The Revised Technology Acceptance Model and the Impact of Individual Differences in Assessing Internet Banking Use in Taiwan

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ABSTRACT
The literature on Internet banking indicates that many researchers have been studying the determinant factors relating to a user’s acceptance or adoption behavior using the technology acceptance model. Little attention has been given, however, to exploring how external variables and perceptions of security, privacy, and confidentiality risks affect acceptance or adoption behavior, although these factors may play a significant role in Internet banking use. This study extends the technology acceptance model by introducing risk perceptions as a new construct to evaluate the determinants influencing Internet banking use behavior and to examine the influences of external variables such as individual differences. Based on data from a questionnaire survey of a sample of 788 experienced users in Taiwan, the results reveal that individual differences play a role in directly affecting perceived usefulness, perceived ease of use, and perceived risk, and a role in indirectly affecting user behavior. The research results provide insightful recommendations for use in developing customer satisfaction policies that promote loyalty and future widespread and repeated use.

Keywords: Internet banking, individual differences, perceived risk, e-commerce, financial services
1. INTRODUCTION

Internet banking (IB) is one of today’s innovative Internet-enabled technology applications. In recent years, it has experienced rapid growth in many countries and has fundamentally changed the competitive landscape of the banking industry worldwide, blurring the traditional lines that define product, market, and customer base. Compared with its use in developed Western countries, however, IB is still a relatively novel issue and a still-emerging trend in Taiwan’s financial services industry [Yu, 2008]. During the last decade, nearly all types of banks with physical offices in Taiwan rushed to establish their Internet presence. In addition to their traditional delivery channels, they adopted the Internet as another way to deliver their existing financial products and services to their customers. With the increase in the number of Internet users, more and more banks have become well aware that IB can offer them more innovative services and lucrative opportunities than traditional bricks-and-mortar bank branches. With increased awareness, however, has come a growing concern among management about how to increase their competitive advantage and earnings potential with online banks.

The success of IB depends to a large extent on consumer acceptance or adoption of this information system (IS). In the last decade, abundant empirical research has explored customers' attitudes and intentions toward IB, such as studies by Sathye [1999], Shanmugam and Guru [2000], Tan and Teo [2000], Suganthi et al. [2001], Chung and Paynter [2002], Chang [2003], Wang et al. [2003], Chan and Lu [2004], Eriksson [2005], Jaruwachirathanakul and Fink [2005], Lassar et al. [2005], Ndubisi et al. [2005], Cheng et al. [2006], Lichtenstein and Williamson [2006], Yiu et al. [2007], and Al-Somali et al. [2009].

All of these studies used the technology acceptance model (TAM) [Davis, 1989; Davis et al., 1989] as a theoretical framework to evaluate the determinants that influence user acceptance or adoption behavior. Little attention has been given, however, to the role that external variables such as individual differences played in predicting the use of a new IS [Hubona and Kennick, 1996; Hubona and Geitz, 1997; Legris et al., 2003], although they are the ultimate drivers of use and have significant effects on use behavior [Agarwal and Prasad, 1999; Burton-Jones and Hubona, 2005; Burton-Jones and Hubona, 2006]. Furthermore, the TAM’s fundamental constructs in determining the acceptance and use of IS
may not fully reflect the user’s behavior toward newly emerging technology like Internet banking [Wang et al., 2003]. Other variables able to affect perceived ease of use, perceived usefulness, and user acceptance need to be addressed [Davis, 1989].

The current study gives insight into the determinants affecting IB user’s adoption behavior by extending previous studies. In this study, the influence of individual differences is addressed, and a theoretical model is developed by extending TAM to incorporate risk perceptions regarding privacy, confidentiality, and security as a construct to capture the features of Internet-based technology, which does not require any face-to-face interaction between the parties to a transaction. Also, this study examines the actual use of IB systems rather than just the intention to use such systems. Structural equation modeling is used to validate the theoretical model.

Since the first online banking service was launched in Taiwan in March 2000, Taiwan's IB has not developed into the sophisticated and immensely popular facility that it is in Western countries, indicating, therefore, that further promotion and development are required. For this growth to occur, it is imperative to investigate the impact of critical factors affecting user behavior. In contrast to prior work, this study focuses on actual use behavior by considering a combination of different use measures. It is believed that the feedback information from actual users, who are familiar with online banking services to a certain extent, will be critical for devising the optimal marketing strategy to meet customer demands, and further to retain and expand customer base.

2. BACKGROUND AND LITERATURE REVIEW

This section includes a discussion of the technology acceptance model, individual differences, and risk perceptions.

