Structural Model Comparison of the Determining Factors for E-Purchase

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Abstract

This study investigates relationships among intrinsic and extrinsic motivational factors of e-purchase. Three alternative causal models capturing the relationships among perceived ease-of-use, perceived usefulness, perceived enjoyment, perceived security, and e-purchase are developed and tested empirically. Structural equation analysis results show that the dual mediation impact model with perceived ease-of-use as the mediator is the best-fit model. Implications and research directions are discussed.

Keywords: e-purchase, perceived security, motivational factors, perceived ease-of-use, perceived usefulness, perceived enjoyment, TAM, alternative causal models, LISREL, structural equation models

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INTRODUCTION

Electronic Commerce(EC) and information technology(IT) are radically changing the face of business and organizational structure. The emergence of online shopping and e-business activities has been acknowledged as bringing about fundamental changes in business practices(Benjamin and Wigand 2001). Various types of Electronic Commerce methods showing growth include business-to-consumer(B2C) activities in the form of Web retailing or e-retailing through Internet shopping(Bramall, Schoefer and McKechnie 2004; McCloskey 2004) and television commerce or t-commerce through the use of high quality television video(Yu et al. 2005). There is growing interest in the use of EC as a means to perform business transactions(Ngai and Wat 2002) and the use of EC will continue to rise(Klopping and McKinney 2004). For many businesses, exploiting and creating e-shopping sites on the Internet have become a priority(Sharp 1998). In a comprehensive review of the e-commerce literature, Ngai and Wat(2002) concluded that previous studies have predominantly focused on determining factors ranging from consumer preferences to B2C e-commerce transaction costs and processes.

In the past, research efforts have been devoted to assessing factors associated with the Internet usage, Web site success, and virtual shopping site usage. These studies have focused on the individual's motivational factors, other determining factors of the Internet(Teo, Lim and Lai 1999) and/or general success factors of e-commerce Web sites(Liu and Arnett 2000). Researchers have theorized that an individual's behavior is determined by both intrinsic and extrinsic motivational factors. Intrinsic motivation can be described as the pleasure or inherent satisfaction derived from a particular activity such that an individual completes the required task for no apparent reinforcement other than the process of performing the task. Extrinsic motivation focuses on the achievement of a defined goal and can be viewed as the performance of a task because the completion of that task is perceived to be instrumental in achieving outcomes that are distinct from the activity itself(Davis, et al., 1992; Venkatesh,

1999).

Previous studies investigating the determining factors of information technology including the Internet and e-commerce Web sites rely heavily on the pioneering work of Davis(1986, 1989). Davis(1986, 1989) studied the determinants of IT adoption and usage by individual users, and subsequently developed the Technology Acceptance Model(TAM). TAM theorizes that two external variables, perceived ease-of-use and perceived usefulness, are primarily relevant for acceptance behaviors.

As shown by Davis(1986, 1989), Teo et al.(1999), and Pavlou (2003), perceived usefulness affects usage of various systems and has a strong significant relationship with the Internet usage and e-commerce acceptance. A plausible explanation for these findings focuses on the extrinsic motivation of individuals. They will only use these systems if they perceive that such usage would help them to achieve the desired task performance. For e-shopping Web sites, e-shoppers will use these sites more if they find them useful for shopping.

The two factors of perceived ease of use and perceived usefulness have been extensively studied by many researchers using different samples and these factors have been generally confirmed to be important factors affecting system usage (Adams, Nelson and Todd, 1992; Hendrickson and Collins, 1996; Subramanian, 1994). In addition, perceived enjoyment, an intrinsic motivational factor, has also been investigated as an important determinant of system usage(Webster and Martocchio 1992). Teo, Lim and Lai(1999) evaluated the impact of the three factors of perceived usefulness, perceived ease-of-use, and perceived enjoyment in the context of Internet usage. Their findings indicate that these three determinant factors are positively related to frequency of Internet usage and daily Internet usage.

Continuing this stream of research, this study extends previous research in three significant ways. First, in this study, both intrinsic and extrinsic motivational factors are evaluated in the context of e-purchase. Instead of the Internet, micro-computer usage, or e-shopping Web site usage, actual e-purchase was selected as the dependent variable in this study. The rapid increase of on-line consumer sales globally makes its study imperative and timely. Second, perceived security of e-

shopping Web sites is integrated into the technology acceptance model(TAM) in this study. Many studies uncovered the increased security concerns related to the Internet and B2C e-commerce Web sites of the users and these studies have reported security for on-line transactions on the Internet as important success factors of these B2C e-commerce Web sites(Forcht 1996; Furnell and Karweni 1999; Liu and Arnett 2000; Suh and Han 2003). Pavlou(2003) tested the impact of trust and perceived risk on e-commerce acceptance in addition to the TAM variables. This study evaluates the role of perceived security relative to other intrinsic and extrinsic factors in the context of e-purchase. Finally, this study develops and empirically tests three alternative causal models capturing the relationships among perceived ease-of-use, perceived usefulness, perceived enjoyment, perceived security, and e-purchase.

