U.S. by the regulatory and market environment that we describe below."
Nanex, " Ongoing Research - Market Events and Phenomena " (2010-2012)	U.S. futures and equities, 2006-2012	Nanex has prepared some of the most compelling - and disturbing - evidence-driven analyses of U.S. capital market dislocations publicly available.

<p>Nasdaq, "Self-Regulatory Organizations: The NASDAQ Stock Market LLC: Notice of Filing of Proposed Rules Change to Amend Rule 4758(a)(1) (A) to Reflect a Change in Nasdaq's Routing Functionality" (2012)</p>	<p>U.S. equities</p>	<p>A remarkable statement by an exchange that quotes posted on US exchanges are often fleeting and inaccessible, resulting in inferior prices for investors; "NASDAQ has observed that upon partial execution of a routable order at NASDAQ...market participants often react to the order by cancelling their orders on other markets and entering new orders at inferior prices. This occurs because the current process directs the order to NASDAQ before attempting to access available liquidity at other markets and thereby allows market participants to react to the execution (an effect known as 'market impact' or 'information leakage'). As a consequence, the available shares at the away market are no longer available, resulting in a lower likelihood of successfully accessing liquidity on away markets (i.e., the 'fill rate') and an increased likelihood of ultimately receiving an execution at an inferior price."</p> <p>See also Van Kervel, "Liquidity: What You See is What You Get?"</p>
<p>Panayides, "Affirmative obligations and market making with inventory" (2007)</p>	<p>U.S. equities, 1991 and 2001</p>	<p>Mandatory market maker obligations reduce volatility.</p>
<p>Pragma Securities, "HFT and the Hidden Cost of Deep Liquidity" (2012)</p>	<p>US equities, 2011 and 2012</p>	<p>"In this essay we present evidence that high-frequency traders' ('HFTs') profits come at the expense of investors. In competing to earn spreads and exchange rebates by posting passive orders, HFTs crowd out directional traders' passive orders, force them to cross the spread more often, and result in higher trading costs for investors."</p>
<p>Quantitative Services Group, "Liquidity Change and Price Reversals: Is High Frequency Trading Adding Insult to Injury?" (2010)</p>	<p>U.S. equities, 2008-2009</p>	<p>"Changes in the microstructure of equity markets and the emergence of HFT competitors have changed the nature and magnitude of transaction costs. Sophisticated pattern recognition algorithms now present a real return burden to active equity managers."; "Order anticipation strategies have long been a feature of equity markets. What have changed are the technology-fueled enhancements for improved pattern recognition, speed of execution and breadth of coverage...The complexity of these interrelationships and their close proximity to legitimate market making activities will be a challenge for regulators to grapple with."</p>

Schroder Investment Management Limited, "High frequency trading: Credible research tells the story" (2011)	Literature review	"As standards in research continue to improve, simple default commentary such as HFT are 'liquidity providers,' HFT 'dampens volatility' and HFT 'decreases bid-ask spreads' have suffered something of a credibility anorexia despite their continued use by some."
Silber, "Marketmaker Behavior in an Auction Market: An Analysis of Scalpers in Futures Markets" , (1984)	U.S. futures, 1982-1983	Unregulated or unconstrained market makers profit from the information advantages of privileged access, two minute inventory cycles.
Smidt, "Trading Floor Practices on Futures and Securities Exchanges: Economics, Regulation, and Policy Issues" (1985)	Literature review and survey	On futures exchanges, inventory imbalances among unregulated or unconstrained market makers create "potentially unstable" markets and price overreactions during "scalper inventory liquidation."
United States Commodity Futures Trading Commission and Securities and Exchange Commission, "Findings Regarding the Market Events of May 6, 2010" (2010)	U.S. futures and equities, 2010	Unregulated or unconstrained HFT market makers exacerbated price volatility in the Flash Crash, hot potato trading. <i>See also</i> Kirilenko, Samadi, Kyle, Tuzun, "The Flash Crash: The Impact of High Frequency Trading on an Electronic Market"
United States Federal Trade Commission, "Report of the Federal Trade Commission on the Grain Trade," Volume 7 (1926)	U.S. futures, 1915-1922	Unregulated or unconstrained market makers both cause and exacerbate price volatility; "The scalpers who operate with reference to fractional changes within the day may have a stabilizing effect on prices so far as such changes with the day are concerned, but when the market turns they run with it, and they may accentuate an upward or downward movement that is already considerable."
Van der Wel, Menkveld, Sarkar, "Are Market Makers Uninformed and Passive? Signing Trades in the Absence of Quotes" (2009)	U.S. futures, 1994-1997	Unregulated or unconstrained market makers demand liquidity for a substantial part of the day and are active and informed speculators.

