SIMUDYNE

A Resting Time Policy for the Limit-order Book

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Can minimum resting times improve execution quality?

Motivation: High-Frequency Trading (HFT) Noise

- **Disturbs** price formation process through near-instantaneous placement and cancellation
  - Significant high frequency changes at millisecond (sometimes nanosecond) speeds
  - Net liquidity consumption
  - Skews observed supply and demand by acting on transient information that is Independent of new market information
- **Exploits** mid to low frequency traders
- **Impacts** order flow

Policy Objective: Minimum Resting Times

- **Prevent** faster-than-human order cancelations (<100ms)
- **Avoids** direct penalties on HFT strategies
- **Cleaner** price formation process
- **Improved** execution quality

McGroarty *et al.* LOB-ABM

- Supports Limit and Market orders
- 5 trading behaviours
  - *Market makers*
  - *Momentum traders*
  - *Mean-reversion traders*
  - *Liquidity takers*
  - *Noise traders*
- Minimal complexity and heterogeneity
- Captures realistic market dynamics

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S.I.: APPLICATION OF O. R. TO FINANCIAL MARKETS

High frequency trading strategies, market fragility and price spikes: an agent based model perspective

Frank McGroarty[1] · Ash Booth[2] · Enrico Gerding[2] · V. L. Raju Chinthalapati[3]

Abstract
Given recent requirements for ensuring the robustness of algorithmic trading strategies laid out in the Markets in Financial Instruments Directive II, this paper proposes a novel agent-based simulation for exploring algorithmic trading strategies. Five different types of agents are present in the market. The statistical properties of the simulated market are compared with equity market depth data from the Chi-X exchange and found to be significantly similar. The model is able to reproduce a number of stylised market properties including: clustered volatility, autocorrelation of returns, long memory in order flow, concave price impact and the presence of extreme price events. The results are found to be insensitive to reasonable parameter variations.

Keywords Agent-based model · MIFiD II · Limit order book · Stylised facts · Algorithmic trading

McGroarty *et al.* LOB-ABM Shortcomings

No concept of calendar time

- Cannot test resting time during pre-open call auction or continuous trading phases

Does not model latency

- HFT traders must be able to place and cancel orders at low latency

Assumes 5 trading types capture market dynamics

- Machine Learning (*work in progress*)
  - Models missing behavioural gap
  - generates complex bias that standard traders miss

Setting

McGroarty *et al.* extensions:

- Agent parameters modeled by distributions
- HFT compatible matching engine and latency logic
- Calendar time with pre-open period during a trading day

Calibration

- (single random) 1-minute window of full-depth Level II MSFT high-frequency data
  - From 14h14 to 14h15
- 10 metrics
  - First 4 moments, Hurst, Autocorrelation on mid-price
  - First 4 moments of ROC on Orderflow Imbalance
- Calibrated Trader Types
  - 8 Market makers
  - 92 Momentum traders
  - 35 Mean-reversion traders
  - 33 Liquidity takers
  - 7 Noise traders

