

Trust, Perceived Risk, and Trusting Behavior in Internet Banking

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In information systems, "trust" and "risk" have been explored by a few trust-related research studies before, but as two separate issues. The way in which these studies have been designed, however, does not help clarify the relationship between trust and risk since they are studied as unconnected determinants of trusting behavior in electronic commerce. As such, this research attempts to examine and specify the relationships among the core constructs surrounding the issue of trust such as risk and trusting behavior. The context of Internet banking adoption is used to develop a conceptual model that incorporates the direct effects of trust and perceived risk on trusting behavior as well as the mediation of the relationship between trust and trusting behavior by perceived risk.

The findings show that perceived risk mediates the relationship between trust and trusting behavior. Specifically, trust in the Internet as a banking medium significantly influences the adoption of Internet banking both directly and indirectly through perceived risk of Internet banking. Trust that the bank will not take advantage of consumers significantly influences the trusting behavior through perceived risk of Internet banking. This study, thus, extends research on trust in e-commerce by simultaneously examining the influence of trust and perceived risk on e-commerce adoption.

Keywords : Trust, Perceived Risk, Trusting Behavior, Electronic Commerce, Internet Banking

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I . Introduction

Use of the Internet among consumers has increased dramatically; the number of users is expected to reach 1.2 billion worldwide this year. However, forecasting shows that e-commerce will account for only 13 percent of total retail sales in 2010, up from 7 percent in 2004 [Xiao and Benbasat, 2007]. The usage of the Internet is even lower in the case of high consequence e-commerce applications, such as online stock trading and online banking. These are the cases in which some negative consequences (e.g., loss of privacy, monetary loss) of using the Internet are perceived to be high. Some scholars [e.g., Jarvenpaa and Leidner, 1999; Castelfranchi and Tan, 2002; Gefen *et al.*, 2003] assert that consumers' lack of trust in e-commerce is a possible reason for the slow adoption of the Internet as a channel for high consequence applications.

In fact, a number of recent studies have examined the issue of trust in the context of e-commerce. Lee and Turban [2001] develop a model of trust focusing on the antecedents of trust in Internet shopping. McKnight and Chervany [2002] set up a model of e-commerce customer relationships using the trust construct, derived from an interdisciplinary review of the literature. Gefen *et al.* [2003] attempt to integrate trust and technology acceptance model (TAM), asserting that these variables are important predictors of online commerce acceptance. Kuan and Bock [2007] examine trust in the "brick and click" retailers' context. Apparently, significant works have been done both to conceptualize and operationalize trust in the context of e-commerce.

This research addresses a closely intertwined issue in e-commerce: trust and risk. Trust arises

only under conditions of risk [e.g., Coleman, 1990]. Risk is considered essential to create an opportunity for trust [Roll, 1986]. Mayer *et al.* [1995] further distinguish between trust and trusting behavior in relation to risk: trust is the willingness to assume risk, while trusting behavior is the assumption of risk. There is no risk taken in the willingness to be vulnerable. Risk is taken only when one engages in trusting action [Mayer *et al.*, 1995]. Making a financial transaction on the Internet is a form of trusting behavior, which is "taking" risk, since a consumer makes him/herself vulnerable to the actions of the other party. An individual's trusting behavior depends on the nature of the consequences. In the case of adoption of high-consequence application, risk avoidance behavior may arise since reducing risk takes precedence over cost savings. The low usage of the Internet in online financial applications may be attributed to the fact that consumers still perceive high risk in this practice, supported by the evidence that only 40 million use Internet banking despite the large number of Internet users [Kandra, 2006].

The purpose of this paper is to examine the relationship between trust and risk as determinants of trusting behavior in e-commerce. A review of prior trust related research reveals that the relationship between trust and risk has not been fully investigated. Although some researchers [e.g., Pavlou, 2003; Pavlou and Gefen, 2004; Cho, 2006] empirically look into the relationship between trust and risk, the exact nature of the relationship has not been specifically addressed (e.g., moderating, mediating, or additive). Reflecting the current status of trust research in information systems (IS), Pavlou [2003] insists that

“future research should further examine the complex interrelationship among trust, perceived risk, and behavioral intention to reach definite conclusions” (p. 125), attesting to the need for systematic investigation of the trust-risk relationship.

In order to address this issue, the research context needs to be a high consequence application in which consumers may perceive some amount of risk in engaging in the trusting behavior. The specific e-commerce application chosen for the study is Internet banking. Internet banking is defined as the delivery of banking services through the Internet directly to customers’ home or private address [Yiu *et al.*, 2007].

This paper is organized as follows. The conceptual framework for this research is presented in the next section. The development of the research model and research hypotheses appears in Section 3. Next, the research methods employed are described. Then, the data analysis is presented, and finally, the implications and avenues for future research are explored.

II . Conceptual framework

2.1 Trust and Risk

Trust has been defined in various ways throughout the research literature. Gefen *et al.* [2003] summarize the prior conceptualizations of trust as follows: (1) trust as a set of specific beliefs dealing with the integrity, benevolence, and ability of trustee; (2) trust as the willingness of a party to be vulnerable to the actions of another; (3) trust as a feeling of confidence and security in the caring response of the other party; and (4) a combination of those three cases.

For this research, we have adopted Mayer *et al.*'s (1995) definition of trust: “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (p. 712). Trust and risk are examined in the following sections.

2.1.1 Trust

After an extensive review of trust literature across disciplines, Rousseau *et al.* [1998] find that there is an agreement on the conditions that must exist for trust to arise. Risk is a condition considered essential across disciplines for the existence of trust [e.g., Coleman, 1990; Williamson, 1993]. Hosmer [1995] also concludes, “trust generally occurs under conditions of vulnerability to the interests of the individual and dependence upon the behavior of other people. An essential part of the definition of trust is the expectation that the loss if trust is broken will be much greater than the gain when trust is maintained; otherwise, the decision to trust would be simple economic rationality” (p. 390).

