From Speed to Stability: The Influence of Low Latency Trading on Market Quality

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Background

The rapid evolution of electronic financial markets, driven by technological advancements such as ultra-low-latency trading systems, high-performance computing, and Field-Programmable Gate Arrays (FPGA) technology, has transformed the landscape of trading. These innovations have enabled the rise of Ultra-Fast Traders (UFT) and High-Frequency Traders (HFT), also known as Low-Latency Traders (LLT), who can react to market events within a few microseconds. These ultra-fast reaction capabilities set them apart from conventional market participants, making them a unique force in financial markets.

Understanding the role and behavior of these traders is critical to analyzing modern market dynamics. UFTs and HFTs play a significant role in liquidity and price formation, but their impact on market stability and efficiency remains the subject of ongoing debate.

Research Objectives

- Contributing to the ongoing discussion about the role of ultra-fast trading in financial markets.
- Proposing a novel market participants' classification method.
- Providing a detailed analysis of participation rates and trading behaviors of UFT and HFT.
- Analyzing if and how these participants affect market microstructure, efficiency, and volatility.

Data and Preprocessing

The study is based on nanoseconds timestamp data from Deutsche Börse's T7 platform, starting from January 2021 until September 2024. Specifically, we selected Euro STOXX 50 and DAX Futures, along with MSCI World and S&P500 iShares ETFs for their high liquidity on Eurex and Xetra, although only the Euro STOXX 50 results are presented on this poster.

To classify a specific market event, we have based our approach on the latency between a prior triggering trade and the event. **Events with a latency of less than 1μs are classified as UFT-triggered, latencies between 1μs and 10μs as HFT-triggered, while latencies exceeding 10μs are attributed to conventional traders.** Additionally, negative latencies are attributed to noise.

Methodology

- The total participation is measured as the sum of the **notional value** (price $\times$ quantity) for all market events triggered by a given participant category.
- Other participation types: aggressive, passive, canceled, and deep (beyond the first order book level).
- Aggregated tick-to-trade data into 1-minute intervals to compute metrics: traded volume, average spread, effective spread, depth, order imbalance ratio (OIR), and mid/micro/trade price volatility.
- Included a control variable similar to SNR.
- Combined 1-minute data into monthly datasets and divided into 5 total participation quantiles.

Conclusion

- LLT (both UFT and HFT) produce, at most, roughly 20% of total participation, including aggressive and passive (Fig. 1).
- All participants primarily generate passive order data, with UFTs contributing almost no passive orders (Fig. 1): market making strategies?
- UFTs cancel around 80% of their orders, but this represents, at most, 20% of total canceled participation. (Fig. 2).
- The deep order book participation (often considered noise) is insignificant, at most 0.06% (Fig. 3).
- Clear correlation between high LLT participation and all eight metrics (Fig. 4), but the impact is positive on spread, effective spread, depth and OIR.
- Interesting difference between UFT and HFT's behaviour: UFTs' SNR decreases with higher participation while HFTs' SNR is stable or slightly increases with higher participation (Fig. 5)
- Causal effect study (ongoing)

