"High-Frequency Trading and Exchange Rate Efficiency: Blessing or Burden?"

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Abstract

Background: High-frequency trading (HFT), a method of algorithmic trading involving extremely low latency trades, has become widely prevalent over the last couple of decades. Its effects on the foreign exchange market are being continually researched. While most articles find increased market efficiency, some feel the potential for inequality, flash crashes, and lack of trust should invoke some intervening regulation or market restructuring.

Results: Using various data sources, it is apparent HFT has had growing effects on the foreign exchange market. HFT has resulted in tighter bid-ask spreads, higher trading volume, and lower volatility.

Conclusions: HFT results in more accurate price discovery, better liquidity, and lower risk in the foreign exchange market. These benefits result in the foreign exchange market being cheaper, faster, more accurate, more stable, and more attractive to global participants. These advantages are preponderate over the potential negative consequences. So HFT is a net-positive on the foreign exchange market.

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1. Introduction

High-frequency trading (HFT), a subset of algorithmic trading characterized by the use of advanced algorithms to execute orders at exceptionally high speeds, emerged in the late 1990s and has since experienced substantial growth. Recent empirical studies indicate that HFT now accounts for over 50% of trading volume in U.S. equity markets and approximately 25% of trading volume in foreign exchange markets.[1]

While both the equity market and the foreign exchange markets host HFT, the foreign exchange market differs in several key ways. Firstly, the foreign exchange market is largely decentralized, meaning there is no single exchange or central clearinghouse for transactions. This allows for high-frequency traders to profit from inefficiencies in pricing and spreads between different market participants. In contrast, equity markets, with centralized exchanges, are more tightly regulated and have less room for arbitrage opportunities across different venues. Secondly, the foreign exchange market has significantly higher trading volumes, averaging $7.5 trillion a day in April 2022.[2] Combined with high liquidity, HFTs can profit from tiny price discrepancies that last milliseconds. The sheer volume of trades and price fluctuations provide continuous opportunities for traders to profit. Lastly, the decentralization of the exchange rate

[1] Carole Comerton-Forde and Talis J. Putniņš, "Competition among High-Frequency Traders and Market Liquidity," *VoxEU.org* (Centre for Economic Policy Research), March 7, 2015, https://cepr.org/voxeu/columns/competition-among-high-frequency-traders-and-market-liquidity; European Central Bank. Financial Stability Review: Special Feature – High-frequency Trading in the Foreign Exchange Market. May 2016. https://www.ecb.europa.eu/press/financial-stability-publications/fsr/focus/2016/pdf/ecb~1c31d95af7.fsrbox201605_03.pdf.

[2] Bank for International Settlements, "OTC Foreign Exchange Turnover in April 2022," BIS, December 2022, https://www.bis.org/statistics/rpfx22_fx.htm.

markets means there is less regulatory oversight. This can create more opportunities for HFT strategies, as high-frequency traders are not subject to the same market structure rules and restrictions that exist in equities. However, this lack of oversight can also lead to potential risks, such as flash crashes (a very abrupt fall in security prices) or other market disruptions, which can be amplified by HFT behavior.

HFT has sparked debate on its dueling effects on the financial markets. On the upside, HFT is praised for its ability to enhance liquidity, narrow bid-ask spreads, and improve price discovery, thus making markets more efficient. Efficient markets allow classical economic policies to have stronger and more predictable effects. On the other hand, critics argue that HFT can exacerbate volatility and contribute to market instability, as seen in events like the 2010 Flash Crash. Additionally, some view HFT as employing "predatory" strategies, where firms exploit microsecond advantages to profit at the expense of slower market participants, potentially distorting market dynamics and undermining fairness. The controversy hinges on whether the benefits of increased liquidity outweigh the risks of market manipulation and systemic instability.

So the question this paper will address is, "*Is HFT a net positive or negative for FX market efficiency?*"

3. Literature Review

There are several scholarly papers that discuss the effects of HFT on the foreign exchange markets. The Bank for International Settlements (BIS) report, "High-Frequency Trading in the Foreign Exchange Market (2011)," finds that HFT can contribute to greater market liquidity and tighter bid-ask spreads, thus improving the efficiency of the market in terms of price discovery and trading costs. HFT allows for faster execution of trades, reducing the time between when information arrives and when it is reflected in market prices.[3] On the other hand, the report found that the speed of HFT could potentially result in higher volatility, especially in the absence of regulation or if there are poorly designed algorithms. It also touches on the fairness of high frequency trading, mentioning that the expense of low latency computers will eliminate competition from smaller firms and individuals.

