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Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit

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ABSTRACT

Online banking (Internet banking) has emerged as one of the most profitable e-commerce applications over the last decade. Although several prior research projects have focused on the factors that impact on the adoption of information technology or Internet, there is limited empirical work which simultaneously captures the success factors (positive factors) and resistance factors (negative factors) that help customers to adopt online banking. This paper explores and integrates the various advantages of online banking to form a positive factor named perceived benefit. In addition, drawing from perceived risk theory, five specific risk facets – financial, security/privacy, performance, social and time risk – are synthesized with perceived benefit as well as integrated with the technology acceptance model (TAM) and theory of planned behavior (TPB) model to propose a theoretical model to explain customers' intention to use online banking. The results indicated that the intention to use online banking is adversely affected mainly by the security/privacy risk, as well as financial risk and is positively affected mainly by perceived benefit, attitude and perceived usefulness. The implications of integrating perceived benefit and perceived risk into the proposed online banking adoption model are discussed.

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1. Introduction

With the rapid growth of Internet technology, online banking has played an important and central role in the e-payment area which provides an online transaction platform to support many e-commerce applications such as online shopping, online auction, Internet stock trading and so on. However, despite the fact that online banking provides many advantages, such as faster transaction speed and lower handling fees (Kalakota and Whinston, 1997), there are still a large group of customers who refuse to adopt such services due to uncertainty and security concerns (Kuisma et al., 2007; Littler and Melanthiou, 2006). Therefore, understanding the reasons for this resistance would be useful for bank managers in formulating strategies aimed at increasing online banking use.

Consumers have shown reluctance to complete simple online purchases (Donna et al., 1999), primarily due to risk concerns (Jarvenpaa et al., 1999; Pavlou, 2001) and, thus perceived risk is posited as a prominent barrier to consumer acceptance of online banking. Compared to online purchases, the adoption of online banking adoption is typically more complex, as it initiates a long-term relationship between the consumer and online banking services. There is a lot at stake for consumers as they contemplate entering into a business relationship with distant, faceless online

banking services. Although consumer perceptions of the risks of adopting online banking have been studied by many researchers (Liao et al., 1999; Tan and Teo, 2000; Yousafzai et al., 2003), the perceived risk variable has only been modeled as a single construct, which fails to reflect the real characteristics of perceived risk and explain why consumers resist such banking services. To provide a deeper understanding of the perceived risks of adopting online banking, we carried out a more in-depth study of the characteristics of the perceived risks. We divided perceived risk into five categories: performance, financial, time, social and security/privacy risks, as theorized by Jacoby and Kaplan (1972), in order to clarify which risk facets are more important in this field.

Although several research projects have focused on the factors that impact on the adoption of information technology or Internet for the past decade (Heijden, 2003; Taylor and Todd, 1995), there is limited empirical work which captures the success factors or positive factors of online banking to help form a strategic agenda. In this study, besides negative factors, we explore and integrate the advantages of online banking to develop a predictor named perceived benefit to explain and predict customer intention to adopt online banking.

In order to provide a solid theoretical basis for examining the adoption of online banking services, this paper draws on two schools of thought regarding the nomological structure of the theory of reasoned action (TRA): (1) the technology acceptance model (TAM) (Davis et al., 1989), and (2) the theory of planned behavior

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(TPB) (Azjen, 1991). Since TAM and TPB have been used in many studies to predict and understand user perceptions of system use and the probability of adopting an online system (Gefen et al., 2003; Hsu and et al., 2006; Wu and Chen, 2005), they are the most appropriate tools for understanding online banking adoption. This study proposes to integrate the five facets of perceived risk listed above with the TAM and TPB in order to provide a more comprehensive model of online banking evaluation and adoption.

This study enlarges the scope of the adoption decision to explicitly include both negative (perceived risk) and positive factors (perceived benefits) simultaneously. The research may give practitioners an increased understanding of customers' risk perceptions which can then be used to devise risk-reducing strategies and trust-building mechanisms to encourage online trading adoption, especially in the emerging area of e-payments. The purposes of this study are as follows:

1. To investigate whether perceived risk and benefit significantly impact customers' behavioral intention to use online banking adoption.
2. To clarify which factors are more influential in affecting the decision to use online banking.
3. To evaluate whether the integration of TAM with TPB provide a solid theoretical basis for examining the adoption of online banking.

This paper proceeds as follows: Section 2 introduces perceived risk, perceived benefit and the theoretical foundations. Section 3 outlines our research model and hypotheses. Section 4 details the methodology and research design, and Section 5 presents the data analysis and hypotheses testing results. Section 6 discusses our research findings. Section 7 provides implications, and finally Section 8 concludes with this paper's limitations, and potential topics for future research.

2. Perceived risk, perceived benefit and theoretical background

Since the 1960s, perceived risk theory has been used to explain consumers' behavior. Considerable research has examined the impact of risk on traditional consumer decision making (Lin, 2008). Peter and Ryan (1976) defined perceived risk as a kind of subjective expected loss, and Featherman and Pavlou (2003) also defined perceived risk as the possible loss when pursuing a desired result. Cunningham (1967) noted that perceived risk consisted of the size of the potential loss (i.e. that which is at stake) if the results of the act were not favorable and the individual's subjective feelings of certainty that the results will not be favorable. Most of scholars claimed that consumers' perceived risk is a kind of a multi-dimensional construct. Six components or types of perceived risk have been identified: financial, performance, social, physical, privacy, and time-loss (Jacoby and Kaplan, 1972; Kaplan et al., 1974; Roselius, 1971). However, the dimensions of perceived risk may vary according to the product (or service) class Featherman and Pavlou, 2003. Online banking does not incur any threat to human

life; therefore, measures of physical risk were not included in this study. We define perceived risk in online banking as the subjectively determined expectation of loss by an online bank user in contemplating a particular online transaction. The dimensions of perceived risk were defined in Table 1.