Results

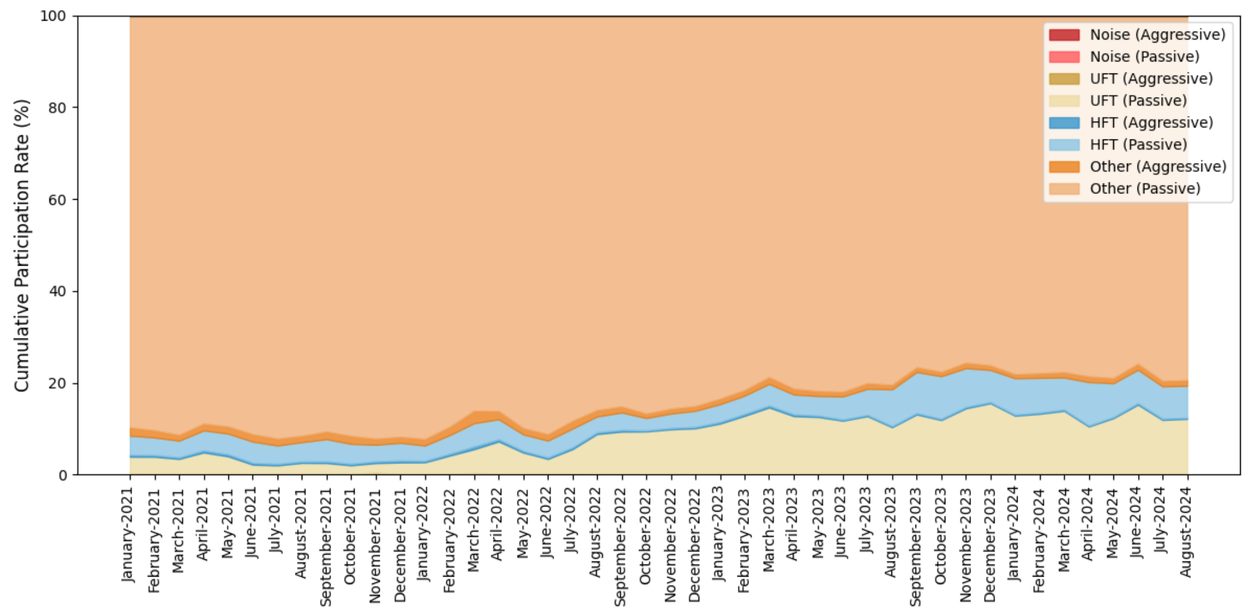

Figure 1: Cumulative Total Participation Rates (aggressive and passive)

