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The Determinants of Customer Interactions with Internet-enabled e-Banking Services

by

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Abstract

This paper empirically explores the major considerations associated with Internet-enabled e-banking systems and systematically measures the determinants of customer interactions with e-banking services. The results suggest that perceived usefulness, ease of use, security, convenience and responsiveness to service requests significantly explain the variation in customer interactions. Exploratory factor analysis and reliability test indicate that these constructs are relevant and reliable. Confirmatory factor analysis confirms that they possess significant convergent and discriminatory validities. Both perceived usefulness and perceived ease of use have significant impact on customer interactions with Internet e-banking services. Perceived security, responsiveness and convenience also represent the primary avenues influencing customer interactions. In particular, stringent security control is critical to Internet e-banking operations. Furthermore, prompt reactions to the service requests from customers should encourage them to use Internet e-banking services. The findings have managerial implications for enhancing extant Internet e-banking operations and developing viable e-banking systems and services.

Keywords:
Customer interactions, determinants, Internet, e-banking, service operations management

Introduction

The Internet-enabled e-banking systems have been extensively developed and implemented to integrate different banking services operations and provide efficient channels for delivering innovative financial services. However, there are considerable challenges in terms of the achievement of actual market penetration and the realization of the expected value of Internet banking in competitive marketplaces (Dewan and Seidmann 2001; Liao and Cheung 2003). As technology-based services, Internet-enabled e-banking involves great exposures in terms of its usability, security and reliability. The acceptance and adoption of Internet e-banking is influenced by a number of factors in the competitive environments. As far as this is concerned, it is meaningful to measure the key determinants of Internet-enabled e-banking services from consumer perspective.

The acceptance of new technology has been extensively explored over the last decades. In particular, the technology acceptance model (TAM) suggested by Davis (1989) has been used to explain user behavior across a broad range of computer-based information systems and information technologies (e.g. Straub, Limayem and Karahanna-Evaristo 1995; Szajna 1996; Gefen and Keil 1998; Anandarajan, Igbaria and Anakwe 2000; Legris, Ingham and Collerette 2003). According to Davis (1989), the TAM asserts that the influence of external variables upon user behavior is mediated through user beliefs and attitudes based on theory of reasoned action (Fishbein and Aizen 1975). Both perceived usefulness and perceived ease of use are belief constructs in the TAM. Numerous studies have sought to expand the TAM by incorporating additional constructs. Taylor and Todd (1995) develop additional antecedent constructs that underlie the decision of technology adoption. Szajna (1996) systematically examines the measures of actual system acceptance instead of intended usage. Venkatesh and Davis (2000) test a theoretical extension of the TAM that explains perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes using longitudinal data collected regarding four different systems at four organizations. Moreover, the TAM has been used to examine the factors influencing the usage of websites (van der Heijden 2003). Recently, the TAM has been applied to explore electronic commerce and Internet e-banking in different contexts (e.g. Devaraj, Fan and Kohli 2002; Gefen, Karahanna and Straub 2003; Akinci, Aksoy, and Atilgan 2004; Cheong and Park 2005; Durkin and O'donnell 2005; Eriksson, Kerem and Nilsson 2005; Lai and Li 2005).

This paper aims to empirically elucidate customer perceptions of the Internet-enabled e-banking services provided by major commercial banks in Singapore. Empirical data have been collected from individual customers. The present work contributes to the development of knowledge in relation to this particular domain of electronic commerce, since it not only extends the application of the TAM in the market environment, but also provides practically useful information for the development of sophisticated Internet e-banking systems and services. The structure of this paper includes research model and hypotheses, research methods, empirical results, discussion and implications, and concluding remarks. It begins with the construction of a research model used to explore a number of variables in relation to customer interactions with Internet e-banking systems. At the same time, several hypotheses are proposed to measure the effect of the constructs on customer interactions. It then illustrates the statistical procedures used to test the hypotheses, followed by presentation of empirical results. The discussion of the findings focuses on the relative impacts of different variables. Finally, it highlights managerial implications for developing Internet e-banking services and suggests the directions for future research.

Model and Hypotheses

In terms of technology-based services, consumers would usually apply a compensatory process to evaluate multiple attributes and gradually form their expectations based on experience (Johnson 1984; Dabholkar 1994). It would be desirable if individuals could provide rational assessments based on experience. Cronin and Taylor (1992) suggest that the quality of services can be assessed using consumption-based perceptions. Dabholkar (1996) constructs a service quality model, within which the expectations assigned to speed of delivery, ease of use, reliability, enjoyment and control determine expected service quality, which might in turn affect individual's intention to use a particular service. Barczak, Ellen and Pilling (1997) empirically explore the motivations behind the use of new financial products and services such as telephone banking and debit cards. They suggest that a market orientation towards customer demands should help achieve competitive advantage and increase the value of services. Today, Internet-enabled e-banking is not an unfamiliar phenomenon especially to Internet users, since many innovative e-banking platforms have been implemented for several years. Therefore, it would be practically meaningful to examine customer interactions in terms of the actual use of the existing Internet e-banking services beyond individual attitudes. The research model depicted in Figure 1 incorporates the major

constructs of the TAM and other constructs to examine customer interactions with Internet e-banking.

