



Dynamics between the trust transfer process and intention to use mobile payment services: A cross-environment perspective

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ABSTRACT

Many Internet-based services have already been ported to the mobile-based environment, embracing the new services is therefore critical to deriving revenue for services providers. Based on a valence framework and trust transfer theory, we developed a trust-based customer decision-making model of the non-independent, third-party mobile payment services context. We empirically investigated whether a customer's established trust in Internet payment services is likely to influence his or her initial trust in mobile payment services. We also examined how these trust beliefs might interact with both positive and negative valence factors and affect a customer's adoption of mobile payment services. Our SEM analysis indicated that trust indeed had a substantial impact on the cross-environment relationship and, further, that trust in combination with the positive and negative valence determinants directly and indirectly influenced behavioral intention. In addition, the magnitudes of these effects on workers and students were significantly different from each other.

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1. Introduction

"Around the world, there is no other market like the market in China that highlights a convergence trend of Internet and mobility."

– YuanKe Deng, Vice president of Nokia Global

After becoming a leading Internet search engine, Google launched mobile search services in 2000; after its success in the Internet mail market, Yahoo launched its mobile mail services in 2005. In China, after becoming a popular instant messenger provider, Tencent launched its mobile instant messenger services in 2002 (see Table 1).

In recent years, the development of China's third-party electronic payment market has also experienced a shift toward diversification. More and more Internet payment providers provide a wide range of services to satisfy users' various needs by extending their services to the mobile environment. Undoubtedly, by providing these services, companies are trying to take advantage of this new market by leveraging their relationship with current users. The underlying assumption made by these

providers was that their users' experiences with Internet payments would positively influence their perception of the companies' extension to mobile payment services. This poses an interesting question: *What are the determinants of the acceptance of mobile payment services and how do prior Internet payment experiences influence users' perceptions of their mobile payment services counterparts?*

Literature on modern IS mostly looks at the determinants of the mobile-based environment and has not addressed their effect on customers. According to trust transfer theory, customer trust accumulated over time in Internet payment services may influence customer trust in mobile-based payment services. Mobile channels are prone to information eavesdropping and are more uncertain than traditional offline and online channels. Surveys have shown that customers' initial lack of trust in mobile payment services is a barrier in the development of the mobile payment industry because 73.5% of all customers worry about security and transaction risks when using mobile payment services. Therefore, building customer trust is critical for helping mobile payment services to become more accepted and used and thus makes the business more successful. In China, mobile payment services are still in an early implementation stage. Thus experience with or knowledge-based trust that usually develops via frequent interaction may not exist because potential adopters have no prior experience. Would the well-established trust that a customer has in current Internet payments influence or transfer to trust in mobile payments? How does this history interact with other determinants and affect the customer's acceptance of mobile

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Table 1

Examples of mobile applications launched from Internet applications.

Corporation	Internet application	Mobile application
Google	Google.com (search engine)	M.Google.com (search engine)
Yahoo	yahoo.com (mail)	wap.yahoo.com (mail)
Tencent	QQ (instant messenger)	Mobile QQ (instant messenger)
AliPay	alipay.com (payments)	wap.alipay.com (payments)

payment services? There is clearly a need to study the adoption of mobile payment service from this standpoint.

2. Mobile payment services in China

Mobile payment services are one of the most critical applications needed for successful mobile e-commerce. Mobile payments involve billing and paying for goods and services using a mobile device [2]. Mobile payments can be achieved in two ways. One provides mobile payments as a seamless part of the system, while the other involves a variety of payment methods, including payment: in stationary e-commerce settings, at vending machines, at manned POS terminals, and money transfer between consumers. The subject of this study is the first type third-party mobile payment services. Such services free customers from the spatial and temporal constraints of a traditional payment channel, while simplifying the complex and time-consuming issues inherent in traditional payments.

2.1. Key characteristics for developing mobile payment in China

Two factors are similar between China and Japan today. First, both countries have large populations of mobile phone and mobile Internet service users. As of, the total number of mobile Internet service subscribers was 105.83 million in Japan as of December 2008. Japan has been leading with mobile Internet services since 1999, when “i-mode” service was introduced by NTT DoCoMo [15]. This has become the world’s most popular mobile Internet service, and it offers a broad range of business functions including financial transactions, ticket reservations, weather forecasts, banking, shopping, etc. Similarly, by June 2009, the number of mobile Internet users in China exceeded 155 million, accounting for 22.6% of the 687 million cell-phone subscribers. China Mobile, China’s leading mobile operator, launched its mobile market (MM) services in August 2009. This was a platform that integrated members in the mobile e-commerce value chain. It provided broad mobile-based applications and digital content in various types of mobile operating systems and terminals. In September 2010, the number of end users of MM reached 20 million. This customer group provides a substantial base target market and clearly presents an opportunity for market growth, which will contribute to the success of mobile payment service options.

Second, both China and Japan have cash-centric payment cultures and therefore they are not like the USA and France, whose populations make heavy use of checking and credit cards as their payment methods. Substantial evidence from the marketplace indicates that payment habit does not change when a customer moves from traditional to e-commerce and mobile e-commerce settings.

Because these two factors have been key in the success of mobile payment services in Japan, it may be expected that they will also affect the acceptance of mobile payment services in China.

