The Determinants of Consumers' Adoption of Internet Banking

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Abstract

The purpose of the study is to investigate determinants of Internet banking adoption based on an individual's benefits and costs of adopting Internet banking. Using data from the 2001 Survey of Consumer Finances, this paper estimates an adoption model for Internet banking. Our findings show that consumers' ability, attitude and opportunity cost of time play a significant role on the decision of adopting Internet banking. Younger and well-educated consumers are more likely to adopt Internet banking. However, when individual's age associated with the level of education, the age effect varies across education groups. Among people with a low educational background, the effect of age on the probability of adopting Internet banking is hump-shaped. However, among people with a higher educational background, the probability of using Internet banking decreases with age. This study also investigates differences across households that use checks, ATM or debit card, direct payment and Internet banking as the payment methods. Our findings show that there are significant differences in terms of the demographics of these households that use different payment methods. The results of our study will help banks and financial institutions to implement successful distribution strategies and consumer educators to guide consumers on how better to use banking services.

Keywords: Technology Adoption, Internet banking, Payment Method

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1. Introduction

For over a decade, information technologies have significantly affected the banking industry. Banks and other financial institutions have improved their functions as a financial intermediary through adopting various information technologies (Chang, 2002; Gourlay & Pentecost, 2002; Hannan & McDowell, 1984; Haynes & Thompson, 2000; VanHoose, 2003). Generally, when the information technologies combine with functions of banks and financial institutions, it is called electronic banking.[1] Electronic banking technologies have led banks and financial institutions to improve effectiveness of distribution channels through reducing the transaction cost and increasing the speed of service (Chang, 2002; VanHoose, 2003). From the consumers' perspective, electronic banking technologies allow consumers easier access to financial services, lower bill-paying, and time saving in managing their finances (Anguelov, Hilgert & Hogarth, 2004). Due to the advantages for both suppliers and consumers in the financial market, electronic banking services have rapidly grown in the U.S. For example, Anguelov et al. (2004) reported that the average number of electronic technologies used by an average U.S household increased from 1.4 in 1995 to 2.5 in 2001, while the average number of non-electronic technologies did not change during the same period.

Among various banking technologies, Internet banking, which is the act of conducting financial intermediation on the Internet (VanHoose, 2003) is the latest banking technology and the most rapidly diffused banking technology in the U.S. For example, Anguelov et al. (2004) stated that U.S households that use Internet banking

[1] According to the Oxford English Dictionary (2004), electronic banking is banking transactions carried out electronically (in later use, especially via the Internet), without involving the physical deposit or receipt of cash or checks; maintenance of a bank account by means of computer and telecommunications equipment and software.

increased from 4.1% in 1995 to 21% in 2001. Electronic Payment International (2001) indicated that 39% of U.S households had access to Internet banking, and 18% of them used the service. Also, Pastore (2001) predicted that 87% of community banks would offer Internet banking in 2003 to meet consumers' needs.

Internet banking has advantages for banks to maintain competition, to save costs, to enhance mass customization, marketing and communication activities, and to maintain and attract consumers (Daniel and Storey, 1997; Mols, 2000; Read, 1998; Sheshunoff, 2000; and Tomkin and Baden-Fuller, 1998). The primary advantage of Internet banking is to save time and cost. Lee and Lee (2001) indicated that Internet banking allows consumers easier access to their bank accounts, lower service charges, and time saving. Moreover, Chang (2002) showed that Internet banking had a low transaction cost and a high speed of service when compared to other banking services. For example, while the cost of transaction for money transfer was 95¢ for checking and 27¢ for ATM, while it was only 1¢ for Internet (Chang, 2002).

Although consumers have had an interest in advanced electronic banking services and tended to have various financial sources or tools for money transactions, they have not quickly changed their main propensity to use banking services or goods that they are already familiar with. For example, new electronic banking goods or services have not quickly substituted for traditional ones and non-electronic banking goods or services. Although various electronic banking services have emerged since the ATM was introduced 30 years ago, a lot of consumers still use checks as a primary source for money transactions, and banks still have a lot of "bricks and mortar" branches in the market. According to the Survey of Consumer Finances in 2001, about 60% of household

heads used checks as a primary source. Furthermore, the number of bank branches expanded from about 65,000 to about 73,000 from 1994 to 2003, even though the number of U.S banks fell from about 12,500 in 1994 to about 9,000 during the same period (Hirtle & Metli, 2004). In spite of the emergence of a series of advanced electronic banking services, both consumers and banks still regard non-electronic banking as one of the important sources for money transaction.

Internet banking has not yet become mainstream (Kolodinsky, 2004). This means that both marketers in banks and financial institutions, and consumer educators still need to make an effort to understand the factors which lead to the adoption of Internet banking. Although many researchers have investigated consumers' adoption behavior for Internet banking (Gerrard and Cunningham, 2003; Jun and Cal, 2001; Lee et al., 2003; and Tan and Teo, 2000), the literature on the adoption of Internet banking in the marketing field has largely focused on motivation factors (Bradley and Stewart, 2002). When we think that the primary advantage of Internet banking is to save time and cost, investigating adoption of Internet banking based on time and cost might be more appropriate. These factors might be more directly related to adoption of Internet banking than attitude or perception factors. At the same time, adopting Internet banking can be costly in terms of the time spent on learning to use a new technology. If an individual thinks that a choice of Internet banking is more costly and less beneficial, he/she might not adopt Internet banking even though he/she has a positive attitude toward Internet banking. Internet banking is based on computer technology and the Internet, so individuals need to learn the basic tools before they use the service. Therefore, individuals should invest time and money to learn to adopt Internet banking. Some people are ready to use Internet banking

since they are familiar with the technology, while others are not. Therefore, we need to study adoption of Internet banking based on benefit and cost.