LITERATURE REVIEW

Perceived Ease-of-Use and Usefulness

Previous studies investigating the determining factors of information technology, including the Internet and e-commerce Web sites, have adopted the Technology Acceptance Model(TAM) developed by Davis(1986, 1989). The basic premise of TAM is that two external variables, perceived ease-of-use and perceived usefulness, are primary determining factors of computer acceptance behaviors by users.

Perceived ease-of-use refers to the degree to which the prospective user expects the use of the target system to be free of effort. According to Radner and Rothschild(1975), a person may allocate effort to the various activities for which he or she is responsible. Therefore, Davis(1989) argued that an application perceived to be easier to use than another application is more likely to be accepted by users, given that all other factors are equal. Perceived ease-of-use has been found to influence computer and application usage(Davis 1989; Davis, Bagozzi and Warshaw 1992; Szajna 1996). In general, if a system is easy-to-use, it requires less effort on the part of users, leading to higher likelihood of its adoption and usage. Perceived ease-of-use has

also been found to influence computer usage and Internet usage indirectly via perceived usefulness(Davis 1986; Teo, Lim and Lai 1999) and perceived enjoyment(Igbaria, Pavri and Huff 1989; Teo, Lim and Lai 1999). Elliot and Fowell(2000) also found ease-of-use as one of the major consumer factors in e-shopping site usage. As perceived ease-of-use has an inverse relationship with the perceived complexity-of-use of the technology, it can also affect perceived usefulness. A system that is difficult to use is less likely to be perceived as useful. Similarly, a system perceived difficult to use is less likely to be perceived as enjoyable further leading to decreased usage.

Perceived usefulness is defined as the prospective user's subjective belief that using a specific application system will increase his or her job performance within an organizational context. A system perceived to be useful is more likely to generate user's belief that the use of such a system would yield positive benefits for task performance. TAM hypothesizes a positive usage and performance relationship. Researchers have theorized that behavior is determined by both intrinsic and extrinsic motivation. Individuals adopt information technology because its use is enjoyable and because they derive benefits from its use. As shown by Davis(1986, 1989), perceived usefulness as an extrinsic factor affects usage of computers. A possible explanation is that individuals will use computers only if they perceive that such usage would help them to achieve the desired task performance. Similarly, Teo, Lim and Lai(1999) found that perceived usefulness has a strong significant relationship with Internet usage. However, they found no direct effect of perceived ease-of-use on internet usage. This suggests that perceived ease-of-use may play a different role in internet usage. For e-shopping Web sites, e-shoppers will use these sites more if they find them useful for shopping. Many researchers found that successful e-shopping Web sites offer quality information helpful for shopping as well as useful functionality such as on-line order status tracking capability(Baty and Lee 1995; Bellman, Lohse and Johnson 1999).

While these two factors of perceived ease-of-use and perceived usefulness have been extensively studied by many researchers using different samples and generally confirmed to be important factors in affecting system usage (Adams, Nelson and Todd 1992;

Hendrickson and Collins 1996; Subramanian 1994), the specific roles played by these two factors in e-shopping situations have not been evaluated. This study tests alternative models that posit different relationships of these two factors with e-purchase. In addition, the perceived enjoyment factor was also investigated as an important determinant of system usage(Webster and Martocchio 1992). Perceived usefulness is a form of extrinsic motivation while perceived enjoyment is a form of intrinsic motivation.

Perceived Enjoyment

Individuals may engage in a particular behavior if it provides a feeling of fun and enjoyment. This suggests that individuals may adopt technology because its use is enjoyable. Lee, Pi, Kwok and Hyun(2003) found that enjoyment and convenience were positively associated with customer satisfaction with online purchasing and Davis, Bagozzi and Warshaw(1992) found that perceived enjoyment has significant effects on intention to use a word processing program. They also found that people's intentions to use computers are affected far more by their perceptions of how useful the computers are for improving their job performance than by the degree of enjoyment they experience in using the computers. Igbaria's(1994) study found a greater influence of perceived usefulness than perceived fun in the acceptance of microcomputer technology.

In the context of Web site usage, Rice(1997) suggests that the likelihood of a recent visit to a Web site is enhanced when the visitors find the visit enjoyable. Similarly, recent studies found that Web site design success depends on not only utilitarian outcomes but also hedonic outcomes. Web design features that help customers enjoy the visit lead to increased customer activities(Bellman, Lohse and Johnson 1999; Jarvenpaa and Todd 1997; Jin and Robey 1999; Lohse and Spillman 1998). E-shopping Web sites need to provide hedonic pleasure by motivating customers to participate, promoting customer excitement, and including interesting features to attract customers.

Perceived Security

Security emerges as one of the major consumer concerns leading to satisfactory experience in e-shopping. Many firms have found that security is one of the important consumer factors for purchasing on the Web(Elliot and Fowell 2000). This has focused researchers on developing models to facilitate discussion and understanding of how trust and perceived security enhances the acceptance of e-commerce and has produced a definition of perceived security risk as the potential for loss in the pursuit of a desired outcome(Keat and Mohan, 2004).

