
Personal innovativeness, security and privacy as determinants of e-trading adoption

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Abstract: Motivated by the growing interest in electronic brokerage firms, we focus our research questions on examining the factors that contribute to acceptance of online trading systems. The research model, based on a Technology Acceptance Model (TAM) and added perceived security, perceived privacy and personal innovativeness, was tested by means of a Partial Least Square (PLS) modelling approach. The findings indicate that perceived security, Perceived Usefulness (PU) and personal innovativeness are positively related to behavioural intentions.

Keywords: e-finance; e-trading; security; privacy; innovativeness.

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1 Introduction

Faster internet connections along with the ubiquity of personal computers allow an increasing number of investors to manage their finances online, at virtually any hour of the day or night. The growth of the online brokerage industry is fundamentally changing the relationship between broker-dealers and their customers by allowing individuals to deal with their own investments in a way never possible before. Online trading gives traders an opportunity to trade stocks, options, currencies and futures all over the world without the physical presence of a broker, and at much lower commissions because everything is done online.

In this research, we define online trading as the act of placing buy/sell orders for financial securities or currencies with the use of a brokerage's internet-based proprietary trading platforms. An Online Trading Site is a brokerage house that allows online investors to buy and sell stocks and obtain investment information from its website. Two factors are contributing to the enormous growth of online investing. First, the internet gives ready access to raw data. Second, investment houses can offer transactions at lower prices than traditional methods by eliminating the need for brokers or financial advisers. Internet is a powerful resource in that it allows investing to be done directly online. However, before investors use the internet for online investing, they should have an overall understanding of the potential risks that are inherent to investing.

E-trading is a growing practice around the world. However, such a practice involves new risks:

- consistency of technology
- compliance with corporate policies and legal requirements
- data and service availability, including business recovery planning
- data confidentiality and privacy standards
- customer security practices/authentication of customers.

In the Information Systems (ISs) domain, we find a considerable amount of academic research that has used the TAM to predict and explain the determinants of Information Technology (IT) acceptance and utilisation among users (e.g., Agarwal and Karahanna, 2000; Barki and Hartwick, 1994; Venkatesh, 2000; Venkatesh and Davis, 1996, 2000).

A number of empirical studies have confirmed that TAM yields highly consistent results in the acceptance of technology by users (e.g., Chang and Cheung, 2001; Gefen and Straub, 1997; Liao and Cheung, 2001).

Consumers obtain benefits from shopping online, such as broader selections, competitive pricing and greater access to information (Alba et al., 1997; Jarvenpaa and Todd, 1997; Peterson et al., 1997), but at the same time, their participation in online retailing is also affected by factors such as security and privacy concerns (Hoffman et al., 1999). Online transactions often require sharing of sensitive personal information (i.e., mailing address, telephone number) and financial information (i.e., credit card numbers) between the transacting parties. Trust helps assure that one party will not take advantage of the vulnerability of the other during or after the transaction.

In this research, we focused our attention on examining the influence of personal innovativeness, perceived security and perceived privacy on the TAM constructs. Specifically, this work was to confirm the influence of these constructs jointly with PU and Perceived Ease of Use (PEU) on behavioural intention to use online trading services. Therefore, the fundamental problem that motivated this study is which factors determine investor acceptance and use of online trading services.

2 Theoretical background

2.1 The Technology Acceptance Model

Theory of Reasoned Action (TRA), a widely researched model in the social psychology domain developed by Fishbein and Ajzen (1975), which suggests that an individual's beliefs influence his or her attitude, joins subjective norms in shaping the behaviour intention that finally influences his or her actual behaviour.

TAM (Davis, 1989) was adapted from TRA and proposes that when a user describes a new technology as useful and easy to use, the more positive his or her attitude towards the technology will be, and the greater his or her intention to use it. TAM was designed to explain or predict individual-level technology acceptance across a wide range of computing technologies and user groups. Davis asserted that PU and PEU represent the beliefs that lead to such acceptance. Thus, TAM identified two key beliefs: PU and PEU. PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance", and PEU is defined as "the degree to which a person believes that using a particular system would be free of physical and mental effort" (Davis, 1989, p.320). TAM specifies that system usage is determined by a behavioural intention to use the system and by the person's attitude towards using it (Davis et al., 1989). It also assumes that PEU influences PU, and therefore acceptance, indirectly because, all things being equal, the easier a technology is to use, the more useful it will be.

Over the years, several researchers have empirically tested TAM to explain the attitudes and behaviours of IS users (Mathieson, 1991; Taylor and Todd, 1995a; Venkatesh, 2000; Venkatesh and Brown, 2001; Venkatesh and Davis, 1996, 2000).

TAM has been broadened by the addition of other constructs such as computer self-efficacy (Compeau and Higgins, 1995), internet self-efficacy (Eastin and LaRose, 2000; Hsu and Chiu, 2004; Igbaria and Iivari, 1995; Joo et al., 2000), subjective norm (Bhattacharjee, 2000; Taylor and Todd, 1995a; Venkatesh and Davis, 2000) or culture (Straub et al., 1997). All these factors have also been found to significantly influence user acceptance.

2.2 *Perceived security*

The online environment makes possible data transaction attacks and information theft, so consumers' feelings of insecurity are reflected in their online behaviour. Since trust in the e-vendor results from security (Gefen et al., 2003), customers need the application of specific security technologies to overcome security concerns, thus, many companies have addressed this problem by encrypting transactions, installing firewalls, utilising authentication mechanisms and ensuring privacy seals and disclosures (Pavlou, 2003; Pavlou and Gefen, 2004). Despite this, prior research found that privacy concerns about website security discourage many consumers from purchasing online (Belanger et al., 2002; Khasawneh et al., 2009; Kim et al., 2008a; Lian and Lin, 2008; Ranganathan and Ganapathy, 2002; Yang and Jun, 2002) and many customers are concerned about the opportunistic behaviour of vendors and the reliability and security of systems (Hwang et al., 2007).

