



Agent Based Modelling:

Market Manipulation

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CRIME

24% of New Tokens Launched in 2022 Bear On-Chain Characteristics of Pump and Dump Schemes

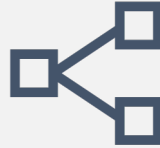
FEBRUARY 16, 2023 | BY CHAINALYSIS TEAM



The complexity of financial markets



Financial markets are complex systems with various agents interacting



Agents have different goals, beliefs, and strategies



Understanding agent behavior is crucial for policymakers, investors, and traders



The role of big investors

- Big investors are institutional investors with a large amount of capital
- Influence the market and get profit from market trends and fluctuations
- There has been increasing interest in studying the impact of big investors on financial markets

Our agent-based model



The model simulates the behaviour of various agents, including **random traders**, **chartists**, and **the big investor**



It assumes a closed environment and a **limit order book** (LOB) mechanism



The model uses **MACD** as a key technical indicator



Examine the manipulation effect of big investors on the market



Investigates how big investors use their capital and complex strategies to generate upward momentum and profit from the market



Examines the impact of big investors on market volatility and their interaction with other agents, such as chartists and random traders

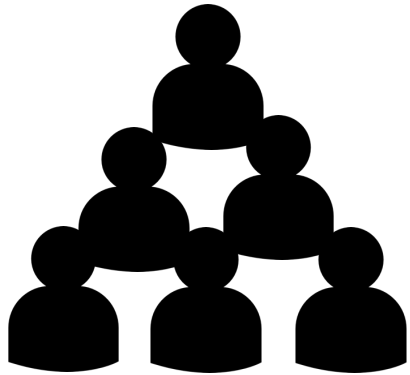
The purpose of the model

Model assumptions

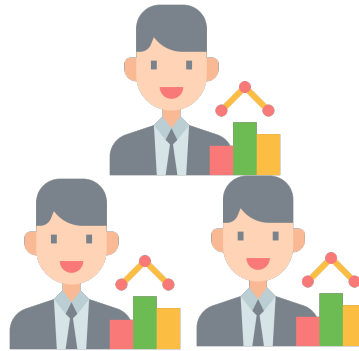
- Closed environment
- Three types of agents:
 - Random traders
 - Chartists
 - The big investor
- Fixed order quantity
- No regulatory measures or transaction taxes

