A Study on the Intention to Use of Internet Banking

A Comparison of Theoretical Models

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국문요약

　　인터넷의 확산과 함께 금융 산업에서 인터넷뱅킹의 등장은 은행 산업 전반에 많은 변화를 가져오고 있다. 인터넷뱅킹은 더 이상 단순한 정보시스템이 아닌 은행의 경쟁력을 결정짓는 중요한 요소로 부각되고 있다. 또한 국내 인터넷뱅킹 사용자의 증가로 인해 은행에서는 기존 인터넷뱅킹 사용자가 지속적으로 인터넷뱅킹을 이용할 수 있도록 여러 가지 전략을 개발하여야 할 것이다. 따라서 본 연구에서는 정보시스템 연구 분야에서 기술 수용에 대한 많은 연구들의 이론적 기반이 되었던 계획적 행동 이론(TPB)과 기술 수용 모델(TAM)을 인터넷뱅킹 이용의도 분석에 적용시켜 인터넷뱅킹 이용 행위를 실증 분석함으로써 지속적인 인터넷뱅킹 이용 의도에 영향을 미치는 요인들을 규명하고자 하였다. 더 나아가 TPB 모형과 TAM 모형을 체계적으로 비교분석하여 인터넷뱅킹 이용의도에 관한 이론적 기초를 제시하고, 인터넷 환경에서 은행의 적극적인 인터넷뱅킹 활용에 도움이 될 수 있는 실무적 시사점을 제공하고자 한다.

Key Words : Internet Banking, TPB, TAM

Ⅰ. Introduction

Internet banking becomes a major trend in the financial marketplace and the number of users of the internet banking has been increasing significantly. Internet banking is a new type of information system that uses the innovative resources of the Internet and WWW to enable customers to effect financial activities in virtual space(Shih and Fang, 2004). In case of Korea, commercial banks have been quick to realize the importance of internet banking to competitive advantage(Lee et al., 2002). Internet banking users in Korea have risen dramatically since 1999 after its introduction. Recent research conducted by The Bank of Korea(http://www.bok.or.kr) in 2006 found that the number of current internet banking users in Korea reached about 40,111 thousand(81.82% of the population of Korea). Nowadays, the internet banking is a necessary service for many banks in Korea. How to maintain and enhance customer relationships is a vital issue in a fiercely competitive environment in Korea.

Internet banking is extremely beneficial to customers because of the savings in costs, time and space it offers, its quick response to complaints, and its delivery of improved services, all of which benefits make for easier banking(Turban et al., 2000). Bank customers, now, perform their banking transactions at the place and time of their choice because of internet banking. Although internet banking may help banks to reduce costs, time and space, there are important considerations such as the factors that influence intention to use internet banking and that affect adoption to use internet banking. Research on the intention to use internet banking may, therefore, enhance the understanding of a customer's internet banking usage.

In recent years, understanding why people accept or reject computer systems such as internet banking has proven to be one of the most challenging issues in information system research(Swanson, 1988). Several theories and models have been proposed for the purpose of explaining and predicting internet banking usage behavior(Liao et al., 1999; Cho and Hwang, 2001; Suh and Han, 2002; Shih and Fang, 2004; Pikkarainen et al., 2004; Lai and Li, 2005; Cheng et al., 2006). Studies of individuals adopting internet banking are not uncommon. Most of studies have dealt with various foreign financial markets. Pikkarainen et al.(2004) stated that internet banking acceptance has gained special attention in academic studies during the past five years.

However, these studies used single model or integrated model to enable customers to accept internet banking. Although Davis et al.(1989), Mathieson(1991) and Taylor and Todd(1995b) suggested a comparison of theoretical models to increase individual's intention to use information system, there are no internet banking usage studies about a comparison of theoretical models in Korea financial marketplace. In Taiwan, Shih and Fang(2004) compared the Theory of Reasoned Action(TRA) to two versions of the Theory of Planned Behavior(TPB) to provide useful results to help internet banking enterprises understand internet banking usage. They extended Taylor

and Todd's(1995b) comparison of the theoretical models and adopted resonable fit and explanatory power to compare their models. User behavior in Korea may differ from overseas. Therefore, understanding of Internet Banking usage behavior can formulate appropriate strategies for banks on how to maximize the rate of internet banking adoption in Korea. These considerations are also very vital to the practitioners who plan and promote internet banking in the current competitive market.

This paper is a comprehensive research in terms of using two theoretical models including TPB and Technology Acceptance Model(TAM) to understand internet banking usage behavior in Korea. The purpose of this research is to test the ability of theoretical models to predict and explain user acceptance of internet banking. In addition, this study compares two theoretical models. The models are compared on two criteria suggested by the study of Davis et al(1989), Mathieson(1991), Taylor and Todd(1995b), Shih and Fang(2004) and Hansen et al.(2004) for a fair comparison. First, how well do they predict an individual's intention to use internet banking? If one model predicts intention better than another, it can provide a more accurate picture of the issues that developers should consider in addressing system acceptability. Second, how valuable is the information provided by the models? If the models do not offer information that can guide development of internet banking, they will not be beneficial to system analysts. TPB and TAM are compared using data from a survey of 202 individuals considering a decision to adopt and use internet banking in Korea.