~ Insert Figure 1 ~

Firstly, perceived usefulness refers to the degree to which a user believes that using a particular system would improve performance (Davis 1989). On one hand, it affects the usage of information systems because of the reinforcement value of outcome. It is postulated to have a direct effect on behavioral intention to the use of an innovation via its influence on individual attitude (Davis, Bagozzi and Warshaw 1989). On the other hand, it captures the extent to which a potential adopter views the innovation as offering value over alternative ways of performing the same task (Agarwal and Prasad 1999). Previous studies suggest that perceived usefulness is influenced by various variables in different environments (e.g. Adams, Nelson and Todd 1992; Davis 1993). In the case of Internet banking, individual customers might use such a banking alternative if it were perceived useful. In other words, they might use Internet e-banking in a relatively more frequent manner, if it could provide conventional banking activities. Therefore, we would explore the following hypotheses.

H1 Perceived usefulness will have a positive effect on customer interactions.

H1a The provision of current banking and financial information is positively related to perceived usefulness.

H1b The capacity to enable real-time financial transactions is positively related to perceived usefulness.

H1c The capacity to facilitate investment planning is positively related to perceived usefulness.

Secondly, perceived ease of use refers to the degree to which the prospective user expects that the usage of a system requires limited effort (Davis, Bagozzi and Warshaw 1989). A system that is difficult to use is less likely to be perceived useful, because perceived benefit might be out-weighed by the effort of using the applications associated with the system (Davis 1989). It has been proven that perceived ease of use influences perceived usefulness (e.g. Adams, Nelson and Todd 1992; Jackson, Chow and Leitch 1997). Perceived ease of use can also affect the usage of the system through perceived usefulness and usages. For instance, Dabholkar (1996) points out that customers tend to be concerned about the effort required to use such options and the complexity of the process of service delivery. In addition, Cooper

(1997) believes that ease of adoption as an important characteristic from the customer perspective. Moreover, Daniel (1999) suggests perceived ease of use to be one of the factors influencing the adoption of e-banking. Because Internet e-banking is performed on the screen of a computer-based device, it should be easy for non-experts of computers to use. In this connection, it might be considered in terms of clear and logical presentation of information, simple and intuitive search and navigation procedure, and the provision of instruction to use the services. The interface of Internet-based e-banking should be designed in the way that customers generally feel not difficult and intimidating to use. Therefore, we would test the following hypotheses:

H2.1 Perceived ease of use will have a positive effect on customer interactions.

H2.2 Perceived ease of use is positively related to perceived usefulness.

H2a Clear presentation of information is positively related to perceived ease of use.

H2b Intuitive search and navigation is positively related to perceived ease of use.

H2c Supportive help and instruction is positively related to perceived ease of use.

Thirdly, empirical studies suggest that security is a general concern in the use of the Internet for electronic transactions (Lunt 1996; Hansen 2001; Cheung and Liao 2003). In the online environment, perceived security is the extent to which one believes that the web is secure for transmitting sensitive information (Salisbury, Pearson, Pearson and Miller 2001). Customers would expect a service with promised security. However, they might feel uncertain when using Internet e-banking since it involves private data and transactions and therefore demand banks to implement stringent security measures to protect e-banking operations. Cooper (1997) identifies that the level of risk is an important characteristic associated with the adoption of an innovation. Dutta and McCrohan (2002) believe that one expecting a higher level of perceived security has a more favorable attitude towards the service. Therefore, we would examine the following hypotheses:

H3 Perceived security will have a positive effect on customer interactions.

H3a Restriction of unauthorized access is positively related to perceived security.

H3b Protection of customer private data is positively related to perceived security.

H3c Rigorous security control is positively related to perceived security.

Furthermore, consumers tend to be time sensitive to financial transactions associated with Internet e-banking (Liao and Cheung 2002). They can get instantaneous access to information through the Internet. Responsiveness could be an attribute of customer interactions, because

customers might expect quick responses to service requests (Zeithaml 2000). In other words, service requests together with business transactions should be processed in an efficient manner (Dabholkar 1996). In addition, a consistently reliable process has an impact on the usage of technology-based services (e.g. Parasuraman, Zeithaml and Berry 1988; Dabholkar 1996). Internet e-banking involves the transfer of funds and the exposure of transactions. One might worry about how accurately a service request is processed, because Internet banking is not conducted face-to-face over counters (Bahia and Nantel 2000; Bahia, Paulin and Perrien 2000). Therefore, we would explore the following.

H4 Responsiveness will have a positive effect on customer interactions.

H4a Prompt response to service requests is positively related to responsiveness.

H4b Reliable processing of service requests is positively related to responsiveness.

