

## **Recent Shifts in Determinants of Internet Banking Adopters: Empirical Evidence from 2001 and 2004 SCF**

The purpose was to investigate whether there were shifts in the factors affecting the probability of adopting Internet banking. The technology acceptance model, the theory of planned behavior, and previous research were used to develop a model. Data were drawn from the 2001 and 2004 Survey of Consumer Finances. Three shifts were identified. In 2004, households adopted Internet banking regardless of income while income was a determinant in 2001. Second, the length of the planning horizon was not significant in 2004 suggesting that household's use Internet banking was a convenience and not a result of long-term planning. Third, occupation as a proxy for social norm influenced the probability of adopting Internet banking.

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### **Introduction**

Security First Network Bank (SFNB) was founded in October, 1995 in Atlanta, Georgia. This institution claimed to be the first ever 'pure' Internet bank (Cramer and Harrell, 1996). Even though it has only been a decade since SFNB was established, no respectable financial institution in the world today functions without extending its offer via Internet. Advancement in information technology, which enabled implementation of digital services, has rapidly gained recognition of financial institutions in the last years. Accessing banks online has become a regular practice of 35% of U.S. households, and it is a forecast that 55 million households will use online banking services by 2010 (Bruene, 2005).

The phenomenon of rapid advancement in implementation of information technology by banks has attracted a significant amount of researchers' attention. Numerous studies, employing a variety of methodologies addressed the adoption of Internet banking. Kim, Widdows and Yilmazer (2005) investigated the determinants of Internet banking adoption based on individuals' benefits and costs. Their study used the 2001 Survey of Consumer Finances (SCF). A similar study by Gerrard and Cunningham (2003) addressed the economic benefits of Internet banking adoption among customers in Singapore. Chang (2003) found that 25% of the population in Korea adopted electronic banking, which means, that in some countries Internet banking has become a widespread service. Some researchers have also addressed the adoption of Internet banking based on the diffusion of innovation and technology acceptance model, or theory of planed behavior (Chang, 2003; Lee, Lee, and Eastwood, 2003; Chau and Lai, 2003). Jun and Cal (2001) addressed the problem of determinants of Internet banking adoption incorporating perceived service quality as a relevant factor explaining adoption. The problem has also been explored from the supply side perspective (Gopalakrishnan, Wischnevsky, and Damanpour, 2003; Tan and Teo, 2000) and in the qualitative studies of adoption of Internet banking among corporate customers (Rotchanakitumnuai and Speece, 2003).

While the previous studies answer the questions about determinants of consumers' adoption of Internet banking, no one has investigated the shifts in the determinants of Internet banking adoption with data from the U.S. Some researchers admit that due to the turbulent nature of the electronic services market, the determinants of adoption of online services still need attention (Kolodinsky, 2004). Providers of online banking services could benefit from learning how these determinants have evolved over recent years. This knowledge could help to adjust market offers by targeting the most promising groups of potential customers. Bank managers understand why they should encourage customers to utilize the electronic banking channel. Their benefits are described by Chang (2002), who compared the average costs of money transfer transactions. For traditional checking transaction the cost is estimated at approximately \$1, for ATM or telephone banking it varies between \$.30 and \$.50, while the cost of Internet transaction is less than \$.01.

The purpose of this research is to determine the dynamics of change in the determinants of adoption of online banking services. The study will use the 2001 and 2004 Surveys of Consumer Finances (SCF) to identify the shifts in the explanatory power of determinants of Internet banking adopters. The online banking services, which are the focus of the study, are all kinds of services offered by commercial banks, saving or loan banks and credit unions.

## Review of literature

Electronic banking is defined as the use of computers and telecommunications to enable banking transactions, usually without human interaction. A person with a personal computer can make transactions, either via direct connection or by accessing the bank's web site. Internet banking is defined as making transactions, payments, etc., over the Internet, usually through the bank's website (Encyclopedia Britannica Online, 2006). In this research, Internet banking and on-line banking are synonymous. Electronic banking is a broader term that includes Internet banking, but also other ways of enabling banking transactions such as telephone banking, m-banking, etc. The term e-banking, often used in other studies will not be used in this paper, as many discrepancies exist in the definitions.

