Algorithmic Trading

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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.

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.

Users of Algorithms

- 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.

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.

Pros and Cons of HFT

- 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.

References I

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