

A Probabilistic Theory of the Buy-Low and Sell-High for Algorithmic Trading

Authors : Peter Shi

Abstract : Algorithmic trading is a rapidly expanding domain within quantitative finance, constituting a substantial portion of trading volumes in the US financial market. The demand for rigorous and robust mathematical theories underpinning these trading algorithms is ever-growing. In this study, the author establishes a new stock market model that integrates the Efficient Market Hypothesis and the statistical arbitrage. The model, for the first time, finds probabilistic relations between the rational price and the market price in terms of the conditional expectation. The theory consequently leads to a mathematical justification of the old market adage: buy-low and sell-high. The thresholds for “low” and “high” are precisely derived using a max-min operation on Bayes’s error. This explicit connection harmonizes the Efficient Market Hypothesis and Statistical Arbitrage, demonstrating their compatibility in explaining market dynamics. The amalgamation represents a pioneering contribution to quantitative finance. The study culminates in comprehensive numerical tests using historical market data, affirming that the “buy-low” and “sell-high” algorithm derived from this theory significantly outperforms the general market over the long term in four out of six distinct market environments.

Keywords : efficient market hypothesis, behavioral finance, Bayes' decision, algorithmic trading, risk control, stock market

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