

Building the model of artificial stock market based on JASA

KANG Wei^a, SUN Cai-hong^b

^a*School of Economics, Renmin University of China, Beijing 100872, China*

^b*School of Information, Renmin University of China, Beijing 100872, China*

Abstract

This paper introduces the major function, system framework, running mechanism and core modules of JASA, an open source auction simulator software. Then it builds a new multi-agent artificial stock market modeling platform, named JASA+ by extending, improving JASA, and adding stock market normal quotas, price limits, stock traders, bid-ask strategies and graphic reports. It studies the effects of price limits on stock market via JASA+ platform. The experimental results demonstrate that with in some extent the price limit policy could improve the market efficiency and return, and reduce the bid-ask spread. JASA+ can simulate true stock market preferably, being different from SFI-ASM, a traditional research tool. JASA+ gives researchers a new thought and method in finance markets.

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Keywords: Artificial stock market; JASA; Price limits; Multi-agent simulation

1. Introduction

Artificial stock market is an automatic matching system of modeling and simulating stock market using computer, usually being consist of agent and trading environment. According to the real-time information and historical information of stock market, agents select different trading strategies under the control of the trading rules, and take selecting, buying, holding, selling and other operations. Researchers can set trading rules of prohibiting short selling and price limits, the initial wealth of agents, trading strategies and other model parameters. They can analyze financial markets by simulating the operation of the artificial stock market system. In theory, artificial stock market is an implementation of the complexity adaptive system theory in the financial markets. In other words, the financial market is a complexity adaptive system. In the method, artificial stock market analyzes and researches the microscopic explanation behind the anomalies of financial markets using computer modeling [1]. One pioneering study is SFI-ASM model of Santa Fe Institute, which consists of some different, non-fully rational agents (investors). Agents make investment decisions with their forecasts of the future state of the market, and replace the bad parts of prediction rules through genetic algorithms [2]. On the basis of SFI-ASM, many scholars carried out relevant researches and extensions in the area. LIU Wei-ni, HAN Li-yan (2007) developed a multi-stocks market, named by IASM [1]. With the order book, GONG Lan-jie, WANG Chun-feng, FANG Zhen-ming (2008) replaced specialist which are responsible for market clearing and achieved a continuous double auction (CDA) [3]. MA Jin-sheng, YANG Min, QIU Wan-hua (2008) changed the asset pricing

mechanism and the learning mode of agents, so that agents have different rates of learning in artificial stock market [4].

JASA (Java Auction Simulator API) is open source software. We improve some functions of JASA, build a new artificial stock market modeling platform JASA+. This paper does experiments and analysis on the impact of price limits on stock through JASA+, and explores new research ideas and methods on the financial markets.

2. JASA - Open Source Auction Software

JASA is a high-performance auction simulator written in JAVA, provides a variety of auction mechanisms, trading strategies, decision-making mechanisms, learning algorithms and statistical reports, the researchers can easily do economics experiments of multi-agent through parameter configuration.

2.1. Introduction of Auction

Auction is a market mechanism, in which participants determine resource allocation by prices and a set of rules. According to whether price is public, Auction is divided into public auction and sealed-bid auction [5].

According to differences in market structure, the auction is divided into one-side auction and double auction. One-side auction is "one to many" market structure, and double auction is "many to many" market structure. Double auction is divided into CDA and clearing house auction (CHA).

2.2. The Architecture of JASA

JASA supports a variety of auction types, such as English auction, Dutch auction, sealed-bid auction, but it is more suitable for building artificial stock market by double auction. The core module of JASA consists of three parts. They are market, auctioneer and trader. The trading goods are undifferentiated commodities. The system architecture is shown in Figure 1. Market is auction scheduler and controls the whole auction process through auction events. Trader includes two types of one-side and two-side. The former can only buy or sell in the whole auction process, while the latter can choose buying or selling based on trading strategy in every time. Auctioneer is responsible for matching trading orders, determining the transaction price, and clearing trading orders.

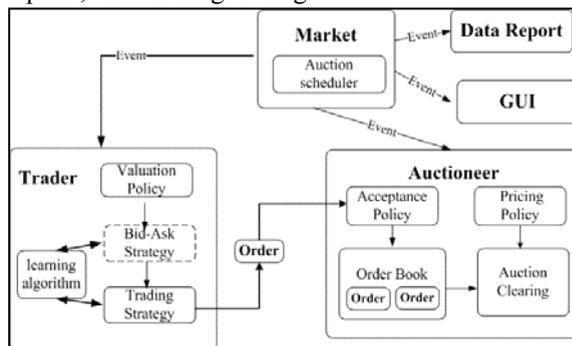


Figure 1 the system architecture of JASA

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