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Self-service technology: Analyzing retail banking services in China

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ABSTRACT

The study is conducted to test how self-service technologies (SSTs) in retail banks impact customer trust in China. To find out the relationship, Electronic Service Quality (E-S-QUAL) model is used. The data have been collected through the online survey. The results indicate that SSTs service quality positively and significantly influence customer trust in two dimensions: efficiency and privacy. As more Chinese banks start to use new retail self-service technologies, this research can assist them in assessing the service quality more accurately to enhance customer trust.

Keywords: Customer trust, E-S-QUAL, Self-service technology, Retail banking

JEL Classification: L80 M31

I. INTRODUCTION

The research aims to find out how self-service technologies (SSTs) service quality influences customer trust in retail banks. Specifically, the study is designed to test the level of customer trust with banking SSTs in China. To do this, the study adopts the E-S-QUAL measurement scale introduced by Parasuraman et al. (2005) to tests the SST service quality. The research is, therefore, relevant to customer trust, SSTs, and the E-S-QUAL model.

The development of information technology changes the way that companies deliver services. The appearance of SSTs brings a trend that traditional face-to-face services are replaced with self-service gradually. Faced with the continuous emergence of innovations, the banking sector adopts many new technologies to cater to the latest trend. In order to improve the quality and the level of customer service, banks start to implement a competition strategy with the core of customer service. The bank industry continually increases the content and types of services to expand its service area. Customers can access self-help service, intermediary service, customer consulting service, and other various services in the bank. Developing new ways of delivering banking services is another means to enhance customer service. Nowadays, the banking industry introduces many new self-service types of equipment using technological innovation, which improves the counter efficiency and reduce the errors of employee's operation and the waiting times of customers. In the past few decades, banks utilize mobile banking, automated teller machines (ATMs), Internet banking, and telephone banking. This transformation reduced the cost of banks. For instance, banks can save 60 to 75 percent of operating expenses if they use Internet banking instead of traditional retail banking (Chau and Lai, 2003). The use of Internet banking requires fewer bank clerks, so the salary of these employees are saved. Due to fewer employees are hired, the training fees and employee welfare expenses are reduced as well. The utilization of SSTs also benefits customers. Due to the

machines work 24 hours a day, which expand the operating hours. Customers can access banking services at any time they want.

In China, business philosophy and behavior are continuously challenged by the rapid development of the Internet. In traditional financial services, commercial banks act as fund intermediaries and information intermediaries. However, Internet finance has lower fixed cost and labor costs in obtaining information, which provides Internet finance with a unique competitive advantage. Lower transaction cost attracts both sides of capital supply and demand to find each other without the intermediary of banks. In addition, third-party payment providers, such as Alipay and WeChat payment, use their platforms to conduct cash payment without the involvement of banks. These third-party payments weaken the payment function of banks and finish the monopoly of bank business on offline payment (Research and Markets Ltd, 2019). Faced with these challenges, the bank industry has to make adjustments to the profit model, business structure, and service quality. Banking services tend to be simple, fast, and low-cost. Therefore, the challenge of Internet finance pushes the commercial bank to find a new area of providing financial services. There are also many competitions inside the banking industry in the Chinese banking industry. More and more competitors are appearing. For instance, state-owned commercial banks, city banks, agriculture banks, foreign banks, and other commercial banks have sprung up, which dramatically increases the intensity of market competition. Banking services are improved under intense competition. However, a large number of similar financial products and services come into being in the banking sector as well. There is few service differentiation in banking markets. In this circumstance, service innovation is critical for banks to become outstanding in the industry. The development of SSTs is one of the directions of banking innovation. In China, retail bankings start to adopt new self-service machines in recent years. For example, in 2017, Bank of China introduced smart counter machines. These intelligent devices can handle more than 90 percent of personal counter

services. They can replace over-the-counter services that used to be delivered by bank employees, which can lead to competitive advantage and customer attractiveness. Compared to Internet finance, transactions in new SST machines are more secure. The security of Internet finance is low. There are many security issues, such as the sale of privacy information, purchase of fraud software, disclosure of identity information, and so on. However, SSTs in commercial banks use closed local area network (LAN), which ensures the protection of customer's privacy. Therefore, the development of new SST machines has a potential benefit in the future.

In order to let more customers continuously use new intelligent devices, banks should build a stable relationship with customers. Trust is a vital factor in the relationship between customers and companies (Morgan and Hunt, 1994). Although banking SSTs have achieved both online and offline adoptions, the usage of banking SSTs is curtailed by trust-related issues. Some fraud events such as the fraud of unauthorized use of ATM in the G20 summit lead to a trust crisis for banking SSTs. Now new self-service devices are widely adopted in retail banking, to facilitate the use of the intelligent machines, the most critical thing banks need to do is develop trust with customers.

To find out how banks can gain customer trust in new SSTs, the relationship between customer trust and the SST service quality is tested. The smart counter machines in the Bank of China are used as representative of Chinese intelligent devices. The service quality of smart counter machines is verified through the E-S-QUAL model. There are four dimensions in the model. They are efficiency dimension, system availability dimension, fulfillment dimension, and privacy dimension. The results indicate that SST service quality positively influences customer trust for Chinese banking customers. Specifically, the efficiency and privacy of SSTs positively and significantly affect customer trust, but the system availability and fulfillment have insignificant impacts on customer trust. This means that Chinese customers concerns more about efficiency and privacy when they use smart counter machines in China.

