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The determinants of customer interactions with internet-enabled e-banking services

Z Liao[1]* and WK Wong[2]

[1]*Hong Kong Baptist University, Kowloon, Hong Kong, China; and* [2]*National University of Singapore, Kent Ridge, Singapore*

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 impacts 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. Prompt responses to service requests can encourage customers to use Internet e-banking services. The findings have managerial implications for enhancing extant Internet e-banking operations and developing viable Internet e-banking services.

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Introduction

The Internet-enabled e-banking systems have been extensively developed and implemented to integrate different banking 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 e-banking in the competitive marketplace (Dewan and Seidmann, 2001; Liao and Cheung, 2003). Internet-enabled e-banking involves great exposures in terms of usability, security and reliability. The acceptance and adoption of Internet e-banking is influenced by a number of factors in the competitive environment. As far as this is concerned, it is meaningful to measure the determinants of Internet-enabled e-banking services from consumer perspective.

The acceptance of new technology has been extensively explored. In particular, the technology acceptance model (TAM) suggested by Davis *et al* (1989) has been used to explain user behaviour across a broad range of computer-based information systems and information technologies (eg Straub *et al*, 1995; Szajna, 1996; Gefen and Keil, 1998; Anandarajan *et al*, 2000; Legris *et al*, 2003). According to Davis *et al* (1989), the TAM asserts that the influence of external variables upon user behaviour is mediated through user beliefs and attitudes based on the theory of reasoned action (Fishbein and Azjen, 1975). Both perceived usefulness and perceived ease of use are belief constructs in the TAM. Numerous studies seek to expand the TAM by incorporating additional constructs. For instance, 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 influences and cognitive instrumental processes using longitudinal data collected from four organizations. Recently, the TAM has been applied to explore electronic commerce and Internet e-banking in different contexts (eg Devaraj *et al*, 2002; Gefen *et al*, 2003a, b; Cheong and Park, 2005; Eriksson *et al*, 2005; Lai and Li, 2005).

This paper aims to measure the determinants of customer interactions with Internet-enabled e-banking services, based on the empirical data collected from individual customers in Singapore. The present work contributes to the development of knowledge in relation to this particular domain of electronic commerce, since it not

*Correspondence: Z Liao, Department of Finance and Decision Sciences, Hong Kong Baptist University, Kowloon, Hong Kong.
E-mail: zqliao@hotmail.com.

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 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 effects 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 usually apply a compensatory process to evaluate multiple attributes and gradually form their expectations (eg 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 intention to use a particular service. Barczak *et al* (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.

Firstly, perceived usefulness refers to the degree to which a user believes that using a particular system would improve job 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 behavioural intention to the use of an innovation via its influence on individual attitude (Davis *et al*, 1989). On the other hand, it captures the extent to which a potential adopter views the innovation as offering value over alternative ways

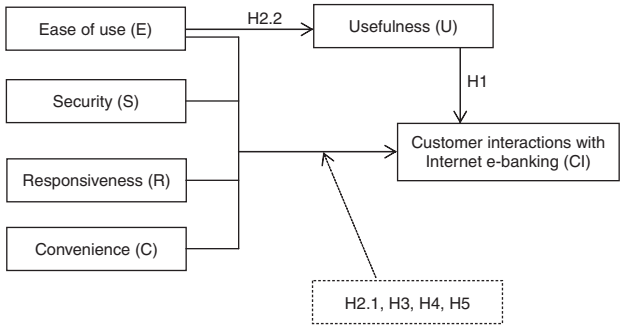

Figure 1 Research model.

of performing the same task (Agarwal and Prasad, 1999). Previous studies suggest that perceived usefulness is influenced by various variables in different environments (eg Adams *et al*, 1992; Davis, 1993). In the case of Internet e-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 services. Therefore, we would explore the following hypotheses.

H1: Perceived usefulness has 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 a person believes that using a particular system would be free of effort (Davis, 1989). Numerous studies show that perceived ease of use affects not only perceived usefulness, but also attitude towards a system, behavioral intention to use, and actual system use (eg Davis *et al*, 1989; Adams *et al*, 1992; Jackson *et al*, 1997). Dabholkar (1996) points out that customers tend to be concerned about the effort required to use technology-based self-service 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, intuitive search and navigation procedure, and the provision of instruction to use the services. The interface of Internet e-banking should be designed in the way that customers generally feel is not difficult to use. Therefore, we

would test the following hypotheses:

H2.1: Perceived ease of use has 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, previous research suggests that security is a general concern in the use of the Internet for electronic transactions (eg Lunt, 1996; Hansen, 2001; Liao and Cheung, 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 *et al*, 2001). Customers would expect a service with promised security. However, they might feel uncertain when using Internet e-banking 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 favourable attitude towards the service. Therefore, we would examine the following hypotheses:

H3: Perceived security has 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 (eg Parasuraman *et al*, 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 e-banking is not conducted face-to-face over counters (Bahia and Nantel, 2000; Bahia *et al*, 2000). Therefore, we would explore the following hypotheses:

H4: Responsiveness has 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 *et al*, 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 would propose Hypothesis 5.