The purpose of the study is to investigate determinants of Internet banking adoption based on individuals' benefits and costs of adopting Internet banking. This paper uses the 2001 Survey of Consumer Finances (SCF), which includes data related to consumers' electronic banking usage including Internet banking in the U.S. Specifically, the study investigates the probability of adopting Internet banking among consumers who have different ability, opportunity cost of time and attitude towards Internet banking. We also study the determinants of the using the following payment methods: i) checks, ii) checks and ATMs or debit cards, iii) checks, ATMs or debit cards and direct payment, and iv) checks, ATMs or debit cards, direct payment and Internet banking.

This study differs from previous literature in two significant ways. First, we aim to show how the demographic factors are associated with individuals' benefits and costs of adopting Internet banking. Although many researchers, such as Daniel (1999), Jayawardhena and Foley (2000), Karjaluoto et al. (2002), Mattila (2001), and Sathye (1999), indicated that demographic factors were significant in their adoption model, they did not explain why the demographic factors had an impact on adoption of Internet banking. Gerrard and Cunningham (2003) included perceived economic benefits as one of the variables in their model. They indicated that consumers perceived Internet banking to have no economic benefits because many consumers already had no fees or nominal transaction fees to their bank. However, they failed to notice economic benefits from time saving which may have more effect on benefits than lowering the transaction fees. Also, many previous researchers have investigated the determinants of Internet banking

adoption based on the theory of planned behavior (TPB), the diffusion of innovation theory, and the technology acceptance model (TAM) which is different than the focus of our paper.[2]

Second, there are a few empirical studies of consumers' adoption of Internet banking that use U.S data. Consumers' adoption behavior has been investigated with European, Asian, and Australian data sets (Chang, 2002; Daniel, 1999; Gerrard and Cunningham, 2003; Jayawardhena and Foley, 2000, Karjaluoto et al., 2002; Mattila, 2001; Pikkarainen et al., 2004; Polatoglu and Ekin, 2001; Sathye, 1999; Tan and Teo, 2000). Some researchers, like Jun and Cal (2001), Lee and Lee (2001), and Lee et al. (2003), used U.S data. However, Lee and Lee (2001) obtained data through online surveys of non-adopters of Internet banking, and Jun and Cal (2001) measured service quality with a Bulletin Board Service (BBS) on an Internet bank website. Lee et al. (2003) used a nationwide data set, the 1999 Survey of Consumers. However, their study did not specifically focus on Internet banking service, but electronic banking technology services including Internet banking.

[2] For example, Tan and Teo (2000) used TPB and the diffusion of innovation theory as a conceptual framework. Their framework had three factors; attitude, which indicated personal perception towards Internet banking; subjective norm, which indicated social influence; and perceived behavioral control, which indicated beliefs about having necessary resources and opportunities to use Internet banking. Tan and Teo (2000) asserted that these three factors influenced consumers' intention to use Internet banking, and this intention influenced adoption of Internet banking. In their results, attitude and perceived behavioral control were significant factors that helped form consumers' intention. Attitude variables included relative advantage, compatibility, complexity, trialability, and risk. Gerrard and Cunningham (2003) and Lee et al. (2003) examined the determinants of Internet banking adoption based on the diffusion of innovation theory. These studies also used similar variables to those adapted in Tan and Teo's (2000) study to represent attitude. Pikkarainen et al. (2004) used TAM which included perceived usefulness, perceived ease of use, perceived enjoyment, information on online banking, security and privacy, and quality of Internet connection. In their results, only perceived usefulness and amount of information were statistically significant. Jun and Cal (2001) adapted service quality measure as a framework. They emphasized customer service quality including responsiveness, reliability, and access; online systems quality including ease of use and accuracy; and banking service including product quality.

The remainder of this paper is structured as follows. The next section describes the methodology and constructs the empirical framework. The third section describes the data, and the fourth section presents the empirical findings. The final section summarizes the results and their implications for policy.

2. Model

We assume individuals' consumption behavior is based on their past consumption, current situation (tastes, prices and income), and future expectations. In addition to this basic perspective, the Beckerian theory of consumer behavior emphasized time, which is non-augmentable resource, as an explanation of consumption behavior. Becker (1971) revised the consumption model using commodities and time to produce a specific good. This resultant model made it possible to explain the relationship between opportunity cost of time for labor participation and consumption, through combining time value and price of commodities within budget constraints. As time was considered in the consumption model, effects of time saving products could be investigated within the model. Ekelund and Watson (1994) indicated that time-saving technologies or goods for households all can be explained within the Beckerian nexus.

Internet banking is the latest banking technology which has advantages of saving time and cost. Internet banking can be regarded as one of the inputs for a money transaction. Consumers will have different responses to Internet banking because they have different ability, opportunity cost of time and attitude towards Internet banking. [3]

[3] Because this study will be conducted with a cross-sectional data set, we cannot investigate the sensitivity of prices and wage rate, and we regard price and wage rate as constants in this study.

Based on these assumptions, the following adoption function is formulated. Specifically, this function follows Trajtenberg's (1989, 1990) approach which assumed that a consumer will accept a new product if the difference between the utility of the new product (U_{new}) and the utility of existing one (U_{old}) exceed some threshold value ($\delta>0$),

$$(U_{new} - U_{old}) > \delta,$$

where U_{new} is the utility function for different goods and services including a new commodity, Internet banking, for money transactions.

