An Artificial Market Model which consists of Various Agents

Hiroki Matsui (010109)

School of Information Science,
Japan Advanced Institute of Science and Technology

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In this study, we improve and extend the artificial market model proposed by Izumi et al. and then a more realistic artificial market model of a foreign exchange market is proposed. Recently, some researchers have paid attention to the psychological or behavioral features to explain stock markets and foreign exchange markets behavior. However most conventional economic theories of exchange markets ignore them and assume that all participants in a market make decision rationally. So there have been several artificial market approaches that try to construct more realistic models for them.

Izumi et al. proposed a multiagent model for a foreign exchange market, named AGEDASI TOF where some factors for exchange rate such as business conditions, prices and interests rates are given to agents and the exchange rates are determined by agents' trade. This model has some features as follows.

- Using real weekly data as market factors, that is taken from Tokyo foreign exchange market .
- Agents (as participants) are characterized by weights of factors which are concerned with fluctuations of exchange rates.

- Using genetic algorithms to describe the interaction between agents and learning of agents.
- They integrate fieldwork studies and multiagent models to implement agents and to analyze this system.

Especially the forth feature have not seen in any other artificial markets model from a point of view that interviews of actual dealers are done for constructing this model. AGEDASI TOF improved the errors between forecast exchange rates simulation showed and actual rates, and has succeeded in analyzing large fluctuations of exchange rates.

But AGEDASI TOF we think seem to have some unrealistic properties in the following points. First, about interaction between agents. If the agents failed to forecast exchange rates, they imitate belief system of successful agents completely. It is senseless to copy weights which are independent of forecasting exchange rates, because their fitness don't improve. Moreover imitating other agents completely, they lose individuality. On the other hand, failed agents interact with succeeded agents on equal terms. Normally, succeeded agents have the wood on failed agents.

Second, about agents. Agents in AGEDASI TOF are homogeneous about the purpose and how to forecast exchange rate. Their purpose is maximization their profit and their way to forecast is using factor of rate prediction as economical indicators and political news on equal terms. But participants in actual markets are various on the purpose and way to forecast.

In this study, we improve and extend considering the information exchange between agents and a diversification of agents. To modify interaction between agents, we don't use genetic algorithms used in AGEDASI TOF. Instead, we propose the new interaction which the weights with no influence for estimating exchange rates are exhibited to he copied. This model improved the precision of forecast exchange rates. Moreover a self learning of agents for estimating exchange rates is introduced.

On the other hand, we introduce various agents called fundamentalists and chartists. They are agents who forecast exchange rates with different ways and agents who intervene . The agents who forecast exchange rates with different ways are so-called fundamentalists and chartist. They are typical types of dealers. Fundamentalists' demand (or supply) is based

on security prices relative to fundamental values of security. Chartists' demand (or supply) is based on the price change of securities. We carry out simulations using the model which consists of these types of dealers. Rate changes of markets which consists of only fundamentalists are stabilized. But rate changes of markets which consists of fundamentalists and chartists are not stable. Chartists create instability for markets. Moreover, large fluctuations are generated by trading between fundamentalists and chartists. Large fluctuations do not arise at the markets which consists of only chartists.

Agents who intervene are as the government or the central bank in actual markets. Because there is the agent who intervene in the markets, he intervenes dynamically. And, we investigate portfolio balance effect and signaling effect of intervention when the amount of intervention is small in 1998. Portfolio balance effect is rates change because intervention affect demand and supply balance. Signaling effect is rates change because participants change their forecasts by finding intervention. There is the large fluctuation, the yen fall from 135 to 116 against the dollar a week on October 1998. In this study, we assume the center bank intervene based on asymmetric leaning against the wind policy. Namely, if the exchange rate is higher than his target rate and high dollar rate is going on, he carry out dollar-selling intervention. If the exchange rate is lower than his target rate and low dollar rate is going on, he carry out dollar-buying intervention. As a result of simulation, considering only portfolio balance effect, exchange rates do not stabilize. But considering signaling effects, exchange rates tend to stabilize. Namely, the influence on the rate change by portfolio balance effect is small, but signaling effect impacts on rate change.