2.1. Technology Acceptance Model

Of a series of models that explain technology acceptance behavior, the technology acceptance model (TAM) proposed by Davis [1989] is considered to be the most influential theory within fields such as information systems (IS), information technology (IT), and information services. It delineates causal relationships among external variables, beliefs and attitudes, and actual use [Hubona and Kennick, 1996]. Adapting the theory of reasoned action (TRA) [Fishbein and Ajzen, 1975], TAM introduces two fundamental belief constructs –
perceived usefulness and perceived ease of use – which substitute for many of TRA’s attitude measure. According to Davis et al. [1989], perceived usefulness relates to the degree to which a person believes that using a particular system would enhance his or her job performance, whereas perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort. These two constructs are postulated to determine an individual’s attitude toward using a technology-based system, with behavioral intention to use playing the role of mediator of actual system use. Perceived ease of use is also posited to have a direct effect on perceived usefulness.

Up to now, TAM has accumulated substantial empirical support and has been fully validated to be powerful as a framework to predict user acceptance in prior studies examining different information technologies [Agarwal and Prasad, 1999]. However, very few studies have validated the full TAM using all original constructs [Hubona and Kennick, 1996]. Either intention to use or mostly actual use was generally excluded. In addition, the role of external variables within TAM has received little attention [Hubona and Kennick, 1996; Hubona and Geitz, 1997; Legris et al., 2003]. Nevertheless, as Agarwal and Prasad [1999] noted, external variables did exhibit an influence on individual behavior toward a new IS via their effects on an individual’s beliefs about a new IS.

2.2. Individual Differences

In a wide variety of disciplines, individual differences are the external variables used to explore the effect on technology use. A set of constructs not specifically included in TAM were external variables related to individual differences, which mean user factors that include characteristics such as cognitive, personality, demographic, and situational variables [Zumd, 1979; Agarwal and Prasad, 1999]. Legris et al. [2003] noted the critical importance of examining individual differences, since they are the ultimate drivers for the use of technology. A number of related studies on TAM also found a significant relationship between individual differences and technology acceptance [Hubona and Kennick, 1996; Jackson et al., 1997; Agarwal and Prasad, 1999; Venkatesh, 2000; Venkatesh and Morris, 2000; Burton-Jones and Hubona, 2005; Burton-Jones and Hubona, 2006].

Several studies have verified that individual experience with a particular system has a significant effect on perception of the system's ease of use [Igbaria et al., 1995; Taylor and Todd, 1995; Igbaria et al., 1996; Thompson et al., 1994;
Hackbarth et al., 2003]. Examining the causal link between system experience and ease of use using a sample of 116 users of electronic spreadsheets, Hackbarth et al. [2003] found that system experience was positively related to perceived ease of use. Szajna [1996] suggested that adding a variable to account for system experience would be a worthwhile extension of TAM.

2.3. Risk Perception

The TAM tends to predict user adoption of new IS in a positive perspective. The user perceptions of both ease of use and usefulness are two critical factors affecting an individual's adoption of a system. However, customers will reduce their use or even refuse to use an IS if they subjectively expect that an injury or a loss might possibly occur while using the IS. Perceived risk is defined as a consumer’s perceptions of the adverse consequences and uncertainty associated with his or her action [Bauer, 1960]. The degrees of risk that consumers perceive and their risk tolerance are factors that affect use behavior [Chan and Lu, 2004; Lu et al., 2005].

Perceived risk is deemed a multi-dimensional construct, consisting of numerous categories of risk, including financial, performance (or functional), time, social, physical, and psychological risks [Jacoby and Kaplan, 1972; Havlena and DeSarbo, 1990; Murray and Schlacter, 1990; Stone and Gronhaug, 1993]. E-commerce and other Internet-based applications related to no face-to-face interactions between the transacting parties are also regarded as a risky undertaking [Chan and Lu, 2004] and may even involve more perceived risk than traditional transactions [Tan, 1999].

