Adoption of Internet Banking:
An Empirical Study in Hong Kong

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Abstract

This study investigates how customers perceive and adopt Internet Banking (IB) in Hong Kong. We developed a theoretical model based on the Technology Acceptance Model (TAM) with an added construct Perceived Web Security, and empirically tested its ability in predicting customers' behavioral intention of adopting IB. We designed a questionnaire and used it to survey a randomly selected sample of customers of IB from the Yellow Pages, and obtained 203 usable responses. We analyzed the data using Structured Equation Modeling (SEM) to evaluate the strength of the hypothesized relationships, if any, among the constructs, which include Perceived Ease of Use and Perceived Web Security as independent variables, Perceived Usefulness and Attitude as intervening variables, and Intention to Use as the dependent variable. The results provide support of the extended TAM model and confirm its robustness in predicting customers' intention of adoption of IB. This study contributes to the literature by formulating and validating TAM to predict IB adoption, and its findings provide useful information for bank management in formulating IB marketing strategies.

Key words: Technology Acceptance Model (TAM), Internet banking, structural equation modeling.

1. INTRODUCTION

The bursting of the Internet bubble in early 2001 has generated numerous speculations that the opportunities for Internet services firms have vanished. The dot.com companies and Internet players have been struggling for survival, and most of the related businesses are still suffering losses. Practicing managers and academics have not yet reached a consensus in their debate about this new technology: whether the Internet brings about a revolutionary change in the fundamental way we do business or whether it is only an evolutionary process, offering simply a new distribution channel and communication medium (Moe and Fader, 2001). According to Brown (2001), the "New Economy" or e-commerce businesses are still at the infancy stage. Despite the crash of dot.com stock prices in March 2001, Internet usage and e-commerce have continued to grow at a fast pace.

According to eMarketer (2003), the US B2C e-commerce revenues reached US$70 billion in 2002, compared to US$51 billion in 2001, i.e., a jump of 37%. It also predicted that by 2003, the e-commerce revenues would increase by 28% to US$90 billion; another 21% increase to US$109 billion by 2004; and to US$133 billion, a further 22% increase, by 2005. Compared with the global economic growth of less than 5%, and the forecast GDP growth of 1%-2% for Hong Kong in 2003, the predicted e-commerce growth of 28% is very encouraging. The anticipated explosive growth of online purchases via the Internet will present immense opportunities to businesses in general, and Internet Banking (IB) in particular.

In this study we use the terms IB and Online Banking (OB) interchangeably. IB/OB is different from Electronic Banking (e-banking) in that the latter is a higher level activity that encompasses not only IB/OB, but also Telephone Banking, ATM, WAP-banking and other electronic payment systems that are not operated through the Internet. We focus on IB

because it is widely seen as the most important and most popular delivery channel for banking services in the cyber age.

Banks can benefit from much lower operating costs by offering IB services, which require less staff and fewer physical branches. Customers will also benefit from the convenience, speed and round-the-clock availability of IB services. However, IB has not taken off in Hong Kong as spectacularly as expected. According to ACNielsen and NetRatings (2003), 522,700 people in Hong Kong visited an IB site from their home PC in January 2003 (out of 2,194,600 active Internet users), representing a penetration rate of only 23.8%. To realize the full potential of IB, banks need to develop new products and services to fully utilize the Internet's capabilities. On the other hand, customers need to be made aware of IB services, and feel secure and comfortable with using such services as the new IB operating procedures are radically different from those they are used to.

There is a clear need to study the factors that influence customers' intention to adopt IB so that banks can better formulate their marketing strategies to increase IB usage in the future. This study aims to investigate the behavioral intention of customers to use IB services with a focus on users' perceptions of ease of use and usefulness of IB, and of security of using this new technology to meet their banking needs. In Section 2, we present a review of the literature on innovation diffusion and technology adoption, based on which we propose a model of customers' intention to adopt IB, and formulate the associated research hypotheses. We discuss the research methodology in Section 3, and present the findings from the analysis of the empirical data in Section 4. Section 5 concludes the paper with discussions of the limitations of the study, managerial implications and further research directions.

2. LITERATURE REVIEW AND MODEL FORMULATION

Although an abundance of studies aimed at extending our understanding of user adoption of technology have been conducted in the past, few of these studies were conducted on IB services by extending the well-established Technology Acceptance Model (TAM). With the number of global banking groups offering and improving IB services rapidly on the rise (American Banker, 2002), it is an opportune time to study the user adoption of IB. Such a study will be of interest to both academics and banking executives. Specifically, this study investigates the individuals' perception on the adoption of internet banking for corporate purposes. In other words, our survey focused on individuals' intention to use internet banking to handle their work-related banking issues.

2.1 Technology Acceptance Models

Davis (1989) developed the Technology Acceptance Model, according to which "users' adoption of computer system" depends on their "behavioral intention to use", which in turn depends on "attitude", consisting of two beliefs, namely Perceived Ease of Use and Perceived Usefulness. In fact, Davis developed TAM by building upon an earlier theory, the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975). In TRA, Fishbein and Ajzen (1975) proposed that intention is "the immediate determinant of the corresponding behavior", which is divided into (1) "attitude toward behavior", and (2) "subjective norm concerning behavior". Davis posited in TAM that the two theoretical constructs, Perceived Usefulness and Perceived Ease of Use, are fundamental determinants of system use in an organization. These constructs also provide better measures for predicting and explaining system use than other constructs (Davis, 1989).

