



Do Trading Algorithms Threaten Financial Market Stability?

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Algorithmic Trading

- By any measure, accounts for major fraction of activity on financial markets
- How does it work?
 - Specific methods and practices highly secretive
 - General ingredients readily apparent
 - Fast computing and communication
 - Real-time data analysis, risk management
 - Clever strategies, detailed understanding of microstructure
 - [AI & machine learning](#)

What is Special about Algorithms?

1. Speed and Precision

- Response far faster than human reaction times
- Can implement complex strategies involving coordinated actions across many markets
- Enables latency arbitrage, “anticipatory” strategies, novel manipulations

2. Autonomy

- Applies programmed and learned models to potentially unanticipated circumstances

3. Scalability

- Replicate methods across securities, exchanges... worldwide

Latency Arms Race: Source of Instability?

Direct
exchange
feeds

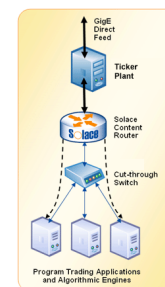


Co-location



Specialized
hardware/software

Dedicated
communication
lines



Ending the Arms Race

- Fundamental problem: no lower bound on a difference in speed that could matter
- Solution: Discrete-time market clearing
 - “one-second call markets”
 - Frequent batch auctions

Flash Crash: 6 May 2010

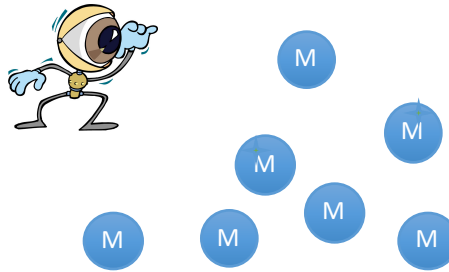


ARB-BOT: A General Framework for AI Traders

- **Arbitrage:**
 - taking advantage of price differences across markets for the same asset
- **Simple arbitrage agent:**
 - monitor multiple markets for price discrepancies, then execute

Account for:

- ▶ Transaction costs
- ▶ Transport/storage costs
- ▶ Execution risk
- ▶ What is meant by “same” asset?



ARB-BOT Early Warning System

- Develop public (non-trading) Arb-Bots as an alert to what the AIs might be finding
- Search approaches
 - Reasoning from security descriptions
 - Automated discovery by machine learning

Levels of ARB-BOT Behavior

1. Passive search for arbitrage opportunities
2. Attempts to amplify arb opps through purposeful instigation of market movements (e.g., spoofing)
3. Attempts to create new arb opps
 - new financial instruments
 - deliberate fragmenting
4. Malicious subversion of markets



most aggressive