Laforet and Li (2005) showed that hackers and fraud were cited as the main concerns that discouraged use of mobile banking. Hoffman et al. (1999), Park and Yoon (2006) found that transactional security is an important factor for building consumer trust on the internet. When users have a high perception of security, their trusting beliefs will usually lead to a positive effect on the customers' intention to shop online (Flavián and Guinalú, 2006; Kim et al., 2008b; Lian and Lin, 2008; Yousafzai et al., 2003). Furthermore, in online banking, consumers' concern over privacy and security is the leading barrier to its adoption and development (Casaló et al., 2007; Chang et al., 2007; Swaminathan et al., 1999; Vatanasombut et al., 2008; Liao and Wong, 2008).

2.3 *Perceived privacy*

Perceived privacy is the possibility that online companies collect data about individuals and use them inappropriately (Jarvenpaa and Todd, 1997; Zorotheos and Kafenza, 2009). Customers are often concerned about the privacy of information when they go online, and they refuse to give their personal or financial data to any online company as a consequence of distrust of these organisations (Hoffman et al., 1999). In the IS domain, Featherman and Pavlou (2003) characterised privacy risk as the

“potential loss of control over personal information, such as when information about you is used without your knowledge or permission. The extreme case is where a consumer is spoofed meaning a criminal uses their identity to perform fraudulent transactions.”

In empirical studies, online shoppers have shown concern regarding personal information collected through the online vendor, and some researchers have found that when customers trust the vendor, they are more likely to provide it. Thus, disposition to trust becomes crucial to their decisions about whether to purchase (Gefen, 2000; Gefen et al., 2003). In this sense, online consumers hesitate to disclose any personal or financial information to companies because they feel that these companies could make unauthorised use of their personal details, or this information can fall into the hands of third parties simply because internet vendors sell or exchange the data (Lim, 2003). Much empirical research has shown that privacy protection is an important factor contributing to trust (McKnight et al., 1998, 2002; Mukherjee and Nath, 2007; Han et al., 2008), which, in comparison with equivalent transactions through traditional channels, plays an important role in determining the users' acceptance of online services (Doolin et al., 2005; Hoffman et al., 1999) and online banking (Liao and Cheung, 2002; Poon, 2008; Sathye, 1999).

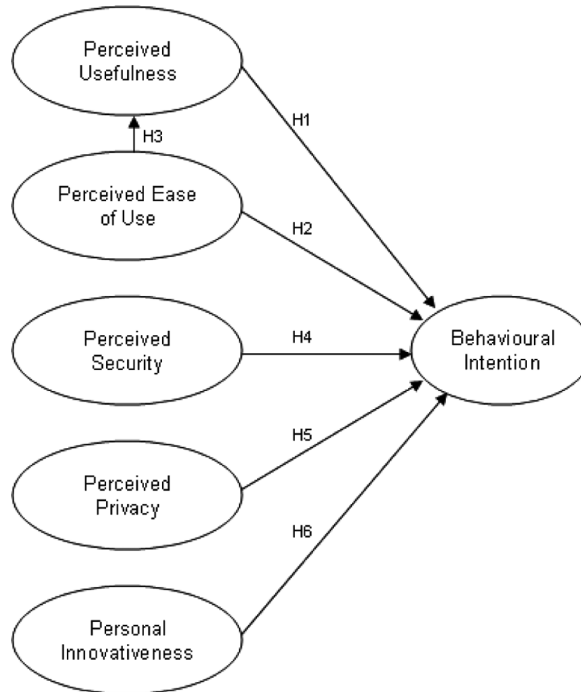
2.4 Personal innovativeness

According to the innovation diffusion theory (Rogers, 1995, 2003), people's adoption of new ideas, practices or objects is influenced by individual differences and personality characteristics. Rogers (1995) defined personal innovativeness as "the degree to which an individual adopts new ideas earlier than other members of a system (p.22)". Following this concept, Agarwal and Prasad (1997, 1998) defined Personal Innovation in IT (PIIT) as the willingness of an individual to try out any new IT. The research conducted by Agarwal and Prasad indicated that individuals with higher levels of innovativeness could be expected to have more positive perceptions of the advantage of a specific innovation in terms of image, visibility, ease of use and compatibility, thus, individuals with higher PIIT show more willingness to use any new technologies. In addition, people who have greater risk-tolerance are more likely to try an innovation because they have more positive beliefs about technology use (Hwang, 2009; Xu and Gupta, 2009).

Online trading is an innovative behaviour that is more likely to be adopted by innovators than non-innovators. It is thus important to include this construct to account for individual differences. Its inclusion has important implications for both theory and practice. From a theoretical perspective, the inclusion of personal innovativeness furthers our understanding of the role of personality traits in innovation adoption (Agarwal and Prasad, 1998). From the practical perspective, the identification of individuals who are more likely to adopt online trading can be very valuable for marketing purposes. Wang and Yang (2006) suggested that personality traits have significant moderating effects on influencing the acceptance of e-finance.

3 The proposed model and research hypotheses

On the basis of a review of literature, a model indicating the acceptance of online trading was developed (Figure 1). The model consists of five factors that we posit to have an effect on acceptance of online trading.