TAM has become a widely used model for predicting the acceptance and use of information systems, and has recently been applied to predict Internet adoption as well. In a recent study, Lederer et al. (2000) adapted TAM to study World Wide Web (WWW) usage and found evidence to support TAM. Another study of applying TAM in the WWW context was conducted by Moon and Kim (2001). They introduced the construct Playfulness to predict Attitude. Data were collected from 152 graduate students of management in Korea. Their findings showed that although TAM-related hypotheses were all supported, the results deviated from the basic belief of TAM that Perceived Usefulness is the key determinant of user acceptance of IT. The results of Moon and Kim (2001) revealed that Perceived Ease of Use has a more significant effect on Attitude than Perceived Usefulness in the WWW context, and Perceived Playfulness (an intrinsic motivational factor) has a more significant effect on Attitude than Perceived Usefulness (an extrinsic motivational factor).

2.2 Theoretical Model for IB Adoption

IB is a new distribution channel for the delivery of banking services. From both academic and practical perspectives, it is interesting to understand and assess customers' intention to use IB services. We have chosen TAM as the baseline model for this study because it is a well-tested model concerning users' acceptance of technology. We augment TAM with the construct Perceived Web Security. Specifically, we hypothesize that Intention to Use is influenced by Attitude, Perceived Usefulness, Perceived Ease of Use and Perceived Web Security. 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 IB in the Hong Kong business environment. The theoretical model is graphically presented in Figure 1.

TAM has been used by various researchers to predict users' intention to accept or adopt a variety of technologies and computer systems. The technologies include electronic

mail, text editor, word processing systems, and graphics software (Davis, 1989; Davis et al., 1989), spreadsheets (Hendrickson et al., 1993), Database Management Systems (Szajna, 1994), voice-mail and word processors (Adams et al., 1992; Chin and Todd, 1995). We use TAM with the constructs Perceived Usefulness and Perceived Ease of Use to assess the determinants of customers' Attitude and Intention to Use (equivalent to the construct Behavioral Intention in TAM). While we adopt the original TAM in this study, we use Behavioral Intention as the dependent variable and skip the construct Actual Usage. On the theoretical front, an abundance of research studies have reported a strong and significant causal relationship between behavioral intention and usage of technology or targeted behavior (Sheppard et al., 1988; Venkatesh and Morris, 2000). It is therefore theoretically justifiable to use Behavioral Intention as a dependent variable to examine the acceptance of IB (Mathieson, 1991). Agarwal and Prasad (1999) also argued that for a survey-based research design, Behavioral Intention is more appropriate than Actual Usage as "they are measured contemporaneously with beliefs" and our study is survey-based research. On the practical front, it is worth noting that IB is still at an early stage of development in Hong Kong. The percentage of usage is relatively low (less than 15% of the total number of bank customers use IB services). Therefore, the choice of Behavioral Intention, rather than Actual Usage, as the dependent variable is considered both appropriate and necessary.

In addition, feeling secure in doing transactions on the Web is often cited by users as a major factor that removes their concerns about the effective use of the Internet for making online purchases (Salisbury et al., 2001). Therefore, we include the construct Perceived Web Security as a predictor of Attitude and Intention to Use, as in the earlier study conducted by Salisbury et al. (2001). In their study, Salisbury et al. (2001) developed a set of four items to measure Perceived Web Security using a 7-point Likert scale. The results of their study showed that the three constructs, namely Perceived Web Security, Perceived Ease of Use and

Perceived Usefulness, have a positive relationship with intention to purchase online. However, Salisbury et al. (2001) did not include the construct Attitude, which is included in our theoretical model.

2.3 Hypothesis Development

Based on the theoretical model developed above, we formulate the research hypotheses as follows. As TAM is used as the base model, we need to test the following TAM hypotheses in the context of IB adoption.

H1: Customers' Attitude positively influences their Intention.

H2a: Perceived Usefulness has a direct positive relationship with customers' Intention.

H2b: Perceived Usefulness has a direct positive relationship with customers' Attitude.

H3: Perceived Ease of Use has a direct positive relationship with customers' Attitude.

H4a: Perceived Ease of Use has an indirect positive relationship with customers' Intention via Perceived Usefulness.

H4b: Perceived Ease of Use has an indirect positive relationship with customers' Attitude via Perceived Usefulness.

In addition, we seek to test the hypothesized relationships related to Perceived Web Security. According to Salisbury et al. (2001), Perceived Web Security was found to favorably influence customers' intention to purchase on the WWW. Customers tend to increase purchases only if they perceive that their credit card and other sensitive information are safe. Therefore, Perceived Web Security is expected to have a positive relationship with customers' Intention to use IB, as well as with their Attitude.

H5a: Perceived Web Security has a direct positive relationship with customer's Intention.

H5b: Perceived Web Security has a direct positive relationship with customer's Attitude.

3. RESEARCH METHODOLOGY

3.1 Research Strategy

There exists virtually no research examining customers' behavioral intention to adopt IB services by extending TAM. To fill this gap, we conducted a postal survey study for hypothesis testing using the framework of the original TAM as the foundation to determine the predictors of customers' Intention to use IB in Hong Kong. To collect data, we designed a questionnaire by adapting the instrument and scales developed for TAM. We augmented TAM by adding the construct Perceived Web Security developed by Salisbury et al. (2001) and adapting their instrument and scale to measure this construct in our questionnaire.

