Determinants of Online Escrow Service Adoption: An Experimental Study

Solomon Antony, Zhangxi Lin, and Bo Xu
The Rawls College of Business Administration, Texas Tech University
{antony, zlin, bxu}@ba.ttu.edu

Abstract: Online escrow is an emerging trust service in consumer-to-consumer auction markets to protect online traders from Internet fraud. This paper reports an empirical study on the factors affecting traders' risk perception and their adoption of online escrow service. A web-based C2C auction experimental system has been implemented to dynamically collect subjects' risk behavior during experiments. The data from online trading are then jointly analyzed with the data from a pre-experiment survey for trader risk attitude. Results show that trade partner's reputation and market fraud rate have significant effects on trader's risk perception, and online traders who are risk averse will most likely to adopt escrow service with regard to the perceived risk.

Keywords: C2C online auction, online escrow, perceived risk, risk attitude, reputation, simulation.

1. Introduction

> *"Online auctions are among the most popular e-commerce destinations on the World Wide Web, with total sales expected to reach $19.6 billion by the year 2004. Yet online auctions have also become the primary venue for online fraud. Online auction problems accounted for 87% of the online complaints reported to the National Consumers League in 1999. A December 2000 survey revealed that 4 in 10 online auction buyers have had a problem with online auctions." - A report for 2001 Annual LCT Conference* (Selis, Ramasastry, and Wright, 2001)

Customer-to-customer (C2C) online auction has attracted every individual a potential trader, who may involve in the business anytime and anywhere via the Internet. However, according to Fraud.org (2001), 41% of online auction participants in the US, or 15.6 million of them, have encountered Internet fraud problems. Even though online escrow has become an effective trust service in protecting them from Internet fraud, its adoption rate is as low as 6%. Many traders are even indifferent to the frauds (Wolverton 2001). The incentive in adopting the online escrow service (OES) is derived by the perceived risk in online transactions, mainly from the fear of being cheated. Traders balance the possible loss with a service fee - an extra cost paid for the secured benefit. Therefore, the risk relief decision of OES adoption depends on perceived risk and perceived benefit (Andrade, 2000; Kim, Cho and Rao, 2001; Bhatnagar, Misra and Rao, 2000).

Hu et al (2001a) defined *perceived risk rate* (PRR) as the level of risk perception with a single subjective probability value. Hu et al (2001b) derived that PRR is flavored by two ingredients: one is *base PRR* which is the overall perception of online trading risk regardless of outcome of a specific transaction. The other is *dynamic PRR*, which reflects the effects of current transaction on the overall PRR. Base PRR is determined by trader's knowledge about fraud situations, his/her risk attitude, previous and any defrauded experience. Risk attitude has traditionally been defined in terms of inherent risk seeking, risk averse, or risk neutral behaviors. Measuring the risk attitudes of individuals has typically been accomplished using lotteries and what-if questions that compare a person's preferences for "sure things" and uncertain alternatives (Kahneman and Tversky 1979). This aspect of risk is considered to be relatively stable and independent of context (Weber and Milliman, 1997). Dynamic PRR is mainly affected by trading partner's reputation (Resnick et al, 2000). Base PRR and dynamic PRR jointly form the PRR of the trade, which is critical to OES adoption decision in trading.

In this research we study OES adoption problem in empirical approach following the theory in Hu et al (2001a; 2001b). We are interested in exploring the effects of perceived risk, traders' reputation, and price of product on OES adoptions. A simulated online C2C auction marketplace has been use to

collect online traders' behavior data. The paper is organized as follows: First, we describe the research model and the research question. Second, we describe the research method followed by analysis. Third, the findings are presented with a discussion on some research implications.

2. Research Model and Hypotheses

Research model

The research model (Figure 1) for this study is a revised version of PRR calculative model by Hu et al (2001b), with other important factors that affect subjects' decisions on OES adoption.