Market participants

180 random agents



20 chartists

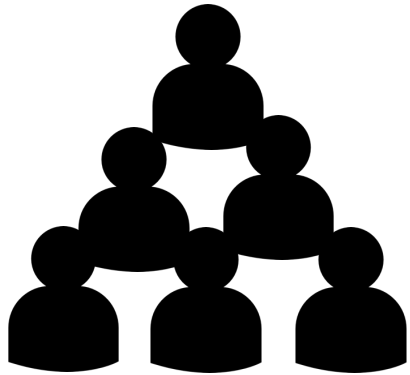


1 big investor

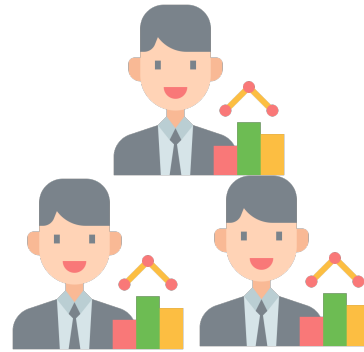


Methodology - Model parameters

- Initial wealth of investors



80 shares+ \$1000 cash

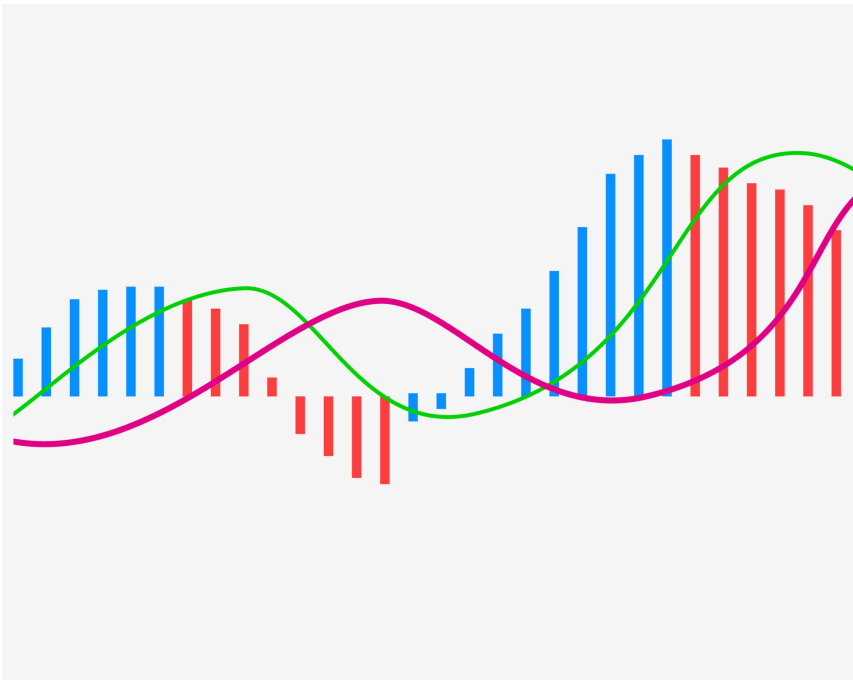


80 shares+ \$1000 cash



adjustable

Methodology - Momentum Strategy



1. Utilized the **Moving Average Convergence Divergence (MACD)** strategy
2. **MACD Line** = 12-day EMA – 26-day EMA
3. **Signal Line** = 9-day EMA of the **MACD Line**
 1. **MACD** – **Signal** > 0 : buying signal
 2. **MACD** – **Signal** < 0 : selling signal

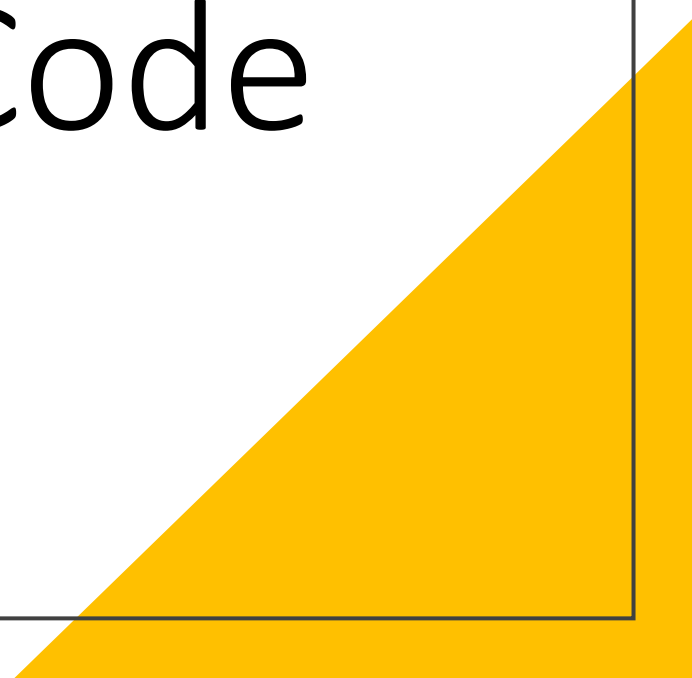
Methodology - Model parameters

- Duration of big investor's strategy is **100** ticks
- Orders in the market expire every **15** ticks
- Investors submit buy or sell orders when they **run out of stocks or funds** with a **25%** chance

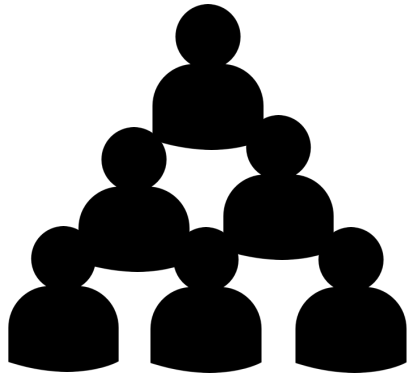
Algorithm 1 Market Simulation with Limit Order Book