2.1. Perceived risks of online banking

The present research investigated five types of risk – security/privacy, financial, social, time/convenience, and performance loss, and the details of these five risks related to online banking are described as follows:

1. *Security/privacy risk*: This is defined as a potential loss due to fraud or a hacker compromising the security of an online bank user. Phishing is a new crime skill by which phishers attempt to fraudulently acquire sensitive information, such as usernames, passwords and credit card details, by masquerading as a trustworthy entity in an electronic communication (Reavley, 2005). A phishing attack takes place when a user receives a fraudulent email (often referred to as a spoof email) representing a trusted source that leads them to an equally fraudulent website that is used to collect personal information (Entrust, 2008). Both fraud and hacker intrusion not only lead to users' monetary loss, but also violate users' privacy, a major concern of many Internet users. Many consumers believe that they are vulnerable to identity theft while using online banking services (Littler and Melanthiou, 2006).
2. *Financial risk*: It is defined as the potential for monetary loss due to transaction error or bank account misuse. According to Kuisma et al. (2007), many customers are afraid of losing money while performing transactions or transferring money over the Internet. At present online banking transactions lack the assurance provided in traditional setting through formal proceedings and receipts. Thus, consumers usually have difficulties in asking for compensation when transaction errors occur (Kuisma et al., 2007).
3. *Social risk*: This refers to the possibility that using online banking may result in disapproval of one's friends/family/work group. It is possible that one's social standing may be enhanced or diminished depending on how online banking is viewed. It may well be that people have unfavorable or favorable perceptions of online banking that in turn affect their views of its adopters; or, alternatively, not adopting online banking may also have negative or positive connotations.
4. *Time/convenience risk*: It may refer to the loss of the time and inconvenience incurred due to the delays of receiving the payment or the difficulty of navigation (finding appropriate services and hyperlinks). Two leading causes of dissatisfying online experiences that may be thought of as a time/convenience risk include a disorganized or confusing Web site and pages that are too slow to download (Forsythe and Shi, 2003). It may also be related to the length of time involved in waiting the website or learning how to operate online banking website.

Table 1
Dimensions of perceived risk.

Dimension	Definition
Performance risk	The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore failing to deliver the desired benefits
Social risk	Potential loss of status in one's social group as a result of adopting a product or service, looking foolish or untrendy.
Financial risk	The probability that a purchase results in loss of money as well as the subsequent maintenance cost of the product
Privacy risk	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
Time risk	Consumers may lose time when making a bad purchasing decision by wasting time researching and making the purchase, learning how to use a product or service only to have to replace it if it does not perform to expectations
Physical risk	The probability that a purchased product results in a threat to human life

5. *Performance risk*: This refers to losses incurred by deficiencies or malfunctions of online banking websites. Customers are often apprehensive that a breakdown of system servers or disconnection from the Internet will occur while conducting online transactions because these situations may result in unexpected losses (Kuisma et al., 2007).

2.2. Perceived benefit

Online banking has recently come to be considered as one of the most effective banking transaction methods (Huang et al., 2005) because it possesses many advantages which offline banking channels can not offer. Thus, online banking managers aim to utilize these advantages to increase the online banking adoption rate. Based to a certain extent on reasons offered by Lee (2008), there are two main types of perceived benefits, which can be categorized as direct and indirect advantages. Direct advantages refer to immediate and tangible benefits that customers would enjoy by using online banking. For example, customers can benefit from a wider range of financial benefits, faster transaction speed, and increased information transparency. First, this wider range of financial benefits includes the lower transaction handling fees, higher deposit rates, opportunities to win prizes and extra credit card bonus points. Second, the faster transaction speed obviously means that time can be saved since online banking does not need paper documents, the processing of which can give rise to errors and delays, and which also requires more personnel. Online banking automates this process by mediating transactions through websites and electronic data interchange, and can also reduce the need for customers to communicate with bank staff regarding transaction details because they can be obtained at a website. Third, during the transaction, online banking allows customers to monitor contractual performance at any time, or to confirm delivery automatically. In other words, more relevant information is immediately available and transparent to customers.

Indirect advantages are those benefits that are less tangible and difficult to measure. For example, online banking allows customer to perform banking transactions anywhere in the world and enjoy 24-hour service, as well as offering customers more investment opportunities and services, such as stock quotations and news updates. The factors outlined above are the perceived benefits that will be considered in the preliminary model of online banking adoption.

2.3. Technology acceptance model

TAM is an adaptation of the theory of reasoned action (TRA) by Fishbein and Ajzen (1975) and was mainly designed for modeling user acceptance of information technology (Davis et al., 1989). This model hypothesizes that system use is directly determined by behavioral intention to use, which is in turn influenced by users' attitudes toward using the system and the perceived usefulness of the system. Attitudes and perceived usefulness are also affected by perceived ease of use. Perceived usefulness, reflecting a person's salient belief in the use of the technology, will be helpful in improving performance. Perceived ease of use is a person's salient belief that using the technology will be free of effort (Taylor and Todd, 1995). The appeal of this model lies in that it is both specific and parsimonious and displays a high level prediction power of technology use. These determinants are also easy for system developers to understand and can be specifically considered during system requirement analysis and other system development stages. These factors are common in technology-usage settings and can be applied widely to solve the acceptance problem (Taylor and Todd, 1995).

2.4. Theory of planned behavior

The TPB underlying the effort of TRA has been proven successful in predicting and explaining human behavior across various information technologies (Ajzen, 2002, 1991). According to TPB, a person's actual behavior in performing certain actions is directly influenced by his or her behavioral intention and, in turn, is jointly determined by his or her attitude, subjective norms and perceived behavioral controls toward performing the behavior. Behavioral intention is a measure of the strength of one's willingness to exert effort while performing certain behaviors. Attitude (A) explains a person's favorable or unfavorable assessment regarding the behavior in question. Furthermore, a favorable or unfavorable attitude directly influences the strength of the behavior and beliefs regarding the likely outcome. Accordingly, attitude (A) is equated with attitudinal belief (ab_i) linking the behavior to a certain outcome weighted by an evaluation of the desirability of that outcome (e_i). This is expressed as: $A = \sum ab_i \times e_i$. Subjective norm (SN) expresses the perceived organizational or social pressure of a person who intends to perform the behavior in question. In other words, the subjective norm is relative to normative beliefs about the expectations of other people. It can be depicted as individual's normative belief (nb_i) concerning a particular referent weighted by their motivation to comply with that referent. This is expressed as: $SN = \sum nb_i \times mc_i$. Perceived behavioral control (PBC) reflects a person's perception of the ease or difficulty of implementing the behavior in question. It concerns beliefs about the presence of control factors that may facilitate or hinder their performing the behavior. Thus, control beliefs about resources and opportunities are the underlying determinant of perceived behavioral control and can be depicted as control beliefs (cb_i) weighted by perceived power of the control factor (p_i) in question. This is expressed as $PBC = \sum cb_i \times p_i$. In sum, grounded on the effort of TRA, TPB is proposed to eliminate the limitations of the original model in dealing with behavior over which people have incomplete volitional control (Ajzen, 1991). In essence, TPB differs from TRA in that it has the additional component of perceived behavior control.