Also, unlike developed countries that have mature land line Internet infrastructures, China has a relatively strong mobile telecommunication infrastructure. For this reason, we expected that resources to develop the infrastructure would go into new technologies that would further encourage the development of mobile payment services. The national policy of China has also

supported the development of most businesses. In 2007, mobile e-commerce was included in the core guiding projects of the “E-commerce Eleventh Five-Year Plan” at the national level, indicating that the development of mobile e-commerce is important to national policy makers, especially in the following five years. In addition, on January 7, 2009, the Ministry of Industry and Information Technology (MIIT) issued three third-generation (3G) licenses to China Mobile, China Unicom, and China Telecom, indicating that mobile payment service applications would be factors in the growth and development of mobile e-commerce.

However, establishing a large user base dedicated to cash payments, even with a favorable policy environment is not easy, therefore the current market share of mobile payment service applications is still relatively small in China. There were 75.7 million Internet payment users in China as of June 2009, representing 22.4% of the 338 million Chinese Internet users. The number of mobile payment service subscribers reached only 19.2 million by June 2009, accounting for 12.4% of the 155 million Chinese mobile Internet users. In addition, the bulk of the revenue from this market share came from customers paying for mobile phone services and products (such as ring tones, music, logos, mobile instant messaging, and games) with only a small percentage coming from payment for other services and products.

Indeed, just as mobile phones gradually replaced the dominating position of the fixed-line telephones, mobile e-commerce was starting to be the new wave in e-commerce in China. As one of the most critical mobile e-commerce applications, mobile-based payment services bring additional benefits and values to customers and will probably evolve into services common in our daily life [19]. However, the current situation indicates that mobile payment services are likely to experience resistance.

2.2. Key characteristics of third-party mobile payment in China

Unlike Internet payment services, the success of mobile payment services depends on effective collaboration between financial institutions and mobile network operators (MNO). China utilizes three principle mobile payment models: (1) mobile network operator centric; (2) financial institution centric; and (3) third-party operator centric, which uses an intermediary who provides mobile payment services by integrating the functions of the MNOs’ communications network with the financial institutions’ payment accounts.

China’s third-party mobile payment market has two unique characteristics that are likely to help it become the most successful of the three models. First, China’s mainstream banking institutions and MNOs are monopolies, giving them strong bargaining power in the payment market: they tend to overemphasize their leading status in the payment industry. Thus, unlike the successful MNO centric model in Japan and the MNO-centric or financial institution-centric models in Korea, China’s MNOs and financial institutions lack an effective cooperative mechanism and do not naturally form “powerful alliances.” In addition, both mobile network operator-centric and financial institution-centric models restrict payment services to their own customers and offer limited payment scenarios. For instance, MNOs usually concentrate on micro-payments, such as phone bills or mobile wallets and financial institutions typically focus on macro-payments. In contrast, the third-party operator-centric model provides both micro- and macro-payments and also offers broader payment services by supporting a wide range of mobile networks and bank accounts.

As a whole, the current credit system in China is imperfect. Users have more confidence in financial institutions than MNOs when choosing mobile payment services. Unfortunately, China’s mobile payment services market is primarily of micro-payments. Financial institutions are unwilling to move to such a system

Table 2
Well-known third-party electronic payment corporations in China.

Corporation (website)	Type	Services domain	Market share
AliPay (www.alipay.com)	Non-independent	C2C; B2C; B2B	56%
Tenpay (www.tenpay.com)	Non-independent	C2C; B2C; B2B	21.5%
Chinapay (www.chinapay.com)	Independent	B2B; B2C	7.8%
99Bill (www.99bill.com/)	Independent	B2B; B2C	4.9%

because the incomes from micro-payments are insufficient to compensate for the operating expenses of service offerings. In addition, different banks may have different standards and system interfaces, which are obstacles to conducting cross-bank mobile payment service operations. By realizing the practical value of “one connection, multiple services,” the third-party operating model facilitates the collaboration of technology and business between MNOs and financial institutions and provides an efficient and economical solution for conducting mobile payment service transactions.

Similar to the mobile payment services market, China's entire electronic payment market is dominated by two or three well-known, third-party payment providers. In China, there are mainly two types of third-party electronic payment providers: the non-independent providers and the independent providers. The difference between them is that the former initially evolved from their internal e-commerce platforms and gradually extended their payment services to provide a wide range of external services, while the latter grew independently. We list China's well-known third-party electronic payment corporations in Table 2.

More electronic payment firms are expanding their electronic payment services by providing mobile-based payment service options. For instance, AliPay launched its mobile payment services in 2008. Customers can therefore use AliPay mobile payment services to conduct their e-commerce transactions conveniently and effectively through mobile devices.

In our study, we chose AliPay as our analysis context for several reasons. First, it is the most important non-independent third-party electronic payment services provider in China; it therefore represents the third-party electronic payment market in China. Second, it launched its mobile payment services nearly four years after it had become the largest Internet payment provider in China, which indicates the direction of trust transfer, a key issue in our research because of the transfer of customers' trust to AliPay's Internet payment services due to their initial trust in its mobile payment services.

Understanding the determinants of third-party mobile payment services adoption is very important for the development of both mobile payment services and mobile e-commerce.

3. Theoretical background and research hypotheses

3.1. The valence framework

The valence framework uses a “cognitive-rationale” customer decision-making model that examines customer behavior by considering both positive and negative attributes. Derived primarily from the economics and psychology literature, this framework considers perceived risk and perceived benefit to be the two fundamental aspects of consumer decision-making. The perceived risk aspect characterizes customers as motivated to minimize any expected negative effect, while the perceived benefit aspect assumes that customers are motivated to maximize its positive aspects.