This study provides theoretical and practical contributions. The discussion on SSTs is extended in this study by analyzing the data in a real-world context with new banking intelligent devices. That may be one of the references for future research about new SSTs. This research also proves that service quality is critical in gaining customer trust. Nowadays, except for the Bank of China, more banks are adopting new intelligent devices in China. The findings provide valuable assistance for the design and implementation of such technologies. By understanding how to get customer trust towards the new SSTs, the banking industry can achieve the objective of reducing the operating cost and maintaining high-quality service simultaneously.

The remainder contents are arranged as follows: First, an extensive literature review on SSTs and customer trust is presented. Then, the discussion of the research methodology is shown. Finally, results are presented along with the conclusion.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Self-service Technology

Self-service technology is defined as the technology that enables customers to consume services without the direct involvement of company employees (Bawan and Elma, 2017; Manickavasagam and Sivagnanasundaram, 2010). Customers can gain benefits independent from face-to-face service. Service providers such as banks, hotels, and restaurants are replacing their traditional way of service offering with self-service technologies (Kokkinou and Cranage, 2013). The utilization of SSTs benefits service companies a lot. SST adoption helps firms improve production efficiency and save the costs of employing unnecessary workers through standardizing service deliveries (Lovelock and Young, 1979; Saeid and Macanovic, 2017). As fewer employees are hired, the training fees are saved as well. SST machines also work more quickly and accurately than human labors with lower operating costs (Mills and Morris, 1986).

Due to the technologies process works faster, customer satisfaction is improved because customers experience lesser waiting times when using SSTs (Weijters et al., 2007). Customers have more choices about when and how to consume services by using SSTs as well. SSTs allow customers to get the service they want regardless of the time and place, which makes the facility more customized (Scherer et al., 2015). Therefore, the use of SSTs not only increase the value of companies but also benefits customers (Scherer et al., 2015; Chang et al., 2016).

Due to SSTs are more productive, many industries adopt SSTs, and the banking industry is one of them. The banking industry has a long history of using SSTs (Curran and Meuter, 2005). In the past few decades, banks utilize many SSTs, such as ATMs and telephone banking. The first ATM was installed in 1985 in China (Research and Markets Ltd, 2019). According to the report of Research and Markets Ltd (2019), the number of ATMs had increased to 1,110,800 units. However, the appearance of mobile payments shocked the cash payment in China, which lead to a decline in the number of ATMs in 2018 (Research and Markets Ltd, 2019). Banks get fewer profits from the payment of offline transactions because people can directly pay cash without the involvement of banks. Faced with the burden of increasing rent expense and employee salary, banks need to find a low-cost solution with high efficiency. The adoption of new SST types of equipment is one of the solutions that meet this requirement (Research and Markets Ltd, 2019). Research and Markets Ltd (2019) also reports that there are lessor banking outlets in China compared with before, and retail bank counters only processed around 11.24 percent of transactions. Under this environment, new SST machines can play a critical role in the future's banking operation.

The technical innovation has powered the banking industry. For instance, the internet, big data, and Artificial Intelligence (AI) have become the components of the bank's ecosystem (EY, 2018). With the dramatic change in technology, the outlet's service has been upgraded. SSTs with traditional services such as ATMs are replacing by smart and intelligent terminals

(EY, 2018). In 2017, some Chinese banks began to utilize the new SSTs in retail outlets, such as smart counter machines in Bank of China (BOC) and intelligent service outlets of Industrial and Commercial Bank of China (ICBC). These new intelligent terminals provide customers with more than 90 percent of the non-cash business, which cannot be achieved using ATMs that can only offer cash-related services (ICBC China, 2017). ATMs offer customers primary and straightforward banking services, such as depositing money, saving money, and transferring money. Before the appearance of new intelligent types of equipment, other types of banking services can only be delivered through counters. Now various banking services can be accessed in new intelligent devices. Customers can print the voucher, register for new bank accounts, inquiry statements, and get banking products by using new smart machines (ICBC China, 2017). Due to the machines process business more efficiently and accurately, customer experience is improved as well. When customers consume banking services in counters, they need to sign numerous documents to verify their identities, which is time-consuming. Intelligent devices in retail banking allow customers to save 70 percent to 80 percent of the time, because the machines can process verification with image recognition and electronic signature quickly (ICBC China, 2017). When business is handled faster, the waiting time of customers is reduced, which enhances customer experience and improves customer satisfaction (Weijters et al., 2007). To make sure the security of intelligent services using, the new smart machines are installed with intelligent PAD and anti peeping screens to avoid identity fraud and information leakage (ICBC China, 2017). The use of intelligent machines brings a new situation of retail banking. There are few studies about the new SSTs in retail banking, which necessitates new researches.

