# Geometric Asset Exchange Model

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# Econophysics contribution to economics

Data analysis techniques for statistical physics to financial data.

Computational Models such as the Asset Exchange Model

# Asset Exchange Model

The Asset Exchange model is a stochastic system where agents interact via pre-determined rules. The aim of this model is to analyze how the distribution of the agents wealth change over time.

Inspired by Yakovenko's Paper "Statistical mechanics of money, wealth, and income". The idea is based on the similarity between the Boltzmann distribution and income distribution in an economy.

# Geometric Asset Exchange Model

GAEM is an Asset Exchange Model divided into different section. The key parameters are the trading rates within a section and the trading rates between section.

Under what conditions do we see wealth inequality and transfer of wealth between two sections?

GAEM can be used to model microeconomics (relationships between industries), international trade and modelling other economic networks.

# Ground State

The simplest version of the Model

2 Section with *a and b* number of agents

Section 1 and 2 have exchange rates *n* and *m*.

Inter-Section exchange rate *i*.

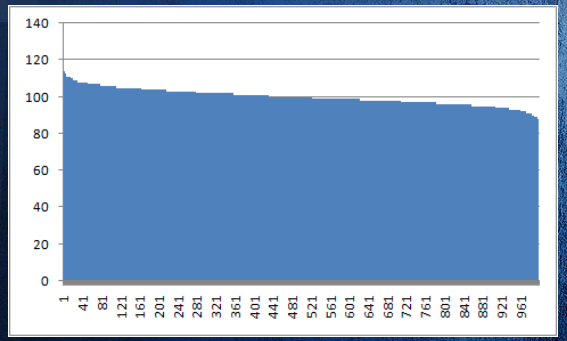
Key things to explore:

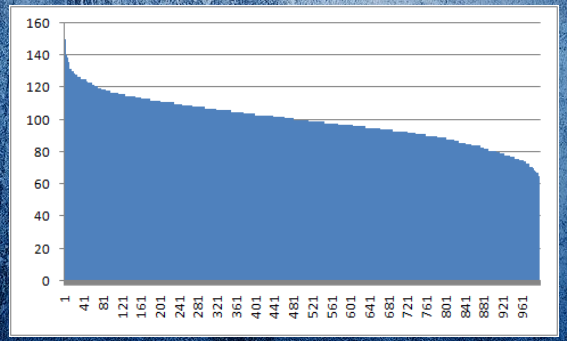
- Wealth transfer between the sections
- agent failure rates
- Wealth condensation

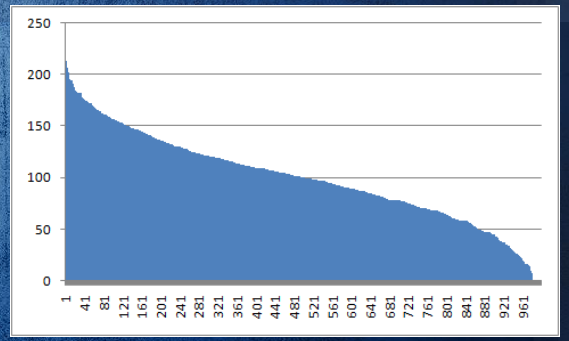
# Key Questions

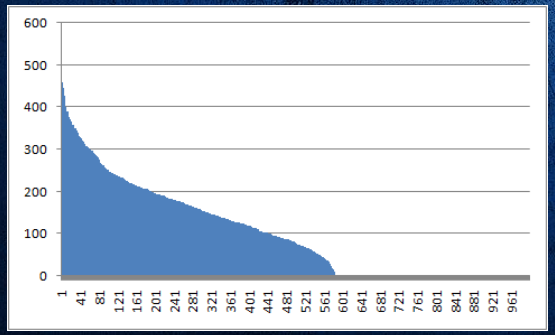
- How does wealth inequality develop in this limiting condition?
- How is inequality affected by trading parameters?
- How does inequality in one sector affect another?