While trusting behavior can entail risk taking, not all risk taking behaviors are trusting behaviors, nor do they need to involve trust. For example, an asset manager, who invests on behalf of his/her clients, takes risk when s/he invests a client’s money into financial assets, but the investment decision is based on simple economic rationality, not on trust. Mayer *et al.* [1995] differentiate trusting behaviors from general risk-taking behaviors in that “trusting behaviors can occur only in the context of a specific, identifiable relationship with another party” (p. 725).

Further, Mayer *et al.* [1995] assert that, to understand how trust influences trusting behavior, we should “separate trust from other situational factors that necessitate trust (i.e., perceived risk)” (p. 726). Therefore, trust research should include risk simultaneously, since risk creates an opportunity for trust, but trust is not always present in all risky situations.

2.1.2 Risk

The task of defining risk has long been fraught with controversy and confusion [Fishoff *et al.*, 1990]. Although the classical decision theory suggests that risk is “the variance of the probability distribution of possible gains and losses associated with a particular alternative” [MacCrimmon and Wehrung, 1986], organizational researchers suggest that this is a poor description of how managers view risk [Chiels and McMackin, 1996]. Instead, the management literature defines risk as the probability of loss, as interpreted by a decision maker [Chiels and McMackin, 1996]. That is, risk is a function of the probability that a hazard arises and the consequences (e.g., cost) of the hazard. Sitkin and Pablo [1993] further contend that since risk is difficult to capture as an objective reality, risk perceptions have drawn scholarly attention [e.g., Simpson and Lakner, 1993]. Risk perception is defined as a decision maker’s assessment of the risk inherent in a situation [Sitkin and Pablo, 1992]. Risk perceptions influence decision makers’ behavior, for example, leading decision makers to deny uncertainty or to exhibit unwarranted confidence in their judgments [Roll, 1986]. Thus, perceived risk is considered in developing the current research model, instead of attempt-

ing to capture risk as an objective reality.

2.2 Relationship between Trust and Perceived Risk

The relationship between trust and risk has recently begun to be explored in the management literature [Peters, 1988; Chiels, 1996] and e-commerce literature [Pavlou, 2003; Pavlou and Gefen, 2004]. However, the complex and interactive nature of the relationship between trust and risk makes it difficult to establish causal links. The relationship between these two constructs is suffused with “the complexities of parallel processing, bi-directional causality and reverberating feedback that characterizes both cognitive and social organizations” [McAllister, 1995]. Bidirectional causality implies that risk creates an opportunity for trust, while at the same time trust influences risk perception. The relationship in each direction is examined in the following sections.

2.2.1 Risk as a Determinant of Trust

According to cognition-based trust researchers, trust relies on rapid, cognitive assessment of a situation [e.g., McKnight and Chervany, 2001]. Prior research has identified several factors relevant to such an assessment: assessment of relationship, assessment of principles, and assessment of benefits [Elangovan and Shapiro, 1998]. For example, any perception of opportunistic behavior by the exchange partner, i.e., negative assessment of the relationship, affects one’s trust level in the trustee [Karahannas and Jones, 1999]. McKnight and Chervany [2001] assert that trusting intention is likely to be fragile, referring to

a trusting intention that is likely to undergo large changes during a given time frame under the conditions of high perceived risk. Tan and Thoen [2000] also identify risk and risk attitude as a potential determinant of trust. Pavlou [2003] describes consumer trust as a function of the degree of risk involved in the situation. From the foregoing discussion, it can be argued that risk influences trust in a given situation.

2.2.2 Trust as a Determinant of Risk

Although the causal relationship between trust and risk is difficult to establish, in the recent academic literature, a consensus seems to have been built based on the simple relationship in which perceived risk of any transaction will be influenced by the degree to which the parties trust each other [e.g., Nootboom, 1997; Jarvenpaa and Todd, 1998; Gefen, 2002].

One of the fundamental elements of trust is a trustor's positive expectation about the likelihood of having a desirable action performed by the trustee in situations entailing risk [Sitkin and Roth, 1993]. Positive expectations of the behavior of the other party reduce the perceived probability of loss. Similarly, "transaction-cost" economists view trust as a cause of reduced opportunism among transacting parties, which results in lower transaction costs [Williamson, 1993]. Thus, the perceived risk of opportunistic behavior by a counter party to a transaction will be influenced by the level of trust in the relationship. Nootboom *et al.* [1996] also propose that trust yields an additional basis for restraining opportunism and that it operates by limiting the inclination of the trading partner to employ available room for opportunism. In IS, Jarvenpaa and

Todd [1996] conceptualize trust in the Internet-shopping environment as a risk reducing mechanism, which considers risk as being influenced by trust. Gefen [2002] explains that trust is a social complexity reduction mechanism, and reduces the perceived risk of doing business with online vendors.

In sum, most theorists would agree that trust is intimately associated with risk [Hill, 1990], although they are independent constructs. It would be difficult to capture the bi-directional relationships between trust and risk in one study, especially considering that trust and risk can be considered "mirror images" of each other [Das and Teng, 1998]. Nonetheless, in this study, trust is hypothesized as a factor that influences perceived risk for the following reasoning. When a reciprocal relationship exists between two variables, one can evaluate them on the basis of the time order between them [Cooper and Emory, 1995]. In the context of Internet banking offered by physical banks, it is typical that consumers would already have accounts with their banks, thereby having a certain level of trust in the bank even before they assess the perceived risk of Internet banking. Therefore, trust in the bank is considered as an influencer of perceived risk of Internet banking. This is consistent with prior research asserting that perceived risk appears to be a mediator in the relationship between trust and trusting behavior [e.g., Neter *et al.*, 1996; Chiels, 1996; Jarvenpaa and Todd, 1996; Gefen, 2002].