- 1: Initialize the simulation environment with the LOB
 - 2: **while** simulation not complete **do**
 - 3: Expire old orders in the LOB
 - 4: Random traders place new buy/sell orders in the LOB
 - 5: The big investor and the chartists place buy/sell orders in the LOB using the MACD indicator
 - 6: Match and execute orders in the LOB based on price-time priority
 - 7: Update investor wealth and stock price based on executed trades
 - 8: Calculate indicators such as traders' wealth, standard deviation, and trading volume
 - 9: Update simulation time
 - 10: Output final results, including stock price and agent wealth distribution
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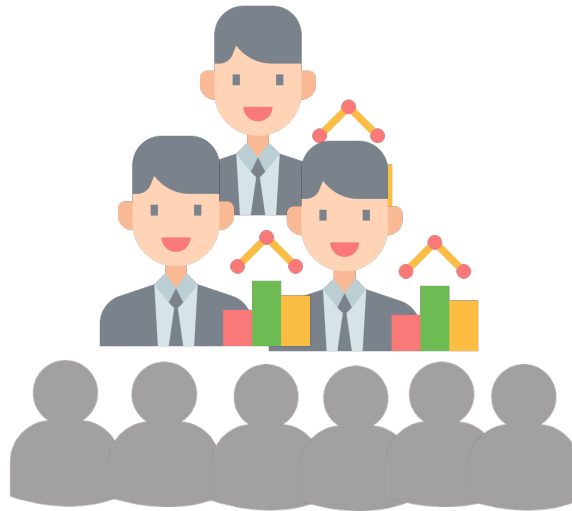
Pseudo Code