<p>Van Kervel, "Liquidity: What You See is What You Get?" (2012)</p>	<p>U.K. equities, 2009</p>	<p>"We show that a specific type of high-frequency traders, those who operate like modern day market makers, might in fact cause a strong overestimation of liquidity aggregated across trading venues. The reason is that these market makers place duplicate limit orders on several venues, and after execution of one limit order they quickly cancel their outstanding limit orders on competing venues. As a result, a single trade on one venue is followed by reductions in liquidity on all other venues."</p> <p>See also Nasdaq, "Self-Regulatory Organizations: The NASDAQ Stock Market LLC: Notice of Filing of Proposed Rules Change to Amend Rule 4758(a)(1)(A) to Reflect a Change in Nasdaq's Routing Functionality"</p>
<p>Venkataraman, Waisburd, "The Value of the Designated Market Maker" (2006)</p>	<p>French equities, 1995-1998</p>	<p>Designated market makers with affirmative obligations improve market quality, increase market valuation.</p>
<p>Wang, Chae, "Who Makes Markets? Do Dealers Provide or Take Liquidity?" (2003)</p>	<p>Taiwanese equities, 1997-2002</p>	<p>Absent mandatory obligations, market maker privileges don't induce market makers to provide liquidity; they derive profits from their own informed trades; "While dealers may be meant to perform the socially beneficial function of liquidity provision, the institutional advantages granted to them also give the ability to act as super-efficient proprietary traders if they choose to."</p>
<p>Weild, Kim, Newport "The Trouble with Small Tick Sizes" (2012)</p>	<p>U.S. equities, 1991-2011</p>	<p>"Rather than supporting long-term company growth by bringing research, sales and capital to investors, high-frequency traders seek to make a quick profit by identifying short-term price discrepancies."</p>
<p>Working, "Tests of a Theory Concerning Floor Trading on Commodity Exchanges" (1967)</p>	<p>U.S. futures, 1952</p>	<p>Unregulated or unconstrained market makers are also trend traders, profiting from the information advantages of privileged access; they can trade aggressively, especially when the market goes against the firm; inventory cycles of "minutes"; trend trading accelerates price changes (but the author believes may moderate extremes).</p>

<p>Ye, Yao, Gai, "The Externality of High Frequency Trading" (2012)</p>	<p>U.S. equities, 2010</p>	<p>"We find that stocks randomly grouped into the same channel have an abnormal correlation in message flow, which is consistent with the quote stuffing hypothesis."; "We also find that fleeting orders, or orders with a life less than 50 milliseconds, have trivial contributions to liquidity and no contributions to price efficiency."</p>
<p>Zhang, "High-Frequency Trading, Stock Volatility, and Price Discovery" (2010)</p>	<p>U.S. equities, 1985-2009</p>	<p>"[H]igh-frequency trading may potentially have some harmful effects" because "high-frequency trading is positively correlated with stock price volatility."</p>
<p>Zigrand, Cliff, Hendershott, "Financial stability and computer based trading" (2011)</p>	<p>Literature review and survey</p>	<p>Self-reinforcing feedback loops in computer-based trading can lead to significant instability in financial markets; market participants become inured to excessive volatility in a cultural "normalization of deviance" until a large-scale failure occurs; research to date has not shown a persistent increase in market volatility, but HFT research is nascent.</p>

Press editorials

["Wall Street Trades at Speed of Light Need Traffic Cops: View"](#)

Bloomberg, January 3, 2012

"At this point, it's beyond doubt that high-frequency trading contributes to volatility, fueling perceptions among retail investors that insiders have the game rigged."