3. Research model and hypothesis

3.1. Research model

We drew upon two primary research streams, information technology (IT) adoption theory and perceived risk theory, to develop this study's research model and associated hypotheses. Over the past decade, TAM and TPB have been widely applied to examine IT usage and e-service acceptance (Davis, 1993; Hsu, 2004; Hsu and et al., 2006). However, neither TAM nor TPB have been found to provide consistently superior explanations or behavioral predictions (Chen et al., 2007). Recently, a growing body of research has focused on integrating them to examine IT usage and e-service acceptance because the two models are complementary, and the results have showed that the integration model had better exploratory power than the individual use of TAM and TPB (Bosnjak et al., 2006; Chen et al., 2007; Wu and Chen, 2005). Since the focus of this study is online banking service adoption, which is an instance of acceptance of innovative technology intertwined with social systems and personal characteristics, the integration of TAM and TPB for our research framework should be comprehensive in order to examine the consumers' intentions towards, and acceptance of, online banking. There are 12 constructs in our model, which includes perceived ease of use, perceived benefit, performance risk, financial risk, time risk, social risk and security risk as independent variables, perceived usefulness, attitude, subjective norm,

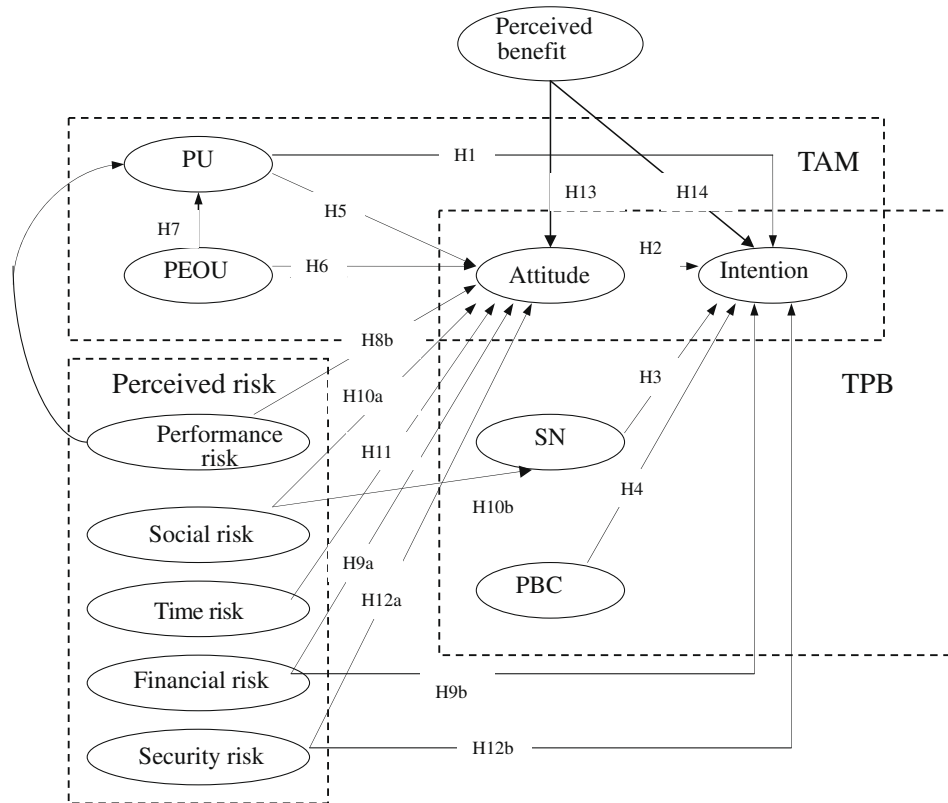


Fig. 1. The proposed research model.

perceived behavioral control as intervening variables, and intention to use as the dependent variable. We will test the strength of the hypothesized relationships embedded in the theoretical model and the robustness of the model in predicting customers' intention to adopt online banking in the Taiwan business environment. The theoretical model is graphically presented in Fig. 1.

3.2. Hypothesis development

3.2.1. Hypotheses about TAM and TPB

Based on the theoretical model developed in Section 2, we formulated the following research hypotheses. As TAM and TPB are used as the base models, we need to test the following TAM and TPB hypotheses in the context of online banking adoption. Hypotheses 1, 2, 5, 6, and 7 are proposed based on TAM as discussed in Section 2.2 while hypotheses 3 and 4 based on TPB as described in Section 2.3.

- H1: Perceived usefulness positively influences the intention to use online banking.
- H2: Attitude positively influences the intention to use online banking.
- H3: Subjective norm has positively influences the intention to use online banking.
- H4: Perceived behavior control positively influences the intention to use online banking.
- H5: Perceived usefulness positively influences attitudes towards the use of online banking.
- H6: Perceived ease of use positively influences attitudes towards the use of online banking.
- H7: Perceived ease of use positively influences the perceived usefulness of the use of online banking.

3.2.2. Hypotheses regarding performance risk

The performance risk refers to losses incurred by deficiency or malfunction of online banking websites. According to Yiu et al. (2007), sudden breakdown of web servers may lead to unexpected losses while conducting online transactions. Littler and Melanthiou (2006) pointed out that malfunctions of online banking websites would reduce customers' willingness to use online banking, while Featherman and Pavlou (2003) found that a high frequency of website breakdowns and disconnections inhibits e-services evaluation (e.g. perceived usefulness). Therefore, it follows that:

- H8a: Performance risk negatively influences the perceived usefulness of using online banking.
- H8b: Performance risk negatively influences attitudes towards the use of online banking.

3.2.3. Hypotheses regarding financial risk

Financial risk refers to the potential for monetary loss due to transaction errors or bank account misuse. Kuisma et al. (2007) indicated that many consumers resist using online banking because they fear such losses. Off-line banks generally provide clerical personnel to verify whether the account number of the payee and amount of money to transact is accurate, but such safeguards are rarely available in online banking, and this can generate feelings of insecurity and uncertainty. Accordingly, the following hypotheses are proposed:

- H9a: Financial risk negatively influences attitudes towards the use of online banking.
- H9b: Financial risk negatively influences intentions towards the use of online banking.

3.2.4. Hypotheses regarding social risk

Social risks is being defined as a threat which creates a possible loss of self-image or prestige resulting from the purchase or use of certain products or services (Forsythe and Shi, 2003). Under this definition, in the context of online banking threats can be generated due to the unfavorable perceptions of online banking of consumers' family, acquaintances, or peers that in turn affect their views of its adopters. Over the past decades, several previous research projects regarding retail purchases have shown that social risk has a negative impact on attitude for consumers (Dowling and Staelin, 1994; Yang et al., 2007). Based on these studies, it is reasonable to expect that social risk could negatively influence customers' attitude to use online banking. Thus, it follows that:

- H10a: Social risk negatively influences attitudes towards the use of online banking.

Within attitude-intentions and technology acceptance research (Davis et al., 1989; Fishbein and Ajzen, 1975), concern about the opinion of referents (friends, family, co-workers) with regard to one's actions has been referred to as subjective norm. According to (Featherman and Fuller, 2002), as the social risks associated with adoption rises increases, consumers are likely to believe that referents would approve less of their purchasing the product or service. Hence, the following hypothesis is proposed:

- H10b: Social risk negatively influences the subjective norm regarding the use of online banking.

