

Likelihood of using Online Banking Services among Consumers: Application of the Logit Model

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Abstract

Research on the area of internet banking has been extensively studied in developing countries since internet banking resumed from the new millennium. Most studies on this topic were conducted in Asian countries. Most methods adopted are attempted to analyze the 'perception' among respondents or consumers on this technology. Very limited studies were using logit or probit regression to explore the 'probability' or 'likelihood' of consumers using internet banking, in particular among Malaysian consumers. The current study aims to analyze the probability of using digital banking services among consumers in Malaysia using survey data collected in the area of Klang Valley. Responses from the survey are analyzed empirically using logistic regression and the study finds that regardless of the choice of consumers on banks whether it is local or foreign, Islamic or conventional and regardless of how often they visit the bank(s), the likelihood of using online banking is significantly determined by the level of education they have, gender and category of employment. There is a higher probability of choosing online banking services among those who are highly educated, females and those who are not working in the government sector.

Keywords - Internet banking; consumers; logistic regression; Malaysia.

Introduction

In Malaysia, due to technological development particularly in Information Technology (IT) and telecommunication, the banking sector together with other service sectors has involved extensively in the improvement of payment system that is compatible with the demands of the electronic marketplace. Sulaiman, Lim, and Wee (2005) show that the e-banking adopters' perceptions of e-banking appear to be a useful, easy and better way to conduct banking transactions than the conventional method. This development has caused the evolution in banking system policy of Malaysia from financial sector restructuring during the late 1990s to institutional development and capacity building recently. More efforts were also intensified

towards evolving a more diversified financial infrastructure to facilitate economic transformation. The blueprint for the development of the financial sector in Malaysia is outlined in Financial Sector Masterplan which was released in 2001. Many positive outcomes have been attained on several fronts related to the adoption of the ICT to the E-banking system. Domestic banking institutions have embraced a higher level of technology and improved business processes. Besides, new delivery channels through technology-based mechanisms such as internet and mobile banking have enhanced the delivery of products and services as well as widened access to banking services (Bank Negara Malaysia, 2004). The issue is whether the potential customers are large enough to ensure a critical mass for the economic viability of providing electronic banking services. If the critical mass is not fulfilled then banks may not be able to use these delivery channels to enhance their profits.

Research on the area of internet banking has been extensively studied in developing countries since internet banking resumed from the new millennium. A study on research trend of internet banking diffusion in developing countries by Sabi (2014) has shown that dominance of research studies on this issue of internet banking was based in Asian countries but still lacking on African, the Caribbean, and South American countries. The study also revealed that, out of 188 articles analyzed, most studies were not based on theoretical framework and the common theories which adapted by the researchers were Technology Acceptance Model, Diffusion of Innovation, Decomposed Theory of Planned Behaviour, Innovation Diffusion Theory, Theory of Planned Behaviour, Theory of Reasoned Action and Unified Theory of Acceptance and Use of Technology (Sukkar and Hasan, 2005; Adesina and Ayo, 2010; AbuShanab, Pearson and Setterstrom, 2010; Echchabi, 2011).

Besides, most of the research conducted on internet banking adoption in developing countries was based on quantitative research. A few have adopted qualitative and mixed-method approaches. As of data collection methods, quantitative research mostly used questionnaires through surveys and case studies with some statistical data analysis. The qualitative research mainly collects data through face to face interviews, case studies, focus groups and observations.

Most methods adopted in previous studies attempted to analyze the 'perception' among respondents or consumers on this technology. It is hard to find any study attempts to explore the 'probability' or 'likelihood' of consumers using

