

Agent-based modelling of Commodity Markets and Fraud Detection

Workshop on Computational and Agent-based modelling

19-11-2021, Philippe Debie, Project HighLO



Project HighLO – Key team

Collaboration between *Wageningen University & Research (WUR)*, *Commodity Risk Management Expertise Centre (CORMEC)* and CERN

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Project HighLO – Background info

Financial market is governed by supply and demand

- Limit order book = Summary of all limit orders
- More sell limit orders → Price goes down
- More buy limit orders → Price goes up

Spoofing = Placing and cancelling limit orders to push the market
(with no intention of execution)

Project HighLO – Research goal

Detect spoofing in the commodity futures market

1. Describe how spoofing works
2. Detect spoofing
3. Help regulators and lawmakers

Spoofing = Placing and cancelling limit orders to push the market
(with no intention of execution)

Challenges

Currently

- Multiple research tracks to detect spoofing

But how to validate results?

1. Compare against court cases → Bias
2. Spoof in the real market → Unethical
3. Spoof in a virtual market → BioDynaMo!

Agent-based simulation - Setup

Components

1. The exchanges
2. Data distribution
3. The agents

Agent-based simulation - Components

The exchange

- Multiple in parallel
 - Traders participate in multiple commodities
- Implementation follows simple rules

Agent-based simulation - Components

Data distribution

- Avoid: each agents collecting data and building models
 - Agents 'buy' data and model subscriptions
 - Data at different snapshot size / latency
 - Pretrained models
- High value subscriptions cost more,
more profit needed to stay alive

Agent-based simulation - Components

Agents: different motivation

1. Speculators
2. Hedgers (reduce the risk of production/consumption of commodity)

Agents: different skill level

1. (Near) random traders
2. Informed traders

Agent-based simulation - Components

Agents: implementation

1. Random traders
2. Hard coded traders
3. Generated using a genetic programming

Future:

4. Crowd sourced
5. Collaboration with investors

Expected apparent behaviour

Most traders

- Trade based on simple statistics (e.g., the market price)

High-frequency traders

- Access to high quality data
- Respond on individual limit orders

→ High-frequency traders required in simulation for spoofing detection

New challenges

Is the market representative?

- Are hedgers reducing their risk?
- Are different markets/exchanges related?
- Do we see similar properties as in literature?

Verify spoofing detection method

1. Insert a spoofing agent in the simulation
 - Hard coded rule-based
 - Reinforcement learning
2. Simulate and export data
3. Apply detection method
4. Calculate performance metrics

Questions