Lastly, Internet e-banking creates a great convenience to customers because it reduces the time spent on banking services and saves physical effort of visiting counters (Howcroft, Hamilton and Hewer 2002). In particular, time and proximity is likely to be significant in differentiating Internet e-banking from traditional retail banking (Liao and Cheung 2002). Customers can conveniently use the Internet anywhere at any time. The access to Internet e-banking services is no longer restricted by geographic constraints. Therefore, we propose Hypothesis 5.

H5 Perceived convenience will have a positive effect on customer interactions.

Research Methods

Data Collection

This project involves the collection of empirical data regarding the use of Internet e-banking system provided by Citibank, Standard Chartered, Development Bank of Singapore and other commercial banks in Singapore. Firstly, a questionnaire was designed to elucidate customer assessments with respect to the current Internet e-banking systems and services. It includes multiple items to evaluate the hypotheses proposed in the previous section. The descriptions of the survey items are shown in Table 1. Respondents were requested to indicate their perceptions with regard to the importance of each item based on a seven-point Likert scale of 1 - 7, with 1 scoring the lowest point "not important at all," to 7 scoring the highest point "extremely important." The questionnaire was circulated to individuals using simple random sampling technique (Cochran 1977; Hair 2000). In order to study customer interactions with Internet e-banking, the respondents were also asked to indicate to what extent they use the

Internet e-banking services within a particular period of time. As a result, three hundred and twenty useful responses were received for data analysis. The sample includes one hundred fifty two females and one hundred sixty eight males. Their ages range from eighteen to over sixty years old, while majority of the respondents are twenty to fifty years old.

Measurement Model

On the basis of the assumed causal relationships of different variables and their potential impacts on customer interactions with Internet-enabled e-banking services, we validate the measures using structural equation modeling. The following mathematically illustrates the analytical process of our research model. Let η be the latent of customer interactions (CI, Unobservable), ξ_1 be perceived usefulness (U), ξ_2 be perceived ease of use (E), ξ_3 be security (S), ξ_4 be responsiveness (R), and ξ_5 be convenience (C). We hypothesize customer interactions, y (Observable), satisfies the following relation:

$$y = f(\xi_1, \xi_2, \xi_3, \xi_4, \xi_5) + \zeta = \eta + \zeta \qquad (1)$$

where ζ is an error term with $\Sigma = \mathrm{Cov}(\zeta)$, see Figure 1. As all the exogenous variables ξ_1, ξ_2, ξ_3, ξ_4 and ξ_5 are hypothesized to lead to the latent η of endogenous variable y positively, we assume:

$$\partial\eta / \partial\xi_i > 0 \qquad i = 1, 2, 3, 4, 5.$$

A linear structural equation is used to approximate equation (1):

$$y = \Gamma \xi + \zeta \qquad (2)$$

where $\xi = [\xi_1, \xi_2, \xi_3, \xi_4, \xi_5]'$ (Figure 1). The endogenous variable, y, is observable but the exogenous variables ξ_1, ξ_2, ξ_3, ξ_4 and ξ_5 are unobservable. As such, several, said n_i, of observed items of x_i ,$(x_{ij}, \; j = 1 \ldots, n_i)$ are used to measure ξ_i for each i = 1, 2, 3, 4 and 5.

The measurement model for the exogenous latent variables is:

$$x = \Lambda_x \xi + \delta \qquad (3)$$

where $x = [x_{11}, x_{12}, \ldots x_{1n1}, x_{21}, x_{22}, \ldots, x_{2n2}, x_{31}, x_{32}, \ldots x_{3n3}, x_{41}, x_{42}, \ldots, x_{4n4}, x_{51}, x_{52}, \ldots x_{5n5}]'$ and $\xi = [\xi_1, \xi_2, \xi_3, \xi_4, \xi_5]'$.

The parameters are estimated using the maximum likelihood estimation as follows:

$$\text{Max:} \quad ML = \ln | C | - \ln | S | + \text{tr } S\, C^{-1} - m$$

where
tr = trace (sum of the diagonal elements),
S = covariance matrix of all indices for the latent variables implied by the model (Table 3),
C = actual covariance matrix of all indices for the latent variables,
ln = . natural logarithm, and
| | indicates the determinant of a matrix.

The Confirmatory factor analysis (CFA) of the hypothesized model (Figure 1) is performed, which includes linear structural equations (Equations 1 and 2) and measurements of the exogenous latent variables (Equation 3). The correlation analysis is also employed to obtain a correlation matrix based on all items for each dimension, which is then used as an input of the path analysis. The CFA allows the examination of the rigorousness of our research model in terms of uni-dimensionality, reliability and convergent validity of the scales (Gefen, Straub and Boudreau 2000). The uni-dimensionality is the extent to which the items are strongly associated with each other, and represent a single factor, which is a necessary condition for reliability analysis and construct validation (Anderson and Gerbing 1982). The benefit of using the CFA, as opposed to an exploratory factor analysis, is the availability of test for factor loadings to examine statistical significance. Both reliability test and correlation analysis can be incorporated into the CFA when assessing the uni-dimensionality of each factor.