Previous studies show that the valence framework is a valid model for the e-commerce environment [5,6]; however, several

extensions are required to adapt it to the mobile environment. In the mobile payment services context, we need to capture its more innovational features when examining its acceptance. Innovation diffusion theory provides a set of characteristics that might influence an individual's intention to adopt new technologies. These include relative advantage, compatibility, complexity, image, trialability, visibility, and results demonstrability. Of these, relative advantage and compatibility have provided the most consistent explanation for consumer action in adopting financial and mobile technologies. Prior studies also suggest that individuals often respond to influences within their social systems to establish or maintain a favorable image. This is especially true in countries that are highly collectivistic, such as China. Given that mobile payment is a relatively new application, an individual's perceived public image will play an important role in his or her decision to use an innovation.

In addition, we chose these three constructs after careful consideration of their value: relative advantage, compatibility, and image. In terms of its inherent features, the need of physically small and light mobile devices forces their screen and keypad to be small and complex, which complicates user input. In our study, the usability of mobile devices would add to the complexity of the use of the mobile payment system. It is reasonable to argue that complexity does not belong to the positive valence of using mobile payment services. Consequently, perceived ease of use was not included in our model. Moreover, consumers' experience in the Internet-based environment may have a supplementary effect on their perceptions about services in the mobile-based environment and this could act as a proxy for the demonstrability and other excluded innovation attributes of adopting mobile payment services.

The traditional valence framework only tests the impact of perceived risk. Modeling the negative valence aspect of adopting mobile payment services solely on perceived risk is insufficient because individuals have to be willing to pay for the handset and communication fees. Therefore, to examine a user's intention to adopt mobile payment services options, we should consider not only the influence of *perceived risk*, but also the impact of *perceived cost*.

Finally, due to the inherently greater risks of uncertainty and developing a sense of a loss of control when conducting transactions within the mobile payment environment, customer trust may be even more important in determining the intention to adopt a mobile payment service. Therefore, customer trust was included in our research model.

3.1.1. The positive valence

Relative advantage, compatibility, and image have been empirically validated as important determinants of technology adoption. In the mobile payment environment, previous studies suggest that one of the key attributes contributing to the relative advantage of mobile technologies is independence of location and time [7,12]. Because mobile payment services provide anytime/anywhere access to financial assets, the relative advantage of mobile payment services can be expected to have a positive influence on customers' intention to adopt the technology. We therefore hypothesized:

H1. A customer's perceived relative advantage of mobile payment services positively affects the customer's intention to use them.

Compatibility captures the consistency between an innovation and the potential adopters' existing values, current needs, and present lifestyle. In the context of mobile payment services, peoples' lifestyles will strongly affect their decision to adopt the technology. Because mobile payment services are an extension of Internet payment services, people who frequently use Internet payment services may have less resistance to accepting the mobile version. We thus hypothesized:

H2. A customer's perceived compatibility with mobile payment services positively affects the customer's intention to use them.

Innovation adopters can be classified into five groups: innovators, early adopters, early majority, late majority, and laggards. It is believed that early adopters are generally more fashionable or intelligent [4]. In the context of mobile e-commerce, mobile payment services may be considered more of a lifestyle service than a necessity; and the use of mobile payment services is associated with a social image. Therefore, if a person wants to be associated with innovators, he or she will more likely be attracted to using innovative mobile technologies. Thus we hypothesized:

H3. A customer's perceived Image of using mobile payment services positively affects the customer's intention to use them.

3.1.2. The negative valence

Transferring from wired Internet payment services to ubiquitous mobile payment options involves incurring additional expenses, both monetary and non-monetary. In our study, monetary expenses included the actual mobile equipment costs, access costs, and transaction fees [22]. These are measured as users' *perception of costs*. In contrast, non-monetary expenses refer to the extent to which prospective users expect mobile payment services to be uncertain and risky. This non-monetary expense is measured as users' *perception of risk* [10]. About 75% of consumers today worry about security and transaction risks, and 60% are concerned with costs of using mobile payment services. Several empirical studies have found that perceived risk and perceived cost are the two major barriers to adopting finance-related mobile services [e.g., 12]. Thus, we hypothesized that:

H4. A customer's perceived risk of mobile payment services negatively affects the customer's intention to use them.

H5. A customer's perceived cost of mobile payment services negatively affects the customer's intention to use them.

3.1.3. Trust

Trust is a subjective belief that a party will fulfill his or her obligations according to the expectations of the trusting party. It is crucial because gaining trust reduces fears and worries [e.g., 3,14,17]. Transactions conducted in a mobile network are more vulnerable and uncertain than those in the traditional settings and therefore entail greater potential risk.

Trust building is a process of long-term interactions between involved parties. This includes three phases: initiating, maintaining, and dissolving trust. At different stages, the determinants of trust are different [1]. In our study, mobile payment services in China are at an innovative stage. We therefore expected that potential adopters' initial trust plays an important role in their decision to adopt mobile payment services for conducting mobile e-commerce transactions.

Initial trust reflects the willingness of an individual to take risks in order to fulfill his or her needs. Several studies have validated the influence of customers' trust on their behavioral intention in the mobile finances context. By examining innovative mobile banking adoption, Kim et al. found that customers' perceptions of initial trust play a vital role in promoting their personal intention to use the services. We hypothesized that:

H6a. A customer's initial trust in mobile payment services positively affects the customer's intent to use them.