The consumers maximize their utility within a subset for money transactions,

$$U_i = f(X_i, t_i ; R),$$

X_i is a vector of input for different goods for technology i, t_i is a vector of inputs of time for technology i, and R is a proxy variable for tastes for new and old technologies. We create a new adoption function by substituting the utility function above;

$$[f(X_{new}, t_{new} ; R) + \epsilon_{new}] - [f(X_{old}, t_{old} ; R) + \epsilon_{old}] > \delta,$$

where i=new denotes the new technology, and i=old denotes the old technology, ϵ_i is the effect of unobserved factors. The above equation can be rewritten as follows:

$$-\eta < U^*,$$

where $U^* = f(X_{new}, t_{new} ; R) - f(X_{old}, t_{old} ; R) - \delta$, and $\eta = \epsilon_{new} - \epsilon_{old}$.

From the function above, this study investigates which consumers (who have different tastes) are more likely to adopt Internet banking, so the dependent variable has a binary code, whether consumers adopt Internet banking or not. The model has a probability function as follows:

$$Y = f(Z, \beta) + \varepsilon, \quad Y = 0, 1$$

$$\Pr(\text{Internet banking is adopted, or } Y=1) = \Pr(-\eta < U^*)$$

$$\Pr(\text{Internet banking is not adopted, or } Y=0) = 1 - \Pr(-\eta < U^*),$$

where Z includes past experiences of banking technologies to reflect the past consumption pattern, experience of computer software for managing money as a proxy for computer skills, demographic factors such as age, education, income, occupation, financial assets, and time horizon value for future spending and saving as a proxy for future expectation or planning.

Through the function above, it is possible to determine which factors will significantly affect consumers' adoption behavior for Internet banking. Also, this investigation will capture individuals' specific threshold value for the adoption of Internet banking. We now develop the hypothesis regarding the demographic factors that would affect individual's benefit and cost of adopting Internet banking.

Computer skills and past consumption. One may well expect that there exist interconnections between technologies such that the diffusion of any technology is not independent of the diffusion of another technology (Stoneman and Kwon, 1993). Internet banking is one of the technologies, that is quite dependent on computer networks. Also, it is an advanced technology over previous banking technologies. Bayus (1987) and Norton and Bass (1987) noted that a consumer's willingness to adopt a new technology is affected by his or her prior pattern of adopting related technologies, and the influence of one technology on the next generation of that innovation is expected to be positive especially when the relationship between two technologies is complementary.

Karjaluoto et al. (2002) indicated that prior computer experience such as Internet, e-mail, and e-payment had the most significant impact on online banking usage, and also technology experience, such as ATM, e-ID, teletext, and automats, was a significant

factor for attitude toward online banking among Finland bank consumers. Prior experience of technologies, especially prior experience of computers, had impact on consumer beliefs and attitudes towards related systems and technology (Arndt et al., 1985; DeLone, 1988; Igbaria et al., 1995; Karjaluoto et al., 2002; Levin & Gordon, 1989).

Lee and Lee (2001) indicated that heavy usage of banking service was the most significant factor in the adoption of Internet banking among non-adopters, and prior Internet purchase behavior was also a significant factor, but not as much as the usage of related banking technologies. Lee and Lee (2001) employed the use of banking service as a proxy variable indicating consumers' need for banking service, and they indicated that heavy users of banking services might adopt Internet banking as a convenient option that can save time and effort. However, if consumers have no experience of previous banking technologies, they might find it hard to adopt recent banking technology. They might not be comfortable and lack the confidence to use Internet banking, even though they think Internet banking is necessary. Therefore, in order to investigate the relationship between banking technologies, it is more appropriate to study the effect of the use of related banking technologies such as ATM, debit cards and direct payments instead the use of banking service.

Consumers who have more ability to use banking technologies and computer software for managing money than others might more easily adopt Internet banking. Their ability might improve their efficiency in the use of Internet banking. Specifically, they might invest less time and money to learn use Internet banking, so they might be able to save more time and cost than others and that would affect their attitude towards Internet banking. Although consumers who have no experience in the use of banking

technologies and computer software also recognize the benefit of Internet banking, they might hesitate to adopt Internet banking because they need to invest more time and money to learn Internet banking.

In this study, prior experience of computer software for managing money will be used as a proxy for prior computer experiences. Also, the prior experience of banking technologies like ATM, debit cards, direct deposit and direct payments will be used as the variables to determine adoption of Internet banking.

H_1: Compared to consumers who have no experience in the use of computer software for managing money, consumers who have experienced computer software for managing money are more likely to adopt Internet banking.

H_2: Compared to consumers who have no experience in the use of banking technologies, consumers who have experienced banking technologies are more likely to adopt Internet banking.

Age, Income and Financial Assets. In addition to the past experience in the use of computer software and of other banking technologies, the demographics factors should effect the adoption of Internet banking. Age affects the attitude of individuals towards Internet banking and their ability to learn how to invest. We expect to find that consumers in the young age group are more likely to invest the time to learn to use Internet banking because young consumers can create more benefits through time saving.

H_3: Compared to consumers in other age groups, younger consumers are more likely to adopt Internet banking.

In addition, consumers with higher income have higher value of time than consumers with lower income, so consumers with high income can create more benefits

through adoption of Internet banking. Also, consumers with higher levels of financial assets benefit from the time saving advantages of Internet banking since they use money transactions more often.