3 Scenarios



Scenario 1



Scenario 2

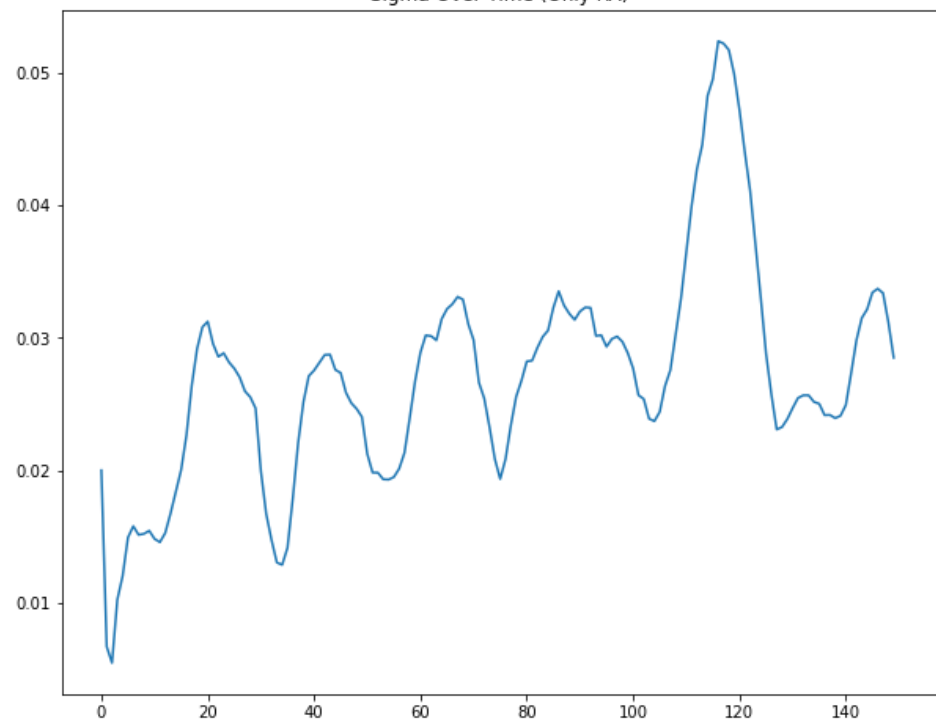


Scenario 3