In addition, we propose that initial trust will exert an indirect effect on behavioral intention via two influential variables: perceived risk and perceived relative advantage. It is reasonable to assume that a customer who has a high level of trust in mobile payment services will perceive a relatively low likelihood that

service providers will violate their transactional obligations. Prior studies have found that increasing trust reduces the perceived risks related to e-commerce. We therefore hypothesized:

H6b. A customer's initial trust in mobile payment services negatively affects the customer's perceived risk.

Trust has a positive impact on perceived relative advantage in various settings. For instance, in a person-to-person setting, trust can increase an individual's productivity and profitability. Similarly, in a person-to-organization setting, trust can reduce an organization's transaction costs. In particular, in the e-commerce setting, Kim et al. found that customers' trust has a strong positive influence on perceived relative advantage. We hypothesized:

H6c. A customer's initial trust in mobile payment services positively affects the customer's perceived relative advantage.

3.2. Trust transfer

Broadly defined, the trust transfer process is a cognitive one in which the trust in one domain has an influence on attitudes and perceptions in another domain. According to trust transfer theory, there are two types of trust transfer: intrachannel (where trust in a channel may influence the evaluation of a product or service in the same channel) and interchannel (between different channels).

Stewart [20] found that the trust transfer process migrated trust of the established trusted websites to the unknown websites because of their links. Lee et al. [9] examined trust transfer from an offline to an online setting and found that customer's trust in an offline bank significantly influenced four perception factors about its online banking counterpart: flow, structural assurance, perceived website satisfaction, and perceived extent of future use. By examining the formation of potential customers' online trust of a brick-and-click retailer before they visited its online website, Kuan and Bock [8] also found that customers' trust in the offline stores significantly affected their trust in the online counterpart. We propose that trust in a well-established Internet payment method can affect (or transfer to) positive perceptions of corresponding advanced mobile payment services.

Although there is no consensus about whether mobile payment services are a new payment instrument or merely a new access channel to existing payment services, in the context of our study, we regard mobile payment services as an innovative instrument because the underlying technologies, transactional processes, and value networks between mobile payment services and Internet payment are undoubtedly different. Therefore, we hypothesized:

H7. The level of trust a customer has in Internet payment services positively affects the customer's initial trust in mobile payment services offered by the same company.

Initial trust in mobile payment services influences customers' intention to use mobile payment services both directly and indirectly. In particular, the realization of these indirect impacts is via a dual mechanism – by reducing the risks and by enhancing the benefits related to using the mobile payment services. We propose that a customer's trust in Internet payment services may have a moderating effect on three hypotheses: H6a, H6b, and H6c. Park and Yang [16] found that a consumer's trust, reflecting previous Internet experience, has a significant moderating effect on the relationships between perceptions of hedonic and utilitarian value in mobile technologies and intentions to use the technology. We therefore formulated the hypotheses:

H8a. The level of trust a customer has in Internet payment services moderates the relationship between initial trust in mobile payment services and behavioral intention to use it.

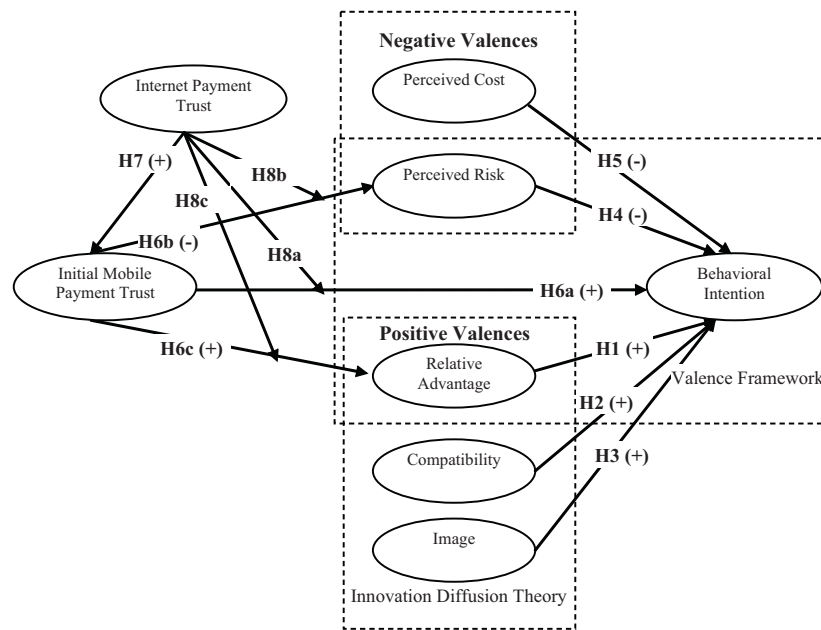


Fig. 1. Research model.

H8b. The level of trust a customer has in Internet payment services moderates the relationship between initial trust in mobile payment services and perceived risk.

H8c. The level of trust a customer has in Internet payment services moderates the relationship between initial trust in mobile payment services and perceived relative advantage.

The proposed model and hypothesis are shown graphically in Fig. 1.

4. Methodology

4.1. Instrument

The research model includes eight constructs. To ensure the validity of all the instruments, each construct was measured with multiple items and all of them were adapted from previous research but modified to fit our context of mobile payment services. The questionnaire used 7-point Likert scales, with response choices ranging from one (strongly disagree) to seven (strongly agree).