3.2.5. Hypotheses about time/convenience risk

Steven et al. (1999) reported on the importance of time considerations and found that it was a significant predictor of online buying behavior. Their research found that "harried" consumers were more likely to purchase over the Internet in order to save time. The current research similarly proposes that some consumers are very time oriented and concerned about potential risks of "wasting time" spent implementing, learning how to use, and troubleshooting a new e-service. These time-conscious consumers likely guard against the possible loss of time risk, and are less likely to adopt an e-service that they consider to have high switching, setup and maintenance costs (Featherman and Pavlou, 2003). Forsythe and Shi (2003) indicated that time risk is a significant barrier to online shopping, and it is therefore hypothesized that:

- H11: Time risk negatively influences attitudes towards the use of internet banking.

3.2.6. Hypotheses about security/privacy risks

Security is being defined as a threat which creates "circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service and/or fraud, waste, and abuse" (Kalakota and Whinston, 1997). Under this definition, in the context of online banking threats can be made either through network and data transaction attacks or through unauthorized access to the account by means of false or defective authentication. According to Milind (1999), security risk is a significant impediment to the adoption of online banking. Further, it has been stated in numerous studies that the greatest challenge to the electronic banking sector will be winning the trust of customers over the issues of privacy and security (Bestavros, 2000; Furnell and Karweni, 1999). It is therefore hypothesized that:

- H12a: Security/privacy risk negatively influences attitudes towards the use of online banking.
- H12b: Security/privacy risk negatively influences intentions to use online banking.

3.2.7. Hypotheses about Perceived benefit

Online banking offers lower transaction costs, faster transaction speed, and better information transparency as well as allow customers to enjoy some free services such as stock quotation, news and 24-hour services (Oh et al., 2007) as mentioned above. Moreover, online banking often offer an incentive program, e.g. higher deposit rate, reduction or waiver of handing free, extra credit card bonus points, luck draw or joining gifts. Evidence provided by an e-business study shows that perceived benefit significantly affects e-business adoption (Zheng et al., 2006). Along the same lines, Beatty et al. (2001) indicated that perceived benefit has a positive influence on the corporate website adoption. Therefore, it is reasonable to infer that perceived benefits positively influence user attitude and intention to adopt online banking, and we hypothesized that:

- H13: Perceived benefit has a positive effect on attitude to use online banking.
- H14: Perceived benefit has a positive effect on intention to use online banking.

4. Research method

4.1. Data collection

In order to collect online banking users' information, we first required the permission of a private bank in Taiwan to express our need for the information research purposes. After that, the private bank helped to email invitation letters to its users with a message explaining the need to understand their (the users) experience in the initial adoption of online banking services. The invitation letter also linked to a web site where users could fill out an online questionnaire. To encourage participation, incentives of the latest models of mobile phones and MP3 players were offered as lucky draw prizes. To reduce the possibility that a respondent participated in the survey more than once, each respondent was required to provide his/her mobile phone number in the survey. Later, duplicate mobile phone numbers were used to filter out multiple responses from the same respondent. Users were free to participate at their own discretion. This online survey, which yielded 446 responses, was conducted for one month, with incomplete responses and missing values deleted, resulting in a sample size of 368 users for an overall response rate of 83%. Sample demographics are depicted in Table 2. Fifty-eight percent of the respondents were male and 42% were female. The majority of respondents (61%) were over 30 years old. About 69% of the respondents did not have experience using online banking. Finally, the education levels of respondents were 62.5% college and 13.6% high school.

4.2. Measurement development

The instrument was designed to include a two-part questionnaire as presented in Appendix A. The first part includes nominal scales, and the remainder includes seven-point Likert scales, ranging from "disagree strongly" (1) to "agree strongly" (7). Accordingly, the first part is basic information. This part of questionnaire was used to collect basic information about respondents' characteristics including gender, age, education, occupation, and experience using online banking. The second part of questionnaire was developed based on the constructs of perceived usefulness, perceived ease of

Table 2
Sample demographics.

Measure	Item	Frequency	Percentage (%)
Gender	Male	156	42.4
	Female	212	57.6
Age	Under 19	14	3.8
	20–24	57	15.5
	25–29	74	20.1
	30–34	78	21.2
	35–39	92	25.0
	40–50	23	6.3
	>50	30	8.2
Occupation	High level managers	33	9.0
	Intermediate level managers	90	24.5
	Supervisory	39	10.6
	Skilled manual laborers	74	20.1
	Government officials	81	22.0
	Students	21	5.7
	Others	30	8.2
Education level	High school	58	13.6
	College/university	230	62.5
	Master	77	20.9
	PhD	3	0.8
Categorization of respondents	Experienced users	114	31
	Non-experienced users	254	69
Years using online banking for experienced users	<1 year	32	28.1
	1–3 years	40	35.1
	3–5 years	25	21.9
	>5 years	17	14.9
Frequencies using online banking for experienced users	One time every day at least	26	22.8
	One time every week at least	44	38.6
	One time every month at least	37	32.5
	One time every year at least	23	20.2

use, perceived benefit, attitude, subjective norm, perceived behavior control, functional risk, financial risk, time risk, social risk, security risk, and intention to use. Perceived usefulness and attitude were adapted from the measurements defined by Cheng et al. (2006) and Lai and Li (2005), containing four items for each construct. Perceived ease of use and Intention to use were adapted from the measurements defined by Cheng et al. (2006) and Lai and Li (2005), containing three items for each construct. Perceived behavior control and subjective norm were adapted from the measurements defined by Wu and Chen (2005), containing three items for each construct. Performance risk, financial risk, time risk and social risk were adapted from the measurements defined by Littler and Melanthiou (2006), containing two items for each construct. Security risk was adapted from the measurement defined by Littler and Melanthiou (2006) and Cheng et al. (2006), and included three items.

Before conducting the main survey, we performed a pre-test to validate the instrument. The pre-test involved 10 respondents who have more than 3 years experience using online banking. Respondents were asked to comment on the length of the instrument, the format, and the wording of the scales. Therefore, the instrument has confirmed content validity.

5. Result

In analyzing the collected data, we followed the two-step procedure suggested by Anderson and Gerbing (1988). First, we examined the measurement model to measure convergent and discriminant validity. Then, we examined the structural model to investigate the strength and direction of the relationships among the theoretical constructs.

5.1. Analysis of the measurement model

Cronbach's alpha scores shown in Table 3 indicated that each construct exhibited strong internal reliability. Convergent validity was assessed based on the criteria that the indicator's estimated coefficient was significant on its posited underlying construct factor. We evaluated the measurement scales using the three criteria suggested by Fornell and Larcker (1981).

- (1) All indicator factor loading (λ) should be significant and exceed 0.5
- (2) Construct reliabilities should exceed 0.8
- (3) Average variance extracted (AVE) by each construct should exceed the variance due to measurement error for the construct (e.g. AVE should exceed 0.5).

