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Security Risk Tolerance in Mobile Payment: A Trade-off Framework

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SECURITY RISK TOLERANCE IN MOBILE PAYMENT: A TRADEOFF FRAMEWORK

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ABSTRACT

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Security is identified as a major barrier for consumers in adopting mobile payment. Although existing literature has incorporated security into the Technology Acceptance Model (TAM), the Unified Theory of Acceptance, and the Use of Technology (UTAUT) and it has investigated the way in which security affects consumers' acceptance of mobile payment, security is a factor only in diverse research models. Studies of mobile payment that focus on security are not available. Additionally, previous studies of mobile payment are based on Direct Carrier Billing- (DCB)-based mobile payment or Near Field Communication- (NFC)-based mobile payment. The results regarding security might not be applicable to Quick Response (QR) code-based mobile payment, the format that has become prevalent in recent years. As such, this study focuses on security of using mobile payment and develops a benefit-cost appraisal and a trade-off framework by integrating the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), the Protection Motivation Theory (PMT), and the Rational Choice Theory (RCT). Particularly, this study introduces security risk tolerance into mobile payment study and sets it as the dependent variable. This study proposes that consumers' security risk tolerance is shaped by their benefit-cost appraisal and their tradeoff process, regarding the use of mobile payment.

Based on an online survey that collected data from 324 respondents in China, this study empirically tests and validates the research model. The findings suggest that consumers'

perceived benefit in using mobile payment is positively related to their security risk tolerance, whereas their perceived cost of using mobile payment is negatively related to their security risk tolerance. Convenience, safety, and savings positively affect consumers' perceived benefit. The security threat positively affects consumers' perceived cost. Payment tradition moderates consumers' benefit-cost appraisal and trade-off process, but normative beliefs do not have a significant moderating effect. Self-efficacy only moderates the relationship between consumers' perceived cost and their security risk tolerance. This study finds that males and females complete their benefit-cost appraisal and their trade-off process regarding security of using mobile payment very similarly. Gender differences only exist in the relationship between savings and consumers' perceived benefit of using mobile payment.

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LIST OF ABBREVIATIONS

Abbreviation	Definition
ACIS	Australasian Conference on Information Systems
ACM	Association for Computing Machinery
AIS	Association for Information Systems
AMCIS	Americas Conference on Information Systems
BLED	Bled Electronic Commerce Conference
BOP	Bottom of the Pyramid
CFA	Confirmatory Factor Analysis
CFI	Confirmatory Fit Index
CGAP	Consultative Group to Assist the Poor
CMIN/DF	Chi Square/Degree of Freedom
CNNIC	China Internet Network Information Center
CR	Composite Reliability
DCB	Direct Carrier Billing
DOI	Diffusion of Innovation
EBSCO	Elton B. Stephens Co.
ECIS	European Conference on Information Systems
GSMA	Global System for Mobile Communications Association
HICSS	Hawaii International Conference on System Sciences
IADIS	International Association for the Development of the Information

	Society
ICEB	International Conference on Electronic Business
ICEC	International Conference on Electronic Commerce
ICMB	International Conference on Mobile Business
IEEE	Institute of Electrical and Electronics Engineers
ICIS	International Conference on Information Systems
INFORMS	Institute for Operations Research and the Management Sciences
IP	Internet Protocol
ISI	Institute for Scientific Information
MNO	Mobile Network Operators
NFC	Near Field Communication
OLS	Ordinary Least Squares
PACIS	Pacific Asia Conference on Information Systems
PBC	Perceived Behavioral Control
PMT	Protection Motivation Theory
POS	Point of Sale
QR	Quick Response
RCT	Rational Choice Theory
RFID	Radio Frequency Identification
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modeling

SET	Secure Electronic Transaction
SMS	Short Message Service
SPSS	Statistical Package for the Social Sciences
SSL	Security Socket Layer
TAM	Technology Acceptance Model
TLS	Transport Layer Security
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TTF	Task Technology Fit
UTAUT	Unified Theory of Acceptance and Use of Technology

1. INTRODUCTION

1.1 MOBILE PAYMENT

Traditional payment methods include cash, check, credit card, and debit card used at a retail point of sale. With the development of electronic commerce, electronic payments have gradually changed the transaction landscape between merchants and consumers (Amendah, 2008). Electronic payments are web-based user interfaces that allow consumers to perform transactions remotely (Lim, 2008; Weir, Anderson, & Jack, 2006). Other than freeing consumers from the spatial and temporal constraints of traditional payments, electronic payments simplify the complex and time-consuming issues that are inherent in traditional payments, and they offer convenience and compatibility with lifestyle (Black, Locklett, Winklhofer, & Ennew, 2001; Gerrard & Cunningham, 2003; Karjaluoto, Mattila, & Pento, 2002).

Although electronic payments are convenient, they cannot be used for real-time purchases (Nseir, Hirzallah, & Aqel, 2013). Consumers are requesting more convenient and practical payment methods, that can be available anytime and anywhere, to satisfy their daily needs (Dewan & Chen, 2005). Accordingly, the era of mobile payment started in 1997 when transactions occurred on Coca-Cola vending machines via short message service (SMS) in Finland (Dahlberg, Guo, & Ondrus, 2015; Mattos, 2010). Since then, mobile payment has evolved with the advances in mobile networks and mobile devices, as well as wireless technologies. Particularly, mobile networks have evolved from second generation cellular technology (2G) to the third generation (3G), and then to the fourth generation (4G) Long-Term Evolution (LTE). The fifth generation wireless systems (5G) with high throughput, low

latency, high mobility, and high connection density will be launched in later 2018 (Fisher, 2018). On the one hand, the mobile Internet is becoming faster and more reliable. On the other hand, mobile devices are becoming more capable of handling data by supporting voice, SMS, and internet data communication. The advances in mobile network and mobile devices create a wider scope for mobile valued-added services (De Vriendt, Lainé, Lerouge, & Xu, 2002). In addition, wireless technologies, such as Near Field Communication (NFC), Bluetooth, Quick Response (QR) Code, and Radio Frequency Identification (RFID), enable consumers to process financial transactions over mobile networks with mobile devices quickly and safely.

Mobile payment has the characteristics of mobility, reachability, compatibility, and convenience (Kim, Mirusmonov, & Lee, 2010). It frees consumers from temporal and spatial limitations and enables them to check account balances, to transfer money, to pay bills, and to conduct financial management at any time, from anywhere (Yan & Yang, 2015; Zhou, 2015). With the improvements in mobile networks and the prevalence of mobile devices, mobile payment is becoming popular across the world (Khan, Olanrewaju, Baba, Langoo, & Assad, 2017). It is changing the payment market (Hedman & Henningsson, 2015) and it is receiving growing attention globally from consumers to merchants as an alternative to using cash, check, credit cards, or debit cards at a retail point of sale (Chen, 2008). According to Statista, worldwide transaction value with mobile payment amounted to $391.435 billion in 2018. Transaction value via mobile payment is expected to show an annual growth rate of 35.7% from 2018 to 2022, resulting in a total amount of $1,328.244 billion in 2022. Figure 1 shows the expected changes in transaction value via mobile payment from 2016 to 2022.

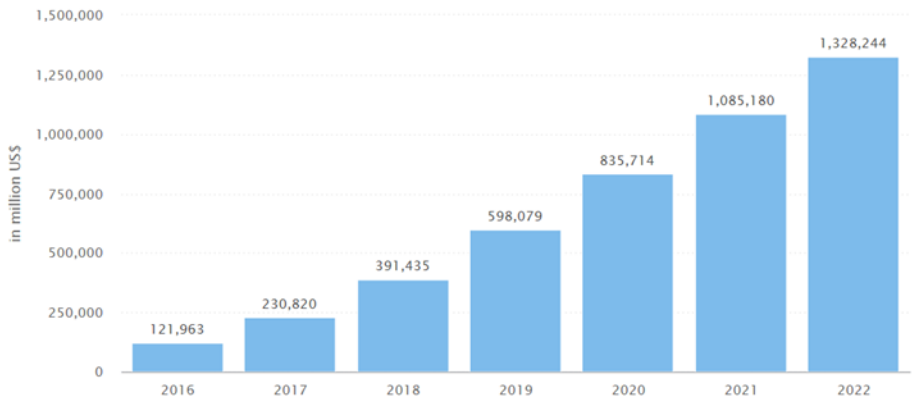

Figure 1 Transaction value via mobile payment from 2016 to 2022 (source: www.statista.com)

The most common ways to conduct mobile payment are by using Direct Carrier Billing (DCB), by mobile payment at the POS, and by using a mobile payment platform (Wang, Hahn, & Sutrave, 2016). Having originated in Europe, DCB allows consumers to purchase goods and services via calling a service number or by sending SMS messages with their mobile devices. Consumers do not need to link their credit cards, debit cards, or bank accounts with their mobile devices. The cost of the purchase is charged on their monthly mobile service bill. DCB is the most common way, in Europe, to conduct mobile payment. The market for DCB on mobile devices alone is projected to be $5.9 billion in 2017 (Boku, 2017). In contrast, NFC- based mobile payment, such as Google Wallet and Apple Pay, are the common ways for U.S. consumers to make mobile payment at a POS (Wang, Hahn, & Sutrave, 2016). Google Wallet was launched in 2011, and Apple Pay was launched in 2014. They require consumers to link their mobile devices to their credit cards or debit cards. When making a mobile payment at a POS, consumers put their mobile devices close to a POS machine with built-in NFC for setting up the communication. If a transaction is successful, the payments for goods and services are charged to the consumers' monthly

credit card or to their debit card bill (Wang, Hahn, & Sutrave, 2016). Unlike Europe and the U.S., in China, a QR code-based mobile payment is the most common form. Consumers link their cell phone numbers with their debit cards or bank accounts. When making a mobile payment, a consumer scans QR codes provided by merchants with his or her mobile devices. Alipay Wallet and WeChat Pay, the two leading mobile payment platforms in China, were launched in 2013. In recent years, mobile payment has become prevalent in China. In 2018, the transaction value via mobile payment in China was $198.232 billion, nearly $76 billion higher than that in the U.S. (Statista, 2018). Figure 2 shows the 2018 list of the five countries with the highest transaction values via mobile payment across the world (Statista, 2018). In contrast to the accelerating rate of innovation in mobile payment technologies in developing countries, the penetration of mobile payment in developed countries is still low (Guo & Bouwman, 2016). Although mobile payment in China began later than it did in Europe and the U.S., China has now become the leader in the use of mobile payment.

Figure 2 Top 5 countries with the highest transaction value via mobile payment in 2018 (source: www.statista.com)

1.2 STUDIES ON MOBILE PAYMENT

There has been a growing body of literature, since the first mobile payment transaction was conducted, that attempts to apply multidisciplinary theories, including theories from psychology and sociology, to the area of mobile payment (Chen, 2008). A considerable number of publications focus on technology and consumer adoption regarding mobile payment (Dahlberg, Bouwman, Cerpa, & Guo, 2015; Dahlberg, Guo, & Ondrus, 2015; Dahlberg, Mallat, Ondrus, & Zmijewska, 2008). The technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT), the diffusion of innovation (DOI) theory, the task-technology fit (TTF) theory, the theory of reasoned action (TRA), perceived behavioral control (PBC), and the theory of planned behavior (TPB) have been adopted in conceptual and empirical studies to investigate consumers' acceptance of mobile payment (Dahlberg, Guo, & Ondrus, 2015). An attitude-intention-behavior paradigm has been developed as a springboard to explore the linear relationship linking consumers' perception, beliefs, attitudes, and behavioral intentions regarding mobile payment (Amendah, 2008).

In the existing adoption literature of mobile payment, TAM and UTAUT are the theories most widely accepted by researchers (Chung & Kwon, 2009; Kleijnen, De Ruyter, & Wetzels, 2004; Luarn & Lin, 2005; Yu & Fang, 2009) to explain and to predict the factors affecting consumers' usage intentions towards mobile payment. Dahlberg, Mallat, Ondrus, and Zmijewska (2008) conducted a comprehensive literature review on 73 papers that studied mobile payment and were published by established conferences and journals in the fields of information systems, electronic commerce, and mobile business between 1999 and 2006. They found that factors such as ease of use, usefulness, and cost, were frequently

examined by researchers. Following the same procedure, Dahlberg, Guo, and Ondrus (2015) performed a systematic literature review on 188 papers that studied mobile payments and were published in major information system and electronic commerce conference proceedings and journals from 2007 to 2014. Their findings were consistent with those in the previous literature review. Perceived usefulness, perceived ease of use, trust, risk, and security remained the main factors examined by researchers. Table 1 shows the frequency of the factors that appeared in the aforementioned two literature reviews on mobile payment.

Table 1 Factors (constructors) in recent studies on adoption of mobile payment

73 papers that studied mobile payment and were published from 1999 to 2006		**188 papers that studied mobile payment and were published from 2007 to 2014**	
Factors (constructors)	**Number of papers**	**Factors(constructors)**	**Number of papers**
Ease of use	12	Perceived ease of use	23
Usefulness	9	Perceived usefulness	22
Cost	7	Trust	22
Trialability	7	Risk	21
Compatibility	6	Demographic	15
Trust	6	Security	15
Convenience	4	Compatibility	10
Risk	4	Social influence	10
Security	4	Cost	10
Social influence	4	Mobility	10
Speed of transaction	3	Convenience	7
Mobility	2	Subjective norm	7
Privacy	2	Personal innovativeness	6
System quality	2	Habit	6
Attractiveness of alternative	1	Privacy	5
Context	1	Self-efficacy	5

Expressiveness	1	Quality	5
Network externalities	1	Experience	4
Observability	1	Payment scenario	4
Technology anxiety	1	Income	3
		Image	3
		Knowledge	3
		Satisfaction	2
		Uncertainty avoidance	2
		Technological impulse	2
		Complementarity	1
		Complexity	1

1.3 RESEARCH QUESTION

Because of its wireless and electronic nature, mobile payment involves great uncertainty and risk (Leong, Ewing, & Pitt, 2003). Mobile networks are vulnerable to hacker attack and information interception, and mobile devices are easily infected by viruses and Trojan horses, or can be lost (Zhou, 2015). Accordingly, security and trust are treated, in the existing literature, as important prerequisites for the adoption and use of mobile payment (Dahlberg, Guo, & Ondrus, 2015; Dahlberg, Mallat, Ondrus, & Zmijewska, 2008). However, although many studies have reported security concerns as a barrier for consumers in adopting mobile payment (Bachfischer, Lawrence, & Steele, 2004; Dahlberg, Mallat, & Öörni, 2003a; Pousttchi, 2003), security is a factor (construct) only in diverse consumer adoption models in the existing mobile payment adoption literature. Research specifically exploring the role of consumers' security concerns in their decision processes is not available.

Additionally, as the use of mobile networks, mobile devices, and wireless technologies advances, the characteristics of security for mobile payments are changing.

Security issues and concerns in DCB mobile payment, in NFC-based mobile payment, and in QR code-based mobile payment are different. However, the existing mobile payment adoption literatures study security, based on data collected from users of DCB mobile payment or NFC-based mobile payment. Security studies based on data collected from users of QR code-based mobile payment are not available.

Furthermore, the existing mobile payment adoption literature focuses on examining consumers' intention to use mobile payment, not on their actual usage of mobile payment. Intentions, rather than actual behavior, are assessed in many studies due to the difficulties in observing secure behavior (Vroom & Von Solms, 2004). However, consumers' usage intentions do not always lead to their action. Thus, the findings of studies that examine consumers' usage intention are not convincing.

In recent years, China has become the leader among mobile payment markets (Cheng, Hsu, & Lo, 2017). The number of mobile subscribers in China reached 1.3 billion as of August 2015 (Kemp, 2015). The transaction value via mobile payment in China is the largest in the world (Satista, 2018). But given the lack of financial infrastructure and the low level of usage of credit cards in China, consumers run great risks when using mobile payment (Cheng, Hsu, & Lo, 2017). Despite the risks, why is mobile payment so prevalent in China? To what extent do consumers accept the risks when using mobile payment?

Accordingly, this study integrates TRA, TPB, Protection Motivation Theory (PMT), and the Rational Choice Theory (RCT) to explore consumers' security risk tolerance while using mobile payment. Particularly, this study proposes a benefit-cost appraisal and a trade-off framework to investigate how consumers' acceptance of security risk is affected in their decision process.

In so doing, this study addresses the following questions:

(1) What factors affect consumers' perceived benefit of using mobile payment?

(2) What factors affect consumers' perceived cost of using mobile payment?

(3) How do consumers trade off the benefits and security risks when using mobile payment?

(4) Does social influence moderate consumers' benefit-cost appraisal and trade off about using mobile payment?

(5) Is there any difference between males and females in benefit-cost appraisal and trade off regarding using mobile payment?

Data to test the proposed model are collected from users of QR code-based mobile payment in China.

1.4 THE CONTRIBUTIONS OF THE STUDY

This study provides important contributions to the literature of mobile payment. The existing adoption literature of mobile payment chooses security as a construct only in the diverse research models. As security becomes a major concern for consumers, it should be investigated comprehensively and systematically. Accordingly, this study focuses on consumers' security risk tolerance and develops a benefit-cost appraisal and trade-off framework which provides a new understanding of the way in which consumers deal with security concerns in their decision process to use mobile payment. Another contribution of this study relies on the fact that it examines consumers' actual mobile payment activities, not their intention to use mobile payment. This approach sheds light on the research of mobile payment adoption because the users' actual activities are easier to measure and are more meaningful than merely their intention of usage. Also, this study collects data in China,

which has fast growing number of mobile payment users and a high transaction value, with an undeveloped financial infrastructure and a low level of credit card use. Thus, the findings of this study make a special contribution to the study of mobile payment in developing countries.

1.5 OUTLINE OF THE STUDY

The research comprises five chapters. The first chapter introduces the research questions and the research purposes by touching upon the status of mobile payment and the studies conducted in the field of mobile payment. The second chapter provides detailed information regarding the definitions of mobile payment, the characteristics of mobile payment, the common ways of making mobile payment, and the theories that this study builds on. It subsequently presents the benefit-cost appraisal and the trade-off framework that shows how consumers deal with security risks when using mobile payment. Research hypotheses are also presented in this chapter. Chapter Three discusses the methodology, including the data collection procedure and the statistical method used. Chapter Four presents the results of the data analysis and the results of the hypothesis testing. Chapter Five presents the conclusions, discussions, and implications, as well as recommendations for future work.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 DEFINITION OF MOBILE PAYMENT

With the evolution of mobile networks, mobile devices, and wireless technologies, mobile payment has been defined by scholars in different ways. Karnouskos (2004), for example, defines mobile payment as a kind of payment in which some kind of a mobile device is used to initiate, authorize, and confirm an exchange of financial value in return for goods and services. According to Dahlberg, Mallat, Ondrus, and Zmijewska (2008), mobile payment is "payment for goods, services, and bills with a mobile device (such as a mobile phone, smart-phone, or personal digital assistant (PDA)) by taking advantage of wireless and other communication technologies" (p165). Ghezzi, Renga, Balocco, and Pescetto (2010) define mobile payment as "a process in which at least one phase of the transaction is conducted using a mobile device (such as mobile phone, smartphone, PDA, or any wireless enabled device) capable of securely processing a financial transaction over a mobile network, or via various wireless technologies (NFC, Bluetooth, RFID, etc.)".

The delivering of mobile payment involves several stakeholders from multiple industries, including consumers, merchants, mobile network operators (MNO), financial institutions or other payment service providers, mobile device manufacturers, software and technology providers, and regulators (Au & Kauffman, 2008; Boer & de Boer, 2009; Dahlberg & Oorni, 2007; Lu, Yang, Chau, & Cao, 2011). For example, MNO provides the infrastructure and connectivity service as a forefront interface for mobile payment. Payment service providers offer payment procedures for consumers.

The continuous development of technologies is facilitating more reliable, user

friendly, versatile, and functionally rich mobile payment (Dahlberg, Mallat, Ondrus, & Zmijewska, 2008). Since the first mobile payment occurred in 1997 in Finland, the mobile network has evolved from 2G to 3G, and even to 4G. Fast data connections and broad areas of network coverage allow consumers to enjoy high speed mobile internet. Mobile devices, such as smartphones, have stronger processing power and better user interfaces to enter, display, process, store, and transmit data. Mobile devices equipped with cameras can be used with barcodes to perform various functions. By scanning barcodes, consumers can easily access websites, search for reviews and information about products, and download products. In addition, new short-range wireless technologies such as NFC, Bluetooth, and RFID are able to support easy and secure wireless communication. At present, mobile payment has been found to be feasibly used both for online purchases and for offline micropayments (Khan, Olanrewaju, Baba, Langoo, & Assad, 2017).