Trust

Customer's continued use is vital to the SSTs (Eriksson and Nilsson, 2007). A critical issue that influences financial services is perceived risk, and this related to the perception of trust

(Rousseau et al., 1998). Trust is defined widely, and there is no commonly accepted definition yet. In the related literature, trust is people's willingness to accept weakness when people positively reckon the behaviors or intentions of others (Ennew and Sekhon, 2007; Cockrill et al., 2009). Swan et al. (1988) conclude that stable social order necessitates trust and a steady relationship between individuals appears based on trust. Trust will exist as individuals feel confident about the reliability and honesty of exchange partners (Morgan and Hunt, 1994). According to the studies of Doney and Cannon (1997) and Casielles et al. (2005), trust is constructed with two dimensions, and it comprises credibility and benevolence. Credibility exists when the perceiver believes that the party can fulfill its duties and obligations (Casielles et al., 2005). The credibility is related to the perceiver's reckon on the other party's capability to complete a commitment (Casielles et al., 2005). The party is more trusted when the perceived credibility is higher. Benevolence is defined as one party's understanding and support for the other party's interest to reach a win-win situation (Doney and Cannon, 1997). Benevolence facilitates the maintenance of relationship because parties seek for a common objective with mutual benefits. Sacrifices necessitate in benevolence for meeting the other party's needs (Ganesan, 1994). Other researches argue that trust consists of three dimensions. They are ability, benevolence, and integrity (Johnson et al., 2008). The ability means the one party believes the other party's capability to fulfill the obligations (Mayer et al., 1995). Integrity exists when the other party can cooperate morally and ethically (Schlosser et al., 2006). The individual is believed that he or she intends to perform with good-faith, regardless of whether he or she has the capability to perform well or not (Schlosser et al., 2006). One party is more trusted when it is perceived as a moral and ethical one. Dimitriadisa and Kyrezis (2011) conclude that trust consists of four dimensions, they are benevolence, integrity, competence, and predictability. The definition of competence is similar to the capacity in a two-dimensional concept and the ability in the three-dimensional theory of trust. It refers to one party's

capability and skill to conduct the duties (Dimitriadisa and Kyrezis, 2011). Predictability means that one party's behaviors are predictable because he or she acts consistently (Dimitriadisa and Kyrezis, 2011). If one party's behaviors change all the time, he or she may not be trustworthy. Based on the referencing of the mentioned pieces of literature, in this study, trust is defined as a positive attitude about the goodwill and ability that the exchange partner has to fulfill their obligations (Dwyer et al., 1987; Ye et al., 2019; Keh and Xie, 2009).

Trust does not form immediately. The development of trust necessitates a process. Doney and Cannon (1997) summarize five processes of obtaining trust in a business relationship. The first process that generates trust is the prediction process (Doney and Cannon, 1997). Doney and Cannon (1997) conclude that one party reckon the behavior of the other party in this process. One party first gathers information about the other party from its past experience and forms an initial impression (Doney and Cannon, 1997). The impression can be tested during the following interactions with the other party by comparing the actual behavior and expected behavior (Doney and Cannon, 1997). The closer the expected behavior is to the actual behavior, the more trustworthy it is. The second process is called the capability process (Doney and Cannon, 1997). One party estimates the other party's capability to fulfill its responsibilities in this process (Doney and Cannon, 1997). The degree of trust is related to the assessment result. The third process is named the calculative process (Doney and Cannon, 1997). In this process, one party calculates the other party's gain of maintaining the relationship or the loss of cheating in the relation (Lindskold, 1978). If the benefit of preserving the relationship is lower than cheating, one party will infer that the other party will not hurt the relationship, because the failure of the relationship cost that party more than what it rewards (Akerlof, 1978). In that situation, the other party is trustworthy. The intentionality process is the fourth process that one party gauges the intentions and objectives of the other party by analyzing the other party's actions (Lindskold, 1978). If one party is willing to assist and reward the other party, its

objective will be seen as meritorious, and this party will become more trusted (Doney and Cannon, 1997). Trust can be formed through the transference process as well (Doney and Cannon, 1997). Individuals determine whether the other party is worth trusting or not based on the information provided by a third-party (Strub and Priest, 1976). The trust is transferred from the third-party to individuals in this process. The five processes are different ways that people measure if the other party is worth trusting (Doney and Cannon, 1997).

Trust is critical for business transactions. Swan et al. (1988) argue that trust assists the conduct of the transaction process because if there is mistrust, both sides of transaction parties need to take time to fix it. The literature recognizes that trust is the prerequisite to establish customer relationships (Morgan and Hunt, 1994; Garbarino and Johnson, 1999). Trust helps companies gain customer loyalty. Gee et al. (2008) state that customer trust is a critical factor in establishing a loyal and stable business relationship. Numbers of researches have proved that trust positively and directly affects customer loyalty (Hoq et al., 2010; Sarwar et al., 2012; Aydin and Özer, 2005). Due to trust is salient in an uncertain environment, service providers should take trust into consideration particularly (Moorman et al., 1992). As more new SSTs are adopting in retail banks, the building of new customer relationship needs to be paid attention to. Johnson et al. (2008) claim that trust in technology is influenced by customers' measurement of the user experience of SST performance quality. Therefore, banks need to concern more about the issue of improving service quality to gain customer trust when they utilize more self-service technologies.

Service Quality Measurement

Many measurements have been introduced for measuring electronic service quality. The SSTQUAL measurement scale developed by Lin and Hsieh (2011) consists of the assurance factor, the convenience factor, the functionality factor, the security factor, the customization factor, the enjoyment factor, and the design factor. This measurement can be applied to test the

SST service quality in today's circumstance where many new intelligent devices are adopted. The SSTQUAL scale is used in many studies for SSTs (Lin and Hsieh, 2006; Radomir and Nistor, 2012; Shahid Iqbal et al., 2018). Cristobal et al. (2007) introduce PeSQ measurement to test the perceived quality of electronic services. There are four dimensions in the PeSQ model. They are design dimension, assurance dimension, order management dimension, and customer service dimension (Cristobal et al., 2007). This measurement is widely used for testing online service quality (Ho and Lin, 2010; Rareş, 2014). In this study, a service quality measurement E-S-QUAL introduced by Parasuraman et al. (2005) is adopted in this study as the model to test the service quality of SSTs. E-S-QUAL model is developed from the e-SQ model created by Zeithaml et al. (2000), and it is more accurate and fittable in today's SST environment. Many studies adopt this scale to assist SST service quality (Kim et al., 2006; Boshoff, 2007; Yang and Tsai, 2007; Marimon et al., 2010; Santouridis, 2012). E-S-QUAL comprises four dimensions. They are system availability, efficiency, privacy, and fulfillment.