All (λ) values in confirmatory factor analysis of the measurement model exceeded 0.5 and were significant at $p = 0.001$. Composite reliabilities of constructs ranged from 0.81 to 0.93 (see Table 3). AVE, ranging from 0.57 to 0.83, was greater than the variance due to measurement error. Therefore, all three conditions for convergent validity were met.

Discriminant validity assesses the extent to which a concept and its indicators differs from another concept and its indicators (Bagozzi et al., 1991). 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. As shown in Table 4, the square root of the variance shared between a construct and its items was greater than the correlations between the construct and any other construct in the model, satisfying Fornell and Larckers' (1981) criteria for discriminant validity. All diagonal values exceeded the inter-construct correlations. The results, therefore, confirmed that our instrument had satisfactory construct validity.

5.2. Multicollinearity

According to Table 4, several correlations between constructs are rather high (e.g. between PU, PEOU and attitude), hitting 0.7–0.8. To determine whether any multicollinearity effects existed, we check whether there was any warning message produced by the AMOS output that signaled a problem of multicollinearity. The results showed that there was no evidence of multicollinearity.

The potential problem of multicollinearity can be further examined formally in the context of regression analysis. The variance inflation factor (VIF), which indicates the degree to which each predictor variable is explained by other predictor variables, is a common measure of multicollinearity in regression analysis (Hair and et al., 1998). A threshold VIF that is less than or equal to 10 (i.e. tolerance >0.1) is commonly suggested (Asher, 1983; Hair and et al., 1998). The VIFs for PU, PEOU and attitude were 9.23, 7.22, and 9.21, respectively, in predicting intention, providing further evidence against multicollinearity.

5.3. Analysis of the structural model

We assessed the overall goodness-of-fit using the chi-square test. The chi-square test assesses the adequacy of a hypothesized model in terms of its ability to reflect variance and covariance of the data. Due to its tendency to be sensitive to sample size, other fit indices (e.g., GFI, AGFI, CFI, NFI, and RFI) were considered in conjunction with the chi-square. For the statistical significance of parameter estimates, t values were used. The results of structural equation modeling obtained for the proposed conceptual model revealed a ratio of chi-square to the degree of freedom (χ^2/df) of 2.04 ($p < 0.001$), goodness-of-fit index (GFI) of 0.91, adjusted goodness-

Table 3
Construct reliability and convergent validity.

Construct/indicator	Item	Factor loading	t-value	Composite reliability (CR)	Average variance extracted	Cronbach's alpha
Perceived usefulness	PU1	0.866	19.410	0.92	0.7315	0.91
	PU2	0.846	18.739			
	PU3	0.852	18.946			
	PU4	0.857	19.116			
Perceived ease of use	PEOU1	0.866	19.318	0.90	0.7534	0.90
	PEOU2	0.873	19.578			
	PEOU3	0.865	19.267			
Attitude	AT1	0.858	19.068	0.91	0.7242	0.91
	AT2	0.851	18.838			
	AT3	0.846	18.661			
	AT4	0.849	18.764			
Perceived benefit	PB1	0.837	12.331	0.89	0.7882	0.89
	PB2	0.845	11.312			
	PB3	0.844	9.334			
Subjective norm	SN1	0.847	18.437	0.89	0.7334	0.88
	SN2	0.862	18.941			
	SN3	0.860	18.857			
Perceived behavior control	PBC1	0.907	20.801	0.91	0.7736	0.89
	PBC2	0.861	19.139			
	PBC3	0.870	19.419			
Intention	IT1	0.917	21.503	0.93	0.8257	0.92
	IT2	0.907	21.100			
	IT3	0.902	20.906			
Performance risk	PR1	0.729	9.963	0.81	0.5978	0.80
	PR2	0.815	10.583			
Financial risk	FR1	0.816	17.289	0.82	0.6908	0.81
	FR2	0.846	18.179			
Social risk	SR1	0.823	16.505	0.82	0.6906	0.81
	SR2	0.839	16.916			
Time risk	TR1	0.905	11.191	0.84	0.7311	0.83
	TR2	0.802	10.541			
Security risk	SSR1	0.758	15.378	0.83	0.5651	0.82
	SSR2	0.756	15.390			
	SSR3	0.741	14.971			

Table 4
Discriminant validity.

Construct	Perceived usefulness	Perceived ease of use	Subjective norm	Perceived behavior control	Attitude	Intention	Perceived benefit	Performance risk	Time risk	Social risk	Financial risk	Security risk
Perceived usefulness	0.855											
Perceived ease of use	0.83	0.867										
Subjective norm	0.41	0.32	0.851									
Perceived behavior control	0.34	0.34	0.35	0.856								
Attitude	0.67	0.81	0.54	0.39	0.85							
Intention	0.69	0.55	0.67	0.71	0.62	0.90						
Perceived benefit	0.52	0.43	0.12	0.22	0.54	0.51	0.88					
Performance risk	-0.61	-0.23	-0.20	-0.20	-0.58	-0.24	-0.23	0.77				
Time risk	-0.23	-0.24	-0.23	-0.26	-0.62	-0.24	-0.21	0.02	0.85			
Social risk	-0.26	-0.34	-0.43	-0.38	-0.09	-0.15	-0.18	0.21	0.26	0.831		
Financial risk	-0.37	-0.32	-0.24	-0.44	-0.63	-0.58	-0.56	0.25	0.49	0.37	0.83	
Security risk	-0.34	-0.24	-0.36	-0.35	-0.76	-0.62	-0.54	0.33	0.45	0.31	0.51	0.75

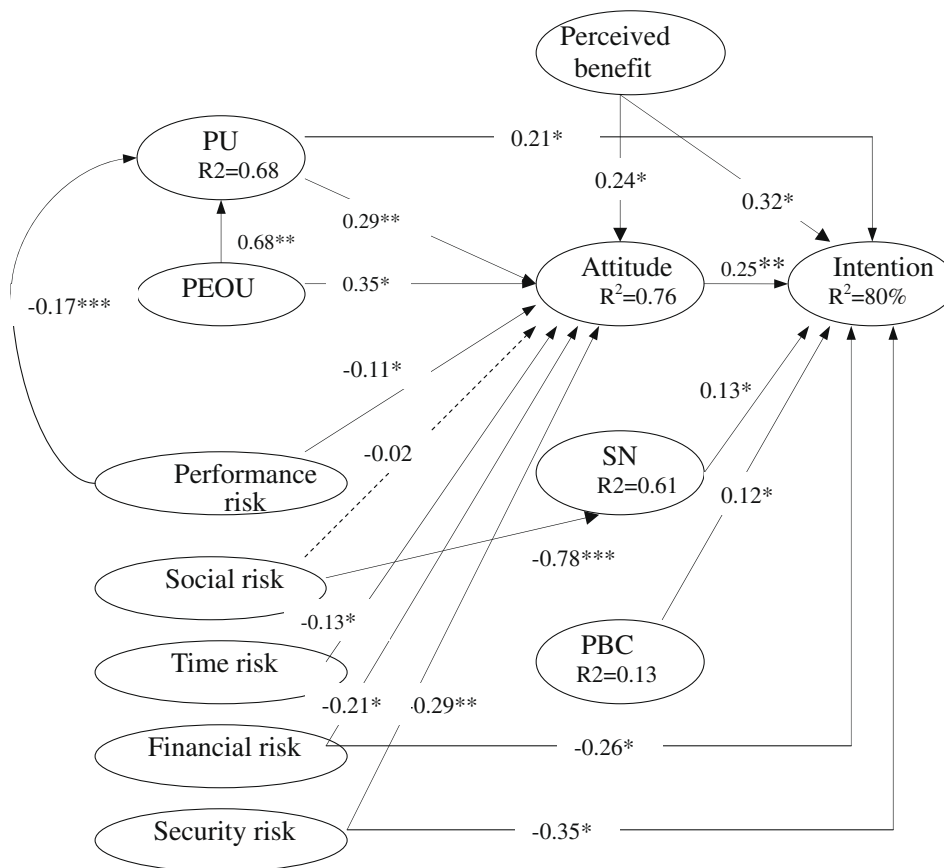
Note: All correlations significant at $p < 0.05$ except where noted. Diagonal elements are square roots of average variance extracted.