H5: Perceived convenience has 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 provided by commercial banks in Singapore. Firstly, a questionnaire was designed to obtain customer feedback with respect to current Internet e-banking systems and services. It includes multiple items to test 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, 320 useful responses were received for data analysis. The sample includes 152 females and 168 males. Their ages range from 18 to over 60 years old, while the majority of the respondents are 20–50 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 modelling. The following mathematically illustrates the analytical process of our research model. Let η be the latent of customer interactions (Unobservable), ξ_1 be perceived usefulness, ξ_2 be perceived

Table 1 Results of exploratory factor analysis and reliability test

Construct	*Item*	*Description of Survey Item*	*Factor loading*	*Cronbach 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 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 requests	0.8989	0.7606
	R2	Reliably process service requests	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.

ease of use, ξ_3 be security, ξ_4 be responsiveness, and ξ_5 be convenience. We hypothesize customer interactions, y (Observable), satisfies the following relation:

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

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 represent Equation (1):

$$y = \Gamma\xi + \zeta \tag{2}$$

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 vector of the exogenous latent variables is:

$$x = \Lambda_x\xi + \delta \tag{3}$$

where $x = [x_{11}, x_{12}, \ldots, x_{1n_1}, x_{21}, x_{22}, \ldots, x_{2n_2}, x_{31}, x_{32}, \ldots, x_{3n_3}, x_{41}, x_{42}, \ldots, x_{4n_4}, x_{51}, x_{52}, \ldots, x_{5n_5}]'$ and $\xi = [\xi_1, \xi_2, \xi_3, \xi_4, \xi_5]'$.

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

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

where tr is trace (sum of the diagonal elements), S is covariance matrix of all indices for the latent variables implied by the model, C is actual covariance matrix of all indices for the latent variables, ln is 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 unidimensionality, reliability and convergent validity of the scales (Gefen *et al*, 2000). The unidimensionality 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 unidimensionality 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 *et al*, 2000).

Empirical results

As shown in Table 1, the results of exploratory factor analysis indicate that the factor loadings of all items are greater than the cutoff value of 0.4 for each factor (Gefen *et al*, 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 items associated with perceived usefulness are 0.9302, 0.8788 and 0.6047, respectively, explaining 65.45% of the variation; (ii) The factor loadings of the items in relation to perceived ease of use are 0.8346, 0.8759, 0.8321, 0.8464 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, and 0.7888, respectively, explaining 60.55% of the variation; and (iv) The factor loadings of the 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 0.7238 (Usefulness), 0.8987 (Ease of use), 0.8327 (Security) and 0.7606 (Responsiveness), which suggest that the items associated with each factor are considerably related to each other (Straub, 1989; Gefen *et al*, 2000).

The CFA has resulted in causal relationships between the endogenous variable and the exogenous variables (Figure 2). The model statistics are detailed in Table 2 and Table 3. It is a standard practice to present 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 *et al*, 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 affects perceived usefulness. In turn, perceived usefulness and other exogenous variables positively affect the endogenous variable of customer interactions.

Table 3 shows that the Goodness of Fit Index (GFI) (Bentler and Bonett, 1980) is 0.9125 and the Adjusted GFI (AGFI) is 0.8469 (adjusted for degree of freedom). According to Bagozzi and Yi (1988) and Hu and Bentler (1999), AGFI higher than 0.80 suggests a good fit of the hypothesize model. In addition, the Root Mean Square Residual (RMSR) is 0.0521. Usually, an RMSR value less than 0.1 is considered a good fit of the data to the 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 *et al*, 2000), while RMSR is a measure of the average of the residual variances and covariances (Jöreskog and Sörbom, 1989). Moreover, Bentler–Bonett Non-normed Index is 0.9149, Bollen Non-normed Index is 0.9438, and Bentler Comparative Fit Index is 0.9433. *Chi-square* statistic (211.47, d.f. = 52) further suggests the validity of constructs is statistically significant (Boudreau *et al*, 2001). The above statistics not only suggest that our hypothesized model considerably explains the causal relationships between endogenous variable and exogenous variables, but also indicates 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 (eg GFI, AGFI, and RMSR) suggest a good fit of the hypothesized model (Figure 2), and 36.81% of the variation of the endogenous variable, Customer interactions (CI) 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

