# Exploring Stock Market Strategies with Risk and Influence with Complex Networks

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***Abstract*—content...**

## I. Introduction

This project was designed with the objective of exploring the impact of risk as defined by a power law distribution and networked brokers in the context of neighbor influence on the brokers' portfolio values over different trading intervals. Economic markets are volatile and have been shown to contain many fat-tailed and power law distributions, such as in growth rates and stock returns **??**. Many different models of the market have been created to explore these behaviors, and data is readily available to examine the impacts of different strategies and inter-dependencies on the market. Scholars have examined risk and risk aversion, explored modeling the market as a network of stocks or brokers, attempted to classify and group the networks, and attempted to design models of crashes that resemble the real world. This project combines the study of risk in psychology with the fat tailed distribution of network connections and the volatility of black swan [2] events to evaluate market broker strategies to maximize portfolio value over typical events and through drastic changes in the market.

## II. Background

This topic has been explored from a variety of perspectives. Most work has been divided into exploring financial markets in terms of complex networks, looking at individuals' perspective on risk, and running case studies with different clustering and strategies in the market. The work in complex networks creates networks with either brokers or stocks at nodes [8], [9]. To create the edges, they have explored the diffusion of information [9], spread of first and rebound shocks [10], and correlation and mutual information of different stocks [12], [13]. This study models the market with brokers at the nodes with influence connecting the brokers.

Further, several models for risk were presented. This involved quantifying the risk with the Chen, Roll, and Ross factors [14] to predict economic activity, assessing the importance of the distribution of risk aversion in the volatility of returns [15], and highlighted the importance of dividends in quantifying the risk level of stocks. These models provide a basis for developing a model of portfolio risk.

## III. Methods

The exploration of the market was designed as a simulation to be run over various time intervals for interconnected brokers that can influence one another and preferred risk levels. This included creating 100 brokers each with a preferred risk level and a number of friends sampled from a power law distribution. The friends also provided their assessment of risk for a given stock which was considered by the broker in their personal assessment. Data for every day in the interval was fed into the simulation, allowing brokers, in a random order, to buy or sell stocks to maintain their preferred level of risk. For interpretation of results, the brokers' indices correspond to the level of preferred risk.

### A. Data Collection and Filtering

### B. Influence and Friend Selection

The number of friends

### C. Risk Calculation

### D. Metrics

## IV. Results

## V. Conclusion

### A. Future Work

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