See also ["U.S. Leads in High-Frequency Trading. Trails in Rules"](#).

["Asia takes on algos"](#)

Financial Times, August 14, 2012

"Two years after the 'flash crash' exposed the risks of automated trading systems running amok, this month's Knight Capital fiasco shows that the US Securities and Exchanges Commission has done too little to control the ever evolving technology traders now rely on to navigate fragmented markets."

See also ["Taming Trading"](#) and ["Calmer markets"](#).

["Wait a second: The latest cock-up on Wall Street shows that more safeguards are needed"](#)

Economist, August 11, 2012

"This newspaper seldom finds itself on the side of restraining either technology or markets. But in this case there is a doubt whether the returns justify the risk. Society needs a stockmarket to allocate capital efficiently, rewarding the best companies with higher share prices. But high-frequency traders are not making decisions based on a company's future prospects; they are seeking to profit from tiny changes in price. They might as well be trading baseball cards. The liquidity benefits of such trading are all very well, but that liquidity can evaporate at times of stress. And although high-frequency trading may make markets less volatile in normal times, it may add to the turbulence at the worst possible moment."

["When Speed Kills"](#)

The Japan Times, August 14, 2012

"Market officials and regulators are increasingly skeptical of the notion that faster is by definition better."

["High-frequency trading insanity"](#)

USA Today, September 26, 2012

"Slap a small transaction tax on rapid trades, impeding the practice and returning markets to their core purpose."

See also ["Flash-crash analysis leaves investors reason to worry"](#) and ["Time to put the brakes on high-frequency stock trades"](#)

["The Dark of Knight"](#)

Wall Street Journal, August 2, 2012

"From the 2010 'flash crash' to trading snafus at Facebook's initial public offering in May, the basic plumbing of the equity markets has never seemed so troubled."

Op-eds and commentary

["Stock-Order Rebates Should Be Stopped. Arnuk Says"](#)

Sal Arnuk and Joseph Saluzzi interviewed by Erik Schatzker and Stephanie Ruhle
Bloomberg, September 20, 2012

"What we've done is we've taken two deep liquidity pools and taken their worst feature - the worst feature - amplified it a billion times, mechanized it, and now that is our modern market structure."

See also http://www.themistrading.com/market_structure

["Serving All. Not Just the Elite Few"](#)

Sal Arnuk and Joseph Saluzzi, New York Times Room for Debate, August 6, 2012

"Trading today is mostly computerized scalping done under a sanitized name – 'market making.'"

["Introduction to HFT Scalping Strategies"](#)

Haim Bodek and Mark Shaw, Decimus Capital Markets, LLC / Haim Bodek Consulting, November 2012

"HFT scalping's impact on the equity markets include high frequency price fluctuations, high order cancellation rates and liquidity gaps."

["Not so fast: The risks posed by high-frequency trading"](#)

Buttonwood, Economist, August 6, 2011

"The problem may be that, unlike marketmakers, HFT investors have no obligation to trade in difficult conditions."

["SEC must put a stop to casino markets"](#)

Leon Cooperman, Sal Arnuk and Joseph Saluzzi, Financial Times, September 24, 2012

"Clearly, the SEC's market structure experiment has failed. Unless something changes, confidence-shaking events will only increase in frequency."

["The Day The Market Almost Died \(Courtesy Of High Frequency Trading\)"](#)

Tyler Durden, ZeroHedge, May 6, 2010

"What happened today was no fat finger, it was no panic selling by one major account: it was simply the impact of everyone in the HFT community going from port to starboard on the boat, at precisely the same time."