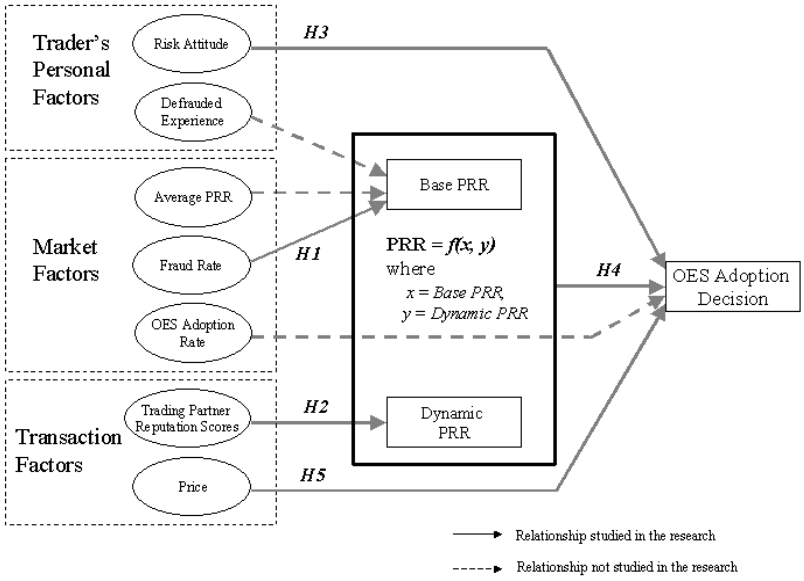

Figure 1. Research Model

There are three types of factors that affect PRR and the ultimate decision to adopt OES: a) Trader's personal factors such as his/her attitude towards risk taking and effects of having been cheated before; b) Market factors such as Average PRR for a group of traders, prevalent fraud rate in online auctions and OES adoption rate; and c) Transaction factors such as reputation of the trading partner, and the price of the product being bought. Our research hypotheses are stated in the alternate form.

Major Hypotheses

H1: Market fraud rate affects base PRR.

H2: Trading partner's reputation scores have an effect on dynamic PRR.

H3: Trader's risk attitude affects OES adoption.

H4: OES adoption is associated with the PRR.

H5: Bidding price affects OES adoption.

We used an alpha of 0.05 for our tests of significance.

3. Research Method

The research method is characterized by a three-step data collection process:

1) A lecture on Online Escrow Service was offered to graduate students enrolled in a data communications course at a major public university.
2) Subjects completed a risk attitude questionnaire (see Appendix) that complements the data to be collected in computer-based experiments.

3) An online system which simulates C2C auctions has been used for the experiments with human subjects.

The major advantage of using the interactive simulation system is that automated program's trading strategies can be dynamically adjusted based on feedback from human subjects.

Operationalization of variables

Variables in the research model are operationalized as follows:

?? Observed variable: Risk attitude, which is surveyed through questionnaires.

?? Controlled variables: Trading partner reputation, Price, and Fraud rate

Controlled variables are controlled in the online experiment system as independent variables.

?? Outcome variables: Base PRR, Dynamic PRR, OES adoption decision

Outcome variables are dependent variables of the online experiments.

Experimental system design

The experimental system is a web-based application with three modules:

1) Front-end application

The front-end application, powered by JavaScript, is the interface for subjects to access auction facilities with selected information for their OES adoption decision-making. It also provides decision support tools for subjects, such as base PRR selection and dynamic PRR selection, expected benefit estimation, etc. See Figure 2 for a screen shot of the OES decision interface. Product information, market statistics and trader's historical data are also displayed on screen.