Efficiency is the ease of use of technology (Wolfenbarger and Gilly, 2003). Due to the intelligent devices are new technologies for customers, simple operations of intelligent devices can help customers get familiar with the machines. Sahadev and Purani (2008) prove that efficiency directly influences customer trust.

H1: Efficiency positively and significantly influences customer trust.

System availability exists when the technical function is correctly processed (Akinci et al., 2010). Sahadev and Purani (2008) find that system availability positively influences customer trust.

H2: System availability positively and significantly influences customer trust.

Fulfillment is the capacity to deliver the promised service reliably (Zeithaml et al., 2002). The research of Kim et al. (2009) shows that consumers are concerned a lot about fulfillment when building trust with companies.

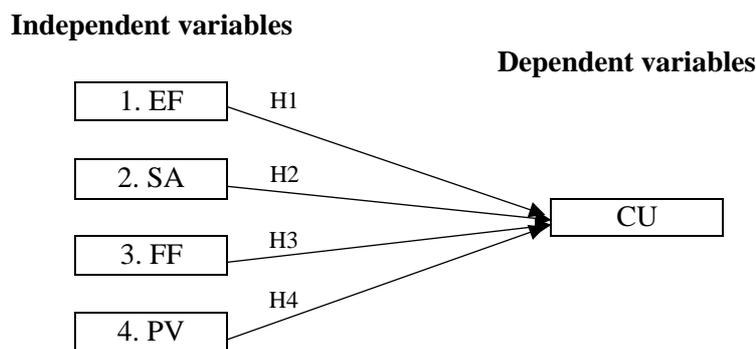
H3: Fulfillment positively and significantly influences customer trust.

Privacy is perceived as security related to fraud, general safety, and loss of personal information (Considine and Cormican, 2016). Privacy involves the prevention of personal information from sharing to third parties, anonymity, and the requirement of informed consent (Friedman et al. 2000). Kim et al. (2009) prove that privacy significantly impacts customer trust.

H4: Privacy positively and significantly influences customer trust.

III. RESEARCH METHODOLOGY

Figure 1 Conceptual framework



Notes:

EF = Efficiency, SA = System availability, FF = Fulfillment, PV = Privacy, CU = Customer trust

Service quality a vital factor that influences customer trust (Johnson et al., 2008). To test the quality of SSTs in retail banking, a multiple-item scale, E-S-QUAL that tests electronic service quality is applied in this research (Parasuraman et al., 2005). The conceptual framework linking E-S-QUAL and customer trust is shown in Figure 1. The independent variables are E-S-QUAL's four dimensions, and the dependent variable is customer trust. Through using this model, the impacts of the four dimensions on customer trust can be found.

This study is empirical research with a quantitative methodology. To answer the research question, a survey questionnaire is conducted. The new SSTs in retail banking are new

technologies for Chinese customers, the earliest application of new intelligent devices occurred in 2017, which means many Chinese have only used the new intelligent device less than two years. To make sure the study results are accurate, the participants need to be familiar with banking new SSTs. Bank of China adopted new SST machines called smart counter machines in 2017. The customers of Bank of China have more user experience than the customers in other banks. In addition, Bank of China is the only Chinese bank that has operated continuously for more than 100 years with the highest degree of internationalization and diversification in China. Therefore, it is chosen as the case of this study. The questionnaires are answered by Chinese customers of Bank of China who have used the smart counter machines. The user experience of the smart counter machines is the prerequisite for respondents. If they have not used the smart counter machines, their answers will not be included in the study. To assist Chinese respondents in understanding the survey better, the questionnaire consists of English questions with Chinese translation.

The survey (see Appendix) comprises three sections. The first part consists of questions about respondents' demographic data. The second section aims to seek customer opinions about the quality of smart counter machines through E-S-QUAL's four dimensions. The third section tests customer trust in the smart counter machines. Consumer experiences with the smart counter machines were measured using a set of 26 scale items in the questionnaire. These items were adapted from previous researchers with some modifications (See Table 1). Seven-point Likert scale, ranging from 1 (I strongly disagree with the statement) to 7 (I strongly agree with the statement), is applied to test five variables: efficiency (EF), system availability (SA), fulfillment (FF), privacy (PV), and customer trust (CU).