Figure 1 Research model

3.1 Perceived Usefulness and Perceived Ease of Use

PU is considered to have a direct effect on intentions to use a technology, and PEU involves an individual's assessment of the effort involved in using a system. Empirical studies of TAM have shown that PU has a positive effect on the adoption of IT (Davis et al., 1989). Prior studies have also demonstrated that PU is positively associated with performance, usage, or use intention (Davis et al., 1989; Venkatesh, 1999; Venkatesh and Davis, 1996, 2000). Many researches have found that PEU has significant effects on PU (Davis, 1989; Davis et al., 1989; Mathieson, 1991; Taylor and Todd, 1995a, 1995b; Venkatesh and Davis, 1996, 2000). In the e-banking domain, there are no consistent results. Cheng et al. (2006) found that PU had the greatest influence on customer intention to adopt internet banking. However, PEU did not have a direct impact on intention to use, although it affected the PU of customers, which in turn led to acceptance of internet banking. However, in other studies, PU and PEU were found to be significant antecedents to intention to use internet banking (Luarn and Lin, 2005; Wang et al., 2003). Therefore, this study tests the following hypotheses:

H1: Higher perceived usefulness will lead to higher behavioural intention to use online trading services.

H2: Higher perceived ease of use will lead to higher behavioural intention to use online trading services.

H3: Higher perceived ease of use will lead to higher perceived usefulness of online trading services.

3.2 Perceived security and perceived privacy

Data and network security concerns, in addition to privacy problems, have been identified as the main difficulties that reduce the end-user's intention to engage in online activities. George (2002) showed that attitude towards online shopping was the result of the perceived privacy of the online context. Similarly, feelings of security make the attitude towards online shopping more positive (O'Casey and Fenech, 2003; Vijayarathy, 2004). According to Flavián and Guinalíu (2006), when customers feel that their personal information and data privacy are safely protected, the development of trust positively affected the intention to buy.

Likewise, some researchers indicated that perceptions of privacy protection and security have a significant impact on trust in e-commerce, which in turn positively influences customers' behavioural intentions (Mukherjee and Nath, 2007; Suh and Han, 2003)

In this sense, certain authors have shown that security (Aladwani, 2001; Furnell and Karweni, 1999; Karjaluoto et al., 2009) and privacy (Liao and Cheung, 2002; Poon, 2008) are the key dimensions to adoption and acceptance of online banking. Therefore:

H4: Higher perceived security will lead to higher behavioural intention to use online trading services.

H5: Higher perceived privacy will lead to higher behavioural intention to use online trading services.

3.3 Personal innovativeness

Empirical research has shown that personal innovativeness can influence user acceptance of new innovation (Lu et al., 2005; Mun et al., 2006; Rogers, 1995; Robinson et al., 2005; Wang et al., 2006). Mun et al. (2006) confirmed the positive influence of personal innovativeness in determining the antecedents of physicians' intention to use a technology. In the e-services context, we found additional support for the inclusion of personal innovativeness as an antecedent to customers' intentions to use online shopping (Donthu and García, 1999; Lian and Lin, 2008) and internet banking (Lassar et al., 2005; Yiu et al., 2007). Therefore:

H6: Higher personal innovativeness will lead to higher behavioural intention to use online trading services.

4 Empirical methodology

A survey was employed in this study to test the hypotheses discussed in the previous section. The data collection method used, and the items selected for each of the constructs, is presented in the following sections.

4.1 Data collection

We targeted 180 business-major students enrolled in an advanced Financial Markets course. This course is designed to provide students with specific training and knowledge

about advanced Stock Exchange transactions required by the curriculum. The students involved in this course were required to use two online trading (www.igmarkets.es and www.renta4.com) systems as part of the course.

The two online trading companies offer practice web-based accounts with a virtual budget of 100,000€ and 10,000€, respectively. In these four weeks, students used the system with the aim of making a profit by the end of the course. They were asked to spend the virtual budgets on making transactions with stocks, currencies, futures, options and bonds. This way, they gained experience of the e-trade system and were able to evaluate it at the course-end. All participants were asked to answer a questionnaire at the last session of the course; 122 were returned, of which 48 belong to male students and 55 to female students. In terms of age, although we did have a variety of ages in the samples, most of the respondents fell into the <35 years age category, as can be seen in Table 1. Of the returned questionnaires, 19 were only partially completed and therefore excluded from the data analysis, resulting in an effective response rate of 57%.

Table 1 Sample characteristics

	<i>n</i>	<i>Percentage</i>
<i>Gender</i>		
Male	48	46.6
Female	55	53.4
<i>Age</i>		
18–25	32	31.1
26–35	49	47.6
>35	22	21.3
<i>Years at university</i>		
1–2	39	37.8
3–4	52	50.4
5–6	12	11.6
<i>Years of internet experience</i>		
<1	2	1.9
1–3	7	6.8
3–5	28	27.2
>5	66	64.1

4.2 Measures

The measures used in this paper were mainly adapted from relevant prior studies. Responses were recorded on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Scales of PEU and PU were modified from the previously validated items developed by Davis (1989). Scales of perceived security and perceived privacy were measured by the items derived from Cheung and Lee (2001), Ranganathan and Ganapathy (2002), O’Cass and Fenech (2003) and Flavián and Guinalíu (2006). Personal innovativeness was taken from Agarwal and Prasad (1998).

Items measuring continuance intention were adapted from prior work by Mathieson (1991) and Bhattacharjee (2001).

5 Data analysis

Reliability was examined using the composite reliability values and Cronbach's alpha. As listed in Table 2, all of these values were greater than 0.7, well above the common acceptance levels of 0.7 (Nunally, 1978).

Table 2 AVE and reliability

	<i>AVE</i>	<i>Composite reliability</i>	<i>Cronbach's alpha</i>
Behavioural intentions	0.74	0.90	0.83
P. Ease of Use	0.68	0.74	0.71
Personal innovativeness	0.73	0.89	0.82
P. privacy	0.66	0.80	0.73
P. Usefulness	0.65	0.83	0.74
P. security	0.63	0.86	0.76

Convergent validity was evaluated for the measurement scales using two criteria suggested by Fornell and Larcker (1981). First, all factor loadings should be significant and exceed 0.70. Second, the Average Variance Extracted (AVE) for each construct should exceed the variance due to measurement error for that construct (i.e., should exceed 0.50). All items loaded (Table 3) on their constructs from 0.71 to 0.91 and, as shown in Table 2, the AVEs all exceed 0.50 indicating an adequate convergent validity for the model.