The convergent validity is the extent to which different approaches used to construct measurements can yield similar results (Campbell and Fiske 1959). The convergent validity of a scale can be calculated using the Bentler-Bonett coefficient (Δ) (Bentler and Bonett 1980). The Bentler-Bonett coefficient (Δ) is the ratio of the difference between the chi-square value of the null measurement model (model with no hypothesized factor loading on a common construct) and the specified hypothesized measurement model to the chi-square value of the

null model. In general, a value of Δ between 0.80 and 0.90 is considered acceptable, while 0.90 or above demonstrates a strong convergent validity (Gefen, Straub and Boudreau 2000).

Empirical Results

As shown in Table 1, the results of exploratory factor analysis indicate that the factor loadings for all items are much greater than the cutoff value of 0.4 for each factor (Gefen, Straub and Boudreau 2000). The items are relevant to those major factors being examined. The high factor loadings support the convergent validity and discriminant validity of the factors: (i) The factor loadings of the three items associated with perceived usefulness are 0.9302, 0.8788, and 0.6047, respectively. They are positively significant and explain 65.45% of the variation; (ii) The factor loadings of five items in relation to perceived ease of use are 0.8346, 0.8464, 0.8321, 0.8759 and 0.8424, respectively, explaining 70.52% of the variation; (iii) The factor loadings of the items related to security are 0.8803, 0.8807, 0.5057, and 0.7888, respectively, explaining 60.55% of the variation; and (iv) The factor loadings of the two items associated with responsiveness are 0.8989 and 0.8989, explaining 80.42% of the variation. In addition, the correlation analysis confirms the convergent validity of these items. Moreover, the reliability test supports the internal consistency of the sample data, because the values of Cronbach alpha are 0.7606 (Usefulness), 0.8987 (Ease of Use), 0.8327 (Security), and 0.7238 (Responsiveness), which suggest that the items associated with each factor are considerably related to each other (Straub 1989; Gefen, Straub and Boudreau 2000).

~ Insert Table 1 ~

The CFA has resulted in causal relationships between the endogenous variable and the five exogenous variables (Figure 2). The model statistics are detailed in Table 2 and Table 3. It is a standard practice to present several measures, because there are several measures to assess the fit of a model (Maruyana 1998). The *t*-statistics (estimated factor loadings divided by their standard errors) for the factor loadings of manifest variables are above two. As shown in Table 2, the three indices of perceived usefulness are 17.7048, 24.7869, and 21.3946, respectively, supporting the statistical significance of parameter estimations. They indicate not only the unidimensionality of each exogenous latent variable, but also the convergent validity of the hypothesized model (Muthén and Muthén 2001). While the relatively large squared

multiple correlations (R^2 values) for each exogenous latent variable (minimum R^2 value is 0.5250) support the assertion that indicators are reasonable measures of the constructs (Bollen 1989; Gefen, Straub and Boudreau 2000), which indicate that these items can represent the exogenous variables.

Table 2 shows that the exogenous variables in the hypothesized model are strongly correlated at the 0.01 level of significance. The estimates of the path coefficients from β_1 to β_5 are calculated using latent variable equations: β_1 to β_2 are significant at the 0.01 level, β_3 and β_4 are significant at the 0.05 level, and β_5 is significant at the 0.1 level. These results indicate that perceived ease of use, which affects perceived usefulness. In turn, perceived usefulness and other exogenous variables positively affect the endogenous variable of customer interactions.

~ Insert Table 2, Table 3, Figure 2 ~

Table 3 shows that the Goodness of Fit Index (GFI) (Bentler and Bonnet 1980) is 0.9125 and the GFI Adjusted for Degrees of Freedom (AGFI) is 0.8469. According to Bagozzi and Yi (1988) and Hu and Bentler (1999), AGFI values higher than 0.80 suggest a good fit of the hypothesize model. In addition, the Root Mean Square Residual (RMR) is 0.0521. Usually, an RMR value less than 0.1 is considered a good fit, while a value less than 0.05 is considered a good fit of the data to the research model (Bagozzi and Yi 1988; Hu and Bentler 1999). GFI is a measure of the relative amount of variances and covariances jointly accounted for the model (Steiger 1990; Gefen, Straub and Boudreau 2000), while RMR is a measure of the average of the residual variances and covariances (Jöreskog and Sörbom 1989). Moreover, Bentler and Bonett's Non-normed Index is 0.9149, Bollen Non-normed Index is 0.9438, and Bentler's Comparative Fit Index is 0.9433. *Chi-square* statistic (211.47, d.f. = 52) further suggests the validity of constructs is statistically significant (Boudreau, Gefen and Straub 2001). The above statistics not only suggest that our hypothesized model considerably explains the causal relationships between the endogenous variable and exogenous variables, but also indicate that the constructs have a good predictive validity. Moreover, the estimates of the path coefficients are positively significant. For example, the *t*-statistic for β_1 is 5.5563, which is significant at the 0.01 level (Table 2). All test statistics (e.g. GFI, AGFI, and RMR) suggest a good fit of the hypothesized model (Figure 2), and 36.81% of the variation of the endogenous variable (Customer Interactions) can be explained by the exogenous variables. Table 2 indicates the relative impacts of different constructs on customer interactions. Usefulness is the most