2.3 Trustees

Following Mayer *et al.* [1995] suggestion to clearly encompass relevant factors of both the

trustor and the trustee, this research identifies the trustees explicitly in order to avoid the possibility of changing referents, which would influence the properties of the trustee to be examined. Due to the dual nature of online interaction, characteristics of both the provider and the underlying Internet infrastructure should be simultaneously considered [Cho, 2006].

When adopting Internet banking, consumers (trustors) have to trust two referents (trustees): the Internet as a banking medium and the bank providing the Internet banking services. Thus, trust in Internet banking encompasses two components listed above: trust in the Internet as a banking medium and trust in the bank.

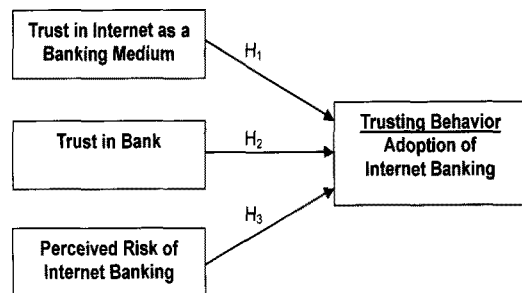
III. Research Model and Hypotheses

This section examines the relationships among the research constructs and develops the hypotheses. First, we discuss the direct effects of trust and perceived risk on trusting behavior. Second, the mediation effects of perceived risk in the relationship between trust and trusting behavior are discussed. Third, the full model is presented, including both the direct effects and the mediation effects.

3.1 Direct effects of trust and perceived risk on trusting behavior

Regarding the functional form of the relationship between perceived risk and trust as determinants of trusting behavior, Mayer *et al.* [1995] suggest an additive relationship. They propose that “the level of trust is compared to the level of perceived risk in a situation. If the level of

trust surpasses the threshold of perceived risk, then the trustor will engage in the (trusting behavior)” [Mayer *et al.*, 1995, p. 726]. This statement suggests that both trust and perceived risk directly influence the trusting behavior held by trustors.



<Figure 1> Direct (Additive) effects of trust and perceived risk on trusting behavior

3.1.1 Trust in the Internet as a banking medium and trusting behavior

Trust in the Internet as a banking medium (T_{Internet}) refers to the willingness of a consumer to be vulnerable to the actions of the Internet based on the expectation that the Internet will perform what the consumer expects it to do, and not something else, despite the possibility of environmental disruption, human user and operator errors, and attacks by hostile parties. So, when a consumer carries out a banking transaction using the Internet, s/he expects the Internet to perform in such a way that the transaction is completed successfully.

Trust may concern a partner’s ability to perform according to the intentions and expectations of a relationship (competence trust), or a partner’s intentions not to defect (intentional trust) [Neter *et al.*, 1996]. Previous research on

trust has mainly dealt with trust in other people and trust as a social phenomenon, focusing mostly on intentional trust. However, considering that IT is an inanimate object, which does not have any intentions by itself, our focus is properly on competence trust.

As a general positive attitude toward another social entity, trust acts as a guideline, influencing one's trusting behavior within a relationship. When a consumer trusts the Internet, thinking it has the ability to perform what the consumer expects it to do, the consumer is likely to adopt Internet banking.

Hypothesis 1 : *The level of trust in the Internet as a banking medium is positively associated with the adoption of Internet banking.*

3.1.2 Trust in the Bank

Trust in the bank refers to the willingness of a consumer to be vulnerable to the actions of the bank based on the expectation that the bank will perform a particular action important to the consumer, irrespective of the ability to monitor or control that other party. In other words, trust in the bank represents the consumer's expectation that the bank will perform an appropriate action important to the consumer if something undesirable happens when using Internet banking. Institutional trust derives from the institutional factors which can act as broad supports for the critical mass of trust that sustains further risk taking and trusting behavior [e.g. Sitkin, 1995]. Specifically, institution-based trust researchers maintain that trust reflects the security one feels about a situation because of guarantees or other

impersonal structures [Zucker, 1986] that are in place to deal with unexpected consequences. The necessary impersonal structures are particularly relevant to trust in the bank since consumers may feel uncertainty due to the several publicized security and performance issues with the use of the Internet for e-commerce. Thus, when a customer has a high level of trust in the bank that provides Internet banking services, the consumer would make him/herself vulnerable to the actions of the bank by adopting Internet banking.

Hypothesis 2 : *The level of trust in the bank is positively associated with the adoption of Internet banking.*

3.1.3 Perceived risk and trusting behavior

It has been noted that consumer adoption of new retail innovations are strongly influenced by perceived risk [Jarvenpaa and Leidner, 1999]. The view that trusting behavior is ultimately determined by risk perceptions is informed by a number of extant theories. For example, March and Shapira [1987] suggest that situations which decision makers label negative lead to risk-averse behavior because the consumer's attention will be directed toward negative consequences. Sitkin and Pablo [1992] further assert that risk perceptions appear to be central influences on trusting behavior. Applying these arguments to the Internet banking context, if a consumer perceives Internet banking as highly risky, then the consumer is likely to avoid using Internet banking. Meanwhile, if a consumer considers Internet banking as low in risk, then it will lead to trusting behavior, that is, the adoption of Internet banking.