The adoption of Internet banking channels is conditional on ownership of computer and access to Internet. It is assumed that the likelihood of owning a personal computer will have a significant effect on the adoption of Internet banking. Yin, DeVaney and Stahura (2005) investigated the determinants of U.S. household expenditures on computers and found several demographic and socioeconomic factors to be significant predictors of probability of computer purchase, e.g. age, gender, education and income. Indirectly, these factors are expected to affect the probability of Internet banking adoption. A cost-benefit study by Kim, et al. (2005) found that age and education were significant predictors of Internet banking adoption. Their analysis showed that younger and better educated customers were more likely to adopt Internet banking and that the probability of adopting Internet banking decreases with age for all levels of education. Similar findings were reached by studies based on the technology diffusion model (e.g. Chang, 2003). Age, education and income factors, however, are expected to have less effect on technology acceptance as the technology matures (Rogers, 2003).

The descriptive studies reported by the U.S. Bureau of Census show patterns of change in the computer ownership and Internet access for U.S. households. Statistics show that 62 percent of households owned a computer in 2003, and 55 percent of households had Internet access from home. In 2001, about 56 percent of households owned a computer and 50 percent had Internet access. The same trends occurred throughout the last decade. These trends are identifiable regardless of the age of the householder. For example, among households with heads over 65, 28 percent had a computer and 23 percent had Internet access in 2001. In 2003, among older households, 34 percent owned a computer and 29 percent had Internet access. There has been a small increase in the percentages of computer owners for all education groups. For example in 2001, 78 percent of the households who were headed by college graduate had a home computer. In 2003 this percentage increased to 82 percent.

Gender and race may have a significant effect on the adoption of Internet banking. Some of the previous studies found that male customers and whites were more likely to adopt online banking compared to female or non-white customers. This should in part be caused by the differences in accumulated human capital and social resources of non-white members of U.S. society. Bureau of Census data for computer ownership by gender and race also present an interesting trend. The rate of obtaining a new computer was higher for female headed households than for male headed households. In 2001 only 39 percent of female headed households had at least one computer, compared to 44 percent of male headed households in the same year. In 2003 these statistics were 43 percent and 45 percent, respectively. Similarly, inequalities in computer ownership are declining among races. The rate of obtaining a new computer was higher for non-whites than for whites between 2001 and 2003. Interestingly, the rate of obtaining Internet access for U.S. households was constant among households characterized by age, education, gender, race, and income. Internet accessibility itself may not affect the shifts in determinants of Internet banking adoption. Based on existing research, age, education, gender and race are hypothesized to be significant predictors of Internet banking adoption. However, these factors are expected to discriminate between adopters and non-adopters of Internet banking less efficiently in 2004 compared to 2001. Income is also hypothesized to have less effect on the probability of Internet banking adoption in 2004 compared to 2001.

A well documented part of the research on Internet banking adoption was based on the technology acceptance model. The technology acceptance model was developed by Davies Bagozzi and Warshaw (Davies et al., 1989; Bagozzi et al., 1992). It was proposed as an extension to Ajzen and Fishbein's (1980) theory of reasoned action. Theory of reasoned action proposes that behavior is driven by behavioral intentions, which are a function of an individual's attitude toward the behavior and subjective norms affecting the occurrence of the behavior. The technology acceptance model replaces measures of attitude with ease of use of technology and usefulness of technology. These factors, when operationalized in research on Internet banking adoption, significantly affect the probability of adoption (Chau and Lai, 2003). Wang et al. (2003) extended the model by including a third construct – perceived credibility. Perceived credibility, operationalized as the level of risk associated with on-line banking was also found to play an important role as determinant of adoption. The credibility of the Internet as a transaction medium has often been questioned. Thus, it can be assumed that an early adoption of Internet banking was influenced by perception of risk. As the Internet has earned a reputation for secure transactions medium, risk tolerance, proxied by self reported risk tolerance in saving and investing behavior, is expected to be less important predictor of the adoption.