H_4: Compared to consumers in the low income and financial asset groups, consumers in the high income and financial asset groups are more likely to adopt Internet banking.

Education and Occupation. Bartel and Sicherman (1998) indicated that more educated individuals may require less training in response to technological change if their general skills enable them to learn the new technology. Gronau and Hamermesh (2001) investigated differences in demand according to differences in the opportunity costs of various activities. They indicated that well educated individuals have better home productivity than less educated individuals because they can produce household goods with relatively smaller inputs and time. Also, well educated individuals have relatively higher income. Therefore, well educated individuals have greater value of time than less educated individuals.

Consequently, well educated individuals will respond more quickly than less educated individuals when Internet banking, which has advantages for saving of time and cost, is introduced. It is hypothesized that well educated individuals will adopt Internet banking relatively more quickly than less educated individuals because the new technology, Internet banking, guarantees reduction of the time needed for money transactions. Well educated individuals might be willing to submit training time to learn how to use Internet banking because they have the skills to acquire the knowledge quicker. However, the effect of education on adopting Internet banking should also

depend on the age of the consumer. For example, the attitude of a college graduate towards adopting Internet banking is different at age 35 than 65 because the benefits and costs of adopting are different.

H_5: Compared to less educated consumers, well educated consumers are more likely to adopt Internet banking. However, the effect of education on adopting Internet banking also depends on the age of the consumer.

Karjaluoto et al. (2002) showed that occupation was a significant factor for adoption of Internet banking. They divided occupation into two groups, white-collar workers and blue-collar workers. White-collar workers were more likely to adopt Internet banking than blue-collar workers. Highly paid skilled workers are more likely to use advanced technologies (Liu et al., 2001) because they can improve their productivity through using advanced technologies within a given time.

In this study, occupation is associated with adoption of Internet banking in terms of ability. If consumers have relatively more opportunity to use computer or Internet in their workplace than others, their ability to use technologies related to computer or Internet might be higher than others. We divide consumers into two groups according to types of occupations. Consumers who have managerial, professional, and technical jobs are included in the first group. In general, they probably use computers or the Internet frequently in their workplace, so they basically have more ability to use computer or the Internet than those in the other group. Consumers who have service, labor, farming, fishing, and forestry jobs are included in the second group. They probably have less

opportunity to use computers or the Internet in their workplace, so their ability to use computers or the Internet might be relatively weaker than the first group.[4]

H_6: Compared to consumers who have service, labor, farming, fishing, and forestry jobs, consumers who have managerial, professional, and technical jobs are more likely to adopt Internet banking.

Time Horizon for Spending and Saving. This study uses time horizon value, which indicates future planning for saving and spending, to represent future value. Generally, time horizon has been used as a standard to estimate level of risk and potential return in the financial sector. Researchers including Boudoukh and Richardson (1993); Browne et al. (2003); Fama (1975); Fuller and Petry (1981); Levy (1984); and Lloyd and Haney (1980) investigated how time horizon was associated with the level of risk and return on various kinds of investments. Generally, if individuals have a longer time horizon, they are classified as individuals with lower levels of risk aversion. They have much time to invest and they might want to consider placing at least some of their money in higher risk investments to maximize potential returns. If individuals have a shorter time horizon, they are classified as individuals with higher level of risk aversion because they will probably want to limit their risk even more. Individuals who have a long time horizon realize the benefit of Internet banking, they might be willing to adopt Internet banking, even though they are not familiar with computers and the Internet, because they are ready to invest time and money to maximize their benefits, which affects their attitude towards Internet banking.

[4] We assumed that consumers who have managerial, professional, and technical jobs are more familiar with the use of computer or Internet in their workplace than those who have service, labor, farming, fishing, and forestry jobs. However, we agree that this categorization may be a problematic in terms of generalization due to the lack of a verified standard in the academic literatures.

H_7: Compared to consumers who have a short time horizon for spending and saving, consumers who have a long time horizon for spending and saving are more likely to adopt Internet banking.

3. Data

Data used in this analysis are from the 2001 Survey of Consumer Finances (SCF) which is sponsored by the Federal Reserve Board of Governors. The data were collected by interviews. The data provide detailed information related to the finances of U.S. families. In this study, the sample consists of the 4,442 households. Among the 4,420 households, 1,079 households used Internet banking as a method for conducting financial business.

Internet banking adoption was measured by the response to the question, "What are the main ways (you do/your family does) business with financial institutions [-by check, by ATM (cash machine), by debit card, in person, by mail, by talking with someone on the phone, by touchtone service on the phone, by direct deposit or withdrawal, by computer or online service, by other electronic transfer, or some other way]?" The response, "computer/Internet/online service," is coded as "1." Other responses are coded as "0." Therefore, the Internet banking adopters in this study are those who use computer, Internet, and online service as a method to conduct financial business.

To identify Internet banking adopters, usage of computer software for managing money as proxy for computer skill, usage of banking technologies (cash machine/ATM, debit card, direct deposit, and direct payment), other demographic factors, and time

horizon factor are used as independent variables in this study. Demographic variables include age, income, education, occupation and financial assets. The variables are defined in Table 1.

3.1 Descriptive Statistics

Descriptive statistics of the households are also presented in Table 1. Among respondents, 18.84% of households used computer, Internet or online service as a method for financial transaction. Approximately 18% of respondents used computer software for managing their money. The percentages of households using ATMs and debit cards were 69.07% and 47.02%, respectively. Also, 67.31% and 40.53% of households use direct deposit and direct payment, respectively. Approximately 53% of respondents had occupations that provide an environment for using computer or Internet frequently. About 59% of respondents reported that that had less than 5-year time planning for saving and spending.