internet banking, in particular among Malaysian consumers. The adoption of logit or probit models in analyzing the probability of consumers choosing internet banking in Malaysia is almost lacking. Most studies using this method are found to use data from developed countries such as the United States (Bauer and Hein, 2006) and New Zealand (Gan et al., 2006). The findings in the study by Gan et al. (2006) indicate that service quality dimensions (reliability, assurance, and responsiveness) and user input factors (control, enjoyment, and intent to use) have a positive impact on consumers' likelihood to use electronic banking. This implies the level of service quality in electronic, the independence and freedom associated with electronic banking and the enjoyment that could be derived from electronic banking will favourably influence consumers' decision in using electronic banking. Perceived risk factors (financial risk, performance risk, physical risk, social risk, and psychological risk) were found to negatively affect the probability to use electronic banking. Furthermore, the threat of personal information accessed by a third party negatively influences a consumer's likelihood to use electronic banking. The results of this research support previous findings that consumers in the older age group are negatively disposed towards electronic banking. The positive relationship between consumers in white-collar occupations and electronic banking use has also identified the study also found that the consumers' different residential areas have different impacts on electronic banking use. In the study by Bauer and Hein (2006), the larger the number of checking accounts a consumer has the more likely they are to adopt Internet banking. The number of savings accounts does not appear to have any significant effect on the adoption rate. The age variable coefficient is significantly negative, indicating that, *ceteris paribus*, older consumers are less likely to adopt Internet banking. Income also appears to have a significant impact on the adoption decision. As suggested by the theory, the higher a consumer's income, everything else equal, the more likely the consumer is to adopt Internet banking. Also, the proxy of Internet familiarity has a significant influence on the adoption decision. The study also found that the more risk-averse a consumer considers his or herself to be the less likely that individual is to adopt Internet banking. The study also shows that risk aversion is an important consideration in the adoption of Internet banking for younger bank customers. The theory suggested that the more expensive is human capital, or the higher the fixed expense of the adoption (proxied in this instance by age), the less likely that risk aversion is an important consideration. This suggests that efforts

to better educate younger bank customers about the risks of Internet banking may be more beneficial than educating older bank customers.

Using a similar method, a recent study by Agwu (2017) revealed that internet banking users of different ages are burdened with various problems within the Nigerian landscape. Most bank customers do not use internet banking due mainly to various risks. Unfortunately, no one reaches out to them as obtained in the developed countries such as the United Kingdom where banks directly market every segment of the society well as design special products for them. It is also found that various bank customers go in and out of bank branches with little or no knowledge of banking products and services, its advantages and its usages, an example is the internet banking services. Skvarciany and Jurevičienė (2018) explore factors influencing trust in internet banking and estimate this impact in the Baltics states. The factors are as follows: provided information, e-banking system, the website of a bank, and a bank's characteristics. The results of the respondents' survey using logistic regression analysis show that the factor that is necessary for trust-building in all the examined countries differs: In Lithuania, information and the bank, in Latvia, the website, and Estonia, the bank. In a study by Serener (2016), logistic regression was used to evaluate the impact of age, gender, income, marital status, education, profession, comfort level with computers and previous experience of shopping online on the likelihood of people using internet banking. The results indicate that 56-65-year-olds were less likely to adopt internet banking than 18-25-year-olds. The odds of adopting internet banking were higher for male respondents compared to females. Married individuals were less likely to adopt internet banking than single respondents were. The likelihood of adopting internet banking rose with increasing levels of income. Respondents with master's or PhD degrees were more likely to adopt internet banking compared to primary and secondary school graduates. Respondents who have previously shopped online and had a high comfort level with computers had a greater tendency towards adopting internet banking. Sole proprietors, public sector workers, private-sector workers, and students were less likely to adopt internet banking than banking personnel.

Some studies are looking at the likelihood of adopting internet banking from banks' perspective rather than consumers' perspective such as Karen Furst, William W. Lang, and Daniel E. Nolle (2000) and Courchane et al. (2002). Karen Furst, William W. Lang, and Daniel E. Nolle (2000) developed logit models to explain why

banks choose to adopt Internet banking, and why some choose to offer a relatively wider array of Internet banking products and services. Among the key factors explaining which banks have chosen to offer Internet banking is membership in a bank holding company, the physical location of the bank in an urban area, relatively higher premises and other fixed expenses to net operating revenue, and higher noninterest income, and efficiency than non-Internet banks. It is also found that among banks that offer Internet banking, larger banks and banks that offered the service for a longer time were significantly more likely to offer a wider range of services on the Internet. Meanwhile, Courchane et al. (2002) examine the optimal exercise of strategic real options to invest in Internet banking technology within a two-stage game, parameterized by the distribution of bank size and uncertainty over the profitability of an investment. They found that relative bank size, as measured by measures of concentration, and demographic information predictive of future demand both positively influence the probability of entry into internet banking.

The current study, thus, aims to close these gaps by analyzing the probability of using digital banking services among consumers in Malaysia using survey data collected in the area of Klang Valley. Responses from the survey are analyzed empirically using logistic regression.