As the questionnaire was in Chinese, we conducted a back-translation procedure to ensure translation validity. First, all original items in the instrument were translated into Chinese by a researcher whose native language was Chinese. Another researcher then independently translated the items back to English. Next, the two researchers confirmed the meaning of the Chinese version by comparing the two English versions. We then invited a panel of experts in the mobile e-commerce field to give suggestions on the measures. Based on their feedback, we modified the wording of some items to make them clear and understandable. Finally, the two initial translators rechecked the modified version and compiled the formal Chinese questionnaire. A pilot test of 28 subjects who were current Internet payment services users was then conducted to test the flow and the wording of the instrument. The final items in each scale are listed in Appendix A.

4.2. Sample

Empirical data were collected through a web-based survey. The subjects were users of AliPay. After obtaining permission

from the website managers, a survey hyperlink was placed on the AliPay forum homepage (<http://club.alipay.com/>). To capture the dynamic trust transfer process, all participants were told that they should have AliPay Internet payment experience. They were given a description of the AliPay mobile payment services solution before they completed the survey. In addition, participants were instructed that the term “mobile payment services” in the survey referred to the AliPay mobile payment services solution. To encourage participation, participants were told that they had a 10% chance of winning a prize by completing the survey. In order to ensure the accuracy and validity of the survey results, we scrutinized all responses and dropped those from any respondent who: had given the same answer for all questions; did not have AliPay Internet payment experience; or had already had mobile payment experience. We carried out two rounds of data collection. The first took place around December 2009. Due to the small sample we obtained in the first round (374 valid responses), we collected a second round of data in September 2010. We performed a chi-square test to examine the differences between the first round sample and the second round sample and found no differences between the two samples in terms of gender, age, education, and other demographic variables. With these two rounds, we had a total of 961 valid responses. The demographic details of the research sample are given in Table 3.

5. Data analysis and results

5.1. Reliability and validity

To assess the psychometric properties of the measures, we first performed an exploratory factor analysis. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.874 and Bartlett’s Test of Sphericity was significant at the 0.0001 level, indicating that the data matrix was sufficiently correlated to the factor analysis. As shown in Appendix B, eight factors with eigen-values greater than one were extracted and they altogether explained 81.6% of the variance. In addition, all indicators loaded on the expected factors and were higher than 0.7, while loading on other factors for all indicators was lower than 0.4, suggesting good convergent and discriminant validity.

Table 3
Demographics of the research sample.

Measure	Item	Overall sample count (%)	The first round	The second round	Differences
Gender	Male	556(57.8%)	55.1%	59.6%	$\chi^2(1)=0.512$ ($p=0.474$)
	Female	405(42.2%)	44.9%	40.4%	
Age (years old)	18 or below	12(1.3%)	0.8%	1.6%	$\chi^2(4)=1.758$ ($p=0.780$)
	>18 and ≤ 24	442(46.0%)	40.9%	49.3%	
	>25 and ≤ 30	345(35.9%)	40.4%	33.0%	
	>31 and ≤ 35	96(10.0%)	10.7%	9.6%	
	36 or above	65(6.8%)	7.2%	6.5%	
Education	High school or below	278(29.0%)	26.7%	30.4%	$\chi^2(3)=2.280$ ($p=0.516$)
	Two-year college	233(24.2%)	29.9%	20.6%	
	Four-year college	363(37.8%)	33.7%	40.4%	
	Graduates school or above	87(9.0%)	9.7%	8.6%	
Occupation	Corporation	390(40.6%)	35.3%	44.0%	$\chi^2(6)=3.678$ ($p=0.720$)
	Government	41(4.3%)	4.0%	4.5%	
	Education	78(8.1%)	9.6%	7.2%	
	Student	253(26.3%)	24.6%	27.4%	
	Self-employed	110(11.5%)	14.5%	9.5%	
	Unemployed	59(6.2%)	7.5%	5.3%	
	Others	29(3.0%)	4.5%	2.1%	
Monthly income (1000 RMB)	≤ 1	299(31.1%)	35.6%	28.3%	$\chi^2(2)=2.005$ ($p=0.367$)
	>1 and ≤ 3	484(50.4%)	49.5%	50.9%	
	>3	178(18.5%)	14.9%	20.8%	
Internet payment experience (years)	≤ 1	363(37.8%)	45.7%	32.7%	$\chi^2(2)=3.698$ ($p=0.157$)
	>1 and ≤ 3	271(28.2%)	23.3%	31.3%	
	>3	327(34.0%)	31.0%	36.0%	

We also conducted a confirmatory factor analysis to further examine the measurement model. This included the assessment of internal consistency reliability and examination of convergent and discriminant validity for construct validity. Internal consistency reliability was calculated using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). As shown in Table 4, the Cronbach's alphas were all greater than 0.8; the composite reliability exceeded 0.8, and the AVE were at least 0.7.

Table 4
Scale properties.