Table 3 Outer loadings

<i>Behavioural intention</i>	
I will use the online trading systems on a regular basis in the future	0.91
I will frequently use the online trading systems in the future	0.89
I will strongly recommend others to use	0.78
Perceived Ease of Use	
Learning to use online trading systems is easy for me	0.89
It would be easy for me to become skilful at using online trading systems	0.71
My interactions with the online trading systems are clear and understandable	0.74
Personal innovativeness	
If I heard about a new information technology, I would look for ways to experiment with it	0.77
Among my peers, I am usually the first to try out new information technologies	0.88

Table 3 Outer loadings (continued)

<i>Behavioural intention</i>	
In general, I am hesitant to try out new information technologies (<i>R</i>)	0.90
Perceived privacy	
I am concerned that the online trading systems will use my personal information for other purposes without my authorisation	0.73
I think that too much of my personal and financial information will be collected by the online trading systems	0.80
I am concerned about the privacy of my personal and financial information during a transaction	0.81
My personal and financial information will be shared with other entities without my authorisation	0.79
Perceived Usefulness	
I would find online trading systems useful in conducting my securities transactions	0.73
Using online trading systems would make it easier for me to conduct securities transactions	0.84
Using online trading systems enable me to accomplish securities transactions more quickly	0.77
Using online trading would improve my performance in conducting securities transactions	0.74
Perceived security	
I think the online trading systems have sufficient technical capacity to ensure that the data I send cannot be modified by a third party	0.78
The online trading systems have enough security measures to protect my personal and financial information	0.82
When I send data to the online trading systems, I am sure that they will not be intercepted by unauthorised third parties	0.75
I think the online trading systems have sufficient technical capacity to ensure that no other organisation will supplant its identity on the internet	0.87

The AVE statistic is also used to assess discriminant validity by comparing the square root of the AVE with the correlations among the latent variables (Chin, 1998). According to Fornell and Larcker (1981), the correlations between items in any two constructs should be lower than the square root of the average variance shared by items within a construct. In our study, none of the intercorrelations of the constructs exceed the square root of the AVE of the constructs (Table 4).

The model was fitted by a PLS method. Because PLS makes no distributional assumptions, statistical significance tests for evaluating PLS path modelling results employ a bootstrapping procedure to generate *t*-statistic and standard errors (Chin, 1998). As recommended in this research, we used a bootstrapping with 500 samples. As shown in Figure 2, PU was related to intention (path = 0.23, $p < 0.05$). This provided full support for H1. H2 was not supported, PEU was not related to behavioural intention (path = 0.15, n.s.). In support of H3, PEU was positively related to PU (path = 0.35, $p < 0.01$). Hypothesis 4 stated that perceived security was positively related to intention, and it was supported (path = 0.31, $p < 0.01$). The path from perceived privacy to intention was not significant ($p = 0.14$, n.s.), thus, Hypothesis 5 was rejected. Personal innovativeness has a significant positive relationship with intention (path = 0.25,

$p < 0.01$). The percentage of variance explained (R^2) of behavioural intention was 32%, but was only 12% for PU. In summary (see Table 5), four of the six hypotheses were supported using the t -student values commonly accepted (Chin, 1998): $p \geq 95\%$, $t_{(0.05;499)} = 19,647$; $p \geq 99\%$, $t_{(0.01;499)} = 25,857$ and $p \geq 99,9\%$, $t_{(0.001;499)} = 33,101$. According to these values, Hypotheses 2 and 5 were rejected due to the low values of the t -student statistics.

Table 4 Discriminant validity^a

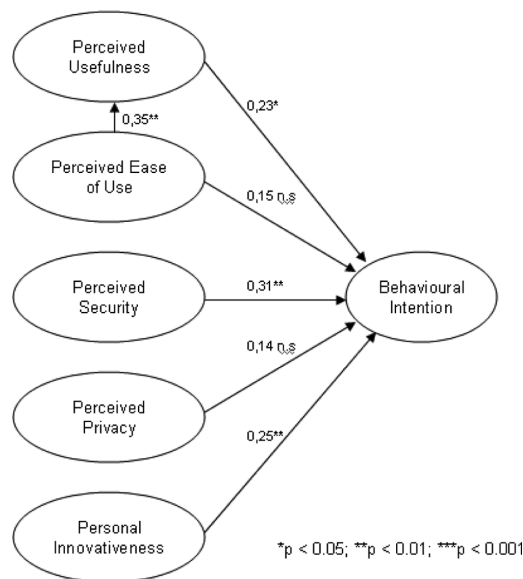
	1	2	3	4	5	6
1 Behavioural intentions	0.86					
2 P. Ease of Use	0.34	0.82				
3 Personal innovativeness	0.33	0.11	0.85			
4 P. privacy	-0.13	-0.22	-0.28	0.81		
5 P. Usefulness	0.35	0.35	0.16	-0.13	0.81	
6 P. security	0.38	0.36	0.20	-0.44	0.16	0.79

^aDiagonal elements in bold (the square root of AVE).

Table 5 Summary of hypotheses tests

	Hypothesised relationship	Estimate	t-value	Supported
H ₁	PU→Intention	0.23	2.07	Yes
H ₂	PEOU→Intention	0.15	1.38	No
H ₃	PEOU→PU	0.35	2.48	Yes
H ₄	P. Security→Intention	0.31	2.88	Yes
H ₅	P. Privacy→Intention	0.14	1.32	No
H ₆	P. Innovativeness→Intention	0.25	2.96	Yes

Figure 2 Analysis of the research model



6 Conclusions

The goal of this study was to empirically extend TAM to a relatively unexplored context. It also represents one of the few attempts to study e-investors acceptance of online dealers and stockbrokerage services. We have also examined the effects of perceived security, perceived privacy and personal innovativeness.