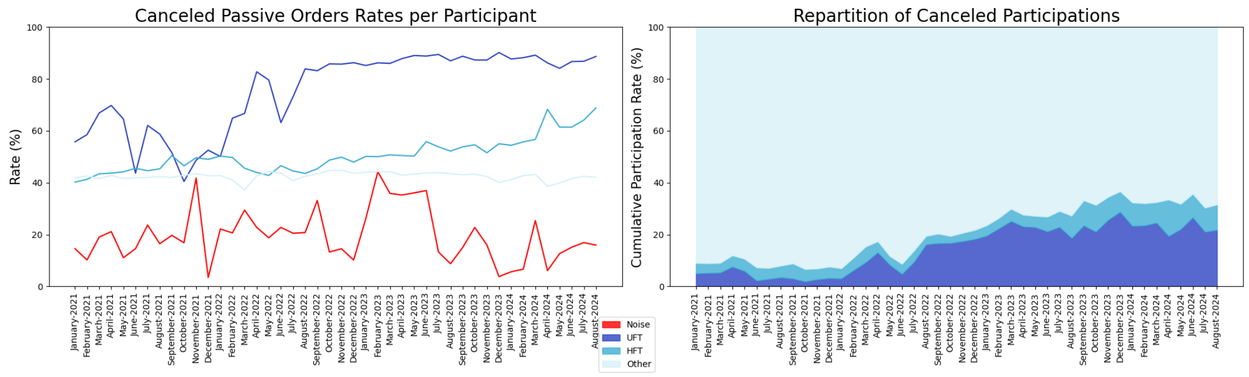

Figure 2: Canceled Participation Insights

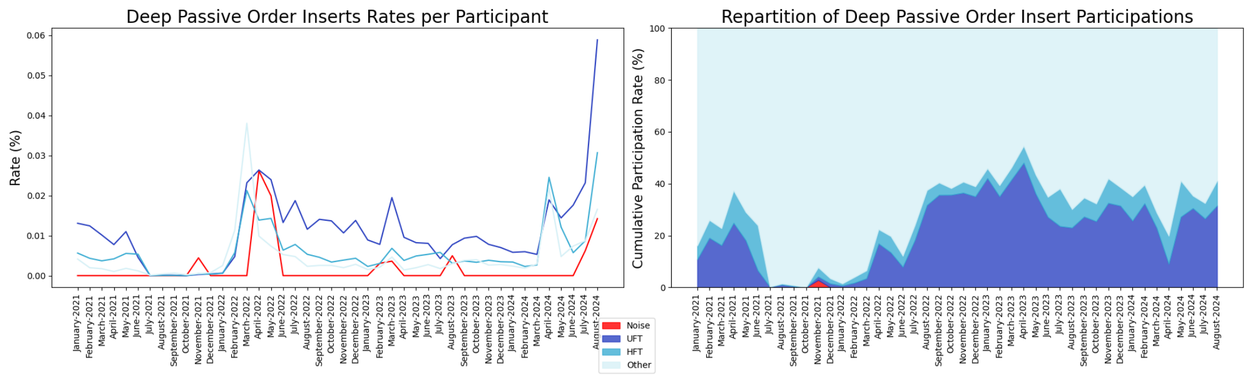

Figure 3: Deep Order Book Participation Insights

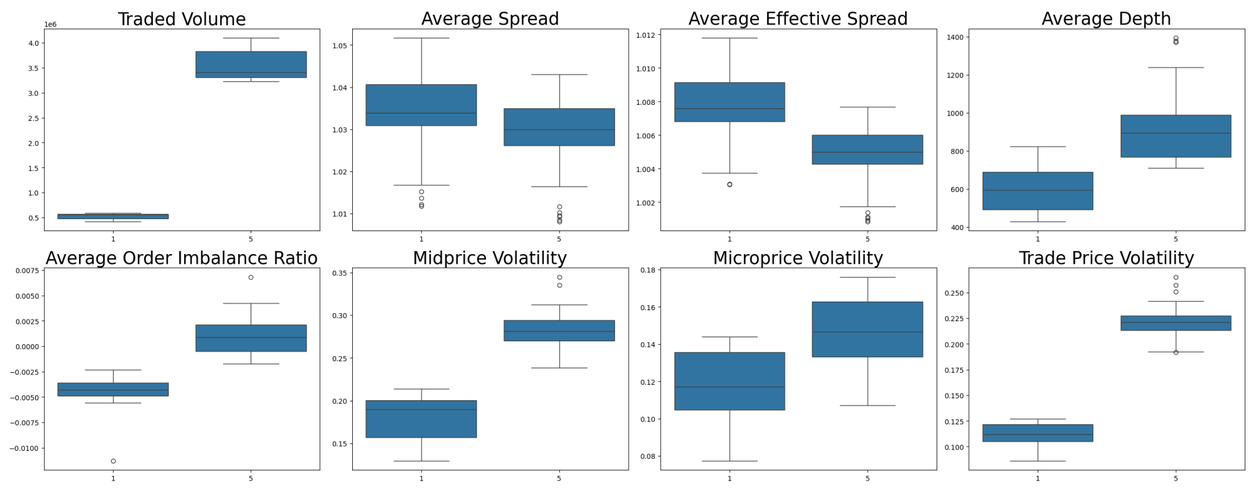

Figure 4: Eight key metrics average value for participation quantile 1 and 5

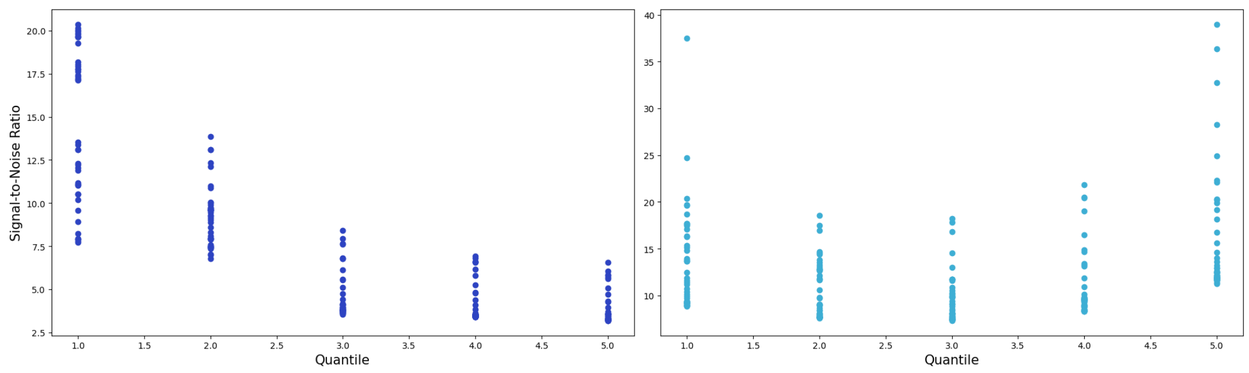

Figure 5: UFT vs. HFT Signal-to-Noise Ratio (SNR) per Quantile

Further Work

Next steps will involve evaluating the classification performance using proprietary data from Deutsche Börse.

Then, we will focus on identifying intraday patterns in LLT participation, particularly how they react to macroeconomic events or news, leveraging NLP to assess both the nature and speed of these reactions. This will provide insight into their behavior in response to key events. Another important avenue will be to explore flash crashes, investigating whether these are triggered by 'micro' bubble bursts, contributing to market instability during extreme volatility.