Ⅱ. Literature review

2.1 TPB

The TPB, proposed by Ajzen(1985, 1991), extends the TRA(Fishbein and Ajzen, 1975), to account for conditions where individuals do not have complete control over their behavior. According to the TRA, a person's performance of a specified behavior is determined by his or her behavioral intention(BI) to perform behavior, and behavioral intention is jointly determined by the person's attitude(A) and subjective norm(SN)(Fishbein and Ajzen, 1975). In order to extend the TRA to the prediction of non-volitional behavior, Ajzen(1988, 1991) suggested TPB by incorporating an additional construct, namely perceived behavior control(PBC). In the TPB, shown in Figure 1, the more favorable the attitude and subjective norm with respect to a behavior and the greater the perceived behavioral control, the stronger should be an individual's intention to perform the behavior under consideration(Ajzen, 1991).
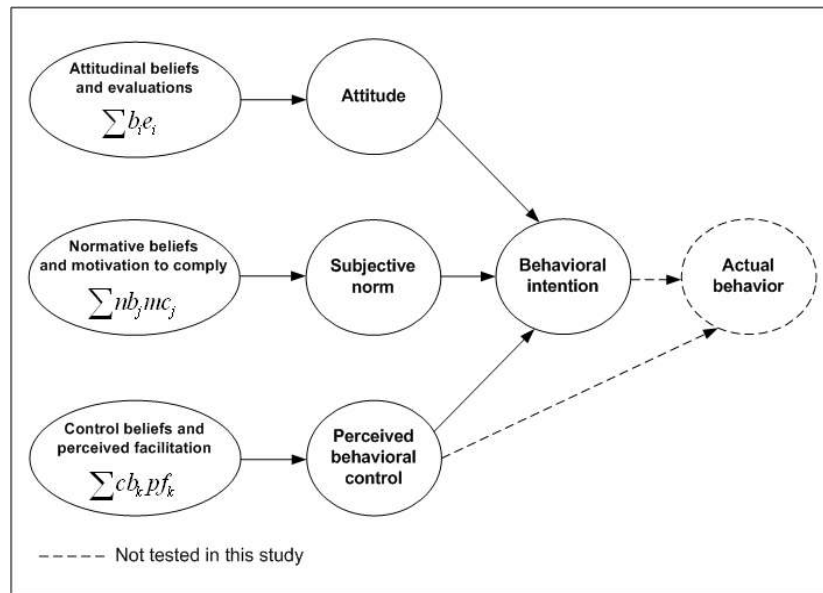
⟨Figure 1⟩ Theory of Planned Behavior

Behavioral intention is a measure of the strength of one's intention to perform a specified behavior(Fishbein and Ajzen, 1975). Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior. As a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance(Ajzen, 1991).

Attitude is defined as an individual's positive or negative feelings about performing the target behavior(Fishbein and Ajzen, 1975). The affective component of attitudes has a like/dislike connotation(Thompson et al., 1994). Attitude is determined by his or her salient beliefs(b_i) about consequences of performing the behavior multiplied by the evaluation(e_i) of those consequences: $A = \sum b_i e_i$.

Subjective norm refers to the person's perception that most people who are important to him think he should or should not perform the behavior. Thompson et al.(1994) argued that subjective norm is a social factor. Triandis(1971) defines a social factor as a general construct that reflects individual norms, roles, and values, which are in turn influenced by subjective culture variables including referent group. Subjective norm represents an individual's normative beliefs(nb_j) concerning a particular referent individuals or groups multiplied by the motivation to comply(mc_j) with that referent(Fishbein and Ajzen, 1975): $SN = \sum nb_j mc_j$.

Perceived behavior control reflects beliefs regarding access to the resources and opportunities needed to perform

a behavior(Ajzen, 1985, 1991; Ajzen and Driver, 1992). Some conception of perceived behavior control includes in the form of "facilitating factors"(Triandis, 1977), "the context of opportunity"(Sarver, 1983), "resources"(Liska, 1984), or "action control"(Kuhl, 1985). Perceived behavior control depends on control beliefs(cb_k) weighted by perceived facilitation(pf_k): $PBC = \sum cb_k pf_k$. The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior. In the TPB, the attitudinal belief structures($\sum b_i e_i$), normative belief structures($\sum nb_j mc_j$) and control belief structures($\sum cb_k pf_k$) are combined into unidimensional constructs(Taylor and Todd, 1995a, 1995b).

Liao et al.(1999) used the TPB and Innovation Diffusion to study individual's intention toward adopting internet banking in Hong Kong. They postulated that the TPB only partly explained relationships, in that behavioral intention is a function of attitude and subjective norm. Cho and Hwang(2001) also used the TPB to study intention toward adopting internet banking in an Korea financial market. They suggest that behavioral intention to use internet banking is formed by attitude, subjective norm, and perceived behavioral control. Shih and Fang(2004) tested the usefulness of a number of IT adoption models to internet banking adoption. These models were the TPB, both in pure and decomposed form, and the TRA. They concluded that both TPB and TRA produce a good fit to the data, although the decomposed TPB model has better explanatory power for behavioral intention, attitude and subjective norm than the TRA and pure TPB models.