Summary statistics on households that adopt Internet banking are presented in Table 2. Internet banking adopters and non-adopters differed significantly by use of computer software for managing money, use of other banking technologies, age, income, education, occupation, time horizon and financial assets. In the usage of computer software, although individuals who have used the computer software for managing money accounted for 48.12% among adopters, their proportion among non-adopters was 11.03%. Usage rate of other banking technologies had a similar result. Individuals who have used ATMS and debit card occupied a larger portion among both adopters (90.57% and 68.56%) than non-adopters (64.97% and 42.02%). Furthermore, those who used direct deposit and direct payment accounted for 82.57% and 68.56% among adopters,

respectively, whereas their proportion were 63.77% and 36.23% among non-adopters, respectively. Consumers under the age of 50 were more likely and consumers above age 65 are less likely to adopt Internet banking.

In case of time horizon, the proportion of adopters with a long planning horizon for saving and spending (58.45%) was larger than the proportion of non- adopters with a long planning horizon for saving and spending (37.42%). Occupation had a similar result to time horizon. The proportion of adopters who have a job related to computer technologies or Internet (76.80%) was larger than the proportion of non-adopters who have a job related to computer technologies or Internet (47.05%). The results also showed that individuals who are well-educated, have high income and financial assets are more likely to adopt Internet banking.

4. Results

For the main analysis, this study uses probit regression to investigate the determinants of Internet banking adoption. The results of probit regression for Internet banking adoption are presented in Table 3. The regression was conducted in two ways in this study, with and without the interaction terms for age and education of the household head. The marginal effects were calculated at the respective weighted sample means.

Compared to household heads who do not use computer software for managing money, those who use computer software were 20.07% more likely to be an Internet banking adopter. Also, compared to household heads who have not used banking technologies, those who have used it were more likely to adopt Internet banking. For example, household heads who have used ATMs and debit cards were 7.12% and 5.07%

more likely to be an Internet banking adopter. Similarly, household head who have used direct deposit and direct payment were 3.08% and 5.72% more likely to adopt Internet banking. The estimation results showed that education had a positive relationship with the adoption of Internet banking. An increase of one year increased the probability of adopting Internet banking by about 1.44%. Compared to household heads who do not have occupations related to using computers or the Internet, those who have occupations related to using computers or the Internet frequently were 4.40% more likely to adopt Internet banking. Household heads with a long planning horizon for saving and spending were more likely to adopt Internet banking. The probability of adopting Internet banking decreases by the age of the household head. For example, compared to household head who are younger than age 35, those who are between age 35-50 and 50-65 were 6.32% and 13.37% less likely to adopt internet banking, respectively. Finally, the probability of adopting internet banking increases significantly by the level of the financial assets.

The second model included the interaction term of age and education. The interaction terms were significant and negative, showing that as education level of the household head increases, the age effect increases (in absolute terms). For most of the variables, the magnitude of marginal effects were about the same as the first model. Only the marginal effect of age and financial assets become smaller when the interactions terms for education and age are included in the model.

Using the estimated coefficients of Model 2 in Table 3, we calculated the probability of adoption of Internet banking by age and education and these results are presented in Table 4. All of the other variables were held constant at their respective sample means. For each age group, the probability of adopting internet banking increased

with education. For example, among those below age 35, the probability of adoption Internet banking is 16.69% for those with 12 years of schooling and 35.53% for those 16 years of schooling, while the probability is equal to 5.98% for those 8 years of schooling. The effect of age was different across different age groups. Among those with low levels of education (8 years of schooling), the effect of age was hump- shaped. However, among people with higher educational background, the probability of using Internet banking decreased significantly with age.

4.1 Comparison of Internet banking users with check, ATM, debit card and direct payment users

In this section, we compare the determinants of using Internet banking to other methods of payment such as check, ATM, debit card and direct payment. Using the same question we used to identify Internet banking users, we categorized respondents who use i) checks, ii) checks and ATM or Debit card, iii) checks, ATM or Debit card and direct payment, and iv) checks, ATM or debit card, direct payment and Internet banking. Table 5 provides a detailed comparison of the demographics of households classified by the method of payment that they use. Overall, our sample contains 879 households who use only checks, 902 households who use checks, ATM or debit cards, 481 households who use checks, ATM or debit card and direct payment, 395 households who use checks, ATM or debit card, and direct payment and Internet banking, and finally 1,785 households that either do not own an account at a financial institution or do use a different combination of payment methods. Table 5 indicates that financial and demographic characteristics are different across methods of payments that household utilize. Specifically, while only 7.6% of check users reported having a prior computer

software experience, 48.8 % of checks, ATM or debit card, direct payment and Internet Baking users reported having prior computer software experience. We observe a similar trend with direct deposit experience. Similarly, households with younger heads and those that have higher education and those with longer time horizon for spending and saving were more likely to use multiple payment methods. As the household income and financial assets increased, households were more likely to use multiple payment methods.