Data and Methodology

A survey is conducted to analyze the probability of using digital banking services among consumers in Malaysia. Using a purposive sampling method, 201 respondents are selected randomly in the area of *Klang Valley* in which most of the banks' main branches are found to be in this area. As of *research instrument*, respondents are required to complete a *written questionnaire*. The study utilizes *descriptive statistics* as well as *econometric techniques* in its analysis. To analyze using the logit model, several variables are developed, such as *socio-economic variables* (age, education level, income level, gender, occupation, etc.) and *banking services variables* (involvement of respondents in banking services/sector).

The econometric model developed in this study is *the Logit* model. This is a nonlinear regression model specifically designed for binary dependent variables. The purpose of this model is to test the probability that demographic and banking service factors (variables) contribute to the selection of using internet banking among respondents. Unlike linear probability model, this model adopts a nonlinear

formulation that forces the predicted values to be between 0 and 1 by using cumulative probability distribution function (c.d.f.) which is denoted by F . The logistic cumulative distribution function has a specific functional form, defined in terms of the exponential function. The population logit model of the binary dependent variable Y with multiple regressors could be expressed as:

$$\Pr(Y = 1|X_1, X_2, \dots) = F(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k)}}$$

The main reason for using logit regression is that the logistic c.d.f. could be computed faster than the normal c.d.f. (Stock and Watson, 2007). In modelling determinants of using online banking services, we develop a Logit Model as follows:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1(\text{DEMOGRAPHIC}_i) + \beta_2(\text{BANKINGSERVICE}_i) + \nu_i \quad (1)$$

where L_i is a dummy variable with a value of 0 or 1. $L_i = 0$, if consumer/respondent does not opt for online banking services (the answer of 'no' in the survey) and $L_i = 1$ if consumer/respondent opt for online banking services (the answer of 'yes' in the survey). In the model (equation 1), if we take the antilog of the j th slope coefficients (β 's), subtract one from it, and multiply the result by 100, we will obtain the *per cent change* in the odds for a unit increase in the j th regressor. The percentage change could be interpreted as a probability that the consumer opts for online banking will change (increase or decrease) due to a unit increase in independent variables such as demographic and other banking service variables. It is also important to note that the R^2 is a poor measure of fit for the linear and nonlinear probability model (Stock and Watson, 2007). Therefore, we use another measure of fit for this model of the binary dependent variable, namely "fraction correctly predicted". Besides, we will also perform Pearson χ^2 -type tests of goodness-of-fit, namely Hosmer-Lemeshow (1989) and Andrews (1988a, 1988b).

Analyses and Findings

3.1 Descriptive Analysis

The descriptive analysis of the survey responses is divided into *two* parts: (1) Demographic data analysis (2) Banking services experienced by the respondents,

3.1.1. Demographic data

From the responses of the survey conducted, the majority of respondents are male (53.2%). Almost half of the total respondents (46.8%) are young with age of fewer than 25 years old. About 25.9% of them are between the age of 25 to 35 years old and 20.9% of them are between 36 to 45 years old. While 58.7% of total respondents are Muslim, the rest (41.3%) are non-Muslim. Almost half of the total respondents (56.2%) are not married. (refer to Table 1)

Table 1: Demographic Data on Respondents

Item	Responses	Frequency	Percent
Gender	Male	107	53.2
	Female	94	46.8
Age	Less than 25 years	94	46.8
	25-35 years	52	25.9
	36-45 years	42	20.9
	46-55 years	11	5.5
	More than 55 years	2	1.0
Religion	Muslim	118	58.7
	Non-muslim	83	41.3
Marital status	Married	87	43.3
	Divorced	1	0.5
	Not married	113	56.2
Education level	Primary school	1	0.5
	Secondary school	12	6.0
	STPM/Matriculation/Diploma	32	15.9
	Undergraduate degree	115	57.2
	Postgraduate degree	41	20.4
Employment service	Government	70	34.8
	Private organization	55	27.4
	Self-employment	27	13.4
	Others	49	24.4

Monthly income	Less than RM900	58	28.9
	RM901-RM1500	30	14.9
	RM1501-RM2000	17	8.5
	RM2001-RM2500	12	6.0
	RM2501-RM3000	6	3.0
	RM3001-RM3500	16	8.0
	RM3501-RM4000	15	7.5
	More than RM4000	47	23.4

By education, most respondents are having a high level of education with 57.2% obtain undergraduate degrees and 20.4% obtain postgraduate degrees. The distribution of employment service is almost even between government/public and private sectors with 34.8% and 27.4%, respectively. About 24.4% are assumed to be unemployed (based on the response of 'others') while 13.4% are self-employed. Data on monthly income show that the distribution of respondents among different levels of income is uneven/unequal. More than 20% of total respondents earn less than RM900 per month and earn more than RM4000 per month. In specific, 28.9% earn less than RM900 per month which marks the highest percentage among the total respondents. Meanwhile, 23.4% of respondents earn more than RM4000 per month. However, less than 10% of the total respondents earn between RM1501 and RM4000 per month at each additional level of RM500 income level. The distribution reflects a larger percentage of respondents earn below than and at RM1500 per month.