The results showed that personal innovativeness, PU and perceived security played an important role in affecting e-investors' intention to use online trading systems. Surprisingly, PEU and perceived privacy did not influence intention to use these systems. In line with prior research on web-based systems (Chan and Lu, 2004; Cheng et al., 2006; Pikkarainen et al., 2004), PEU did not have a significant effect on intention to use. One plausible explanation is that these online systems have good navigation structures, adequate interfaces and other user-friendly features that help e-investors to use it without effort. Therefore, they perceived online trading systems as easy to use.

E-investors do not doubt the usefulness of online investments, which positively affected their intentions to use online dealers and stockbrokerage services. The easy to use interface was important in determining perceptions of usefulness. Therefore, e-investors with strong beliefs in the effectiveness of their securities transactions through online trading systems are more likely to perceive the relative advantages or usefulness that the online dealers and stockbrokers provide in comparison with other traditional and online investment channels. Thus, e-investors evaluated the performance and effectiveness of online investments more positively owing to the web interface of the online trading systems. The positive influence of PEU on PU indicates that intuitive or effort-free interfaces may contribute to e-investors' tendency to view online trading systems as a valuable instrument to conduct desired/adequate online transactions. Those systems with friendly interfaces promote the development of positive beliefs about the efficient service or reliable information provided by the electronic brokerage firm, and it will in turn affect the e-investors' intentions to use the online dealers and stockbroker services. In contrast, online trading systems with a modern interface or friendly screens do not increase e-investors' intentions to conduct online securities transactions. This lack of influence is consistent with prior studies in web services (Chan and Lu, 2004; Cheng et al., 2006; Pikkarainen et al., 2004).

According to prior studies of online shopping (Belanger et al., 2002; Lian and Lin, 2008; Vijayarathy, 2004) or internet banking (Cheng et al., 2006), perceived security associated with online dealers and stockbrokerage services was the most important determinant for online securities' transactions. Theoretically, this implies that the factor of perceived security works equally well in predicting the acceptance of online trading, internet banking or online shopping. Thus, electronic brokerage firms should convince potential e-investors of the security features available in their online trading systems to improve positive beliefs in online investment. In turn, this finding highlights the importance of security threats acting as a barrier to usage of online dealers and stockbrokerage services. In line with Cheng et al. (2006), we suggest that electronic brokerage firms should emphasise their system security mechanism to assure their customers that online trading is a safe way to conduct their transactions.

In contrast, e-investors were not sensitive to the effects of privacy concerns, indicating that a safe system with visible protection may reduce their perceptions and assessments of these threats. This finding may be partially explained by the security mechanism that protects e-investors' confidential information from unauthorised

or fraudulent use during securities transactions (Kim et al., 2008b). Therefore, when e-investors recognise the security and protection mechanism, they tend to reduce their concerns about the relative probability of losing personal and financial information or its theft by third parties. Kim et al. indicated that

“although logically it might seem that privacy superfluous when security is present, and security is superfluous when privacy is present, our results suggest that consumers independently value privacy and security,” (Kim et al., 2008a, p.556)

thus, our study supports their findings. Similarly, Vijayarathy (2004) argued that this may be a reflection of consumers’ resigned acceptance of some level of privacy invasion in the internet era.

Since using online trading systems is a relatively new experience, e-investors’ acceptance of this e-service is directly affected by personal innovativeness. According to our findings, people with an innovative attitude are more likely to use online trading systems, which is consistent with prior studies of e-services (Lian and Lin, 2008; Robinson et al., 2005; Yiu et al., 2007). This suggests that e-investors are increasingly motivated to use online dealers and stockbrokerage services when their use is associated with a significant, relative advantage over traditional investment methods, which in turn positively affects their adoption behaviour. These individuals tend to perceive e-trading as more compatible with their lifestyle and they feel more comfortable using these systems.

The significant influence of PEU on PU indicates that the effectiveness of online trading systems helps to improve e-investors’ beliefs towards conducting online investments. However, for online trading systems’ designers, it is not sufficient just to develop user-friendly systems with valuable functions. It is also important to assure e-investors that they are protected when using their system and, therefore, their security concerns should disappear or at least be kept to a minimum.

Some limitations may affect these results. First, the different dimensions of security and privacy were not incorporated in our model. The influence of these dimensions on other constructs should be carefully studied in future research. Second, there is still a need to find additional variables that can improve a higher R^2 , for example familiarity, loyalty or information quality among others.

Since the study is cross-sectional in design, future research could undertake a more in-depth longitudinal study. These studies may be conducted by further extending and refining TAM using other constructs as satisfaction, information quality, service quality or system quality.

References

- Agarwal, R. and Karahanna, E. (2000) ‘Time flies when you’re having fun: cognitive absorption and beliefs about information technology usage’, *MIS Quarterly*, Vol. 24, No. 4, pp.665–694.
- Agarwal, R. and Prasad, J. (1997) ‘The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies’, *Decision Sciences*, Vol. 28, No. 3, pp.557–582.
- Agarwal, R. and Prasad, J. (1998) ‘A conceptual and operational definition of personal innovativeness in the domain of information technology’, *Information Systems Research*, Vol. 9, No. 2, pp.204–215.