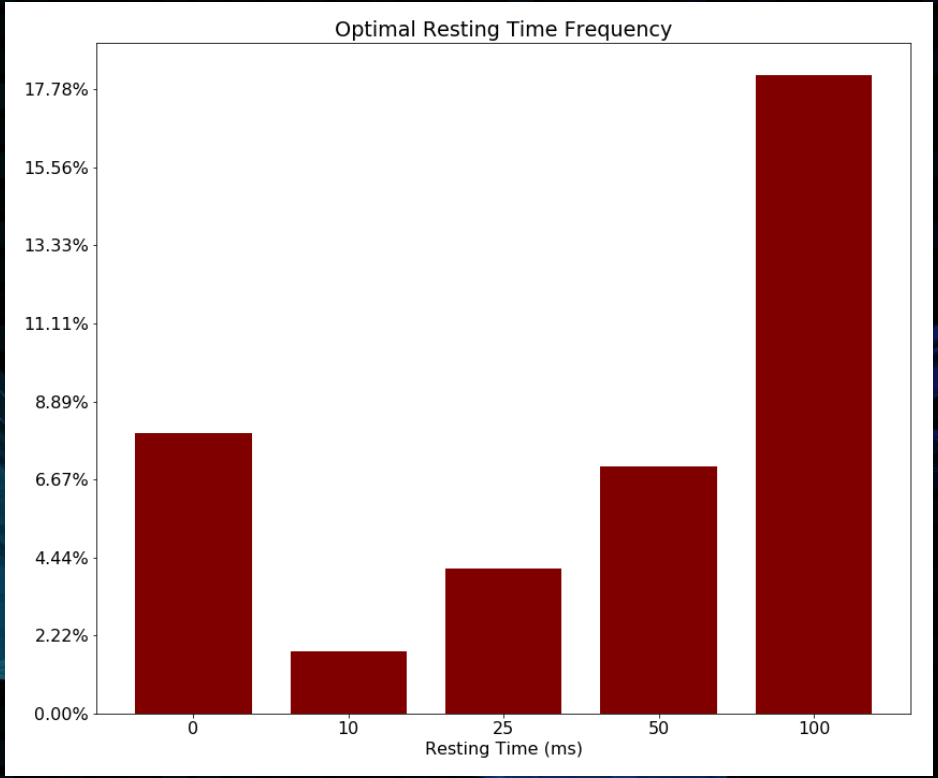
Policy Intervention

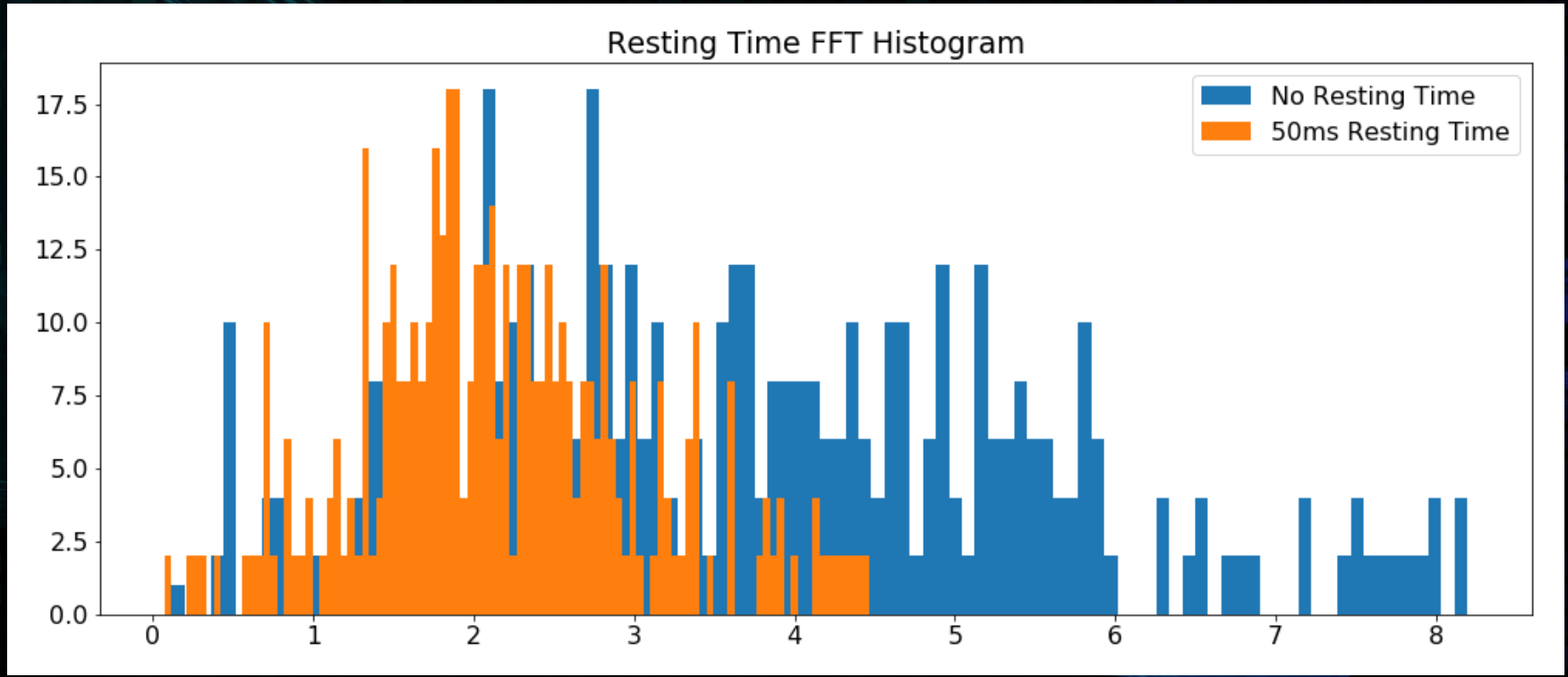
- Single root calibration with 100,000 scenarios (seeds), $S = \{1, \dots, 100{,}000\}$
- Resting time interventions $R = \{0\ ms, 25\ ms, 50\ ms, 100\ ms\}$
- The performance of resting time r in scenario s is defined by,
  - $y^{s,r} = \max \mathrm{ROC}(\mathrm{OFI}^{s,r})$
- The optimal resting time for scenario s defined by,
  - $y^{s,*} = \min_r \max \mathrm{ROC}(\mathrm{OFI}^{s,r\}})$