The Financial Conduct Authority (FCA) research article, "The Role of High-Frequency Traders in FX Markets (2023)," found similar effects.[4] However, it put more weight on the issue of fairness, arguing that algorithmic trading not only promoted inequality but allowed for "predatory" behaviors where HFT firms may engage in strategies that exploit slower participants. For these reasons, the FCA article took a bit more negative view on HFT in the foreign exchange market.

[3] Guy Debelle, High-Frequency Trading in the Foreign Exchange Market, Report submitted by a Study Group established by the Markets Committee, Bank for International Settlements, September 2011, https://www.bis.org/publ/mktc05.pdf.
[4] Peter O'Neill and Shihao Yu, The Role of High-Frequency Traders in FX Markets, Financial Conduct Authority, 2023, https://www.fca.org.uk/publications/research-articles/role-high-frequency-traders-fx-markets.

On the other hand, “High-Frequency Trading and Price Discovery” by Jonathan Brogaard, Terrence Hendershott, and Ryan Riordan took a very positive outlook on HFT.[5] It focused on the positive effects of increased liquidity and price discovery. It noted that reported macroeconomic information was not enough to find the true value of currencies and that using algorithms could extrapolate more accurate evaluations.

Lastly, Stenfors, Alexis, and Masayuki Susai take a strong negative stance on HFT foreign exchange trading. The authors argue that HFTs rapid response to new information can result in liquidity withdrawal. This challenges the traditional market norms based on mutual trust and reciprocity among human traders. They argue that this will result in increased artificial volatility.

3. Data and Methodology

For simplicity this paper will be primarily focusing on only the foreign exchange market for the Dollar-Euro exchange rate. I’ll be doing analysis on bid-ask spreads, trading volume, and market volatility from time periods where HFT adoption increased significantly (2006-2025), and compare it with a pre-HFT period (1999-2005). Using data from the FCA, the BIS, and the Federal Reserve Bank of St. Louis, I will examine if the positive effects of HFT outweigh the potential downsides.

[5] Jonathan Brogaard, Terrence Hendershott, and Ryan Riordan, "High-Frequency Trading and Price Discovery in the Foreign Exchange Market," *Review of Financial Studies* 27, no. 8 (2014): 2267-2306

4. Findings

"The table below presents several stylised facts of the liquidity provision of different trader categories. RQS is the (half) relative bid-ask spread. DepthTop is the top-of-book depth. DepthTopShr is a trader category's top-of-book depth as a fraction of the total top-of-book depth.

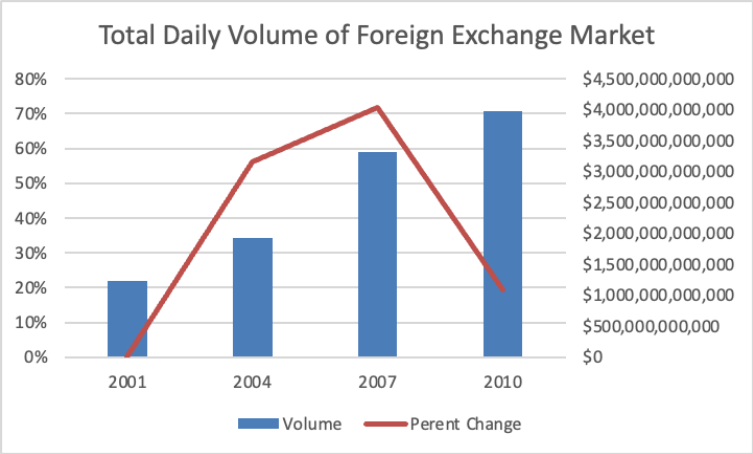
	Measure	RQS (bp)		DepthTop (mil)		DepthTopShr	
		Mean	SD	Mean	SD	Mean	SD
GBP/USD	Dealer	1.34	0.29	2.30	0.56	0.33	0.06
	HFT	0.88	0.15	3.54	0.84	0.50	0.07
AUD/USD	Dealer	1.97	0.51	2.71	0.62	0.25	0.05
	HFT	1.18	0.23	6.25	1.67	0.55	0.08

Source: Financial Conduct Authority. High-frequency Trading in the UK Equity Market: Evidence from the FCA's Supervisory Data. Occasional Paper No. 63. London: Financial Conduct Authority, 2020.