We assume that there is no natural ordering of choices among various methods from which a consumer can choose. Given this assumption, we employed a multinomial logistic regression framework to perform the analysis appropriate when the dependent variable takes on multiple discrete but, unordered, values. We excluded 1,785 households who reported using a combination of other payment methods, and we allowed the dependent variable to take on values of 1-4 depending on whether the households use i) checks, ii) checks and ATM or Debit card, iii) checks, ATM or Debit card and direct payment, and iv) checks, ATM or debit card, direct payment and internet banking. Table 6 provides the results of the multinomial logit estimation. The comparison group was the group of households who use ii) checks and ATM or Debit card and the estimated coefficients discussed here are in comparison to this group. The coefficient estimates show that differences across households who use i) checks, ii) checks, ATM or debit card, and iv) checks, ATM or debit card, direct payment and Internet banking were more pronounced than differences between households who use ii) checks, ATM or debit card and iii) checks, ATM or debit card, direct payment. Younger household were less likely to use i) checks and more likely to use iv) checks, ATM or debit card, direct payment and Internet banking. Education had a significant effect on the payment methods that

households use. As the education level increased, households were more likely to use iii) checks, ATM or debit card, direct payment and iv) checks, ATM or debit card, direct payment and Internet banking, and less likely to use i) checks. However, household income was only significant for households who use i) checks. Those who use direct deposits were more likely to use iii) checks, ATM or debit card, direct payment and iv) checks, ATM or debit card, direct payment and Internet banking, and less likely to use i) checks. Also, those who have previous computer experience were less likely use i) checks and more likely to use iv) checks, ATM or debit card, direct payment and Internet banking. Time horizon for spending and saving had only a significant effect for household who use iv) checks, ATM or debit card, direct payment and Internet banking. Finally, financial assets did not play a significant role on use of i) checks. However, the probability of use of iii) checks, ATM or debit card, direct payment and iv) checks, ATM or debit card, direct payment and Internet banking increased significantly with financial assets.

5. Conclusion

Using data from the 2001 SCF, this study investigated the effect of household demographics on Internet banking adoption behavior, through comparing costs and benefits. The results showed that all hypothesis regarding individuals' ability and opportunity cost of time were supported. Age had different significance according to the level of education. As mentioned in the results section, consumers who are younger, affluent, well-educated, with computer ability, with experience of other banking technologies, with occupation related to computer or Internet, and with a long time

horizon for saving and spending are more likely to adopt Internet banking. When age was interacted with the level of education, the effect of age on the adoption of Internet banking varied across different education groups. Among consumers with a low level of education, the effect of age on the adoption of Internet banking was hump- shaped. However, among consumers with the high level of education, the probability of adopting decreases with age.

Thus, this study showed that ability and opportunity cost of time have significant impacts in explaining consumers' adoption behavior for Internet banking. Also, this study showed that consumers' benefit and cost associated with attitude should be considered to decide the determinants of Internet banking adoption. This study showed that consumers' past consumption pattern, current situation, and future expectations influenced Internet banking adoption. Although all independent variables were analyzed by comparison between individuals' benefit and cost, the nature of each variable is based on the past, present, and future consumption.

Since the new law, Financial Services Modernization Act in 1999 loosened previous restrictions on the permissible activities for U.S financial institutions, the U.S financial market has been more competitive. All of the various financial institutions can have the same functions in the financial market. Therefore, the financial institutions have tried to exert competitive power in the market through various ways such as affiliations with other financial companies, downsizing their physical facilities, and expanding their service scope. In this situation, Internet banking has been attractive to the financial sector. Companies can expect to save a lot of the cost of maintaining their large physical distribution systems by adopting Internet banking. Although many financial companies

have realized the advantages of Internet banking and launched this service, the companies have not obtained a lot of benefits yet because some consumers have not been ready to adopt Internet banking. Therefore, financial companies need to make an effort to provide information about Internet banking based on accurate customer segmentation. The results of this study will help marketers in the financial companies to build distribution strategies for Internet banking.

This study showed that usage of other banking technologies had a significant impact on Internet banking adoption. This means that customers, who have mainly depended on traditional banking services such as checks, mail, and phone, have lower probabilities to adopt Internet banking. Therefore, at first, retailers or marketers in banks and other financial companies should focus on customers who have already used other banking technologies to boost usage of Internet banking. However, if financial companies have not had various banking services, it is really difficult to grasp which consumers have experience of other banking technologies. The companies may not have information about their customers' degree of use of other banking technologies. Financial companies need to have various banking services within a consolidated distribution system to grasp and also to meet customers' needs. If a financial company has only a few functions or a small number of distribution channels, the company will find it difficult to survive in the market. Internet banking is growing. Affiliations and business alliances can be an efficient way to increase Internet banking use because marketers or retailers in the financial companies can segment customer groups more accurately based on customers' various use of banking services.

Internet banking was born in the financial market by home-financial management software companies' alliance with banks (VanHoose, 2003). This study showed that the usage of computer software for managing money was a significant factor for Internet banking adoption. Moreover, Karjaluoto et al. (2002) indicated that consumers with a good knowledge of computers are generally more likely to engage in online banking usage. Therefore, computer education might be more important than simple promotion or advertising for Internet banking use. Financial companies have usually provided guidance on how to use Internet banking on the web. This might be one way of marketing to promote Internet banking. Also, assuring the security of the Internet transactions to costumers might positively affect consumers' attitude towards adoption and use of Internet banking. The companies can expect computer-literate consumers to react more positively to advertising on the web. However, online advertising and promotion might not be attractive to all computer-literate consumers. Lee and Lee (2001) indicated that consumers who use the Internet for the purpose of fun or enjoyment were not likely to adopt Internet banking. Financial companies cannot directly approach their target consumers with random advertising on the web. Therefore, the companies need to approach their customers more directly with a long term perspective.