For our empirical case of Internet banking, attitudinal belief(b_i) refers to an individual's confidence that Internet banking represents faster, easier and more convenient banking services. The associated evaluation(e_i) would be the importance of improving banking services. For example, an individual may believe that using internet banking will result in better banking services, and may consider this a highly desirable outcome. The normative belief(nb_j) refers to an individual's perception of the use Internet banking by families, friends or colleagues. This perception plays the significant role in influencing the referent group's opinion. The relevant motivation to comply(mc_j) is the importance he or she attaches to the opinions of families, friends or colleagues. For instance, an individual may believe that his or her peers think that one should use internet banking and that complying with the wishes of peers is relatively important. The control belief(cb_k) refers to knowing how to perform transactions via internet banking. An individual who is skillful in using a computer and the internet is more inclined to adopt internet banking. Perceived facilitation(pf_k) refers to externally based resource constraints such as time, technological infrastructures and resources. In fact, banking services will be more feasible when resources become easily and readily available. For example, an individual may feel that he or she has the skill to use internet banking and that skill level is important in determining internet banking usage. In addition, attitudinal belief structure($\sum b_i e_i$),

normative belief structure($\sum nb_j mc_j$) and control belief structure($\sum cb_k pf_k$) are monolithic belief sets.

Although it is difficult to estimate eventual system use, an individual's intention to use the system can be measured. There is considerable evidence that intention to perform a behavior predicts actual behavior(Sheppard et al., 1988). Sheppard et al.(1988) stated that there would be a significant and substantial relationship between individuals' intentions and behavior. Therefore, actual behavior is not tested in this study.

2.2 TAM

TAM was developed to explain the effect of the user's perception of system characteristics on the user acceptance of information system(Davis, 1989). TAM(Davis, 1989; Davis et al., 1989), adapted from TRA, appears to be the most widely accepted among information systems researchers. The technologies include electronic mail, text editor, word processing system, graphics software, internet banking, spreadsheets and database management systems(Davis, 1989; Davis et al., 1989; Hendrickson et al., 1993; Szajna, 1994; Cheng et al., 2006). The main reason for its popularity is perhaps its parsimony, as well as its wealth of recent empirical support(Agarwal and Prasad, 1999). While TRA is a general theory of human behavior, TAM is specific to information system usage(Mathieson et al., 2001).

TAM shows that two particular beliefs, perceived usefulness(PU) and perceived ease of use(PEU), are most relevant to information system acceptance behaviors. Figure 2 presents the TAM model. TAM states that the two beliefs determine the attitude towards using information system. Davis(1981) defined perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance", and perceived ease of use as "the degree to which an individual believes that using a particular system would be free of physical and mental effort".
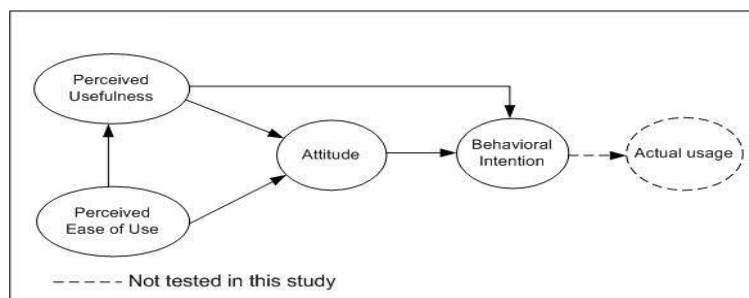
〈Figure 2〉 Technology Acceptance Model

According to TAM, perceived usefulness is also influenced by perceived ease of use because, other things being equal, the easier the system is to use more useful it can be(Venkatesh and Davis, 2000). Similar to TRA, TAM postulates that actual usage is determined by behavioral intention, but differs in that behavioral intention is viewed as being jointly determined by the attitude and perceived usefulness. TAM dose not include TRA's subjective norm as a determinant of behavioral intention, because Davis(1989) estimated that subjective norm had negligible effect on behavioral intention.

Suh and Han(2002) conducted an investigation based on the TAM to analyze customer acceptance of internet banking in Korea. They claimed TAM as an appropriate model for explaining acceptance in the context of internet banking. Pikkarainen et al.(2004) applied the traditional TAM in Finland and found that perceived usefulness of, and information on, online banking were the main factors influencing customer acceptance. With the model, it is argued that actual behaviour is determined by perceived usefulness and perceived ease of use which are related to attitude and thereby to actual use. Lai and Li(2005) applied different levels of invariance analysis on the TAM construct in the context of internet banking acceptance in Hong Kong. They concluded that the TAM construct was invariant for their internet banking users across different gender, age, and information technology competence subgroups. Cheng et al.(2006) developed a theoretical model based on the TAM with an added construct perceived web security, and empirically tested its ability in predicting customers' behavioral intention of adopting internet banking in Hong Kong. The results of their study provide support of the TAM model.

For our empirical case of Internet banking, perceived usefulness refers to the individual belief that using the internet banking will enhance banking services. Internet banking allows customers to access their banking accounts from any location, at any time of the day and so provides enormous advantage and to users. Perceived ease of use refers to individual belief that using a internet banking will be easy to understand, learn or operate. As the internet is very user friendly with its "point and click" interface, it is likely that potential customers may feel that internet banking services are less complex to use, and hence are more likely to use them. Actual behavior, also, is not tested in this study. Agarwal and Prasad(1999) 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.