Means and standard deviations are computed across daily averages."[6] Specifically note that the RQS is significantly lower for HFT than dealers. Lower bid-ask spreads benefit the foreign exchange market by reducing transaction costs for traders and investors, making it cheaper to exchange currencies. Narrower spreads also signal higher liquidity and faster, more accurate price discovery, improving overall market efficiency. As a result, lower spreads contribute to a more stable and accessible trading environment for all participants.

Now looking at trading volumes using the Bank for International Settlements Triennial Surveys, we can see the effect of the introduction of HFT in the foreign exchange market. From

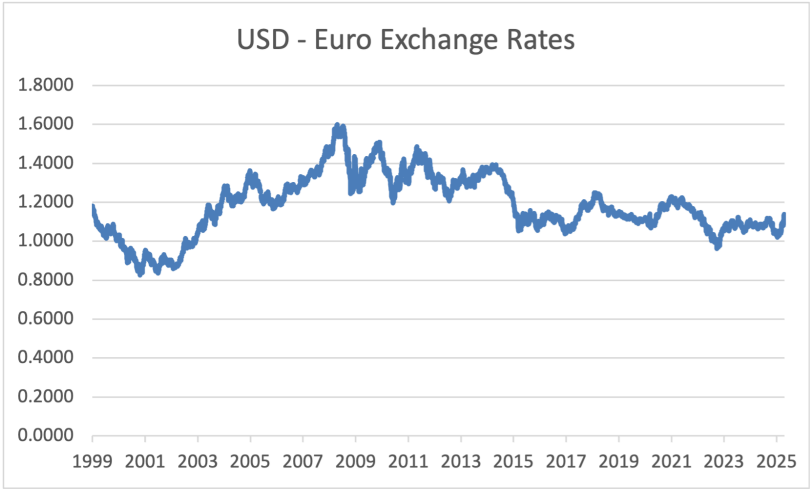
[6] Financial Conduct Authority, *High-frequency Trading in the UK Equity Market: Evidence from the FCA's Supervisory Data*, Occasional Paper No. 63 (London: Financial Conduct Authority, 2020), https://www.fca.org.uk/publication/occasional-papers/op63.pdf.



Source: Bank for International Settlements Triennial Surveys (2001-2010)

2004 to 2007 there was an increase of 71.87% in the average daily volume of the foreign exchange market. This was a 15.78 percentage point jump from 2001 to 2004's 56.09% increase in daily volume and was significantly larger than the 19.52% increase from 2007 to 2009. This could imply that with the mass growth in usage of HFT, the market reflected this through high trading volume. With increased volume comes better liquidity. Better liquidity makes the foreign exchange market cheaper, faster, more accurate, more stable, and more attractive to global participants.

For market volatility, I used the Federal Reserve Bank of St. Louis to find the historical exchange rate. Using this data set in stata, I could determine the daily volatility of the Dollar-Euro exchange rate. The volatility calculated here is the standard deviation of daily returns over the given periods. In simpler



Source: Federal Reserve Bank of St. Louis, FRED, DEXUSEU Series.

terms, volatility measures the degree of variation or fluctuation in the price (or exchange rate) of the asset over time. I determined that the average volatility from 1999-2005 was around 0.62% while the volatility from 2006-2025 was 10% smaller at 0.56%. This means that after the introduction of the widespread use of algorithmic trading, the average standard deviation of daily change decreased meaning assets became less risky during this time. This would give evidence to the pro-HFT arguments: faster and more competitive trading would help correct mispricings quickly, smoothing out sudden price swings.

4. Conclusions

High frequency trading has resulted in tighter bid-ask spreads, increased trading volumes, and lower volatility. These effects have resulted in more accurate price discovery, better liquidity, and lower risk. While the potential for increased inequality, flash crashes, and potential liquidity withdrawal remains, I believe the advantages of using HFT to promote market efficiency outweigh the negatives. With an efficient market, International Finance theory is more likely to hold. Governments and central banks can perform more efficient fiscal and monetary policies due to more predictable responses. However, it remains important to monitor the foreign exchange market for unintended consequences of high-frequency trading. Continued research and careful regulation are necessary to ensure that innovation does not come at the expense of

market stability. As technology advances, striking a balance between efficiency and fairness will be crucial for maintaining the integrity of global financial markets.

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