- Aladwani, A.M. (2001) 'Online banking: a field study of drivers, development challenges, and expectations', *International Journal of Information Management*, Vol. 21, No. 3, pp.213–225.
- Alba, J., Lynch, J., Weitz, B., Janiszewski, C., Lutz, R., Sawyer, A. and Wood, S. (1997) 'Interactive home shopping: consumer, retailer, and manufacturer incentives to participate in electronic marketplaces', *Journal of Marketing*, Vol. 61, pp.38–53.
- Barki, H. and Hartwick, J. (1994) 'Measuring user participation, user involvement, and user attitude', *MIS Quarterly*, Vol. 18, No. 1, pp.59–82.
- Belanger, F., Hiller, J.S. and Smith, W.J. (2002) 'Trustworthiness in electronic commerce: the role of privacy, security, and site attributes', *The Journal of Strategic Information Systems*, Vol. 11, Nos. 3–4, pp.245–270.
- Bhattacharjee, A. (2000) 'Acceptance of internet applications services: the case of electronic Brokerages', *IEEE Transactions on systems, Man, and Cybernetics – Part A: Systems and Humans*, Vol. 30, pp.411–420.
- Bhattacharjee, A. (2001) 'An empirical analysis of the antecedents of electronic commerce service continuance', *Decision Support Systems*, Vol. 32, No. 2, pp.201–214.
- Casaló, L.V., Flavián, C. and Guinalíu, M. (2007) 'The role of security, privacy, usability and reputation in the development of online banking', *Online Information Review*, Vol. 31, No. 5, pp.583–603.
- Chan, S. and Lu, M.T. (2004) 'Understanding internet banking adoption and use behavior: a Hong Kong perspective', *Journal of Global Information Management*, Vol. 12, pp.21–43.
- Chang, K.L., Kang, I. and McKnight, D.H. (2007) 'Transfer from offline trust to key online perceptions: an empirical study', *Engineering Management, IEEE Transactions*, Vol. 54, No. 4, pp.729–741.
- Chang, M.K. and Cheung, W. (2001) 'Determinants of the intention to use internet/www at work: a confirmatory study', *Information and Management*, Vol. 39, No. 1, pp.1–14.
- Cheng, E., Lam, D. and Yeung, A. (2006) 'Adoption of internet banking: an empirical study in Hong Kong', *Decision Support Systems*, Vol. 42, No. 3, pp.1558–1572.
- Cheung, C.M.K. and Lee, M.K.O. (2001) 'Trust in internet shopping: instrument development and validation through classical and modern approaches', *Journal of Global Information Management*, Vol. 9, No. 3, pp.23–35.
- Chin, W.W. (1998) 'The partial least squares approach to structural equation modelling', in Marcoulides, G.A. (Ed.): *Modern Methods for Business Research*, Lawrence Erlbaum Associates, Mahwah, NJ, pp.295–336.
- Compeau, D.R. and Higgins, C.A. (1995) 'Computer self-efficacy: development of a measure and initial test', *MIS Quarterly*, Vol. 19, No. 2, pp.189–211.
- Davis, F.D. (1989) 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *MIS Quarterly*, Vol. 13, No. 3, pp.319–340.
- Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989) 'User acceptance of computer technology: a comparison of two theoretical models', *Management Science*, Vol. 35, No. 8, pp.982–1002.
- Donthu, N. and García, A. (1999) 'The internet shopper', *Journal of Advertising Research*, Vol. 39, No. 3, pp.52–58.
- Doolin, B., Dillon, S., Thompson, F. and Corner, J.L. (2005) 'Perceived risk, the internet shopping experience and online purchasing behavior: a New Zealand perspective', *Journal of Global Information Management*, Vol. 13, No. 2, pp.66–88.
- Eastin, M.S. and LaRose, R. (2000) 'Internet self-efficacy and the psychology of the digital divide', *Journal of Computer Mediated Communication*, Vol. 6, No. 1, <http://jcmc.indiana.edu/vol6/issue1/eastin.html>
- Featherman, M.S. and Pavlou, P.A. (2003) 'Predicting e-services adoption: a perceived risk facets perspective', *International Journal of Human Computer Studies*, Vol. 59, No. 4, pp.451–474.
- Fishbein, M. and Ajzen, I. (1975) *Belief, Attitude, Intentions and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.

