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**Correlations between customer choice and online banking security aspects**

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by

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## **ABSTRACT**

In modern society, with the popularization of mobile communication equipment and the wide use of Internet technology, Internet banking has become a convenient and fast financial means. And the security of Internet banking has been widely concerned by consumers. Consumers' choice of Internet banking is bound to have some relationship with the security of Internet banking. The security of Internet banking is divided into many aspects. This paper is about the relationship between consumers' choice of Internet banking and the security of Internet banking. The research content includes three parts: the relationship between consumers' choice of Internet banking and external factors, internal factors and equipment factors of Internet banking. The data will be collected by questionnaire and analyzed by multiple regression analysis.

## **1. INTRODUCTION**

Internet banking refers to a new type of banking organization and service form, which is based on information technology and Internet technology and provides users with various financial services such as account opening, account cancellation, inquiry, reconciliation, intra bank transfer, inter-bank transfer, credit, online securities, investment and financial management through Internet platform. With the popularity of Internet banking and the increase of the number of bank users, the security of Internet banking, a new financial service mode, has been the focus of the outside world. In the years of the emergence and popularization of Internet banking, the security measures of banks have been improved continuously with the passage of time, and the external security evaluation of Internet banking has also changed with various factors. The public opinion once believed that the Internet bank is an extremely insecure service system, because few consumers know how to ensure the security of their property. Even in a period of time, a considerable number of consumers regard this new financial service as a kind of scam. However, with the popularity of the Internet and even mobile communication, online banking is more diversified and convenient to show around consumers. At the same time, due to the bank's advertising and the convenience of information transmission in modern society, consumers' attitudes towards the security of online banking began to change.

In this research, I will divide into four parts to analyze the factors that affect the security of Internet banking and the trust degree of Chinese consumers to the security of Internet Banking under the influence of different factors. In the first part, I will describe the influence of internal factors on network security, such as password design and security of online banking. In the second

part, I will analyze the impact of external factors on the security of online banking, such as consumers' operating habits and operating environment. In the third part, we will discuss the impact of new types of online banking such as mobile app and new payment methods on the security of online banking. In the end, we will discuss the specific reasons that affect consumers' judgment on the security of Internet banking, so as to determine whether consumers use Internet banking.

## **2. LITERATURE REVIEW**

In the field of Internet banking security, there are a lot of documents describing the factors that affect internet banking security. At the same time, there are many literatures that study consumers' attitudes towards the security of Internet banking. However, few articles classify the factors that affect the security of Internet banking, and analyze the impact of various factors on consumers' choice of Internet banking. Especially in the Chinese market, with the rapid development of new payment methods, more and more citizens can easily access to this new financial service method. Therefore, it is valuable to study the relationship between the influencing factors of Internet banking security and consumer choice.

### **2.1 Internal factors of Internet banking security**

#### **2.1.1 The system security danger of early Internet Banking**

In terms of the internal factors affecting the Internet banking, the early Internet banking did have obvious problems in account encryption and password design. According to K.J. hole and V. Moen's research on online banking in Denmark from 2003 to 2004, most of the early online banks directly use the SSN number of citizens as the account number of online banking, which makes it

very easy for online attackers to guess the account of a citizen registered with online banking. In addition, in the early design of Internet banking password, there were no restrictions on the design of password for customers: for example, it must contain letters and numbers, it must contain upper and lower case letters, etc. According to Ross Anderson, a leading security expert, about a third of customers will use the date of birth as their password. But this kind of password has no security in the face of hacker attack.

### **2.1.2 Important changes in internal security**

In the development of Internet banking, in order to enhance the security, some banks use pin calculator. Its purpose is to provide dual authentication by requiring customers to have something (pin calculator) and know something (secret pin of activating calculator). Usually, the customer enters a fixed four digit password into the calculator to obtain a dynamic six digit password or one-time password. In this way, the real-time password of online banking becomes dynamic and more difficult to crack. This encryption method is called "U shield" in China. In the future, new internal security methods may be used. According to Fatima (1970), traditional personal identification methods (such as passwords, pins) have many defects, which cannot meet the security requirements of our highly interconnected information society. Biometrics provides new possibilities for our needs. Although biometric technology is not omnipotent, it can still provide a very powerful tool for problems that need to be identified. In the future, online banking may provide biometric based security verification. With the development of AI technology, this idea has gradually become a reality.

## **2.2 External factors of Internet banking security**

Among the external factors that affect internet banking, the fact that it may be different from what many consumers think is. In any online banking service and transaction, it is not only the bank that needs to be responsible for the security, but also the consumers who need to be responsible for their own online banking security. As (P. subsorna, S. limwiriyakul, 2011) mentioned in their research, the most widespread Internet banking security threats and risks are advertising software, malware, spyware, phishing and viruses. And the place that these risks may produce is exactly the client of network bank. The wrong network environment of Internet banking users and the too risky operating system are all the hidden dangers that may lead to the security problems of Internet banking services. As we have seen in the news, landing online banking in the public, unencrypted WiFi network environment will increase the security risk of online banking.