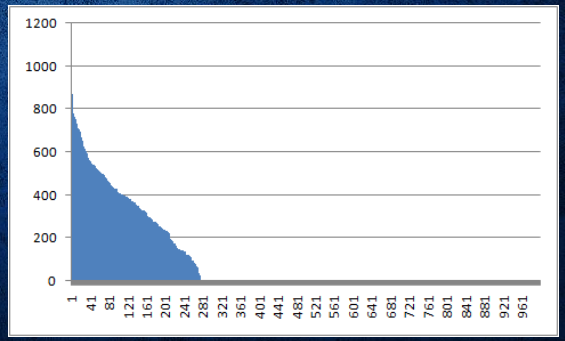
# Wealth Distribution



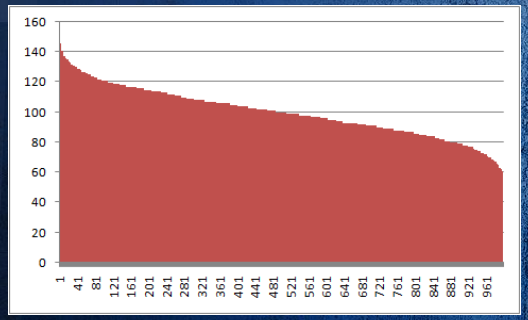



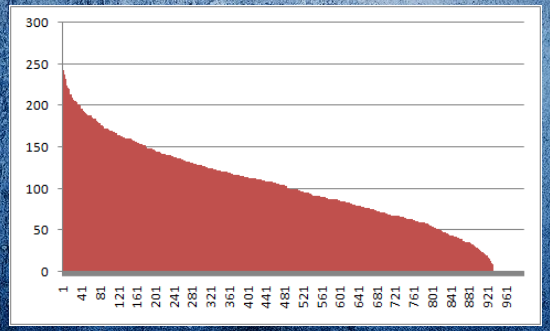



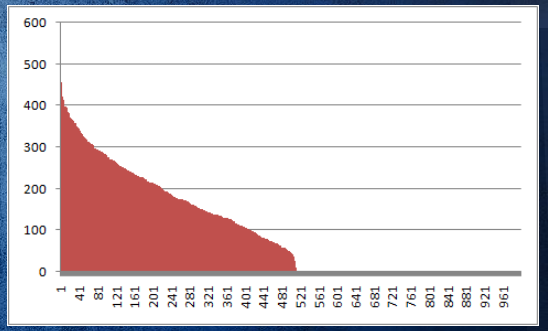



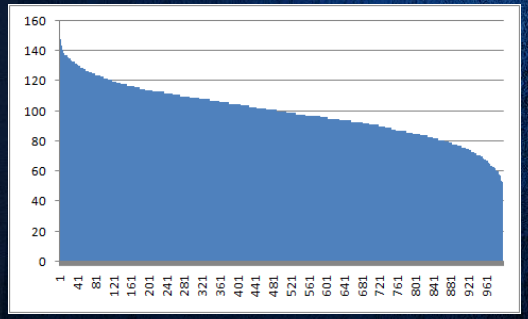



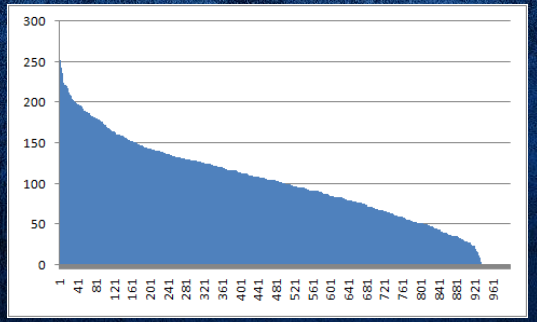
# Inter-Section Trading

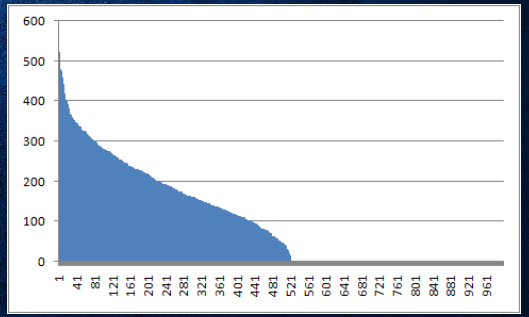


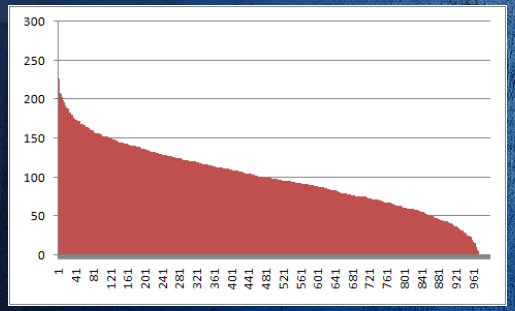



# Inter-Section Trading: Biased Paramters

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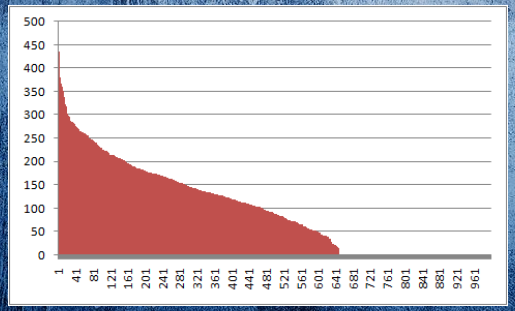