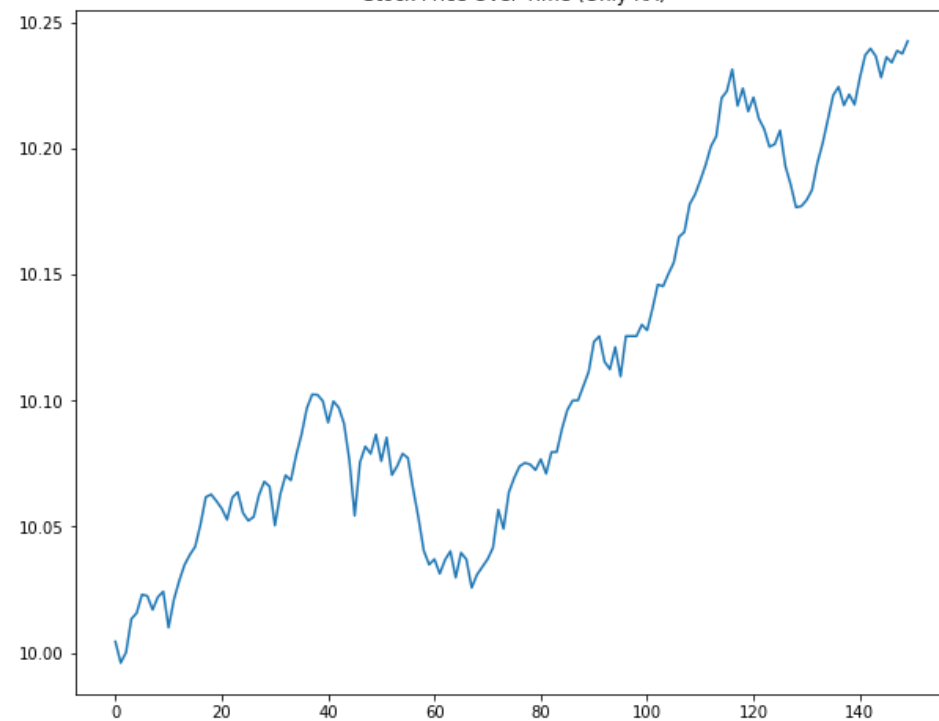
S1



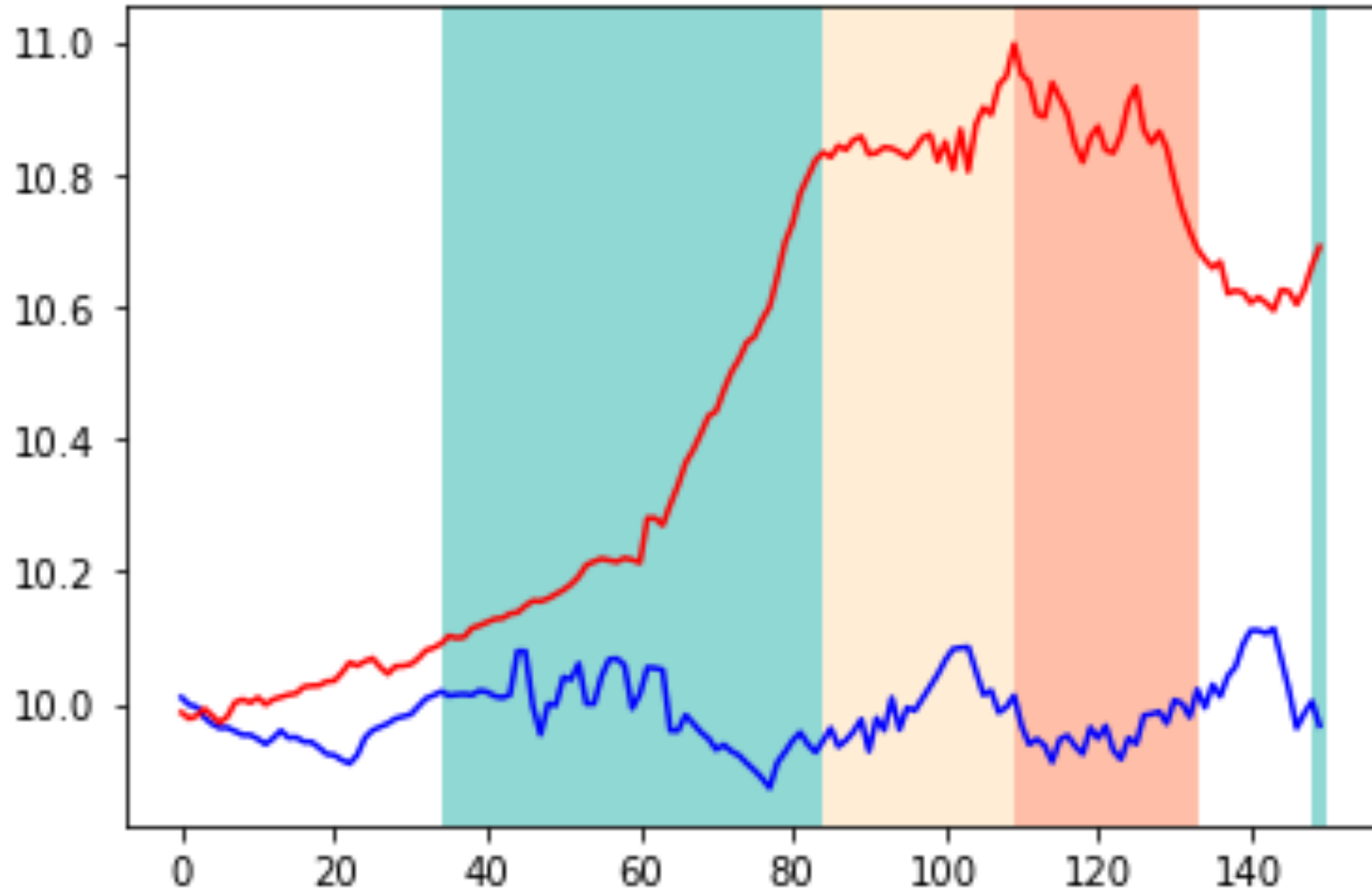
Sigma Over Time (Only RA)