In this context, risk perceptions regarding Internet security and privacy have been identified as issues for both new and experienced users of Internet technology [Miyazaki and Fernandez, 2001]. Security and privacy refer to the protection of information or the system from outflow or unsanctioned intrusion [Wang et al., 2003]. Customers are very concerned about the security offered by commercial web sites, as sensitive personal and financial details are regularly provided during the course of transactions [Furnell, 2004]. The perceived lack of security and privacy over the Internet has been a common and widely recognized deterrent to e-commerce acceptance and use [Bhimani, 1996; Cockburn and Wilson, 1996; Quelch and Klein, 1996; Miyazaki and Fernandez, 2001; Chan and Lu, 2004; Kallanamarthodi and Vaithiyathanathan, 2012; Kesharwani and Bisht, 2012], and has been identified as affecting the growth and development of
e-commerce [Miyazaki and Fernandez, 2001]. Especially, in the IB context, consumers’ concerns about security have been emphasized as being the important factor restraining the adoption and use of IB [Sathyé, 1999; Wang et al., 2003; Gerrard et al., 2006; Laudon and Traver, 2007; Calisir and Gumussoy, 2008, Aldas-Manzano, 2009]. And, the greatest obstacle to increased use of online financial services is found to be fears about security and confidentiality of financial information [Laudon and Traver, 2007]. It is expected that only individuals who view IB as a low-risk undertaking would have a tendency to perceived it as useful [Chan and Lu, 2004].

3. METHODOLOGY

This section includes a discussion of the research model and hypotheses, operationalization constructs, and the questionnaire design.

3.1. The Research Model and Hypotheses

Based on the discussion in Section 2, the research model proposed by this study is shown in Figure 1.

![Figure 1. The Research Model](image)

There are ten variables in this model: four variables are measured variables, and six are latent constructs. The measured variables are external variables associated with the construct of individual differences, including age, education level, prior experience in using IB, and personal income. The latent variables are perceived ease of use, perceived usefulness, perceived risk, attitude toward using
IB, intention to use, and actual use. Each of the external variables is assumed to be mediated by perceived ease of use, perceived usefulness, and perceived risk – which are, in turn, posited to be major determinants of attitude. Attitude influences intention to use, and then intention determines the level of actual use of IB. The following hypotheses detail these relationships:

H1. Individual differences affect perceived ease of use.
   H1a. Age affects perceived ease of use.
   H1b. Education affects perceived ease of use.
   H1c. Experience affects perceived ease of use.
   H1d. Income affects perceived ease of use.

H2. Individual differences affect perceived usefulness.
   H2a. Age affects perceived usefulness.
   H2b. Education affects perceived usefulness.
   H2c. Experience affects perceived usefulness.
   H2d. Income affects perceived usefulness.

H3. Individual differences affect perceived risk.
   H3a. Age affects perceived risk.
   H3b. Education affects perceived risk.
   H3c. Experience affects perceived risk.
   H3d. Income affects perceived risk.

H4. Perceived ease of use affects perceived usefulness.
H5. Perceived risk affects perceived usefulness.
H6. Perceived ease of use affects attitude toward using.
H7. Perceived usefulness affects attitude toward using.
H8. Perceived risk affects attitude toward using.
H9. Attitude toward using affects intention to use.
H10. Intention to use affects actual use.
3.2. Operationalization Constructs

Six crucial latent constructs were considered in the research model used in this study: perceived ease of use, perceived usefulness, perceived risk, attitude toward using, intention to use, and actual use. A number of validated items used to operationalize these constructs were in principal adopted from prior TAM-related research and revised by this study for use in the IB context. The constructs are defined as follows.

- **Perceived Ease of Use (PEOU)** – Refers to the degree to which a person believes that using IB systems would be free of effort [Davis et al., 1989]
- **Perceived Usefulness (PU)** – Captures the extent to which a user views IB as offering advantages over previous ways of conducting banking transactions [Chan and Lu, 2004]
- **Perceived Risk (PR)** – Defined here as the degree to which an individual believes that banking transactions would be conducted confidentially and safely through IB systems. It comprises three dimensions – namely, security, privacy, and confidentiality – which are frequently used interchangeably, although each has a different meaning. *Security* denotes protecting the IB system from both internal and external threats such as illegal intrusion, theft, or destruction. *Privacy* means the ability of a person to control the availability of information about himself or herself. *Confidentiality* relates to the protection of individuals’ information, and ensuring that the information is not made available or disclosed to unauthorized individuals or entities.
- **Attitude Toward Using (ATU)** – Refers to an individual’s positive or negative feelings (evaluative effect) about using IB [Fishbein and Ajzen, 1975]
- **Intention to Use (ITU)** – Refers to a state of mind that drives an individual to use or not to use IB
- **Actual Use (AU)** – Contains three dimensions: IB transaction amount, frequency of IB use, and volume of IB use. *Transaction amount* is defined as the money transactions that a user makes over the IB each month (includes movement of funds, online purchases, paying bills,
Frequency of use refers to the number of times a person uses IB in a given period, a week, or a day. Volume of use refers to the number of hours a person spends using IB in a week.