Factor ^a	Item	Standard loading	Cronbach's alpha	CR	AVE
REA	REA1	0.795	0.867	0.910	0.718
	REA2	0.887			
	REA3	0.891			
	REA4	0.811			
IMG	IMG1	0.933	0.934	0.958	0.884
	IMG2	0.958			
	IMG3	0.929			
ONT	ONT1	0.893	0.886	0.929	0.815
	ONT2	0.918			
	ONT3	0.896			
PRI	PRI1	0.869	0.872	0.922	0.797
	PRI2	0.914			
	PRI3	0.895			
MOT	MOT1	0.918	0.907	0.942	0.843
	MOT2	0.926			
	MOT3	0.910			
COM	COM1	0.874	0.829	0.898	0.745
	COM2	0.823			
	COM3	0.892			
PEC	PEC1	0.773	0.801	0.880	0.788
	PEC2	0.988			
INT	INT1	0.943	0.867	0.938	0.883
	INT2	0.937			

^a REA, relative advantage; ONT, Internet payment; Trust IMG, image; PRI, perceived risk; MOT, initial mobile payment trust; COM, compatibility; PEC, perceived cost; INT, behavioral intention.

Considering the acceptable threshold values for Cronbach's alpha, CR, and AVE, 0.7, 0.7, and 0.5, respectively, the values obtained suggest adequate internal consistency reliability and convergent validity.

To test the discriminant validity, we compared the square root of the AVE of each construct and its correlation coefficients with other constructs. Table 5 shows that the square roots of the AVEs were larger than their corresponding correlation coefficients, indicating acceptable discriminant validity.

As self-reported data from a single source were used, we performed two statistical analyses to assess the possible severity of common method bias. First, a Harman's one-factor test suggested by Podsakoff et al. [18] was conducted on the eight conceptually crucial constructs in our proposed model. The results indicated that the eight factors were present and the variance explained by the most significant factor was only 13.0%, indicating that common method bias was unlikely a problem in our dataset. Second, following the procedure used by Liang et al. [11], a new measurement model with all indicators loading on a common method factor was constructed and compared with the original measurement. The results of the statistical analyses demonstrated that the principal variable loadings were all significant at the $p < 0.001$ level, while the common method factor loadings were not significant. These results indicated that common method bias was unlikely in our results.

5.2. Hypothesis testing

The research model and the corresponding hypotheses were tested using partial least squares (PLS-Graph version 3.01060). Fig. 2 presents the results. All the hypotheses were found to be supported. Specifically, the three components of positive valence all had strong positive effects on behavioral intention. The two components of the negative valence (perceived risk and perceived cost) also had negative influences on behavioral intention. The three hypothesized paths on the effects of initial trust in mobile payment services to customers' behavioral intentions, perceived risk, and perceived benefit were significant at $p < 0.001$. The hypothesized path from trust in Internet payment services to initial trust in mobile payment services was significant at the 0.001

Table 5
Inter-construct correlations.

	REA	IMG	ONT	PRI	MOT	COM	PEC	INT
REA	0.847							
IMG	0.324	0.940						
ONT	0.285	0.161	0.903					
PRI	0.109	−0.036	−0.031	0.893				
MOT	0.407	0.336	0.597	−0.145	0.918			
COM	0.478	0.319	0.481	−0.022	0.620	0.8630		
PEC	−0.039	−0.024	0.056	0.326	−0.062	−0.052	0.888	
INT	0.472	0.409	0.280	−0.116	0.526	0.547	−0.135	0.939

REA, relative advantage; ONT, Internet payment; Trust IMG, image; PRI, perceived risk; MOT, initial mobile payment trust; COM, compatibility; PEC, perceived cost; INT, behavioral intention. Diagonal elements are the square root of AVE. These values should exceed the inter-construct correlations for adequate discriminant validity.

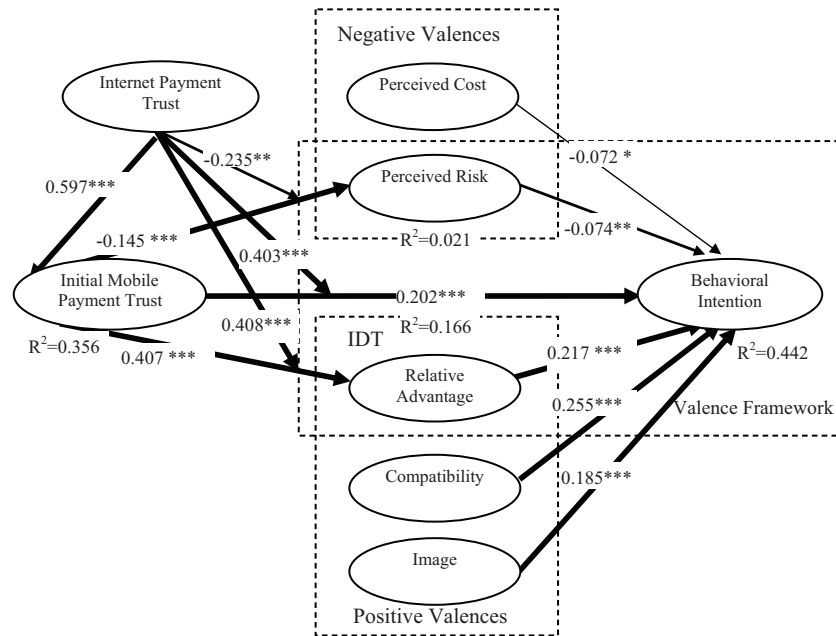


Fig. 2. Results of the model tests. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

level. The R^2 s for initial trust in mobile payment services and behavioral intention to use the services were 0.356 and 0.442, suggesting that the model provided a reasonable explanation of the variance in customers' initial trust in mobile payment services and their intention to use mobile payment services.