Prior experience of managing finances with computers or Internet may cause more confidence in the electronic banking services and cause favorable perceptions of the Internet banking channel as easy to utilize. Kim et al. (2005) found that factors measuring experience, e.g. prior experience with money management software, use of ATM, etc., were significant predictors of the probability of the Internet banking adoption. Kim et al. (2005) also identified occupation characteristics and financial planning horizon to have influence on Internet banking adoption. Professional position may proxy for a linkage between the attitude and the influence of social norms and peer group effect. Planning horizon, on the other hand, represents wariness in financial behavior. People, who plan their savings and expenditures in advance, will carefully consider the decision to adopt electronic banking channel. Progressive accessibility of information technology results in a hypothesis that technological experience has less influence on the probability of adoption of Internet banking in 2004 compared to 2001. For the same reason, adoption of Internet banking has become a decision based on convenience rather than analysis of costs and benefits. Planning horizon, representing wariness in financial behavior, is hypothesized to be a less important predictor of adoption in 2004 than it was in 2001. No directional hypothesis however, was developed in respect to the shifts in occupation characteristics as the determinant of the Internet banking adoption.

## **Methodology**

### Data

The characteristics of households in this report are from the 2001 and 2004 Surveys of Consumer Finances (SCF). The SCF is a comprehensive survey of US households' finances that is carried out every three years. It is sponsored by the Board of Governors of the Federal Reserve System. Households in the survey are referred to as 'primary economic units' (PEU). These units consist of the dominant individual or a couple in the household as well as other individuals that are financially dependent on the household's head. The Federal Reserve Board used multiple imputation process to compensate for missing data, which resulted in five imputates for each variable. For this analysis only the first implicate was used. The use of weight variables in the 2001 SCF and in the 2004 SCF provides descriptive statistics representative of the entire U.S. population.

### Variables and preliminary data analysis

This study used the entire sample of 4,442 and 4,519 observations in the 2001 and the 2004 SCFs, respectively. Table 1 presents the measurement of variables with both surveys. Table 2 presents similar information for the pooled data. Data in the analysis was pooled to estimate the shifts in the effects of the factors explaining the Internet banking adoption.

The dependent variable - adopters of Internet banking, is measured as 1 if the household's head reports that he or she uses the Internet as one of the ways to do business with commercial bank, saving or loan bank, or credit union. In 2001, 13.57 percent, and in 2004, 28.26 percent of the population adopted Internet banking. The proportion for pooled data is 21.10 percent.

The average age in 2001 was 48.97 years, and 49.56 years for 2004. The mean values of household income were \$67,366 and \$68,489 for 2001 and 2004, respectively. Survey of Consumer Finances allows for reporting of negative income. Negative household income was coded as zero for this analysis.

Over 73 percent and over 71 percent of households were headed by a male for 2001 and 2004 surveys respectively. Race is coded as 1 for white respondents and 0 otherwise. Seventy six percent of respondents in 2001 were white, compared to 73.55 percent of white respondents in 2004.

Education was coded using three levels. About 30 percent of people held a college degree in 2001. In 2004 this proportion was 32 percent. In 2001, 47.44 percent of people had at most high school degree. In 2004, 45.25 percent had at most a high school degree.

Occupation was measured with a dichotomous variable that takes value 1 if the respondent holds a managerial, professional or technical job. Managerial or professional jobs include executive, administrative, administrative support and sales positions. For all other occupations and unemployed respondents the value is 0. About 28 percent of respondents were employed in a managerial, professional or technical position in both survey years.

Experience was measured as 1 if the respondent has the experience of managing own money with the use of computer software. Although the respondents state that they adopted Internet banking, they do not always state that they are experienced in management of their money with computer software. For this reason the percentages of experienced users are less than a hundred percent for adopters of Internet banking. Less than 20% of respondents state they managed their finances with computer software in both survey years.

Risk attitude in respect to credit or investment decisions is coded as 1 when a respondent chooses "take substantial financial risks expecting to earn substantial returns" or "take above average financial risks expecting to earn above average returns" as the statements that best describe his or her willingness to take risk. The percentage of risk tolerant households was 60.45 percent in 2001 and 57.45 percent in 2004.

Planning horizon was measured by 1 if the household head plans expenditures or savings for at least 5 years in advance. In 2001 and 2004, the proportion of long term financial planners was 41 percent, and 39 percent, respectively.