3.2 Sample Size

This study aims to investigate the self-reported behaviors of individual customers and their intention to use IB services for corporate purposes in Hong Kong. We requested respondents to return their completed questionnaires either by fax or by Freepost. We collected data from bank customers in Hong Kong who use internet banking for their work and targeted to obtain no less than 193 usable responses (a 19% effective response rate) from a randomly selected sample of 1,000 customers, in order to achieve 0.80 statistical power, a 0.05 statistical significance criterion, and an r-value of 0.20 in accordance with the suggestions of Cohen (1988). We mailed the survey questionnaires to a sample of 1,000 names randomly selected from a total of 157,000 names listed in the Yellow Pages, which is the telephone directory of virtually all businesses in Hong Kong. We used Excel to generate 1,000 random numbers, which were then used to select the names from the Yellow Pages. Sathye (1999) employed a similar process to randomly select 1,000 business clients from the Yellow Pages in his study and found that "security concerns" and "benefits not clear" are the main factors that explain why Australian clients do not adopt IB.

3.3 Measurement/Operationalization of the Constructs

In devising a useful measurement instrument for this study, we adapted the instrument and scales developed and validated in the following two studies:

1. The questionnaire developed for TAM by Davis (1989) – adapting the scales for Perceived Usefulness and Perceived Ease of Use.

2. The questionnaire developed by Salisbury et al. (2001) – adapting the scale for Perceived Web Security.

Both studies have established the validity and reliability of their instrument, particularly the TAM instrument, which has been replicated and widely used in other studies. In this study we use the adapted question items as the instrument to measure the respective constructs below, using a 7-point Likert scale for each item (with 1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = agree, and 7 = strongly agree). The constructs are defined in the following:

Perceived Ease of Use (PEOU) - defined by Davis (1989) as "the degree to which a person believes that using a particular system would enhance his job performance". Four question items are used to measure PEOU.

Perceived Usefulness (PU) - defined by Davis (1989) as "the degree to which a person believes that using a particular system would be free of effort". Four question items are used to measure PU.

Perceived Web Security (PWS) **-** defined by Salisbury et al. (2001) as "the extent to which one believes that the World Wide Web is secure for transmitting sensitive information." It is also noted that "the adoption of purchasing products on the World Wide Web may involve a greater degree of risk than the adoption of other IT innovations. When one purchases products online, there may be a perception of risk involved in transmitting sensitive

information such as credit card numbers across the World Wide Web." Four question items are used to measure PWS.

Attitude (ATT) - refers to an individual's positive or negative feelings (evaluative affect) about performing a particular behavior (Fishbein and Ajzen, 1975). Three question items are used to measure ATT.

Intention to Use (INT) - refers to customers' intention to use, as opposed to their actual use of, IB services. Three question items are used to measure INT.

3.4 Survey Questionnaire and Pilot Test

Based on the hypothesized model (Figure 1) developed through a detailed review of the related literature on user acceptance of technology and new technology diffusion, we devised a 33-item questionnaire (19 items relate to user acceptance behavior and 14 are demographic/general questions) as a measurement scale for the research. The questionnaire was originally developed in English, and subsequently translated into Chinese by a university graduate with special training in English-Chinese translation. A back translation was carried out by another trained translator to ensure the accuracy of the translation.

The bilingual questionnaire was then used in a pilot test involving 120 trainees from the Vocational Training Center, who completed the questionnaire and provided valuable comments. Based on the respondents' feedback, we made modifications to the questionnaire to improve its readability and ensure its accuracy and appropriateness. A factor analysis was performed on the data collected from the pilot study. The test results were satisfactory, with five factors corresponding to the five intended constructs emerging with the factor loadings ranging from 0.6 to 0.9, and all Cronbach's alpha values surpassing the commonly adopted threshold value of 0.70.

4. RESULTS AND DISCUSSIONS

A total of 212 responses were received, of which 203 were accepted as valid responses for further analysis after removing a few erroneous (e.g., the respondent gave more than one answer to a question that expected only one answer) and missing items. The response rate was 20%, which exceeded the minimum desirable percentage (19%) for statistical power for the purpose of this research. To assess the possible existence of non-response bias, we divided the respondents into two groups as follows. The first group of respondents (N1 = 143) consisted of those whose returns were received within two days of sending out the questionnaires. The second group (N2 = 60) included those who sent in their returns more than two days after dispatching the questionnaires and after receiving a follow-up phone call to prompt them to give their reply. The second group was taken to represent the non-respondents. A t-test was performed on the responses of the two groups to see if they were different. The results of the t-test showed no differences in the responses of the two groups, suggesting that there was no evidence of non-response bias.

To ensure research rigor and validity of the results, we followed the procedures proposed by Koufteros (1999) in applying Structural Equation Modeling (SEM) to analyze the data. First, we developed an instrument for the measurement scale by following a systematic approach and incorporating a pre-test and a pilot test to ensure the appropriateness of the instrument. Second, we adopted an effective approach for data collection. Third, we performed an evaluation at the item level using the tests for convergent validity and item reliability. Fourth, as a satisfactory model was derived, we carried out the analysis with an assessment of the model fit and unidimensionality. Fifth, we evaluated the diagnostics and tests for discriminant validity, composite reliability and variance extracted to gain confidence in the measurement scales. Finally, we tested the structural model by means of Confirmatory Factor Analysis (CFA).

4.1 Demographic Characteristics of the Respondents

The descriptive statistics of the respondents' demographic characteristics were analyzed and presented in Table 1. Of the 203 respondents, 59% were female; 37% were in the 19-30 age group, 36% were 31-45 in age, and 24% were 46-60 in age. Few were under the age of 18, or over 60. Other demographic details can be found in Table 1.