influential factor (t = 5.5563), followed by ease of use (t = 3.6403), responsiveness (t = 2.0732), security (t = 1.8987), and convenience (t = 1.4947). The corresponding percentages of the impacts are 37.89, 24.83, 14.14, 12.95 and 10.19. The findings in relation to the hypotheses are as follows.

Firstly, H1 is supported, because the path coefficient β_1 in the CFA model (U --> CI) is 0.2939 and positively significant at the 0.01 level (Table 2). At the same time, H1a, H1b and H1c are supported, because the factor loadings resulted from exploratory factor analysis (Usefulness) range from 0.6047 to 0.9302 (Table 1). There is a confirmation of convergent validity, because the high correlation values between the items associated with the factor, ranging from 0.23 to 0.77, are positively significant at the 0.01 level. The factor loadings resulted from the confirmatory factor analysis for perceived usefulness range from 0.8137 to 0.9954, which are positively significant at the 0.01 level.

Secondly, H2.1 is supported, because the path coefficient β_2 in the CFA model (E → CI) is 0.2747 and positively significant at the 0.01 level (Table 2). H2.2 is also supported, because the path coefficient in the CFA model is 0.4170 and positively significant at the 0.01 level. H2a, H2b and H2c are supported, because the factor loadings resulted from exploratory factor analysis (Ease of Use) range from 0.8321 to 0.8759 (Table 1). There is a confirmation of convergent validity, because the high correlation values between the items associated with the factor, ranging from 0.70 to 0.88, are positively significant at 0.01 level. The factor loadings in the CFA model, ranging from 0.7590 to 0.9447, are positively significant at the 0.01 level.

Thirdly, H3 is supported, because the path coefficient β_3 in the CFA model (S --> CI) is 0.1219 and positively significant at the 0.05 level (Table 2). H3a, H3b and H3c are supported, because the factor loadings resulted from exploratory factor analysis (Security) range from 0.5057 to 0.8807 (Table 1). There is a confirmation of convergent validity: The high correlation values between those items associated with the factor range from 0.56 to 0.75 and are positively significant at 0.01 level. The factor loadings in the CFA model, ranging from 0.6389 to 0.8754, are positively significant at the 0.01 level.

Moreover, H4 is supported, because the path coefficient β_4 in the CFA model (R --> CI) is 0.1372 and positively significant at the 0.05 level (Table 2). H4a and H4b are also supported, because the factor loading resulted from exploratory factor analysis (R) is 0.8989 (Table 1).

There is a confirmation of convergent validity: The high correlation values between those items associated with the factor is 0.61, which is also positively significant at the 0.01 level. Factor loadings resulted from the CFA model are 0.7245 and 0.8398, being positively significant at the 0.01 level. Finally, H5 is supported, since the path coefficient β_5 (C → CI) within the CFA model is 0.0757 and positively significant at the 0.1 level. The empirical findings in relation to different hypotheses are summarized in Table 4.

~ Insert Table 4 ~

Discussion and Implications

The present empirical work measures the effect of several constructs on customer interactions with Internet e-banking. The exploratory factor analysis and reliability analysis show that the individual measures and indices are relevant and reliable. The convergent validity of the measures has also been proved by the factor loadings. The present constructs within the model have been validated, since the estimates of path coefficients in the latent variable equation indicate that the endogenous variable is positively affected by the exogenous variables. In other words, such constructs as perceived usefulness, ease of use, responsiveness, security and convenience have significant impact on customer interactions with Internet e-banking.

Firstly, perceived usefulness has a relatively great impact on customer interactions. It is a key success factor of Internet e-banking, because e-banking system is built for the provision and extension of banking services. The actual use of the Internet banking by individual customers might vary from looking for banking and financial information to carrying out transactions. At present, a practically useful Internet e-banking system can enable customers to search for banking financial information, conduct real-time transactions, and make investment plans. However, there are a variety of banking and financial services which might include legal requirements and obligations. Customers are required to sign particular forms and submit individual documents. Therefore, traditional branch banking still remains its importance to these services. However, Internet e-banking can play a role in facilitating the traditional banking operations, although it is not easy to effectively run all different banking and financial services over the Internet. As far as this is concerned, commercial banks should aim to continuously enhance the existing Internet e-banking services operations.

Additionally, perceived ease of use remains an important attribute significantly influencing customer interactions with Internet banking. As an openly available service platform, Internet e-banking should enable different customers to easily use the relevant functions associated with the e-banking together with services provided. Practically, different customers might different knowledge about the Internet and e-banking services. Therefore, the e-banking website should possess simple navigation procedures, intuitive help functions and clear instructions. In addition, it would be desirable if the e-banking website were aesthetically appealing and had functionalities catering to the preferences of different consumers.

