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Stock Index Pricing with Random Walk and Agent-Based Models

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Oral Presentation O2.1

STOCK INDEX PRICING WITH RANDOM WALK AND AGENT-BASED MODELS

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The objective of this work is to empirically test the EMH (efficient market hypothesis) and compare its results to those of a viable agent-based competitor using computational simulation. Random walk and agent-based models for the determination of stock market prices are statistically compared using the criteria of stationarity, randomness, and autoregressive behavior. The agent-based approach used, styled the “ant trader” model, is based on the ant model established by Kirman in his 1993 work “Ants, Rationality, and Recruitment”. Daily returns of the Hang Seng and Nikkei 225 indices are used over the periods 1987-2007 and 1984-2007, respectively. Preliminary simulations run with the agent-based model indicate high sensitivity to parameter changes; parameter imbalances lead to unrealistic growth in returns. Batch stationarity tests using ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) tests suggest that the two models behave similarly under the chosen parameter conditions. However, the random-walk model is found to be more consistent with the available data when using the Wald-Wolfowitz runs test and the Lo-MacKinlay variance ratio test. We conclude that the EMH can be theoretically challenged by the ant trader model, but not empirically. The agent-based model has more realistic assumptions and is more flexible; however, the random walk model agrees with the properties of real-world stock index return in this case, specifically stationarity and randomness.