See also http://www.zerohedge.com/taxonomy_vtn/term/140 and http://www.zerohedge.com/taxonomy_vtn/term/12411

["Regulator puts a spotlight on high-frequency trading "](#)

Boyd Erman, The Globe and Mail, June 18, 2012

"From retail investors commenting on The Globe and Mail's website to Tony Fell, who once ran the country's biggest brokerage, the message is the same: The markets are seen as a casino where high-frequency traders are winning too often for it all to be just chance."

["High Frequency Trading HFT panel \(Finance Watch Conference\)"](#)

Finance Watch (2012)

"Significant concerns have been raised about the quality of liquidity provided, as well as the risks posed in terms of stability and integrity for our financial markets by these types of trading."

See also www.finance-watch.org.

"High frequency trading needs severe regulation"

Anthony Hilton, London Evening Standard, October 23, 2012

"HFT is now so dominant it overwhelms everyone so there is no countervailing force to the direction taken by the computers."

"Preventing the Next Flash Crash"

Edward E. Kaufman Jr and Carl M. Levin, New York Times, May 5, 2011

"America's capital markets, once the envy of the world, have been transformed in the name of competition that was said to benefit investors. Instead, this has produced an almost lawless high-speed maze where prices can spiral out of control, spooking average investors and start-up entrepreneurs alike."

"Testimony on 'Computerized Trading: What Should the Rules of the Road Be?'"

David Lauer testimony before the U.S. Senate Committee on Banking, Housing, and Urban Affairs Subcommittee on Securities, Insurance and Investment, September 20, 2012

"US equity markets are in dire straits. We are truly in a crisis."

"Public Comment on Consultation Report"

R. T. Leuchtkafer, August 12, 2011

"A basic function of any market is to produce a quote. Today's HFT quotes are toxic, a hoax on equities markets."

See also "No more 'hot potatoes' please" and <http://www.sec.gov/comments/s7-02-10/s70210-107.htm>.

"High-frequency trading - split seconds"

Lex, Financial Times, September 26, 2012

"Constraining the relentless advance of technology is rarely easy. But that is no excuse for not trying when its potential effects may be damaging."

"A Speed Limit for the Stock Market"

Roger Lowenstein, New York Times, October 1, 2012

"The 'liquidity' H.F.T. provides is long past the point of being helpful."

"Why High-Frequency Trading Doesn't Compute"

Jim McTague, Barrons, August 11, 2012

"Markets have been jarred by four major computer mishaps this year, including the recent one at Knight Capital. It's time to rein in the Street's speed demons: trading bots."

"The Rise of the HFT Machines"

Nanex, LLC

"The following animated GIF chronicles the rise of the HFT Algo Machines from January 2007 through January 2012."

See also <http://www.nanex.net/FlashCrash/OngoingResearch.html>

"Dennis Kelleher on PBS Discussing High Frequency Trading"

National Business Report interviews Dennis Kelleher, September 20, 2012

"There's been shockingly little done regarding our capital markets since the flash crash."

See also www.bettermarkets.com.

["Cuban, Cooperman: Curb High-Frequency Trading"](#)

Bruno J. Navarro, CNBC, October 2, 2012

(Includes CNBC interviews of Mark Cuban and Leon Cooperman)

"There is no value to HFT, period. End of story."

["Frankenstein Takes Over the Market"](#)

Joe Nocera, New York Times, August 4, 2012

"This week, yet another Wall Street firm most people have never heard of, relying on a computerized trading program that they can't possibly understand, shook investors' faith in the market."

["Strong and Fast Markets, but No Time to Think"](#)

Floyd Norris, New York Times, August 3, 2012

"The same computerization and increased competition that provided the benefits also weeded out people who had the obligation to step up in times of stress, and virtually eliminated the ability of people and institutions to slow or halt markets when something goes badly wrong."

["Long-term investors would benefit from Tobin tax"](#)

John Plender, Financial Times, September 28, 2011

"It is a paradoxical result of increased competition from off-exchange trading platforms and from regulatory developments such as Europe's Markets In Financial Instruments Directive that long-term investors are being disadvantaged. A financial transactions tax might help redress the balance."