The Privacy Trust Survey(2003) surveyed individuals regarding their belief that government and business would safeguard the personal information that they collect from consumers. The results from this survey indicate that that physicians, hospitals, and banks rated as the top three organization types for privacy trust perceptions with these organization types receiving an 80% trust rating. However, the results from this survey indicated that retail stores, U.S. Department of Homeland Security, and grocery stores ranked as the bottom three organization types with these organization types receiving a 36% trust rating(Swartz 2004). Clearly, many organization types have to improve their perceived privacy trust ratings.

Lee and Turban(2001) posited in their trust model of Internet shopping that infrastructural variables such as security and third-party certification influence consumer trust in Internet shopping. Suh and Han(2003) found that customer perceptions of security control including privacy protection and data integrity have significant impact on e-commerce acceptance. Consequently, firms are realizing that they must rely on a comprehensive risk management approach to determine their specific security needs(King 2001; Power 2000). In addition, Ngai and Wat(2002) identified data and system security as an important area of research focus. Customers would not pay for products or services over the Web if financial information could not be transmitted securely. Liu and Arnett(2000) suggested that secure transactions are critical to the success of e-commerce Web sites. Security technologies such as secure sockets layer(SSL) and secure electronic transactions(SET) are adopted

by on-line shopping sites to ensure secure transactions and elicit secure feelings from e-shoppers. E-shopping Web sites that adopt these security features will provide e-shoppers increased confidence leading to e-purchase.


ALTERNATIVE MODELS

Three competing e-purchase determinant models, shown in figure 1, were proposed and investigated in this research. While many alternative models can be generated from the existing literature, the three most feasible models that capture structural relationships among determining factors of e-purchase rather than e-commerce related behaviors such as computer usage are selected in this study. The proposed alternative models integrate perceived security into TAM. The primary difference among the three competing models is the role played by the mediator variable. As noted in the literature review, perceived ease-of-use or perceived usefulness shows a differential role in determining computer and Web site usage (Teo, Lim and Lai 1999). Thus, the three competing models test the proposition that either perceived ease-of-use or perceived usefulness exhibits a characteristically different role in determining e-purchase from the other variables in its respective model. That is, the three competing models investigate the role of perceived ease-of-use or perceived usefulness by testing whether they are merely an alternative factor to e-purchase, or whether either of the two factors plays the role of mediator.

The "Direct Impact" model posits that each of the determining factors directly yields e-purchase. No hierarchy is hypothesized among the intrinsic and extrinsic motivational factors of e-purchase. In this model, all four determining factors are depicted as playing similar roles showing direct effects on e-purchase. Dillon and Reif(2004) and Pikkarainen et al.(2004) utilize a model similar to the "direct impact" model and find support for the four determinant factors.

The "Perceived Usefulness Mediated Impact" model posits that only perceived usefulness has a direct impact on e-purchase and that all other determining factors have an indirect impact on e-purchase, mediated by perceived usefulness. As a dominant
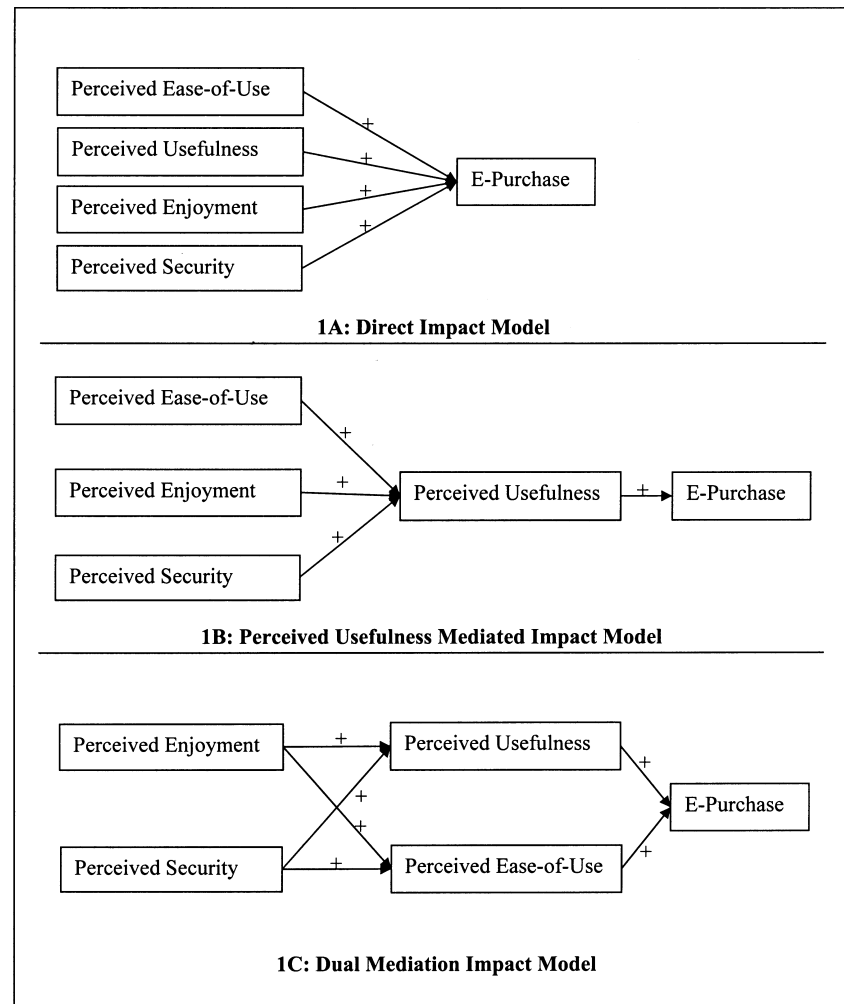
Figure 1. Three Competing Models