Ⅲ. Research Methodology

3.1 Subjects

To determine user intention to adopt internet banking, a survey was conducted during the first half of 2005.

Questionnaires were distributed to 300 personal banking customers who use internet banking in Korea. Participation in the study was voluntary and was limited to customers with at least one bank account. A total 202 usable, complete responses were obtained; 55 respondents were female. These respondents ranged in age from 15 to over 55, but most(77.7%) were between 20 and 40. Most respondents(93.1%) had higher vocational training or university education. In addition, over half of the participants(62.4%) reported that they worked for a company; 17.8% were students. Detailed descriptive statistics relating to the respondents' characteristics are shown in Table 1.

<Table 1> Descriptive statistics of respondents' characteristics

Measure	Value	Frequency	Percentage
Gender	Male	147	72.77
	Female	55	27.23
Age	<20	3	1.49
	20-29	89	44.06
	30-39	68	33.66
	40-49	36	17.82
	>50	6	2.97
Education	Some high school or less	14	6.93
	Some university or Bachelor's degree	97	48.02
	Some graduate or more	91	45.05
Occupation	Student	36	17.82
	Company employee	114	56.44
	Public official	7	3.47
	Specialist	20	9.90
	Self-employed	12	5.94
	other	13	6.43

3.2 Measurements

A questionnaire using a 7-point scale was employed to collect the data for the constructs of the three research models. Items from previous studies were modified for adaptation to the Internet banking context.

<Table 2> Measurement items of internet banking

Construct	Item	Questionnaire	Studies
Behavioral intention	BI1	I plan to use internet banking.	Fishbein and Ajzen(1975) Ajzen and Fishbein(1980) Ajzen(1985, 1991) Davis(1989) Davis et al(1989)
	BI2	I will frequently use internet banking in the future.	
	BI3	I will add internet banking to my favorite links.	
	BI4	I will strongly recommend others to use internet banking.	
Attitude	A1	I feel using internet banking is a wise idea.	
	A2	I like to use internet banking	
	A3	My attitude towards internet banking is favorable.	
	A4	I think it is good for me to use internet banking.	
Subjective norm	SN1	Most people who are important to me would think that using internet banking is a wise idea.	Fishbein and Ajzen(1975) Ajzen and Fishbein(1980) Ajzen(1985, 1991) Mathieson(1991) Taylor and Todd(1995a, 1995b) Yoh(1999)
	SN2	Most people who are important to me would think that using internet banking is a good idea.	
	SN3	Most people who influence my behavior would think that I should use internet banking.	
Perceived behavioral control	PBC1	I would be able to operate internet banking.	
	PBC2	I have the knowledge to use internet banking.	
	PBC3	I have the ability to use internet banking.	
	PBC4	Using internet banking is entirely within my control.	
Attitudinal belief structures $(\sum b_i e_i)$	b1	Using internet banking will save time.	Fishbein and Ajzen(1975) Ajzen and Fishbein(1980) Ajzen(1985, 1991) Mathieson(1991) Taylor and Todd(1995a, 1995b) Cho and Hwang(2001) Shih and Fang(2004)
	e1	The use of internet banking will save time is important to me.	
	b2	Using internet banking has more advantages.	
	e2	The advantages of internet banking are important to me.	
	b3	The internet banking will be easy to learn.	
	e3	The internet banking will be easy to learn is important to me.	
	b4	Using internet banking will fit well with my lifestyle.	
	e4	The internet banking that fit well with my lifestyle is important to me.	
Normative belief structures $(\sum nb_j mc_j)$	nb1	Most people would think that I should use internet banking.	
	mc1	Generally speaking, I want to do what most people think I should do.	
	nb2	My friends would think that I should use internet banking.	
	mc2	Generally speaking, I want to do what my friends think I should do.	
	nb3	Bank tellers would think that I should use internet banking.	

	mc3	Generally speaking, I want to do what bank teller think I should do.	
Control belief structures ($\sum cb_k pf_k$)	cb1	I have enough knowledge to operate internet banking.	
	pf1	Knowing enough to operate internet banking is important to me.	
	cb2	I could access network easily to use internet banking.	
	pf2	Accessing network easily to use internet banking is important to me.	
	cb3	I have the time to use internet banking.	
	pf3	Having the time to use internet banking is important to me.	
Perceived usefulness	PU1	Using internet banking will save time.	Venkatesh and Davis(2000) Suh and Han(2002) Lai and Li(2005) Cheng et al et al(2006)
	PU2	Using internet banking has more advantages.	
	PU3	Using internet banking will improve my performance in conducting banking services.	
Perceived ease of use	PEU1	The internet banking will be easy to learn.	
	PEU2	It is easy to use internet banking to accomplish my banking tasks.	
	PEU3	The internet banking will be easy to operate.	

A questionnaire using a 7-point scale was employed to collect the data for the constructs of the three research models. Items from previous studies were modified for adaptation to the Internet banking context. The measurement items of behavioral intention and attitude were common to TPB(Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Ajzen, 1985, 1991) and TAM(Davis, 1989; Davis et al., 1989). The measures of subjective norm, and perceived behavioral control were adapted from various studies related to TPB, Mathieson(1991), Taylor and Todd(1995a, 1995b) and Yoh(1999), in particular. To be specific, the items used for attitudinal belief structures, normative belief structures and control belief structures were redesigned from Mathieson(1991), Taylor and Todd(1995a, 1995b), Cho and Hwang(2001) and Shih and Fang(2004). In addition, the measures of perceived usefulness and perceived ease of use were adapted from studies related to TAM, Venkatesh and Davis(2000), Suh and Han(2002), Lai and Li(2005) and Cheng et al(2006), in particular. A summary of the Questionnaire items is shown in Table2.