The moderating effect of trust in Internet payment services on the paths of initial trust in mobile payment services to behavioral intention, perceived risk, and relative advantage were all significant at 0.01. To further interpret the interactions, we conducted separate regression analyses for subgroups of the sample. First, following the criterion of one standard deviation below and above the mean, we split the sample into low-Internet payment trust and high-Internet payment trust subgroups. Then, we regressed initial mobile payment services trust on the behavioral intention for each subgroup and plotted the in-subgroup regression equations (see Fig. 3). The same procedure was conducted on the relationships between initial mobile payment services trust and perceived relative advantage, and also between initial mobile payment services trust and perceived risk.

As greater than 60% of respondents in our study fell into the corporation (41%) and student (26%) categories, we labeled the corporation category as the worker group and the student category as the student group. The model was further tested with data on the two subgroups. As shown in Table 6, there were significant differences between the two sets of results. In the worker group, the two paths reflecting the negative valence of using mobile payment services was no longer significant, indicating the loss of the effects of perceived risk and perceived cost on the behavioral

intention in the worker group. However, in the case of students, the hypothesized path from compatibility to behavioral intention was not significant. No negative effect of perceived cost on behavioral intention was found. All other hypothesized relationships in the student group were supported.

A comparison test was conducted to examine whether the strengths of the path coefficients between two sets of model results were significantly different. As shown in Table 6, with the exception of H6c, all causal relationships were statistically significant, suggesting that the magnitudes of these effects on the two groups were significantly different from one another.

6. Discussion

Our study resulted in several important findings. First, the initial trust in mobile payment services directly and indirectly affects customers' intentions to use mobile payment services. Customers' initial trust in mobile payment services positively affects their perception of relative advantage, which, in turn, increases their intention to use mobile payment services. Similarly, a customer's perception of risk reduces their intention to use mobile payment services, and their initial trust in mobile payment services negatively influences this perceived risk.

Second, in the mobile finance setting, customers' perceptions of cost and risk reduce their intention to use mobile payment services. In contrast, customers' perceptions of relative advantage, compatibility, and image strongly increase the intention to use such services. Because prior work has shown that relative

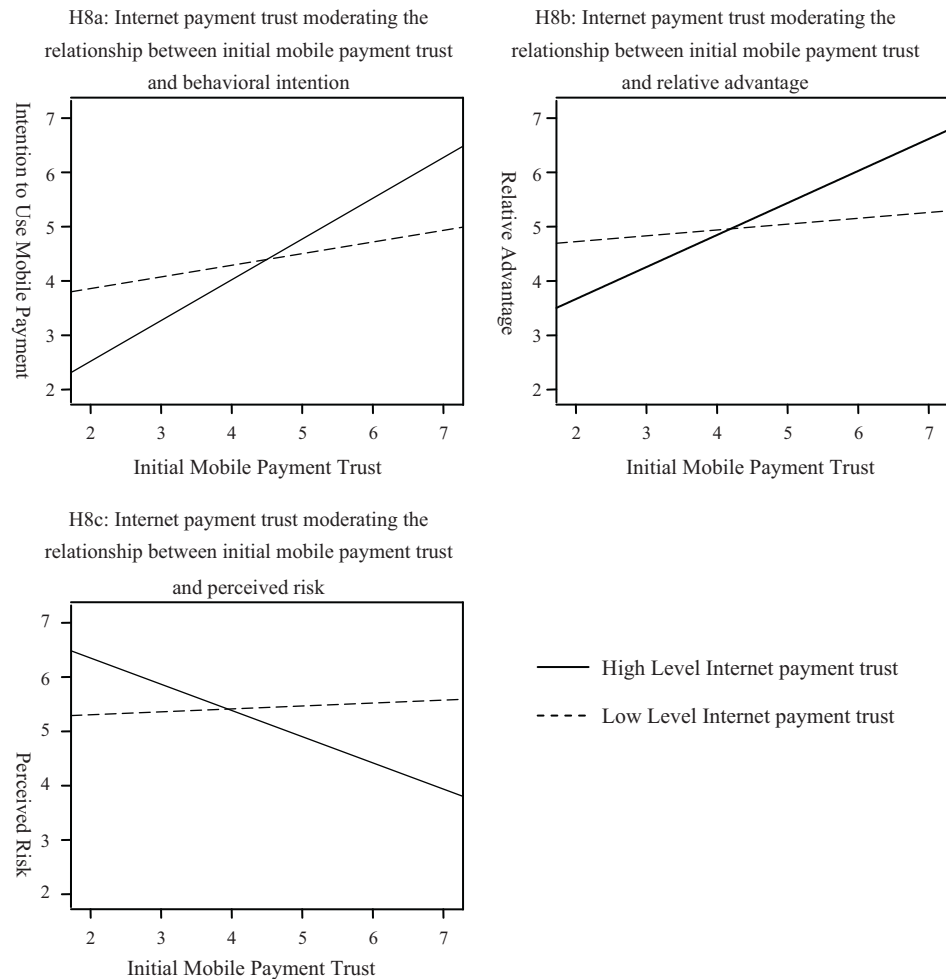


Fig. 3. Significant interaction relationships.

Table 6
Model comparison results between workers and students.