of-fit index (AGFI) of 0.85, comparative fit index (CFI) of 0.95, normed fit index (NFI) of 0.95, relative fit index (RFI) of 0.94, and root mean square error of approximation (RMSEA) of 0.05 (see Fig. 2). Generally, fit statistics greater than or equal to 0.9 for GFI, NFI, RFI, and CFI indicate a good model fit (Bagozzi et al., 1991; Hair and et al., 1998). Furthermore, RMSEA values ranging from 0.05 to 0.08 are acceptable (Hair and et al., 1998); therefore, the RMSEA suggested that our model fit was acceptable. Other fit indices, ex-

cept AGFI, indicated that our proposed model obtained an adequate model fit. Low AGFI statistics may have resulted from the small sample size used.

5.4. Hypotheses testing

A structural equation modeling (SEM) approach was adopted in our data analysis (Bagozzi et al., 1991). Fig. 2 presents the results of



$\chi^2 / df = 2.04$, GFI=0.91, AGFI=0.85, CFI=0.95,
NFI=0.95, RFI=0.91, RMSEA=0.05

* $P < 0.05$
** $P < 0.01$
*** $P < 0.001$

Note: dotted line represents no significance

Fig. 2. Results of structural modeling analysis.

the structural model with non-significant paths as dotted lines, and the standardized path coefficients between constructs. Intention to use Internet banking in this study was jointly predicted by PU ($\beta = 0.21$, Standardized path coefficient, $p < 0.05$), perceived benefit ($\beta = 0.32$, $p < 0.05$), attitude ($\beta = 0.25$, $p < 0.01$), perceived behavior control ($\beta = 0.12$, $p < 0.05$), financial risk ($\beta = -0.26$, $p < 0.05$), security risk ($\beta = -0.35$, $p < 0.05$) and subjective norm ($\beta = 0.13$, $p < 0.05$) and these variables together explained 80% of the variance of intention to use ($R^2 = 0.80$, coefficient of determination). As a result, Hypotheses 1, 2, 3, 4, 9a, and 12b were all supported.

Attitude was predicted by PU ($\beta = 0.29$, $p < 0.01$), PEOU ($\beta = 0.35$, $p < 0.05$), financial risk ($\beta = -0.21$, $p < 0.01$), time risk ($\beta = -0.13$, $p < 0.05$), performance risk ($\beta = -0.11$, $p < 0.05$), and security risk ($\beta = -0.29$, $p < 0.01$). Together these variables explained 76% of the total variance. These findings validated Hypotheses 5, 6, 8b, 9a, 11, and 12a respectively. Social risk ($\beta = -0.78$, $p < 0.001$) significantly influenced subjective norm while explaining 61% of the total variance in subjective norm. Accordingly, Hypothesis 10b was supported. Time risk ($\beta = -0.13$, $p < 0.05$) significantly influenced attitude. Consequently, Hypothesis 11 was supported. Both

performance risk ($\beta = -0.17$, $p < 0.001$) and PEOU ($\beta = 0.81$, $p < 0.001$) significantly influenced PU and jointly explained 68% of the total variance in PU. As a result, Hypotheses 7 and 8a were supported. Social risk ($\beta = -0.02$, $p > 0.05$) did not significantly affect attitude. Hence, Hypotheses 10a was not supported. Our hypotheses results are shown in Fig. 2. The level of PEOU had significant indirect effects on intention to use online banking, suggesting the important mediating effects of PU and attitude. To further assess the significance of indirect effects of predictor variables on intentions to use online banking, a decomposition of the effects analysis was conducted (see Table 5).

6. Discussion

The results of this study provide support for the research model presented in Fig. 1 and for the hypotheses regarding the directional linkage among the model's variables. The overall explanatory power of our research model had an R-square of 80% for intention to use online banking and an R-square of 76% for attitude towards online banking, suggesting that the extended TAM with TPB model

Table 5

Direct, indirect and total effects – estimates.

Criterion variable predictors	Attitude			Intention to use		
	Direct effects	Indirect effects	Total effects	Direct effects	Indirect effects	Total effects
Security risk	–0.29**		–0.29*	–0.35*	–0.07**	–0.42*
Financial risk	–0.21*		–0.21*	–0.26*	–0.05*	–0.31**
Time risk	–0.13*		–0.13*		–0.02*	–0.02*
Social risk	–0.02		–0.02		–0.1**	–0.1**
Performance risk	–0.11*	–0.05**	–0.16*		–0.08**	–0.08**
Perceived usefulness	0.29**		0.29**	0.21*	0.07**	0.28*
Perceived easy of use	0.35*		0.55*		0.28*	0.28*
Perceived benefit	0.24*		0.24*	0.32*	0.06**	0.38**
Attitude				0.25**		0.25**
Perceived behavior control				0.12*		0.12*
Subjective norm				0.13*		0.13*

* Significant at $p < 0.05$.** Significant at $p < 0.01$.

is capable of explaining a relatively high proportion of variation of intention to adopt online banking. Several insightful results could be summarized from our research framework, and these are presented below in two categories: positive and negative predictors.

Security, financial, time, social and performance risks all emerged as negative factors in the intention to adopt online banking. First, the intention is adversely affected primarily by security risk ($\beta = -0.35$, $p < 0.05$), which is the only one among the five types of perceived risk to have both significant direct and indirect influences on intention to adopt such services. Security risk appears to be the most important inhibitor to the adoption of online banking. This underscores the fact that concerns about fraud and identity theft are foremost in the minds of Internet users. Thus, providing encryption and strong authentication to prevent fraud and identity theft should be a priority in this field.