4.2 Exploratory Factor Analysis

An exploratory factor analysis using SPSS was conducted on the survey data. The rotated factor matrix, resulting from a Varimax rotated principal axis factor extraction of the independent variables using the 1.0 eigenvalue cut-off criterion, is shown in Table 2, which indicates that five factors emerged and reports their factor loadings.

The data were tested using the SPSS Exploratory Factor Analysis (EFA) to evaluate the Cronbach's alpha, which ranged from 0.902 to 0.939. Each item was evaluated individually to ensure convergent validity and item reliability. Except for b7 and b8 (0.403 and 0.406, respectively), all factor loadings were larger than 0.5, representing an acceptable significant level of internal validity. The factor loadings ranged from 0.689 to 0.722 for Perceived Ease of Use, 0.403 to 0.619 for Perceived Usefulness, 0.751 to 0.901 for Perceived Web Security, 0.618 to 0.710 for Attitude, and 0.501 to 0.608 for Intention. Since all factor loadings were of an acceptable significant level, all 19 questionnaire items were retained for further analysis.

4.3 Confirmatory Factor Analysis

We used the hypothesized model to test model fitness by performing a Confirmatory Factor Analysis (CFA) on the data. The results show that the hypothesized model is recursive, i.e., uni-directional (Table 3). There were 190 distinct sample moments (i.e., pieces of information) from which to compute the estimates of the default model, and 45 distinct

parameters to be estimated, leaving 145 degrees of freedom. The minimum iteration was achieved, thereby providing an assurance that the estimation process yielded an admissible solution, eliminating any concern about multicollinearity effects. The results also provide a quick overview of the model fit, which includes the χ^2 value (395.03), together with its degrees of freedom (145) and probability value (<0.0005).

4.4 Model Assessment

Conformance to the Expected Parameter Estimates: To begin with, it is necessary to assess the fit of individual parameters in the hypothesized model to determine the viability of their estimated values. Parameter estimates are expected to exhibit the correct sign and size, and to be consistent with the underlying theory. Any unexpected estimate indicates either the model is inappropriate or the input data are missing. The results indicated that the estimates were quite normal and acceptable.

Reliability of Parameter Estimates: Another test statistic is the Critical Ratio (C.R.), which represents the parameter estimate divided by its standard error (S.E.). As a "rule of thumb", the C.R. needs to be > ±1.96 if the estimate is acceptable (Chau, 1997; Hair et al., 1998). The results showed that all C.R. values were larger than 1.96, indicating that they were all acceptable.

Review of Fit Statistics: Reviewing the fit statistics in Table 3, we noted that not all the fit statistics indicated a well-fit. The key fit statistics showed a value of χ^2 (145 df) = 395.03, GFI of 0.84, NFI of 0.91, CFI of 0.94, and RMSEA of 0.09 (PCLOSE of 0.000). These statistics indicated a marginal fit, instead of a very good fit, according to commonly suggested criteria (Chau, 1997). Therefore, it was necessary to apply the procedures to test whether any misspecifications and/or any violation of the assumptions existed.

4.5 Post-hoc Analyses

To take all reasonable precautions with respect to the statistical analysis of our assertions, we performed additional post-hoc analyses to detect multicollinearity and performed bootstrapping.

Multicollinearity: To determine whether any multicollinearity effects existed, we reviewed the correlations in-depth to look for the presence of any correlation >1.00 and to 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 et al., 1998; Sharma, 1996). High multicollinearity masks the effects of an individual predictor, and results in incorrect estimations of regression weights (Hair 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 et al., 1998). The VIFs for PU, PWS, PEOU and ATT were 4.23, 1.65, 3.38, and 3.39, respectively, in predicting INT, providing further evidence against multicollinearity.

Incorporating the Construct Actual Use: We conducted a further analysis of an "Expanded Model" that incorporates the construct Actual Usage following the construct Intention to Use, and compared the results with the hypothesized model. The results of the SPSS Exploratory Factor Analysis showed that the Total Variance Explained for the "Expanded Model" was 76.898%. Comparing with the corresponding value of the hypothesized model of 78.194% (Table 2), we see that the hypothesized model has a higher percentage of Total Variance Explained. We conclude that the hypothesized model is better in explaining the data and representing the relationships between the variables.

4.6 Results of Hypothesis Testing

After establishing an acceptable measurement model, we evaluated the structural model shown in a path diagram in Figure 2. The regression weights are reported in Table 5. The results of the SEM analysis show that H1, H2a, H2b, H4a, H4b, H5a, H5b, and H6 were supported, while H3 and H5b were not supported.

Attitude and Web Security

To test the statistical significance of the parameter estimates from SEM, the test statistic is the Critical Value (C.R.), which represents the parameter estimate divided by its standard error (S.E.). Based on a significance level of 0.05, the C.R. needs to be $> \pm 1.96$. Below this level, the parameter can be considered unimportant to the model. The factor loading on PEOU-ATT (Table 5) was 0.082 (with C.R. = 0.645, p = 0.519), which was not significant, and thus H3 was not supported. The factor loading on PWS-ATT was 0.06 (with C.R. = 1.665, p = 0.096), which did not support hypothesis H5b. These results about Attitude are not surprising. They are consistent with the suggestion of Moore and Benbasat (1991) that in the context of IT usage, attitude can be synthesized from perceived characteristics of innovating (Rogers, 1995). In recent empirical studies, the revised TAM frequently drops the construct Attitude. Future research can also consider taking this alternative approach.