extrinsic factor, only perceived usefulness is considered to have a direct and positive impact on e-purchase. Perceived usefulness is directly influenced by the other three factors, perceived ease-of-use(Heijden et al. 2003; Monsuwe, et al. 2003; Venkatesh 1999), perceived enjoyment(Davis 1986; Elliot and Fowell 2000; Pavlou 2003; Teo et al. 1999), and perceived security(Keat and Mohan 2004; Pavlou 2003). This argument is also supported by the literature review described in Ziethaml et al.(2002). The research

demonstrated that perceived usefulness was the dominant predictor on dependent variables.

The "Dual Mediation Impact" model posits that both perceived usefulness and perceived ease-of-use have a direct impact on e-purchase. Perceived enjoyment and perceived security have an indirect impact on e-purchase, mediated by perceived usefulness. Support for these paths was presented earlier. Perceived ease-of-use is directly influenced by perceived enjoyment(Keat and Mohan 2004; Venkatesh 2000) and perceived security(McCloskey 2004; Pavlou 2003; Venkatesh, et al. 2002). In this case, perceived ease-of-use also becomes a dominant extrinsic factor offering critical utility by facilitating the e-purchase process in addition to perceived usefulness. E-shoppers will use an e-shopping site only when they perceive the shopping site easy enough to complete the transaction such that they can achieve the desired task of e-purchase.

METHODOLOGY

Among various strategies of empirical applications of structural equation models, this study adopted the model comparison approach(Joreskog and Sorbom 1993). This process requires the specification and test of alternative a priori models using the same set of data. Such models may represent competing theoretical hypotheses developed based on previous conflicting findings or uncertainty about the expected relationships among variables.

Subjects and Procedures

A self-administered questionnaire method was used in this study. A total of 223 juniors and seniors of a business school in a midwest university participated in the study and 219 usable responses(90 males and 129 females) were obtained.

The data collection was made in a group of 10 to 40 subjects in a classroom setting. Neither monetary nor non-monetary incentives were given to the respondents. The respondents were first presented with an overview of the study and then the respondents received a questionnaire. The respondents were

asked to answer all the questions carefully.

Construct Measures

The instrument employed in this study contained question items measuring perceived ease-of-use, perceived usefulness, perceived enjoyment, perceived security, and e-purchase(table 1). The respondents were asked to use the e-shopping site from which they most recently made a purchase. If they had not made any e-purchase, they were asked to use an e-shopping site that they had visited for an e-shopping purpose. Also included in this questionnaire were various demographics items such as age, gender, and income.

The items used to measure perceived usefulness and perceived ease-of-use were adapted from Davis(1986) and Igbaria, Iiarvi and Maragahh(1995). Respondents were asked to indicate their agreement and disagreement with several statements using a 5-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree.

Perceived enjoyment was measured using a 5-point semantic differential scale adapted from Igbaria, Iivari, and Maragahh (1995). Respondents were asked to rate the items according to how they felt about the e-shopping Web sites. The items are, "for me using the e-shopping Web site is:" frustrating-fun, unpleasant-pleasant, dull-exciting, and unenjoyable-enjoyable.

A new scale measuring perceived security was developed in this study. Perceived security was measured by a four-item, 5-point Likert-type scale. Respondents were asked to indicate their perceived degree of security when making e-purchases through e-shopping sites that guarantees e-transaction security with SSL technology. The items are, "the e-shopping Web sites give me the feeling of:" confidence, secure, protected, and safe.

E-purchase was captured by a two-item itemized rating scale. The conceptualization and operationalization of the construct was adapted from DeLone(1998) and Igbaria, Pavri, and Huff (1989). The two items in this construct measure included the dollar amount spent and the number of items purchased through on-line shopping in the past one year. The dollar amount spent was measured by a 5-point scale with "Not at all" (1), "$1-$50" (2), "$51-$100" (3), "$101-$150" (4), and "$151 or