Hypothesis 3 : *The level of perceived risk of Internet banking is negatively associated with the adoption of Internet banking.*

3.2 Mediation effects of perceived risk in the relationship between trust and trusting behavior

With regard to the relationship between trust in the Internet as a banking medium and perceived risk of Internet banking, trust in the Internet as a banking medium is considered to influence perceived risk, since trust in the Internet refers to a consumer's trust level in a technology (electronic communication channel) component of Internet banking. Internet banking has other components involved such as the bank's customer service and information systems. Therefore, trust in the Internet as a banking medium is modeled as a determinant of perceived risk.

3.2.1 Trust and perceived risk

Trust in the Internet as a banking medium represents the consumer's expectation that the Internet has the ability to facilitate the completion of the banking transactions as intended by a consumer. The consumer's trust in the Internet influences his/her assessment of the risk inherent in Internet banking. When a consumer trusts the Internet as a competent banking medium, s/he perceives less risk in using Internet banking. Hence, there is less need to have elaborate contracts to safeguard their interests and, thus, lower transaction costs. Conversely, if the users do not trust the Internet as a banking me-

dium, then they perceive greater risk in making banking transactions over the Internet. In the same vein, the consumer's trust in the bank providing Internet banking services influences his/her assessment of the risk inherent in Internet banking. Hence, the following hypotheses are constructed:

Hypothesis 4 : *The level of trust in the Internet as a banking medium is negatively associated with the perceived risk of Internet banking.*

Hypothesis 5 : *The level of trust in the bank is negatively associated with the perceived risk of Internet banking.*

3.2.2 Mediation effects

When reconceptualizing the determinants of risk taking behavior, Sitkin and Pablo [1992] assert that perceived risk appears to be central, mediating influences on risk taking behavior. Trust reflects an optimistic expectation of the behavior of the trustee under conditions of organizational vulnerability and dependence [Hill, 1990]. Positive expectation of the behavior of the other party enhances the perceived probability of desired behavior, thereby reducing the perceived probability of loss and enabling partners to take risk, even when not all contingencies arising in the relationship are known [Andaleeb, 1992]. That is, trust will increase the likelihood of trusting behavior because trust is likely to alleviate concerns regarding possible negative consequences. Thus, it is hypothesized that the relationship between trust and trusting behavior will be mediated by perceived risk.

Hypothesis 6 : *The higher the trust in the Internet as a banking medium, the higher will be the adoption of Internet banking because of the lower perceived risk of Internet banking.*

Hypothesis 7 : *The higher the trust in the bank, the higher will be the adoption of Internet banking because of the lower perceived risk of Internet banking.*

3.3 Full model

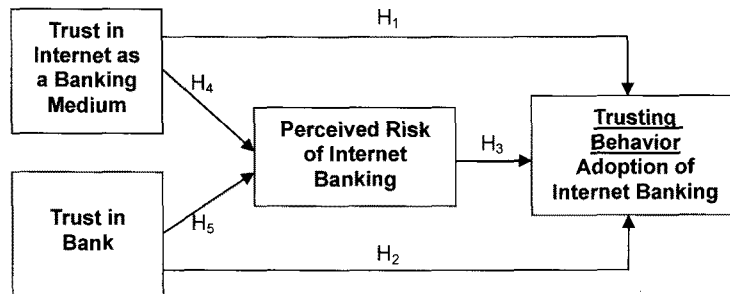
The full model includes the direct effects of trust and perceived risk on trusting behavior, and the mediating effects of perceived risk in the

relationship between trust and trusting behavior.

IV. Research Method

4.1 Operationalization of the Variables

The research instrument to measure the constructs of interest was developed either by adapting existing measures to the research context or by converting the definitions of the constructs into a questionnaire format. The research constructs and the sources of the various scales used to measure them are summarized in <Table 1>. All the variables were measured on a 7-point Likert scale. Details of the final instru-



<Figure 2> Full model

<Table 1> Constructs and Sources of Measures

Construct	Dimensions	Source of Scales
Perceived Risk of Internet Banking	Misuse of information Loss of privacy Monetary loss	Developed based on Jarvenpaa and Todd [1998]
Trust in the Internet as a banking medium	Correctness Availability Reliability Security Survivability	Developed based on Schneider [1998]
Trust in the Bank	Commitment Misuse of an opportunity	Adapted from Cummings and Bromiley [1996]

ment are shown in <Appendix 1>.

4.2 Sample

The data for the study were collected on-line from the Web site of a major Mid-west bank in the U.S. that was offering Internet banking and from the Web sites of a local media company, in order to get responses from both users and non-users of Internet banking. Users were directed to the online survey using banner advertisements placed on the home page of the bank as well as the homepages of seven local radio and television station websites. The survey was solicited from the two sources for 5 days each. The banner advertisement linked to a jump page inviting them to participate in the online survey and then linking them to the survey consent form. Once the users agreed to take the survey, they were directed to the online survey form. Users were expected to take about 15 minutes to complete each survey. Respondents were offered a \$25 gift certificate at a major local grocery store chain as an incentive for completing the on-line survey.

From the bank's Web site, 221 responses were collected during the survey period, while 125 responses were collected from the local media company's Web sites. Multiple responses from the same person or family were checked either by looking at the IP addresses of the computers used to respond to the survey as well as by looking at other information such as last name, address, and the time the respondent filled in the survey. After eliminating multiple responses and unusable responses, the final sample comprised of 266 responses. Out of 266 sample subjects, 180 were adopters and 86 were non-adopt-

ers of Internet banking. All the sample subjects had accounts at physical banks.

Since the data were collected from the Internet users, the population to which the inferences of the study findings should be made is the Internet users who have bank accounts in physical banks. An implicit assumption for the online Internet survey was that only those Internet users with accounts in off-line banks would be potential adopters of Internet banking.