3.1.2. Banking Services

Extracted from the survey response, all respondents (100%) possess at least one bank account (refer to Table 2). The results infer the importance of banking services to almost all Malaysians. The sector plays a vital role in facilitating the economic activities of the country particularly facilitating other sectors in the economy. Most of the respondents are having account(s) in local banks (81.6%) and only 1.5% of them have account(s) with foreign banks. A substantial number of respondents (more than 10%) has accounts in both local and foreign banks. As for the types of banks they deal with, almost 42.8% of respondents prefer conventional banks while only 27.9% prefers Islamic banks. However, 29.4% prefer to deal with both conventional and Islamic banks. It is expected that this is due to low switching rates among users. Particularly, users always maintain the preference of more established banks with good records and performances. Thus, it is not surprising to

find that respondent rate of having both conventional and Islamic banks account(s) (29.4%) is higher than the respondent rate of having an Islamic bank account(s) alone (27.9%). The results are also supported by the high rate of respondents having more than one bank account, that is 65.7%.

Table 2: Responses on Banking Services Items

Item	Responses	Frequency	Per cent
The possession of bank account(s)	Yes	201	100
	No	0	0
Status of the bank (where the respondents are having the account(s) with)	Local bank	164	81.6
	Foreign bank	3	1.5
	Both	34	16.9
Type of bank (where the respondents are having the account(s) with)	Conventional	86	42.8
	Islamic	56	27.9
	Both	59	29.4
Number of bank account(s)	One	69	34.3
	More than one	132	65.7
Preferable bank to deal with	Local	181	90
	Foreign	20	10
Reasons dealing with the above bank	More efficient	79	39.3
	Service cost is lower	51	25.4
	Attractive products/services	33	16.4
	Location is very convenience	146	72.6
	The only bank available in the area	35	17.4
Types of banking services preferred	Online	138	68.7
	Desk counter	63	31.3
Frequency of visit to the bank(s)	Weekly	26	12.9
	Fortnightly	18	9.0
	Monthly	31	15.4
	As and when required	126	62.7

Empirical Analysis

The study attempts to evaluate the factors that might contribute to the likelihood (probability) of using online banking among a sample of consumers. Logistic regression allows us to test models to predict categorical outcomes with two or more categories. The predictors/independent variables can be either categorical or continuous, or a mix of both in one model. The model developed in this study is Binary Logistic, where the dependent variable has only two categories, one and zero. One is coded to the response of 'online service' for the survey question on 'What type of banking services preferred?' and zero is coded to the response of 'desk counter service' on a similar question. There are two sets of questions developed to capture the independent variables or regressors. One is *demographic variables* such as gender, age, religion, marital status, education level, employment, and income level. Second is *banking variables* such as status of the bank the respondent is currently having, either 'local' or 'foreign', type of bank the respondent is dealing with, either 'Islamic', 'conventional' or 'both Islamic and conventional', preference of respondent to deal with, either 'local' or 'foreign' bank and frequency of visit to the bank(s), ranging from 'as and when required' to 'weekly'. In some cases, the independent variables are dummy variables such as gender, marital status, religion, and others. There are also continuous variables such as age, educational level, income level and frequency of visit to bank(s).