All but two of these constructs were measured by six question items. The exceptions were intention to use (ITU) and actual use (AU), which were measured by only three items. Of those, each item of AU was linearly transformed to fit a measurement scale in the same range as all the other measured constructs, which were measured on a 7-point Likert-type scale, ranging from 1 representing “strongly disagree” to 7 representing “strongly agree,” with the items capturing perceived risk being reverse-scored.

3.3. Questionnaire Design

The questionnaire used a structured format and comprised 39 questions divided into three sections. In the first section, 6 questions were designed as fixed alternative items to collect respondents’ use-behavior-related information, such as users’ most frequently used IB account, most frequently used IB service, years of IB experience, online transaction amount of each month over IB, frequency of IB use, and volume of IB use. The second section, containing 27 questions, focused on a number of factors related to users’ perception toward IB and measured these dimensions: PU, PEOU, PR, ATU and ITU. Each dimension except ITU consisted of six items. ITU contained only three items. Respondents were asked to rate all these items on a 7-point Likert-type scale. The final section, consisting of 6 questions, collected basic respondent data related to demographic characteristics such as the respondent’s gender, age, residential area, occupation, education level, and annual personal income.

4. DATA COLLECTION AND ANALYSIS

In this study, the subjects were experienced users of IB. Consumers who had not used IB in the last one month were excluded, since they were supposed to be unfamiliar with IB systems and thus unable possibly to answer the questionnaire items precisely. Data for this study were collected via a questionnaire survey. Respondents were screened to ensure that they had used IB systems at least once over the last four weeks. One pilot test was carried out to assess questionnaire clarity, question wording, and question applicability. During the test session, 56 active users of IB from diverse banks were invited to
comment on the questionnaire. The comments from these users provided the basis for questionnaire revisions. The formal survey was conducted in September 2009. In addition to a traditional paper-and-pencil survey over face-to-face contact, an electronic survey via e-mail and websites was also conducted. A total of 892 responses were received. Of these, 104 are invalid, which left a total of 788 completed and usable questionnaires for analysis. The effective response rate was up to 88.34%. The total sample for this study thus consisted of 788 online banking users.

Structural equation modeling (SEM) was applied to evaluate the entire pattern of the inter-correlations among the constructs and to test related propositions in the theoretical model developed by this study. Basically, SEM is a family of statistical techniques that incorporates and integrates factor analysis and path analysis. It can be used to model multivariate casual relationships and to test multivariate hypotheses. In recent years, the application of SEM is becoming increasingly prevalent in the field of consumer behavior. SEM model building consists of a two-stage process [Jöreskog, and Sörbom, 1993; Hair et al., 1998; Maruyama, 1998], in which the measurement models are tested before testing the structural model. The measurement models specify how hypothetical constructs are measured in terms of the observed variables, whereas the structural model describes causal relationships among the latent variables.

5. RESULTS

This section presents results relating to the profile of survey respondents, the analysis of the measurement model, and the analysis of the structural model.