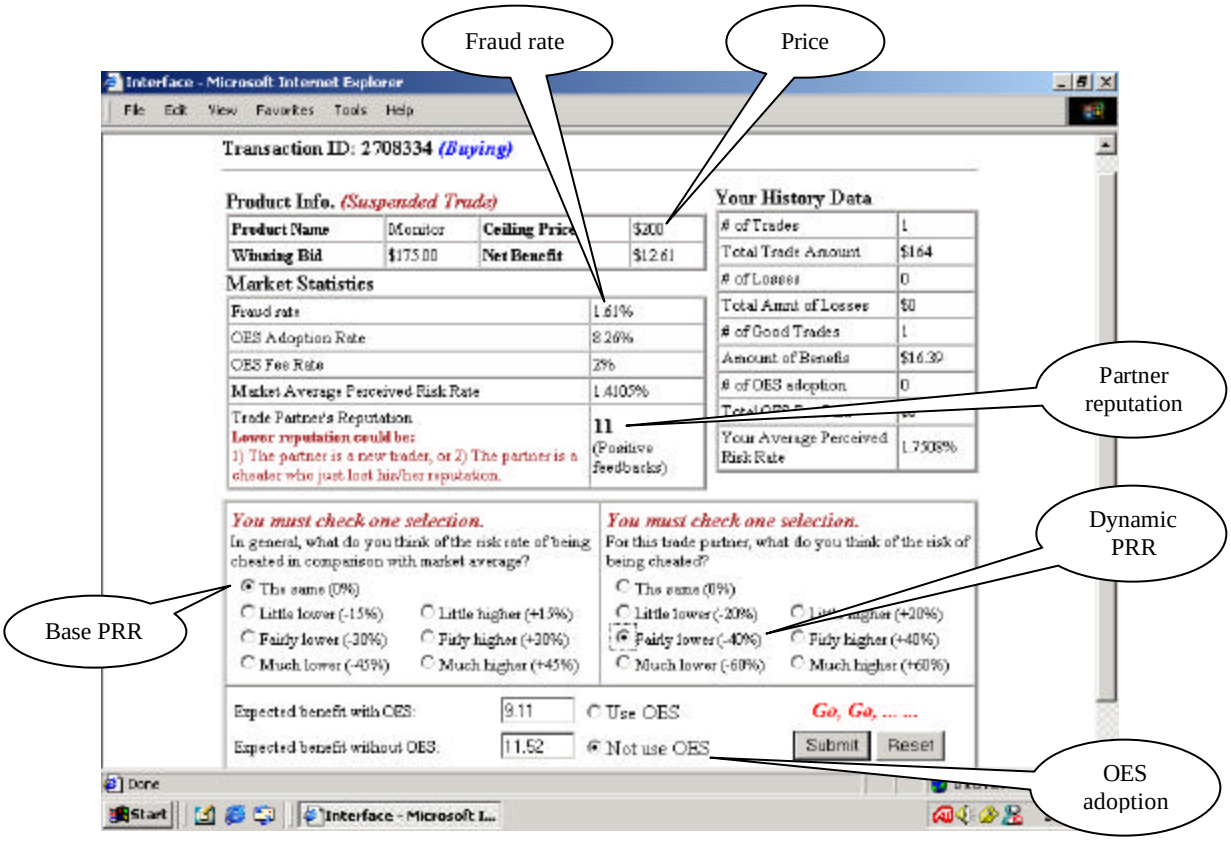

Figure 2. OES selection interface

2) Server-side application

The server side application simulates the functions of online marketplace, including user authentication, trader interaction, fraud generation, and data collection. It keeps track of each transaction, and computes statistics for the market and for each trader.

3) Simulation subsystem

This program runs on the background at the server-side. It serves two purposes: (1) to simulate the full process of a C2C auction transaction, so that it can generate required data in automatic operation mode, and (2) to support the server-side application that guarantees consistent performance of the simulated auction marketplace.

Data collection procedure

Thirty students volunteered to participate in the study. Prior to the experiment, we collected data on subjects' risk attitudes. Questions similar to the ones reported in Kahneman and Tversky (1979) were used to identify subjects' general risk attitude. Using the subjects' answers, we computed risk attitude. It ranges from 0 to 8, the higher the rate, the more risk seeking the person is (see Appendix).

Each subject was assigned a user ID and a password with which he/she can log in to the experiment system. Then he/she starts trading on a fictitious auction site. A subject can play either a buyer or a seller in a trade. In each transaction, he/she is required to do three things: (1) select a base PRR level, (2) select a dynamic PRR level, and (3) decide whether or not to adopt OES. No trade can be dropped before it is completely done.