Compared with the internal security factors that most researchers and consumers are aware of, these external factors are often unknown in the past few years. Consumers often attribute this part of the problem to the security loopholes of the banking system itself, and online banking itself rarely tells consumers these problems alone. With the increasing number of users of Internet banking and mobile devices, the complex network environment and the huge number of users make the external security of Internet banking more and more important. The media and banks began to publicize basic online banking safety knowledge to consumers.

## **2.3 New payment method, online banking client and its security**

### **2.3.1 Security concerns about mobile banking**

With the development of electronic technology and the popularization of mobile communication. New payment methods, new Internet banking terminals began to face the market. Because of its convenience, more consumers will choose to use new payment methods to complete online financial services in new mobile terminals. Especially in the Chinese market, due to the popularity of new payment methods such as “Alipay” and “WeChat”, more than three hundred million users have become potential users of online banking. Therefore, the security of new Internet banking terminals needs to be paid more attention. As mentioned by Tommi Laukkanen in his study, Internet banking is booming due to the unprecedented convenience of mobile devices. However, around 2005, this kind of development entered a certain stage of stagnation. According to the research of (Brown et al., 2003; Luarn and Lin, 2005), the security of online banking is probably the most important and noteworthy factor that hinders the development of online banking on mobile devices.

### **2.3.2 New security problems of mobile banking**

In Jin Nie, Xiang Hu's research, he mentioned the complex security impact of new Internet banking, such as mobile banking. On the one hand, with the help of modern communication technology, compared with traditional Internet banking, mobile banking is more safe and friendly for consumers. On the other hand, the wide implementation and application of wireless communication technology in Wi-Fi technology leads to more complex information security

problems. For example, when using mobile banking, the instability of wireless signal may lead to the loss of services and data in the transaction. Another possibility is that mobile banks are more vulnerable to hackers because of the frequent changes of network environment and base stations used by mobile networks.

In the Chinese market, mobile banking began to rise in 2001. In addition to the biggest factor of national policy, the security of mobile banking is also considered as a major obstacle to the widespread popularity of mobile banking in China (Wong et al., 2004).

## **2.4 Reasons that affect consumers' judgment on the security of Internet banking**

### **2.4.1 External Factors' affect**

After the advent of the 21st century, Internet-based Internet banking has experienced explosive growth. This growth changes the traditional way of banking services and business content. Based on the huge potential user group of Internet banking, various banks have adopted various operation methods based on Internet banking in order to expand market share. However, research shows that (ABA, 2004; fox, 2005), this operation mode is effective. Because of its convenience, online banking has become an indispensable key link in modern banking services. How to gain customer loyalty in this link is a problem that every bank wants to know. Customer loyalty represents whether a customer will continue to seek services in a company after receiving services from the company, rather than turning to a new company. According to the research of Chung and Paynter (2002), the security, privacy and risk of online banking constitute the main

trust issues of consumers.

At the same time, further research shows that different groups of people have different trust in online banking security and their own risk assessment methods. For example, young people are more willing to take the risk of online banking and enjoy their convenient services and trading methods than their elders, Howcroft (2002). At the same time, the educated groups are more able to evaluate the security of online banking and reasonably accept this new financial service Karjaluo (2002).

#### **2.4.2 Online banking system (Internal) affect**

In addition to the impact of external environmental factors on consumers' judgment of online banking security, the online banking system itself also determines consumers' views on its security. The way of password input of online banking login system will affect consumers' view on its security. In general, the way of login that requires dynamic password (mobile phone verification code) will make consumers feel more secure than the traditional way of login that uses fixed password. (Maria Nilsson 2005)

However, in the existing research, it is rare to compare the impact of external factors and internal factors on consumers. In my opinion, a clear understanding of the priority of internal security factors and external security factors in the minds of consumers can make the online banking system improve reasonably.

#### **2.4.3 New banking method (mobile banking) affect**

Compared with external factors and internal factors, mobile device factor seems to be an independent factor. However, in recent years, people's great changes in mobile devices make mobile devices become a major factor affecting consumer choice. Because the emergence of mobile banking seems to divide "Internet banking" into "traditional" and "new" parts again, mobile banking has independent risks, and the emergence of such independent risks changes customers' views on the external and internal risks of traditional Internet banking. For example, nowadays, due to the popularity of mobile banking and infinite communication system (Karjaluoto, 2002), people may take more external risks into account when considering the security risks of Internet banking. Ten years ago, when people could only operate online banking with computer dynamic password, consumers may only need to worry about the internal risks of online banking system. Therefore, it is necessary to discuss the security impact of the new mobile device based online banking separately.