4.7 Predictive and Explanatory Power of the Model

The results of this study provide support for our extended TAM. The original TAM postulates that intention is the major determinant of user behavior, and it is powerful in predicting and explaining user behavior based on only three theoretical constructs, i.e., Intention, Perceived Usefulness and Perceived Ease of Use (Davis et al., 1989). These

hypotheses were supported in our findings. The positive influence of Perceived Web Security on behavioral intention in our extended TAM was supported, too.

Regarding the individual predicting power of each construct on Behavior Intention, the results indicate that Perceived Usefulness (0.573) has slightly significant explanatory power, maintaining its influential role. Perceived Ease of Use (0.559) and Perceived Web Security (0.403) have an added significant effect on Intention. However, Perceived Ease of Use does not impact on intention to use directly. Attitude (0.302) has a smaller effect. Hence, we review the Attitude-Intention relationship by contrasting it with TRA and TAM. Both TRA and TAM postulate that Attitude is determined by one's relevant beliefs. TRA combines all beliefs into a single construct, whereas TAM posits Usefulness and Ease of Use as two fundamental and distinct constructs. TRA suggests that Attitude has an intervening effect on beliefs and intention, but TAM and alternative intention models provide theoretical justification and empirical evidence for direct beliefs-intention links such as the Usefulness-Intention link (Davis et al., 1989; Bagozzi, 1982). In some empirical studies, it has also been found that Attitude might on some occasion show an insignificant effect on Intention (Davis et al., 1989), which is consistent with the findings of this study.

Our results provide support for TAM. Our findings are also consistent with the findings of Davis et al. (1989) in that Attitude does not fully intervene the effect of Perceived Usefulness and Perceived Ease of Use on Intention. In conclusion, these results provide several key insights into the determinants of IB usage. First, Perceived Usefulness is a major determinant of customer's intentions to use IB. Second, Perceived Ease of Use is a significant secondary determinant of customer's Intention. However, it is mediated through Perceived Usefulness instead of having a direct impact on Intention. Finally, Perceived Web Security is too a significant and direct determinant of customer's Intention.

5. CONCLUSIONS AND IMPLICATIONS

5.1 Limitations

Since this empirical study was performed with a time constraint, as with other cross-sectional studies, it is not without limitations. The IB market in Hong Kong, as well as knowledge about user behavior in relation to IB, is at the infancy stage. At a time when rapid changes in new technologies come to market daily, the results of a cross-sectional study may not be perfectly generalizable. A longitudinal study to more fully investigate the pre-launch stage, the promotion stage and the post-launch stage of IB would certainly be a significant contribution to the IB literature in the future.

This study only covers the construct of Web security. Future research may deal with the issue of security and privacy separately, as the latter is arousing increasing attention in the Web literature (Jarvenpaa and Todd, 1997). In addition, the measurement instrument for Web security could be further refined to enhance its validity in future studies.

Our study was carried out in Hong Kong. It may not be fully generalizable to other territories and countries, especially those with the western culture such as the USA or Australia. More importantly, in the Chinese market, with rapid changes in rural areas and increasing numbers of Internet users and WAP phone applications, the IB adoption environment could change dramatically at any time. It is not difficult to argue that a theory applicable to Hong Kong may not necessarily hold true on the Chinese mainland.

5.2 Implications for Bank Management

Sathye's (1999) survey revealed that over 70% of customers expressed concerns on Web security and real benefits when considering internet banking, which are the highest among other factors such as difficulty in use and no internet access. However, Sathye (1999) did not propose any model to test the impact of these factors on acceptance of

internet banking. Our research based on TAM suggests that perceived usefulness has the greatest influence on customer intention to adopt internet banking. Perceived ease of use, however, does not have a direct impact on intention to use, although it affects the perceived usefulness of customers, which in turn leads to acceptance of internet banking. Similar findings were obtained by Pikkarainen et al. (2004) and Chan and Lu (2004), who investigated 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 technology acceptance of internet banking. One interpretation is that difficulty in using on-line systems is becoming less of a concern as they are increasingly user-friendly. In addition, since on-line systems are more prevalent and standardized nowadays, the public becomes increasingly competent on its use. Accordingly, in the planning and development of internet banking, software developers should pay attention to practical functions and extend key features that are frequently required. On the marketing side, bankers should accentuate the full functionality of their systems to cater for the different banking needs of the users efficiently.

This study has also revealed that, in additional to perceived usefulness, perceived Web security has a strong and direct effect on acceptance of internet banking, too. Perceived Web security was not taken into consideration in previous research on TAM in the context of internet banking (e.g., Chan and Lu, 2004; Lai and Li, 2005). We suggest bankers improve the security features of their systems and stress their system security and the precaution functions they have implemented. With these functions, they could reassure their customers that internet banking is a safe mode to perform transactions.

Banks should also consider how to shift the perceptions of their customers by emphasizing the positive safety features in any marketing campaign. They should pass an effective message to customers that the Web security facility now available will eliminate

any third-party intrusions into their IB account in order to turn around the negative perceptions of their customers, thereby enabling customers to feel secure and comfortable in using IB services. However, incidents where on-line banking suffers from security breaches could seriously undermine consumer confidence. In this regard, proper training of customers on the safe use of internet banking could help improve security and enhance their overall confidence in long-term.

Although we did not study the robustness of our revised TAM model, previous research has suggested that the constructs of TAM are generally invariant across different gender, age, and IT competence subgroups (Lai and Li, 2005). Accordingly, bankers could adopt this revised TAM with reasonable confidence.

