Agent-Based Simulation of C2C Internet Auctions with Online Escrow

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Extended Abstract

The spectacular growth of consumer-to-consumer (C2C) e-commerce has made every individual a potential buyer and a seller in the electronic marketplace. However, Internet fraud is emerging as a main threat to the adoption of the online business. According to Internet Fraud Watch, online auction sales suffered the highest Internet fraud during 1998-2000 with a rate of reported cases as high as 87% in 1999. Even though the rate has dropped back to 79% in the first month of 2000, the average loss per person rose about one third in 2000 from $310 in 1999. To ensure security in exchanging goods and payments, online escrow is now appearing as an attractive service from the trusted third party (TTP) that acts as an intermediary between the buyer and the seller. The economic implication of online escrow in the C2C marketplace is profound: it changes the strategies online traders are applying in trades and hence the equilibria of the game between online cheaters and honest traders. Hu et al. (2000, 2001) developed a fundamental model for this theory. Perceived risk rate (PRR) is defined as a thread to link up the three agents in the model: the cheater, the honest trader, and the online escrow service provider. Although a set of optimum trading strategies for traders have been revealed leading to subgame equilibriua, the dynamics of the observational and control variables remain unknown in the model.

This paper presents a generic research project in studying the dynamics of the C2C online marketplace with online escrow service, focusing on the economic experimental approach that uses the agent-based technology. As a methodological exploration, the project is to verify whether software agents could replace human subjects for e-commerce experiments, with the parameters calibrated from the latter. This is to be addressed in the following steps:

- First, a single computer program based simulation is conducted to tune up key parameters for the experiment.
- Second, human subjects are recruited for the experiment using experimental parameters tested in the simulation system.
- Third, experiments are carried out with an agent-based system using the parameters fine-tuned in human subject based experiments.
- Fourth, experimental results using different schemes are compared.

All above experiments can be carried out using an integrated system, which is capable of supporting agent-based simulations as well as human subject based experiments, or even the experiments involving both software agents and human subjects.

There are three architectures for the experimental system if different configurations are defined:

Integrated architecture: the simulation of the C2C market with online escrow service is operated on a single computer.

2-tier: There could be two choices: seller-side processing, i.e. market operation is integrated with the seller module; and, buyer-side processing, market operation is integrated with the buyer module.

3-tier: It is a seller-market-buyer architecture (Figure 1). Three modules are needed.

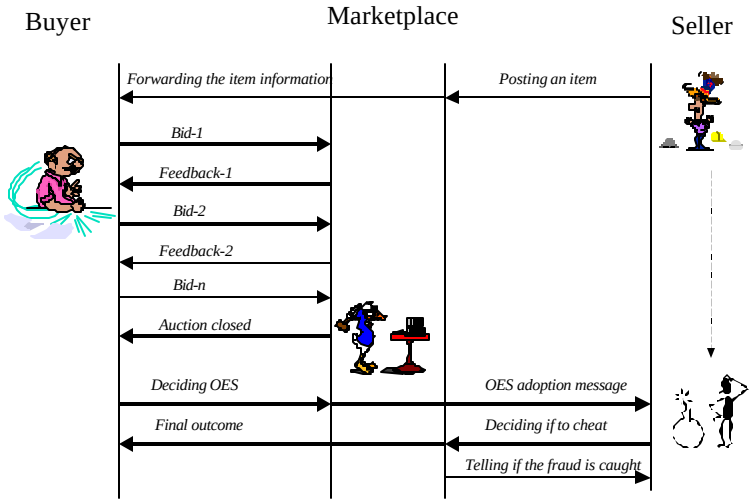

Figure 1. Interactions between agents in an e-market

The market module has six states as depicted in Figure 2. If let all biding activities operate at buyer side module, the bidding process can be omitted in the market module. The process is: (1) the market module sends current information about the item for bidding to the buyer module; (2) the buyer module bids on the item until auction closes; (3) the winner decides if online escrow to be used; (4) all these messages: agreed price, buyer parameters, and OES decision, are sent from the buyer module to the market module; (5) The market module finalizes the auction by disseminating all information to both buyer and seller in the trade; (6) The market module let a seller initialize a new auction. Figure 3 shows this simplified process.

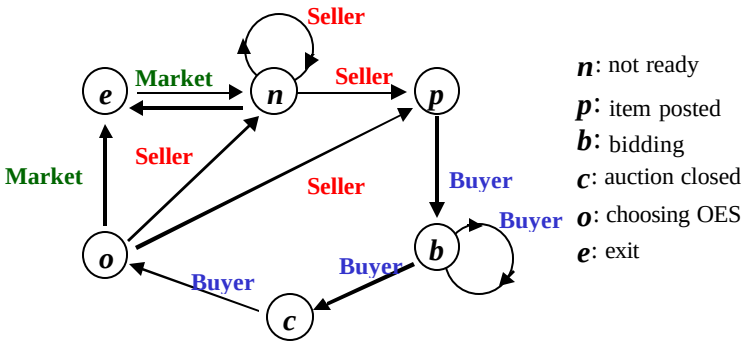

Figure 2. A market state model for the 3-tier architecture

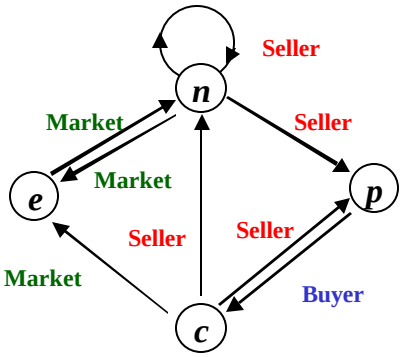

Figure 3. A simplified market state model for the 2-tier architecture

The three crucial factors responsible for limited loyalty of consumers in e-commerce are convenience, time and cost of procurement process. A buyer walking through the auction site would follow a predefined pattern in selecting a product and making a purchase decision. We have listed the important variables that are to be considered during the process of simulation.

The Control variables, which are given as input to the simulation process, are *OES fee rate* and *Cheating rate.* The following variables are observed in deriving an output: (a) *OES adoption rate* – The rate of seller adopting the escrow service if the buyer demands it. (b) *Buyer PRR distribution* – The mean and standard deviation is observed. It is calculated based on *Fraud effect* and *Reputation of seller*. (c) *Fraud rate* – The rate at which the seller decides to cheat even after the OES is adopted. (d) *Escrow agent's profit*. (e) *Seller reputation records* – This is a dynamically updated variable whereby, it increments by one when an honest trade is done and set to zero if the seller cheated.

At present, the experimental system can operate in the integrated mode – running with a single computer to simulate the process of online C2C auctions. The distributed operation features are being developed.

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