- Flavián, C. and Guinaliu, M. (2006) 'Consumer trust, perceived security, and privacy policy: three basic elements of loyalty to a web site', *Industrial Management and Data Systems*, Vol. 106, Nos. 5–6, pp.601–620.
- Fornell, C. and Larcker, D.F. (1981) 'Evaluating structural equation models with unobservable and measurement error', *Journal of Marketing Research*, Vol. 18, pp.39–50.
- Furnell, S. and Karweni, T. (1999) 'Security implications of electronic commerce: a survey of consumers and business', *Internet research. Electronic Networking Applications and Policy*, Vol. 9, pp.372–382.
- Gefen, D. (2000) 'E-commerce: the role of familiarity and trust', *Omega*, Vol. 28, No. 6, pp.725–737.
- Gefen, D. and Straub, D.W. (1997) 'Gender differences in perception and adoption of e-mail: an extension to the technology acceptance model', *MIS Quarterly*, Vol. 21, No. 4, pp.389–400.
- Gefen, D., Karahanna, E. and Straub, D.W. (2003) 'Trust and TAM in online shopping: an integrated model', *MIS Quarterly*, Vol. 27, No. 1, pp.51–90.
- George, J.F. (2002) 'Influences on the intent to make internet purchases', *Internet Research*, Vol. 12, No. 2, pp.165–180.
- Han, L., Rathindra, S. and Zhang, J. (2008) 'The role of emotions in shaping consumers' privacy beliefs about unfamiliar online vendors', *Journal of Information Privacy and Security*, Vol. 4, No. 3, pp.36–63.
- Hoffman, D.L., Novak, T.P. and Peralta, M. (1999) 'Building consumer trust online', *Communications of the ACM*, Vol. 42, No. 4, pp.80–85.
- Hsu, M. and Chiu, C. (2004) 'Internet self-efficacy and electronic service acceptance', *Decision Support Systems*, Vol. 38, pp.369–381.
- Hwang, H-G., Chen, R-F. and Lee, J-M. (2007) 'Measuring customer satisfaction with internet banking: an exploratory study', *International Journal of Electronic Finance*, Vol. 1, No. 3, pp.321–335.
- Hwang, Y. (2009) 'The impact of uncertainty avoidance, social norms and innovativeness on trust and ease of use in electronic customer relationship management', *Electronic Markets*, Vol. 19, Nos. 2–3, p.89.
- Igbaria, M. and Iivari, J. (1995) 'The effects of self-efficacy on computer usage', *Omega*, Vol. 23, No. 6, pp.587–605.
- Jarvenpaa, S.L. and Todd, P.A. (1997) 'Consumer reactions to electronic shopping on the world wide web', *International Journal of Electronic Commerce*, Vol. 1, No. 2, pp.59–88.
- Joo, Y.J., Bong, M. and Choi, H.-J. (2000) 'Self-efficacy for self-regulated learning, academic self-efficacy, and Internet self-efficacy in Web-based instruction', *Educational Technology, Research and Development*, Vol. 48, No. 2, pp.5–17.
- Karjaluoto, H., Jarvenpaa, L. and Kauppi, V. (2009) 'Antecedents of online banking satisfaction and loyalty: empirical evidence from Finland', *International Journal of Electronic Finance*, Vol. 3, No. 3, pp.253–269.
- Khasawneh, A., Al Azzam, I. and Bsoul, M. (2009) 'A study on e-commerce security in Jordan', *International Journal of Electronic Finance*, Vol. 3, No. 2, pp.166–176.
- Kim, D.J., Ferrin, D.L. and Rao, H.R. (2008a) 'A trust-based consumer decision-making model in electronic commerce: the role of trust, perceived risk, and their antecedents', *Decision Support Systems*, Vol. 44, No. 2, pp.544–564.
- Kim, D.J., Steinfield, C. and Lai, Y.J. (2008b) 'Revisiting the role of web assurance seals in business-to-consumer electronic commerce', *Decision Support Systems*, Vol. 44, No. 4, pp.1000–1015.
- Laforet, S. and Li, X. (2005) 'Consumers' attitudes towards online and mobile banking in China', *International Journal of Bank Marketing*, Vol. 23, No. 5, pp.362–380.

- Lassar, W.M., Manolis, C. and Lassar, S.S. (2005) 'The relationship between consumer innovativeness, personal characteristics, and online banking adoption', *International Journal of Bank Marketing*, Vol. 23, No. 2, pp.176–199.
- Lian, J.W. and Lin, T.M. (2008) 'Effects of consumer characteristics on their acceptance of online shopping: comparisons among different product types', *Computers in Human Behavior*, Vol. 24, No. 1, pp.48–65.
- Liao, Z. and Cheung, M.T. (2001) 'Internet-based e-shopping and consumer attitudes: an empirical study', *Information and Management*, Vol. 38, No. 5, pp.299–306.
- Liao, Z. and Cheung, M.T. (2002) 'Internet-based e-banking and consumer attitudes: an empirical study', *Information and Management*, Vol. 39, No. 4, pp.283–295.
- Liao, Z. and Wong, W.K. (2008) 'The determinants of customer interactions with internet-enabled e-banking services', *The Journal of the Operational Research Society*, Vol. 59, No. 9, pp.1201–1211.
- Lim, N. (2003) 'Consumers' perceived risk: sources versus consequences', *Electronic Commerce Research and Applications*, Vol. 2, No. 3, pp.216–228.
- Lu, J., Yao, J.E. and Yu, C.S. (2005) 'Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology', *Journal of Strategic Information Systems*, Vol. 14, pp.245–268.
- Luarn, P. and Lin, H. (2005) 'Toward an understanding of the behavioral intention to use mobile banking', *Computers in Human Behavior*, Vol. 21, No. 6, pp.873–891.
- Mathieson, K. (1991) 'Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior', *Information Systems Research*, Vol. 2, No. 3, pp.173–191.
- McKnight, D.H., Choudhury, V. and Kacmar, C. (2002) 'The impact of initial consumer trust on intentions to transact with a web site: a trust building model', *The Journal of Strategic Information Systems*, Vol. 11, Nos. 3–4, pp.297–323.
- McKnight, D.H., Cummings, L.L. and Chervany, N.L. (1998) 'Initial trust formation in new organizational relationships', *Academy of Management Review*, Vol. 23, No. 3, pp.473–490.
- Mukherjee, A. and Nath, P. (2007) 'Role of electronic trust in online retailing: a re-examination of the commitment-trust theory', *European Journal of Marketing*, Vol. 41, Nos. 9–10, pp.1173–1202.
- Mun, Y., Fiedler, K.D. and Park, J.S. (2006) 'Understanding the role of individual innovativeness in the acceptance of IT-based innovations: comparative analyses of models and measures', *Decision Sciences*, Vol. 37, No. 3, pp.393–426.
- Nunally, J.C. (1978) *Psychometric Theory*, McGraw Hill Book Company, New York.
- O'Casey, A. and Fenech, T. (2003) 'Web retailing adoption: exploring the nature of internet users Web retailing behaviour', *Journal of Retailing and Consumer Services*, Vol. 10, No. 2, pp.81–94.
- Park, S. and Yoon, M-S. (2006) 'Towards a trust-based framework for electronic payment: collaborative coupons in Korea', *International Journal of Electronic Finance*, Vol. 1, No. 2, pp.171–180.
- Pavlou, P.A. (2003) 'Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model', *International Journal of Electronic Commerce*, Vol. 7, No. 3, pp.69–103.
- Pavlou, P.A. and Gefen, D. (2004) 'Building effective online marketplaces with institution-based trust', *Information Systems Research*, Vol. 15, No. 1, pp.37–59.
- Peterson, R.A., Balasubramanian, S. and Bronnenberg, B.J. (1997) 'Exploring the implications of the internet for consumer marketing', *Journal of the Academy of Marketing Science*, Vol. 25, No. 4, pp.329–346.
- Pikkarainen, T., Pikkarainen, K., Karjaluoto, H. and Pahnala, S. (2004) 'Consumer acceptance of online banking: an extension of the technology acceptance model', *Internet Research*, Vol. 14, No. 3, pp.224–235.