### **3. DATA AND METHODOLOGY**

#### **3.1 Discussion of data and sample**

In this section, I will discuss how to collect data about how the external security, internal security of online banking and how the new online banking will affect consumers' choice of online banking and how to set samples. I will use the self-produced survey method to collect data. The data survey period of the questionnaire will be designed as November.

My research contains three hypotheses. 1. The external security factors of online banking have influence on consumers' choice. 2. The internal security factors of online banking affect the choice of consumers. 3. The type of Internet Banking (mobile Internet Banking) has an impact on consumers' choice of Internet banking. In addition to basic information such as gender and age, my questionnaire also designed questions about the education, income and contact with new technology of consumers themselves. These questions can reflect the influence of consumers' own conditions on their cognition of online banking security and their choice of online banking.

In the second part of the questionnaire, my questions include consumers' perceptions of the external security, internal security and mobile Internet banking security of Internet banking, as well as their preferences and choices for different security environments.

I will share the questionnaire links to the interviewees through wechat, microblog and other social media. This will be a new online questionnaire supported by professional questionnaire software "questionnaire star". The expected number of respondents in this questionnaire is about 200. My main respondents are Internet banking consumers of different age groups (18-58 years old) and education and income groups

### **3.2 DISCUSSION OF METHODOLOGY & MODEL:**

I put forward three hypotheses and hope to get feedback through survey. Therefore, I will use multiple regression analysis to carry out this study. Multiple regression analysis can analyze

the relationship between multiple dependent variables and independent variables at the same time, so as to judge whether there is a relationship between dependent variables and

This paper will use multiple regression analysis, Likert scale and descriptive analysis to process, classify and analyze the collected data. By using multiple regression in data analysis function, I will analyze whether every aspect of online banking security (external, internal, mobile banking) will affect consumers' choice of online banking. At the same time, I will use the Richter scale to reflect the attitudes of respondents towards various factors.(Figure 1)

H1: The external security factors of online banking have no influence on consumers' choice.

H2: The internal security factors of online banking have no affect the choice of consumers.

H3: The type of Internet Banking (mobile Internet Banking) has no impact on consumers' choice of Internet banking.

My questionnaire contains not only the basic information of the interviewees themselves, but also the choices of the interviewees for the Internet Banking under various Internet Security scenarios. At the same time, my questionnaire also contains the respondents' own cognition about the connection between various network security issues. So this kind of correlation problem needs to use both expression analysis and Likert scale. The p value of regression is 0.10. (Figure 2) The purpose is to prove the hypothesis, the size of the correlation depends on the following image.

## **4 ANALYSIS & FINDINGS**

My topic is the relationship between internal security factors, external security factors and equipment factors of Internet banking and consumers' choice of Internet banking. The data source of this study is 91 questionnaires, and the main results are from three most relevant questions. My sample is students of Wenzhou Ken University, their parents, relatives and friends. The total number of questionnaires is 57. I post my questions through wechat questionnaire, QQ questionnaire, Weibo questionnaire and other forms. Finally, I collected 57 questionnaires from the website through professional questionnaire collection. My respondents include people of all ages and education background, including those from 18 to over 30 years old.

### **4.1 DISCUSSION OF RESULTS**

I offer three hypotheses in my research

H1: The external security factors of online banking have no influence on consumers' choice.

H2: The internal security factors of online banking do not affect the choice of consumers.

H3: The type of Internet Banking (mobile Internet Banking) has no impact on consumers' choice of Internet banking.

In the first hypothesis, the problem I studied is that consumers' choice of online banking is not related to internal factors (including operating system) of online banking. According to multiple regression analysis, the value of P value of the first hypothesis in my study is 0.01, which is less

than the standard value of 0.1. Therefore, according to multiple regression analysis, the conclusion is that consumers' choice of Internet banking has nothing to do with the internal factors of Internet banking security.

In the second hypothesis, the question I designed is whether consumers think the security of online banking is related to its external factors (WiFi environment security, network environment security). The result of multiple regression analysis is 0.301, which is greater than the standard value of 0.1. It proves that in the current consumer's concept, the security of online banking is not significantly related to the external security (Network Security) of online banking . Therefore, the second hypothesis is accepted.

In the third hypothesis, my question is consumers think the security of online banking is not related to their operating equipment. In this questionnaire survey, consumers think that the safety of online banking has nothing to do with the operation of online banking equipment. In the survey results, I get a p value of 0.907, which is far greater than the set value of 0.1.