Furthermore, perceived security control has a significant and positive effect on customer interactions with Internet e-banking. The implementation of a series of rigorous measures such as the restriction of unauthorized access, the control of transactions and the protection of customer private data is essential to assure the security of e-banking services. The elimination of security risk is essential for enhancing individual confidence. In order to secure financial transactions and look after the assets of customers, the banks should continuously strengthen the security control of the information systems and implement the most advanced and latest security technologies, even if substantial resources and investments are required. At the same time, the banks should pay attention to consumer education in terms of Internet e-banking operations and the use of e-banking services. Although the banks had implemented the most advanced technologies to secure Internet banking operations, customers might be not aware of the security procedures and technologies adopted by banks. Some might still worry about uncertainties of Internet e-banking in terms of unauthorized access, disclosure of private data and release of transactions data. As far as this is concerned, banks should consistently inform the customers about security measures and policies in relation to e-banking operations and financial transactions when promoting the use of Internet e-banking services. For instance, customers should be regularly informed of how to uptake virus checker programs, change passwords and not to respond to any suspicious e-mails.

Finally, the responsiveness to service requests is critical to Internet e-banking services. The prompt response to consumer request for service can encourage individuals to use the Internet e-banking services in a more frequent manner. Although a customer virtually places a request for service through e-banking site, the corresponding bank should devote to provide quality service. It is desirable that e-banking is at least comparable with face-to-face services at a

brick-and-mortar branch, even if it is relatively difficult to provide instant assistance and instructions to online customers. Today, with the Internet e-banking, individual customers do not have to queue up for routine banking services in a branch. They are no longer constrained by physical access and opening hours of branches, because there are no restrictions in terms of time and geographical location. It is expected that such convenience will encourage more customers to use Internet e-banking. However, possessing the capacity to enable customers to access e-banking services at anytime has considerable resource implications in terms of service operations management, because it requires the banks to consistently support Internet e-banking operations and effectively maintain the systems.

Concluding Remarks

This research empirically explores the determinants of customer interactions with Internet e-banking and systematically analyzes the impacts of several constructs based on exploratory factor analysis and confirmatory factor analysis. The results suggest that perceived usefulness, perceived ease of use, security, responsiveness and convenience significantly influence customer interactions with Internet e-banking. In particular, individuals would place a great emphasis on the security of Internet-based financial transactions. As a conventional practice, commercial banks and financial institutions must continuously review security policy and strengthen the security control of Internet e-banking. It is challenging to immediately respond to online enquiries and service requests from customers. The findings provide practically useful information for improving extant Internet e-banking operations. However, it is recognized that the present work has its limitations because most responding customers are relatively young. Future research should be conducted to obtain data especially from senior citizens and customers with different experiences. Comparative studies in light of different demographics should generate meaningful findings. In addition, future research should explore the determinants and success factors of Internet e-banking services in different social contexts. Such empirical studies are expected to have significant implications for managing Internet e-banking services. Finally, commercial banks and financial institutions should continuously improve traditional banking operations and develop innovative banking and financial services. At the same time, they should also consistently reengineer business processes and implement best practices in the industry in order to strengthen customer confidence in Internet e-banking and achieve great market penetrations.

Understanding the relationship between Customer Interactions and e-Banking Services will be useful for banks to provide better service. The information of the banks (Thompson and Wong, 1991; Wong and Chan, 2004), the Economic and Financial environment (Fong, Wong, and Lean 2005; Broll, Wahl, Wong 2006) can also be utilized to improve banking service. Further study also includes utilizing other advanced statistical analysis (Matsumura, Tsui, and Wong 1990; Wong and Miller 1990; Tiku, Wong, Vaughan, and Bian 2000) to explore deeper the relationship between Customer Interactions and e-Banking Services. Another extension to study the behavior of customers (Wong, W.K., Li, C.K., (1999; Wong and Ma 2007) to enable banks to provide better service to meet the needs of their customers.