- Poon, W.-C. (2008) 'Users' adoption of e-banking services: the Malaysian perspective', *Journal of Business and Industrial Marketing*, Vol. 23, No. 1, pp.59–69.
- Ranganathan, C. and Ganapathy, S. (2002) 'Key dimensions of B2C web sites', *Information and Management*, Vol. 39, pp.457–465.
- Robinson, Jr. L., Marshall, G.W. and Stamps, M.B. (2005) 'Sales force use of technology: antecedents to technology acceptance', *Journal of Business Research*, Vol. 58, No. 12, pp.1623–1631.
- Rogers, E.M. (1995) *Diffusion of Innovations*, 4th ed., The Free Press, New York.
- Rogers, E.M. (2003) *Diffusion of Innovations*, 5th ed., The Free Press, New York.
- Sathye, M. (1999) 'Adoption of internet banking by Australian consumers: an empirical investigation', *International Journal of Bank Marketing*, Vol. 17, Nos. 6–7, pp.324–335.
- Straub, D., Keil, M. and Brenner, W. (1997) 'Testing the technology acceptance model across cultures: a three country study', *Information and Management*, Vol. 33, No. 1, pp.1–11.
- Suh, B. and Han, I. (2003) 'The impact of customer trust and perception of security control on the acceptance of electronic commerce', *International Journal of Electronic Commerce Research*, Vol. 7, No. 3, pp.135–161.
- Swaminathan, V., Lepkowska-White, E. and Rao, B.P. (1999) 'Browsers or buyers in cyberspace? An investigation of factors influencing electronic exchange', *Journal of Computer-mediated Communication*, Vol. 5, No. 2, <http://jcmc.indiana.edu/vol5/issue2/swaminathan.htm>
- Taylor, S. and Todd, P. (1995a) 'Assessing IT usage: the role of prior experience', *MIS Quarterly*, Vol. 19, No. 4, pp.561–570.
- Taylor, S. and Todd, P. (1995b) 'Understanding information technology usage: a test of competing models', *Information Systems Research*, Vol. 6, No. 2, pp.144–176.
- Vatanasombut, B., Igarria, M., Stylianou, A.C. and Rodgers, W. (2008) 'Information systems continuance intention of web-based applications customers: the case of online banking', *Information and Management*, Vol. 45, No. 7, p.419.
- Venkatesh, V. (1999) 'Creation of favorable user perceptions: exploring the role of intrinsic motivation', *MIS Quarterly*, Vol. 23, pp.239–260.
- Venkatesh, V. (2000) 'Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model', *Information Systems Research*, Vol. 11, No. 4, pp.342–365.
- Venkatesh, V. and Brown, S.A. (2001) 'A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges', *MIS Quarterly*, Vol. 25, No. 1, pp.71–102.
- Venkatesh, V. and Davis, F.D. (1996) 'A model of the antecedents of perceived ease of use: development and test', *Decision Sciences*, Vol. 27, No. 3, pp.451–181.
- Venkatesh, V. and Davis, F.D. (2000) 'A theoretical extension of the technology acceptance model: four longitudinal field studies', *Management Science*, Vol. 46, No. 2, pp.186–204.
- Vijayasathya, L.R. (2004) 'Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model', *Information and Management*, Vol. 41, No. 6, pp.747–762.
- Wang, H-I. and Yang, H-L. (2006) 'Do personality traits affect the acceptance of e-finance?', *International Journal of Electronic Finance*, Vol. 1, No. 2, pp.200–221.
- Wang, H-C., Pallisterb, J.G. and Foxallb, G.R. (2006) 'Innovativeness and involvement as determinants of website loyalty: III. Theoretical and managerial contributions', *Technovation*, Vol. 26, pp.1374–1383.
- Wang, Y.-M., Lin, H.-H. and Tang, T.-I. (2003) 'Determinants of user acceptance of internet banking: an empirical study', *International Journal of Service Industry Management*, Vol. 14, No. 5, pp.501–519.

- Xu, H. and Gupta, S. (2009) 'The effects of privacy concerns and personal innovativeness on potential and experienced customers' adoption of location-based services', *Electronic Markets*, Vol. 19, Nos. 2–3, p.137.
- Yang, Z. and Jun, M. (2002) 'Consumer perception of e-service quality: from internet purchaser and non-purchaser perspectives', *Journal of Business Strategies*, Vol. 19, No. 1, pp.19–41.
- Yiu, C.H., Grant, K. and Edgar, D. (2007) 'Factors affecting the adoption of internet Banking in Hong Kong – implications for the banking sector', *International Journal of Information Management*, Vol. 27, No. 5, pp.336–351.
- Yousafzai, S.Y., Pallister, J.G. and Foxall, G.R. (2003) 'A proposal model of e-trust for electronic banking', *Technovation*, Vol. 23, pp.847–860.
- Zorotheos, A. and Kafeza, E. (2009) 'Users' perceptions on privacy and their intention to transact online: a study on Greek internet users', *Direct Marketing*, Vol. 3, No. 2, p.139.