["The problem with high frequency trading"](#)

Felix Salmon, BBC Radio, October 6, 2012

"But if you look at what's happened over the past five years, since 2007, the benefits of high-frequency trading have pretty much plateaued. And the downsides are becoming more and more obvious."

["Cramer Slams High-Speed Trading"](#)

Drew Sandholm, CNBC, September 18, 2012

(Includes excerpts from "Mad Money with Jim Cramer")

"To me, right now, the high-speed traders are this generation's equivalent of the German machine guns that mowed down British soldiers by the thousands and the people being annihilated by the traders? That's you, the average investor, just trying to using stocks to save some money as generations have before you."

["A Tax to Kill High Frequency Trading"](#)

Lee Sheppard, Forbes.com, October 16, 2012

"The United States should adopt a financial transactions tax (FTT) to kill high frequency trading (HFT) by removing the juice from this pernicious practice."

["Hurrying Into the Next Panic?"](#)

Paul Wilmott, New York Times, July 28, 2009

"Thus the problem with the sudden popularity of high-frequency trading is that it may increasingly destabilize the market."

["When Will Retail Investors Call It Quits?"](#)

Jason Zweig, Wall Street Journal, August 2, 2012

"So much for the reassurances from regulators and stock-exchange officials that a repeat of the 'flash crash' is impossible."

Books and documentaries

["Broken Markets: How High Frequency Trading and Predatory Practices on Wall Street are Destroying Investor Confidence and Your Portfolio"](#)

Sal L. Arnuk and Joseph C. Saluzzi (2012)

"The market has been hijacked. An evolved class of leveraged short-term, high-speed traders, sometimes called *high frequency traders*, who trade massive amounts of shares based on proprietary algorithms, has eclipsed other types of traders."

See also http://www.themistrading.com/market_structure

["The Payoff"](#)

Jeff Connaughton (2012)

"Our stock market had changed dramatically. No one understood how these changes were affecting average investors. Today's stock market is a constantly evolving, bewilderingly complex electronic labyrinth."

["Crapshoot Investing"](#)

Jim McTague (2011)

"The stock market has changed radically since 2005, yet few persons realized the greatness of the seismic shift until May 6, 2010, when the major averages collapsed over the course of 10 minutes."

["Dark Pools: High-Speed Traders, A.I. Bandits, and the Threat to the Global Financial System"](#)

Scott Patterson (2012)

"Insiders were slowly realizing that the push-button turbo-trading market in which algos battled algos inside massive data centers and dark pools at speeds measured in billionths of a second had a fatal flaw."

["Backlight - Money and Speed: Inside The Black Box"](#)

VPRO, Dutch public broadcasting (2011)

Produced by Mariska Schnider for the series "Backlight"; Directed by Marije Meerman.

"On May the 6th 2010, at 1400 hours, 42 minutes, and 44 seconds, the U.S. stock markets go into free fall. The Dow Jones takes the fastest and most dramatic nosedive in its history, an event that will be remembered as the 'Flash Crash.'"

Government (central banks)

"How to Keep Markets Safe in the Era of High-Speed Trading"

Carol Clark, Federal Reserve Bank of Chicago, October 2012

"A number of recent technology-related snafus have focused attention on high-speed trading and affected investor confidence in the markets. These incidents and the resulting losses highlight the need for risk controls at every step of the trading process."

"High-frequency trading in the foreign exchange market"

Guy Debelle, Reserve Bank of Australia, October 12, 2011

"While HFT generates increased activity and narrower spreads in normal times, it may have reduced the resilience of the system as a whole in stressed times by reducing the activity of traditional market participants who may have otherwise been an important stabilising presence in volatile environments."

"European Commission's Public Consultation on the Review of the MiFID - Eurosystem Contribution"

European Central Bank, February 2011

"In the last few years, automated trading, and in particular High-Frequency Trading (HFT), has experienced strong growth. Such a development may trigger a number of risks for orderly trading and for financial stability."