Ⅳ. Results

The three research models were analyzed using the structural equation modeling(SEM) technique, supported by

SPSS10.0 software and AMOS4.0 software. Data analysis proceeded in two stages. The measurement model was first examined for validating and refining the research instrument, as well as assessing reliability. Then, our research models including TPB and TAM were tested.

4.1 Reliability and validity of measurement model

The internal consistency reliability using SPSS10.0 was assessed by computing Cronbach's alpha. The value range from 0.7368(for $\sum nb_j mc_j$) to 0.9156(for perceived behavioral control). Hair et al.(1998) suggested that the lowest limit for Cronbach's alpha be 0.70. All constructs in our research model demonstrated acceptable reliability. Two items, BI3 and b4e4, was dropped from the test of reliability, because these items did not load well on their underlying constructs. These coefficients are represented for each of the constructs in Table 3.

<Table 3> Results of internal consistency reliability

Construct	Item	Cronbach's alpha
Behavioral intention (BI)	BI1, BI2, BI4	0.8504
Attitude (A)	A1, A2, A3, A4	0.8999
Subjective norm (SN)	SN1, SN2, SN3	0.8794
Perceived behavioral control (PBC)	PBC1, PBC2, PBC3, PBC4	0.9156
$\sum b_i e_i$	b1e1, b2e2, b3e3	0.8197
$\sum nb_j mc_j$	nb1mc1, nb2mc2, nb3mc3	0.7368
$\sum cb_k pf_k$	cb1pf1, cb2pf2, cb3pf3	0.9118
Perceived usefulness (PU)	PU1, PU2, PU3	0.8761
Perceived ease of use (PEU)	PEU1, PEU2, PEU3	0.8239

A confirmatory factor analysis using AMOS4.0 was conducted to examine the convergent and discriminant validity of the constructs. The fit of the overall measurement model was estimated by various indices. Firstly, in the measurement model of TPB, the ratio of χ^2 to degrees-of-freedom(χ^2/DF) was used, and a value of 2.346 was obtained, which is within the suggested value of 3. Also note the goodness-of-fit(GFI) and adjusted goodness-of-fit(AGFI) were 0.902 and 0.855, respectively. The normalized fit index(NFI) and comparative fit index(CFI) were two other indices of fit. We observed values of 0.927 and 0.957 for NFI and CFI indicating

good model fit, because values are greater than 0.9 representing reasonable model fit. Convergent validity could also be assessed by factor loadings and squared multiple correlations from the confirmatory factor analysis shown in Table 4. The composite reliabilities range from 0.847(behavioral intention) to 0.925(perceived behavioral control) which exceed the recommended level of 0.70. The variance extracted measures range from 0.649(behavioral intention) to 0.758(perceived behavioral control) which also exceed the recommended level of 0.50(Hair et al., 1995).

Secondly, in the measurement model of TAM, χ^2/DF was 2.349, which is also within the suggested value of 3. GFI, AGFI, NFI and CFI were 0.906, 0.854, 0.925 and 0.955, respectively. Convergent validity could also be shown in Table 5. The composite reliabilities range from 0.843(Perceived ease of use) to 0.902(attitude) which exceed the recommended level of 0.70. The variance extracted measures range from 0.645(Perceived ease of use) to 0.704(attitude) which also exceed the recommended level of 0.50(Hair et al., 1995). In addition, R^2 were above 0.5 in all cases. The result, therefore, demonstrate convergent validity of the measurement models.

<Table 4> Results of convergent validity test: TPB

Factor	Item	Standardized loading	Standard error	R^2	Composite reliability	Variance extracted
Behavioral intention	BI1	0.773	0.795	0.597	0.847	0.649
	BI2	0.768	0.765	0.590		
	BI4	0.872	0.304	0.760		
Attitude	A1	0.833	0.394	0.694	0.902	0.698
	A2	0.811	0.570	0.658		
	A3	0.819	0.399	0.670		
	A4	0.878	0.259	0.771		
Subjective norm	SN1	0.870	0.302	0.758	0.883	0.716
	SN2	0.895	0.220	0.802		
	SN3	0.768	0.579	0.590		
Perceived behavioral control	PBC1	0.863	0.255	0.745	0.925	0.758
	PBC2	0.938	0.118	0.880		
	PBC3	0.951	0.082	0.904		
	PBC4	0.708	0.577	0.502		

·χ^2/DF=2.346; GFI=0.902; AGFI=0.855; NFI=0.927; CFI=0.957; PNFI=0.723

·The belief structures($\sum b_i e_i$, $\sum nb_j mc_j$, $\sum cb_k pf_k$) are combined into unidimensional constructs.   They are monolithic belief sets. (Standardized loading=1.000, R^2=1.000)