Table 1. Variable and Factor Listing

Variable	Questionnaire Item	Associated Factor	Factor Description
V1	Learning to shop on the Internet is easy.	F1	
V2	I find it easy to use the Internet to shop on line.	F1	Perceived
V3	It is easy for me to become skillful at shopping on the Internet.	F1	Ease-of-Use
V4	I find the e-shopping Web sites easy to use.	F1	
V5	Using the e-shopping Web sites increases my shopping performance.	F2	
V6	The e-shopping Web sites are useful for shopping.	F2	Perceived
V7	Using the e-shopping Web sites enhances my shopping effectiveness.	F2	Usefulness
V8	Using the e-shopping Web sites provides me with information that leads to better purchase decisions.	F2	
V9	For me, using e-shopping Web sites is frustrating—fun.	F3	
V10	For me, using e-shopping Web sites is unpleasant— pleasant.	F3	Perceived
V11	For me, using e-shopping Web sites is dull—exciting.	F3	Enjoyment
V12	For me, using e-shopping Web sites is unenjoyable— enjoyable.	F3	
V13	The e-shopping site gives me the feeling of confidence.	F4	
V14	The e-shopping site gives me the feeling of security.	F4	Perceived
V15	The e-shopping site gives me the feeling of protection.	F4	Security
V16	The e-shopping sites give me the feeling of safe.	F4	
V17	How much money have you spent on e-shopping in the past one year?	F5	
V18	How many items have you purchased using e-shopping over the Internet in the past one year?	F5	E-Purchase

more" (5). The number of items purchased was measured by a 5-point scale with "Not at all" (1), "1-2 items" (2), "3-4 items (3), "5-6 items" (4), and "7 or more items" (5).

ANALYSIS AND RESULTS

Data were analyzed by structural equation analysis via LISREL (Joreskog and Sorbom 1989, 1993). In testing the three alternative models, overall fit of each of the model as well as their individual coefficients were evaluated and compared.

Measurement Model

Confirmatory Factor Analysis(CFA) was used to assess the measurement model of the five factors. The measurement model specifies the structural model linking the observed variables(V1 to V18) and the underlying theoretical factors(F1 to F5), which are presumed to determine responses to the observed variables (Anderson and Gerbing 1982). The measurement model was tested using LISREL 8.3. Table 2 shows standardized estimates, overall model fit indices, construct reliabilities, construct mean values and standard deviations. Multiple fit criteria were used to rule out measuring biases inherent in the various measures (Hair et al. 1995). The overall measurement model fit was judged to be satisfactory based on the overall goodness-of-fit criteria. The ratio of chi-square to degrees of freedom was 2.04(Chi-square of 255.58 with 125 df, p = .00). In addition, the Normed Fit Index(NFI) was .92, Bentler and Bonett's Non-Normed Fit Index(NNFI) was .95, and Bentler's Comparative Fit Index(CFI) was .96 which were all above the desired minimum acceptable .90 level(Bagozzi and Yi 1988; Hair et al. 1995).

In addition to overall measurement model fit, convergent validity, construct reliability, and discriminant validity were addressed. Convergent validity was assessed by examining the magnitude and sign of the factor loadings of the observed variables onto their respective latent variables(Table 2). Each loading was in the anticipated direction and magnitude, and each loading was significantly different from zero at the .05 level. The scale reliabilities representing internal consistency of
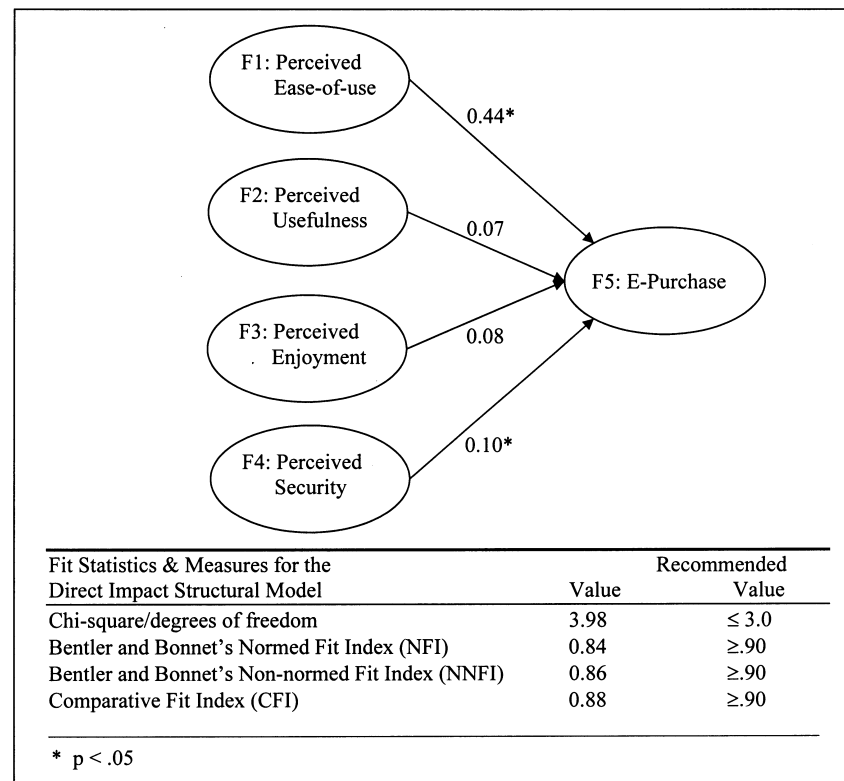
Table 2. Measurement Model Standardized Estimates