Stock Price Over Time (Only RA)



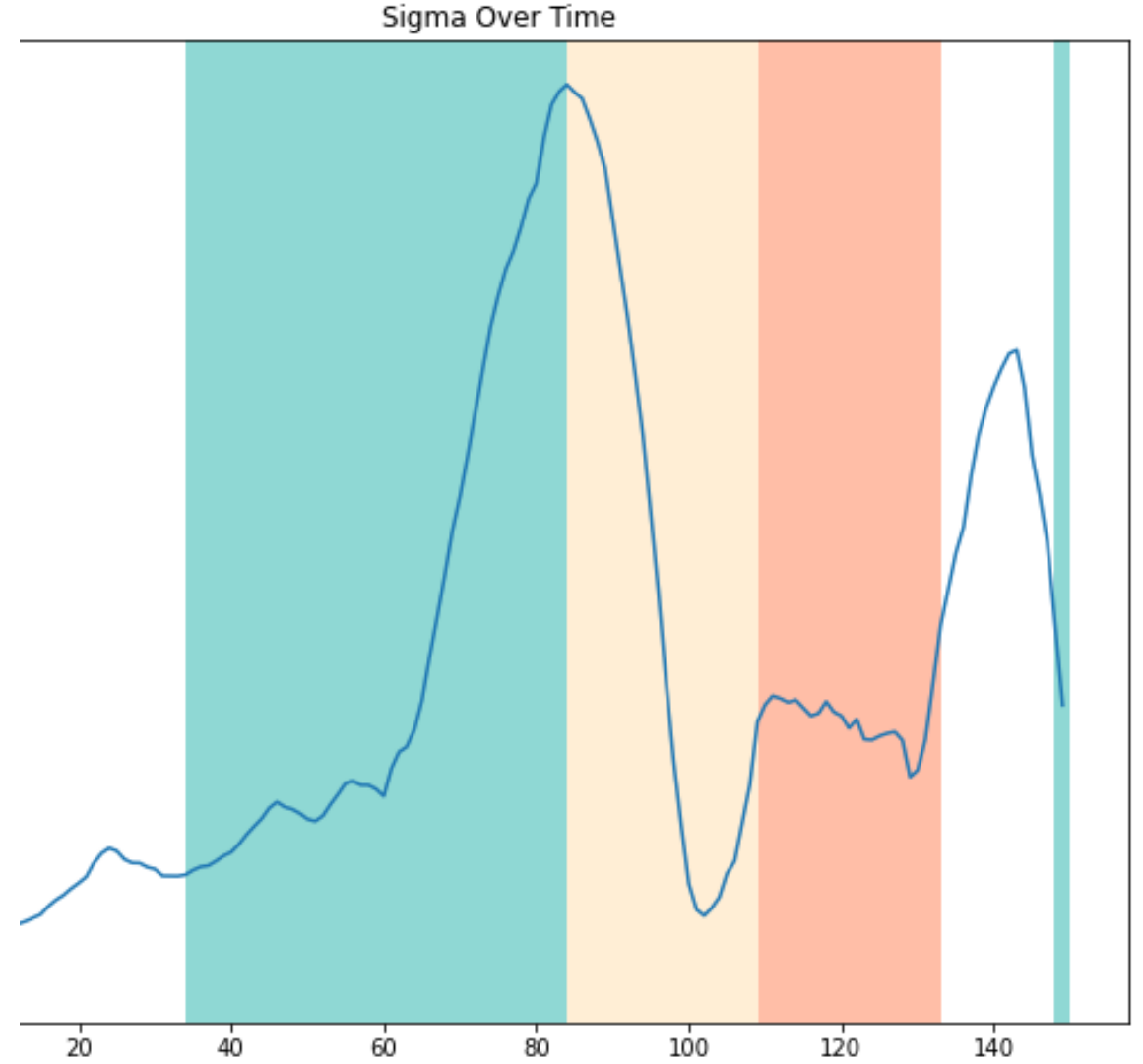
Stock price over time



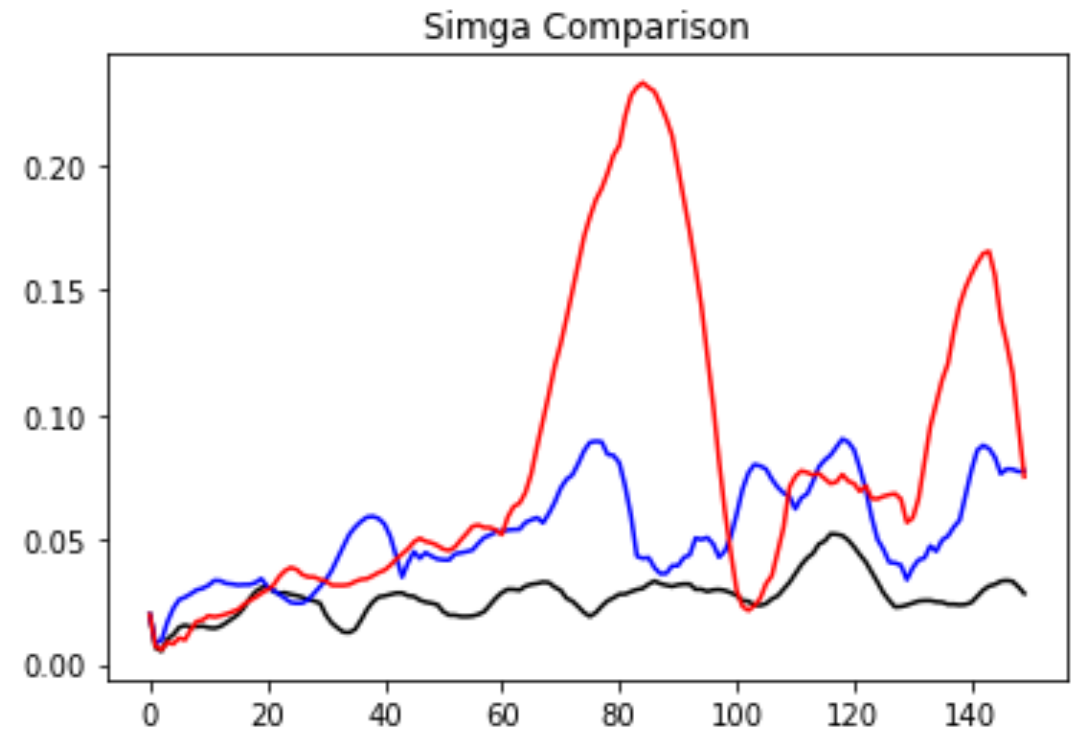
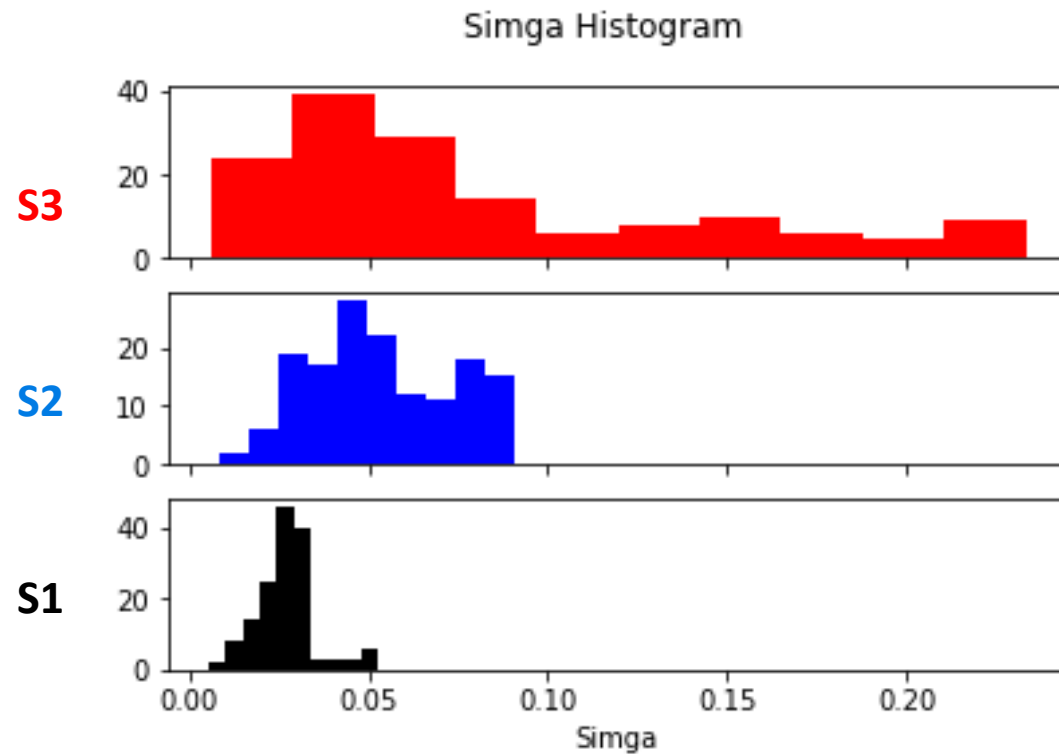
Comparing
S2 with S3

S3 Sigma

- **Pump** : the volatility would **upsurge**.
- **The static stage** : Plummet to almost 0
- **Dump** : Went up to a certain level



- **The big investor** significantly increased market volatility
- This affect the magnitude of stock price movements.
- We can easily compare the three scenarios with the histograms on the right side.



Results

- The return from 3 different situation in 2000 ticks
- The big investor had outperformed the other investors with a respectable return.

	Random Agents	Chartists	The Big Investor
Return rate	-29.05 %	109.03 %	157.06 %

Potential Mitigation Strategies

1.Enhanced Market Surveillance

- Implement advanced data analytics and artificial intelligence techniques to monitor market activities in real-time.
- Detect unusual trading patterns and identify potential pump and dump schemes early.

2.Increased Transparency

- Encourage greater transparency in financial markets by mandating timely and accurate disclosure of relevant information.
- Promote the use of secure and transparent platforms for conducting market transactions.

Future Work

- Define better-designed big-investor strategies
- Introduce new investor types
- Consider the trading countdown
- Insert multiple stocks in our model