"Race to Zero"

Andrew Haldane, Bank of England, July 8, 2011

"Far from solving the liquidity problem in situations of stress, HFT firms appear to have added to it. And far from mitigating market stress, HFT appears to have amplified it. HFT liquidity, evident in sharply lower peacetime bid-ask spreads, may be illusory. In wartime, it disappears."

"High-frequency trading and market implications - an assessment from a central bank perspective"

Dr. Joachin Nagel, Deutsche Bundesbank, July 4, 2012

"There are increasing signs, for example, that, especially in volatile market situations, HFT might prove to be tricky - in the sense of further destabilising the market."

"Electronic trading and financial markets"

Kiyohiko Nishimura, Bank of Japan, November 29, 2010

"Although the expansion of electronic trading has brought many positive effects, as noted, it also has its own negative side with respect to the proper functioning of financial markets."

Government (regulators)

["New Species: How Market Participants Have Evolved in Financial Ecosystems"](#)

Bart Chilton, Commissioner, U.S. Commodities Futures Trading Commission, February 1, 2011

"Mini-flash crashes occur all the time, too. More than once last year in futures markets and several times in stocks, runaway robotic programs disrupted markets and cost people money. One company lost a million dollars in the oil market in less than a second when an algo ran wild."

["OSC head leans to the negative about high-frequency trading"](#)

Boyd Erman, The Globe and Mail, August 20, 2012

Interview of Howard Wetston, Chairman, Ontario Securities Commission (Canada)

"We ask ourselves the fundamental question: Is this type of trading actually consistent with what we expect of financial services and financial markets?"

["New rules for high-frequency trading"](#)

Federal Financial Supervisory Authority (Germany), November 22, 2012

"High-frequency trading has increased the speed and complexity of trading. This is associated with risks: for example, large order volumes may place a heavy burden on trading systems. Algorithms may also react to market events and trigger additional algorithms as a result, which may in turn trigger even more algorithms (cascade effect), leading to an increase in volatility."

["Speed limit for high-frequency trading - Federal Government adopts legislation to avoid risks and prevent abuse in high-frequency trading"](#)

Federal Ministry of Finance (Germany), September 26, 2012

"Computer-based high-frequency trading using algorithms poses multiple risks of extreme and irrational price fluctuations, overloaded trading systems and new opportunities for abuse."

["France wants tougher HFT regulation"](#)

Jeremy Grant and Philip Stafford, Financial Times, December 19, 2011

Press conference of Thierry Francq, secretary-general of Autorité des Marchés Financiers (France)

"Mr Francq called for the creation of a 'preventive framework' of new market rules to 'minimise the risk of HFT, and that means probably a rather harsh slowdown of this technique.'"

See also ["Issues related to MiFID II"](#) .

["Keynote speech by Jean-Pierre Jouyet"](#)

Jean-Pierre Jouyet, Chairman of the Autorité Des Marchés Financiers (France), February 13, 2012

"More generally, high-frequency algorithmic trading can aggravate the instability of a market by provoking unfounded price oscillations or anomalies arising from the interaction of two algorithms, as we saw with the Wall Street flash crash of May 6th 2010."

See also ["Issues related to MiFID II"](#) .

["ASIC Chairman's address to FINSIA Conference 2012"](#)

Greg Medcraft, Chairman, Australian Securities and Investments Commission, October 10, 2012

"And while some say high-frequency trading provides liquidity, I know some very senior bankers that privately describe it as providing only 'phantom liquidity.'"

["Remarks Before the Investment Company Institute's General Membership Meeting"](#)

Mary L. Schapiro, Chairman, U.S. Securities and Exchange Commission, May 6, 2011

"High frequency traders turned what was a very down day for many investors into a very profitable one for themselves by taking liquidity rather than providing it."

["We need rules to limit the risks of superfast trades"](#)

Martin Wheatley, CEO, Hong Kong Securities and Futures Commission
Financial Times, September 20, 2010

"When a single strategy becomes as dominant as HFT appears to have become - as happened in 1987 with 'portfolio insurance' and as is happening now with HFT - markets become fragile. And this fragility will lead to more shock events such as the 'flash-crash'."