5.1. Profile of Survey Respondents

The demographic profile of the respondents is presented in Table 1. Of the 788 survey respondents, the gender balance was 52% female and 48% male. The survey respondents were young, with 86% under 35 years of age. Of those, 32% were in the 25-29 years group, 28% in the 20-24 years group, and 17% in the 30-34 years group. In terms of their residential area, about 36% lived in the northern part of Taiwan, 30% in the middle, and 27% in the south. It should be noted that the survey respondents were generally well educated. Around 57% indicated that they had obtained a bachelor’s degree; 21%, a master’s degree or higher; and 12%, an associate’s degree.
Table 1
Profile of Survey Respondents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Category</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>381</td>
<td>48.3</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>407</td>
<td>51.7</td>
</tr>
<tr>
<td>Age</td>
<td>≤20 years</td>
<td>75</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>20-24 years</td>
<td>221</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td>25-29 years</td>
<td>248</td>
<td>31.5</td>
</tr>
<tr>
<td></td>
<td>30-34 years</td>
<td>134</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>35-39 years</td>
<td>69</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>40-44 years</td>
<td>28</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>&gt;45 years</td>
<td>13</td>
<td>1.6</td>
</tr>
<tr>
<td>Residential Area</td>
<td>North</td>
<td>281</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>237</td>
<td>30.1</td>
</tr>
<tr>
<td></td>
<td>South</td>
<td>212</td>
<td>26.9</td>
</tr>
<tr>
<td></td>
<td>East</td>
<td>51</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>7</td>
<td>0.9</td>
</tr>
<tr>
<td>Education Level</td>
<td>Junior high school or less</td>
<td>31</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Senior high school</td>
<td>50</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>Associate’s degree</td>
<td>91</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s degree</td>
<td>449</td>
<td>57.0</td>
</tr>
<tr>
<td></td>
<td>Master’s degree</td>
<td>153</td>
<td>19.4</td>
</tr>
<tr>
<td></td>
<td>Doctorate</td>
<td>14</td>
<td>1.8</td>
</tr>
<tr>
<td>Occupation</td>
<td>Student</td>
<td>98</td>
<td>12.4</td>
</tr>
<tr>
<td></td>
<td>Financial</td>
<td>146</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>General services</td>
<td>158</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>IT-related</td>
<td>121</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td>80</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>Government</td>
<td>107</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>60</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>18</td>
<td>2.3</td>
</tr>
<tr>
<td>Personal Income (in NT$)</td>
<td>≤150,000</td>
<td>72</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>150,001 – 300,000</td>
<td>90</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td>300,001 – 450,000</td>
<td>268</td>
<td>34.0</td>
</tr>
<tr>
<td></td>
<td>450,001 – 600,000</td>
<td>207</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>600,001 – 750,000</td>
<td>68</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>750,001 – 900,000</td>
<td>50</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>&gt;900,000</td>
<td>33</td>
<td>4.2</td>
</tr>
<tr>
<td>Most Frequently Used Service</td>
<td>Checked bank account</td>
<td>246</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td>Moved bank funds</td>
<td>217</td>
<td>27.6</td>
</tr>
<tr>
<td></td>
<td>Traded mutual funds</td>
<td>117</td>
<td>14.8</td>
</tr>
<tr>
<td></td>
<td>Paid bills</td>
<td>160</td>
<td>20.3</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>48</td>
<td>6.1</td>
</tr>
<tr>
<td>IB Use Experience</td>
<td>&lt; 1 year</td>
<td>73</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>1 to &lt; 2 years</td>
<td>262</td>
<td>33.2</td>
</tr>
<tr>
<td></td>
<td>2 to &lt; 3 years</td>
<td>204</td>
<td>25.9</td>
</tr>
<tr>
<td></td>
<td>3 to &lt; 4 years</td>
<td>169</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>4 to &lt; 5 years</td>
<td>51</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>&gt;5 years</td>
<td>29</td>
<td>3.7</td>
</tr>
</tbody>
</table>
In terms of occupation, the largest group of respondents (20%) worked in the general services industry. Next, in order, were those working in the financial services industry (19%), IT-related industry (15%), and the government sector (14%). Students accounted for 12% of the respondents, and 10% worked in the manufacturing industry.

Personal income was measured in NTD. At the time of the study, NT$32.5 was equal to US$1.0. The largest group of respondents (34%) included those with an annual income between NT$300,001 and NT$450,000. Next in order came those earning NT$450,001 to NT$600,000 per year (26%); those earning between NT$150,001 and NT$300,000 (11%); those with an income of more than NT$600,000 per year (11.4%); and then those earning less than NT$150,000 per year (9.1%).

In terms of IB use experience, the respondents were familiar with IB systems, at least to some extent. More than 33% of the respondents had been using IB for 1-2 years, followed by those with 2-3 years of experience (26%) and 3-4 years of experience (21%). More than 10% of the respondents had more than 4 years of experience, whereas only 9% reported less than one year’s experience.

Respondents ranked the most frequently used IB services in this order: checked bank accounts (31%), moved bank funds (28%), paid bills (20%), and traded mutual funds (15%).

5.1. Analysis of the Measurement Model

Confirmatory factor analysis (CFA) using LISREL8.8 was first conducted to assess the measurement model. The results from fit measures indicated a fairly good fit for the model. As shown in Table 2, the ratio of chi-square to degrees of freedom ($\chi^2/df$) was 2.18, which was lower than 5 recommended by Wheaton et al. [1977]. The adjusted goodness-of-fit index (AGFI), non-normalized fit index (NNFI), and comparative fit index (CFI) were all greater than the recommended cut-off value of 0.90 [Bentler, 1983; Bentler and Bonett, 1980]. The root mean square error of approximation (RMSEA) was 0.04, which was less than the recommended threshold of 0.08 [Browne and Cudeck, 1993]. These results provide evidence that the data collected supports the model.