In recent years TAM has also been adopted as a theoretical framework to study the acceptance of online shopping. Klopping and McKinney (2004) found that perceived usefulness is the key aspect of adoption, while perceived ease of use has only a minor effect. Consistent to our findings, Liu et al. (2003) found that although perceived ease of use affects perceived usefulness, it does not impact on attitude to use directly. They explained that since online shopping systems have become easier to use and users have become more technically savvy, variations in the perceived ease of use dimension are reduced. Similar to this research on internet banking, Shih's (2004) study on e-shopping extended TAM by adding perceived Web security as a factor and found that high perceived Web security directly increases consumer attitudes toward e-shopping, while privacy is not a factor. Gefen et al. (2003) suggested that a belief that there are safety mechanisms built into the Web site is essential.

It appears that technology acceptance for internet banking is very similar to that of on-line shopping. Theoretically, this implies that the revised TAM with the factor of perceived Web security works equally well in predicting the acceptance of internet banking

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and online shopping. Perceived usefulness and Web security are key factors nowadays in both types of system. However, one might predict that with security features properly built, Web security might not be a key concern and perceived usefulness will become the sole key factor in the future.

5.3 Conclusions

The findings of this empirical study provide support for the theoretical model embracing TAM and the construct Perceived Web Security. The results support the view that Perceived Ease of Use and Perceived Web Security are predicting variables, affecting Perceived Usefulness and Attitude as intervening variables, and Intention to Use IB as the dependent variable. Perceived Usefulness and Perceived Web Security has a direct effect on Intention, while Perceived Ease of Use has only an indirect impact. All hypotheses were supported except for H3 (i.e., PEOU-ATT) and H5b (i.e., PWS-ATT). Perceived Web Security influences Intention directly, rather than passing through the intervening variable Attitude. This is consistent with the findings of earlier empirical studies (Salisbury et al., 2001). As is clear from the key fit statistics, the model testing yielded a set of fit indices with an overall well-fit, indicating that the model fitted well with the data. The results of hypotheses testing provide satisfactory support for the extended TAM through the SEM analysis.

5.4 Suggestions for Future Research

Since the study is cross-sectional in design, future research could undertake a more in-depth longitudinal study. It would also be worthwhile to examine any specific new IB product/service to be launched on the market, such as mutual funds management services or insurance protection. In particular, the study could be conducted at an early stage of service launching, or at a pilot test stage in order to investigate customers' behavior towards the

adoption of the new IB service. Any corrective actions if necessary could then be made at an early stage so that bank management can improve the new service and accelerate the usage rate to recoup the investment costs earlier. Future research may be conducted by further extending and refining TAM and test it in the context of other technologies. In particular, research could be carried out on technology acceptance in an organizational setting, such as acceptance of Enterprises Resource Planning (ERP), and inter-organizational context, such as adoption of Point of Sales (POS). Other potential factors, such as senior management attitude, could be considered in such studies as well.

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Figure 1: Research Model of Customer's Intention to use Internet Banking

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Figure 2: AMOS Graphic of the Re-specified Model
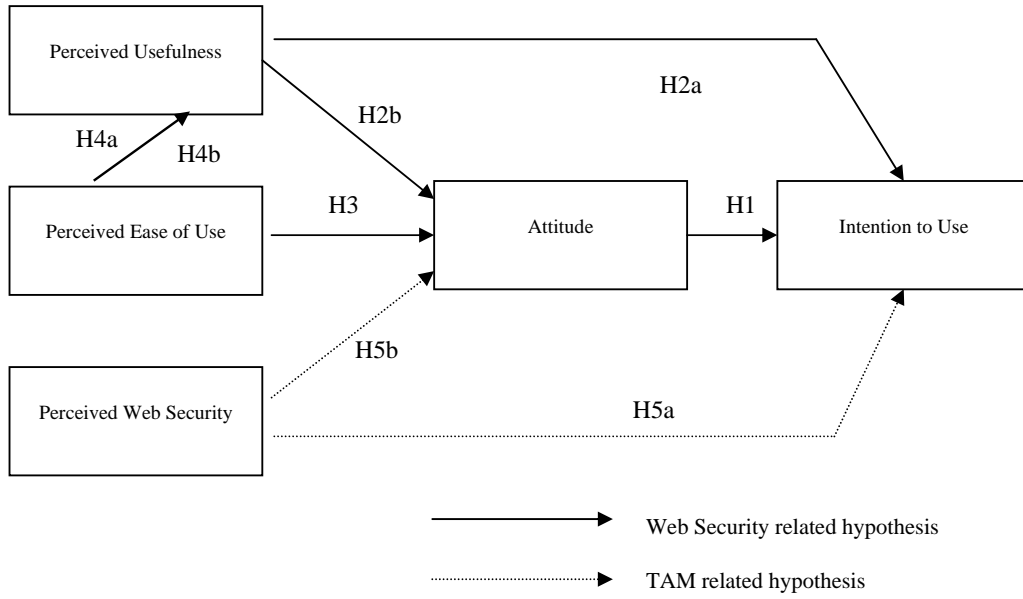
Figure 2: AMOS Graphic of the Re-specified Model
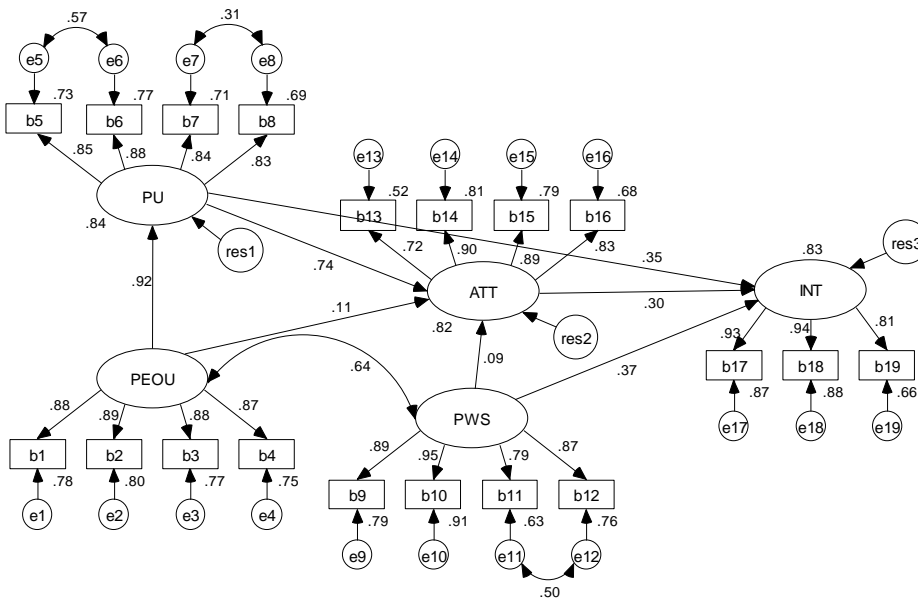
Table 1: Demographics of Respondents