Second, financial risk also has a significant negative effect ($\beta = -0.26$, $p < 0.05$) on the intention to adopt online banking and was the second most important inhibitor to the adoption of such services. At present, online banking transactions lack the assurance provided by staff assistance in traditional settings with the use of formal proceedings and receipts, and because of this customers usually have difficulties in asking for compensation when transaction errors occur. Thus, this may explain why many customers resist adopting online banking.

Third, the results indicate that performance risk has a significant negative influence on perceived usefulness ($\beta = -0.17$, $p < 0.001$) and attitude ($\beta = -0.11$, $p < 0.05$). Therefore, minimizing the risk of website malfunction might increase the willingness of consumers to conduct transactions online.

The fourth finding reveals that the influence of social risk on attitude was insignificant. This shows that customers do not care about social pressure from their friends/family/work group with regard to online banking. One interpretation is that online banking is already very common and most respondents have friends or family with favorable perception of it. Another possible explanation is that the decision to use online banking is voluntary rather than mandatory. This is related to the findings of Venkatesh and Davis (2000), that social norms could significantly determine intention to use in a mandatory-usage context, but have little impact in a voluntary-usage context.

Fifth, this study found that the time/convenience risk to has a negative influence on attitudes towards the intention to adopt online banking. This implies that online banking users might worry about delays in receiving online payments and might be concerned with the length of time involved in waiting for the website or learning how to operate it. Thus, reducing the possibility of delays of payment and waiting time is an important issue for online banking service providers.

On the other hand, compared with the negative factors of perceived risk, the intention to use online banking is primarily and positively affected by perceived benefit ($\beta = 0.32$) and less so by attitude ($\beta = 0.25$), perceived usefulness ($\beta = 0.21$) and perceived behavioral control ($\beta = 0.11$). This implies that the perceived benefit is the most important positive predictor of the intention to use online banking, which is consistent with Featherman and Fuller (2002). Our results also support the idea that the inclusion of perceived benefit significantly improves the prediction about the intention to use online banking.

Attitude also has a significant impact ($\beta = 0.25$) and appears to be the second positive determinant of a consumer's intention to adopt online banking. Moreover, attitude is predicted jointly by perceived usefulness ($\beta = 0.29$), perceived ease of use ($\beta = 0.35$), perceived benefit ($\beta = 0.24$), and the five types of perceived risk. Previous researchers have suggested that the inclusion of attitude is not meaningful (Heijden, 2003) but our research suggests otherwise.

Our results suggest that perceived usefulness has a significant effect ($\beta = 0.21$) on the intention to use online banking. Moreover, it has an indirect influence, via attitude, on behavioral intention to use online banking. This result is similar to the finding reported in Taylor and Todd (1995), which indicated that perceived usefulness has both direct and indirect influences on behavioral intentions toward system use. Perceived ease of use does not have a direct impact on intention to use, although it affects the perceived usefulness, which in turn leads to greater acceptance of online banking. Similar findings were obtained by Pikkarainen (2004) and Chan and Lu (2004), who investigated the acceptance of Internet banking in Finland and Hong Kong, respectively. Both studies reached the same conclusion that perceived usefulness is more influential than perceived ease of use in explaining the acceptance of online banking. As we knew from previous research, perceived usefulness was always an important determinant of attitude in TAM, and it may mediate the influence of perceived ease of use on attitude. Indeed, perceived ease of use has long been recognized as a basic requirement for system design (Chau, 1996; Davis et al., 1989). Another interpretation is that difficulty in using online systems is becoming less of a concern as they are increasingly user-friendly. In addition, since online systems are more common and standardized nowadays, the public has become increasingly competent in using them. Accordingly, in the planning and development of online banking, software developers should pay attention to practical functions and extend key features that are frequently required (Chen et al., 2007). On the marketing side, banks should accentuate the full functionality of their systems to cater efficiently to the different banking needs of users.

7. Implications

7.1. Managerial implications

The results of this study shed light on some important issues related to customer intentions toward online banking that have not been addressed by previous studies. First, although both perceived benefit and risk have a significant influence on intention, this study reveals that the latter is a more influential factor, implying that controlling the risk of online banking is more important than providing benefits. This finding is particularly important for managers as they decide how to allocate resources to retain and expand their current customer base. However, building a risk-free online transaction environment is much more difficult than providing benefits to customers. Therefore, online banking companies need to search for risk-reducing strategies that might assist in inspiring high confidence in potential customers. This study suggests that they should consider focusing on the prevention of intrusion, fraud and identity theft. For example, building secure firewalls to avoid intrusion, developing methods for strengthening encryption, and authenticating websites in order to prevent fraud and identity theft are all measures that should be undertaken. In addition, this study suggests that online banking companies could develop trust-building mechanisms to attract customers, such as statements of guarantee, increased familiarity through advertising, and long-term customer service. It is worth noting that because online banking is a less verifiable and controllable environment, online banking customers usually have difficulty in asking for compensation when transaction errors occur. Thus, we suggest that online banking companies should provide customers with digital receipts or a guarantee for every transaction in order to increase confidence in such services.

7.2. Academician implications

In terms of theory building, this study attempts to develop a new theory by grounding new variables in an integration of two schools of the nomological structure model (TRA) and applying them into a new context. It is important to note that the two new variables – perceived benefit and risk – are compatible with the TAM and TPB variables that have already been placed within the TRA framework (Davis, 1989). This approach is likely to ensure a stable theory development. Hence, the proposed model makes an important contribution to the emerging literature on e-commerce, especially with regard to online banking.

The present study has many implications for future online banking research. First, the empirical results show that the perceived benefit and five risk facets all have significant effects on behavioral intention to use online banking, where security risk has the biggest negative effect ($\beta = -0.35$), while perceived benefit has the strongest positive effect ($\beta = 0.32$). This result indicates that the risk factor exerts a stronger effect on customers' decision making than the benefit factor, implying that risk precedes benefit for online banking customers when they consider using online banking. Moreover, according to the risk theory of consumer behavior (Bauer, 1960), Bauer indicated that benefits are often accompanied with risks, and thus, it is worth investigating the causal relationship between these two elements. This study provides an initial blueprint to develop further understanding of this causal relationship.