There are two regressions (Model 1 and Model 2) formed with the first one only include demographic variables as regressors into the model and the second regression is where both demographic and banking variables are inserted into the model. This technique of regression is also a way to conduct a sensitivity analysis of the model, which is to analyze the consistency of the results before and after a new set of variables are added into the model. From Table 5, the regression results of Model 1 show that the significant predictors are 'Dummy of gender', 'education level' and 'Dummy of employment as government servant'. The positive value of beta (β) for Education, that is 0.700, indicates that an increase in independent variable score, that is the higher the level of education of respondents, will result in an increased probability of the case recording a score of 1 in the dependent variable (ie. opt of online banking). On the other hand, the negative beta value for variable 'dummy gender' indicates that there is a decreased probability of using online banking among males compared to females. The negative and significant beta for 'dummy

employment as government servant' implies that there is a decreased probability of using online banking among those who are employed in government sector as compared to the private sector and self-employed. Other variables did not contribute significantly to the model. The odd ratio (Exp (β)) for the variable 'Education level' is 2.014. This could be interpreted that the odds of a person opt for online banking, is 2.014 times higher for someone who has a higher level of education as compared to those who have a lower level of education, all other factors being equal. The odd ratio of 0.505 for the variable of 'dummy gender' indicates that for males, the odds of him using the online banking decreases by a factor of 0.505, all other factors being equal. The odd ratio of 0.353 for 'dummy employment as government servant' implies that the odds of a person who is working in government sector choose online banking is decreased by a factor of 0.353, other things constant. Overall, the probability that consumers opt for online banking services is higher among those with a better level of education, females and those who are employed in the private sector or self-employed. In the classification table, with no predictor, the overall percentage of correctly classified cases is 68.7%. When a set of predictor variables is entered, it improves the accuracy of this prediction to 71.6%. Since the Omnibus tests of Model coefficients in Block 1 are significant (p -value < 0.05), the model with a set of variables used as predictors is better than the SPSS's original guess shown in Block 0. The Chi-square value in this test is 24.610 with 8 degrees of freedom. The Hosmer & Lemeshow test also supports the 'goodness of fit' of the model with the Chi-square statistics of 8.932 and significance level of 0.348. The pseudo-R-square statistics (Cox & Snell R-square and Nagelkerke R-square) show that between 12% and 16% of the variability in the dependent variable is explained by the set of predictor variables.

In model 2, when a set of banking variables are added in the existing model, all banking variables do not significantly affect the probability of opting online banking services among the consumers. Similar independent variables which are significant in Model 1 remain significant in Model 2 with no major difference in the value of coefficients and the sign of coefficients. In sum, the results indicates that, regardless of the choice of consumers on banks whether it is local or foreign, Islamic or conventional and regardless of how often they visit the bank(s), the likelihood of using online banking is significantly determined by the level of education they have, gender and category of employment. There is a higher probability of choosing online

banking services among those who are highly educated, females and those who are not working in the government sector. Bauer and Hein (2006) examine the demand for remote access to banking accounts by consumers and the results showed that when the technology is new, perceived risks in internet banking are seen to be responsible for some of the hesitation to adopt. In the case of Malaysians, low levels of risk tolerance probably very high among low educated consumers, males and those who are highly secured employed in the public sector. Gan et.al (2006) also found that education is one of the dominant variables that influence consumers' choice of electronic banking and non-electronic banking channels in New Zealand. Basically, in Model 2, the diagnostic tests show that Model 2 is better in its performance. When a set of predictor variables is entered, it improves the accuracy of this prediction to 73.1%. The Chi-square value for the Omnibus test is 27.748 with 8 degrees of freedom and the p-value < 0.05 which indicates that the model with a set of variables used as predictors is better than with no predictor. The Hosmer & Lemeshow test also supports the 'goodness of fit' of the model with the Chi-square statistics of 12.053 and significance level of 0.149. The pseudo-R-square statistics (Cox & Snell R-square and Nagelkerke R-square) is even better than Model 1 which show that between 13% and 18% of the variability in the dependent variable is explained by the set of predictor variables.

Conclusion and Policy Recommendations

In the path towards efficiency and cost savings, banks across the nation are intensely promoting electronic transactions or internet banking. The current study aims to analyze the probability of using digital banking services among consumers in Malaysia. Using a purposive sampling method, a survey is conducted on consumers in the area of *Klang Valley* in which most of the banks' main branches are found to be in this area. Responses from the survey are analyzed empirically using logistic regression and the study finds that regardless of the choice of consumers on banks whether it is local or foreign, Islamic or conventional and regardless of how often they visit the bank(s), the likelihood of using online banking is significantly determined by the level of education they have, gender and category of employment. There is a higher probability of choosing online banking services among those who are highly educated, females and those who are not working in the government sector. Thus, it would be essential for the success of electronic banking by having a

sufficient critical mass, especially among educated, female and private sector users. There should be more plans to boost confidence among consumers on this new technology and to increase their levels of risk tolerances, particularly among consumers who are less educated, male and government employed.

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