Providing computer education at the physical distribution facility can be an effective way for financial companies to boost Internet banking use. If banks provide computer education in their branches, their own customers will be educated. They might be willing to use Internet banking later. Computer education will be more effective in recruiting Internet banking customers than random advertising and promotion. Also, as Anguelov et al. (2004) indicated, consumer educators need to help consumers understand

how to use computers and Internet for a wide range of financial management tasks, including Internet or computer banking and comparison shopping for financial products and services.

This study showed that demographic factors, age, income, education, occupation were significant factors for Internet banking adoption. Although the demographic factors were less important statistically in explaining consumers' adoption behavior for Internet banking than computer skill and experience of other banking technologies, these factors can provide basic information for marketers or retailers in the financial sector to segment their consumers. One important finding of this study is that among consumers with the high level of education, age is not a standard for segmentation.

This study has some limitations. First, the variable, past consumption for other banking technologies was measured by four banking technologies based on questions in the 2001 SCF. It is not known whether each individual had adopted Internet banking before he/she used other technologies. Second, the question to measure the dependent variable, Internet banking adoption, includes individuals' various sources for transaction business, so individuals could mark various sources for transaction business in the questionnaire. Future studies need to define the Internet banking adopters more carefully. Finally, this study used a cross-sectional data set, so it is difficult to estimate adoption rates for Internet banking, actual opportunity cost, and shadow price in the function. Longitudinal data might be more useful in investigating the diffusion rate, the rate of converting from non-adopters to adopters, the factors influencing the conversion, and so on.

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Table 1. Measurement of Variables and Descriptive Statistics for the 2001 SCF (Weighted Values) (N = 4,442)

Variables	Measurement	Mean (S. D.)	Frequency
Dependent variable			
Households that adopted Internet banking	1 if households use Internet banking, 0 otherwise		18.84%
Independent variables			
Computer software experience	1 if households use computer software for managing money, 0 otherwise		18.02%
Banking technologies experience (ATM)	1 if households use ATM, 0 otherwise		69.79%
Banking technologies experience (debit card)	1 if households use debit card, 0 otherwise		47.02%
Banking technologies experience (ddeposit)	1 if households use direct deposit, 0 otherwise		67.31%
Banking technologies experience (dpayment)	1 if households use direct payment, 0 otherwise		40.53%
Age			
Below 35	1 if households below age 35, 0 otherwise		22.74%
35-50	1 if households between 35 and 50, 0 otherwise		33.82%
50-65	1 if households between 50 and 65, 0 otherwise		23.38%
Above 65	1 if households above age 65, 0 otherwise		20.05%
Education	Continuous	13.33	
Household Income	Continuous	$67,416.71	
Occupation Skilled job	1 if households have managerial, professional, technical job, 0 if households have service, labor, farming, or forestry job		52.66%
Time horizon Below 5-year time planning	1 if below 5-year time planning, 0 otherwise		58.62%
Financial assets			
Below $2,110	1 if households' financial assets are less than $2,110, 0 otherwise		25%
$2,110-22,280	1 if households' financial assets are between $2,110 and $22,280, 0 otherwise		25%
$22,280-113,900	1 if households' financial assets are between $22,280 and $113,900, 0 otherwise		25%
$113,900-378,000	1 if households' financial assets are between $113,900 and $378,000, 0 otherwise		15%
Above $378,000	1 if households' financial assets are more than $378,000, 0 otherwise		10%

Table 2. Summary Statistics of Households that Adopt Internet Banking (Weighted values) (N = 4,442)

Variables	Adopters (N = 1,079)	Non adopters (N = 3,363)
Prior Computer software experience		
Yes	48.12%	11.03%
Prior ATM experience		
Yes	90.57%	64.97%
Prior debit card experience		
Yes	68.56%	42.02%
Prior direct deposit experience		
Yes	82.57%	63.77%
Prior direct payment experience		
Yes	62.91%	35.34%
Age		
Below 35	27.53%	21.63%
35-50	42.50%	31.81%
50-65	23.74%	23.30%
Above 65	6.24%	23.26%
Education	15.36	12.86
Income	$123,027	$54,494
Occupation		
Skilled job	76.80%	47.05%
Time horizon		
Below 5-year time planning	41.55%	62.58%
Financial assets		
Below $2,110	4.80%	29.70%
$2,110-22,280	21.43%	25.83%
$22,280-113,900	30.76%	23.66%
$113,900-378,000	21.48%	13.50%
Above $378,000	21.53%	7.31%

Table 3. Results of Probit Regression for Internet Banking Adopters (N = 4,442)