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Figure 1 Research Model

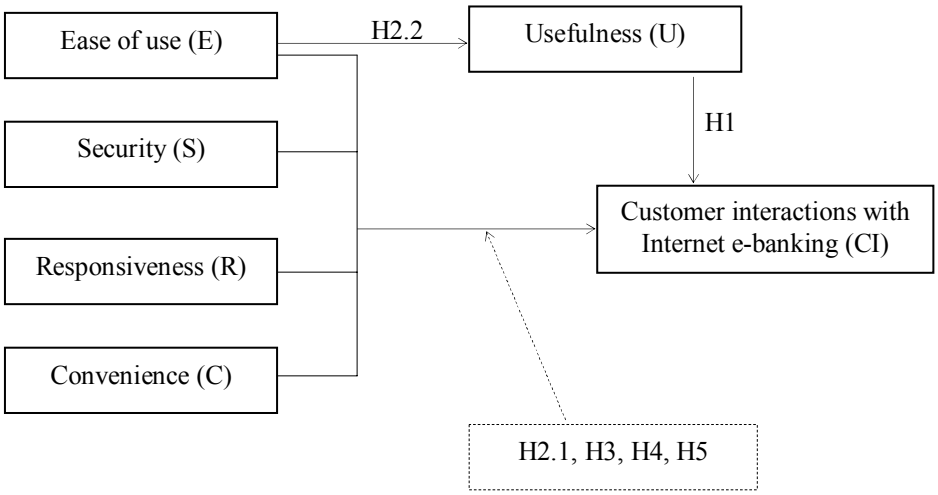
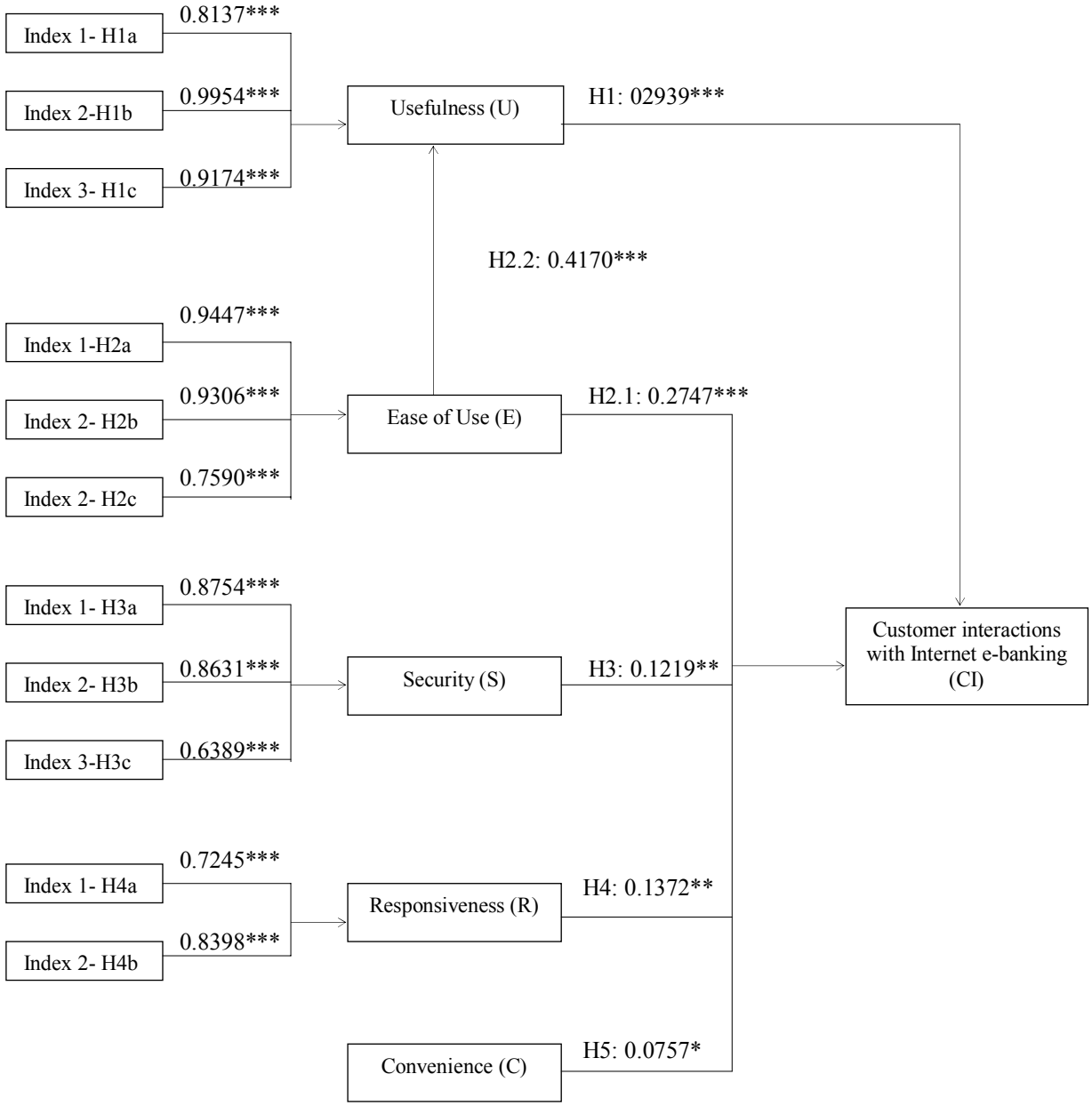