Table 1
Measurements of variables and references

Abbr.	Item	Source
<i>Efficiency (EF)</i>		
EF1	It is easy to find the transaction needs in BOC smart counter machines.	(Joseph et al., 1999)

Table 1
Measurements of variables and references

Abbr.	Item	Source
EF2	Banking transactions can be processed quickly in BOC smart counter machines.	(Boshoff, 2007)
EF3	BOC smart counter machines offer user-friendly service.	(Parasuraman et al., 2005)
EF4	BOC smart counter machines are easy to use.	(Lopes et al., 2019)
EF5	BOC smart counter machines display the banking information with good arrangement.	(Lopes et al., 2019)
EF6	BOC smart counter machines deal with my transaction efficiently at the bank.	(Parasuraman et al., 2005)
<i>System availability (SA)</i>		
SA1	The service in BOC smart counter machines is always available.	(Akinci et al., 2010)
SA2	BOC smart counter machines processe the banking services I need immediately.	(Handayani et al., 2018)
SA3	BOC smart counter machines do not crash when I use it.	(Boshoff, 2007)
SA4	BOC smart counter machines do not have the issue of freezing during the transaction.	(Boshoff, 2007)
SA5	BOC smart counter machines' response right way after my actions.	(Parasuraman et al., 2005)
<i>Fulfillment (FUL)</i>		
FF1	BOC smart counter machines provide quality banking services as promised.	(Lopes et al., 2019)
FF2	The banking service that BOC smart counter machines provide is the same as what physical bank offers.	(Parasuraman et al., 2005)
FF3	BOC smart counter machines process the banking services quickly.	(Marimon et al., 2010)
FF4	BOC smart counter machines fulfill my requirements.	(Lopes et al., 2019)
FF5	BOC smart counter machines promise accurately about the banking services offered to the customers.	(Handayani et al., 2018)
<i>Privacy (PRI)</i>		
PV1	BOC smart counter machines protect my action information.	(Akinci et al., 2010)
PV2	BOC smart counter machines protect my confidentiality banking information.	(Lin and Hsieh, 2011)
PV3	I trust BOC smart counter machines will not reveal my personal information except legal permission.	(Boshoff, 2007)
PV4	BOC smart counter machines will keep my personal information safe.	(Blut, 2016)
PV5	I feel safe to make banking transactions in BOC smart counter machines.	(Lin and Hsieh, 2011)
<i>Customer trust (CT)</i>		
CU1	I trust that the transaction in BOC smart counter machines will meet my requirements.	(Sanchez-Franco, 2009)
CU2	I trust the transactions in BOC smart counter machines are error-free.	(Chu et al., 2012)
CU3	I trust that administrators of BOC smart counter machines will not abuse my information.	(Chu et al., 2012)
CU4	I am willing to enter private information to BOC smart counter machines.	(Kassim and Asiah, 2009)
CU5	I believe BOC smart counter machines will keep its commitment to customers.	(Sanchez-Franco, 2009)

The survey is conducted on a Chinese survey platform named Wenjuanxing (www.wjx.cn). This platform distributes questionnaires through the Internet. The survey can be distributed to a broader area, which avoids regional limitations. Statistical Product and Service Solution (SPSS) is the analytical method that assesses the statistical significance of the relationships among variables.

IV. EMPIRICAL RESULTS

Table 2
Demographic data of participants

	Percentage	Cumulative Percentage	Frequency
<i>Gender</i>			
Male	48.6	48.6	86
Female	51.4	100.0	91
<i>Age</i>			
< 25	24.3	24.3	43
25-40	30.5	54.8	54
41-55	32.8	87.6	58
>55	12.4	100.0	22
<i>Education level</i>			
High school or less	11.3	11.3	20
Some college	22.6	33.9	40
College Graduate	57.1	91.0	101
Graduate School	9.0	100.0	16
<i>Annual household income</i>			
<\$25,000	28.2	28.2	50
\$25,000-\$49,999	45.2	73.4	80
\$50,000-\$74,999	15.8	89.3	28
\$75,000 or more	10.7	100.0	19
<i>Length of Bank of China smart counter machines use</i>			
< 0.25 year	32.2	32.2	57
0.25 to 0.5 year	36.7	68.9	65
0.5 year to 1 year	16.9	85.9	30
1 year or more	14.1	100.0	25
<i>Frequency of Bank of China visits</i>			
= < 4 times per month	36.2	36.2	64
5 - 8 times per month	34.5	70.6	61
9 - 12 times per month	18.1	88.7	32
>13 times per month	11.3	100.0	20

The data of this research were collected with the help of a survey agency that distributed the questionnaire to a random sample in China. The answers are included in the study only if the participants have used the smart counter machines in the Bank of China. The number of surveys that are returned is 180, and 177 of them are answered by the users of Bank of China smart counter machines. Therefore, the sample in this study consists of 177 Chinese customers. The gender composition of the sample is almost even (48.6% male; 51.4% female). More detailed information on all respondents is displayed in Table 2.

Green (1991) discusses the minimum number of subjects to do regression analysis in his study, according to him, the minimum size of a survey sample is determined by the quantity of independent variables and the statistic method. For regression analysis, the sample size should follow the equation: $S > 50 + 8n$ (where n is independent variables amount) in for multiple regression (Green, 1991). In this research, the quantity of the independent variable is four, so the minimum sample size is 82 respondents. A volume of 177 questionnaires is larger than the minimum requirement, so the sample size is valid.

Before analyzing the data, the survey's reliability test and validity test are necessary to ensure the accuracy of the variables. When a survey with reliability is answered many times with similar participants, the result of responses should be consistent (Heale and Twycross, 2015). According to the study of MacKenzie et al. (2011), the reliability analysis of variables in a model is carried using Cronbach's alpha coefficients (α). Based on the rules set by Georgy and Mallery (2003) that the variable is reliable when α value is greater than 0.70. Table 3 displays the reliability test results. The α variables of all variables are beyond 0.70, which means the questionnaire is reliable.