V. Results

5.1 Research Instrument Validation

5.1.1 Pretest

A pretest of the research instruments was carried out with 61 full-time MBA students at a major Mid-West university in the U.S. Principal component analysis was used to validate the instrument. As a result of the pretest, several items were refined. Some initial items were found to be unclear expressions of the research constructs and these items were eliminated.

A second pretest was conducted with an online version of the research instrument to test the functioning of the Web-based form. Sixty undergraduate students in the same university participated in an online survey. The data collected during this pretest was not part of the final sample. As a result of the pretest, a few questions and the layout of the online form were further refined.

5.1.2 Validation of Research Instrument

After the final data collection, the validity of

the measures used for the research constructs was evaluated using principal component analysis with oblique factor rotation. The choice of oblique factor rotation over orthogonal rotation was made because we were interested in obtaining theoretically meaningful dimensions. (Since oblique factor rotation allows for correlation of underlying dimensions) [Hill, 1990]. The results of the factor analysis are presented in <Table 2>. Four factors with Eigen values greater than one were extracted. The items measuring the trust in the bank loaded on the two different factors as operationalized, trust in the bank's commitments (TB_Commit) and trust in the bank that the bank does not take excessive advantage of

another even when the opportunity is available (TB_Intent). Thus, these factors were treated separately in the subsequent analyses. All the other items converged on their respective dimensions. The descriptive statistics of the research variables, including Cronbach's Alpha, are presented in <Table 3>, while the correlation matrix of independent variables is presented in <Table 4>.

5.2 Analysis

In order to check any systematic differences between the two response groups—one from the bank's home page and the other from the local media company's Web sites, t-tests were per-

<Table 2> Factor Analysis Results

	1	2	3	4
1. Trust in Bank				
1-1. Commitments (TB_Commit)				
Item 1	.939	-.104	.280	-.203
Item 2	.948	-.171	.228	-.162
Item 3	.943	-.153	.209	-.171
1-2. Taking Advantage (TB_Intent)				
Item 4	.121	-.730	.041	-.076
Item 5	-.180	-.716	-.010	-.113
Item 6	.371	-.797	.023	-.250
Item 7	.240	-.815	-.030	-.263
2. Trust in the Internet as a Banking Medium (T_Internet)				
Item 8	.230	-.011	.875	-.201
Item 9	.212	-.003	.863	-.138
Item 10	.303	.017	.879	-.193
Item 11	.046	-.036	.631	-.136
Item 12	.180	.024	.747	-.314
3. Perceived Risk of Internet Banking (P_Risk)				
Item 13	-.096	.203	-.200	.928
Item 14	-.140	.181	-.211	.930
Item 15	-.210	.140	-.227	.819
% of Total Variance Explained (72.871%)	14.428	17.919	29.722	10.801

Note) Extraction method = principal component analysis.
Rotation method = oblique rotation.

<Table 3> Descriptive Statistics

	No. of Items	Mean	Standard Deviation	Cronbach's Alpha
Trust in Bank (TB_Commit)	3	5.49	1.284	0.95
Trust in Bank (TB_Intent)	4	4.13	1.379	0.77
Trust in the Internet as a Banking Medium (T_Internet)	5	4.86	1.424	0.86
Perceived Risk of Internet Banking (P_Risk)	3	3.92	1.489	0.87

Note) N = 266.

<Table 4> Correlation Matrix of Independent Variables

	1	2	3	4
1. TB_Commit	1.000			
2. TB_Intent	-.203**	1.000		
3. T_Internet	.280**	-.011	1.000	
4. P_Risk	-.187*	.232**	-.251**	1.000

Note) N = 266, ** p < .01, * p < .05.

formed on all the independent variables. No statistically significant differences were found between the two groups at the 0.05 level of significance. In addition, a chi-square test was conducted to check the difference between the two groups in terms of the dependent variable (i.e., adoption of Internet banking), but again, no significant differences were found ($X^2 = 2.853$, Asymptotic significance = 0.091, N = 266). Therefore, these two groups were combined into one sample.

The independent variables were tested for normal distribution, using the Shapiro-Wilk test and all the independent variables satisfied the normality assumption at the $\alpha = 0.05$ level of significance. In addition, histograms, stem and leaf plots and box plots were also used to further verify compliance with the assumption of

normality.

Since significant correlations among explanatory variables were observed, unstandardized regression coefficients were used to test the hypotheses. Several researchers [e.g., Govindarajan and Fisher, 1990] have demonstrated that multicollinearity problems can be completely eliminated by manipulating the origin points for the observed variables. Thus, significant values for the unstandardized regression coefficients would support the hypotheses.

5.2.1 Test of the direct effects model

The joint ability of the independent variables to explain the adoption of Internet banking was examined using path analysis. Path analysis uses regression models to test theories of causal rela-

tionships among a set of variables. Where the number of categories in dependent variables is small, the linear model used in structural equation modeling (SEM) based statistical software (e.g., EQS) is probably not optimal [Bentler, 1995]. In this study, the dependent variable was a dichotomous measure and thus SEM was not deemed to be an appropriate technique.