Given the diverse format and the evolving definition of mobile payment, this study focuses on the kind of mobile payment that is provided by a third party (neither MNOs nor financial institutions) and allows consumers to make payment at the point of sale (POS) with their mobile devices.

2.2 MOBILE PAYMENT ACROSS THE WORLD

With the advancements in mobile networks and mobile devices, mobile payment can be performed in different ways in various countries (Wang, Hahn, & Sutrave, 2016). Fast data connections, broad areas of network coverage, and cheaper data plans are boosting the adoption of mobile payment. The convenience and practicality of mobile payments have already been well recognized by consumers and merchants in Asian and European markets (Dewan & Chen, 2005). Particularly, the widespread penetration of mobile phones, their

almost constant proximity to consumers, and their storage and transmission capabilities make them an ideal replacement for a physical wallet (Mallat, 2007). The most common ways to conduct mobile payment across the globe include Direct Carrier Billing (DCB) in Europe, mobile payment at the POS (NFC- based mobile payment) in the U.S., and mobile payment platform (QR code-based mobile payment) in China (Wang, Hahn, & Sutrave, 2016).

2.2.1 MOBILE PAYMENT IN EUROPE

In Europe, DCB is the most common way to conduct mobile payment (Wang, Hahn, & Sutrave, 2016). Consumers do not need to link their credit, debit card, or bank account to their mobile devices. When making payments for products or services, a consumer calls a premium rate service number or sends an SMS message to a short code which is assigned to a particular merchant for a specific product or service, either by the MNO or by a regulatory authority (Valcourt, Robert, & Beaulieu, 2005). A transaction code is sent to the consumer via an SMS message. Next, the consumer enters that code to confirm his or her purchase. At the end, payments for goods and services are charged to the consumer's monthly mobile phone bill or deducted from prepaid airtime of prepay subscribers (Mallat, 2007; Menke & de Lussanet, 2006; Wang, Hahn, & Sutrave, 2016). This format for mobile payment is simple to implement and to use (with a low requirement for mobile devices), and is usually aimed at low-value micropayments (Wilcox, 2010). However, it cannot facilitate all payment scenarios. Furthermore, SMS can take time to reach merchants and can be easily lost by consumers. Therefore, DCB is not reliable and has serious security risks (Amoroso & Magnier-Watanabe, 2012; Chou, Lee & Chung, 2004). The main DCB provider in Europe is Boku, which works with 250 carrier partners and providers. Although the market for DCB is growing in Europe, its growth outside of Europe has been very slow, due to many regulatory

constraints (Wang, Hahn, & Sutrave, 2016). The penetration rate of NFC-based mobile payment in Finland, France, Italy, the Netherlands, Norway, and the U.K has been slow as well. Apanasevic (2013) identified several factors for this, which include a number of demand and supply barriers, such as network externalities and the lack of consumer awareness about NFC services from the demand side, and the lack of uniform technological standards, the lack of NFC- enabled mobile phones, and "the coopetition issue" from the supply side.

2.2.2 MOBILE PAYMENT IN THE U.S.

U.S. consumers have several options, when making mobile payments (Wang, Hahn, & Sutrave, 2016). The most common ways are via Apple Pay and Google Wallet. Consumers need to set up an Apple Pay account or a Google Wallet account on their mobile devices, first. Then, they need to link their credit card or debit card with their mobile devices. When making payments at a store, consumers' mobile devices talk with POS machines via built-in NFC technology, which enables devices to establish communication with each other within four inches by combining RFID and two-way short-range communication, without any physical contact, between these devices (Chen, 2008; Dai, Zhou, Luo, Chen, & Xie, 2011; Lai & Chuah, 2010). Compared with Bluetooth, NFC has a shorter transmission range but can deliver richer information and services (Akhgar, Rahman, Jopek, Siddiqi, Atkinson, Salvodeli, Prato, Montrucchio, Guella, & Vilmos, 2008; Ondrus & Pigneur, 2007). Payments for goods and services are charged to consumers' monthly credit card or to their debit card bill (Wang, Hahn, & Sutrave, 2016). At present, mobile payment is not prevalent in the U.S. From the perspective of financial environment and consumer habit, financial infrastructures in the U.S. are well-established, and private banks are highly competitive (Cheng, Hsu, &

Lo, 2017). U.S. consumers are used to making payments with credit cards and debit cards at the POS. In addition, the usage of a credit card can provide the consumer with a certain level of protection, should a dispute occur. Thus, consumers are not motivated to purchase smartphones or other mobile devices for making mobile payment. Furthermore, a learning curve exists for setting up a mobile payment account on their mobile devices. Moreover, security and trust have been found to impact the adoption of mobile payments among U.S. consumers (Dewan & Chen, 2005). From the perspective of merchants, mobile payment requires new infrastructure at the POS. Neither merchants nor the existing payment service providers are willing to make the investment, given the current small number of mobile payment users in the U.S. (Hoofnagle, Urban, & Li, 2012). Accordingly, the dilemma is that merchants are unwilling to invest in the mobile payment systems needed to enable mobile payment transactions unless there is enough consumer demand, whereas consumers will not use mobile payment unless their merchants accept it (Contini, Crowe, Merritt, Oliver, & Moth, 2011; De Bel & Gâza, 2011).

2.2.3 MOBILE PAYMENT IN CHINA

Although mobile payment originated in Europe, large-scale adoption and use of mobile payment can been seen in China. Mobile payment is prevalent in China because of the following reasons. First, the financial infrastructure is not well developed and financial service is lacking in remote areas. Second, many consumers do not hold credit cards due to the lack or the poor performance of credit-rating agencies (Kshetri, 2016). Third, the primary mobile payment in China is micro-payment. It is difficult for micro-businesses to gain the qualifications necessary to obtain credit card information from the banking industry (Cheng, Hsu, & Lo, 2017). On the one hand, micro-businesses cannot accept payment through credit

cards because of the high costs for installing a credit card machine and the expensive transaction fees (Cheng, Hsu, & Lo, 2017). On the other hand, financial institutions are unwilling to move to micro-payment because the income from micro-payments are insufficient to compensate for the operating expenses of service offerings (Lu, Yang, Chau, & Cao, 2011). Therefore, third party payment becomes the prevalent way to conduct mobile payment (Wang, Hahn, & Sutrave, 2016). Fourth, China has the world's largest mobile subscriber base; the number of mobile subscribers in China reached 1.3 billion as of August 2015 (Kemp, 2015). The number of mobile Internet users in China reached 753 million, accounting for 97.5% of the total netizen population (CNNIC, 2018). The situation in China is favorable for the development of mobile payment. Fifth, China has a relatively strong mobile telecommunication infrastructure, compared with developed countries that have mature landline Internet infrastructures (Lu, Yang, Chau, & Cao, 2011). Such a technology infrastructure encourages the development of mobile payment. In some places, particularly in rural areas where banking services are not convenient, consumers can choose their mobile devices to access their bank accounts via the mobile Internet.

In order to make purchases with mobile payments, consumers need to install a mobile application from a third-party service provider on their mobile devices. When they create an account with a third-party service provider, they need to link this account to their bank account or to their debit card. Merchants are assigned a QR code by a third party service provider. The code is displayed at the checkout point in a POS. After the consumer scans the merchant's QR code, he or she is directed to a payment page where the transaction amount is entered and the transaction is made (Okazaki, Li, & Hirose, 2012). Other than daily purchases, consumers can choose mobile payment to pay for public service charges,

including television bills, hospital registration, utility bills, tuition fees, charitable donations, airline and train tickets, lottery tickets, or movie tickets (Cheng, Hsu, & Lo, 2017).

This format of mobile payment is an efficient method that saves costs for business owners, especially micro-business owners (GeekPark, 2014), because they only need to print out their QR code on a piece of paper instead of purchasing and installing a POS machine. Furthermore, they do not need to pay a service fee for using POS machines. However, consumers have to take all of the risks for making this format of mobile payment, because there is no or there is little protection from banks or mobile payment providers when disputes about purchases occur.

Other than making payments, consumers can access their bank account and perform mobile banking with the downloaded application on their mobile devices. For example, they can easily send/receive money to/from others who have accounts with the same third-party service provider via their mobile devices. This is a very useful and convenient feature for those who are underserved by traditional banking services in remote areas.

Alipay Wallet and WeChat Pay are the two leading mobile payment providers in China. They are third-party economic entities that are independent from banks and mobile carriers. They act as a bridge, connecting consumers, merchants, and banks. They are responsible for bank accounts' funds transfer and for settlement between consumers and merchants. Alipay Wallet was released in 2013. In the past several years, Alipay Wallet's growth in China has skyrocketed, supporting consumers' online purchases and offline micropayments (Heggestuen, 2014). Now, it is China's largest third-party mobile payment provider (iResearch, 2017). WeChat Pay, the other third-party mobile payment provider, was launched by Tencent in August 2013. By successfully competing with Alipay Wallet,

WeChat Pay has become one of the most popular mobile payment providers in China - in less than three years. During the first half of 2016, WeChat Pay firmly occupied the second largest mobile payment market share and has continued to narrow the gap with Alipay Wallet (Wu, Liu, & Huang, 2017). The transaction volume of third-party mobile payment in China is $9.48 trillion in 2016, with an increase of 492.5 percent over that of 2015 (iResearch, 2017). The size of China's mobile payment market was 90 times larger than that of the U.S. in 2016 (iResearch, 2017).

2.3 SECURITY IN MOBILE PAYMENT

Mobile payment involves great uncertainty and risk, due to its electronic and wireless nature (Leong, Ewing, & Pitt, 2003). Concerns about the security of mobile payment have been raised for a long time. A number of studies report that security concerns are an essential barrier to adoption of mobile payment (Chen, 2008; Dahlberg & Mallat, 2002; Gerpott & Kornmeier, 2009; Hoofnagle, Urban, & Li, 2012; Lu, Yang, Chau, & Cao, 2011; Mallat, 2007; Shin, 2010; Yang, Lu, Gupta, Cao, & Zhang, 2012; Yi, 2016). Security has two dimensions, namely objective security and subjective security (Kreyer, Pousttchi & Turowski, 2002). As a concrete technical characteristic, objective security is a set of procedures, mechanisms and computer programs for authenticating the source of information and guaranteeing the process (Linck, Pousttchi, & Wiedemann, 2006; Tsiakis & Sthephanides, 2005). Objective security can be measured by how a certain technological solution responds to all of the four security objectives: confidentiality, authentication, integrity, and non-repudiation (Stallings, 2003).

In the context of mobile payment, confidentiality means that data exchanged during a payment transaction can only be viewed by authorized users (Chen, 2006). Confidentiality

protects transaction data from passive attacks. Authentication means that data exchanged during a payment transaction will be restricted to legitimate users only (Chen, 2006; Chen & He, 2013). Authentication is a visible procedure that is directly related to payment security, and thus influences consumers' perceptions of security and trust (Chen & He, 2013; Kousaridas, Parissis, & Apostolopoulos, 2008; Tsiakis & Sthephanides, 2005). Authentication includes user authentication and transaction data origin authentication. Only an authorized person should gain access to the payment transaction. Pins, passcodes, screen locks, and fingerprints are usually required for accessing a mobile device or for making a purchase. Integrity means that data exchanged during a payment transaction are accurate (Chen, 2006; Chen & He, 2013). It measures the security of consumers' payment information during and after a payment process (Romdhane, 2005). Integrity prevents transaction data from being modified when data is at rest, in transit, and/or in use. Non-repudiation means that the participants of a payment transaction cannot deny their participation in the transaction (Suh & Han, 2003). It prevents either a consumer or a mobile payment service provider from denying a transmitted message.

The security of a mobile payment depends on systems factors (technical infrastructure and implementation), transaction factors (secure payment, in accordance with specific and well defined rules), and legal factors (a legal framework for electronic transactions (Hwang, Shiau, & Jan, 2007; Lim 2008; Peha & Khamitov, 2004). Some security mechanisms, such as user name, password, multi-factor authentication, Security Socket Layer (SSL)/Transport Layer Security (TLS), Secure Element, Secure Electronic Transaction (SET), fingerprint, facial recognition, iris recognition, sound recognition, and vein recognition, have been adopted to ensure mobile payment security (Cheng, Hsu, & Lo,

2017; Dahlberg, Mallat, Ondrus, & Zmijewska, 2008; Wang, Hahn, & Sutrave, 2016).

Subjective security is the degree of security that consumers feel about a specific procedure (Linck, Pousttchi, & Wiedemann, 2006). Security concern in mobile payment is subjective security. It is the extent to which consumers are concerned about the aforementioned four security objectives, relevant to their mobile payment. Consumers' attitudes toward mobile payment are associated with their perceptions of mobile payment's security. Cheong, Cheol, and Hwang (2002) found that the lack of subjective security is the most frequent reason for a refusal to use mobile payment. Dewan and Chen (2005) conducted an exhaustive exploratory study regarding the potential adoption of mobile payment in the U.S. They found that even though consumers acknowledge the benefits of mobile payment, they are willing to adopt this payment method only if security and privacy issues are addressed. Shin and Kim (2008) assert that the feeling of security is largely determined by the users' feeling of control of the interactive system. Diniz, Porto de Albuquerque, & Cernev (2011) found that security is a factor that impacts consumer adoption from the perspective of technology. Hoofnagle, Urban, and Li (2012) found that Americans overwhelmingly oppose the revelation of contact information to merchants and overwhelmingly reject mobile payment systems that track their movements or that share identification information with retailers.

2.4 REVIEW OF MOBILE PAYMENT STUDIES

2.4.1 MAJOR LITERATURE REVIEWS ON MOBILE PAYMENT STUDIES

Studies on mobile payment began soon after the first mobile payment transaction was conducted with a mobile device in 1997. There has been an emerging body of literature about mobile payment since late 1990s (Chen, 2008). Several comprehensive literature

reviews on mobile payment studies have been conducted so far and have generated fruitful findings. Table 2 shows the details of recent literature reviews on mobile payment studies.

Table 2 Recent literature reviews of mobile payment studies

	Time Range	Papers Reviewed	Journal/Project Databases	Conferences Proceedings	Topics	Factors (constructors)
Dahlberg, Mallat, Ondrus, and Zmijewska (2008)	1999 - August 2006	73	ProQuest Direct EBSCO ScienceDirect IEEE Xplore ACM Digital Library AIS eLibrary M-lit online bibliographical database Google Scholar	ICIS HICSS AMCIS ECIS PACIS ACIS IEEE proceedings BLED ICEC ICEB IADIS on E-Commerce IADIS on WWW/Internet ICMB Mobility Roundtable	Technological Consumers M-Payment Market & Providers Multiple Categories Merchants Legal, Regulatory, Standards Overviews New E-Payments Commercial	Ease of use Usefulness Cost Trust Compatibility Social influence Risk Security Convenience Speed of transaction Mobility Privacy System quality Attractiveness of alternative Context Expressiveness Network externalities Trialability Technology anxiety Observability
Diniz, Porto de Albuquerque, and Cernev, (2011)	2002-June, 2011	196	ACM Digital Library AIS eLibrary CAPES database EBSCO Academic EBSCO ISTA IEEE Xplore INFORMS ISI Web of Knowledge SCOPUS Google Scholar CGAP Gartner Group		Consumer Adoption Market analysis Mobile money for the BoP Technical Frameworks approaches Merchant adoption Analysis of failures	

			GSM Association		Technological factors	
Slade, Williams, and Dwivedi (2013)	2002-2012	94	ISI Web of Knowledge Google Scholar		Readiness, determinants, or success of mobile payment acceptance Develop, characterize, compare, and evaluate different mobile payment Analyze mobile payment ecosystem, business models, and stakeholders	Perceived ease of use Perceived usefulness Compatibility Interest Social influence Use context Payment scenario Trust Costs Risk Attractiveness of alternative payment systems
Dahlberg, Guo, and Ondrus (2015)	2007–2014	188	ProQuest Direct EBSCO ScienceDirect IEEE Xplore ACM Digital Library AIS eLibrary Google Scholar Scopus Web of Knowledge Emerald Wiley	ICIS HICSS AMCIS ECIS PACIS ACIS BLED ICEC ICEB IEEE proceedings IADIS E-Commerce IADIS WWW/Internet Mobility Roundtable	Technological Consumers M-Payment Market & Providers Overviews Multiple Categories Legal, Regulatory, Standards New E-Payments Merchants Commercial Social & cultural Traditional payments	Perceived ease of use Perceived usefulness Trust Risk Demographic Security Compatibility Social influence Cost Mobility Convenience Subjective norm Personal innovativeness Habit Privacy Self-efficacy Quality

					Experience Payment scenario Income Image Knowledge Satisfaction Uncertainty avoidance Technological impulse Complementarity Complexity
Dennehy and Sammon (2015)	1999-2014	40	Google Scholar	Social, Cultural & Economic Technology, Security & Architecture Multiple Categories Legal, Regulatory & Standardisa-tion	

Note: CAPES [Federal Agency for Support of Post-graduate Education] is a department of the Brazilian Ministry of Education that is responsible for post-graduate education programs (http://periodicos.capes.gov.br).

Dahlberg, Mallat, Ondrus, and Zmijewska (2008) conducted a literature review on academic journal papers and conference proceedings in the general context of mobile payments. They systematically scanned journal and conference databases, such as ProQuest, IEEE Xplore, Google Scholar, International Conference on Information Systems (ICIS), Americas Conference on Information Systems (AMCIS), IEEE Conference proceedings, and International Conference on Electronic Commerce (ICEC). Altogether, they found 73 papers published between 1999 and 2006. Mobile payment technologies and consumer perspective of mobile payments were found to be the two main research topics. Among the 73 papers, 29 studied technologies, whereas 20 studied consumers. Further analysis of the 29 technology papers shows that technical constructions for mobile payment systems and mechanisms addressing overall architecture, security and trust, transaction protocol details, and the use of short-range wireless technologies were well covered. The 20 studies on consumers mainly applied TAMU, TAUT, and DOI to investigate the factors that affect consumers' intention to use mobile payment, their actual use of mobile payment, or their readiness to use mobile payment. Ease of use, trust, security, usefulness, cost, and compatibility were identified as the important factors that impact consumers' adoption of mobile payment (Dahlberg, Mallat, Ondrus, & Zmijewska, 2008).

Later, Diniz, Porto de Albuquerque, & Cernev (2011) performed a comprehensive literature review on mobile payment, aiming to address mobile payment issues in developing countries. They scanned indexed journals and conference proceedings, as well as non-peer-reviewed, practitioner-oriented sources. Compared with the databases selected in Dahlberg, Mallat, Ondrus, and Zmijewska (2008), Diniz, Porto de Albuquerque, & Cernev (2011) extended their search to the CAPES database, INFORMS, and ISI Web of Knowledge. They

found 196 papers (94 peer-reviewed and 92 non-peer-reviewed) published between 2002 and June, 2011. The results show a significant and continuous increase in the number of publications regarding mobile payment since 2007. They found that a large portion of studies on mobile payment deals with the situation in developed countries and rarely addresses social and development issues in developing countries. Consumer adoption, market analysis, mobile money, and payment for the poor were found to be the most common issues addressed in the literature. A significant concentration on TAM and its variations (TRA, UTAUT, and TPB) was found among the studies on the consumer adoption of mobile payment (30%). This literature review finds that security, privacy, trust, fraud, and risk perception are related to consumers' adoption of mobile payment.

Slade, Williams, and Dwivedi (2013) reviewed 94 papers that were published from 2002 to 2012 and studied the mobile payment adoption. They found that more than two-thirds of the papers in this literature review were published after 2007. Papers were found to focus on the readiness, determinants, or success of mobile payment acceptance; on developing, characterizing, comparing, and evaluating different mobile payment; and on analyzing the mobile payment ecosystem, business models, and stakeholders. Both positive factors and negative factors were found to affect adoption of mobile payment. The most research contexts were found to be in Finland, Germany, Switzerland, the U.S., and China. Consumers were found to be the main research focus.