Variables	Sample Mean (weighted)	Without Interaction term			With Interaction term		
		Estimate	Standard Error	Marginal Effect	Estimate	Standard Error	Marginal Effect
Intercept		-2.9755	0.2354***		-4.2746	0.4212***	
Age							
35-50	0.34	-0.2394	0.0792**	-0.0632	1.0593	0.4336*	-0.0409
50-65	0.23	-0.5064	0.0817***	-0.1337	1.2418	0.4412**	-0.0932
Above 65	0.20	-0.8401	0.1038***	-0.2218	0.7241	0.5103	-0.1894
Below 35 (Reference)							
Education	13.33	0.0547	0.0097***	0.0144	0.1475	0.0264***	0.0146
LN(Income)	10.49	0.0268	0.0187	0.0071	0.0295	0.0187	0.0077
CSE[1]							
Yes	0.18	0.7601	0.0508***	0.2007	0.7632	0.0509***	0.1980
No (Reference)							
ATM							
Yes	0.70	0.2695	0.0708***	0.0712	0.2800	0.0709***	0.0726
No (Reference)							
Debit Card							
Yes	0.47	0.1919	0.0549***	0.0507	0.1876	0.0551***	0.0487
No (Reference)							
Direct Deposit							
Yes	0.67	0.1168	0.0562*	0.0308	0.1088	0.0563	0.0282
No (Reference)							
Direct Payment							
Yes	0.41	0.2168	0.0497***	0.0572	0.2187	0.0498***	0.0567
No (Reference)							
Occupation							
Skilled job	0.53	0.1167	0.0595**	0.0440	0.1528	0.0597*	0.0396
Non skilled job (Reference)							
Time horizon							
Below 5-year	0.59	-0.1756	0.0503***	-0.0464	-0.1720	0.0503***	-0.0446
More than 5-year (Reference)							
Financial assets							
$2,110-22,280	0.25	0.4959	0.1076***	0.1309	0.4463	0.1085***	0.1158
$22,280-113,900	0.25	0.7285	0.1088***	0.1923	0.6652	0.1059***	0.1725
$113,900-378,000	0.15	0.7824	0.1198***	0.2066	0.7273	0.1200***	0.1887
Above $378,000	0.10	1.1041	0.1264***	0.2915	0.0722	0.1259***	0.2781
Interaction terms	4.53				-0.0913	0.0295**	
(35-50)*Educ	3.07				-0.1201	0.0297***	
(50-65)*Educ	2.67				-0.1091	0.0337**	
(Above 65)*Educ							
Pseudo R^2		0.259			0.262		
Log L		-1825.6			-1816.9		

Note. * < .05 **< .01 ***< .001

Table 4. Probability of Adapting Internet Banking by Age and Education

Education(year)	8	12	16
Age			
Below 35	0.0598	0.1669	0.3533
35-50	0.1098	0.1580	0.2183
50-65	0.1011	0.1219	0.1455
Above 65	0.0441	0.0750	0.0992

Table 5. Summary Statistics of Households who Use Different Payment Methods (Weighted values)

Variables	Checks (N=879)	Checks+ATM or Debit Card (N=902)	Checks+ATM or Debit Card+Direct Payment (N=481)	Checks+ATM or Debit Card+Direct Payment+Internet Banking (N=395)	Other (N=1,785)
Prior Computer software experience					
Yes	7.6%	14.8%	16.9%	48.8%	19.7%
Prior direct deposit experience					
Yes	64.3%	67.6%	83.8%	89.6%	59.4%
Age					
Below 35	12.3%	28.3%	22.5%	31.7%	23.7%
35-50	24.9%	38.2%	39.5%	41.1%	33.1%
50-65	23.5%	22.2%	25.3%	22.7%	23.5%
Above 65	39.2%	11.3%	12.7%	4.4%	19.7%
Education	12.4	13.4	14.4	15.5	13.1
Income	51,597	58,464	75,849	119,945	68,056
Occupation					
Skilled job	37.5%	58.6%	63.9%	79.2%	49.0%
Time horizon					
Below 5-year time planning	62.6%	60.1%	54.5%	43.2%	59.9%
Financial assets					
Below $2,110	29.1	24.9	12.7	4.4	30.7
$2,110-22,280	25.6	30.0	26.4	21.3	22.2
$22,280-113,900	24	24.2	31.4	30.2	23.0
$113,900-378,000	13.9	13.1	20.5	23.3	13.4
Above $378,000	7.4	7.7	8.9	20.9	10.8
Check	100%	100%	100%	100%	39.1%
ATM+Debit Card	0	100%	100%	100%	35.8%
Direct Payment	0	0	100%	100%	26.0%
Internet Banking	0	0	0	100%	29.2%
No Institution	0	0	0	0	12.7%

Table 6. Results of Multinomial Logit Regression for Payment Methods (N=2,657)

	Checks		Checks+ATM+Debit Card+Direct Payment		Checks+ATM+Debit Card+Direct Payment+Internet Banking	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Intercept	1.579	0.498***	-2.333	0.625***	-4.630	0.724***
Age						
35-50	0.470	0.161***	0.003	0.166	-0.534	0.197***
50-65	1.068	0.169***	-0.092	0.183	-0.943	0.221***
Above 65	2.098	0.195***	-0.374	0.234	-1.826	0.315***
Below 35 (Reference)						
Education	-0.049	0.018***	0.066	0.023***	0.113	0.028***
LN(Income)	-0.110	0.045**	-0.035	0.056	-0.020	0.058
CSE						
Yes	-0.368	0.144***	-0.096	0.145	1.152	0.142***
No (Reference)						
Direct Deposit						
Yes	-0.587	0.111***	1.033	0.147***	1.277	0.183***
No (Reference)						
Occupation						
Skilled job	-0.193	0.116*	-0.031	0.139	0.257	0.177
Non skilled job (Reference)						
Time horizon						
Below 5-year	-0.114	0.107	-0.096	0.122	-0.312	0.142**
More than 5-year (Reference)						
Financial assets						
$2,110-22,280	-0.231	0.157	0.468	0.206**	0.964	0.350***
$22,280-113,900	-0.100	0.170	0.644	0.215***	1.473	0.349***
$113,900-378,000	-0.115	0.205	0.748	0.249***	1.686	0.376***
Above $378,000	0.042	0.227	0.597	0.284**	2.089	0.396***
Below $2,110 (Reference)						
Pseudo R^2	0.143					
Log L	-3019.9					

Note. Checks+ATM or Debit Card is the omitted category. * < .05 **< .01 ***< .001