Multiple logistic regression analysis was performed to test the hypotheses explaining the adoption of Internet banking because there were multiple predictors for a binary response variable. The method of maximum likelihood was adopted to estimate the parameters of the logistic response function, since this method is well suited to deal with the problems associated with binary responses. The logistic regression formula is as follows:

$$Use_IB = a + b1*T_Internet + b2*TB_Commit + b3*TB_Intent + b4*P_Risk + e \quad (1)$$

in which: Use_IB is the adoption of Internet banking; T_Internet is the trust in the Internet as a banking medium; TB_Commit is the trust

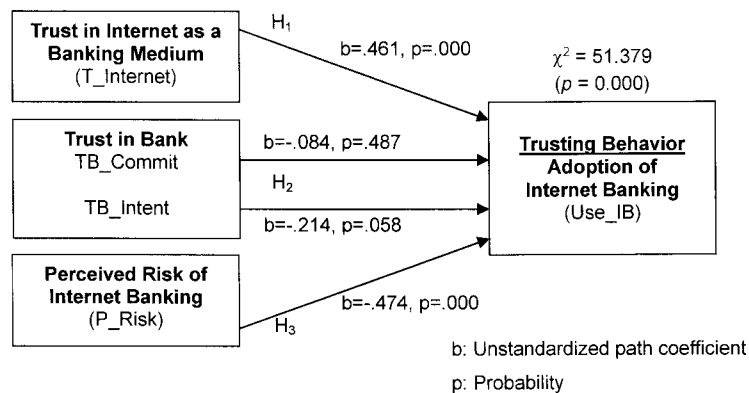
in the bank's commitments; TB_Intent is the trust in the bank's intention not to take advantage of an opportunity; and P_Risk is the perceived risk of Internet banking.

The intercept a and the terms b1 through b4 are path coefficients obtained by fitting the model, and e is the unexplained error term.

For Use_IB, the Chi-square statistic of 51.379 (p-value = 0.000) with four degrees of freedom was significant (McFadden's Rho-Squared = 0.153). The analysis of each independent variable, presented in <Figure 3>, indicated that as predictors of Use_IB, T_Internet and P_Risk were significant at the 0.001 level, but TB_Commit and TB_Intent were not significant at the 0.05 level.

5.2.2. Test of the mediation effects model

In order to test the effects of the two trust variables on the perceived risk of Internet banking, a multiple regression analysis was performed. A logistic regression analysis was performed to test the effect of perceived risk of Internet banking on the adoption of Internet banking. The re-



<Figure 3> Directs effects model

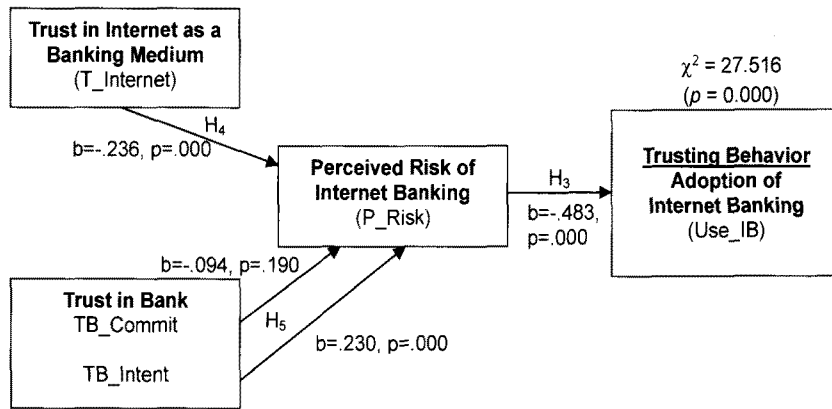
gression formulae are,

$$P_Risk = a + b1 * T_Internet + b2 * TB_Commit + b3 * TB_Intent + e \quad (2)$$

$$Use_IB = a + b1 * P_Risk + e \quad (3)$$

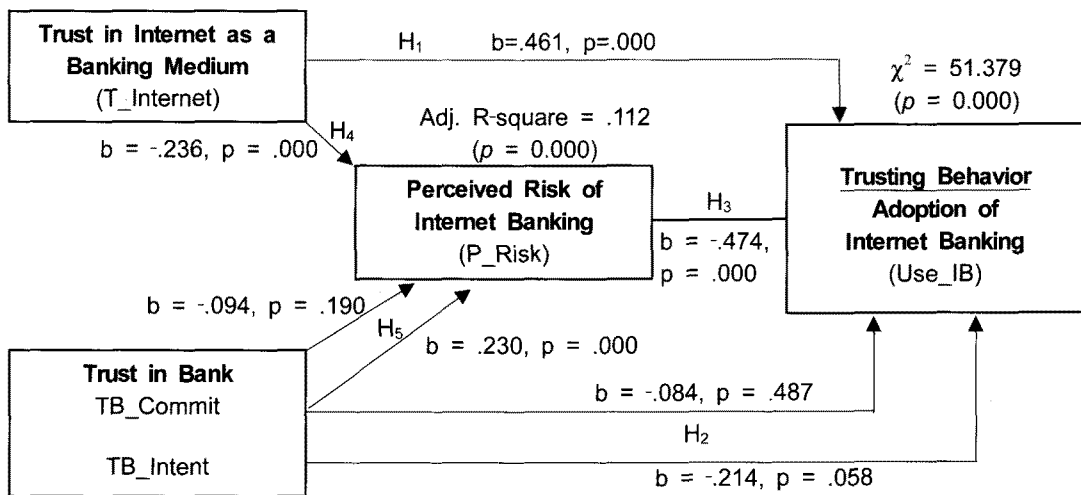
The analysis results of the direct effects of

T_Internet and trust in the bank on perceived risk as well as the effect of perceived risk of Internet banking on the adoption of Internet banking are presented in <Figure 5>. The percentages of variance explained (adjusted R²) by the model were 11.1 percent (R² = .348) for P_Risk and 28 percent for Use_IB. For Use_IB,



Note) Indirect effect of TB_Commit on Trusting Behavior: $(-0.094) \times (-0.483) = 0.045$.
 Indirect effect of TB_Intent on Trusting Behavior: $(0.230) \times (-0.483) = -0.111$.
 Indirect effect of T_Internet on Trusting Behavior: $(-0.236) \times (-0.483) = 0.114$.