The survey's validity exists when the concepts in the questionnaire are tested accurately (Heale and Twycross, 2015). Bartlett test of sphericity and Kaiser-Meyer-Olkin (KMO) are universal tools to measure whether the questionnaire in the study is valid or not. According to

Kaiser and Rice (1974), the validity interpretation of KMO is middling when the KMO value is larger than 0.70, it is meritorious when the value is larger than 0.80, and it is marvelous when the value is larger than 0.90. As Table 4 presents, the KMO values of variables are beyond 0.90, which is within the acceptable value. Table 4 also shows that the Bartlett's tests of sphericity for all variables are significant, which indicates the variables are related and, therefore, suitable in the survey.

Table 3
The reliability of the variables

	α	Number of Items
EF	.936	6
SA	.931	5
FF	.937	5
PV	.932	5
CU	.932	5

Notes:

EF = Efficiency, SA = System availability, FF = Fulfillment, PV = Privacy, CU = Customer trust

Table 4
The validity of variables

	KMO	Bartlett's Test		
		χ^2	df	p-value
EF	.932	827.846	15	.000
SA	.905	679.634	10	.000
FF	.902	730.403	10	.000
PV	.904	689.702	10	.000
CU	.900	691.817	10	.000

Notes:

a. EF = Efficiency, SA = System availability, FF = Fulfillment, PV = Privacy, CU = Customer trust

b. Bartlett's Test shows significant when $p < 0.05$

To test the relationship between customer trust and the service quality of smart counter machines in the Bank of China, the correlations of variables is tested (see Table 5). The p-values of the correlations between each independent variable and dependent variable are greater than 0.05, which shows positive correlations between customer trust and system availability, efficiency, privacy, and fulfillment.

Table 5
The relationship between independent variables and dependent variable

	EF	SA	FF	PV	CU
EF	1				
SA	.947** .000	1			
FF	.938** .000	.940** .000	1		
PV	.939** .000	.950** .000	.943** .000	1	
CU	.933** .000	.927** .000	.921** .000	.932** .000	1

Notes:

- a. N =177; **. Correlation shows significant when $p < 0.01$.
- b. Dependent Variable: CU
- c. Predictors: (Constant),EF, SA, FF, PV
- d. EF = Efficiency, SA = System availability, FF = Fulfillment, PV = Privacy, CU = Customer trust

Table 6
Test of coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	p-value
		β	Std. Error	Beta		
1	(Constant)	.135	.127		1.065	.288
	EF	.355	.087	.344	4.065	.000
	SA	.164	.091	.165	1.800	.074
	FF	.144	.082	.147	1.760	.080
	PV	.312	.089	.314	3.528	.001

Notes:

- a. Dependent Variable: Customer trust (CU)
- b. EF = Efficiency, SA = System availability, FF = Fulfillment, PV = Privacy, CU = Customer trust

The regression results are displayed in Table 6. The regression results indicate that the efficiency ($p = 0.000$) and privacy ($p = 0.001$) independent variables are statistically significant because their p-values are lower than the usual significance level of 0.05. Therefore, the efficiency and privacy of the smart counter machine have a significant impact on customer trust in China. Table 6 also shows that the independent variable system availability ($p = 0.074$) and fulfillment ($p = 0.080$) are not statistically significant because their p-values are greater

than 0.05. This indicates that the system availability and fulfillment of smart counter machine have an insignificant effect on customer trust in China.

The ANOVA result is displayed in Table 7. It shows that $F(4, 172) = 396.301$ and $p < 0.05$, which suggests that the regression equation is significant, and the model is perfectly fit. Therefore, the independent variables are appropriately selected. R Square shows how much of the variation of the independent variables can explain the dependent variable.

Table 7
The ANOVA interaction

Model		Sum of Squares	df	Mean Squares	F	p-value
1	Regression	468.243	4	117.061	396.301	.000 ^b
	Residual	50.806	172	.295		
	Total	519.049	176			

Notes:

- a. Dependent Variable: CU (Customer trust)
- b. Predictors: (Constant), EF (Efficiency), SA (System availability), FF (Fulfillment), PV (Privacy)

According to the results (see Table 8), the relationship between efficiency and customer trust is positive and significant. This suggests that efficiency affects customer trust. Therefore, hypothesis 1 is accepted. The significant relationship generates because of the characteristics of Chinese customers. The smart counter machines were introduced in 2017, and they are set for dealing with numbers of the non-cash businesses. Compared to simple SST machines in retail banking such as ATMs, smart counter machines are new devices for Chinese banking customers. Therefore, the essential factor for the successful adoption of smart counter machines is that Chinese customers know how to use the machines. The ease of use is a vital characteristic of the application of smart counter machines. Only when the access to functions is simple and well organized in the machines will customers start to use them. In addition, there are 45.2 percent of people who are older than 40 years old in the sample of this study. They are not young people who can accept new technologies quickly, and they need time to learn how to use new SST machines. After customers begin to use the machines, they perceive the service

quality and determine customer trust. Simple and effective operations can reduce input errors and redundant information entry, which improves customer trust. Therefore, the efficiency of smart counter machines is very important for customer trust. This finding is consistent with the results Sahadev and Purani (2008) and Kim et al. (2009) made in their studies.