Experiments with different parameters and settings are called schemes that can be defined by configuring a profile. Current experiments are conducted using eight schemes by varying three parameters each in two values: price - high ($2,000) or low ($200), trading partner's reputation information – available or unavailable, and fraud rate – higher or lower than OES fee rate. The schemes are tested by two experiment arrangements differentiated in fraud rates. In each scheme with a combination of the above three variables, every subject is required to trade 25 times. The performance of subjects is assessed by benefit rate – the ratio of net benefit from trading and the total transaction amount. Cash prizes of four levels ranging from $5 to $30 are paid to the winners in the game to motivate the incentive in this experimental economy.[1]

The research model suggests that the proposed relationships are based on features that apply to all rational human beings, so using student subjects can be justified.

4. Findings and Analyses

The summary statistics for the independent and dependent variables are listed in Table 1, 2 and 3, where reputation score is the number of positive feedbacks for a trading partner.

Table 1. Descriptive Statistics for Variable in The Survey (Risk Attitude)

Variable	N	Max	Min	Mean	Median	SD
Risk Attitude	30	6	1	3.33	3.5	1.21

Table 2. Descriptive Statistics for Variables (Experiment 1: High fraud rate)

Variable		N	Max	Min	Mean	Median	SD
Price	(Low)	1126	179	92	162.20	166	14.23
	(High)	1104	2249	1181	2038.65	2086.5	182.22
Reputation Score		2230	169	0	30.22	26	23.28
Fraud rate		2230	0.0315	0.0162	0.0192	0.0182	0.0039
Dynamic PRR		2230	0.6	-0.6	0.0132	0	0.176
Base PRR		2230	0.03089	0.01007	0.01949	0.0197	0.003
PRR		2230	0.04942	0.00403	0.02	0.0196	0.006

[1] See the experiment instruction (http://zlin.ba.ttu.edu/projects/OES -exp.htm).

Table 3. Descriptive Statistics for Variables (Experiment 2: Low fraud rate)

Variable		N	Max	Min	Mean	Median	SD
Price	(Low)	1104	179	104	162.62	166	14.08
	(High)	1100	2249	1364	2034.17	2085	181.71
Reputation Score		2204	128	0	28.30	23	21.62
Fraud rate		2204	0.0161	0.0137	0.0148	0.0147	0.001
Dynamic PRR		2204	0.6	-0.6	0.004	0	0.237
Base PRR		2204	0.02197	0.0059	0.01377	0.0131	0.0029
PRR		2204	0.03294	0.0028	0.0141	0.013	0.0054

An ANOVA test confirmed that there is a difference between base PRRs from the above two experiments ($F = 6.90$, $p = 0.0183$). So Hypothesis H1 is supported.

Multiple regression methods were used to test the effects of the independent variables. Table 4 presents the results of a least square regression analysis between dynamic PRR and partner reputation scores. Partner reputation scores showed a significant negative effect on dynamic PRR (beta = -0.00405, $p < .0001$), so hypothesis H2 was supported.

Table 4: Results of Hypothesis H2 Testing

Y: Dynamic PRR; X1: Partner reputation

Variable	Coefficient	P-value
Partner Reputation score	-0.00405	<.0001

Table 5 presents the results of a logistic regression between price, PRR, risk attitude and OES adoption. Price showed a positive effect on OES adoption (beta = 0.0051), but not significant, so hypothesis H5 was not supported; PRR showed strong positive effect on OES adoption (beta = 1.3208, $p<.0001$), so hypothesis H4 was supported; risk attitude showed strong negative effect on OES adoption (beta = -0.5198, $p<.0001$), so hypothesis H3 was supported.

Table 5: Results of Hypotheses H3, H4, H5 Testing

Y: OES adoption; X1: Price; X2: PRR; X3: Risk attitude

Variable	Coefficient	P-value
Price	0.0051	0.5644
PRR	1.3208	<.0001
Risk attitude	-0.5198	<.0001

5. Discussion and Conclusion

The results show that trader's decision on Online Escrow Service adoption is mainly affected by his/her perception of the risk of being cheated. The decision is also affected by the trader's risk attitude, the more risk seeking he is, the less likely he will adopt OES. The data also indicates that trading partner reputation has a negative effect on the dynamic PRR, and that the market fraud rate has a positive effect on trader's risk perception. Interestingly, bidding price has no significant effect on OES adoption. It can be attributed to the experimental nature of the trades. The subjects were not dealing with 'real' money. In addition, subjects were under no budgetary constraints. In future experiments budgetary constraints will be specified to test the influence of price.