Government (legislators)

["Tougher rules to protect investors and curb high-frequency trading"](#)

European Parliament, October 26, 2012

"MEPs also tightened up proposed rules on high-frequency trading."

["MiFID: European Parliament wants safer financial markets"](#)

EPP Group in the European Parliament, September 27, 2012

"The new EU Directive on Markets for Financial Instruments (MiFID) ought to ban destructive speculation on financial markets."

["Harkin: Tax high-speed traders to fill budget hole"](#)

U.S. Senator Tom Harkin interviewed by Ronald D. Orol of MarketWatch, November 29, 2012

"I really don't see any evidence that these high-speed traders add anything to the economy, but they do also create some aberrations in the market that have led to some disturbances."

["Ongoing Market Structure Review"](#)

U.S. Senator Edward E. Kaufman, August 5, 2010

"For example, while speed and efficiency can produce certain benefits, they have also created a micro-arms race that is being waged in our public marketplace by high frequency traders and others."

["Kaufman Delivers Final Senate Floor Speech on Market Structure Issues. High Frequency Trading"](#)

U.S. Senator Edward E. Kaufman, September 28, 2010

"Simply put, technological developments must operate within a framework that ensures integrity and fairness."

See also ["Archived Web Site \(captured November 2010\) of Ted Kaufman \(U.S. Senate, 2009-2010\)"](#).

["Request for Comments Regarding Findings and Recommendations of the Joint CFTC-SEC Advisory Committee on Emerging Regulatory Issues"](#)

U.S. Senator Carl Levin. April 8, 2011

"Regulations designed to ensure the stability and integrity of our markets must be coordinated across all of the markets, and while the recent coordination by the SEC and CFTC is a useful step, I believe much more needs to be done."

See also ["Statement of Sen. Carl Levin - Subcommittee on Securities, Insurance and Investment"](#).

[Letter to U.S. Commodity Futures Trading Commission Chairman Gary Gensler](#)

U.S. Congressman Edward J. Markey, September 19, 2012

"The 2010 Flash Crash in equity markets severely damaged confidence and sent a signal to ordinary investors that they are at a disadvantage. If high-frequency traders are now causing similar crashes in the commodity markets, both the investment community and the general public will lose confidence that the markets are working properly."

["Senator Jack Reed: Market Disruptions Are 'Wake Up Call' on HFT"](#)

U.S. Senator Jack Reed interviewed by Lee Pacchia, Bloomberg, September 20, 2012

"I think we need much more emphasis on what's going on. I think we have to look very carefully. We've had some wake up calls - the flash crash, the situation with the Facebook public offering - and so we've been put on notice we have to look."

["SCHUMER TO SEC: IMPOSE TOUGHER RULES ON HIGH-FREQUENCY TRADERS TO CURB STOCK PRICE VOLATILITY AND PREVENT ANOTHER FLASH CRASH"](#)

U.S. Senator Charles E. Schumer, August 11, 2010

"This disappearance of high frequency traders and their withdrawal of liquidity reveal a serious problem with our market regulation."

See also ["SCHUMER TO SEC: SLOW DOWN HIGH-FREQUENCY TRADERS WHEN MARKETS GET VOLATILE; SENATOR ALSO CALLS FOR PROBE INTO 'QUOTE STUFFING.' POSSIBLE BAN ON SUB-PENNY BIDS"](#)

Government (other)

["ESRB response to the ESMA Consultation Paper"](#)

European Systemic Risk Board, September 21, 2011

"There is also a growing concern that the expansion of HFT might undermine investor confidence and their willingness to participate in the markets."

["Position Paper"](#)

Securities and Markets Stakeholder Group, European Securities and Markets Authority (ESMA), October 26, 2011

"On one hand, studies demonstrate that HFT firms are also active during times of crises, but on the other hand, they also found that when volatility is rising, HFTs increase their demand for liquidity, while decreasing their supply of liquidity."