Applying the same method as Dahlberg, Mallat, Ondrus, and Zmijewska (2008), Dahlberg, Guo, and Ondrus (2015) performed a systematic literature search in the same databases for papers that studied mobile payment and were published from 2007 to 2014. Beyond merely journals, papers from a few established conferences in the fields of IS,

electronic commerce, and mobile business were scanned as well. Altogether, 188 papers were found in this literature review. Consumer, technology, and mobile payment market and providers were found to be the three main research topics. Among the 188 papers, 44 studied technologies, 34 studied consumers, and 20 studied the mobile payment market and providers. In terms of studies on technology, approximately 75% of the papers focused entirely on security. Thus, security became the dominant topic. For studies on consumer adoption, other than the well-established adoption and diffusion theories found in Dahlberg, Mallat, Ondrus, and Zmijewska (2008), TTF, TRA and TPB were applied to investigate consumer adoption of mobile payment. Analysis of the 34 papers that considered consumer adoption shows that the findings of earlier adoption studies were confirmed, but no new construct or approach was introduced after 2007, even though this set of papers has a better empirical data collection and more rigorous statistical analyses. Data in the seven empirical studies were collected in Europe (Apanasevic, 2013; Dahlberg, Huurros, & Ainamo, 2008; Dahlberg & Oorni, 2007; Ghezzi, Renga, Balocco, & Pescetto; 2010; Mallat, 2007), Qatar (Alshare & Mousa, 2014), and Taiwan (Cheng & Huang, 2013). A deeper understanding of the factors that impact consumer acceptance of mobile payment was achieved. Perceived ease of use, perceived usefulness, trust, and risk remained the top factors that affect consumers' adoption of mobile payment (Dahlberg, Guo, & Ondrus, 2015).

Lastly, Dennehy and Sammon (2015) reviewed the 20 mobile payment papers that were most cited in Google Scholar from 1999 to 2014 and the 20 most recently published papers between 2013 and 2014. Among the 20 most cited papers, seven papers used a version of TAM and five papers conducted case studies in India, Tanzania, Korea, the U.S., and Germany. Of the 20 most recently published papers, 11 papers focused on consumer

adoption and 8 papers conducted case studies in Canada, Germany, Ireland, Jordan, Portugal, Tanzania, Kenya, and the U.K. Their finding was consistent with the results in Dahlberg, Mallat, Ondrus, and Zmijewska (2008). Consumer adoption remained the most popular area in mobile payment study. They also found that more recent studies were focusing on technology, security and architecture issues, and the impact on consumer adoption.

2.4.2 MAJOR FINDINGS OF LITERATURE REVIEWS ON MOBILE PAYMENT STUDIES

The literature regarding mobile payment between 1998 and 2014 has been dominated by the topics of technology and consumer adoption (Guo & Bouwman, 2016). Existing literature has identified the security concern as a major barrier to consumers' adoption of mobile payment, along with trust and cost (Dahlberg, Mallat, & Öörni, 2003b; Dennehy & Sammon, 2015; Diniz, Porto de Albuquerque, & Cernev, 2011; Pousttchi 2003; Zmijewska, Lawrence, & Steele, 2004). Mobile payment involves great uncertainty and risk, due to its virtuality and lack of control (Yan & Yang, 2015). On the one hand, mobile networks are more vulnerable to hacker attack and information interception, when compared with wired networks (Yan & Yang, 2015). On the other hand, mobile devices, such as smart phones, may also be infected by viruses and Trojan horses (Zhou, 2015). Therefore, security and trust are important pre-requisites for the adoption and use of mobile payments (Dahlberg, Guo, & Ondrus, 2015).

In terms of research methods, both qualitative methods and quantitative methods have been applied in mobile payment research (Dahlberg, Guo, & Ondrus, 2015; Dennehy & Sammon, 2015; Diniz, Porto de Albuquerque, & Cernev, 2011; Duncombe & Boateng, 2009; Slade, Williams, & Dwivedi, 2013). Data of those empirical studies were mainly collected in Europe or the U.S. However, researchers have continued to focus on consumer adoption and

technology, with a limited accumulation of new knowledge and similar findings (Dahlberg, Guo, & Ondrus, 2015). In those papers that focus on technology, security was studied from the perspective of technology solely. Mechanisms were proposed and examined for improving the security of mobile payment at the technology level. In contrast, for those studies that focus on consumer adoption, security was found to be a factor (construct) only, but not the dependable variable, in the research models. An empirical study that specifically focuses on consumers' security concern in their decision process regarding the adopting of mobile payment is not available.

2.4.3 STUDIES OF MOBILE PAYMENT IN CHINA

Mobile payment started later in China than in Europe. Accordingly, studies of mobile payment in China do not begin until 2011. Similar to studies on mobile payment in Europe and in the U.S., scholars mainly applied TAM and UTAUT to investigate the factors affecting consumers' acceptance of mobile payment in China. Most of the data in the empirical studies are not collected from users of QR code-based mobile payment, because Alipay Wallet and WeChat Pay were launched in 2013. Findings in these studies are consistent with those in studies on mobile payment in other countries. For example, Lu, Yang, Chau, and Cao (2011) explored the dynamic trust transfer process in mobile payment. They found that consumers' trust in Internet payment services has a cross-environment effect on initial trust and behavioral intention regarding mobile payment. Peng, Xu, and Liu (2011) developed a model based on UTAUT and found that performance expectancy and social influence are the drivers, whereas cost and perceived risks are the barriers in the adoption of mobile payment via an empirical test. Zhou (2011) incorporated initial trust into TAM and developed a model to examine the effect of initial trust on consumers' adoption of mobile

payment. Zhang, Yue, and Kong (2011) investigated the way in which national culture affects consumers' intention of adopting mobile payment based on TAM. Yang, Lu, Gupta, Cao, and Zhang (2012) found that behavioral beliefs, social influences, and personal traits were important determinants for mobile payment adoption. Cheng and Huang (2013) integrated mental accounting theory and TAM to analyze mobile payment adoption among high speed rail passengers. They found that mobile payment adoption is influenced by potential loss (perceived risk) and benefit (perceived ease of use and perceived usefulness). Liu, Kostakos, and Deng (2013) explored how privacy risk, performance risk, psychological risk, and financial risk contribute to the perceived risk of mobile payment users. They found that privacy risk and psychological risk are more important in the four risk dimensions. Zhou (2013) empirically examined consumers' continuance intention of mobile payment, based on data collected in China. However, mobile payment relied on SMS, not QR, at that time. Moreover, their findings lack generalizability, because their data was collected only in an eastern city. Li, Liu, and Heikkilä (2014) extended TAM and developed a model to explore the factors determining consumers' adoption of mobile payment. The results of their empirical test show that compatibility, perceived ease of use, and mobile payment knowledge are the determinants. Zhao and Kurnia (2014) conducted a qualitative study and found that system quality and service quality are the key factors affecting consumers' adoption of mobile payment. Jia, Hall, and Sun (2014) followed the transfer of learning theory and developed a model to explore the impact of consumers' technology usage habits (their mobile service usage habits, online shopping habits, cell phone usage habits, and mobile payment usage habits) on their intention to use mobile payment. Zhou (2014) empirically examined initial trust in mobile payment. Although AliPay Wallet was available

when the data was collected in this study, samples are from only one eastern city in China. By testing a model that integrates TRA and TAM with data collected from university students, Yan and Yang (2015) found that perceived ease of use, perceived usefulness, structure assurance, and ubiquity have significant effect on users' trust, which further affects user usage intention of mobile payment. Yang, Liu, Li, and Yu (2015) developed an uncertainty-risk-value framework based on perceived risk theory, prospect theory, and perceived value theory, and investigated how perceived risk hinders mobile payment acceptance among Chinese consumers. Wu, Liu, and Huang (2017) extended TAM and developed a model to explore the impact of affective factors on perceived risk and usefulness, and the relationship between perceived risk and usefulness.

2.5 THEORIES APPLIED IN MOBILE PAYMENT RESEARCH

Theories from psychology and sociology have been incorporated into studies of consumers' adoption of mobile payment during the past two decades. The most frequently adopted theories are TRA, TPB, TAM, UTAUT, and DOI (Lebek, Uffen, Breitner, Neumann, & Hohler, 2013). TRA and TPB are the fundamental stream of literature on consumer behavior. They serve as the solid theoretical basis for TAM, which is applied widely in studies of consumers' adoption of mobile payment.

2.5.1 THEORY OF REASONED ACTION (TRA)

Reasoned action is "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fisbein & Ajzen, 1975, p.216). Such feelings are named as attitude, which is determined by an individual's beliefs regarding the consequences arising from a behavior and an evaluation of the desirability of these consequences (Fisbein & Ajzen, 1975). Assuming that people are rational and are not influenced by unconscious

inducement, TRA proposes that an individual's behavior intention determines his/her actual behavior, whereas that person's attitudes and subjective norms determine his/her behavior intention and actual behavior (Ajzen & Fishbein, 1980). TRA provides an exceptional explanation of the link between people's attitude and their behavior. However, it does not consider objective constraint variables, such as self-control and situational variables from the outside environment (Yang, Pang, Liu, Yen, & Tarn, 2015).

2.5.2 THEORY OF PLANNED BEHAVIOR (TPB)

Because extrinsic variables influence people's behavior intention and indirectly determine their behavior, Ajzen (1991) adds an extrinsic variable, perceived behavioral control, into TRA. It represents the consumer's perception of the required resources and opportunities to perform the behavior of interest. This results in TPB. Perceived behavioral control represents the extent to which performing the behavior is difficult or easy (Ajzen, 1991). As an extension of TRA, TPB implies that individuals' intentions are the proximal cognitive antecedent of actions or behavior (Fishbein & Ajzen, 1975) and that individuals' behavior intentions are determined by their attitude towards behavior, subjective norm, and perceived behavioral control (Ajzen, 1991). Attitude towards behavior refers to an individual's judgment about whether it is good or bad to perform a behavior of interest. Subjective norm is an individual's perception of the social pressure to perform or not perform a behavior in question. It reflects an individual's perceptions of whether his/her behavior is accepted and encouraged by social circles consisting of people who are important to him/her (Ajzen, 1991).

2.5.3 TECHNOLOGY ACCEPTANCE MODEL (TAM)

The theoretical foundation for TAM is based on TRA. Davis, Bagozzi, and Warshaw

(1989) developed TAM as an extension to TRA, aiming to overcome the limitations associated with TRA in predicting and explaining people's acceptance of a new technology. Similar to TRA and TPB, TAM predicts that an individual's behavioral intention is determined by his/her attitude (Davis, 1989). It highlights two key determinants of people's acceptance of a new technology: perceived usefulness and perceived ease of use. Perceived usefulness means "the degree to which an individual believes that using a particular system would enhance his or her job performance in an organizational context", whereas perceived ease of use means "the degree to which an individual believes that using a particular system would be free of physical and mental efforts" (Davis, Bagozzi, & Warshaw, 1989 p.320). The fundamental rationale of TAM is that individuals act rationally when they decide to use a product or service related to information technology (Kim, Mirusmonov, & Lee, 2010).

A number of studies on mobile payment have been based primarily on TAM, with additional constructs adapted, such as security, cost, trust, mobility, expressiveness, convenience, speed of transaction, use situation, social reference groups, facilitating condition, the attractiveness of alternatives, privacy, system quality, and technology anxiety (Chen & Adams, 2005; Cheong, Park, & Hwang, 2004; Dahlberg, Mallat, Penttinen, & Sohlberg, 2002; Dahlberg, Mallat, & Öörni, 2003a; Dahlberg, Mallat, & Öörni, 2003b; Dewan & Chen, 2005; Mallat, 2004; Mallat & Dahlberg, 2005; Torsten, Gerpott, & Kornmeier, 2009; Valcourt, Robert, & Beaulieu, 2005; Zmijewska, Lawrence, & Steele, 2004). Scholars have proposed research models by extending TAM to explore consumers' adoption of mobile payment and by testing their models in diverse environment. For example, Kreyer, Pousttchi, and Turowski (2002) extended TAM and developed a structural equation model to identify and to assess the determinants of customers' intention to use

mobile payment in developed countries. Dahlberg, Mallat, and Öörni (2003c) examined the effectiveness of TAM in their study of consumers' adoption of mobile payment and suggested that a new construct, trust, be added into TAM. Zmijewska, Lawrence, and Steele (2004) expanded and customized TAM and developed multi-item scales to measure perceived ease of use, usefulness, mobility, cost, trust, and expressiveness regarding the use of mobile payment. Chen and Adams (2005) proposed a model to invest consumers' acceptance of mobile payment by integrating TAM and DOI. Chen (2006) expanded TAM and DOI and developed a model to examine U.S. consumers' acceptance of mobile payment. Pousttchi and Wiedemann (2007) integrated TAM and the Task-Technology Fit (TTF) model to examine consumer acceptance of mobile payment in Germany. Viehland and Leong (2007) applied TAM to examine perceived usefulness and perceived ease of use on consumer willingness to use mobile payment services in New Zealand. Mallat, Rossi, Tuunainen, and Öörni (2008) investigated the factors affecting Finland users' adoption of mobile payment in public transportation, based on TAM. Mallat, Rossi, Tuunainen, and Öörni (2009) incorporated use context into TAM and developed a model to investigate the role of use context on the effect of perceived benefit on users' intention to adopt mobile payment. Goeke and Pousttchi (2010) incorporated payment scenarios into TAM to explore consumer acceptance of mobile payment. Schierz, Schilke, and Wirtz (2010) developed a model based on TAM to explore the determinants of consumers' acceptance of mobile payment. They empirically tested their model with data collected in Germany and found that compatibility, individual mobility, and subjective norms were the key determinants. Kim, Mirusmonov, and Lee (2010) integrated TAM with user-centric factors and four mobile payment system characteristics to determine the factors that affect the use of mobile payment, based on data

collected in South Korea. Leong, Hew, Tan, and Ooi (2013) incorporated trust-based behavioral control theories into TAM to explore the factors influencing the adoption of NFC-based mobile payment in Malaysia. Augsburg and Hedman (2014) integrated TAM and DOI and investigated the role of Value Added Services (VAS) in consumers' adoption of mobile payment in Denmark. Shin and Lee (2014) developed a model by incorporating technology readiness and technology acceptance into TAM to investigate the factors affecting consumers' adoption of mobile payment in South Korea. Tan, Ooi, Chong, and Hew (2014) extended TAM with personal innovativeness, social influence, perceived risk, and perceived financial cost, and tested their model based on data collected in Malaysia. They found that finance-related risks were not a significant factor and, also, that the moderating effect of gender was not significant. Thakur and Srivastava (2014) examined the effect of adoption readiness, perceived risk and personal innovativeness on consumers' adoption of mobile payment, based on a model that integrated TAM and UTAUT. Liébana-Cabanillas, Sánchez-Fernández, and Muñoz-Leiva (2014a) integrated TAM, TRA, and UTAUT to analyze the impact of the age on the acceptance of mobile payment systems by consumers in Spain. Liébana-Cabanillas, Sánchez-Fernández, and Muñoz-Leiva (2014b) incorporated trust and risk into TAM, aiming to explore the moderating effect of gender on consumers' acceptance of mobile payment in Spain. Liébana-Cabanillas, Sánchez-Fernández, and Muñoz-Leiva (2014c) developed a model by modifying TRA and TAM to investigate the moderating effect of experience in consumers' adoption of mobile payment in Spain. Based on TAM, Hahn and Kodó (2017) explored the way in which the adaption of mobile payment differs in Germany, Hungary and Sweden.

The application of TAM to technology acceptance demonstrates that individuals'

intention to use a technology is based on their propensity to accept the new technology (Davis, Bagozzi, & Warshaw, 1989). Although TAM is widely used in the context of mobile payment, Legris, Ingham, and Collerette (2003) report that it only interprets 40-60% of consumer behavior intention, with nearly half of the relative factors not explained. The reason is that TAM does not consider the subjective norm factor in TRA, even though consumers will be impacted by their surroundings when they accept mobile payment. Moreover, TAM was initially developed in a business context. It might not be applicable to a private context, such as mobile payment, in which organizational factors do not exist. Additionally, cost is not considered by TAM (Goeke & Pousttchi, 2010).

2.5.4 DIFFUSION OF INNOVATION (DOI)

Diffusion of Innovation (DOI) examines innovations and the success of their dissemination through consumer behavior (Rogers, 2003). DOI contends that innovation is a vital element (Zhao & de Pablos, 2011) and that personal innovativeness is an important variable in determining outcomes of technology adoption as well (Mun, Jackson, Park, & Probst, 2006). DOI determines five innovation characteristics that affect technology adoption: relative advantage (similar to perceived usefulness), complexity (perceived ease of use), compatibility (the level to which innovation is believed to be in agreement with the present values, past experiences, and the needs of prospective users), trialability (the degree to which a new invention can be tested within a limited time frame), and observability (the degree to which the results of an innovation can be observed with others) (Rogers, 1995). Rogers (2003) categorizes adopters into innovators (venturesome), early adopters (respectable), the early majority (deliberate), the late majority (skeptical), and the laggards (traditional). According to Rogers (2003), DOI is able to explain a variance in the range of

49% to 87% in adoption. However, Tornatzky and Klein (1982) assert that only relative advantage, complexity, and compatibility are consistently related to adoption. DOI is applied by some research on consumers' adoption of mobile payment. For instance, Oliveira, Thomas, Baptista, and Campos (2016) applied DOI and UTAUT2 and found that compatibility, perceived technology security, performance expectations, innovativeness, and social influence impact consumers' adoption of mobile payment.

2.5.5 UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) integrates TRA, TPB, TAM, DOI, the model of PC utilization, and social cognitive theory. UTAUT posits that four main factors are likely to influence the consumer behavioral intention to adopt a technology, namely performance expectancy (perceived usefulness and relative advantage), effort expectancy (similar to perceived ease of use and complexity), social influence (similar to subjective norm), and facilitating condition (similar to perceived behavioral control) (Venkatesh, Morris, Davis, & Davis, 2003). Additionally, UTAUT introduces gender, age, experience, and voluntariness as moderators that are posited to moderate the impact of the four key constructs on usage intention and behavior (Kim, Mirusmonov, & Lee, 2010).

UTAUT has been empirically tested and has proven to be superior to other prevailing competing models (Park, Yang, & Lehto, 2007; Venkatesh, Morris, Davis, & Davis, 2003). For example, Shin (2009) developed a model by incorporating trust, social influence, self-efficacy, and perceived security into UTAUT. The result of his model test not only confirmed the role of perceived usefulness and ease of use as antecedents in consumers' acceptance of mobile payment, but also indicated that consumers' attitudes and intentions are influenced by perceived security and trust. Alshare and Mousa (2014) integrated UTAUT

and Hofstede's cultural dimensions to examine the impact of espoused national cultural values on consumers' intention to use mobile payment in Qatar. Oliveira, Thomas, Baptista, and Campos (2016) developed a model by integrating the extended UTAUT and DOI. They conducted an empirical test based on data collected in Portugal and found that compatibility, perceived technology security, performance expectations, innovativeness, and social influence have significant effects, both direct and indirect, on consumers' adoption of mobile payment.

2.5.6 LIMITATIONS OF THE ADOPTION THEORIES

Existing consumer adoption literature has examined consumers' intention to use mobile payment intensively (Dahlberg, Mallat, Ondrus, & Zmijewska, 2008; Dahlberg, Guo, & Ondrus, 2015). The literature typically predicts behavioral outcomes by investigating the relationship between attitudes and intentions (Shropshire, Warkentin, & Sharma, 2015). Their fundamental assumption is that individuals' usage of information technology can be predicated by their intention to use the information technology (Venkatesh, Morris, Davis, & Davis, 2003). However, this is problematic, because adoption is based on an individual's unpredictable behavior and is hard to explain (Özkan, Bindusara, & Hackney, 2010), and because intention may not be the best predictor of actual behavior (Shropshire, Warkentin, & Sharma, 2015). Moreover, consumers' intention does not always cause their actual behavior. Even though TPB and UTAUT take into account the situational variables from the outside environment, the conclusions achieved in the existing consumer adoption literature on mobile payment are still questionable.

2.6 RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

Kreyer, Pousttchi, and Turowski (2002) pointed out that security, costs, and

convenience are the major concerns for consumers when they make decisions about whether to choose mobile payment. Shen, Huang, Chu, and Hsu (2010) contended that the key benefit of mobile payment is convenience, whereas the key cost is security. Previous studies identified security as an important factor that plays a role in consumers' acceptance of mobile payment. However, security was added into TAM or UTAUT as a construct only in research models. No study on consumer adoption of mobile payment has chosen security as the focus. In the era of big data, volume, velocity, and variety are the characteristics of consumer data (Chen, Chen, Gorkhali, Lu, Ma, & Li, 2016). Mobile payment allows merchants to easily collect a huge amount of consumer data, which are valuable because businesses can target consumers more precisely based on the analysis of these data. Accordingly, consumers run the risk of leaking their personal information and transaction records when using mobile payment. In addition, mobile networks are more vulnerable to hacker attack and information interception, compared with wired networks (Zhou, 2015). Moreover, mobile devices are easily infected by viruses and Trojan horses, and can be lost (Zhou, 2015).