The measurement model was further assessed for construct reliability, convergent validity, and discriminant validity. Construct reliability was examined using both Cronbach’s $\alpha$ and composite reliability, which estimate internal consistency of items in measuring a single construct. Table 3 shows that the Cronbach’s $\alpha$ values of all six constructs ranged from 0.784 to 0.936, well exceeding the recommended level of 0.7 [Nunnally, 1978]. The value of composite reliability for each construct was also found well above the benchmark of 0.7 suggested by Nunnally and Bernstein [1994]. These results confirmed reliable scales.
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Table 2
Fit Indices for Measurement and Structural Models

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Measurement Model</th>
<th>Structural Model</th>
<th>Recommended Values</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\chi^2/df)</td>
<td>2.18</td>
<td>2.32</td>
<td>&lt;5.00</td>
<td>Wheaton, et al. [1977]</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.92</td>
<td>0.91</td>
<td>&gt;0.90</td>
<td>Bentler [1983]</td>
</tr>
<tr>
<td>NNFI</td>
<td>0.99</td>
<td>0.97</td>
<td>&gt;0.90</td>
<td>Bentler and Bonett [1980]</td>
</tr>
<tr>
<td>CFI</td>
<td>0.98</td>
<td>0.97</td>
<td>&gt;0.90</td>
<td>Bentler [1983]</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.04</td>
<td>0.05</td>
<td>&lt;0.08</td>
<td>Browne and Cudeck [1993]</td>
</tr>
</tbody>
</table>

Table 3
Results of CFA for Measurement Model

<table>
<thead>
<tr>
<th>Items</th>
<th>Factor Loading in Each Item</th>
<th>Cronbach’s Alpha</th>
<th>Composite Reliability</th>
<th>Average Variance Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEOU1, PEOU2, PEOU3, PEOU4, PEOU5, PEOU6</td>
<td>0.865, 0.899, 0.894, 0.818, 0.807, 0.875</td>
<td>0.899</td>
<td>0.924</td>
<td>0.812</td>
</tr>
<tr>
<td>PU1, PU2, PU3, PU4, PU5, PU6</td>
<td>0.814, 0.821, 0.837, 0.807, 0.819, 0.762</td>
<td>0.936</td>
<td>0.947</td>
<td>0.783</td>
</tr>
<tr>
<td>PR1, PR2, PR3, PR4, PR5, PR6</td>
<td>0.817, 0.814, 0.834, 0.826, 0.744, 0.742</td>
<td>0.892</td>
<td>0.901</td>
<td>0.796</td>
</tr>
<tr>
<td>ATU1, ATU2, ATU3, ATU4, ATU5, ATU6</td>
<td>0.792, 0.833, 0.807, 0.812, 0.826, 0.762</td>
<td>0.851</td>
<td>0.893</td>
<td>0.635</td>
</tr>
<tr>
<td>ITU1, ITU2, ITU3</td>
<td>0.824, 0.821, 0.817</td>
<td>0.814</td>
<td>0.867</td>
<td>0.759</td>
</tr>
<tr>
<td>AU1, AU2, AU3</td>
<td>0.807, 0.815, 0.819</td>
<td>0.784</td>
<td>0.845</td>
<td>0.674</td>
</tr>
</tbody>
</table>

In addition, the constructs of the proposed research model also exhibited adequate convergent validity and discriminant validity. As Table 3 shows, all measurement items loaded on their respective constructs from 0.742 to 0.899, meeting the 0.5 threshold recommended by Hair et al. [1998], supporting convergent validity. Average variance extracted (AVE) can also be applied to evaluate convergent validity. Guidelines suggested that the AVE should be greater than 0.5 [Hair et al., 1998]. Table 3 shows that the AVE were all above the benchmark of 0.5, demonstrating that convergent validity was well supported.
On the other hand, to test discriminant validity, Fornell and Larcker [1981] recommended that the AVE per construct should be higher than the correlations between any two different constructs. Table 4 presents the AVE matrices, with the AVE on the diagonal and squared correlations among constructs on the off-diagonal. The results indicate that the elements in the principal diagonal were always greater than the off-diagonal elements in their corresponding row and column, confirming discriminant validity.