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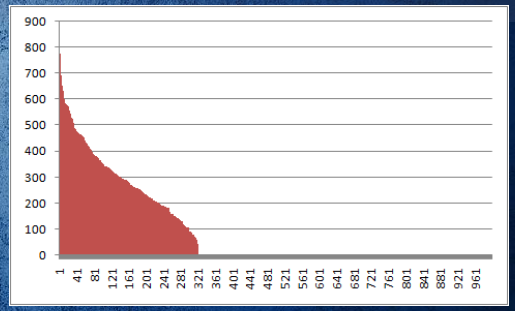


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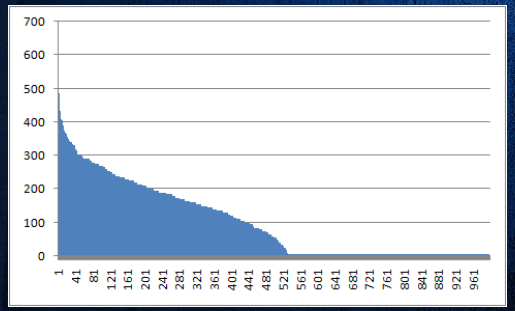


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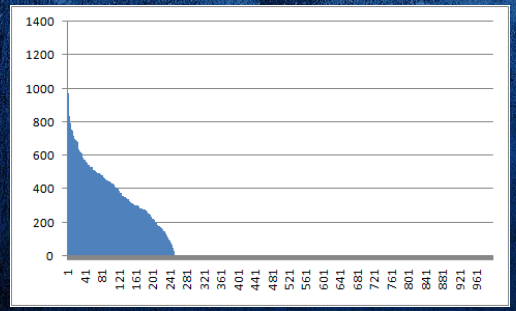


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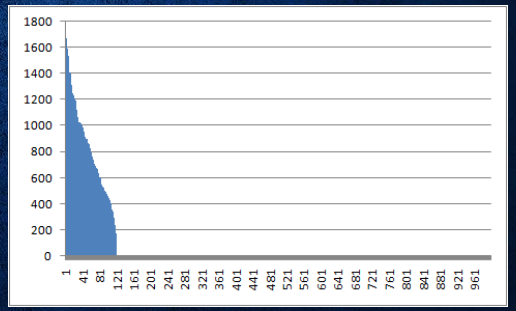


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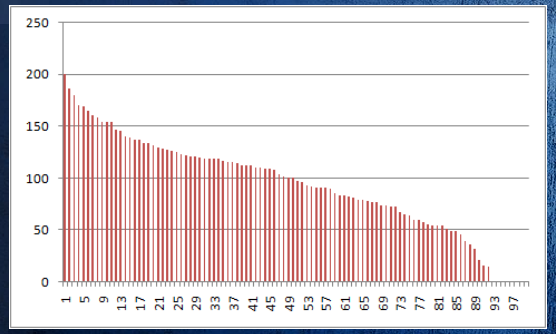
# Inter-Section Trading: Biased Paramters

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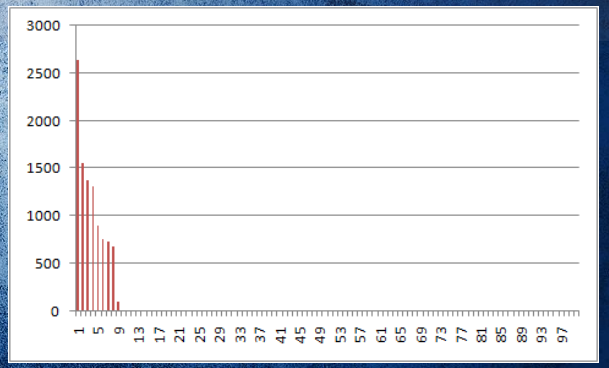