Given the uncertainty and the risk of using mobile payment, why does the number of mobile payment users keep growing? Khan, Olanrewaju, Baba, Langoo, and Assad (2017) assert that there should be a suitable trade-off between usability and security. Therefore, this study proposed a benefit-cost appraisal and a trade-off framework to investigate how consumers' acceptance of security risk is affected in their decision process. Particularly, this study introduced the concept of security risk tolerance to the research on mobile payment.

Traditionally, tolerance is understood as political tolerance. Political tolerance thereby signifies the permitting of certain groups to be actively involved in political life,

such as taking part in elections or peaceful demonstrations (Sullivan, Piereson, & Marcus, 1979). However, tolerance is "not only related to political rights, but also to the toleration and acceptance of socio-cultural and socio-economic differences within a society" (Weldon, 2006, p 335). This kind of tolerance, "the willingness to live and let live, to tolerate diverse life styles and political perspectives", is known as social tolerance (Norris, 2002, p158). In the context of information technology, risk tolerance is "the level of risk or degree of uncertainty that is acceptable to organizations and is a key element of the organizational risk frame" (Initiative, N. J. T. F. T., 2011, p14). It affects "the nature and extent of risk management oversight implemented in organizations, the extent and rigor of risk assessments performed, and the content of organizational strategies for responding to risk" (Initiative, N. J. T. F. T., 2011, p14). Organizational risk tolerance is determined as part of the risk framing component and is defined in the risk management strategy. In order to perform risk management, organizations need to determine their risk tolerance before establishing their risk management strategy. More risk-tolerant organizations and less risk-tolerant organizations act differently in their risk assessments and risk response. The former might be concerned with those threats that peer organizations have experienced, whereas the latter might be concerned with threats that are theoretically possible, but that have not been observed, and might tend to adopt mature safeguards and countermeasures (Initiative, N. J. T. F. T., 2011).

This study expands the concept of risk tolerance to the individual level. Individuals, not organizations, set the level of risk or degree of uncertainty that is acceptable to them. In the context of mobile payment, security risk tolerance is defined as the level of uncertainty that a consumer is prepared to accept when using mobile payment. It is dependent on

consumers' overall evaluation of benefit and cost, regarding the use of mobile payment. The evaluation follows the benefit-cost appraisal and the trade-off framework shown in Figure 3.

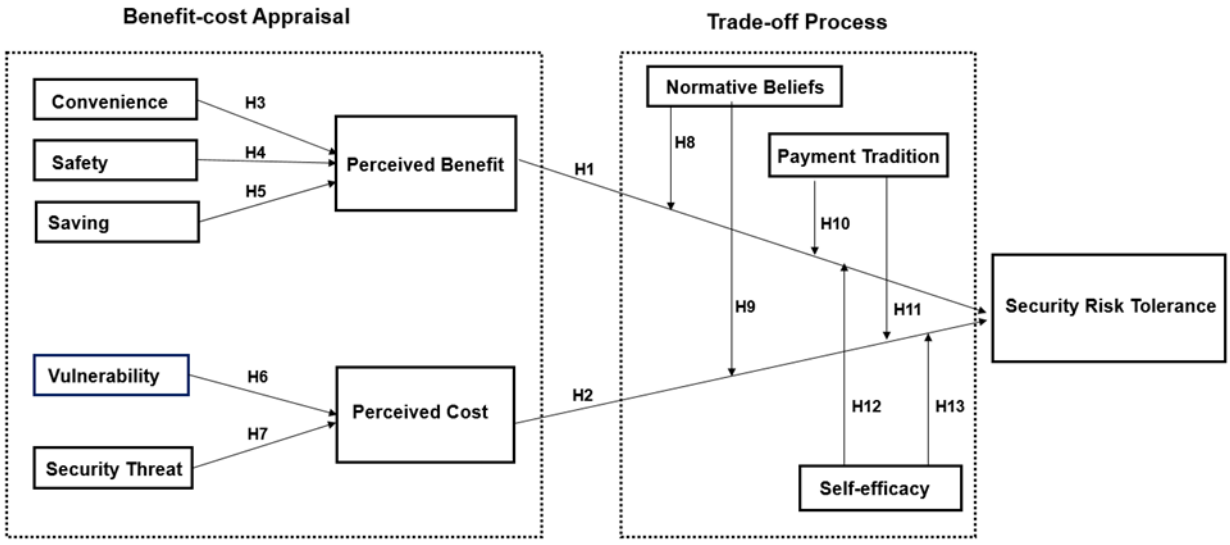

Figure 3 The benefit-cost appraisal and trade-off framework

The framework integrates theories that have been applied in studies on mobile payment (TRA and TPB) as well as new theories from other disciplines (PMT and Rational Choice Theory (RCT)). Unlike existing consumer adaptation literatures on mobile payment, this study sets consumers' security risk tolerance as the dependent variable. First, TRA and RCT are applied to investigate the way in which consumers conduct tradeoff. Then, PMT is applied to explore the way in which consumers perform threat appraisal and coping appraisal (specifically, their perceived benefit and perceived cost regarding the use of mobile payment). At the end, the role of social influence in consumers' tradeoff process is examined by following TRA and TPB.

2.6.1 TRADE-OFF PROCESS

2.6.1.1 PERCEIVED BENEFIT

According to Ajzen (1991) and Fishbein (2007), an individual's attitude toward

performing a giving behavior is related to his/her beliefs about behavior-related consequences. The outcomes of an action contribute to this individual's assessment of the benefits and costs of this action (Paternoster & Pogarsky, 2009).When an individual chooses to use or not to use mobile payment, he/she considers the benefits, as well as the costs, of doing so. Guided by RCT, this study posits that the tradeoff assessment consists of two key beliefs: (1) the perceived benefit of making mobile payment, and (2) the perceived cost of making the mobile payment. The perceived benefit of making mobile payment is defined as the overall expected favorable consequences of using mobile payment. The perceived cost of making mobile payment is defined as the overall expected unfavorable consequences of using mobile payment. The tradeoff assessment is affected by consumers' perception of the benefit and cost associated with making mobile payment (Bulgurcu, Cavusoglu, & Benbasat, 2010). Usually, an individual tends to favor behaviors with desirable consequences, and doesn't favor behaviors with undesirable consequences (Fishbein & Ajzen, 1975).

Compared with traditional payment and with Internet-based electronic payment, mobile payment has a number of benefits, which can be characterized by their convenience, safety, and savings. According to Davis (1989), the reason some people accept or reject a certain information technology is predicated on the extent to which the technology can help them to better perform jobs and on the extent to which using the technology is free of effort. This assessment of benefits is explained by the cost-benefit framework, which suggests that in deciding to adopt a technology, consumers would consider both the benefits and the costs, and trade off between the benefits and the costs to decide the course of action (Shen, Huang, Chu, & Hsu, 2010). Benefits occur if the outcome surpasses the effort invested. The cost-benefit framework has been applied to study the decision behavior and the design of decision

aids (Karim, Hershauer, & Perkins, 1998; Todd & Benbasat 1999; Vessey, 1994), as well as information technologies for financial management (Chen, Harford, & Li, 2007; Ferguson, Lam, & Lee, 2002).

Assessment of benefits can also be explained by Rational Choice Theory (RCT), a neo-classical economic approach that explains how individuals make decisions when faced with choices (Bulgurcu, Cavusoglu, & Benbasat, 2010). RCT contends that an individual determines how he/she will act by balancing the costs and benefits of his/her options to make prudent and logical decisions (McCarthy, 2002). RCT assumes that all people try to actively maximize their advantage in any situation and therefore consistently try to minimize their losses. In a rational decision making process, an individual first recognizes alternative courses of action and then contemplates the likely outcomes of each courses of action (Paternoster & Pogarsky, 2009). Because an action can lead to various outcomes, and because people have preferences for outcomes, people will perform an assessment of the costs and benefits associated with an action. After balancing the costs and benefits of all actions, people determine the best alternative.

Convenience, safety, and saving are benefits generated by mobile payment. When consumers receive benefit derived from using mobile payment and realize that less effort is expended for using mobile payment, they will likely choose to use mobile payment. As consumers use mobile payment, the perceived cost will be offset by the perceived befit. If the benefit is large enough, consumers will have the incentive to take the higher security risks caused by using mobile payment. The higher the perceived benefit, the higher the security risk tolerance. This leads to the following hypothesis:

Hypothesis 1: Consumers' perceived benefit of using mobile payment is positively

related to their security risk tolerance.

2.6.1.2 PERCEIVED COST

Mobile payment involves great uncertainty and risk (Zhou, 2015), which might cause losses. Perceived cost is the expected value of loss that consumers have when they use certain products or when they enjoy certain services (Peter & Ryan, 1976). Consumers' assessment of cost can be explained by Protection Motivation Theory (PMT).

Drawing from the expectancy-value theories and the cognitive processing theories, PMT explains the coping process with potential threats by predicting a variety of protective behaviors (Rogers, 1983). It implies that individuals conduct a threat appraisal and a coping appraisal when they face threats (Maddus & Rogers, 1983). Threat appraisal describes an individual's assessment of the level of danger posed by a threatening event (Rogers, 1983; Woon, Tan, & Low, 2005). It consists of perceived severity and perceived vulnerability (Maddus & Rogers, 1983). Coping appraisal refers to an individual's assessment of his or her ability to cope with, and to avert, the potential loss or damage arising from the threat (Woon, Tan, & Low, 2005). It is determined by response costs, perceived behavior, and response efficacy (Maddus & Rogers, 1983). Individuals who are aware of potential security risks form attitudes about perceptions of these threats to security (Anderson & Agarwal, 2010; Herath & Rao, 2009a). According to Johnston and Warkentin (2010), PMT is a robust theoretical foundation for analyzing and exploring recommended actions or behaviors to avert the consequences of threats. Anderson and Agarwal (2010) also note that PMT is one of the most powerful explanatory theories for predicting an individual's intention to engage in protective actions.

Vulnerability and security threat are the cost in using mobile payment. When using

mobile payment, consumers first conduct a threat appraisal and a coping appraisal. Then, they do the trade-off between benefits and costs. If their perceived cost is higher than their perceived benefit, consumers will hesitate to use mobile payment, or will be sensitive to security risks. They might choose not to use mobile payment, or to use mobile payment carefully. In this case, consumers do not have any incentive to take security risks. Therefore, their security risk tolerance is low. This leads to the following hypothesis:

Hypothesis 2: Consumers' perceived cost of using mobile payment is negatively related to their security risk tolerance.

2.6.2 BENEFIT-COST APPRAISAL

2.6.2.1 CONVENIENCE

As a research construct, convenience has primarily been discussed in the marketing and consumer behavior literature (Berry, Seiders, & Grewal, 2002; Ng-Kruelle, Swatman, Rebme, & Hampe, 2002). It is related to the elements generating time and place utility for consumers (Clarke, 2001). Supported by the mobility, reachability, and compatibility that are offered by mobile technology (Kim, Mirusmonov, & Lee, 2010), mobile payment is convenient because it makes life easier for consumers and ameliorates the difficulty of traditional payments (Obe & Balogu, 2007). Particularly, mobile payment provides consumers with payment anytime/anywhere and with timely access to financial assets (Mallat, 2007).

Consumers can carry cell phones or other mobile devices to conduct mobile payment from anywhere within a mobile network area (Au & Kauffman, 2008; Ding, Ijima, & Ho, 2004). This is built on the feature called "always on", which confers to consumers the ability to constantly carry the cellular phone, given its portable nature (Mahatanankoon, Wen, &

Lim, 2005). Mobile payment makes payment independent of time and place. In comparison with traditional payment and conventional electronic commerce, in which transactions are conducted commonly via wire-Internet, mobile computing provides users with more freedom. The anytime and anywhere access provided by mobile computing allows consumers to access information, communication, transactions, and services regardless of time or place (Amendah, 2008; Anckar & D'Incau, 2002). In addition, mobile payment requires consumers and service providers to actively participate. The reachability of mobile devices makes it possible for consumers to be contacted anytime and anywhere (Perry, O'Hara, Sellen, Brown, & Harper, 2001). This feature makes it easy for mobile payment service providers to contact mobile payment users for informational purposes. Clarifications of transactions can be sent to consumers via SMS or via timely emails (Amendah, 2008).

Furthermore, mobile payment helps consumers avoid using cash and it also offers faster conduction of payments (Dewan & Chen, 2005; Linck, Pousttchi, & Wiedemann, 2006). Without consumers having to hand over cash, find change, or swipe cards, transactions become easier and faster. In addition, the transaction records saved by mobile payment on mobile devices make personal financial management much easier.

Although some consumers might have a poor experience with using mobile payment caused by the constraints of mobile devices, such as inconvenient input and slow responses (Zhou, 2015), it has been shown that convenience, constant access to the service, and time and effort saving are the main factors that contribute to consumers' adoption of mobile payment (Dewan & Chen, 2005; Suoranta, 2003; Xu & Gutierrez, 2006). The convenience offered by mobile payments can help consumers increase their productivity and improve their time management (Bouwman, Carlsson, Walden & Molina-Castillo, 2009). This leads

to the following hypothesis:

Hypothesis 3: The convenience of using mobile payment positively affects consumers' perceived benefit.

2.6.2.2 SAFETY

Safety is a unique characteristic of mobile payment, compared with traditional payment via cash, check, credit card, or debit card. The use of mobile payment can provide consumers with better safety by verifying buyers via location information, security features on mobile devices, or one-time account identifiers (Hoofnagle, Urban, & Li, 2012). Mobile payment helps consumers avoid the need to carry a large amount of cash in their wallets. In this way, consumers are less likely to lose cash or to be robbed. Furthermore, the possibility for consumers to receive falsified cash will be lessened (Khan, Olanrewaju, Baba, Langoo, & Assad, 2017). It is well known that fraud is very common in the usage of credit cards. The authentication in mobile payment reduces card fraud greatly (Yi, 2016). For example, NFC-based mobile payment approaches, such as Apple Pay and Google Wallet, utilize the secure element that is built into mobile devices for cryptographic processing, including encryption, hashing, and digital signatures, to certify a consumer's identity in the transaction process. When consumers use Apply Pay, their fingerprint and their device's unique account numbers are stored in the secure element for cryptographic processing. In 2015, Alipay Wallet began to use fingerprint recognition functions to process mobile payment transactions (Cheng, Hsu, & Lo, 2017). Moreover, many other biological detections have been developed to ensure security certification before transactions, including facial recognition, iris recognition, sound recognition, and vein recognition. Security issues inherent in traditional payment are overcome by mobile payment. Compared with traditional payment, mobile payment has a

higher level of safety. This leads to the following hypothesis:

Hypothesis 4: The safety of using mobile payment positively affects consumers' perceived benefit.

2.6.2.3 SAVING

The usage of mobile payment can reduce the overall transaction costs for merchants (Hoofnagle, Urban, & Li, 2012). In traditional payment, merchants are charged two to three percent of the money that is exchanged in a credit transaction. The transaction fee can be saved if merchants choose mobile payment, which allows them to directly pull funds from consumers' bank accounts. Mobile payment eliminates credit risk and attendant fees (as well as other costs). With the savings in transaction costs, merchants are able to offer consumers discounts or lower prices (Hoofnagle, Urban, & Li, 2012). As a result, consumers can buy more goods or services with the same amount of money. Savings are generated for consumers by their usage of mobile payment. This leads to the following hypothesis:

Hypothesis 5: The saving generated by using mobile payment positively affects consumers' perceived benefit.

2.6.2.4 VULNERABILITY

Due to its virtuality and lack of control, mobile payment involves great security risks. From the perspective of technology, mobile networks are vulnerable to hacker attacks and to information interception, compared with wired networks (Yan & Yang, 2015; Zhou, 2015). In addition, mobile devices might be infected by viruses or Trojan horses (Zhou, 2015). A leak of consumers' personal information is likely to occur. Furthermore, the portability of mobile devices makes theft, loss, and damage of mobile devices much more likely (Chari, Kermani, Smith, & Tassiulas, 2000; Linck, Pousttchi, & Wiedemann, 2006). As scanning a

QR code becomes popular in making mobile payment, integrity is facing challenges, because QR codes are not human-readable, and it is hard for users to distinguish between QR codes from trusted or untrusted sources, some of which may contain URLs with hidden malware or which direct users to a cloned website to commit fraud, to download malware, or to be phished for credentials (Wang, Hahn, & Sutrave, 2016). From the monetary perspective, supports from financial institutions are not available in countries with undeveloped financial infrastructure, should disputes about transactions occur. The protection that U.S. consumers get from their credit card issuers regarding disputed transactions does not always exist.

Vulnerability is a major cost of using mobile payment. Consumers doubt whether mobile payment can effectively protect their account and payment from potential problems (Yan & Yang, 2015). When vulnerability is high, consumers tend to think that the cost of using mobile payment is high. This leads to the following hypothesis:

Hypothesis 6: The vulnerability of using mobile payment positively affects consumers' perceived cost.

2.6.2.5 SECURITY THREAT

According to Kalakota & Whinston (1997), security threats are "circumstances, conditions, or events with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service and/or fraud, waste and abuse" (p. 317). Security threats in the context of mobile payment come from a lack of authentication, confidentiality, non-repudiation, and data integrity (Chen, 2006; Dewan & Chen, 2005). They are mostly present through inappropriate data collection and tracking (Hoofnagle, Urban, & Li, 2012).

Mobile payment technologies offer merchants the ability to collect more information

about consumers than ever before (Hoofnagle, Urban, & Li, 2012). It becomes easier for merchants to identify consumers and to share consumers' information with other merchants (Hoofnagle, Urban, & Li, 2012). Consumers' personal and sensitive financial data can be used for marketing. Moreover, mobile payment allows merchants to track consumers' movements through their mobile phones (Hoofnagle, Urban, & Li, 2012). Therefore, consumers are concerned that their purchases have been tracked or that they will receive a lot of advertisements (Dahlberg, Mallat, & Öörni, 2003a). When the security threats are high, consumers tend to think that the cost of using mobile payment is high. High security threats hinder customers from using mobile payment. This leads to the following hypothesis:

Hypothesis 7: Security threats in using mobile payment positively affect consumers' perceived cost.

2.6.3 MODERATING EFFECT

2.6.3.1 NORMATIVE BELIEFS

Social pressure provides extrinsic incentives to consumers (Herath & Rao, 2009b; Kreps, 1997). It is "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh, Morris, Davis, Davis, 2003). Essentially, social influence is the extent to which one member's social network influences another member's behavior (Venkatesh & Brown, 2001). It is a significant direct determinant of behavioral intent in TRA (Fishbein & Ajzen 1975) and TPB (Ajzen 1991; Venkatesh & Davis, 2000).

Social influence is exerted through messages and signals that help to form perceptions of the value of an activity (Venkatesh & Brown, 2001). It comes from other people who are perceived, by an individual, to be important, such as friends, family

members, and supervisors (Shen, 2012). Social influence plays an important role in determining how consumers will react to technology use (Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, Davis, 2003). Huang (2016) found that some people choose mobile financial services because their friends, colleagues, family encourage or support them to do so. Thakur (2013) found that there is a significant relation between social influence and consumers' intention to use mobile payment.

A norm can be a reason to act, believe, or feel. Norms can be categorized into descriptive norms and subjective norms. The former means the "is", whereas the latter means the "ought" (Sheeran & Orbell, 1999). Subjective norms are based on the notion that an individual's behavior is influenced by what relevant others expect her/him to do (Herath & Rao, 2009b). Those relevant others include family members and friends. Herath and Rao (2009b) also note that individuals are influenced by the observed behavior of others or by messages about expectations from others. In specific, normative beliefs are about whether or not a significant person wants an individual to perform a behavior (Herath & Rao, 2009b). Peer behaviors are found to be a motivational source for performing a behavior (Li, He, Xu, Ivan, Anwar, & Yuan, 2014; Li, Xu, He, Chen, & Chen, 2016; Thompson, Higgins, & Howell, 1994).

In the context of mobile payment, if consumers see that their family members, friends, or colleagues are using mobile payment, and feel that these relevant others expect them to use mobile payment, they are likely to carry out similar behaviors, driven by a fear of being left out. The influence from subjective norms plays a role in consumers' balance of benefit and cost, regarding security risk when using mobile payment. This leads to the following hypotheses:

Hypothesis 8: Normative beliefs moderate the relationship between mobile payment users' perceived benefit and their security risk tolerance.

Hypothesis 9: Normative beliefs moderate the relationship between mobile payment users' perceived cost and their security risk tolerance.