Figure 2 Empirical Results



Note: * p < 0.1, ** p < 0.05, *** p < 0.01

Table 1 Results of Exploratory Factor Analysis and Reliability Test

Construct	Item	Description of Survey Item	Factor Loading	Conbach α
Usefulness (U)	U1	Provide current banking and financial information	0.9302	0.7238
	U2	Enable real-time financial transactions	0.8788	
	U3	Facilitate investment planning	0.6047	
Ease of use (E)	E1	Present clear banking and financial information	0.8346	0.8987
	E2	Have logical navigation procedure	0.8759	
	E3	Possess intuitive search engine	0.8321	
	E4	Provide help and support to customers	0.8464	
	E5	Provide instruction to customers	0.8424	
Security (S)	S1	Restrict unauthorized access	0.8803	0.8327
	S2	Protect customer private data	0.8807	
	S3	Have rigorous security control	0.7888	
Responsiveness (R)	R1	Promptly respond to service request	0.8989	0.7606
	R2	Reliably process service request	0.8989	
Convenience (C)	C1	Enable the use of banking services anywhere at anytime		

Note: Respondents were requested to assess the importance of the survey items with regard to Internet e-banking using a seven-point Likert scale of 1-7.

Table 2 Results of Confirmatory Factor Analysis

Construct and Measurement Item	Standardized Item-Construct Loading	t-value	R-square
Usefulness (U)			
Index 1	0.8137***	17.7048	0.6622
Index 2	0.9954***	24.7869	0.9907
Index 3	0.9174***	21.3946	0.8417
Ease of Use (E)			
Index 1	0.9447***	22.3714	0.8924
Index 2	0.9306***	21.7943	0.8660
Index 3	0.7590***	15.8676	0.5761
Security (S)			
Index 1	0.8754***	18.3512	0.7664
Index 2	0.8631***	17.9894	0.7449
Index 3	0.6389***	12.1326	0.4082
Responsiveness (R)			
Index 1	0.7245***	12.1856	0.5250
Index 2	0.8398***	13.8444	0.7053
Latent variable equations			
β_1 (U $\rightarrow$ CI)	0.2939***	5.5563	0.3681
β_2 (E $\rightarrow$ CI)	0.2747***	3.6403	
β_3 (S $\rightarrow$ CI)	0.1219**	1.8987	
β_4 (R $\rightarrow$ CI)	0.1372**	2.0732	
β_5 (C $\rightarrow$ CI)	0.0757*	1.4947	
Covariance among exogenous variables			
γ_1 (U – E)	0.4170***	8.727	
γ_2 (U – S)	0.3526***	6.655	
γ_3 (U – R)	0.2867***	4.857	
γ_4 (U – C)	0.3423***	7.112	
γ_5 (E – S)	0.6067***	14.716	
γ_6 (E – R)	0.5581***	11.295	
γ_7 (E – C)	0.3863***	8.139	
γ_8 (S – R)	0.3346***	5.405	
γ_9 (S – C)	0.2529***	4.566	
γ_{10} (R – C)	0.3336***	5.918	

Note: CI: Customer Interaction; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3 Statistics of Confirmatory Factor Analysis

Goodness of Fit Index (GFI)	0.9125
GFI Adjusted for Degrees of Freedom (AGFI)	0.8469
Mean Square Residual (RMR)	0.0521
Chi-square = 211.4723: df = 52	Prob. > Chi**2 = 0.0001
Null Model Chi-square: df = 78	2889.9545
Bentler's Comparative Fit Index	0.9433
Normal Theory Reweighted LS Chi-square	200.0019
Akaike's Information Criterion	107.4723
Bentler & Bonett's (1980) Non-normed Index	0.9149
Bentler & Bonett's (1980) NFI	0.9268
Bollen (1986) Normed Index Rho1	0.8902
Bollen (1988) Non-normed Index Delta 2	0.9438
Hoelter's (1983) Critical N	108

Table 4 Summary of Empirical Findings

	Effect	Loading	Hypothesis Result
H1	Usefulness (U) → CI	0.2939***	Supported
H1a	Provision of current financial information → U	0.8137***	Supported
H1b	Enabling financial transactions → U	0.9954***	Supported
H1c	Facilitating investment planning (U	0.9174***	Supported
H2.1	Ease of use (E) (CI	0.2747***	Supported
H2.2	Perceived ease of use → U	0.4170***	Supported
H2a	Clear presentation of financial information → E	0.9447***	Supported
H2b	Intuitive search and navigation → E	0.9306***	Supported
H2c	Supportive help and instruction → E	0.7590***	Supported
H3	Security (S) → CI	0.1219 **	Supported
H3a	Restriction of unauthorized access → S	0.8754***	Supported
H3b	Protection of customer private data → S	0.8631***	Supported
H3c	Rigorous security control → S	0.6389***	Supported
H4	Responsiveness (R) → CI	0.1372 **	Supported
H4a	Prompt response to service request → R	0.7245***	Supported
H4b	Reliable processing of service request → R	0.8398***	Supported
H5	Convenience (C) → CI	0.0757 *	Supported

Note: CI: Customer Interaction; * p < 0.1, ** p < 0.05, *** p < 0.01