<Figure 4> Mediation effects model



<Figure 5> Full Model

the Chi-square statistic of 27.516 (p -value = 0.000) with one degree of freedom was significant. The analysis of each independent variable indicated that as predictors of P_Risk, both TB_Intent and T_Internet were significant at the 0.001 level, but TB_Commit was not significant. As predictors of Use_IB, P_Risk turned out to be significant at the 0.001 level.

5.2.3. Test for the mediating effects of perceived risk

In order to test the mediation effects of P_Risk, a procedure developed by Barron and Kenny [1986] was applied to the path analysis results. The procedure produces evidence of mediation when (a) explanatory variables are statistically significant in the estimates of regression Equations (2) and (b) the mediator variable is statistically significant in the estimates of regression Equation (1). No mediation exists if the regression coefficient for an explanatory variable is insignificant in regression Equation (2) or if the regression coefficient for mediator variable in regression equation (1) is insignificant. Partial mediation exists if the regression coefficient for an explanatory variable is significant in regression Equations (2) and (1). Full mediation exists if the regression coefficient for an explanatory variable

for regression Equation (2) is significant but not in regression Equation (1).

Since the coefficient of P_Risk in the regression Equation (1) was significant, we could check the type of mediation effects: no mediation, partial mediation, and full mediation. The results of the test of mediation effects are given in <Table 6>. Partial mediation effects of P_Risk were found in the relationship between Use_IB and T_Internet. Full mediation effects of P_Risk were found in the relationship between Use_IB and TB_Intent. However, the coefficient of TB_Commit in regression Equation (2) was not significant and therefore mediation effects were not checked.

5.2.4 Test for the moderating effect of perceived risk

Although we could not find strong theoretical support that perceived risk is a moderator of the relationship between trust and trusting behavior, we tested the moderating effects of perceived risk in order to fully clarify the relationship between trust and perceived risk. The multiplicative model is a powerful vehicle to investigate the moderation effects that co-variation between antecedent variable (trust) and intervening variable (risk) affects the criterion varia-

<Table 6> Testing for Mediation Effects

Variables	Dependent Variable		Interpretation
	P_Risk Reg. Eq. (2)	Use_IB Reg. Eq. (1)	
TB_Commit	$b = -.094(t = -1.313, p = .190)$	$b = -.084(x^2 = 0.484, p = .487)$	No mediation
TB_Intent	$b = .230(t = 3.606, p = .000)$	$b = -.214(x^2 = 3.595, p = .058)$	Full mediation
T_Internet	$b = -.223(t = -3.737, p = .000)$	$b = .461(x^2 = 16.973, p = .000)$	Partial mediation
P_Risk		$b = -.474(x^2 = 19.413, p = .000)$	N/A

ble. Thus, the logistic regression formula is,

$$\begin{aligned} Use_IB = & a + b1*T_Internet + b2*TB_Commit \\ & + b3*TB_Intent + b4*P_Risk \\ & + b5*T_Internet* P_Risk \\ & + b6*TB_Commit* P_Risk \\ & + b7*TB_Intent* P_Risk + e \end{aligned} \quad (4)$$

The results showed that none of the interaction terms were significant at the .05 level, thereby showing the lack of moderation effects.

VI. Discussion and Implications

6.1 Discussion

The research results show that perceived risk of Internet banking mediates the relationship between trust and trusting behavior, i.e., the adoption of Internet banking. Specifically, trust in the Internet as a banking medium significantly influences the adoption of Internet banking both directly and indirectly through perceived risk of Internet banking. Trust in the bank's intent—that the bank does not take excessive advantage of its customers even when the opportunity is available—influences the trusting behavior indirectly through perceived risk of Internet banking, but the direct relationship between trust in the bank's intent and trusting behavior is not significant. Contrary to our expectations, trust in the bank's commitments turned out to be a non-significant factor in determining the adoption of Internet banking. The mixed results of trust in the bank can be interpreted as follows: since the potential liability of the consumer is not explicitly limited in Internet banking, the bank's commitment may not be an important

factor in a consumer's decision to adopt Internet banking. Meanwhile, consumers may be concerned about the bank's intent to misuse their confidential information collected during Internet banking to its own advantage. Further, many rules and regulations to protect consumers' rights in e-business transactions still need to be established. Thus, consumers may be concerned about the bank's intent to take advantage of ambiguous situations in Internet banking. This concern may lead to high perceived risk of Internet banking.

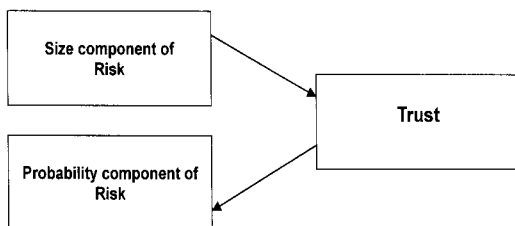
6.2 Implications

6.2.1 Implications for Future Research

A future research implication is that the interactive nature of the relationship between trust and the two dimensions of risk needs to be further scrutinized: specifically, the probability that something will go wrong and the size of the loss incurred when it does [Berger, *et al.*, 1995]. Nooteboom *et al.* [1997], in a study of effects of trust and governance on relational risk, find that different dimensions (institutionalization and habitualization) of trust relate differently to different dimensions of risk. In the adoption of an e-business application, we contend that the size of the potential loss as a component of risk influences trust and trust, in return, influences the probability component of risk. Due to the limitations of the current research, that is, a field study in the Internet banking context, we could not manipulate the size of the potential loss as a component of risk; therefore, this component was not included in the research design. This model, presented in <Figure 6>, needs to be in-

investigated further.