2.6.3.2 PAYMENT TRADITION

Cash has represented the main means of financial transaction between buyers and sellers for a long time. Making payments with cash offers many benefits, including convenience of use, protection of consumers' privacy, ease of payment finality, accessibility to liquidity, and the confidence that it procures to consumers (Taylor, 2006). Payment with cash does not require any device. Consumers do not need to purchase any equipment or learn any software. In addition, it is hard to track consumers, because transactions with cash are anonymous. Moreover, making payment with cash allows seller and buyers to be directly engaged: sellers get the money and buyers receive the goods/services. Unlike in the U.S. and in Europe, some countries, such as China and Japan, have cash-centric payment cultures (Lu, Yang, Chau, & Cao, 2011). Consumers in these countries prefer to use cash instead of checks or credit cards. Additionally, Chinese consumers have a habit of carrying cash (Laforet & Li, 2005). Lu, Yang, Chau, and Cao (2011) find that consumers' payment habits do not change when they move from traditional transactions to electronic transactions. In the context of mobile payment, consumers in cash-centric payment cultures still prefer to use cash, due to the influence of their payment habits. They tend to be more sensitive to the security risk of making a mobile payment. Their preference for cash gives them a lower security risk tolerance, regardless of the benefits of mobile payment. In contrast, consumers in card-centric payment cultures are more likely to accept mobile payment. They tend to be

driven by the benefits of mobile payment and thus have a higher level of security risk tolerance. This leads to the following hypotheses:

Hypothesis 10: Payment tradition moderates the relationship between mobile payment users' perceived benefit and their security risk tolerance.

Hypothesis 11: Payment tradition moderates the relationship between mobile payment users' perceived cost and their security risk tolerance.

2.6.3.3 SELF-EFFICACY

Self-efficacy is the judgment about one's ability to accomplish a particular job or task (Bandura, 1977; Compeau & Higgins, 1995). It is the degree to which one is confident in completing a task. Self-efficacy is an important motivational factor that influences people's choices, goal commitment, goal level, emotional reactions (Gist & Mitchell 1992; Locke, Frederick, Lee, & Bobko, 1984; Taylor, Locke, Lee, & Gist, 1984), coping efforts (Lent, Brown, & Larkin, 1987, Stumpf, Brief, & Hartman, 1987), and affective reactions (Gist, Schwoerer, & Rosen, 1989, Kanfer & Ackerman, 1989). According to Bandura (1986), information and enactive experiences are the factors that impact self-efficacy. This paper defines self-efficacy as an individual's judgement of personal skills, knowledge, or competency about taking measures to protect his/her security when using mobile payment.

In the context of mobile payment, with the advances in security technologies, many security-related tasks are now being automated, to reduce knowledge and time burdens on consumers (Herath & Rao, 2009b). However, to cope with and to avert the potential for loss or damage, consumers still need to set pin/password/screen-lock patterns for mobile devices, to upgrade the operating systems of their mobile devices, to install security patches, to prevent downloading malware, and to deal with suspected SMS messages (Wang, Hahn, &

Sutrave, 2016). Consumers must assess their ability to cope with or to perform these security measures. When they think that they are capable of taking these measures, they tend to care more about the benefit of making mobile payment, because they can handle the security issues by themselves. Accordingly, they might have a higher level of security risk tolerance. On the contrary, when consumers are incapable of taking security measures, they are more concerned about the cost of making a mobile payment. As a result, they tend to have a lower level of security risk tolerance. This leads to the following hypotheses:

Hypothesis 12: Self-efficacy moderates the relationship between mobile payment users' perceived benefit and their security risk tolerance.

Hypothesis 13: Self-efficacy moderates the relationship between mobile payment users' perceived cost and their security risk tolerance.

2.6.4 GENDER DIFFERENCE

Gender is an important individual characteristic included in the growing body of research in information technology. Gender difference has been identified in the context of mobile payment. For example, Gefen and Straub (1997) found that males are more competitive and assertive, while females are encouraged to be more cooperative and nurturing. Males were found to have higher level of openness to ideas (Costa, Terracciano, & McCrae, 2001) and to be bolder to try new technological products (Morris, Venkatesh, & Ackerman, 2005). Males' decisions are easily affected by perceived usefulness (Choi, 2010), whereas females' decision is easily affected by perceived ease of usefulness because they have lower computer self-efficacy (Venkatesh & Morris, 2000). Liébana-Cabanillas, Sánchez-Fernández, and Muñoz-Leiva (2014b) found that gender difference exists in ease of use, usefulness, attitude, and intention to use, as well as trust regarding mobile payment. In

addition, males are more pragmatic and task-oriented (Sun & Zhang, 2006), whereas females are more concerned with others' opinions and feelings (Venkatesh & Morris, 2000). Compared with females, males perceive lesser risk (Aguirre-Urreta & Marakas, 2010). When considering the use of new technologies, males tend to rely less on facilitating conditions, whereas females tend to place greater emphasis on external supporting factors (Faqih & Jaradat, 2015; Venkatesh, Thong, & Xu, 2012). Accordingly, differences between males and females in benefit-cost appraisal and trade-off regarding using mobile payment are expected. This leads to the following hypotheses:

Hypothesis 14a: Gender difference exists in the relationship between consumers' perceived benefit of using mobile payment and their security risk tolerance.

Hypothesis 14b: Gender difference exists in the relationship between consumers' perceived cost of using mobile payment and their security risk tolerance.

Hypothesis 14c: Gender difference exists in the relationship between convenience and consumers' perceived benefit of using mobile payment.

Hypothesis 14d: Gender difference exists in the relationship between safety and consumers' perceived benefit of using mobile payment.

Hypothesis 14e: Gender difference exists in the relationship between saving and consumers' perceived benefit of using mobile payment.

Hypothesis 14f: Gender difference exists in the relationship between vulnerability and consumers' perceived cost of using mobile payment.

Hypothesis 14g: Gender difference exists in the relationship between security threat and consumers' perceived cost of using mobile payment.

3. METHODOLOGY

3.1 RESEARCH PLAN

The primary research instrument for this study is a questionnaire designed to collect data on mobile payment. The research questionnaire was developed via a multi-stage approach to measure constructs in the proposed research model. First, relevant literature and corresponding scales were reviewed. Second, scales were adjusted for the context of mobile payment. Third, if no existing scale was available, new ones were developed. Fourth, the questionnaire was created in English and administered in Chinese. Researchers fluent in English and Chinese translated the questionnaire from English into Chinese and then back-translated it into English to confirm translation equivalence (Brislin, 1980). All of the measurement items are included in Appendix A and in Appendix B (the Chinese version).

Most of the questions attempted to gauge the level of agreement for the statements related to mobile payment. The respondents rated the questionnaire items, noting the extent to which they agreed with each statement. Most of questionnaire items were scored on a seven-point Likert scale (1 = extremely disagree and 7 = extremely agree). The questionnaire contains a few nominally scaled background questions. These questions sought information on demographics, annual income, occupation, and working experience.

The survey instrument was primarily adapted from Ajzen (1991), Bulgurcu, Cavusoglu, and Benbasat (2010), Karahanna, Straub, and Chervany (1999), Ng, Kankanhalli, and Xu (2009), and Srite and Karahanna (2006), with adjustments for the context of mobile payment. It should be noted that the dependent variable in this study is the security risk tolerance of mobile payment, which is a new term in the studies of mobile payment. The level of people's risk tolerance is hard to assess because risk tolerance is an elusive and ambiguous concept

(Roszkowski, 1993). Because no previous literature considered this topic, this study defines risk tolerance and develops a six-item scale to measure it. They are: (1) The security measures that I get from my mobile payment provider are effective; (2) The security measures taken by the bank where I have an account linked to my mobile payment account are effective; (3) The security measures taken by my mobile payment provider are effective; (4) The biological detection feature of my cell phone, such as facial recognition, fingerprint recognition, iris recognition, sound recognition, or vein recognition, is effective to protect my mobile payment; (5) How long have you been using mobile payment?; and (6) I accept the uncertainty existing in mobile payment. For item 5, the answers are: less than 0.5 year, 0.5-1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, and longer than 5 years.

Structural equation modeling (SEM) is applied to analyze benefit-cost appraisal and the trade-off process in the research model with AMOS 24, because security risk tolerance is a second-order construct in the model (MacKenzie, Podsakoff, & Jarvis, 2005). In Figure 4, the proposed benefit-cost appraisal and the trade-off process for security risk tolerance in mobile payment is illustrated.

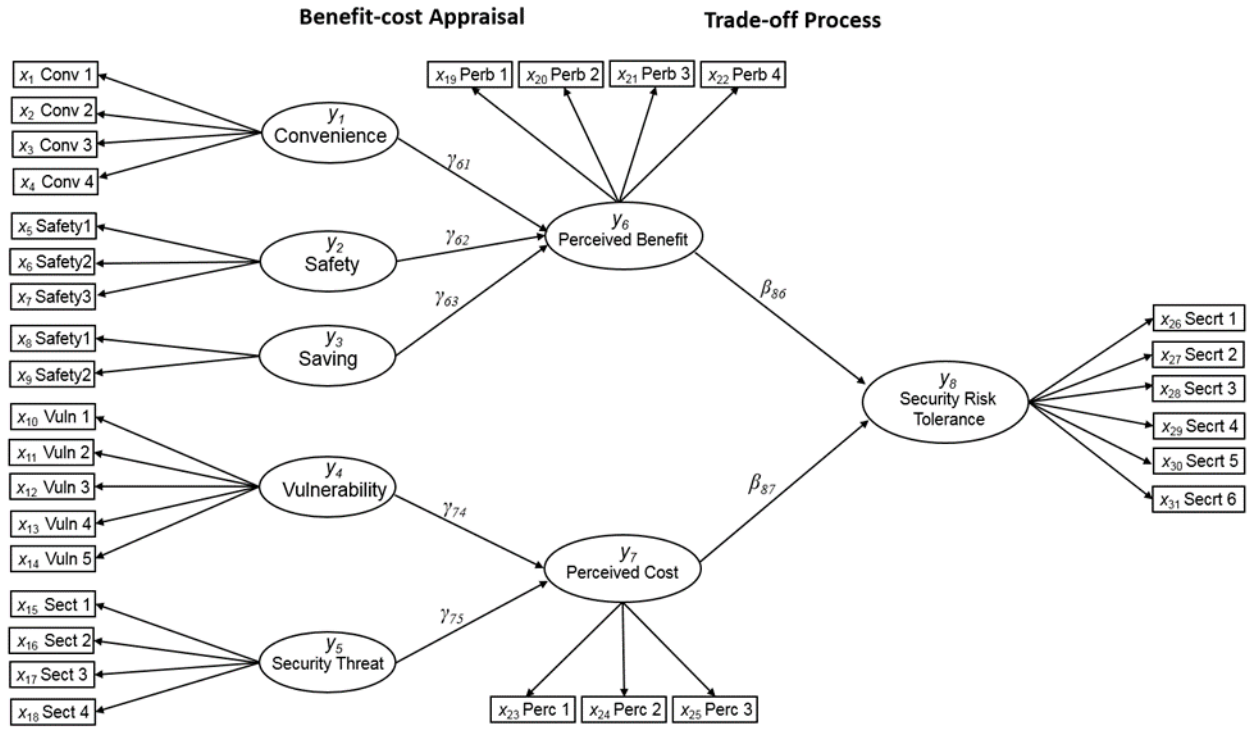

Figure 4. Benefit-cost appraisal and trade-off process in the research model

Note: See Table 4 and Appendix A for information about x_1 to x_{31}, y_1 and y_8.

The covariance structure model was expressed using classical structural equations (Li, 1997):

$$y = \beta y + \gamma x + \varepsilon \qquad (1)$$

where

y is the $p * 1$ vector of observed dependent variables measured without error

β is the $p * p$ matrix of coefficients relating p dependent variables to one another

x is the $q * 1$ vector of observed independent variables measured without error

γ is the $p * q$ matrix of coefficients relating q independent variables to the p dependent variables

ε is the $p * 1$ vector of errors in the equations.

The Benefit-cost appraisal and trade-off process in Figure 4 represents the following matrix equation:

$$\begin{bmatrix} y_8 \\ y_6 \\ y_7 \end{bmatrix} = \begin{bmatrix} 0 & \beta_{86} & \beta_{87} \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} y_8 \\ y_6 \\ y_7 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ \gamma_{61} & \gamma_{62} & \gamma_{63} & 0 & 0 \\ 0 & 0 & 0 & \gamma_{74} & \gamma_{75} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix} \quad (2)$$

As specified in the SEM (Jöreskog & Sörbom, 1989), the disturbance errors were not correlated with x, and none of the equations in the model are redundant. The causal equations were linear, additive, and unidirectional.

The moderating effects of normative beliefs, payment tradition, and self-efficacy on the hypothesized relationships were run with a three-level hierarchy analysis in Statistical Package for the Social Sciences (SPSS) 24. The moderating effects are shown in Figure 5, Figure 6, and Figure 7.

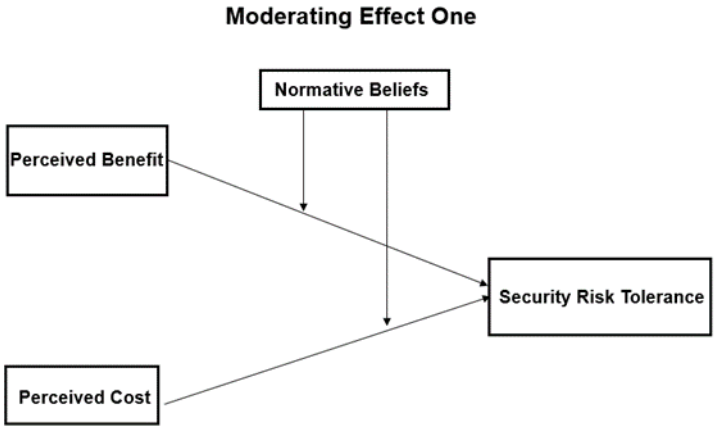

Figure 5 The moderating effect of normative beliefs

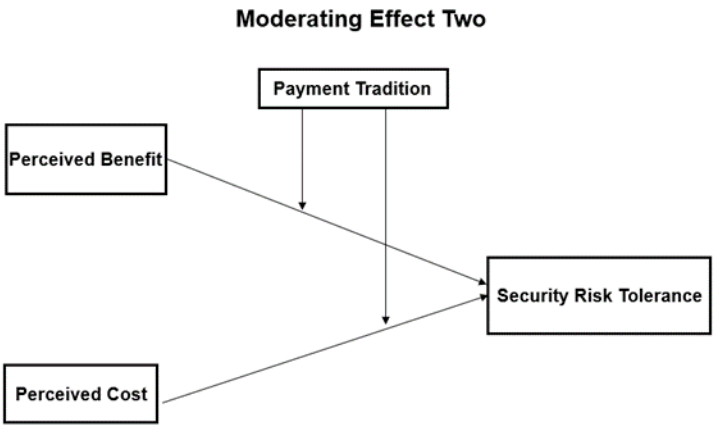

Figure 6 The moderating effect of payment tradition

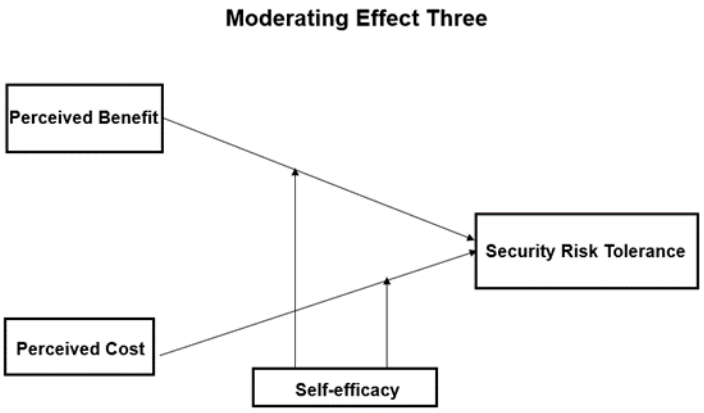

Figure 7 The moderating effect of self-efficacy

According to Dawson (2014), the two-way interaction of the moderator and the interaction can be described as:

$$y = \beta_0 + \beta_1 x + \beta_2 z + \beta_3 xz + \varepsilon, \qquad (5)$$

where:

y is security risk tolerance

x represents perceived benefit or perceived cost

z represents the moderator (normative beliefs, payment tradition, or self-efficacy)

xz represents the interaction

β_0 is the intercept (the expected value of y when x = 0 and z= 0). β_1 and β_2 determine whether there is any main effect of *x* or *z*, respectively, independent of the other. Only β_3 determines the moderation. Whether *z* is a statistically significant moderator can be found by comparing the ratio β_3 to its standard error with a known distribution. When the result of the comparison is significant, *z* is a statistically significant moderator of the linear relationship between *x* and *y*.

3.2 SURVEY ADMINISTRATION

This study performed a two-stage survey to test the research hypotheses. First, prior to the conduct of a formal survey, a web-based pilot test was carried out to validate the initial version of the survey questionnaire, including survey instructions, completion time, and appropriate wording. The respondents for the pilot test were selected in March of 2018 from a city in northern China. They consist of 33 mobile payment users (Alipay Wallet or Wechat Pay). Some of the questions that the respondents failed to clearly understand were revised. The order of some of the items was adjusted, as well. Two IS professors were asked to review the questions to improve the construct validity. The results from the pilot test led to the final version of the survey questionnaire. In order to avoid skewing the results, the data from the pilot test were not used in the second stage of data collection.

A structured and web-based questionnaire was deployed in the formal survey, which was conducted to evaluate the proposed model and to test the hypotheses. This survey was distributed by a company called Wen Juan Xing (www.wjx.cn) during the period between April 13, 2018 and April 18, 2018 in China. Users of Alipay Wallet and Wechat Pay in China were the target respondents. For this survey, the survey company randomly selected respondents from its user database. Respondents gave their answers anonymous to the 55 questions and were assured that their responses would be treated confidentially. Each respondent was requested to carefully

complete the questionnaire. Incomplete questionnaires and those questionnaires the have the same answer for each question were eliminated.

Altogether, 328 questionnaires were collected from respondents. Four questionnaires were eliminated because the respondents were not users of Alipay Wallet or Wechat Pay, leaving 324 questionnaires for the empirical analysis. According to McShane and Böckenholt (2016), when testing a correlation coefficient, a sample size of 320 is required to achieve a power level of 0.9 and a significance level of 0.01 in a one-sided test with a correlation of 0.2 and an uncertainty variance of 0.01. Thus, the sample size of 324 is appropriate for this study.

Table 3 presents respondents' demographic characteristics with respect to gender, age, education, annual income, occupation, industry, and working experience. Regarding gender, 58% of the subjects are females. In terms of age, 63% of the subjects are in the 25-34 age group and 25% are in the 35-44 age group. The composition of the sample could potentially limit the generalization of the results, because around 88% of the respondents fall into the 25-44 age group. However, the results obtained from the analysis of this type of sample can still reflect true phenomena and can provide significant outcomes, because young and middle-aged users are the most important strata of the user-of-mobile-payment population in China. Individuals with an associate degree or a bachelor degree account for 90% of the data. Around 65% of the subjects are salaried employees and 18% are managers. Their occupation makes them capable of making mobile payment. Additionally, the Internet Protocol (IP) addresses of the respondents show a high geographic diversity across China. This allows the findings of this study to be generalized to represent overall mobile payment users in China.

Table 3 Demographic information

Demographic information	**Number**	**%**
Total sample	324	

Gender		
Male	135	41.67
Female	189	58.33
Age		
18-24	25	7.72
25-34	203	62.65
35-44	82	25.31
45-54	10	3.09
55 and above	4	1.23
Education		
Middle School	3	0.93
High school	8	2.47
Associate	39	12.04
Bachelor	253	78.09
Master	18	5.56
Doctoral	3	0.93
Annual Income		
Less than 20,000RMB	8	2.47
20,000RMB- 60,000RMB	41	12.65
60,000RMB- 100,000RMB	133	41.05
100,000RMB- 150,000RMB	95	29.32
150,000RMB- 180,000RMB	26	8.02
Over 180,000RMB	21	6.48
Occupation		
Student	4	1.23
Salaried Employee	210	64.81
Manager	57	17.59
Small Business Owner	13	4.01
Officeholder	32	9.88
Retiree	2	0.62
Other	6	1.85
Industry		
Chemical	17	5.25
Construction	28	8.64
Power/Energy	47	14.51
Transportation	25	7.72
Food/Beverage	28	8.64

Defense	1	0.31
Education	43	13.27
Government	16	4.94
Nonprofit	4	1.23
Pharmaceutical	12	3.70
Aerospace	6	1.85
Service	54	16.67
Other	43	13.27
Working Experience		
Less than 2 years	13	4.01
2-3 years	34	10.49
3-5 years	45	13.89
5-10 years	150	46.30
11-15 years	48	14.81
15-20 years	17	5.25
Longer than 20 years	17	5.25

3.3 DATA ANALYSIS

According to Jöreskog and Sörbom (1989), the covariance structure model consists of two parts: the measurement model (the CFA stage) and the structural model (the SEM stage). Thus, following the two-stage approach recommended by Anderson and Gerbing (1988), this study assesses the quality of the measures first, and then tests the hypotheses through the structural model.