#### **4.2 Findings and Comparison**

In the analysis of the above three variables, through multiple regression analysis, this paper analyzes the influence of external factors, internal factors and equipment factors of online banking on consumers' choice of online banking. The analysis formula is: consumers' choice of online banking = 0.558 \* internal factors + 0.243 \* external factors -0.019 \* equipment factors. This paper focuses on the analysis of the impact of equipment factors on consumers' online

banking security awareness. Compared with the device factor (mobile phone, laptop) and external factor (WiFi, operator's environment when using Internet Banking), consumers feel that the operating system security of Internet banking is the key factor to determine whether they use Internet banking. The vast majority of consumers will consider their own environment and equipment less when making choices.

My results are similar to those of k.j.hole and v.moen in 2003. In the research results, consumers' choice of online banking has a strong positive correlation with the internal factors (operating system) of online banking. , and in my research results, consumers' choice of online banking has a strong correlation with the security of online banking operating system. In comparison, my research results are from the 2019 Chinese consumer survey, 16 years apart from the 2003 study, but the results are similar. So we can see that consumers always think that the security of Internet banking is related to internal factors.

In the cited literature, it studies more than 30000 problem samples, including samples from Australia, the Netherlands, Thailand and other countries. Different from the sample of this study, my sample includes Chinese college students and their relatives and friends. My result comes from a smaller sample, but it has a higher user accuracy.

## **5 Conclusion**

Through the questionnaire survey and data analysis, my final research results show that: in China, consumers' choice of online banking is related to the external factors of online banking

security, but not to the internal factors and equipment factors of online banking security. The results of this study are partly the same as those in other literatures. For example, in the study of k.j.hole and v.moen, it is mentioned that consumers' trust in the security of Internet banking is strongly related to the security level of the operating system (internal security factors) of Internet banking. This result is similar to my research result. In other literatures, for example (P. subsorna, S. limwiriyakul, 2011), it is mentioned that the external security factors of online banking greatly affect the security of consumers' use of online banking. However, my research results show that consumers' choice of Internet banking is not significantly related to the security of its external factors. In my research, the result of the third hypothesis is also different from that in the literature. In the paper (Brown et al., 2003; luarn and Lin, 2005), the results show that the development of mobile phones and other devices has a strong correlation with the security of Internet banking. However, through my questionnaire survey, the research results show that consumers think that the security of Internet banking is not related to the change of equipment.

This research has a certain directional effect on the development direction of Internet banking security. The results show that consumers pay more attention to the internal factors of Internet banking security when choosing Internet banking. Therefore, to improve the operation interface of Internet banking and the security of password input may greatly improve consumers' trust in Internet banking, so that more consumers choose Internet banking.

The reason for the difference may be that my research has some limitations in the collection of questionnaires and data analysis. First of all, in the questionnaire collection, I only collected 60

questionnaires, most of which are 20-30-year-old young consumers with college degree. This limitation may lead to the fact that there are too many participants in the questionnaire with similar preferences, which does not cover all levels and types of consumers' choices. On the other hand, in my data analysis part, I use the method of multiple regression analysis, which can avoid the interference of various factors on the analysis results. However, when consumers fill in the questionnaire, they may still be affected by the relationship between the questions and make uncertain judgments.

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## TABLES AND FIGURES

Response Scale	Degree of Intensity	Frequencies of using Internet bank	Mean Interval
4	Strongly Agree	Always	3.51-4.0
3	Agree	Often	2.51-3.5
2	Disagree	Rarely	1.51-2.5
1	Strongly Disagree	Never	1.0-1.50

Figure 1(Likert Chart)

Size of Correlation	Interpretation
0.90 to 1.0 (-0.90 to -1.0)	Very high positive (negative) correlation
0.70 to 0.90 (-0.70 to -0.90)	High positive (negative) correlation
0.50 to 0.70 (-0.50 to -0.70)	Moderate positive (negative) correlation
0.30 to 0.50 (-0.30 to -0.50)	Low positive (negative) correlation
0.00 to 0.30 (-0.00 to -0.30)	Negligible correlation

Figure 2 (Size of Correlation)

## Appendix

### Questionnaire

1. Your gender
2. Your age
3. Your current education level (degree)
4. Your monthly income (salary, living expenses)

Select the answers that you think fit your situation

1. How often do you use online banking?
2. Do you think the security of online banking is related to the operating system and bank website?
3. Do you think the security of online banking is related to the operating environment?  
(Network Environment)
4. Do you think the security of Internet banking is related to operating equipment? (Computer, mobile phone)
5. When there is an internal problem in the online banking system (the system is temporarily paralyzed and the online banking data is temporarily lost), you believe that your transaction is still safe.
6. When using online banking, there are problems in the external environment (signal instability, public WiFi environment), you believe that your transaction is still safe
7. When you use the new online banking, you believe that your transaction is safe
8. The safety factor of online banking is also related to the operator's operation mode
9. Do you want to update the current online banking system to improve the safety factor?
10. Do you want online banking to detect the network operating environment to improve the security of online banking?