Table 8
The test result of the hypothesis

Paths	Results
H1: Efficiency has a significant impact on customer trust.	Significant
H2: System availability has a significant impact on customer trust.	Insignificant
H3: Fulfillment has a significant impact on customer trust.	Insignificant
H4: Privacy has a significant impact on customer trust.	Significant

The path between privacy and customer trust is significant and supports hypothesis 4. The result connotes that the privacy of smart counter machines is a critical factor for banks to maintain customer trust. People have few secrets in front of the bank in China. Customers provide their names, ID numbers, phone numbers, education level, and other information to open a bank account. When customers complete the first transaction with banks, part of their personal information is accessible for banks. Banks know the transaction time, monetary amount, and transaction location, people’s consuming habits can even be analyzed using these data. Under this environment, the protection of customer privacy is crucial. The fraud events of SSTs in Chinese banks, such as the fraud of unauthorized use of ATM in the G20 summit stop the usage of SSTs in some way. Therefore, the privacy issue of new SST machines is an essential factor that affect customer trust. There are researches provide support to the finding that privacy significantly affects customer trust (Sahadev and Purani, 2008; Kim et al., 2009).

The conclusion can be made from the findings that system availability insignificantly affect customer trust. Hypothesis 2 is rejected. This result is inconsistent with the findings of Sahadev and Purani (2008) and Kim et al. (2009). They prove that system availability is a significant factor for gaining customer trust (Sahadev and Purani, 2008; Kim et al., 2009). In China,

customers seldom meet system availability issues. There are many same machines display in retail banking. Even though one machine is not available, customers can get access to the system on another machine quickly. In addition, Bank of China arranges employees to assist customers. The issue of system availability can be solved immediately compared to the problems of privacy and efficiency.

The relationship between fulfillment and customer trust is insignificant. This connotes that fulfillment does not affect customer trust significantly. Therefore, hypothesis 3 is rejected. In China, customers focus more on the services provided to them in smart counter machines. They seldom think about what they need but not accessible in SST machines. Therefore, the fulfillment of smart counter machines does not really influence customer trust. The finding is inconsistent with the past studies that conclude that fulfillment significantly affect customer trust (Sahadev and Purani, 2008; Kim et al., 2009).

V. CONCLUSIONS

This study explores how the service quality of SSTs influences customer trust in Chinese retail banking. The study concludes that the efficiency and privacy of SSTs have a positive and significant impact on customer trust in China, while system availability and fulfillment have a positive but insignificant impact on customer trust in China. This result suggests that efficiency, privacy, fulfillment, and system availability are all the evaluation criteria for the performance of the smart counter machines. Due to more and more bank fraud events occurred in recent years, the Chinese take into account more the privacy of banking devices. In the sample of this study, 45.2 percent of people are older than 40 years old. They are unfamiliar with the function and operation of new SST machines because this is a new phenomenon in their life. Therefore, the ease of use and user-friendly operations are very important for them, which is associated with the efficiency of the smart counter machines. The privacy issue and the operation

problems are bothering Chinese customers a lot, but the problems of system availability and fulfillment do not occur very frequently, so when Chinese customers evaluate the service quality of the smart counter machines, they care more about efficiency and privacy than system availability and fulfillment.

Due to new SST machines in retail banking have appeared for only two years, there is few pieces of research studys these intelligent devices. This research theoretically provides a reference for the new topic about intelligent devices in retail banking. The study shows that the E-S-QUAL model is applicable in the evaluation of the quality of SSTs in today's circumstance where new intelligent devices are adopted. The knowledge of how SST service quality dimensions may influence customer trust is improved. The research proposes for further discussion on the applicability of the determinants in the banking industry. In this study, efficiency and privacy are significant dimensions fot the quality of SSTs in Chinese retail banking, but system availability and fulfillment dimensions are not that determinable for the test of SSTs quality. Therefore, further study can be set to find more appropriate dimensions for the new banking SSTs' quality measurement. This research also provides more understanding of the practical issues in banking SSTs in China. The results can assist the bank managers in figuring out the factors that Chinese customers concerned about most when they use new intelligent devices. In order to improve customer trust, Bank of China can implement some policies that contribute to the enhancement of the efficiency and privacy of smart couner machines. As more banks are adopting the new intelligent devices in China, the findings can also assist the implementation of such technologies for other banks in China. These banks need to placed the focus on the efficiency and privacy of new intelligent devices. In this way, they can guarantee the service quality of new machines and gain customer trust to establish a stable relationship with customers.

Limitations

Despite the significant findings in this study, some limitations must be acknowledged. This study only focuses on the smart counter machines in Bank of China, so the results are not universal for all Chinese banks. Future implement of new intelligent devices in other banks can not thoroughly refer to the results of this study. The functions and constructions of new SSTs are upgrading and improving quickly. The study findings of today's smart counter machines may not be suitable for the assessment of future SST machines. Future studies are recommended to include more banks and consider upgraded functions. Recent researches mention that culture components will influence people's attitudes about trust, and the perceptions vary from country to country (Kim, 2008). Therefore, the findings are not suitable for banks in other countries in the world. Chinese customers' attitude to the new intelligent devices in retail banking cannot represent all thinkings of other countries' customers. Future researches are suggested to include the banks in more countries to generate a universal answer to the research question.