3.3.1 RELIABILITY AND VALIDITY

In the first stage, an extensive confirmatory factor analysis was processed to assess construct reliability, indicator reliability, convergent validity, and the discriminant validity of the measures.

Construct reliability was tested by using Cronbach's alpha and the composite reliability (CR). Cronbach’s alpha is a popular method for measuring reliability (Mukherjee & Nath, 2003).

It provides a lower bound estimate of the internal consistency. Nunnally (1978) suggested that the Cronbach's alpha of a construct should be at least 0.7. CR measures the internal consistency of the scales. Compared with Cronbach's alpha, CR is a more rigorous estimate for reliability (Chin & Gopal, 1995). The recommended value of CR for establishing acceptable model reliability is above 0.70 (Gefen, Straub, & Boudreau, 2000; Werts, Linn, & Jöreskog, 1974). As shown in Table 4, the values of Cronbach's alpha and CR for all of the constructs were above 0.7, except for safety. The result shows that the construct reliability is not perfect, but that it is acceptable. Indicator reliability is evaluated based on the criteria that the loadings should be greater than 0.70, and that the loading less than 0.4 should be eliminated (Henseler, Ringle, & Sinkovics, 2009). Two loadings (Vuln5 and Secrt 1 in Vulnerability construct) did not meet this criterion. Because removing these two items caused significant changes in other criteria, these two items were kept.

Average variance extracted (AVE) was used as the criterion to test convergent validity. The AVE should be higher than 0.5, so that the latent variable would explain more than half of the variance of its indicators (Bhattacherjee & Premkumar, 2004; Fornell & Larcker, 1981; Hair, Sarstedt, Ringle, & Mena, 2012; Henseler, Ringle, & Sinkovics, 2009). As shown in Table 4, only three constructs had an AVE higher than 0.5, suggesting that the principal constructs captured lower construct-related variance than error variance.

Table 4 Quality criterion (Cronbach's alpha and AVE) and factor loadings

Construct	Item	Question	Loadings	R^2	Cronbach's Alpha	CR	AVE
Convenience					0.773	0.769	0.466
	Conv1	Mobile payment makes my purchases easier	0.887***	0.787			
	Conv2	Mobile payment makes my purchases faster	0.716***	0.512			
	Conv3	Making purchases with mobile payment is hassle-free	0.521***	0.271			
	Conv4	Mobile payment allows me to take fewer cash with me	0.541***	0.292			
Safety					0.584	0.607	0.344
	Safety1	Mobile payment enhance safety of my payment for purchases	0.476***	0.227			
	Safety2	The biological detection feature of mobile payment, such as facial recognition, fingerprint recognition, iris recognition, sound recognition, or vein recognition, makes my purchase safe	0.669***	0.447			
	Safety3	Mobile payment lowers the service fee I paid to my banks	0.599***	0.359			
Saving					0.725	0.735	0.581
	Saving1	Mobile payment allows me to enjoy discounts and promotions offered by merchants	0.787***	0.619			
	Saving2	Mobile payment allows me to enjoy discounts and promotions offered by mobile payment providers	0.737***	0.543			
Perceived Benefit				0.505	0.751	0.747	0.425
	Perb1	Using mobile payment would be favorable to me	0.652***	0.426			
	Perb2	Using mobile payment would result in benefits to me	0.636***	0.405			
	Perb3	Using mobile payment would create advantages for me	0.625***	0.391			
	Perb4	Using mobile payment would provide gains to me	0.694***	0.482			
Vulnerability					0.761	0.781	0.457

	Vuln1	My cell phone is easy to be lost	0.733***	0.538			
	Vuln2	My cell phone is easy to be infected by viruses, which cause the leak of my personal information about mobile payment	0.859***	0.737			
	Vuln3	Mobile networks are easy to be hacked so the details of the transactions of my mobile payment leak	0.821***	0.674			
	Vuln4	Fake mobile payment QR codes are hard to distinguish	0.562***	0.316			
	Vuln5	When a dispute occurs, my bank helps me find a solution	0.140***	0.020			
Security Threat					0.747	0.751	0.436
	Sect1	Malwares and virus for cell phones are everywhere	0.566***	0.321			
	Sect2	Data transferred via mobile internet are easy to be intercepted	0.515***	0.265			
	Sect3	Merchants might sell my payment data for profits	0.75***	0.563			
	Sect4	Using mobile payment might cause the leak of my personal information, such as bank accounts, ID number, and address	0.773***	0.598			
Perceived Cost				0.927	0.746	0.755	0.513
	Perc1	Using mobile payment leaks my personal information	0.867***	0.752			
	Perc2	Using mobile payment makes me lose money	0.665***	0.442			
	Perc3	Resolving a dispute in mobile payment is time consuming	0.588***	0.346			
Normative Beliefs					0.738	0.740	0.419
	Norb1	My friends /colleagues think that I should use mobile payment regardless the security risk	0.643***	0.413			
	Norb2	My family members think that I should use mobile payment regardless the security risk	0.726***	0.528			
	Norb3	Despite of risks, my colleagues still use mobile payment	0.516***	0.266			
	Norb4	Despite of risks, my family members still use mobile payment	0.686***	0.470			
Payment Tradition					0.767	0.777	0.543

	Payt1	Transactions with cash are more normal	0.567***	0.321			
	Payt2	I am more used to making payments with cash	0.856***	0.733			
	Payt3	Compared with mobile payment, I feel more comfortable when making payments with cash	0.759***	0.577			
Self-efficacy					0.759	0.760	0.389
	Selfe1	I have the necessary knowledge to take security measures protecting my mobile payment	0.635***	0.403			
	Selfe2	I have the necessary skills to take security measures protecting my mobile payment	0.674***	0.454			
	Selfe3	I have the necessary competencies to take security measures protecting my mobile payment	0.661***	0.437			
	Selfe4	The password I set for my cell phone provides enough protection for my mobile payment	0.620***	0.385			
	Selfe5	The antivirus programs running in my cell phone are effective	0.518***	0.268			
Security Risk Tolerance				0.707	0.705	0.731	0.349
	Secrt1	Security measures that I get from my mobile payment provider are effective	0.241***	0.058			
	Secrt2	Security measures taken by the bank where I have an account linked to my mobile payment account are effective	0.501***	0.251			
	Secrt3	Security measures taken by my mobile payment provider are effective	0.770***	0.592			
	Secrt4	The biological detection feature of my cell phone, such as facial recognition, fingerprint recognition, iris recognition, sound recognition, or vein recognition, is effective to protect my mobile payments	0.470***	0.221			
	Secrt5	How long have you been using mobile payment?	0.693***	0.480			
	Secrt6	I accept the uncertainty existing in mobile payment	0.700***	0.216			

Note: *** $p<0.001$

Discriminant validity refers to the extent to which measures of the different model dimensions are unique. The discriminant validity of the constructs was evaluated by using Fornell-Larcker criteria and cross-loadings criteria. Fornell-Larcker criteria indicates that the square root of AVE should be greater than all of the correlations between each pair of constructs (Chin, 1998). As seen in Table 5, all of the diagonal values (square root of AVE) were greater than the off-diagonal values (correlations between the construct) except security threat. The cross-loadings criterion suggests that the loading of each indicator should be higher than all cross-loadings (Fornell & Larcker, 1981). As shown in Table 4 and Table 5, all loadings were greater than the correspondent cross-loadings except for saving, vulnerability, security threat, and self-efficacy. The Fornell-Larcker criteria was met, whereas the cross-loadings criteria was not met. Thus, the discriminant validity of the measurement is not perfect. All of the constructs were not completely distinct from each other.

Table 5 Matrix of correlation constructs and the square root of AVE (in bold)

Construct	Mean	Std. Dev.	CON	SAF	SAV	PB	VUL	ST	PC	NB	PT	SE	SRT
Convenience (CON)	6.12	0.80	**0.683**										
Safety(SAF)	5.06	0.95	.331**	**0.587**									
Saving (SAV)	5.41	1.01	.367**	.392**	**0.762**								
Perceived Benefit (PB)	5.23	0.91	.348**	.451**	.380**	**0.652**							
Vulnerability (VUL)	3.88	1.14	-.180**	-0.109	-0.025	-.121*	**0.676**						
Security Threat (ST)	4.13	1.09	-0.092	-0.094	0.031	-0.105	.677**	**0.661**					
Perceived Cost (PC)	3.65	1.18	-.189**	-.233**	-.132*	-.244**	.650**	.713**	**0.716**				
Normative Beliefs (NB)	5.50	0.90	.437**	.309**	.252**	.420**	0.015	0.097	-0.016	**0.648**			
Payment Tradition (PT)	3.39	1.28	-.278**	0.057	-0.006	-0.057	.373**	346**	.359**	-.119*	**0.737**		
Self-efficacy (SE)	5.42	0.82	.410**	.568**	.342**	.556**	-.206**	-.247**	-.302**	.334**	-0.006	**0.624**	
Security Risk Tolerance (SRT)	5.08	0.75	.423**	.443**	.351**	.537**	-.250**	-.253**	-.336**	.318**	-.117*	.558**	**0.591**

Note: n=324,

** Correlation is significant at the 0.01 level (2-tailed),

* Correlation is significant at the 0.05 level (2-tailed)

3.3.2 MODEL FIT

The second stage (SEM stage) specifies the direct and indirect causal relationships among the constructs and the amount of unexplained variance (Anderson & Gerbing, 1988). The test of the structural model includes estimating the path coefficients, which indicate the strength of the relationships between the independent and dependent variables, and the R^2 value, which is the amount of variance explained by the independent variables.

As suggested in the literature (Bollen & Long 1993; Jöreskog & Sörbom, 1993; Kline, 1998), the model fit is assessed by Comparative Fit Index (CFI), the Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), and the Root Mean Square Error of Approximation (RMSEA). CFI is an index of overall fit (Gerbing & Anderson, 1993). GFI measures the fit of a model compared to other models (Hair, Anderson, Tatham, & Black, 1998). RMSEA provides information in terms of the discrepancy for the degrees of freedom for a model (Steiger, 1990). The accepted thresholds for CFI and GFI are 0.90 (Bagozzi & Yi 1988; Gefen, Straub, & Boudreau, 2000). RMSEA is recommended to be, at most, 0.05, and acceptable up to 0.08 (Browne & Cudeck, 1993; Gefen, Straub, & Boudreau, 2000). The Chi-square model is 777.94 with a degree of freedom 409, indicating a good fit with the model (a ratio of 1.902 and less than 3) (Bentler, 1990). However, since the Chi-square test is very sensitive to sample size, a number of other indices were employed to further test the model fit. As shown in Table 6, the CFI, GFI, AGFI, and RMSEA were higher than the thresholds, but the GFI was lower than the threshold. Overall, the results show that the research model provides a valid framework for the measurement of convenience, safety, saving, perceived benefit, vulnerability, security threat, perceived cost, and security risk tolerance, when using mobile payment.

Table 6 Indices of fit and comments for model analysis

Indices in SEM analysis	**Default model**	**Recommended Critical Value**
Chi-square/degrees of freedom ratio	777.942/409 = 1.902	< 3 (Bentler, 1990)
GFI (Goodness of Fit Index)	0.864	> 0.90 (Bagozzi & Yi 1988; Jöreskog & Sörbom, 1989).
AGFI (Adjusted GFI)	0..835	> 0.8 (Bollen, 1989)
CFI (Comparative Fit Index)	0.901	> 0.90 (Browne & Cudeck,1993; Gefen, Straub, & Boudreau, 2000)
RMSEA (Room Mean Square Error Approximation)	0.053	< 0.08 (Gefen, Straub, & Boudreau, 2000)

4. FINDINGS AND ANALYSES

4.1 HYPOTHESES TESTING

4.1.1 BENEFIT-COST APPRAISAL AND TRADE-OFF PROCESS

This section presents the statistical results of the measurement validation and hypothesis testing. The effects of convenience, safety, saving, vulnerability, security threat, perceived benefit, perceived cost, normal belief, payment tradition, self-efficacy, and security risk tolerance were assessed with AMOS 24. The empirical results are shown in Table 7.

As shown in Table 7, consumers' perceived benefit ($\hat{\beta}$= 0.985, $p < 0.01$) was positively associated with consumers' security risk tolerance, whereas consumers' perceived cost ($\hat{\beta}$ = -0.209, $p < 0.01$) was negatively associated with consumers' security risk tolerance. Thus, Hypothesis 1 (H1) and Hypothesis 2 (H2) are supported.

The results also show that convenience ($\hat{\beta}$= 0.295, $p < 0.01$), safety ($\hat{\beta}$ = 0.384, $p < 0.01$) and saving ($\hat{\beta}$= 0.176, $p = 0.009$) were positively associated with consumers' perceived benefit of using mobile payment. Thus, Hypothesis 3 (H3), Hypothesis 4 (H4), and Hypothesis 5 (H5) are supported.

The relationship between vulnerability and consumers' perceived cost ($\hat{\beta}$= 0.734, p = 0.179) was not significant. Thus, Hypothesis 6 (H6) is not supported. In contrast, security threat ($\hat{\beta}$= 0.617, $p < 0.01$) was positively associated with consumers' perceived cost of using mobile payment. Thus, Hypothesis 7 (H7) is supported.

Overall, the path coefficients of H1, H2, H3, H4, H5, and H7 were significant at a level of $p < 0.01$, thereby indicating support for these hypotheses. Hypothesis 6 is not supported.

Table 7 Hypotheses-testing of the research model

Hypothesized path	Estimate	Standard error	CR	p-Value
H1: Perceived benefit -> Security risk tolerance	.985	.104	9.484	***
H2: Perceived cost -> Security risk tolerance	-.209	.049	-4.217	***
H3: Convenience-> Perceived benefit	.295	.078	3.804	***
H4: Safety -> Perceived benefit	.384	.098	3.915	***
H5: Saving -> Perceived benefit	.176	.068	2.601	.009
H6: Vulnerability -> Perceived cost	.734	.546	1.343	.179
H7: Security threat -> Perceived cost	.617	.101	6.094	***

Note: *** $p < 0.01$.
S.E. is an estimate of the standard error of the covariance.
C.R. is the critical ratio obtained by dividing the covariance estimate by its standard error.

Figure 8 shows a summary of the results for Hypotheses 1-7 in the research model. The significance of the estimates is shown in parentheses.

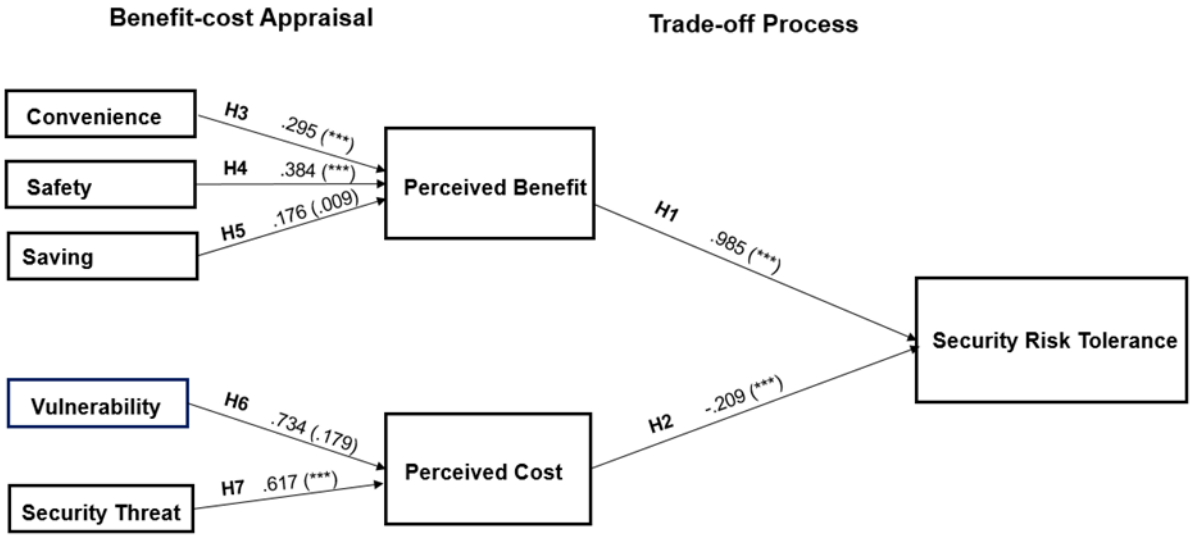

Figure 8. Path coefficients in benefit-cost appraisal and trade-off process

Note: Numbers in parentheses are significance level. *** $p<0.001$

4.1.2 MODERATING EFFECT ANALYSIS

An additional analysis tested the moderator influences of normative beliefs, payment tradition, and self-efficacy on the hypothesized relationships between perceived benefit and

security risk tolerance, as well as between perceived cost and security risk tolerance.

A three-level hierarchy analysis (ordinary least squares (OLS) regression) was conducted for each moderator. First, data was centered by subtracting their means to avoiding multicollinearity (Aiken & West, 1991; Kraemer & Blasey, 2004). The values of perceived benefit, perceived cost, normative beliefs, payment tradition, self-efficacy, and security risk tolerance were converted into Zscores. They were subtracted from mean and divided by their corresponding standard deviations. This allows meaningful comparisons. Then, six new Zscores of cross product were generated by multiplying the results gotten in the previous step in six interaction groups, namely perceived benefit and normative beliefs, perceived benefit and payment tradition, perceived benefit and self-efficacy, perceived cost and normative beliefs, perceived cost and payment tradition, perceived cost and self-efficacy. When the data were ready, a three-level hierarchy analysis was conducted in SPSS (Dawson, 2014). Consider the moderating effect of normative beliefs on the relationship between perceived benefit and security risk tolerance as an example. In level one, a regression was set with the Zscore of perceived benefit as the independent variable and the Zscore of security risk tolerance as the dependent variable. In level two, a regression was set with the Zscore of normative beliefs as the independent variable and the same dependent variable as in Step 1. In level three, a regression was set with the product of perceived benefit and normative beliefs as the independent variable and the same dependent variable as in Step 1. At the end, the hierarchical analysis was ready to run. The same process was applied to the other five moderating effects. The results of the six hierarchical analyses are shown in Table 8.

Table 8 Results of hierarchical analyses for moderators

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Collinearity Statistics	
	Beta	Std. Error	Beta			Security Risk Tolerance	VIF
Constant	5.077	.038		134.191	.000		
Zscore (Perceived Benefit)	.368	.039	.489	9.488	.000	.824	1.214
Zscore (Normative Beliefs)	.087	.039	.116	2.238	.026	.812	1.232
Perceived Benefit * Normative Beliefs	.018	.033	.025	.539	.590	.982	1.018
Constant	5.090	.035		145.428	.000		
Zscore (Perceived Benefit)	.398	.035	.529	11.355	.000	.996	1.004
Zscore (Payment Tradition)	-.079	.035	-.104	-2.212	.028	.972	1.028
Perceived Benefit * Payment Tradition	.082	.034	.112	2.388	.018	.975	1.025
Constant	5.066	.036		140.619	.000		
Zscore (Perceived Benefit)	.252	.040	.335	6.329	.000	.684	1.462
Zscore (Self-efficacy)	.290	.040	.386	7.244	.000	.675	1.482
Perceived Benefit * Self-efficacy	.033	.027	.057	1.246	.214	.930	1.075
Constant	5.086	.037		136.812	.000		
Zscore (Perceived Cost)	-.252	.037	-.335	-6.755	.000	.998	1.002
Zscore (Normative Beliefs)	.249	.038	.331	6.507	.000	.944	1.059
Perceived Cost * Normative Beliefs	.054	.035	.078	1.536	.126	.943	1.061
Constant	5.037	.040		124.641	.000		
Zscore (Perceived Cost)	-.289	.042	-.384	-6.831	.000	.834	1.200
Zscore (Payment Tradition)	-.013	.042	-.017	-.313	.755	.862	1.160
Perceived Cost * Payment Tradition	.134	.033	.214	3.999	.000	.926	1.080
Constant	5.129	.035		146.46	.000		
Zscore (Perceived Cost)	-.169	.036	-.225	-4.737	.000	.867	1.153
Zscore (Self-efficacy)	.378	.035	.502	10.816	.000	.909	1.100
Perceived Cost * Self-efficacy	.146	.036	.181	3.990	.000	.950	1.053

The results of the hierarchical analyses show that the moderating effects of three cross products, namely perceived benefit and payment tradition, perceived cost and payment tradition, and perceived cost and self-efficacy, are significant. In other words, payment tradition moderates the relationship between perceived benefit and security risk tolerance, as well as the relationship between perceived cost and security risk tolerance. Self-efficacy moderates the relationship between perceived cost and security risk tolerance. Thus, Hypothesis 10 (H10), Hypothesis 11 (H11), and Hypothesis 13 (H13) are supported. The moderating effects of the other three cross products are not significant. Thus, Hypothesis 8 (H8), Hypothesis 9 (H9), and Hypothesis 12 (H12) are not supported. Figure 9 shows the significance of moderating effects.