<Table 5> Results of convergent validity test: TAM

Factor	Item	Standardized loading	Standard error	R^2	Composite reliability	AVE
Behavioral intention	BI1	0.771	0.801	0.594	0.847	0.650
	BI2	0.774	0.745	0.600		
	BI4	0.869	0.310	0.755		
Attitude	A1	0.831	0.399	0.690	0.902	0.698
	A2	0.813	0.566	0.660		
	A3	0.820	0.396	0.673		
	A4	0.877	0.261	0.769		
Perceived usefulness	PU1	0.804	0.529	0.647	0.877	0.704
	PU2	0.832	0.438	0.693		
	PU3	0.879	0.408	0.772		
Perceived ease of use	PEU1	0.863	0.421	0.745	0.843	0.645
	PEU2	0.878	0.306	0.771		
	PEU3	0.647	0.945	0.418		

· χ^2/DF=2.349; GFI=0.906; AGFI=0.854; NFI=0.925; CFI=0.955; PNFI=0.700
·AVE: Average Variance Extracted

Discriminant validity can be tested by comparing the squared correlation between tow constructs with their respective variance extracted measure. Table 6 shows the squared correlation of each pair of constructs and the variance extracted measures. The variance extracted measures of each construct are in the diagonal. It shows that all squared correlations between two constructs are less than the variance extracted measures of both constructs.

<Table 6> Squared correlations between two constructs

TPB	1	2	3	4
1. Behavioral intention	(0.649)			
2. Attitude	0.509	(0.698)		
3. Subjective norm	0.211	0.265	(0.716)	
4. Perceived behavioral control	0.340	0.341	0.066	(0.758)

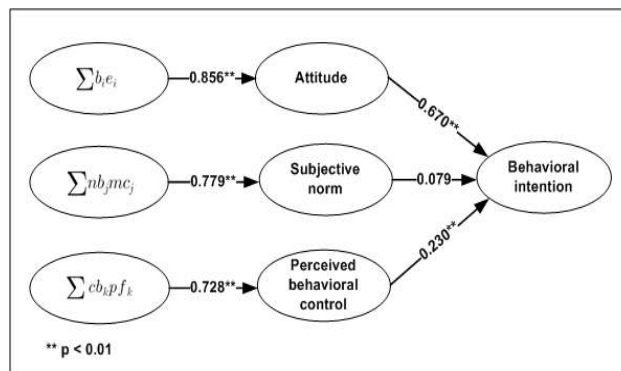| TAM	1	2	3	4
1. Behavioral intention	(0.650)			
2. Attitude	0.487	(0.698)		
3. Perceived usefulness	0.276	0.328	(0.704)	
4. Perceived ease of use	0.278	0.333	0.321	(0.645)

·( ) Average Variance extracted

4.2 Structure models

After assessing the reliability and validity, the hypothesized paths in models were tested by the AMOS4.0 software to which a matrix of correlation between the variables was input, using the maximum likelihood estimated. For each model, overall fit, predictive power and the significance of paths were considered. R^2 for each dependent construct was examined to assess explanatory power, and the significance of individual paths was assessed.

4.2.1 Model 1: TPB

The fit statistics indicate that the TPB model provides a good fit to the data (x^2/DF=2.010, p<0.01; GFI=0.892, RMSEA=0.071; AGFI=0.849, NFI=0.919, RFI=0.898, CFI=0.957; PGFI=0.636, PNFI=0.736). In terms of predictive power, the TPB accounts for over half of the variance in all four dependent variables(R^2_{BI}=0.763, R^2_A =0.732, R^2_{SN}=0.607, R^2_{PBC}=0.529). Attitude, subjective norm, and perceived behavioral control explain 76.3% of the variance in behavioral intention to use internet banking. Thus, overall the TPB model performs well.
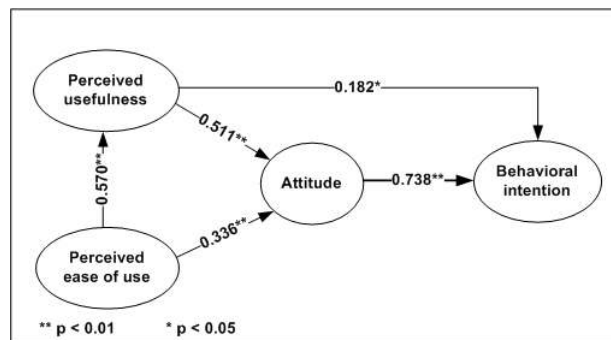

<Figure 3> Path coefficients for the Model 1: TPB

As indicated in Figure 3, attitudinal belief structures(0.856; p<0.01), normative belief structures(0.779; p<0.01) and control belief structures(0.728; p<0.01) are significant determinants of attitude, subjective norm and perceived behavioral control, respectively. Attitude(0.670; p<0.01) and perceived behavioral control(0.230; p<0.01) are significant determinants of behavioral intention. Attitude has a slightly stronger effect on behavioral intention than perceived behavioral control. However, subjective norm(0.079; p=0.204) is not significantly related to behavioral intention. The indirect effect of attitudinal belief structures is represented by the 0.573 path coefficient(0.856×0.670; p<0.01), the indirect effect of normative belief structures is 0.062(0.779×0.079; p<0.01) and the indirect effect of control belief structures is 0.167(0.728×0.230; p<0.01). Attitude and attitudinal belief structures had significant direct and indirect effects on behavioral intention to use internet banking. Perceived behavioral control and control belief structures also had significant direct and indirect effects on behavioral intention. However, Normative belief structures had only a small indirect effect on behavioral intention.