Table 1.  
Measurement of the Variables: 2001 SCF and 2004 SCF (weighted values).

Variable	Measurement	SCF 2001 N=4,442		SCF 2004 N=4,519	
		Mean	Frequency	Mean	Frequency
Adopters of Internet banking	=1 if household uses Internet banking; =0 otherwise		13.57%		28.26%
Age	Continuous	48.0		49.6	
Income	Continuous	\$67,366		\$68,488	
Male	=1 if male; =0 if female		73.34%		71.86%
White	=1 if white; =0 otherwise		76.30%		73.55%
High school or less	=1 if respondent has no education beyond high school; =0 otherwise		47.44%		45.25%
Some college					
College	=1 if respondent has started college but not graduated; =0 otherwise		22.74%		22.80%
Occupation	=1 if respondent has graduated from college; =0 otherwise		29.82%		31.95%
	=1 if respondent holds managerial, professional or technical job; =0 otherwise		27.70%		28.18%
Experience	=1 if uses a computer to manage his/her money; =0 otherwise		18.02%		19.26%
Risk taker	=1 if respondent takes average or above average risk in saving or investment behavior; =0 otherwise		60.48%		57.45%
Planning horizon	=1 if respondent plans expenditures and savings at least 5 years ahead; =0 otherwise		41.38%		38.89%

Table 2.  
Measurement of the Variables: Pooled Data (weighted values).

Variable	Measurement	Pooled data N=8,961	
		Mean	Frequency
Adopters of Internet banking	=1 if household uses Internet banking; =0 otherwise		21.10%
Year2004	=1 if observation from 2004; =0 if observation from 2001		48.72%
Age	Continuous	49.3	
Income	Continuous	\$67,941	
Male	=1 if male; =0 if female		72.58%
White	=1 if white; =0 otherwise		74.89%
High school or less	=1 if respondent has no education beyond high school; =0 otherwise		46.32%
Some college	=1 if respondent has completed some years of college but not graduated; =0 otherwise		22.77%
College	=1 if respondent has graduated from college; =0 otherwise		30.91%
Occupation	=1 if respondent holds managerial, professional or technical job; =0 otherwise		27.94%
Experience	=1 if respondent has a computer at home, or has computer experience; =0 otherwise		18.65%
Risk taker	=1 if respondent takes average or above average risk in saving or investment behavior; =0 otherwise		58.93%
Planning horizon	=1 if respondent plans expenditures and savings at least 5 years ahead; =0 otherwise		40.10%

## Results

The data analysis was preceded by t-tests and chi-square tests for differences in means of continuous variables and population proportions of categorical variables. Separate logistic regression models of the probability of Internet banking adoption were estimated with maximum likelihood estimation procedure for 2001 and 2004. Next, pooled surveys logistic regression coefficients were estimated. At this stage, another dichotomous independent variable was added to the model to control for the survey year. The purpose of the survey year variable was to identify the change of Internet banking adoption probability between 2001 and 2004. In the third step of estimation, interaction terms of the year variable and particular explanatory variables were added to identify the shifts of the effects of particular predictors between 2001 and 2004.

Table 3 presents the t-tests and chi-square tests results for significance of the differences in means and population proportions of adopters and non-adopters for both surveys, and for pooled data. In both surveys, adopters and non-adopters of Internet banking differ significantly in respect to mean age. For both adopters and non-adopters the mean age was higher in 2004. For income, a significant difference is found only in 2001, which suggests that income may not discriminate between Internet banking adopters and non-adopters after 2001. No significant difference among adopters and non-adopters of Internet banking were found for groups of respondents who started but did not complete college. Respondents who started but did not complete college constitute a turning point education group. Most non-adopters of Internet banking are less educated, whereas college graduates dominate among adopters.

Table 4 presents the t test and chi square test results for adopters across survey years. Tests accompanying surveys show significant differences in the proportion of Internet banking adopters. The number of adopters doubled in 3 years. Income, race, lower and higher education levels, and risk attitude were also significantly different in means and proportions.

Table 3.  
Summary Statistics by Adopters of Internet Banking (weighted values).