Variable	F1: Perceived Ease-of-Use	F2: Perceived Usefulness	F3: Perceived Enjoyment	F4: Perceived Security	F5: E-Purchase
V1	.87				
V2	.91				
V3	.86				
V4	.81				
V5		.79			
V6		.73			
V7		.80			
V8		.68			
V9		.86			
V10			.90		
V11			.86		
V12			.81		
V13				.89	
V14				.94	
V15				.91	
V16				.92	
V17					.87
V18					.91
Mean	3.92	3.24	3.32	3.50	2.44
Standard Deviation	1.02	.87	.95	1.09	.88
Construct Reliability	.92	.84	.92	.95	.88

Fit Statistics for the Confirmatory Factor Analysis	Value	Recommended Value
Chi-square/degrees of freedom	2.04	3.0
Bentler and Bonnet's Normed Fit Index (NFI)	.92	.90
Bentler and Bonnet's Non-normed Fit Index (NNFI)	.95	.90
Comparative Fit Index (CFI)	.96	.90

operationalizations were calculated as recommended by Fornell and Larcker(1981) and Werts, Linn, and Joreskog(1974). The construct reliabilities for the perceived ease-of-use, perceived usefulness, perceived enjoyment, and perceived security were

.92, .84, .92, and .95 respectively. The construct reliability for e-purchase was .88. Discriminant validity was assessed by examining the cross-factor loadings of each manifest variable onto all other latent variables on which high loadings were expected. The correlations among the five latent factors ranged from .17 to .72. Mean values of the five constructs ranged from 2.44 to 3.92(Table 2).

Based on the CFA results, it can be concluded that the measurement model is adequate to employ in the testing of the three proposed models. The next section describes the structural model analysis for the three competing models.

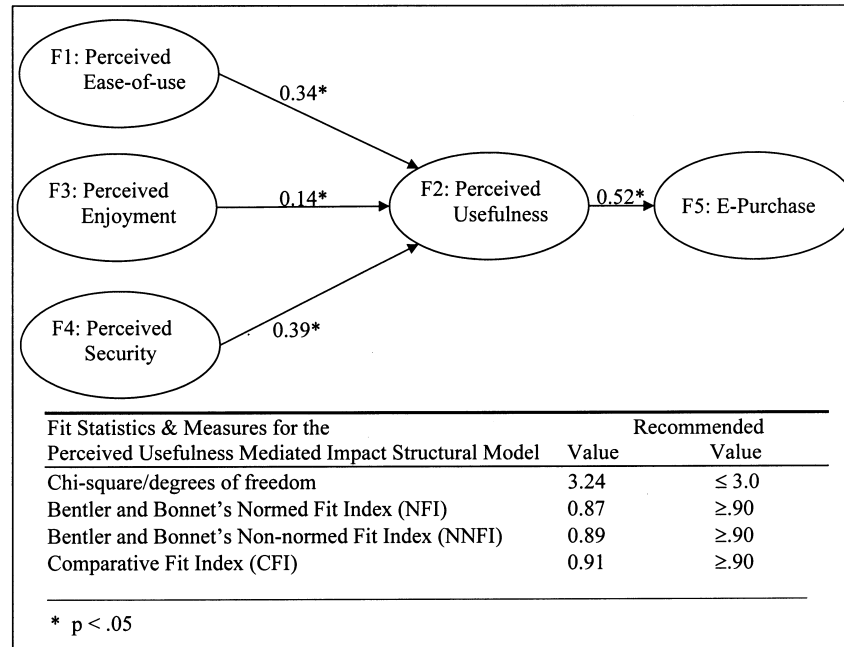| Fit Statistics & Measures for the Direct Impact Structural Model	Value	Recommended Value
Chi-square/degrees of freedom	3.98	≤ 3.0
Bentler and Bonnet's Normed Fit Index (NFI)	0.84	≥.90
Bentler and Bonnet's Non-normed Fit Index (NNFI)	0.86	≥.90
Comparative Fit Index (CFI)	0.88	≥.90

* p < .05

Figure 2. Direct Impact Model

Direct Impact Model

Figure 2 presents the "Direct Impact" model. Measures of overall model fit include: (1) Chi-square = 521.33 (131 df, p = .00); (2) Normed Fit Index (NFI) = 0.84; (3) Non-Normed Fit Index (NNFI) = 0.86; and (4) Comparative Fit Index (CFI) = 0.88. Based on these measures and the recommended values, the fit of this model was determined not to be satisfactory (Bagozzi and Yi 1988; Hair et al. 1995).