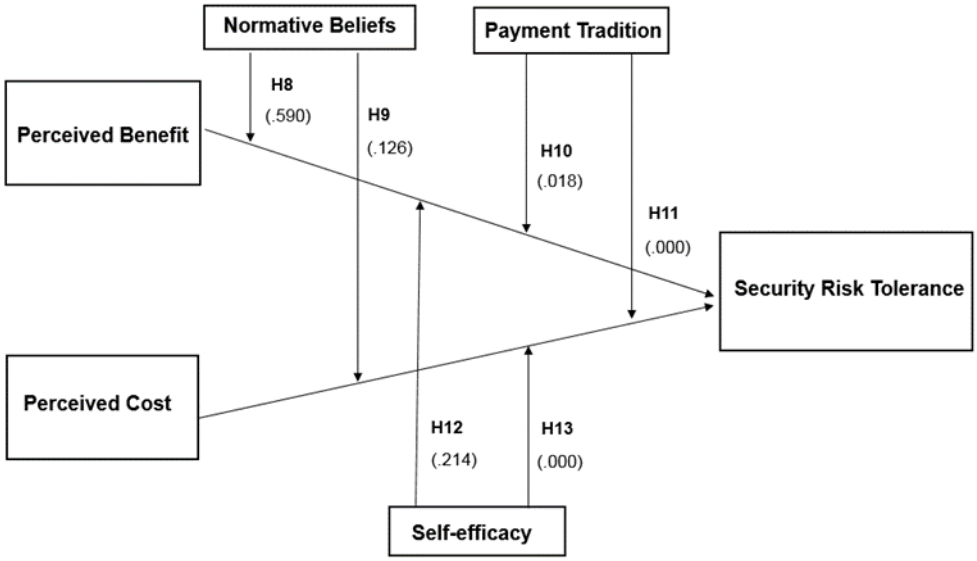

Figure 9. Significance of moderating effects

Note: Numbers in parentheses are significance

4.1.3 GROUP ANALYSIS OF GENDER EFFECT

Following the approach in Lowry and Gaskin (2014), a group analysis was performed to test the difference in benefit-cost appraisal and the trade-off process between male and female. First, the data were categorized into two groups, male and female, in AMOS 24. Then, Critical

Ratios for Differences between male and female were calculated. Last, a Z test was performed, based on the regression weights for males and females, together with the Critical Ratios for Differences. The results of the Z test are shown in Table 9.

Table 9 Results of group analysis of gender effect

Path	**Male**		**Female**		**Z-score**
	Estimate	***p***	**Estimate**	***p***	
Perceived benefit -> Security risk tolerance	1.082	0.000	0.854	0.000	-1.102
Perceived cost -> Security risk tolerance	-0.147	0.033	-0.228	0.000	-0.834
Convenience-> Perceived benefit	0.300	0.004	0.334	0.002	0.224
Safety -> Perceived benefit	0.324	0.161	0.374	0.000	0.203
Saving -> Perceived benefit	0.324	0.029	0.017	0.825	-1.841
Vulnerability -> Perceived cost	0.520	0.120	1.072	0.715	0.187
Security threat -> Perceived cost	0.597	0.000	0.655	0.000	0.273

Notes: $p<0.10$

The results reveal that only the Zscore of the path between saving and perceived benefit is significant ($p<0.10$). Thus, Hypothesis 14e (H14e) is supported. However, Zscores of the other paths are not significant. Therefore, Hypothesis 14a (H14a), Hypothesis 14b (H14b), Hypothesis 14c (H14c), Hypothesis 14d (H14d), Hypothesis 14f (H14f), and Hypothesis 14g (H14g) are not supported.

4.2 FINDINGS

This study has several key findings. First, the results of benefit-cost appraisal and trade-off process analysis indicate that when consumers value the benefits that mobile payment brings them, they tend to have a higher level of acceptance for security risks. Even though they know that they need to deal with cost caused by using mobile payment, the benefit of mobile payment offsets that cost. Accordingly, they tend to not care as much about the security risk. This finding is in line with RCT, because, when they have many options, consumers will choose the one that

will bring them the maximum benefit. On the contrary, when consumers think that the cost generated by mobile payment is serious and is higher than the benefit they receive, they have a lower level of acceptance for security risks. In this case, they are more sensitive to security risks. This finding is in line with PMT, because consumers make their decisions based on the result of their risk appraisal.

Second, the results of the benefit-cost appraisal and the trade-off process analysis indicate that convenience, safety, and saving positively affect consumers' perceived benefit. These are the unique benefits of mobile payment, when compared with other payment methods. They are the drivers of the rapid development of mobile payment in recent years, as well. In countries where financial services are not well developed, such as in China, mobile payment allows consumers to make purchases without credit cards or debit cards, and to manage their personal finances with their mobile devices. This is a great convenience for people in rural or remote areas where financial services are limited.

The results also indicate that security threat positively affects consumers' perceived cost. Security has become consumers' major concern. Consumers treat the leaking of their personal information and transaction information as damage to their privacy. They do not want merchants to target them for business based on this information or to sell this information to other parties.

However, the results show that vulnerability does not positively affect consumers' perceived cost. The reason might be that consumers think that vulnerability is not specifically related to mobile payment. Mobile payment is built on a mobile network, on mobile devices, and on wireless technologies. It is likely that consumers contribute vulnerability to the mobile network, to mobile devices, or to wireless technologies. They have not yet directly connected vulnerability with mobile payment.

Third, the moderating effect analysis generated surprising results. In Figure 10, the slopes

between perceived benefit and security risk tolerance are similar under low normative beliefs and high normative beliefs (high normative beliefs is one standard deviation above the mean and low normative beliefs is one standard deviation below the mean). So are the slopes between perceived cost and security risk tolerance, as shown in Figure 11. The results indicate that normative beliefs do not moderate consumers' trade-off processes, regarding the use of mobile payment. Surprisingly, consumers do not care about other people's opinions, expectations, or actions when they use mobile payment. They do the trade-off and make the decision independently.

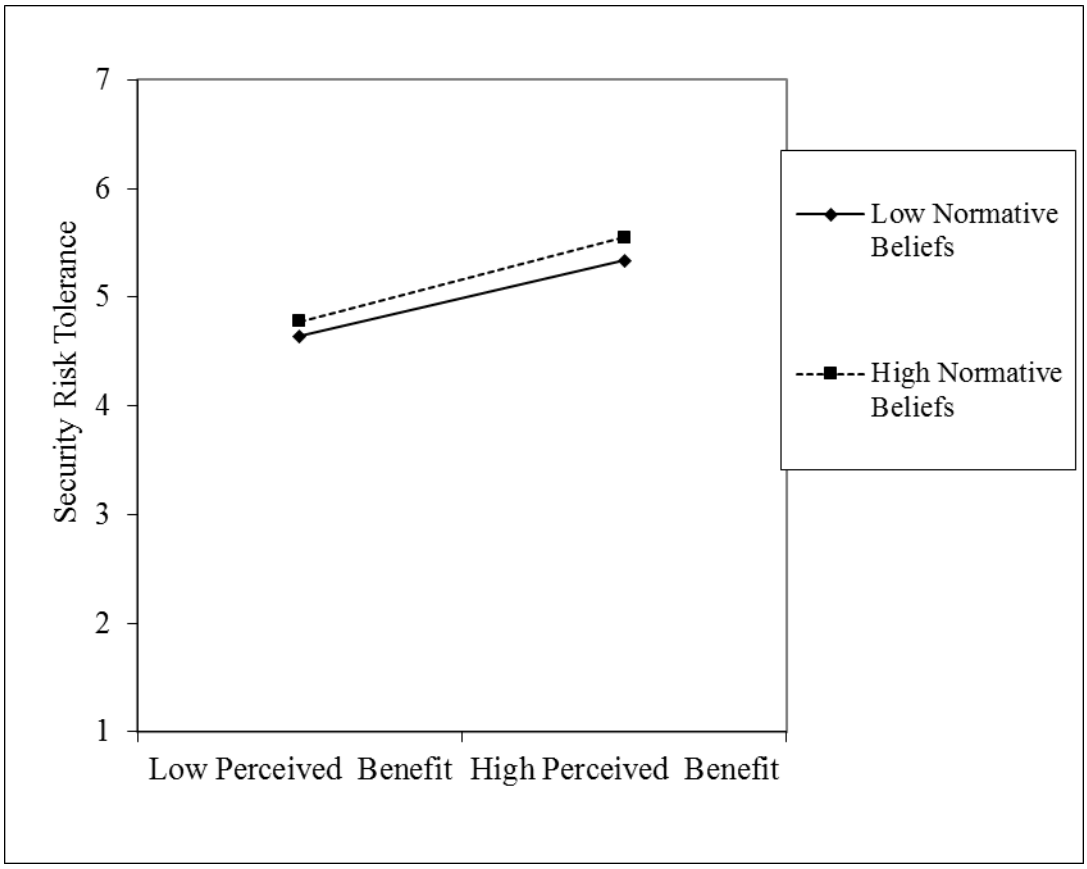

Figure 10 Moderating effect of normative beliefs on the relationship between perceived benefit and security risk tolerance

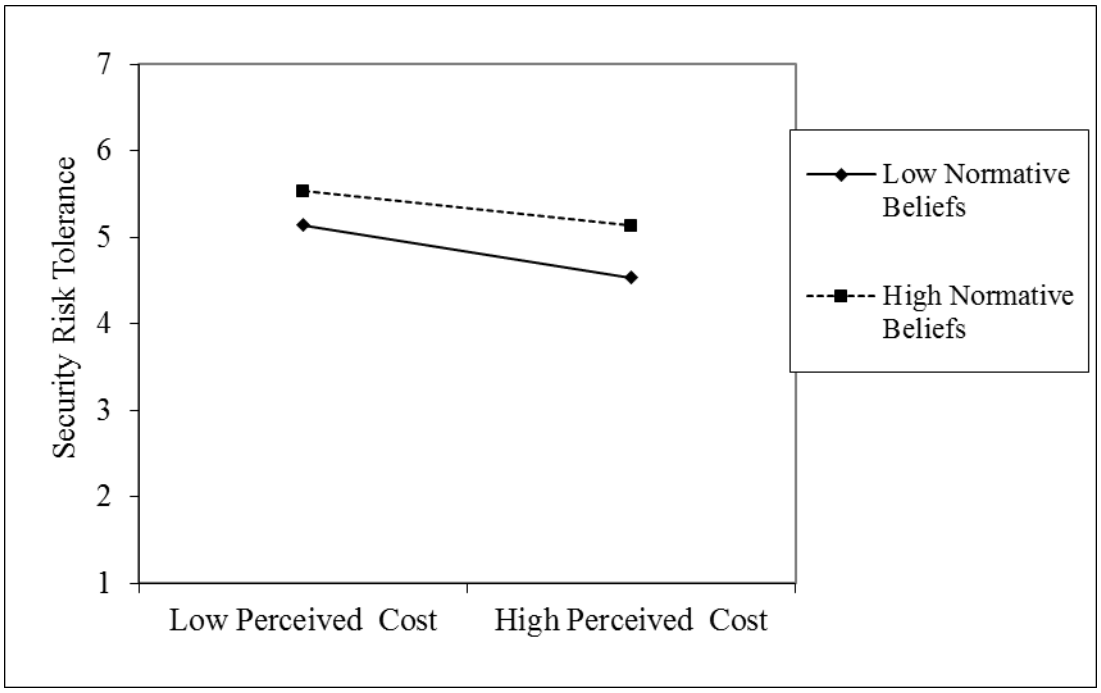

Figure 11 Moderating effect of normative beliefs on the relationship between perceived cost and security risk tolerance

In contrast, payment tradition moderates the consumers' trade-off process. In Figure 12, the slopes between perceived benefit and security risk tolerance cross under low payment tradition and high payment tradition (high payment tradition is one standard deviation above the mean and low payment tradition is one standard deviation below the mean). So are the slopes between perceived cost and security risk tolerance, as shown in Figure 13. It can be seen that the moderating effect of payment tradition is more obvious on the relationship between perceived cost and security risk tolerance. The moderating effect of payment tradition, as displayed in Figure 12 and Figure 13, indicates that the influence comes from consumers' payment habits.

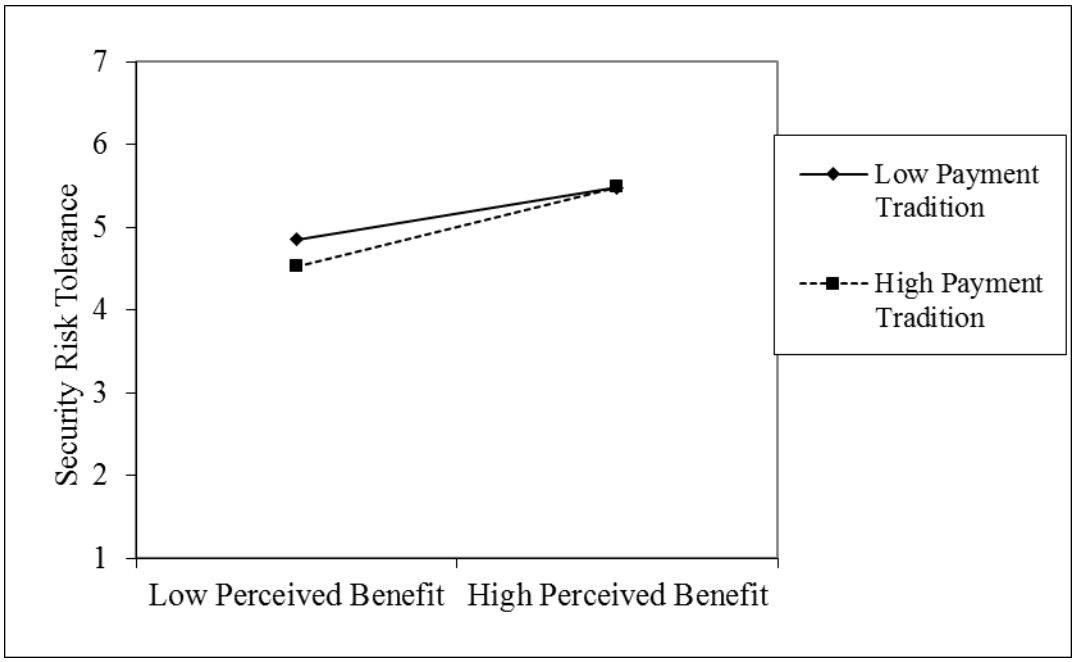

Figure 12 Moderating effect of payment tradition on the relationship between perceived benefit and security risk tolerance

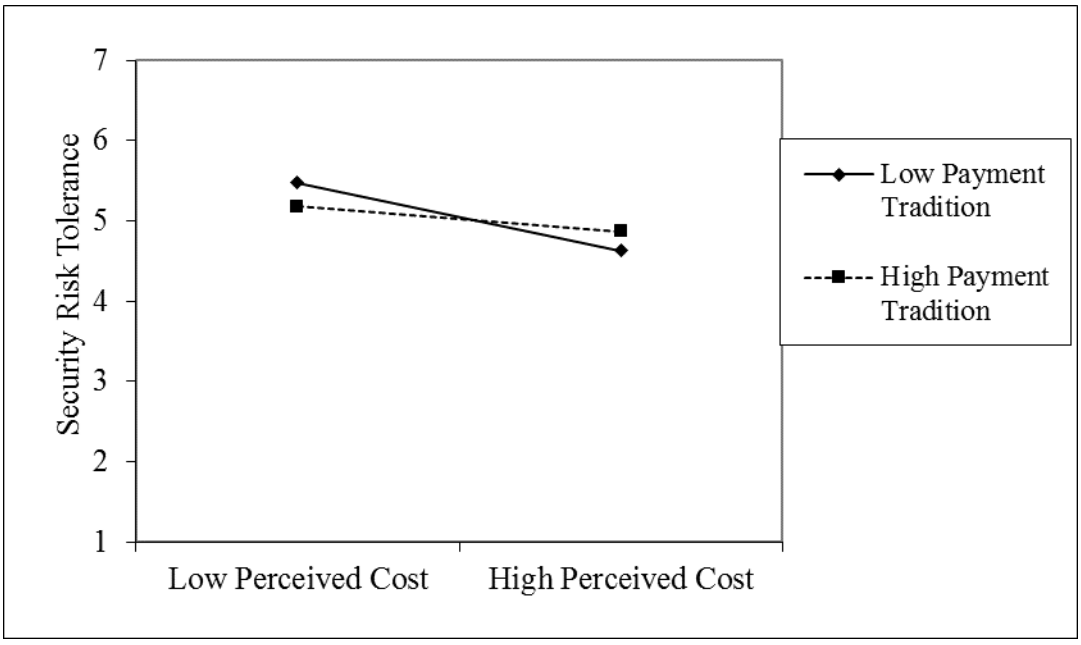

Figure 13 Moderating effect of payment tradition on the relationship between perceived cost and security risk tolerance

In terms of self-efficacy, when consumers have a higher level of security risk tolerance, they value the benefit of mobile payment. Protection is not their priority. Therefore, skills and knowledge regarding security are not their major concerns. As shown in Figure 14, the slopes between perceived benefit and security risk tolerance are similar under low self-efficacy and high self-efficacy (high self-efficacy is one standard deviation above the mean and low self-efficacy is one standard deviation below the mean).

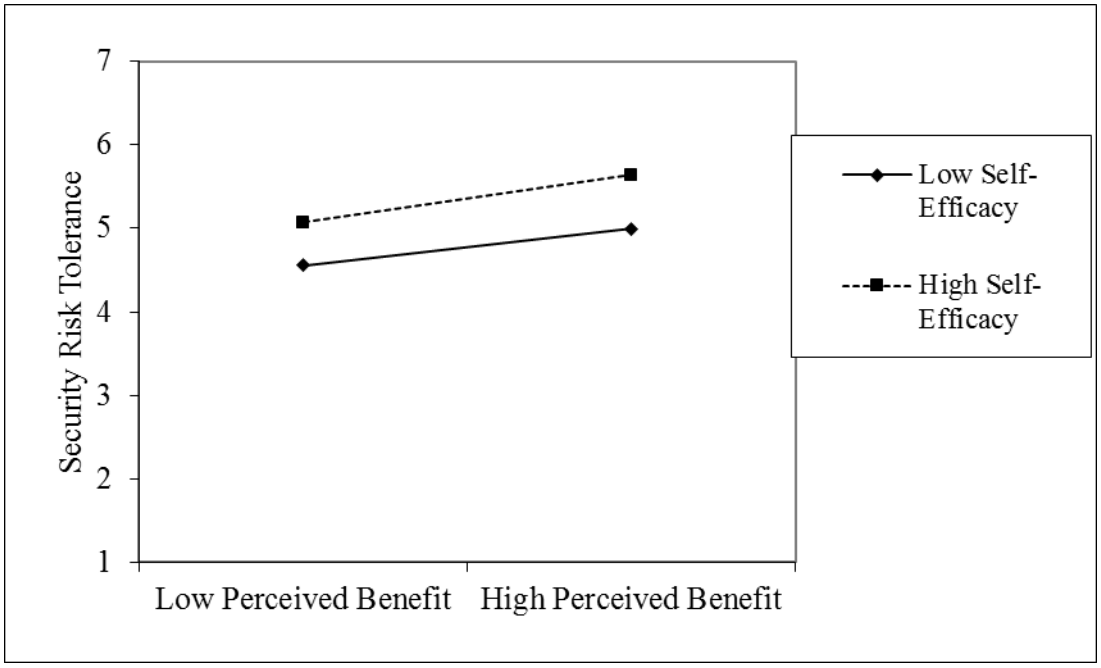

Figure 14 Moderating effect of self-efficacy on the relationship between perceived benefit and security risk tolerance

On the contrary, consumers' skills and knowledge play a role when they have a lower level of security risk tolerance. They will need the skills and knowledge to protect themselves. As shown in Figure 15, the slopes between perceived cost and security risk tolerance cross under low self-efficacy and high self-efficacy.

