Digital Finance 3: Technology in Finance

Lesson 29: Algorithmic Trading Concepts

FHGR

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Learning Objectives

By the end of this lesson, you will be able to:

- Classify different types of algorithmic trading strategies
- Design and execute backtesting frameworks
- Identify and avoid common backtesting pitfalls
- Understand overfitting in trading models
- Account for transaction costs and market impact
- Set realistic performance expectations

What is Algorithmic Trading?

Definition:

- Automated execution based on rules
- No human intervention
- Computer algorithms make decisions
- Processes data faster than humans

Market Share:

- US equities: 70-80% of volume
- Futures: 60-70%
- FX: 50-60%

Key Advantages:

- Speed (microseconds)
- Consistency (no emotions)
- Backtesting capability
- Scalability

Challenges:

- Overfitting to historical data
- Model decay (regime changes)
- Technology costs
- Regulatory scrutiny

Types of Strategies

Execution Algorithms:

- VWAP, TWAP
- Minimize market impact
- Cost minimization

Market Making:

- Provide liquidity
- Profit from spread
- High-frequency trading

Statistical Arbitrage:

- Mean reversion
- Pair trading
- Market-neutral

Momentum:

- Follow trends
- Breakout strategies
- Moving averages

ML-Based:

- Prediction models
- Alternative data
- Classification/regression

HFT:

- Ultra-short holding
- Latency arbitrage
- Co-location required

Backtesting Framework

Steps:

1. Define strategy rules
2. Acquire historical data
3. Simulate trades
4. Calculate returns (net of costs)
5. Evaluate metrics
6. Iterate and refine

Key Metrics:

- Total return
- Sharpe ratio (risk-adjusted)
- Maximum drawdown
- Win rate
- Profit factor

Realistic Targets:

- Sharpe ¿ 1.5: Good
- Sharpe ¿ 2.0: Very good
- Sharpe ¿ 3.0: Exceptional (or overfitting?)

Common Pitfalls:

- Look-ahead bias
- Survivorship bias
- Data snooping
- Ignoring costs
- Market impact
- Overfitting

Warning: Backtest performance usually overstates live performance.

Summary

Key Takeaways:

- Algorithmic trading dominates modern markets
- Many strategy types (execution, market making, stat arb, ML)
- Backtesting essential but has pitfalls
- Overfitting is the central danger
- Transaction costs matter (0.2-0.5% per round-trip)
- Realistic expectations: Alpha is scarce

Next Lesson: Credit Scoring and Risk Models