Perceived Usefulness Mediated Impact Model

Figure 3 shows the "Perceived Usefulness Mediated Impact" model. In this model, perceived usefulness is specified as a mediator mediating the relationships between the other three determinant factors and e-purchase. Measures of overall model fit include: (1) Chi-square = 424.89 (131 df, p =.00); (2) Normed

Fit Statistics & Measures for the Perceived Usefulness Mediated Impact Structural Model	Value	Recommended Value
Chi-square/degrees of freedom	3.24	≤ 3.0
Bentler and Bonnet's Normed Fit Index (NFI)	0.87	$\geq .90$
Bentler and Bonnet's Non-normed Fit Index (NNFI)	0.89	$\geq .90$
Comparative Fit Index (CFI)	0.91	$\geq .90$

* $p < .05$

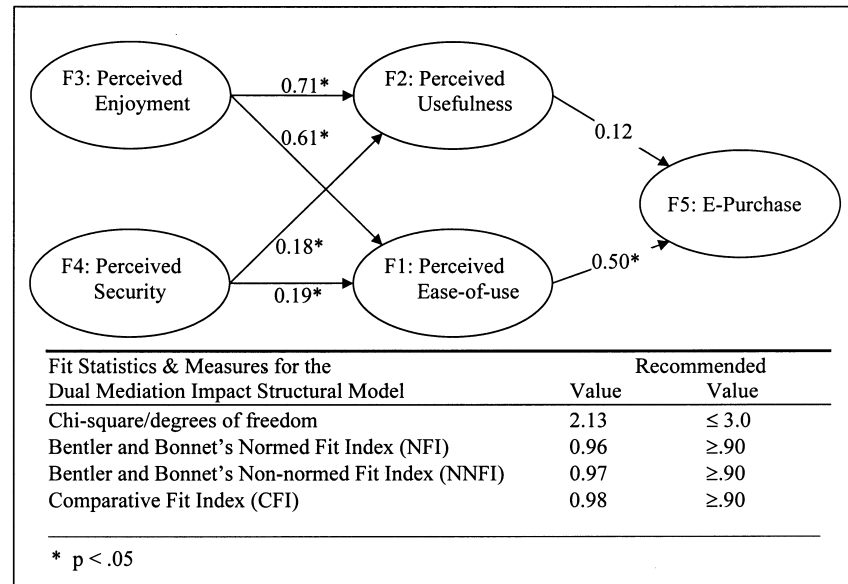**Figure 3. Perceived Usefulness Mediated Impact Model**

Fit Index (NFI) = 0.87; (3) Non-Normed Fit Index (NNFI) = 0.89; and (4) Comparative Fit Index (CFI) = 0.91. Based on these measures and the recommended values, this model showed marginally acceptable fit to the data.

Dual Mediation Impact Model

Figure 4 shows the "Dual Mediation Impact" model. In this model, both perceived usefulness and perceived ease-of-use are specified as the mediators mediating the relationships between the other two determinant factors and e-purchase. Measures of overall model fit included: (1) Chi-square = 274.24 (129 df, p = .00); (2) Normed Fit Index (NFI) = 0.96; (3) Non-Normed Fit Index (NNFI) = 0.97; and (4) Comparative Fit Index (CFI) = 0.98.

To conduct a statistical test for model comparison, a chi-square difference test among three competing models was performed. Pair-wise comparison tests were utilized following the model comparison procedure suggested by Mackenzie et al. (1986). The results of the pair-wise model comparison tests are presented in Table 3. For each pair of the three models, a

Fit Statistics & Measures for the Dual Mediation Impact Structural Model	Value	Recommended Value
Chi-square/degrees of freedom	2.13	≤ 3.0
Bentler and Bonnet's Normed Fit Index (NFI)	0.96	≥.90
Bentler and Bonnet's Non-normed Fit Index (NNFI)	0.97	≥.90
Comparative Fit Index (CFI)	0.98	≥.90

* p < .05

Figure 4. Dual Mediation Impact Model

common shared path model was first estimated. Then, a chi-square difference was calculated between the common shared path model and the two models being compared. The significant chi-square difference test result suggests that the improvement from the common shared path model is significant. The non-significant chi-square difference test result shows that the improvement of the tested model from the common shared path model is not significant. If one tested model shows a significant chi-square difference while the other model shows a non-significant chi-square difference, then the model showing a significant chi-square test is a better fit model than the model showing a non-significant chi-square test. When Model 1A and Model 1B are compared, the two models show significant improvements from the common shared path model. However, when model 1A is compared with model 1C, only model 1C shows significant improvement from the common shared path model ($\Delta\chi^2$ = 250.13, 4 d.f.). When model 1B and model 1C were compared, both models showed significant improvement over the common path model. Model 1C ($\Delta\chi^2$ = 173.81, 3 d.f.) shows a much larger chi-square difference than model 1B ($\Delta\chi^2$ = 23.16, 1 d.f.). These chi-square difference tests render further support for the model 1C for being a better fit model than model 1A or model 1B. Based on the goodness fit indices, recommended values, and the chi-square difference tests, the overall fit of the "Dual Mediation Impact" model was satisfactory and provided a better overall model fit than the "Direct Impact" model and the "Perceived Usefulness Mediated Impact" model.

