Introduction

Modern electronic markets operate on millisecond-to-second timescales, where anticipating near-term price movements is essential for market makers and algorithmic traders managing inventory risk and execution quality. At these horizons, traditional predictors are largely irrelevant, and the microstructure of the limit order book becomes the dominant source of information.

Order book imbalance, the relative difference between liquidity on the bid and ask sides, is a natural candidate for prediction: asymmetric liquidity indicates the direction in which prices can move more easily. However, existing evidence is mixed, as imbalance is correlated with other microstructure variables, and its predictive power decays rapidly with horizon. Moreover, most studies focus on returns alone without linking statistical predictability to execution realities such as adverse selection.

This paper analyzes order book imbalance using millisecond-resolution data across multiple liquid U.S. equities. We examine how predictability decays from 10 milliseconds to several seconds, test robustness to standard microstructure controls, and analyze effects on execution outcomes. We find that imbalance contains significant predictive information at very short horizons, that this information decays systematically over time, and that it is not subsumed by spread or volatility. Additionally, it meaningfully affects adverse selection and post-trade price dynamics. These results clarify when and how order book imbalance functions as an informational signal rather than a purely mechanical feature of market microstructure.

Hypothesis

In electronic limit order markets, prices respond to the balance between supply and demand liquidity. The limit order book aggregates this balance by showing where liquidity is concentrated and how easily prices can move in either direction. Order book imbalance, therefore, summarizes short-term trading pressure and price impact asymmetry.

Imbalance can arise from three related mechanisms. Market makers manage inventory by shifting quotes asymmetrically, creating imbalances that precede price adjustments. Liquidity itself is often asymmetric, so trades on the thinner side of the book move prices more, causing prices to drift toward the side with less depth. Finally, large traders executing over time leave persistent footprints by repeatedly consuming liquidity on one side, generating sustained imbalance before prices fully adjust. These mechanisms imply that imbalance should predict near-term returns, but only over very short horizons, as the information is rapidly incorporated through execution and quote updates.

We therefore hypothesize that order book imbalance predicts short-horizon future returns, that this predictability decays monotonically as the horizon increases, that it is strongest during stable periods of continuous trading and weaker during the open and close, and that trades executed in the direction of imbalance suffer less adverse selection than trades executed against it.