	Demographic Profile		Frequency	Percent
	Sex			
F	Female		120	59.1%
M	Male		83	40.9%
		Total	203	100.0%
	Age			
A	Under 18		1	0.5%
B	19 – 30		76	37.4%
C	31 – 45		74	36.5%
D	46 – 60		49	24.1%
N	Over 60		3	1.5%
	Respondent Position			
A	CEO		7	3.4%
B	CFO		8	3.9%
C	CIO		3	1.5%
D	Owner		47	23.2%
E	Manager		70	34.5%
F	Clerk		58	28.6%
O	Other		10	4.9%
	Respondent Industry			
B	Banking		4	2.0%
F	Financial Institutional		9	4.4%
I	IT related		44	21.7%
M	Manufacturing		48	23.6%
O	Other		29	14.3%
R	Retail		60	29.6%
T	Telecommunication		6	3.0%
U	Tourism		3	1.5%
	Company size (employees)			
A	Less than 50		120	59.1%
B	51 – 100		41	20.2%
C	101 – 300		24	11.8%
D	301 – 500		10	4.9%
E	501 – 1000		3	1.5%
F	Over 1000		1	0.5%
N	Not applicable		4	2.0%

Table 2: Factor Loadings (from SPSS exploratory factor analysis)

	Factor Loading	Cronbach Alpha	Variance Explained %
Total Cumulative %			**78.194**
Perceived Ease of Use (PEOU)	0.722	0.934	19.484
B/b1 - Using the Internet Banking (IB) service is easy for me	0.718		
B/b2 - I find my interaction with the IB services clear and understandable	0.689		
B/b3 - It is easy for me to become skillful in the use of the IB services	0.720		
B/b4 - Overall, I find the use of the IB services easy			
Perceived Usefulness (PU)		0.929	8.219
B/b5 - Using the IB would enable me to accomplish my tasks more quickly	0.619		
B/b6 - Using the IB would make it easier for me to carry out my tasks	0.595		
B/b7 - I would find the IB useful	0.403		
B/b8 - Overall, I would find using the IB to be advantageous	0.406		
Perceived Web Security (PWS)		0.939	21.568
B/b9 - I would feel secure sending sensitive information across the IB	0.751		
B/b10 - The IB is a secure means through which to send sensitive information	0.825		
B/b11 - I would feel totally safe providing sensitive information about myself over the IB	0.804		
B/b12 – Overall, the IB is a safe place to transmit sensitive information	0.901		
Attitude (ATT)		0.902	20.456
B/b13 - Using the IB is a good idea	0.654		
B/b14 - I would feel that using the IB is pleasant	0.710		
B/b15 - In my opinion, it would be desirable to use the IB	0.697		
B/b16 - In my view, using the IB is a wise idea	0.618		
Intention (INT)		0.923	8.466
B/b17 - I would use the IB for my banking needs	0.566		
B/b18 - Using the IB for handling my banking transactions is something I would do	0.608		
B/b19 - I would see myself using the IB for handling my banking transactions	0.501		

Note: Used SPSS Principal Axis Factoring extraction with Varimax rotation method.

Table 3: Fit Statistics (Original Model)

Fit Statistic	Suggested	Obtained
Chi-square		395.03
DF		145
Chi-square significance	$p <$ or $= 0.05$	< 0.0005
Chi-square/DF (Wheaton et al., 1977)	< 5.0	2.72
GFI (Joreskog and Sorbom, 1988)	> 0.90	0.84
NFI (Bentler and Bonett, 1980)	> 0.90	0.91
CFI (Bentler, 1990)	> 0.90	0.94
RMSEA (Steiger and Lind, 1980)	< 0.05	0.09
PCLOSE	> 0.50	0.00

Table 4: Fit Statistics of Final Re-specified Model

Fit Statistic	Suggested	Obtained
Chi-square		202.31
DF		141
Chi-square significance	$p <$ or $=0.05$	0.001
Chi-square/DF (Wheaton et al., 1977)	< 5.0	1.44
GFI (Joreskog and Sorbom, 1988)	> 0.90	0.91
NFI (Bentler and Bonett, 1980)	> 0.90	0.95
CFI (Bentler, 1990)	> 0.90	0.99
RMSEA (Steiger and Lind, 1980)	< 0.05	0.05
PCLOSE	> 0.50	0.65

