

Algorithmic Trading

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Pros and Cons of HFT

What is Algorithmic Trading?

Trading executed automatically by computers

- Also known as automated trading or system trading

Not all such trading is mathematically sophisticated

- Mathematically sophisticated trading, using standard item marker
 - Statistical methods
 - Time series analysis
 - Machine learning
 - Deep learning
- Trading that isn't mathematically sophisticated
 - Trading that merely automates routine procedures
 - Simple agency trades
 - Trades targeting momentary arbitrage opportunities

Objectives of Algorithmic Trading

Expanding the stability of profits

■ Pursuit of returns

- Automatically buying low and selling high
- Pursuit of profit opportunities

■ Cost reduction

- Automation of routine execution tasks
 - Automated market making
 - Automated basket trading
- Automatic selection of markets with optimal fees
- Reduction of costs due to market impact
 - Market impact refers to the increase in one's own trading costs when one's own execution causes prices to move unfavorably. definition

■ Risk control

- Controlling the execution probability for desired quantities
- Controlling the market risk of one's own positions

The pursuit of returns, cost reduction, and risk control involve trade-offs with each other.

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Types of Algorithmic Trading

- Algorithms aiming to reduce trading costs
 - Market impact reduction
 - Trading cost reduction
 - Execution algorithms
 - Iceberg, etc.
 - Benchmark execution algorithms
 - VWAP, etc.
 - These aim to reduce trading costs through effects such as splitting trades finely to hide (make less obvious) the execution volume from the market.
- Algorithms aiming for profit opportunities
 - Market-making algorithms
 - Placing both sell and buy orders in the market, using the price difference as a source of profit.
 - Arbitrage algorithms
 - Algorithms that earn profit by detecting when financial instruments of identical value can be traded at different prices.
 - Directional algorithms
 - Algorithms that aim for profit from the price difference by predicting the market to buy low and sell high.
- Market manipulation algorithms
 - Algorithms aiming to move the market in a favorable direction by misleading the market about the liquidity or trading intentions they provide.

■ Some individual investors

- Directional algorithms are used.
- Due to constraints of the system environment, algorithms advantaged by high speed and high frequency are difficult to use.
 - Market-making and arbitrage algorithms are difficult to use.

■ Institutional investors

- Agency execution departments
 - Execute based on client requests.
 - Execution for the fulfillment of their own best execution obligations.
- Proprietary trading departments
 - The objective is to obtain trading profits from the market.
 - Market-making algorithms
 - Arbitrage algorithms
 - Directional algorithms
- Specific examples
 - Index managers use execution-type algorithms.
 - If pursuing trading profits, algorithms similar to those in proprietary trading are used.

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Pros and Cons of HFT

HFT (High-Frequency Trading)

- HFT holds an advantage in market-making and arbitrage algorithms.
- To conduct high-frequency and high-speed trading requires:
 1. Speeding up information acquisition for trading decisions
 - Narrowing down the information utilized.
 - Accelerating one's own systems.
 2. Speeding up the process from information processing to execution
 - Accelerating the algorithms.
 3. Speeding up the arrival of order information at the trading system
 - Installation of dedicated lines.
 - Shortening transit time through the use of DMA (Direct Market Access).
 - Placing orders from within the same network as the exchange via exchange colocation.
 4. Speeding up the processing speed per unit time of exchange and other trading systems
 - Speed is increasing due to the competition for market share among exchanges.
 - In Japan as well, HFT became possible in 2010 when Arrowhead started operating on the TSE.
- Since bottlenecks must be avoided, acceleration is necessary in all four areas mentioned above.

■ High-frequency and high-speed trading is thought to utilize market-making algorithms.

- Therefore, there is an argument that it benefits general investors by supplying liquidity to the market.
- On the other hand, only HFT firms capture profit opportunities, impairing fairness among investors.
- There is also an argument that it harms market stability by repeatedly placing, modifying, and canceling orders at speeds invisible to general investors.

-  The Essence of Algorithmic Trading: Strategies and Execution - NTT Data Financial Technology
-  Algorithmic Trading - Takanori Adachi
-  Advances in Financial Machine Learning - Lopez de Prado, Marcos