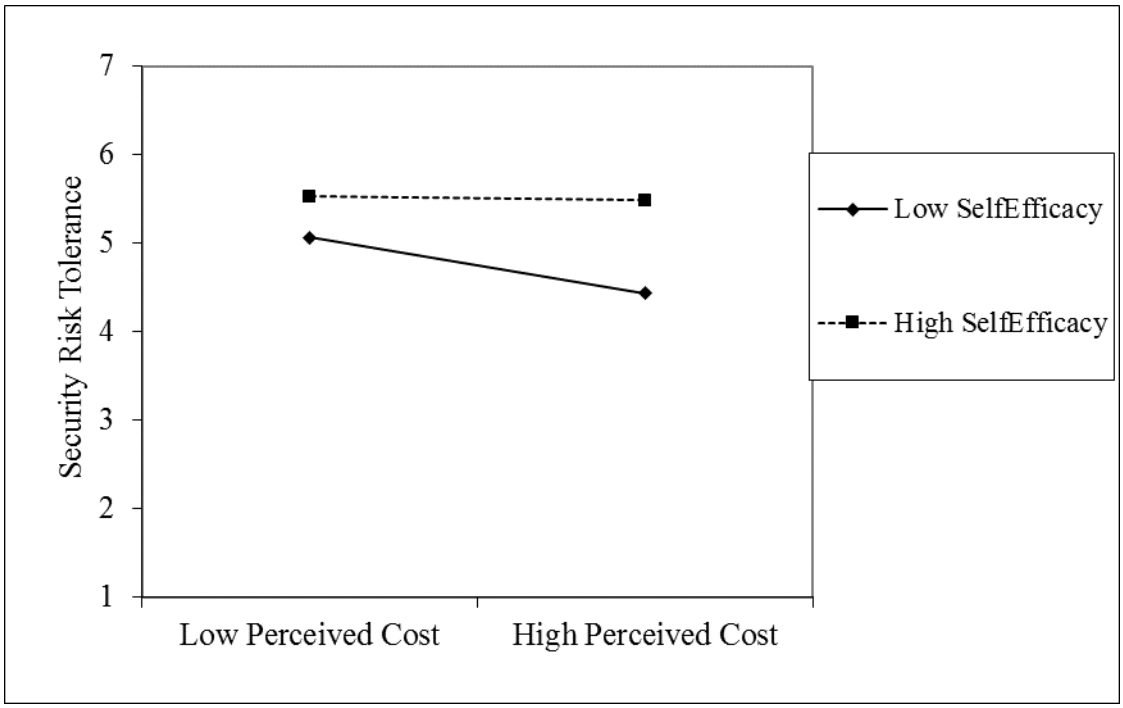

Figure 15 Moderating effect of self-efficacy on the relationship between perceived cost and security risk tolerance

Fourth, the results of group analysis of gender effect indicate that gender difference only exists in the relationship between saving and perceived benefit. When doing a benefit appraisal, males think about savings differently from females. Other than this, males and females act rather similarly in benefit-cost appraisal and in the trade-off process regarding security risk of using mobile payment. This finding is in line with the results of some previous studies. For example, Tan, Ooi, Chong, and Hew (2014) found that gender difference did not exist in consumers' acceptance of mobile payment. Faqih and Jaradat (2015) also found that there was no difference between males and females regarding the adoption of mobile commerce technology.

5. DISCUSSION AND CONCLUSION

Security is consumers' major concern when they use mobile payment. Existing literature has incorporated security into TAM and UTAUT and has investigated how security affects consumers' acceptance of mobile payment. However, no study has focused on security specifically in the context of mobile payment adoption research. In addition, security issues have evolved, with the advances in mobile networks, mobile devices, and wireless technologies. Findings about security achieved in previous studies are based on DCB-based mobile payment or NFC-based mobile payment. They might not be applicable to QR code-based mobile payment. As such, this study focused on security and developed a benefit-cost appraisal and trade-off framework by integrating TRA, TPB, PMT, and RCT. Particularly, this study introduced security risk tolerance into the mobile payment study and set it as the dependent variable. An online survey was conducted in China to collect data for testing the proposed research model. Moderating effects of normative beliefs, payment tradition, and self-efficacy on consumers' benefit-cost appraisal and trade-off as well as gender difference were investigated.

5.1 MANAGERIAL IMPLICATIONS

From a practical point, this study provides implications for design, development, and implementation of mobile payment.

The benefits and costs of mobile payment coexist, just like the two sides of a coin. Because mobile payment is built on a mobile network, mobile devices, and wireless technologies, vulnerability and security threats will continue to be main issues. For practitioners, the main task is to guide consumers to perceive the benefits and costs of using

mobile payment. When consumers are attracted to benefit, they pay less attention to cost, and vice versa. Therefore, in order to increase consumers' security risk tolerance, mobile payment providers should offer consumers more benefits, such as making mobile payment more convenient and providing consumers with more saving and discounts (Zhou, 2013). Moreover, mobile payment providers should take effective measures to protect the personal information and transaction data of mobile payment users.

Consumers know that mobile payment causes security issues. They choose mobile payment because it brings them benefits such as convenience, safety, and savings. The benefits that consumers receive are higher than their cost. This is why mobile payment is prevalent in countries where the financial infrastructure is not well developed. With the improvement of financial infrastructure, though, consumers will have more options for making payments. If use of mobile payment does not bring them enough benefit, consumers will think that their security risk is not offset by the benefit. As a result, they might use mobile payment less and switch to other payment methods.

The moderating effect of payment tradition indicates that the challenge for mobile payment does not come from credit cards or from debit cards, but from cash. Although mobile payment is becoming popular, it will not replace cash completely. As Au and Kauffman (2008) point out, each payment instrument has its own characteristics and offers it own particular benefits. The habit of making payment with cash can be either a driver or a barrier for the spread of mobile payment. For consumers who are used to making payments with cash, but who feel that cash is not convenient and safe, mobile payments will be a good alternative. However, those who are used to making payments with cash and have concern their privacy, may have the fear that mobile payments will leak their personal information

and transaction information.

Because males and females perform benefit-cost appraisal and trade-off process regrading using mobile payment in mostly the same way, it is unnecessary to consider gender issue in design, development, and implementation of mobile payment.

5.2 THEORETICAL CONTRIBUTIONS

Unlike many prior studies that have attempted to extend and modify conventional TAM and UTAUT in order to examine consumers' adoption of mobile payment, this study proposes a benefit-cost framework to explore the security risk tolerance of mobile payment users. The findings of this study offer important contributions to the literature of mobile payment in several ways.

First, the research model successfully integrates PMT, RCT, TRA, and TPB and explains how consumers perform a benefit-cost appraisal and the trade-off process regarding security risk tolerance when using mobile payment, and it explains how normative beliefs, payment traditions, and self-efficacy moderate their decision process. In addition, gender difference in the decision process is examined. No prior study has set security risk tolerance as a focal variable. In the previous literature on mobile payment, security was studied as a construct, but only in a consumer adoption model. To the best knowledge of the author, this is the first study that specifically focuses on security risk tolerance in the field of mobile payment.

Second, in this study, security risk tolerance is measured by consumers' actual behavior, not their behavior intention. Previous studies on mobile payment usually examine consumers' behavior intention, which is then applied to predict their actual behavior. However, it is more meaningful to investigate consumers' use of experience, instead of

predicting their using intention. Compared with their behavior intention, their actual behavior is more convincing.

Third, the moderating test indicates that payment tradition plays an important role in consumers' benefit-cost appraisal and in the trade-off process regarding security risk tolerance in the use of mobile payment. In the literature of mobile payment, payment tradition has not yet been investigated as a factor that impacts consumers' decision. This work originates the study of the addition of payment tradition to former studies on mobile payment. These new findings regarding payment tradition's role shed light on former research into mobile payment.

Finally, samples in this study were selected from mobile payment users in the working force, not from college students. Some previous studies on mobile payment have collected data from students as a convenient approach. In this study, most of the respondents were salaried employees and used mobile payment regularly. Thus, the data collected in this study have better quality and provide solid support for the empirical study.

5.3 LIMITATIONS AND AVENUES FOR FUTURE RESEARCH

There are several limitations in this study that create opportunities for further research.

Because no existing measurements are available, new scales were developed for measuring constructs, particularly for security risk tolerance, in this study. Accordingly, convergent validity and discriminant validity need improvement. The values of AVE did not meet the criterion well. Only three of the eleven constructs had a value of AVE higher than 0.5. Furthermore, cross-loadings for saving, vulnerability, security threat, and self-efficacy were too high. The scales developed by this study need improvement in future studies.

Findings from the study suggest that the normative beliefs regarding the opinions, actions, and expectations of other people do not play a role in consumers' benefit-cost appraisal and trade-off process regarding their use of mobile payment. However, the data in this study were collected in China, which has, typically, a collectivism culture. According to Hofstede (1983), individuals in collectivism cultures tend to pursue group goals over individual goals, and the self is seen as interdependent and inseparable from the group. Rothaermel, Kotha, and Steensma (2006) note that collectivism cultures value the collective good instead of the individual, and that members are strongly tied to one another via some kind of relationship, such as birth and family. From a national cultural perspective, normative beliefs, such as other people's opinions, expectations, or actions, should moderate consumers' benefit-cost appraisal and trade-off process regarding using mobile payment in collectivism cultures. Surprisingly, the results of this study reveal that the moderating effect of normative beliefs is not significant in consumers' benefit-cost appraisal and trade-off process regarding their use of mobile payment. Accordingly, future studies should examine the moderating effect of normative beliefs in other collectivism cultures and should explore the explanation of that finding in this study.

In this study, data were collected only in China. Future studies should conduct the survey in the U.S. or in other countries in Europe and Africa. For example, Kenya's M-PESA, a person-to-person money transfer service, has been widely adopted in sub-Saharan Africa (Hughes & Lonie, 2007). A cross-border study is required to validate the findings in this study. Meanwhile, future studies that compare the current findings to those in other countries could yield insights into how consumers perform benefit-cost appraisals and trade-off processes regarding security risk tolerance when using mobile payment in different

cultural settings.

Regarding the research method, because security risk tolerance is a second-order construct in the research model, a covariance-based SEM technique, such as AMOS, might be problematic for the analysis (Chin, 1998). Thus, future studies could apply non-covariance-based SEM techniques to perform the analysis.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

Q1. Do you use mobile payment?

(1)Yes (2) No

Q2. Which mobile payment do you use?

(1) Alipay Wallet (2) WeChat Pay (3) Alipay Wallet and WeChat Pay (4) Other mobile payment provider

Q3. What bank account is linked to your mobile payment account?

(1) Debit card (2) Credit card (3) Other

Q4. Mobile payment makes my purchases easier.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q5. Mobile payment makes my purchases faster.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q6. Making purchases with mobile payment is hassle-free.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q7. Mobile payment makes my personal financial management easier.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q8. Mobile payment allows me to take fewer cash with me.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q9. Mobile payment enhance safety of my payment for purchases.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q10. The biological detection feature of mobile payment, such as facial recognition, fingerprint recognition, iris recognition, sound recognition, or vein recognition, makes my purchase safe.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q11. Mobile payment allows me to enjoy discounts and promotions offered by merchants.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q12. Mobile payment allows me to enjoy discounts and promotions offered by mobile payment providers.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q13. Mobile payment lowers the service fee I paid to my banks.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q14. My cell phone is easy to be lost.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q15. My cell phone is easy to be infected by viruses, which cause the leak of my personal information about mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q16. Mobile networks are easy to be hacked so the details of the transactions of my mobile payment leak.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q17. Fake mobile payment QR codes are hard to distinguish.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q18. When a dispute occurs, my bank helps me find a solution.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q19. When a dispute occurs, my mobile payment provider helps me find a solution.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q20. Malwares and virus for cell phones are everywhere.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q21. Data transferred via mobile internet are easy to be intercepted.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q22. Merchants might sell my payment data for profits.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q23. Using mobile payment might cause the leak of my personal information, such as bank accounts, ID number, and address.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q24.Using mobile payment would be favorable to me.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q25. Using mobile payment would result in benefits to me.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q26. Using mobile payment would create advantages for me.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q27. Using mobile payment would provide gains to me.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q28. Using mobile payment leaks my personal information.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q29. Using mobile payment makes me lose money.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q30. Resolving a dispute in mobile payment is time consuming.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q31. Security measures that I get from my mobile payment provider are effective.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q32. Security measures taken by the bank where I have an account linked to my mobile payment account are effective.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q33. Security measures taken by my mobile payment provider are effective.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q34. The biological detection feature of my cell phone, such as facial recognition, fingerprint recognition, iris recognition, sound recognition, or vein recognition, is effective to protect my mobile payments.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q35. The password I set for my cell phone provides enough protection for my mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q36. The antivirus programs running in my cell phone are effective.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q37. My friends /colleagues think that I should use mobile payment regardless the security risk.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q38. My family members think that I should use mobile payment regardless the security risk.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q39. Transactions with cash are more normal.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q40. I am more used to making payments with cash.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q41. Compared with mobile payment, I feel more comfortable when making payments with cash.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q42. Despite of risks, my colleagues still use mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q43. Despite of risks, my family members still use mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q44. I have the necessary knowledge to take security measures protecting my mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q45. I have the necessary skills to take security measures protecting my mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q46. I have the necessary competencies to take security measures protecting my mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q47. How long have you been using third-party mobile payment?

(1) < 0.5year (2) 0.5-1 year (3) 1 －2 years (4) 2 －3 years (5) 3 －4 years (6) 4 －5 years (7) > 5 years

Q48. I accept the uncertainty existing in mobile payment.

(1) Extremely disagree (2) Quite disagree (3) Slightly disagree (4) Neutral (5) Slightly agree (6) Quite agree (7) Extremely agree

Q49. Gender

(1) Male (2) Female

Q50. Age

(1) 18-24 (2) 25-34 (3) 35-44 (4) 45-54 (5) Over 55

Q51. Education

(1) Middle School (2) Completed high school (3) Completed technical school or a community college

(4) Completed a university or bachelor's degree (5) Completed a master's degree (6) Completed a Ph.D. degree

Q52. Annual income

(1) ¥20K or less (2) ¥20-60K (3) ¥60-120K (4) ¥120-180K (5) Over ¥180K

Q53. Occupation

(1) Student (2) Salaried employee (3) Senior manager (4) Small business owner (5) Retired (6) Other

Q54. Industry

(1) Chemical/Chemical Distribution (2) Construction (3) Power /Energy (4) Transportation (5) Beverage Distribution (6) Defense Contracting

(7) Government Facility (8) Nonprofit (9) Pharmaceutical Research (10) Aerospace (11) Service/Legal Service (12) Other

Q55. Working Experience

(1) < 2 years (2) 2-3 years (3) 3-5 years (4) 5-10 years (5) 11-15 years (6) 16-20 years (7) > 20 years

APPENDIX B: QUESTIONNAIRE (Chinese version)

Q1. 您使用移动支付吗（移动支付指允许您使用手机扫描二维码的支付方式，如支付宝和微信支付）？

(1) 是 (2) 否

Q2. 您使用哪种移动支付？

(1) 支付宝 (2) 微信支付 (3) 支付宝和微信支付 (4) 其他第三方支付平台

Q3. 您的移动支付的账号是和哪种银行卡捆绑的？

(1) 储蓄卡/借记卡 (2) 信用卡 (3) 其他

Q4. 使用移动支付让我的购物更简单。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q5使用移动支付让我的购物更快捷。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q6. 移动支付容易上手，操作简便。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q7. 移动支付使我的个人财务管理变得容易。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q8. 移动支付减少了我携带现金的数量。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q9. 移动支付增强了我购物支付的安全。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q10. 移动支付采用的安全措施，如人脸识别，指纹识别，虹膜识别，声音识别，静脉识别，让我的购物更安全。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q11. 移动支付让我享受到商家提供的优惠和折扣。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q12. 移动支付让我享受移动支付平台提供的优惠和折扣。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q13. 移动支付降低了我支付给银行的服务费。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q14. 我的手机很容易丢失。这导致我移动支付的信息泄露。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q15. 我的手机很容易感染病毒。这导致我移动支付的信息泄露。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q16. 我使用的手机网络很容易被攻击。 这导致我移动支付的信息泄露。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q17. 假的二维码让我防不胜防，无法区别。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q18. 当我使用移动支付产生纠纷的时候，跟我的移动支付账号捆绑的银行会帮我解决。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q19. 当我使用移动支付产生纠纷的时候，给我提供服务的移动支付平台会帮我解决。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q20. 恶意软件和病毒对我的手机的威胁无处不在。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q21. 跟固定网络相比，移动网络的数据传输更容易被拦截和窃取。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q22. 商家会出售我的移动支付的数据牟利。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q23. 使用移动支付会泄漏我的个人信息，包括我的银行帐号，身份证号码和地址等。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q24. 使用移动支付对我有好处。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q25. 使用移动支付为我产生利益。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q26. 使用移动支付使我具备优势。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q27. 使用移动支付使我有所收获。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q28. 使用移动支付导致我的个人信息泄露。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q29. 使用移动支付让我损失资金。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q30. 解决有关移动支付的纠纷费时费力。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q31. 移动支付平台提供给我的安全措施有效果。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q32. 跟我的移动支付账号捆绑的银行采取的安全措施有效果。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q33. 移动支付平台采取的安全措施有效果。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q34. 我的手机的辨识功能，包括面部识别，指纹识别，虹膜识别， 声音识别和动脉识别，能为我的移动支付提供有效的安全保护。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q35. 我给自己的手机设置的开机密码能为我的移动支付提供有效的安全保护。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q36. 我的手机上运行的防病毒软件能为我的移动支付提供有效的安全保护。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q37. 我的朋友和同事认为我应该使用移动支付， 尽管移动支付有风险。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q38. 我的家人认为我应该使用移动支付， 尽管移动支付有风险。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q39. 用现金支付更像交易。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q40. 我更习惯用现金支付。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q41. 与移动支付相比，用现金支付让我感到更舒心。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q42. 尽管有风险，我的朋友和同事仍在使用移动支付。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q43. 尽管有风险，我的家人仍在使用移动支付。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q44. 我有必要的知识指导我自己采取安全措施保护我的移动支付。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q45. 我有必要的技术采取安全措施保护我的移动支付。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q46. 我能胜任采取安全措施的任务，从而保护我的移动支付。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q47. 您使用移动支付有多长时间？

(1) < 0.5年 (2) 0.5-1年 (3) 1 －2年 (4) 2 －3年 (5) 3 －4年 (6) 4 －5年 (7) > 5年

Q48. 我接受移动支付存在的风险。

(1) 非常不同意 (2) 完全不同意 (3) 有点不同意 (4) 没意见 (5) 有点同意 (6) 完全同意 (7) 非常同意

Q49. 您的性别

(1) 男 (2) 女

Q50. 您的年龄

(1) 18-24岁 (2) 25-34岁 (3) 35-44岁 (4) 45-54岁 (5) 大于 55岁

Q51. 您的教育程度

(1) 初中 (2) 高中 (3) 大专 (4) 本科 (5) 硕士 (6) 博士

Q52. 您的年收入

(1) 2万以下 (2) 2万-6万 (3) 6万-12万 (4) 12万-18万 (5) 18万以上

Q53. 您的职业

(1) 学生 (2) 职员 (3) 职员 (4) 私营企业主 (5) 退休人员 (6) 其它

Q54. 您工作的行业

(1) 化工 (2) 建筑 (3) 能源电力 (4) 运输 (5) 食品饮料 (6) 国防 (7) 政府

(8) 非盈利机构 (9) 制药 (10) 航空 (11) 服务业 (12) 其它

Q55. 工作经验

(1) 小于2年 (2) 2-3年 (3) 3-5年 (4) 5-10年 (5) 11-15 年 (6) 16-20年 (7) 大于20年

VITA

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Education

Ph.D., Information Technology, Old Dominion University, Norfolk, VA, 2018

M.A., Educational Technology, San Diego State University, CA, 2009

M.A., Advertising, Michigan State University, MI, 2005

B.A., Advertising, Peking University, Beijing, China, 1999

Journal Publications

Chen, Y., Dong, F., & Chen, H. (2016). Business Process and Information Security: A Cross-Listing Perspective. *Journal of Industrial Integration and Management, 1*(02), 1650009.

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Professional Societies

Association for Information Systems

Association of Information Technology Professionals

American Society for Information Science and Technology

Decision Sciences Institute