Table 5: Parameter Estimates (AMOS report) of Re-specified Model

Regression Weights

			Estimate	S.E.	C.R.	P
PU	<--	PEOU	0.878	0.062	14.216	0
ATT	<--	PU	0.574	0.138	4.144	0
ATT	<--	PEOU	**0.082**	0.127	**0.645**	**0.519**
ATT	<--	PWS	**0.06**	0.036	**1.665**	**0.096**
INT	<--	ATT	0.476	0.191	2.484	0.013
INT	<--	PU	0.422	0.145	2.903	0.004
INT	<--	PWS	0.378	0.051	7.395	0
b6	<--	PU	1.046	0.042	25.129	0
b7	<--	PU	0.988	0.066	15.06	0
b8	<--	PU	0.985	0.067	14.736	0
b4	<--	PEOU	1			
b3	<--	PEOU	1.003	0.058	17.301	0
b2	<--	PEOU	0.956	0.054	17.85	0
b1	<--	PEOU	0.929	0.053	17.49	0
b12	<--	PWS	1			
b11	<--	PWS	0.917	0.046	20.05	0
b10	<--	PWS	0.967	0.047	20.526	0
b9	<--	PWS	0.946	0.053	18.013	0
b13	<--	ATT	1			
b14	<--	ATT	1.266	0.1	12.687	0
b16	<--	ATT	1.238	0.106	11.653	0
b19	<--	INT	0.945	0.056	16.818	0
b18	<--	INT	1.071	0.044	24.266	0
b17	<--	INT	1			
b5	<--	PU	1			
b15	<--	ATT	1.26	0.1	12.544	0

The Appendix – The Questionnaire

PART A:

I. Introductory / general questions (Please circle your choice of answer)

Internet usage habit:
1.   I have access to the Internet: No / yes at home / yes at work

2.   Months using IB : < 3M / 3-6M / 6-12M / >12M / N.A.

	Strongly disagree		Neutral			Strongly agree	
	1	**2**	**3**	**4**	**5**	**6**	**7**
3. I use IB frequently	1	2	3	4	5	6	7
4. I encounter problem frequently in using IB	1	2	3	4	5	6	7
5. I use IB service frequently as source of information	1	2	3	4	5	6	7
6. I use IB from more than one bank frequently	1	2	3	4	5	6	7
7. Besides IB, I use frequently other banking channels (ATM, branch teller, phone banking...)	1	2	3	4	5	6	7

II. Demographic characteristics of the respondent (Please circle your choice of answer)

8.   Respondent Position   : CEO / CFO / CIO / Owner / Manager / Clerk / Other (Please state:_____)

9.   Industry of corporate   : Manufacturing / Retailing / IT related / Telecomm / Banking / Financial Institutions /Tourism / other (Please state: _____)

10.   Company size: Staff no. < 50 / 51-100 / 101-300 / 301-500 / 501-1000 / >1000 / N.A. (Circle one choice only).

11.   Using banking services for: Enquiry / Deposit / Loan / Export Financing / Import Financing / Fixed Income / Equity / Corporate Finance / Private banking / Asset Management (Circle more than one choice).

12.   Sex: Male / Female

13.   Age group: <18 / 19-30 / 31-45 / 46-60 / >60

Please respond to questions below by circling your choice (1=strongly disagree, 7=strongly agree)

		Strongly disagree		Neutral			Strongly agree
		1	**2**	**3**	**4**	**5**	**6**	**7**

Perceived Ease of Use

(1) Using the Internet Banking service is easy for me
   1 2 3 4 5 6 7

(2) I find my interaction with the use of the Internet Banking services clear and understandable
   1 2 3 4 5 6 7

(3) It is easy for me to become skillful at the use of the Internet Banking services
   1 2 3 4 5 6 7

(4) Overall, I find the use of the Internet Banking services easy
   1 2 3 4 5 6 7

Perceived Usefulness

(5) Using the Internet Banking would enable me to accomplish my tasks more quickly
   1 2 3 4 5 6 7

(6) Using the Internet Banking would make it easier for me to carry out my tasks
   1 2 3 4 5 6 7

(7) I would find the Internet Banking useful
   1 2 3 4 5 6 7

(8) Overall, I would find using the Internet Banking to be advantageous
   1 2 3 4 5 6 7

Perceived Web Security

(9) I would feel secure sending sensitive information across the Internet Banking
   1 2 3 4 5 6 7

(10) The Internet Banking is a secure means through which to send sensitive information
   1 2 3 4 5 6 7

(11) I would feel totally safe providing sensitive information about myself over the Internet Banking
   1 2 3 4 5 6 7

(12) Overall, the Internet Banking is a safe place to transmit sensitive information
   1 2 3 4 5 6 7

Attitude

(13) Using Internet Banking is a good idea
   1 2 3 4 5 6 7

(14) I would feel that using Internet Banking is pleasant
   1 2 3 4 5 6 7

(15) In my opinion, it would be desirable to use Internet Banking
   1 2 3 4 5 6 7

(16) In my view, using Internet Banking is a wise idea
   1 2 3 4 5 6 7

Intention to Use

(17) I would use the Internet Banking for my banking needs. 1 2 3 4 5 6 7

(18) Using the Internet Banking for handling my banking transactions is something I would do 1 2 3 4 5 6 7

(19) I would see myself using the Internet Banking for handling my banking transactions 1 2 3 4 5 6 7