5.2. Analysis of Structural Model

After validating the measurement scale, the same set of fit indices was applied to analysis of the structural model. As shown earlier in Table 2, the confirmatory factor analysis indicated that the structural model provided a good fit to the data ($\chi^2$/df = 2.32, AGFI = 0.91, NNFI = 0.97, CFI = 0.97, RMSEA = 0.05). Then, the structural model could be further assessed by the path coefficients and explanatory power. Figure 2 illustrates the results of SEM analysis in a path diagram, where TAM was extended by incorporating the PR construct regarding user perceptions of security, privacy, and confidentiality risks, and introduced the influence of four external variables – age, education, experience, and income. In the figure, the significance of path coefficients is indicated, and all non-significant paths are removed.

As expected, ATU positively affected ITU ($\beta=0.58$, p<0.001), which in turn positively affected AU ($\beta=0.39$, p<0.001), providing support for H9 and H10. ATU explained 46.2% of the variance in ITU, which accounted for 35.7% of the variance in AU. Furthermore, hypotheses H6, H7, and H8 were also supported, in that PEOU, PU, and PR all had a significant effect on ATU. Altogether, the three constructs accounted for 74.8% of the variance in ATU with PU ($\beta=0.74$, p<0.001) contributing more to ATU than both PEOU ($\beta=0.25$, p<0.001) and PR ($\beta=-0.33$, p<0.001). Note that the effect of PR on ATU was negative, whereas the effects of the other two elements, PU and PEOU, were positive. In addition, the effect of PEOU on PU was significant. Thus, H4 was significantly supported ($\beta=0.79$, p<0.001). However, H5 (which posits that PR significantly influences PU) was not supported by the data.

As for individual differences variable, this study expected that age, education, experience, and income would each significantly influence PEOU, PU, and PR, but the results for the hypotheses showed that only five sub-hypotheses (H1a, H1b, H1c, H2b, H3c, and H3d) were supported.
### Table 4
**Average Variance Extracted Matrix**

<table>
<thead>
<tr>
<th>Factor</th>
<th>PEOU</th>
<th>PU</th>
<th>PR</th>
<th>ATU</th>
<th>ITU</th>
<th>AU</th>
<th>Age</th>
<th>Ed</th>
<th>Exp</th>
<th>Inc</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEOU</td>
<td>0.812</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>0.545</td>
<td>0.783</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td>0.019</td>
<td>0.253</td>
<td>0.796</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATU</td>
<td>0.346</td>
<td>0.381</td>
<td>0.293</td>
<td>0.635</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITU</td>
<td>0.194</td>
<td>0.172</td>
<td>0.089</td>
<td>0.455</td>
<td>0.759</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AU</td>
<td>0.199</td>
<td>0.087</td>
<td>0.011</td>
<td>0.510</td>
<td>0.373</td>
<td>0.674</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.266</td>
<td>0.010</td>
<td>0.059</td>
<td>0.016</td>
<td>0.054</td>
<td>0.018</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ed</td>
<td>0.440</td>
<td>0.335</td>
<td>0.038</td>
<td>0.031</td>
<td>0.079</td>
<td>0.186</td>
<td>0.072</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp</td>
<td>0.145</td>
<td>0.403</td>
<td>0.114</td>
<td>0.178</td>
<td>0.171</td>
<td>0.082</td>
<td>0.096</td>
<td>0.119</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Inc</td>
<td>0.112</td>
<td>0.093</td>
<td>0.246</td>
<td>0.127</td>
<td>0.143</td>
<td>0.125</td>
<td>0.112</td>
<td>0.181</td>
<td>0.097</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Note: Diagonal elements are the average variance extracted for each factor. Off-diagonal elements are the squared correlations among factors. PEOU = perceived ease of use; PU = perceived usefulness; PR = perceived risk; ATU = attitude toward using; ITU = intention to use; AU = actual use; Ed = education level; Exp = IB experience; Inc = personal income.
Notes: ** P<0.01; *** P<0.001. All non-significant paths were removed.

Figure 2. Results of the Structural Model
Specifically, age, education, and experience significantly affected PEOU ($\gamma=-0.27$, 0.32, and 0.37, respectively, $p<0.001$); education also had a significant effect on PU ($\gamma=0.23$, $p<0.001$); both experience and income had a significant effect on PR ($\gamma=-0.14$ and -0.21, respectively, $p<0.01$). Clearly, experience exhibited a stronger effect than age and education in influencing PEOU. Moreover, the effects of education on PEOU and PU were positive, and so did experience on PEOU. In contrast, the effects of both experience and income on PR and age on PEOU were negative. The percentages of variance explained in PEOU, PU, and PR were 29.1%, 54.6%, and 33.3%, respectively.