Second, although previous research has found TAM to be a parsimonious and robust model, it only employs three variables, namely user attitude and two attitudinal beliefs (perceived usefulness and perceived ease of use), to explain behavioral intention. However, a user's behavioral intention will also be affected by

other factors, such as the opinions of other important persons (subjective norms) (Fishbein and Ajzen, 1975). Furthermore, even if users have a strong intention to perform a behavior, they will not be able to do so without necessary resources and skills (perceived behavioral control) (Ajzen, 1991). According to Ajzen's research (2002), TPB fills this gap, but while TPB captures the roles of individuals, organizational members, and social influence on behavioral intention, it does not inform us which attitudinal beliefs would affect a users' attitude toward intention. The attitudinal beliefs of TAM can make up the precedent factors of attitude for TPB, and thus they are complementary approaches. Moreover, the empirical results show that the integration of TAM and TPB has good explanatory power, and this may provide a basis for the integration of other technology acceptance models. For example, information technology (IT) acceptance research (Venkatesh and et al., 2003) has yielded many competing models such as innovation diffusion theory (IDT), social cognitive theory (SCT), expectation confirmation model (ECM), and theory of reasoned action (TRA), each with different sets of acceptance determinants. It is anticipated that this study may encourage other research that integrates these competing models to develop unified ones.

Third, although consumer perceptions of the risks of adopting online banking have been studied by many researchers (Liao and et al., 1999; Tan and Teo, 2000; Yousafzai et al., 2003), the perceived risk variable has only been modeled as a single construct, which fails to reflect the real characteristics of perceived risk and explain why consumers resist such banking services. This study divides the perceived risk into five facets, consequently providing a more in-depth understanding of the characteristics of such risks regarding online banking. The technology acceptance model variables and their integration with these risk facets have been theorized and empirically validated in this work. However, there are significantly different effects on attitude and behavioral intention toward online banking among the five risk facets, and there remains a considerable amount of work to be done investigating these particularly, as with this research, with regards to online banking or e-payment acceptance.

8. Conclusions and future research

This paper aims to develop an extended TAM with a TPB model to predict and explain customers' behavioral intentions with regard to adopting online banking. The proposed model incorporates five categories of perceived risk to provide a more comprehensive investigation covering both the positive and negative aspects of online banking. The results show that the proposed model has good explanatory power and confirms its robustness in predicting customers' intentions to use such services.

As with any research, care should be taken when generalizing the results of this study. First, the survey was conducted using web based forms and employed a non-random convenience sample. Gathering a larger sample using an alternate survey modality and random sampling methods would be costly. The online survey method was appropriate for collecting data from participants with Internet experience and who were free of geographical constraints. However, generalizability could be enhanced if future research is systematically sampled from a more dispersed sample.

Second, in essence, causal relationships are likely to exist between perceived benefits and perceived usefulness. However, when we first resurveyed the literature, we did not find any evidence to support the existence of the causal relationships. Secondly, we added two causal paths ("perceived usefulness → perceived benefits" and "perceived benefits → perceived usefulness"), respectively into our proposed research model and reran the structural equation analysis to validate whether there are possible causal relationships

between them, but only obtained two insignificant path coefficients. While to date there is no direct evidence, we believe that the possible causal relationship between perceived benefits and usefulness is worth investigation in future research.

Third, while this study has identified two external factors (perceived risk and perceived benefits) influencing consumers' adoption of online banking, it is important to recognize the cultural and national limitations of these findings. This is because cultural differences have been found with respect to how individuals respond to a potential risk (Bontempo et al., 1997; Weber and Hsee, 1998). Moreover, according to Tse's research (1988), individual's cognitive propensity to risk differs across culture and is likely to affect the perceptions of the presence of risks as well as the evaluation of the risks. In other words, the customers' acceptance of online banking may be indirectly influenced by cultural differences. However, this phenomenon needs further investigations and validations. Hence, the replication of this study on a wider scale with different national cultures is essential for the further generalization of the findings.

Finally, the conclusions drawn from our study are based on cross-sectional data. With our cross-sectional data, we only took a snapshot of this model. A stricter test of our argument, however, could be employed by using a longitudinal study to evaluate this aspect. By using a longitudinal study in the future, we could investigate our research model in different time periods and make comparisons, thus providing more insight into the phenomenon of online banking adoption.

Appendix A. The questionnaire

Questionnaire items: please respond to questions below by circling your choice (1 = strongly disagree, 7 = strongly agree)

Constructs	Source
<i>Perceived usefulness</i>	
I think that using the online banking would enable me to accomplish my tasks more quickly.	Cheng et al. (2006)
I think that using the online banking would make it easier for me to carry out my tasks.	
I think the online banking is useful.	
Overall, I think that using the online banking is advantageous.	
<i>Perceived ease of use</i>	
I think that learning to use online banking would be easy.	Cheng et al. (2006)
I think that interaction with online banking does not require a lot of mental effort.	
I think that it is easy to use online banking to accomplish my banking tasks.	
<i>Attitude</i>	
I think that using online banking is a good idea.	Cheng et al. (2006)
I think that using online banking for financial transactions would be a wise idea.	
I think that using online banking is pleasant	
In my opinion, it is desirable to use online banking.	
<i>Subjective norm</i>	
People who are important to me would think that I should use online banking.	Wu and Chen, (2005)
People who influence me would think that I should use online banking.	
People whose opinions are valued to me would prefer that I should use online banking.	

Appendix A (continued)

Constructs	Source
<i>Perceived behavior control</i>	
I think that I would be able to use the online banking well for financial transactions.	Wu and Chen (2005)
I think that using online banking would be entirely within my control.	
I think that I have the resources, knowledge, and ability to use online banking.	
<i>Intention to use</i>	
I would use the online banking for my banking needs.	Cheng et al. (2006)
Using the online banking for handling my banking transactions is something I would do.	
I would see myself using the online banking for handling my banking transactions.	
<i>Perceived benefit</i>	
I think that using online banking can save my time in performing banking transaction.	Yiu et al. (2007)
I think that using online banking can offer me a wider range of banking products, services and investment opportunities.	
I think that using online banking can save the transaction handling fees in performing banking transaction.	
<i>Performance risk</i>	
Online banking servers may not perform well because of slow download speeds, the servers' being down or because the web site is undergoing maintenance.	Featherman and Pavlou (2003)
Online banking servers may not perform well and process payments incorrectly.	
<i>Financial risk</i>	
When transferring money on Internet, I am afraid that I will lose money due to careless mistakes such as wrong input of account number and wrong input of the amount of money.	Featherman and Pavlou (2003)
When transaction errors occur, I worry that I can not get compensation from banks.	
<i>Social risk</i>	
I'm sure that if I decided to use online banking and something went wrong with online transactions, my friends, family and colleagues would think less of me.	Featherman and Pavlou (2003)
When my bank account incurs fraud or the hacker invades, I will have potential loss of status in one's social group.	
<i>Time risk</i>	
Using online banking service would lead to a loss of convenience of me because I would have to waste a lot of time fixing payments errors.	Featherman and Pavlou (2003)
It would take me lots of time to learn how to use online banking services.	
<i>Security risk</i>	
I would not feel totally safe providing personal privacy information over the Internet Banking.	Featherman and Pavlou (2003)
I'm worried to use online banking because other people may be able to access my account.	
I would not feel secure sending sensitive information across the online banking.	

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