Variables	SCF 2001 (N=4,442)			SCF 2004 (N=4,519)			Pooled data (N=8,961)		
	Adopters (N=732)	Non-adopters (N=3,710)	p-value (t statistic for continuous) ( $\chi^2$ for categorical)	Adopters (N=1,402)	Non-adopters (N=3,117)	p-value (t statistic for continuous) ( $\chi^2$ for categorical)	Adopters (N=2,134)	Non-adopters (N=6,827)	p-value (t statistic for continuous) ( $\chi^2$ for categorical)
Age	42.2	50.0	<0.0001	43.3	52.0	<0.0001	42.0	50.0	<0.0001
Income	\$117,366	\$59,515	0.0001	\$99,064	\$56,444	0.1293	\$104,797	\$58,083	<0.0001
Male	85.37%	71.45%	<0.0001	78.26%	69.34%	<0.0001	80.49%	70.47%	<0.0001
White	85.76%	74.82%	<0.0001	81.78%	70.31%	<0.0001	83.02%	72.72%	<0.0001
High school or less	22.02%	51.43%	<0.0001	22.65%	54.16%	<0.0001	22.45%	52.71%	<0.0001
Some college	22.82%	22.73%	0.2689	28.09%	20.72%	0.2682	26.44%	21.79%	0.3325
College	55.15%	25.84%	<0.0001	49.26%	25.13%	<0.0001	51.11%	25.51%	<0.0001
Occupation	31.01%	25.53%	0.0331	33.34%	26.46%	0.0230	32.76%	25.88%	0.0199
Experience	49.99%	13.00%	<0.0001	42.08%	10.27%	<0.0001	44.56%	11.72%	<0.0001
Risk taker	84.41%	56.73%	<0.0001	78.33%	49.22%	<0.0001	80.24%	53.23%	<0.0001
Planning horizon	56.34%	45.36%	<0.0001	47.04%	35.68%	<0.0001	49.96%	37.47%	<0.0001

Note: p-values are delivered for unweighted data. Weighting the t-tests and chi-square tests makes all statistics highly significant (p-value<.0001 in each case).

Unequal variance t-test for significance in mean differences for age and income were presented.

Test for variance equality resulted in rejection of equal variances hypothesis for both age and income, both for 2001 and 2004 datasets.

Table 4.

T-tests and Chi-square Tests for Adopters of Internet Banking & General Population Characteristics T-tests and Chi-square Tests Across Survey Years (weighted values)

Variables	Pooled data (N=8,961)			Tests across survey years		
	Adopters in 2001 (N=732)	Adopters in 2004 (N=1,402)	p-value (t statistic for continuous) ( $\chi^2$ for categorical)	2001 SCF (N=4,442)	2004 SCF (N=4,519)	p-value (t statistic for continuous) ( $\chi^2$ for categorical)
Internet adopters	-----	-----	-----	13.57%	28.26%	<0.0001
Age	42.2	43.3	0.3792	48.0	49.6	0.1293
Income	\$117,366.52	\$99,064.12	0.6223	\$67,366.35	\$68,488.59	0.0003
Male	85.37%	78.26%	0.0023	73.34%	71.86%	0.9304
White	85.76%	81.78%	0.0052	76.30%	73.55%	0.0019
High school or less	22.02%	22.65%	0.5041	47.44%	45.25%	0.0389
Some college	22.82%	28.09%	0.0849	22.74%	22.80%	0.7485
College	55.15%	49.26%	0.0511	29.82%	31.95%	0.0238
Occupation	31.01%	33.34%	0.6639	27.70%	28.18%	0.3427
Experience	49.99%	42.08%	<0.0001	18.02%	19.26%	0.6116
Risk taker	84.41%	78.33%	0.0008	60.48%	57.45%	0.0261
Planning horizon	56.34%	47.04%	0.0026	41.38%	38.89%	0.2228

Note: p-values are delivered for unweighted data. Weighting the t-tests and chi-square tests makes all statistics highly significant (p-value<.0001 in each case). Unequal variance t-test for significance in mean differences for age and equal variance t-test for income were presented. Test for variance equality resulted in rejection of equal variances hypothesis for age and acceptance of equal variances hypothesis for income.