6. DISCUSSION AND IMPLICATIONS

The main purpose of this study was to extend the TAM to shed light on the impact of individual differences on use behavior in the IB environment and to incorporate risk perception as a new construct to reflect the features of the Internet-based technology context. The dimensions of PR (security, privacy, and confidentiality) are more comprehensive than in the previous studies. Distinct from the literature, the current study examined AU of IB systems rather than just ITU and attempted to validate the full TAM using all of the original constructs.

The results confirmed the causal relationships among constructs derived from TAM (H4, H6, H7, H9), implying that it is suitable to adopt TAM in the IB context. In the study, the two fundamental briefs of TAM, PEOU, and PU were found to have significantly positive effects on ATU, with PEOU being less important than PU in affecting ATU. This finding is consistent with results in the IT system research literature [Davis, 1989; Davis et al., 1989; Taylor and Todd, 1995]. The possible explanation is as follows. Only experienced IB users were included in the current study, and more than 90% of the respondents in this study had at least one year of experience in using IB, indicating that most of them were already familiar with the operation of the IB system. The effect of PEOU on ATU generally declines as users become more familiar with the IB system. Therefore, PEOU may not be the most important concern for these sample users. As noted earlier, although the impact of PEOU on ATU is not as important as PU, PEOU was found to have a direct positive effect on PU. The results showing that the positive effect of PEOU on PU are consistent with past studies such as those conducted by Hubona and Kennick [1996], Hubona and Geitz [1997], Agarwal and Prasad [1999], Burton-Jones and Hubona [2006], and Medyawati, Christiyanti and Yunanto [2011]. On the other hand, since the IB users pay great attention to PU, banks should devote much effort to improving efficiency, effectiveness, and the user-friendliness of their Internet banking system and should disseminate the benefits of using IB system to keep their current users.
Furthermore, the results of this study also showed partial support for a direct effect of individual differences on PEOU, PU, and PR (H1, H2, and H3, respectively), and individual differences had an indirect effect on ITU and AU via the four key constructs (PEOU, PU, PR, and ATU). Of these, PR exerted a stronger effect on ATU (H8) than PEOU. Similar to the findings of Burton-Jones and Hubona [2006], the influence of users’ age on PEOU appeared to be negative. The results clearly demonstrated that the younger learn new skills relating to emerging technologies more easily than the older.

Moreover, similar to findings of the previous empirical study [Harrison and Rainer, 1992; Hubona and Kennick, 1996], the current study indicated positive effects of the users’ education level on PEOU and PU. The results revealed that higher levels of education are positively related to abilities to use innovative technologies and will thus increase PEOU of the IB system. This study also found especially evidence of a positive effect from prior experience on PEOU [Agarwal and Prasad, 1999; Burton-Jones and Hubona, 2006] and a negative effect on PU, but no significant effects on PU.

The results of this study seemed to be logical and reasonable. The longer that one has used an IB system, the more likely it will become an easy way and a routine tool for him or her to conduct banking business. In addition, it is quite intuitive that an experienced user tends to pay less attention to the risks of using a system because habits can weaken the feelings of fear. In addition, a user’s annual income level was found to have a significant negative effect on risk perception. This can be explained by the fact that higher income earners generally have a higher risk tolerance. As income and wealth increase, one’s level of PR will reduce.

It is noteworthy that PR played a key role in affecting the determinants of AU such as ATU and ITU, even through PR did not directly influence AU. In particular, online banking transactions are concerned with a greater degree of risk that consumers perceive than traditional face-to-face transactions. PR becomes a decisive consideration, besides PEOU and PU. It is therefore suggested that the IB authorities should improve the security measures, privacy protection, and confidentiality advancement in order to enhance online users’ perception of safety toward online banking services, and should take proper precautions to ensure the security of their customers’ online transactions.

7. CONCLUSIONS

The main purpose of this study was to identify the critical factors affecting actual use behavior in the context of Taiwan’s Internet banking and to explore the roles of external variables. The research model was based on an extension of the TAM and incorporated perceptions of privacy, confidentiality, and security risks as a new construct to capture the characteristics of Internet-enabled technology.
Empirical data were collected from experienced users via a questionnaire survey, and SEM was used to test for the relationships among the constructs hypothesized in the research model. Based on a sample of 788 experienced users, the results provided support of the appropriateness of the extended research model in identifying the predictors of user behavior. Also, the study confirmed that individual differences play an important role in directly affecting perceived usefulness, perceived ease of use, and perceived risk, and indirectly affecting user behavior. The findings may provide useful guidelines for developing service satisfaction strategies to build stronger customer loyalty and encourage future widespread and repeat use.

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