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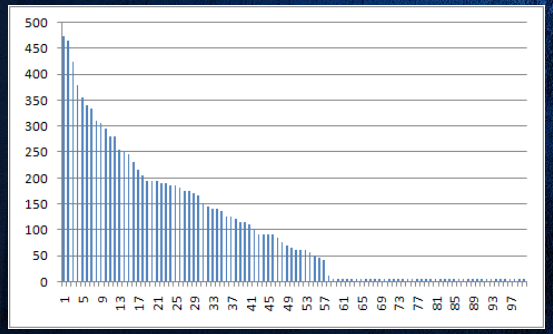


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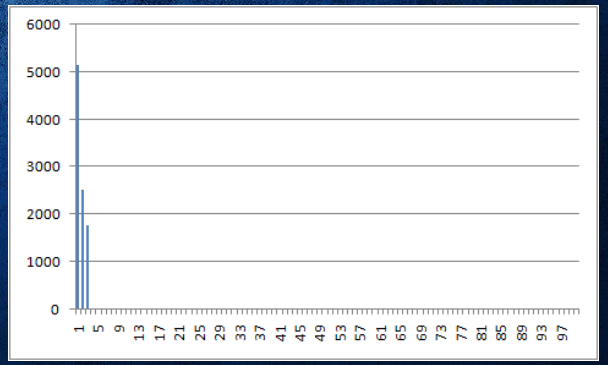


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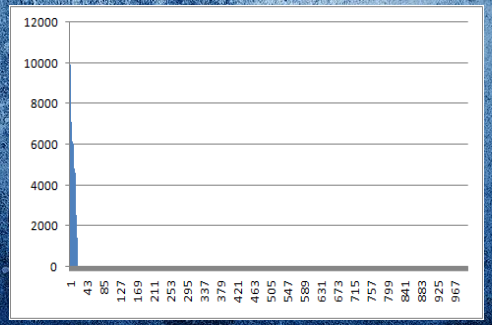
# Inter-Section Trading: Heavy Bias

The trading rate of Blue is raised significantly higher.

All parameters held constant in both cases and run for 10^8 time steps.

- Power Law when there is a high wealth condensation
- Wealth Condensation on Blue causes the wealth condensation in Red to speed up.

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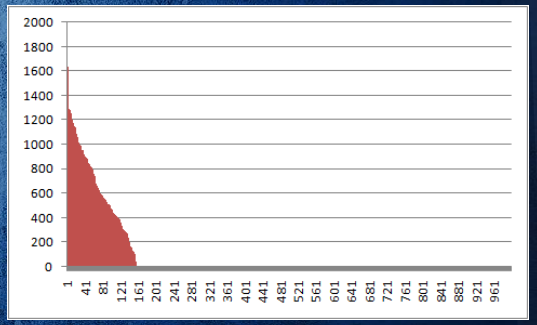


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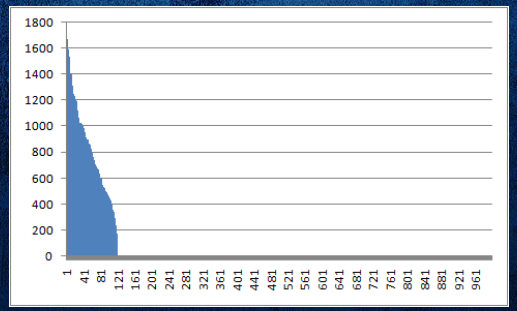


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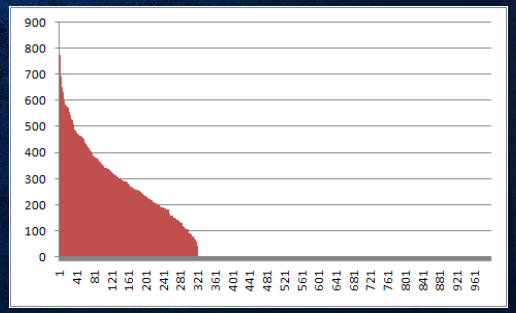


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# Key Points

- Wealth Condensation at large time steps. There is a power law distribution which gets ‘steeper’ with time.
- Agent Failure Rate decreases with the number of agents.
- Wealth Transfer between sections. Rate of wealth transfer is faster with lower agents.

# Future Projects

- Incorporate Growth Rate, Taxation, Failure Sites into the system.
- Use simple machine learning algorithms to simulate behavioral economics models
- Find analytical description of the system