4.2.2 Model 2: TAM

The fit statistics indicate that the TAM model also fits the data reasonably well (x^2/DF=1.620, p<0.01; GFI=0.934, RMSEA=0.056; AGFI=0.897, NFI=0.949, RFI=0.932, CFI=0.980; PGFI=0.595, PNFI=0.706). In terms of predictive power, the TAM accounts for over half of the variance in all three dependent variables (R^2_{BI}=0.768, R^2_A=0.570, R^2_{PU}=0.325). Attitude and perceived usefulness explain 76.8% of the variance in behavior intention to use internet banking.

〈Figure 4〉 Path coefficients for the Model 2: TAM

As indicated in Figure 4, perceived ease of use(0.570; p<0.01) is a significant determinant of perceived usefulness. Perceived usefulness(0.511; p<0.01), and perceived ease of use(0.336; p<0.01) are significant determinants of attitude. Although attitude(0.738; p<0.01) and perceived usefulness(0.182; p<0.05) are significant

determinant of behavioral intention, attitude has a greatly stronger effect on behavioral intention than perceived usefulness. The indirect effect of perceived usefulness is represented by the 0.377 path coefficient(0.511×0.738; p<0.01), the indirect effect of perceived ease of use is 0.567(p<0.01).

<Table 7> Standardized path coefficients of TPB and TAM

Path	TPB		TAM	
	Path coefficient	p−value	Path coefficient	p−value
A → BI	0.670**(0.103)	0.000	0.738**(0.108)	0.000
SN → BI	0.079 (0.068)	0.204	-	-
PBC → BI	0.230**(0.082)	0.000	-	-
$\sum b_i e_i$ → A	0.856**(0.004)	0.000	-	-
$\sum nb_j mc_j$ → SN	0.779**(0.007)	0.000	-	-
$\sum cb_k pf_k$ → PBC	0.728**(0.003)	0.000	-	-
PU → BI	-	-	0.182* (0.083)	0.024
PU → A	-	-	0.511**(0.078)	0.000
PEU → A	-	-	0.336**(0.064)	0.000
PEU → PU	-	-	0.570**(0.069)	0.000

·( )Standard errors, **p<0.01, *p<0.05
·BI: behavioral intention, A: attitude, SN: subjective norm, PBC: perceived behavioral control, PU: perceived usefulness, PEU: perceived ease of use

Both TPB and TAM, shown in Table 7, indicate that attitude(in TPB 0.670; in TAM 0.738) is the major determinant of behavioral intention. In the TPB models, the lack of a significant subjective norm(SN)-behavioral intention(BI) effect is found. In the TAM, the path from perceived usefulness to behavioral intention is significant on p<0.05, and the other path coefficients are significant on p<0.01.

4.2.3 Model comparison

This study adopted resonable fit and explanatory power to evaluate two theoretical models and determine which version was best(Davis et al, 1989; Mathieson, 1991; Taylor and Todd, 1995b; Shih and Fang, 2004; Hansen et al., 2004). First, Compared fit indices between TPB and TAM, our TAM has a higher ability to explain behavioral intention to use internet banking. Table 8 shows fit indices for TPB model and TAM model.

<Table 8> Fit indices and for each of the hypothesized models

FIT (Recommended value)		Models	
		TPB	TAM
Absolute fit indices	χ^2/DF (≤ 3.000)	2.010	1.620
	P (≥ 0.050)	0.000	0.000
	GFI (≥ 0.900)	0.892	0.934
	RMSEA (0.050~0.080)	0.071	0.056
Incremental fit indices	AGFI (≥ 0.800)	0.849	0.897
	NFI (≥ 0.900)	0.919	0.949
	RFI (≥ 0.900)	0.898	0.932
	CFI (≥ 0.900)	0.957	0.980
Parsimony fit indices	PGFI (≥ 0.600)	0.636	0.595
	PNFI (≥ 0.600)	0.736	0.706

Second, the R^2 for each dependent construct, shown in Table 9, is used to assess predictive power. TPB explains 76.3% of the variance in behavioral intention and TAM explains 76.8%. The TAM model has better explanatory power for behavioral intention than the TPB model. It appears that TPB explains attitude much better than TAM(0.732 for TPB and 0.570 for TAM). However, this results may be due to the fact that there is a strong correlation between attitudinal belief structures and attitude.

<Table 9> R^2 for each of the hypothesized models

R^2	Models	
	TPB	TAM
R^2_{BI}	0.763	0.768
R^2_{A}	0.732	0.570
R^2_{SN}	0.607	-
R^2_{PBC}	0.529	-
R^2_{PU}	-	0.325

Our findings support Mathieson(1991), who in a study of user intention also found that TAM explains intention to use information system much better than TPB(0.693 for TAM and 0.601 for TPB). Davis et al.(1989) found that TAM(0.47 at time 1 and 0.51 at time 2 for TAM) predicted software usage intention better than the TRA(0.32 at time 1 and 0.26 at time 2 for TRA).