Standardized parameter estimates for the "Dual Mediation Impact" model are also shown in Figure 4. Statistical significance for each parameter was assessed at the 0.05 level to evaluate the significance of the causal paths. Perceived ease-of-use has a direct and positive impact on e-purchase, as the parameter estimate(0.50) is statistically significant and substantial. Surprisingly, perceived usefulness has no significant direct effect on e-purchase. Perceived enjoyment and perceived security have a direct and positive impact on perceived ease-of-use. The standardized parameter estimates were 0.61 and 0.19. They are statistically significant and in the expected direction. Perceived enjoyment and perceived security also show a direct and positive impact on perceived usefulness.

Table 3. Model Comparison Test

Models Compared	Common Shared Path Model (χ^2 / d.f.)	Model 1A (χ^2 / d.f.)	χ^2 Difference (χ^2 / d.f.)	Model 1B (χ^2 / d.f.)	χ^2 Difference (χ^2 / d.f.)	Model 1C (χ^2 / d.f.)	χ^2 Difference (χ^2 / d.f.)
1A vs. 1B	561.26/ 134	521.33/ 131	39.93/ 3	424.89/ 131	136.37/ 3		
1A vs. 1C	524.37/ 133	521.33/ 131	3.04/ 2			274. 24/ 129	250.13/ 4
1B vs. 1C	448.05/ 132			424.89/ 131	23.16/ 1	274. 24/ 129	173.81/ 3

DISCUSSION

This research tested three competing models of e-purchase determinants. The "Direct Impact" model fit was not statistically significant and the fit indices indicated a lack of fit. The "Perceived Usefulness Mediated Impact" model showed a marginally acceptable fit. The "Dual Mediation Impact" model fit was statistically significant and the fit indices indicated a good fit of the model. All parameter estimates except the path from perceived usefulness to e-purchase showed statistically significant relationships. These estimates were positive and in the expected direction.

The results suggest that perceived ease-of-use is a key enabler of e-purchase transactions. As expected, perceived ease-of-use shows a strong significant positive relationship with e-purchase. However, perceived usefulness was not found to have a direct impact on e-purchase. While past research has consistently found that perceived usefulness and perceived ease-of-use are positively related to system usage and the Internet usage(Davis, Bagozzi and Warshaw 1989; Igbaria, Iivari and Maragahh 1995; Teo, Lim and Lai 1999), this study only found perceived ease-of-use having a direct positive impact on e-purchase. This finding may be due to the fact that this study employed actual e-purchase instead of Web site usage. If e-shopping Web sites are

easy-to-use, e-shoppers will have greater confidence of completing a transaction in a given time leading to increased actual e-purchase. Hence, Web site designers and managers seeking to increase the actual on-line sales should make their Web sites easy-to-use for e-purchase activity and should include features that enhance the customer service perception as well as reducing perceived risk(Doolin et al. 2005).

Contrary to the findings of previous studies reporting a significant direct effect of perceived enjoyment on the system and Internet usage(Igbaria, Schiffman and Wieckowshi 1994; Teo, Lim and Lai 1999), the direct effect of perceived enjoyment on e-purchase was not significant at the .05 level. This result may be due to the dependent measure used in this study. In this study, e-purchase was the dependent measure while most previous studies employed e-commerce related behavior such as computer acceptance or computer usage. In the case of e-commerce related behaviors such as Internet use, users are involved in various activities other than shopping. Therefore, if an activity is enjoyable, it is likely that users will spend more time and visit frequently those Web sites. In the case of e-purchase tasks, users are visiting the e-shopping Web sites with the intention of making purchases through the Web sites. Perceived enjoyment itself may not motivate users to increase e-purchase. Rather, it facilitates e-shopping if it is enjoyable. Perceived enjoyment shows a significant indirect effect through perceived ease-of-use on e-purchase.

This study found no direct effect of perceived security on e-purchase. However, the indirect effect of perceived security on e-purchase through perceived ease-of-use was significant. The more secure an e-shopping Web site is, the greater will be a user's feelings of self-confidence and low risk. Thus, e-shoppers will follow through e-shopping task leading to actual e-purchase. Perceived security in itself may not be a direct motivator for e-purchase but rather may act as a deterrent(Elliot and Fowell 2000). This suggests that perceived security is a necessary component of e-shopping Web sites because it reduces a user's purchase risk at the time of e-purchase. The results provide support for Liu and Arnett's(2000) contention that security is a necessary condition but not a sufficient condition of designing a successful e-commerce Web site.

Interestingly, this study did not find a direct effect of perceived usefulness and perceived enjoyment on e-purchase. This suggests that e-shopping sites may not need extensive entertaining components that slow down the site responsiveness. The finding also shows no direct effect of perceived security on e-purchase. While it is important to make e-shopping sites secure, the sites must first be easy-to-use for e-shoppers to complete e-purchase transaction.

In interpreting the findings of this study, care should be given. Due to the nature of the sample, the generalizability of the results is somewhat limited. In addition, the e-purchase measure used in this study was self-reported. Future research can replicate or extend this study by using different samples and test the three alternative models using other objective measures of e-shopping activity.

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