The estimation of probability of Internet banking adoption was conducted separately for particular survey years. Maximum likelihood estimates of logistic model coefficients are presented in Table 5. Another estimation was conducted for pooled data including the survey year dummy. The pooled estimation model including the interactions between year dummy and explanatory variables was introduced to identify the shifts in Internet banking adoption. Results for pooled models estimates are reported in Table 6. In all estimation models, natural logarithm of income was included to normalize the income distribution and reduce estimation errors. In research involving dollar amounts it is common to adjust the values with Consumer Price Index if the values come from different periods. This study also employed such procedure, adjusting the dollar amounts to 2004 values.

Table 5.  
 Estimation Results for Separate Survey Years.

Variable	2001 model n=4,442			2004 model n=4,519		
	Coefficient estimate	Odds ratio	Standardized estimate	Coefficient estimate	Odds ratio	Standardized estimate
Intercept	-3.7896 **			-1.6780 **		
Age	-0.0335 ***	0.967	-0.2985	-0.0373 ***	0.963	-0.3229
Log(Income)	0.1608 ***	1.174	0.1473	0.0713 **	1.074	0.0689
Male	0.1433	1.154	0.0325	-0.0685	0.934	-0.0155
White	0.2947 *	1.343	0.0643	0.4148 ***	1.514	0.0947
High school or less (reference group)	-----	-----	-----	-----	-----	-----
Some college	0.4077 **	1.503	0.0893	0.7106 ***	2.035	0.1547
College	0.6272 ***	1.872	0.1711	0.8421 ***	2.321	0.2311
Occupation	0.1524	1.165	0.0358	0.3201 **	1.377	0.0742
Experience	1.3353 ***	3.801	0.3214	1.2429 ***	3.466	0.3010
Risk taker	0.4673 **	1.596	0.1191	0.4676 ***	1.596	0.1213
Planning horizon	0.2360 *	1.266	0.0650	0.1088	1.115	0.0299
Pseudo R-square	0.1438			0.1916		

\*\*\*p-value<.0001, \*\*p-value<.01, \*p-value<.05



Table 6.  
Estimation Results for Pooled Data.

Variable	Pooled model n=8,961		Pooled model with interactions n=8,961	
	Coefficient Estimate	Odds ratio	Coefficient Estimate	Odds ratio
Intercept	-3.1145 **		-3.8667 ***	
Year 2004	1.0243 ***	2.785	2.2144 ***	9.156
Age	-0.0359 **	0.965	-0.0358 ***	0.965
Log(Income)	0.1073 ***	1.113	0.1782 ***	1.195
Male	-0.0010	0.999	0.0055	1.005
White	0.3702 ***	1.448	0.3249 *	1.384
High school or less (reference group)	-----	-----	-----	-----
Some college	0.5988 ***	1.820	0.4052 **	1.500
College	0.7634 ***	2.146	0.6355 ***	1.888
Occupation	0.2533 **	1.288	0.2628 **	1.301
Experience	1.2839 ***	3.611	1.2813 ***	3.601
Risk taker	0.4563 ***	1.578	0.4660 ***	1.594
Planning horizon	0.1563 **	1.169	0.2362 *	1.266
Interaction terms				
Year2004*Log(Income)			-0.1157 **	0.891
Year2004*White			0.0743	1.077
Year2004*Some college			0.3114	1.365
Year2004*College			0.2014	1.223
Year2004*Planning horizon			-0.1340	0.875
Pseudo R-square	0.1905		0.1920	

\*\*\*p-value<.0001, \*\*p-value<.01, \*p-value<.05

Age is a significant predictor of Internet banking adoption. Consistently with previous studies, age is negatively related to the probability of adoption for all models. One year increase in age reduces the probability of adoption by about 3 percent. Examination of standardized coefficients on age in separate surveys models informs that age is among the most important predictors of Internet banking adoption. There was however no change in explanatory power of age between 2001 and 2004, which may be attributed to the fact, that the mean age has shifted only marginally between 2001 and 2004.