Questionnaire

Section I

Personal Data

1. Have you used BOC smart counter machines? 请问您使用过中行智慧柜员机吗?
 - Yes 是
 - No 否

2. What's your gender? 请问您的性别是?
 - Male 男
 - Female 女

3. What's your age? 请问您的年龄是?
 - < 25 小于25岁
 - 25-40 25到40岁
 - 41-55 41到55岁
 - >55 大于55岁

4. What's your level of education? 请问您的教育水平是?
 - High school or less 高中及以下
 - Some college 本科在读
 - College Graduate 本科毕业
 - Graduate School 研究生

5. What's your annual household income? 请问您的家庭年收入是?
 - <\$25,000 (小于¥174447)
 - \$25,000-\$49,999 (¥174447到¥348888)
 - \$50,000-\$74,999 (¥348888到¥523335)
 - \$75,000 or more (大于¥523335)

6. What is your length of BOC smart counter machines use? 请问您已经使用中行智慧柜员机多长时间了?
 - < 3 months 小于三个月
 - 3 to less than 6 months 三到六个月
 - 6 to less than 12 months 六个月到一年
 - 12 months or more 大于等于一年

7. What is your frequency of BOC Visits? 请问您每个月去中国银行办理几次业务?
 - 4 or less times a month 小于等于4次/每月
 - 5 to 8 times a month 5到8次/每月
 - 9 to 12 times a month 9到12次/每月
 - 13 or more times a month 大于等于13次/每月

Section II

A. Efficiency 效率

1. It is easy to find the banking needs in BOC smart counter machines.
使用中行智慧柜员机时，我很容易找到与银行交易所需的信息。
1 2 3 4 5 6 7
2. Banking transactions can be processed quickly in BOC smart counter machines.
我能在中行智慧柜员机快速地完成银行交易。
1 2 3 4 5 6 7
3. BOC smart counter machines offers user-friendly service.
中行智慧柜员机为顾客提供人性化的自助服务。
1 2 3 4 5 6 7
4. BOC smart counter machines are easy to use.
中行智慧柜员机的操作很简单。
1 2 3 4 5 6 7
5. BOC smart counter machines display the banking information with good arrangement.
中行智慧柜员机提供的银行信息组织有序。
1 2 3 4 5 6 7
6. BOC smart counter machines deal with my financial transaction efficiently at the bank.
中行智慧柜员机为我提供了高效的金融交易服务。
1 2 3 4 5 6 7

B. System availavility 系统可用性

7. The service in BOC smart counter machines is always available.
中行智慧柜员机随时为我服务。
1 2 3 4 5 6 7
8. BOC smart counter machines process the banking services I need immediately.
中行智慧柜员机会立刻提供我所需要的银行服务。
1 2 3 4 5 6 7
9. BOC smart counter machines do not crash when I use it.
中行智慧柜员机在我使用的过程中不会故障。
1 2 3 4 5 6 7
10. Pages at BOC smart counter machines do not freeze during the transaction.
中行智慧柜员机的页面在我开始银行交易后不会卡顿。
1 2 3 4 5 6 7
11. BOC smart counter machines' response right way after my actions.
当我使用中行智慧柜员机，执行操作和智能服务区的响应之间的等待时间很短。
1 2 3 4 5 6 7

C. Fulfillment 执行力

12. BOC smart counter machines deliver quality banking services as promised.
中行智慧柜员机承诺为客户提供优质的银行服务。
1 2 3 4 5 6 7
13. The banking service that BOC smart counter machines provide is same as what physical bank offers.
中行智慧柜员机提供的银行服务与实体银行相同。

1 2 3 4 5 6 7

14. BOC smart counter machines process the banking services quickly.

中行智慧柜员机快速执行银行交易服务。

1 2 3 4 5 6 7

15. BOC smart counter machines fulfill my requirements.

中行智慧柜员机满足了银行客户的需求。

1 2 3 4 5 6 7

16. BOC smart counter machines promise accurately about the banking services offered to the customers.

中行智慧柜员机明确承诺为客户提供的银行服务类型。

1 2 3 4 5 6 7

D. Privacy 隐私

17. BOC smart counter machines protect my action information.

中行智慧柜员机对我的操作信息有安全保护。

1 2 3 4 5 6 7

18. BOC smart counter machines protect the my confidentiality banking information.

中行智慧柜员机为我的银行信息保密。

1 2 3 4 5 6 7

19. I trust BOC smart counter machines will not reveal my personal information except the legal permission.

我相信除了在法律允许的情况下，中行智慧柜员机不会把我的个人信息分享给第三方。

1 2 3 4 5 6 7

20. I trust BOC smart counter machines will keep my personal information safe.

我相信中行智慧柜员机能确保我个人信息的安全。

1 2 3 4 5 6 7

21. I feel safe when I make banking transactions in BOC smart counter machines.

我在工商银行智能服务区办理银行业务时感到很安全。

1 2 3 4 5 6 7

Section III

E. Customer trust 客户信赖度

22. I trust that the transaction in BOC smart counter machines will meet my requirements.

我相信中行智慧柜员机的交易将满足我的银行需求。

1 2 3 4 5 6 7

23. I trust the transctions in BOC smart counter machines are error-free.

我相信中行智慧柜员机将会有有一个没有错误的银行交易。

1 2 3 4 5 6 7

24. I trust that administrators of BOC smart counter machines will not misuse my personal information.

我相信中行智慧柜员机的管理人员不会滥用我的个人信息。

1 2 3 4 5 6 7

25. I am willing to enter private information to BOC smart counter machines.

我愿意向中行智慧柜员机提供我的个人信息。

1 2 3 4 5 6 7

26. I believe BOC smart counter machines would keep its commitment to customers.
我相信中行智慧柜员机会恪守对银行服务的承诺。
1 2 3 4 5 6 7

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