According to research on knowledge-based trust, trust develops over time as the parties involved in a trusting relationship accumulate trust relevant knowledge of each other [Lewicki and Bunker, 1995]. In this study, we focused on a consumer's trust level at the point of adoption of Internet banking. It is possible that the trust level can change over time even before he/she adopts Internet banking. Also, after a consumer adopts Internet banking, his/her experience with Internet banking will modify the level of trust in the medium. According to Rousseau *et al.* [1998], there are three phases of trust: (1) building (where trust is formed or reformed), (2) stability (where trust already exists), and (3) dissolution (where trust declines). Further, scholars operationalize trust differently, depending on the focus and phase of trust they study. Trust in one-time transactions typically derives from the calculus of gains and losses, weighed by perceived risks. However, in ongoing relationships the question is not so much "how much do I trust?" but "In what areas and in what ways do I trust?" [Lewicki and Bunker, 1995]. Thus, future research should examine the process of change in a consumer's level of trust and the forms of trust in the Internet both before and after they adopt the Internet as a banking medium.



<Figure 6> Reciprocal Relationship between Trust and Risk

Also, studies looking into antecedents of trust and risk, as well as their relative impacts on relevant variables, are to be worth exploring. Prior research in trust has identified antecedents of trust such as the consumer's propensity to trust, word-of-mouth referrals, or transfer of trust from other related services. Another variable that could be of potential interest in studying the adoption of high consequence systems is risk propensity. Risk propensity is defined as the tendency of a decision maker to either take or avoid risks [Sliwa, 2000]. Given the close association between risk and trust, the influence of risk propensity on the adoption of high consequence systems needs to be addressed in future research.

6.2.2 Implications for Internet Banking Providers

While Internet banking has been clearly gaining popularity, mobile banking is growing based on ubiquitous mobile phone usage and consumer's growing expectation of "anytime/anywhere" access. The number of actual user, however, remains disproportionally small; only 400,000 out of almost 240 million U.S. mobile phone subscribers are banking over their mobile phones [Hoffman, 2007]. The most important impediment to adoption of mobile banking is customers' privacy and security concern [Hamblen, 2007]. Although both online banking and mobile banking have some different environment, they are subject to the same barrier against growth: perceived risk. Thus, the findings of this study could provide practical implications for banks that intend to provide online and mobile banking services.

An important implication for managers is that perceived risk of Internet banking should be reduced to enhance the adoption of Internet banking. The determinants of perceived risk of Internet banking are trust in the Internet as a banking medium and trust in the intentions of the bank. Internet banking providers can reduce perceptions of risk involved with Internet banking by increasing trust in the Internet as a banking medium and trust in the intentions of the bank. This may be achieved by educating users about the use of the Internet for transactions and by making explicit the bank's policies on how the bank will deal with issues that could arise from the use of Internet banking. The bank should proactively take steps to address concerns that the users may have about the possible losses, by informing them of the bank's guarantees that are in place to deal with such situations.

6.3 Limitations

We have acknowledged the reciprocal nature of the relationship between risk and trust, but were able to test only a one-way relationship, that is, trust as an influencer of perceived risk. Future research should be looking into the inter-

active nature of the trust-risk relationship by considering the complexities of parallel processing, bi-directional causality, and reverberating feedback between them. This undertaking is expected to be a challenging one.

Another limitation of this study lies in the population from which the data sample was obtained. Since the data for this study was collected on-line from the Web site of a local bank and from the Web sites of a local media company, the inferences of the study findings should be made to Internet users who have bank accounts with physical banks, not to all the potential customers of a bank. However, since this study was conducted in the context of Internet banking, targeting Internet users who possess accounts with physical banks as the population of this study can be considered valid.

This study has focused on the two components of Internet banking: the bank and the Internet as a banking medium. However, Internet banking has other components involved such as the bank's customer service and the bank's technical competence in information technology. Future research looking into other factors of e-commerce would be beneficial to the IS community.

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〈Appendix 1〉 Final Research Instrument

1. Trust in Internet Banking

1.1 Trust in the bank (Items 1~7)

- (1) The bank will behave according to its commitments
- (2) The bank will keep the spirit of its agreements with me
- (3) The commitments made to me will be honored by the bank
- (4) The bank may use confidential information about me to its own advantage
- (5) The bank may take advantage of changed situations (e.g., Fed's interest rate change)
- (6) The bank may take advantage of my weaknesses/problems
- (7) The bank may interpret ambiguous information in its own favor

1.2 Trust in the Internet as a banking medium (Items 8~12)

- (1) When I first considered using Internet banking, I expected the Internet to perform as well as other technologies such as the telephone.
- (2) When I first considered using Internet banking, I expected the Internet to be available for use without interruption of service.
- (3) When I first considered using Internet banking, I was very confident that the Internet would perform reliably as I expected it to perform.
- (4) When I first considered using Internet banking, I thought that the Internet has the capability to provide a desired level of service in adverse or hostile conditions (e.g., natural disasters)
- (5) When I first considered using Internet banking, I believed that the Internet banking system resists attacks that can compromise the bank's data and services

2. Perceived Risk of Internet Banking (Items 13~15)

- (1) Considering the possibility of monetary loss associated with Internet banking, how risky would you consider Internet banking to be?
- (2) Considering the possibility of harm to you resulting from the misuse of important personal and financial information (e.g., checking account number, S.S.#) due to the use of Internet banking, how risky do you consider Internet banking to be?
- (3) Considering the possible loss of privacy because of information collected about you as you use Internet banking, how risky would you consider Internet banking to be?

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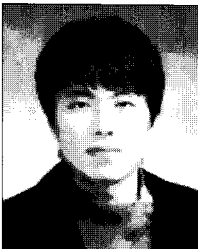
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