Income has also a significant and positive effect on adoption in both models. However, the decrease in the value of standardized coefficient estimates between 2001 and 2004, and the negative value of coefficient estimate on interaction involving income in the pooled model suggest that it has less affect on adoption in 2004 than in 2001. It supports the hypothesis that adoption of Internet banking is conditioned by accessibility to

computer and Internet. Given the reduction of prices of computer hardware and Internet access, Internet banking adoption has become less reliant on households income.

The probability of Internet banking adoption for white respondents was only marginally significant in 2001, however strongly significant in 2004. The odds were 34 percent and 51 percent higher for white respondents for both survey years respectively. In the pooled model, race remained significant; however the shift in the effects on adoption was not apparent in the interaction term. This does not support the hypothesis in respect to race. A possible explanation is that race was one of the least important predictors of adoption, and that the inequalities in the rate of computer hardware and Internet access acquisition are still in favor of white households.

Consistent with previous studies, the level of education is positively related to probability of Internet banking adoption. The odds of adoption for respondents with some college and a college degree were higher by 50-87 percent compared to respondents with lower education in 2001. In 2004, the corresponding odds were twice as high for educated respondents than for low education group. Standardized coefficients estimates inform that the level of education is among important factors affecting probability of Internet banking adoption, especially in 2004. This may seem against the hypothesis in respect to education; however no significance of interaction term involving education levels informs that there has been no significant shift in the effects of education on adoption. The short time span between the surveys could reduce the precision of this conclusion.

Holding a managerial, professional or technical job is positively related to Internet banking adoption in 2004, however remains not influential in 2001. This finding may suggest that the influence of social norms on Internet banking adoption may become stronger as these kinds of banking services mature and gain popularity.

Experience with money management software was significant across all models. The odds of Internet banking adoption by experienced users are more than three times higher than by inexperienced users for both 2001 and 2004. Experience was the most important explanatory factor of adoption in 2001 and it was almost equally as important in 2004.

Likelihood of adoption was 60 percent higher for risk tolerant users compared to risk averse or risk neutral users for both survey years. No shift in risk tolerance effect on the adoption probability was noticed between 2001 and 2004. This finding, which does not support the stated hypothesis, may indicate that Internet has not yet earned a reputation of secure transaction medium. Other possible explanation is that risk tolerance in respect to investments and savings may not proxy well for the perceived credibility of Internet banking channel.

Long term planning horizon was a significant predictor of Internet banking adoption in 2001. However, it was not significant in 2004 model. This supports a hypothesis that adopting the on-line banking channel has become a matter of convenience rather than a carefully planned decision.

### **Discussion, implications and limitations**

The purpose of this paper was to identify the shifts of the determinants of Internet banking adoption between 2001 and 2004. While it was possible to identify some changes in the factors affecting adoption, the three year time span between 2001 and 2004 was too short for a major shift in the determinants of on-line banking adoption. The widespread application of IT reflects a rapid advancement of modern society. Several factors affecting the acceptance of Internet channels in banking operations remain unchanged. The literature suggests that demographic and socio-economic factors usually become less important as the technology matures (Rogers, 2003).

Some findings indeed indicate, that Internet channel has become more affordable and convenient way of doing business with a bank. However, this technology is not yet mature enough, thus several demographic and socio-economic factors still differentiate between adopters and non-adopters. These findings may help bank managers in targeting the right segments of customers. Interestingly, risk tolerance was positively related to probability of adoption in all estimated models. This indicates that banks still need to address security issues of on-line account access and build their potential customers' confidence. It is important to notice, that studies based on panel data or cross-sections with longer time span would produce more accurate results in respect to the shifts in on-line banking adoption determinants.

Given the deficiencies of previous studies and limitations of this research, studies based on data that allow for more behavioral and attitudinal variables are needed to fully utilize the approach based on Ajzen and Fishbein's (1980) theory of planned behavior. Several previous studies addressed the adoption based on technology acceptance model. Separate studies are needed to identify shifts in the determinants derived as constructs of perceived usefulness, perceived ease-of-use and perceived credibility of Internet banking adoption. Finally, to fully portray the shifts in determinants of adoption, studies on dynamics of predictors of adoption among corporate customers are necessary.

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## Endnotes

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