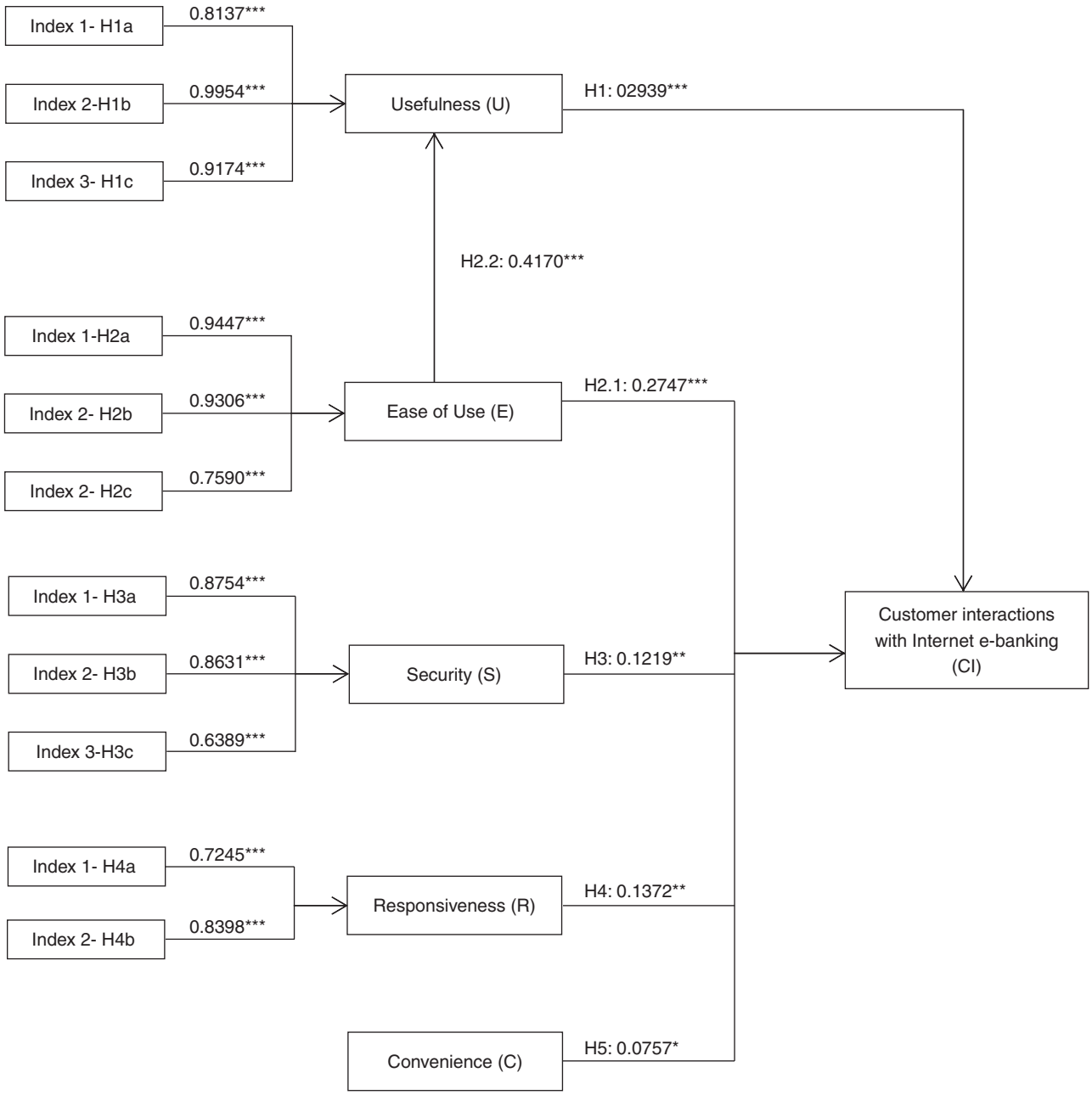

Figure 2 Empirical results.

the 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 0.7888 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 the 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

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 → CI)	0.2939***	5.5563	0.3681
β_2 (E → CI)	0.2747***	3.6403	
β_3 (S → CI)	0.1219**	1.8987	
β_4 (R → CI)	0.1372**	2.0732	
β_5 (C → 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
Adjusted GFI	0.8469
Root Mean Square Residual (RMSR)	0.0521
Chi-square = 211.4723: df = 52	Prob. > χ^2 = 0.0001
Null Model Chi-square: df = 78	2889.9545
Bentler-Bonett Non-normed Index	0.9149
Bollen Non-normed Index	0.9438
Bentler Comparative Fit Index	0.9433

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 and 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.

Discussion and implications

The present empirical work measures the effects of several constructs on customer interactions with Internet e-banking. The exploratory factor analysis and reliability analysis show that the 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 impacts 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 Internet e-banking by individual customers might vary from

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 requests → R	0.7245***	Supported
H4b	Reliable processing of service requests → R	0.8398***	Supported
H5	Convenience (C) →CI	0.0757*	Supported

Note: CI: Customer interaction; $^{*}P < 0.1$, $^{**}P < 0.05$, $^{***}P < 0.01$.

looking for financial information to carrying out transactions. At present, a practically useful Internet e-banking system can enable customers to search for 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 continuously enhance the existing Internet e-banking service operations.

Additionally, perceived ease of use remains an important attribute significantly influencing customer interactions with Internet e-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 services. Practically, different customers might have 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 that the e-banking website is aesthetically appealing and has functionalities catering to the preferences of different consumers.

Furthermore, perceived security 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 are necessary 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. 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, the 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, the banks should periodically suggest to customers that they update antivirus systems, change passwords, and do not respond to suspicious e-mails.

Finally, the responsiveness to service requests is critical to Internet e-banking services. Prompt responses to service requests can encourage individuals to use the Internet e-banking 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 analyses the impacts of several constructs based on exploratory factor analysis and confirmatory factor analysis. The results suggest that perceived usefulness, 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 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.

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