During the pilot study, subjects reported that they became more cautious after being cheated once. It is believed to be an important variable, and it will be studied in detail in our next study. It has been reported that risk behavior is affected by the frequency of information seeking by the subjects (Thaler et al, 1997). In the current study, all the subjects got to view the results of the transactions, and the status of their funds with equal frequency. In future studies, we are planning to incorporate more variance in the frequency of information reporting and study its effect on risk behavior. Plans for doing a larger study with more variables are afoot.

Implementation of the dynamic experimental system provides a good means to simulate the online auction process. It becomes possible for us to better understand the behavioral effects in risk

perception and performance. More experiments are to be conducted to further test the research model to confirm the current findings and explore new findings.

References:

Andrade, E. B. "Identifying Discriminating Variables of Online and Offline Buyers: A Perceived-Risk Approach," *The Proceedings of ICIS 2000*.

Bhatnagar, A., Misra, S., and Rao, H. R., "On Risk, Convenience and Internet Shopping Behavior," *Communications of the ACM*, 43(11), 98-105, November 2000.

Fraud.org, "Fraud Alert," January 31, 2001, http://www.fraud.org/news/newsset.htm

Hu, X., Lin, Z., Whinston, A. B., and Zhang, H. "Trick or Treat? ? Escrow Services in Online Consumer-to-Consumer Auction Markets," working paper, 2001a.

Hu, X., Lin, Z., Whinston, A. B., and Zhang, H. "Perceived Risk and Online Escrow Adoption: An Experimental Study of the C2C Auction Market," forthcoming ICIS 2001, 2001b.

Kahneman, D., and Tversky, A. "Prospect theory: An analysis of decision under risk," *Econometrica*, 47, 263-291, 1979.

Kim, D. J., Cho, B., and Rao, H. R. "Effect of Consumer Lifestyles on Purchasing Behavior on the Internet: A Conceptual Framework and Empirical Validation," *The Proceedings of ICIS 2000*.

Resnick, P., Zeckhauser, R., Friedman, E., and Kuwabara K. "Reputation Systems," *Communications of the ACM* (43:12), 45-48, December 2000.

Selis, P., Ramasastry, A., and Wright, C. S. "BIDDER BEWARE: Toward a Fraud-Free Marketplace – Best Practices for the Online Auction Industry," *2001 Annual LCT Conference*, April 2001, http://www.law.washington.edu/lct/publications.html#Online

Thaler, R.H., Tversky, A., Kahneman, D., and Schwartz, A. (1997). The effect of myopia and loss aversion on risk taking: En experimental test. *Quarterly Journal of Economics*, v112n2, (May 1997): 648-661.

Weber, E. U., and Milliman, R. A. "Perceived risk attitudes: Relating risk perception to risky choice," *Management Science*, 43, 123-144, 1997.

Wolverton, T. "Consumers indifferent to auction fraud," CNET News.com, April 20, 2001, http://news.cnet.com/news/0-1007-200-5682384.html

Appendix: Risk Attitude Questionnaire

	Choice A	**Choice B**	**Circle one**
1)	50% chance of winning $1,000	$450 for sure	**A B**
2)	80% chance of winning $4,000	$3,000 for sure	**A B**
3)	80% chance of losing $4,000	Losing $3,000 for sure	**A B**
4)	20% chance of losing $4,000	25% chance of losing $3,000	**A B**
5)	45% chance of winning $6,000	90% chance of winning $3,000	**A B**
6)	10% chance of winning $1,000	$100 for sure	**A B**
7)	10% chance of losing $1,000	Losing $100 for sure	**A B**
8)	50% possibility to win $1,200 and 50% probability to lose $400	50% possibility to win $500 and 50% probability to lose $20	**A B**

Coding scheme: A = 1, risk seeking; B = 0, risk averse. If a trader's scores < 4 the trader is risk averse, otherwise, he is risk seeking.