Ⅴ. Discussion and Conclusion

This study tests two models, TPB and TAM, in terms of their contribution to the understanding of internet banking usage. The aim was to test the ability of theoretical models and to provide useful results to help internet banking enterprises understand individuals' intention to use internet banking. Our analytical results show that TPB model and TAM model exhibit reasonable fit to the data based on the measures presented in Table 8. The TAM model provides the significantly best fit to the data and offers the best prediction of internet banking usage. We also adopted explanatory power to evaluate the models and determined which version was best. TAM model has the best explanatory power for behavioral intention.

5.1 Understanding behavioral intention

Since behavioral intention is the most important determinant of internet banking usage in all three models, it becomes important to examine the direct and indirect influences of other factors on behavioral intention. TAM explains 76.8% of the variance in behavioral intention, TPB explains 76.3%.

First, our TPB has an ability to explain behavioral intention to use internet banking. Attitude explains behavioral intention in TPB. The addition of subjective norm and perceived behavioral control provides some additional insight into behavioral intention. In addition, attitudinal belief structures, normative belief structures, contrail belief structures are related to attitude, subjective norm and perceived behavioral control, respectively. However, the path from subjective norm to behavioral intention failed to achieve significance. According to Mathieson(1991), Liao et al.(1999) and Shin and Fang(2004), behavioral intention is not predicted by subjective norm. In the early stages of user experience where user interaction with the target system has been somewhat limited, even if an individual does not have a favorable reaction to the information system, the individual will tend to comply with others' views and use the target system to attain a favorable reaction from important referents(Venkatesh and Morris, 2000). As direct experience with technology increases over time, however, individuals have a better assessment of the benefits and costs associated with using that technology. Even if their original decision was based on others'

opinions, individuals begin to internalize others' opinions especially if they are consistent with the results of their own direct experience. Thus, the direct effect of subjective norm on behavioral intention is reduced(Oliver and Bearden, 1985; Warshaw, 1980). Reinecke et al.(1996) has shown that the direct effect of subjective norm on intention is strong in the early stages of new behavior and tends to wear off over time. The research of Venkatesh and Morris(2000) suggests that the influence of people diminishes to non-significance over time with increasing experience with the target system. In our research, more than 75 percent of the sample respondents had at least two years' experience with the internet banking. They may be good at operate internet banking services. In addition, the Bank of Korea in 2006 indicated that internet banking in Korea has already become essential and is broadly accepted.

Second, in the TAM, both perceived usefulness and perceived ease of use explain attitude, and behavioral intention can be explained by attitude. In addition, perceived ease of use has significant effect on perceived usefulness. TAM differs from the other two models in that it allows a direct link from perceived usefulness to behavioral intention. The direct effect of perceived usefulness is significant in our TAM. Individual would directly rely on his or her perception of usefulness to form his or her behavioral intention. Suh and Han(2002) and Cheng et al.(2006) postulate that TAM fully explain relationships, in that behavioral intention is a function of attitude and perceived usefulness. Cheng et al.(2006) also studied their research based on the TAM. They concluded that perceived usefulness is a major determinant of customer's intention to use internet banking and perceived ease of use is a significant secondary determinant of customer's intention.

5.2 Comparison and Selection of models

This discussion provides some guidelines for choosing between two models. Clearly, all two models were empirically strong and provided good predictions of individuals' intentions to use internet banking. In the introduction, two criteria were suggested for comparing the models. First of all, the first criterion was the models ability to predict intention to use internet banking. TAM explained intention towards using internet banking better than TPB. The result of TPB was similar to Ajzen(1991) who concluded that the inclusion of perceived behavioral control significantly improved the prediction of behavioral intention. Thus, TPB suggests specific effect of perceived behavioral control and provides greater insight into the factors that influence internet banking usage. However, our result that TAM slightly outperformed TPB is similar to Taylor and Todd(1995b).

The second criterion was the value of the information provided by the models. Davis(1989) has developed standard instruments for TAM. TAM supplies very general information about perceived usefulness and perceived ease of use(Mathieson, 1991). On the other hand, TPB could delivers more detailed information and measures belief structures. For example, while TAM might show that respondents feel that a system is marginally useful,

TPB would show which of a set of outcomes was not being achieved. In other words, TAM would tell developers that internet banking was not easy to use, but would not identify other issues that might prevent internet banking use. Moreover, the information TPB offers is probably more useful during early stages of user experience or first interaction with systems than the information TAM provides. TPB can focus on new systems or innovative systems because of constructs which could provide the information of social pressures and action control.

In short, each model has clear strengths. If the central goal is the prediction of internet banking usage during any stages, it can be argued that TAM is preferable. However, if internet banking managers and researchers are interested in more specific information of internet banking usage during early stage, TPB provides a fuller understanding of usage behavior and intention.

5.3 Limitations

By explaining usage intention from a user's perspective, the findings of this research can not only assist the development of better user-accepted internet banking, but can also provide insight into how to promote the new information technology to potential users. Despite this, the study has some potential limitations. First, although behavioral intention to use internet banking was measured, the relationship between intention and behavior was not. However, this is not a serious problem because TPB and TAM predict behavior from intention(Sheppard et al., 1988; Mathieson, 1991). Second, various internet banking systems are used by many different people. We limited our research only in Korea. In other situations, subjective norm may influence behavioral intention. Lastly, there is a need to search for additional variables that can improve our ability to more accurately predict usage intention. These limitations may provide a meaningful research area for the future.

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