Result

1. Resting times reduce maximum ROC(OFI)

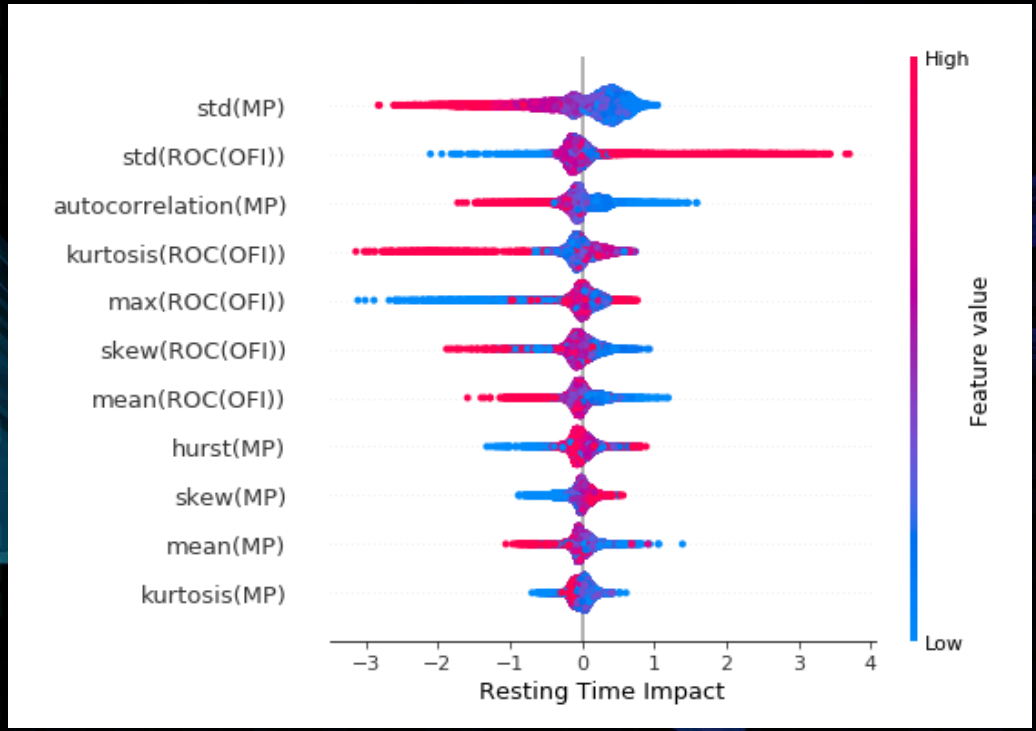
2. No single best resting time for all states




Resting Time FFT Histogram
No Resting Time
50ms Resting Time
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0
1
2
3
4
5
6
7
8

Policy: State-Dependent Resting Times

- Approximate map from scenarios to their optimal resting times
- Decompose local sensitivities
- Use sensitivities to guide state-dependent resting time policy



Conclusion

A state-dependent resting time policy may clean the price formation process and improve execution quality

Thank you!