Path	Workers ($N_1 = 390$)		Students ($N_2 = 253$)		T value
	Coefficient	Support	Coefficient	Support	
H1: REA → INT	0.223***	Yes	0.200** ^a	Yes	5.2
H2: COM → INT	0.314***	Yes	0.121 ^a	No	39.
H3: IMG → INT	0.174***	Yes	0.215*** ^a	Yes	−9.0
H4: PRI → INT	−0.008	No	−0.117 ^a	Yes	9.3
H5: PEC → INT	0.010	No	−0.089 ^a	No	22.
H6a: MOT → INT	0.180***	Yes	0.249** ^a	Yes	−13.
H6b: MOT → REA	0.394***	Yes	0.318*** ^a	Yes	18.
H6c: MOT → PRI	−0.158***	Yes	−0.160 ^a	Yes	0.4
H7: ONT → MOT	0.559***	Yes	0.523*** ^a	Yes	8.9

REA, relative advantage; IMG, image; ONT, Internet payment trust; PRI, perceived risk; MOT, initial mobile payment trust; COM, compatibility; PEC, perceived cost; INT, behavioral intention. $t = (PC_1 - PC_2) / [\text{Spooled} \times \text{SQRT}(1/N_1 + 1/N_2)]$; $\text{Spooled} = \text{SQRT}[(N_1 - 1)/(N_1 + N_2 - 2) \times SE_1^2 + [(N_2 - 1)/(N_1 + N_2 - 2) \times SE_2^2]$; SE, standard error of path in the structural model; PC, path coefficient in the structural model.

^a t-Tests showed significant ($p < 0.001$) differences for these coefficients between workers and students.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

advantage and compatibility are two main factors that positively influence the adoption of new innovations [13], one particularly important finding of this study was that image is also a strong determinant of behavioral intention.

Third, the strong positive impact of trust in existing Internet payment services on the initial trust in mobile payment services also provides empirical evidence on a dynamic trust transfer process between Internet and mobile environments. This implies that well-established trust in Internet payment services does affect

(or transfer to) a customer's trust in corresponding mobile payment services.

Fourth, the significant interaction relationships between Internet payment trust and three paths in the mobile environment further validate the important effect of previous payment experience in the Internet environment on the perceptions of the mobile environment.

Fifth, the multisample analysis between the worker and the student groups yields several interesting findings. One is the impact

of the two negative valence components, perceived risk and perceived cost, on behavioral intention in the two groups. The magnitudes of the two negative impacts on behavioral intention were found to be greater for students than for workers. In particular, perceived risk and perceived cost had no significant impact for workers on mobile payment services adoption. Workers can use a relatively small proportion of their earning to pay for mobile payment services. Thus, the additional expenses of using the services usually can be well controlled and managed by workers' budgets, which then may result in an insignificant impact on behavioral intention. In addition, compared with students, workers have more needs to frequently use mobile payment services or other financial transaction services. Such interactive experiences will reduce workers' perceived risk of using mobile payment services. The result suggests that the perceived cost of using mobile payment services is still a concern that suppresses students' intentions to use the services.

For workers, the significant components in the order of importance are compatibility, relative advantage, and image. Consistent with existing studies, this highlights the importance of lifestyle fitness in mobile payment services adoption decisions. For students, however, image is the most significant factor, as indicated by its path loadings and significance levels, followed by relative advantage and compatibility. This suggests that students tend to form their mobile payment services adoption intention mainly by considering its associated social image.

The paths in the trust transfer process between the two groups are all found to be significant in both groups and the relative importance of all these impacts is not different. This highlights the importance of trust transfer mechanism in forming initial trust and in determining next adoption behavior among various groups.

7. Conclusions

7.1. Limitations

As with all empirical research, this study has limitations. First, the study did not cover users who do not use the Internet and this excluded the elderly and the computer illiterate segments of the population. However, this is not a serious limitation because our study focused on trust transfer from the Internet channel to the mobile channel. Non-Internet users were not within the scope of the study. Also, innovators and early adopters tend to be young and educated, and the profile of our sample fell into that category.

Another limitation is that we used the simplified measures of several constructs in order to reduce the size of the questionnaire and promote user willingness to participate in our survey. Although we obtained good psychometric properties of these measures, some may argue that using only two items for each construct may not capture the full meaning of the measure.

Third, customers' initial trust in mobile payment services may be solidified or weakened as they interact with the service provider. One major goal of our study was to explore the trust transfer mechanism from a cross-environment perspective, so we only examined initial trust in mobile payment services.

Fourth, it is worth noting that the data in this study were collected from customers of a single company: such a narrow focus may hinder the generalizability of our results. In addition, a potential limitation also rises from the different cultural and market conditions: thus research results may vary from one country to another.

7.2. Implications

7.2.1. Theoretical implications

First, unlike many prior studies that attempted to extend and modify conventional technology adoption models to examine

customer adoption of new information and communication technologies, we developed and validated a trust-based consumer decision-making model by capturing the additional unique characteristics of the mobile finances environment. Our results indicated that positive and negative valences are two fundamental aspects that customers take into account to make their decisions about using mobile payment services.

Second, few empirical studies in the ISs literature have examined innovation adoption from a cross-environment perspective. We explored the dynamic trust transfer process in the new mobile payment services context. The results demonstrated that consumers' trust in Internet payment services indeed has a cross-environment effect on initial trust in mobile payment services and behavioral intention in the mobile environment.

Third, we bridged two important factors (trust and behavioral intention) over two distinct environments (Internet and mobile). We believe that our study thus provided a holistic insight into the decision-making process of innovation adoption. Indeed, we believe that our conceptual model is not necessarily limited to mobile payment services but would be applicable to other contexts (e.g., mobile retailing, mobile banking services, and mobile stock services).

7.2.2. Practical implications

This study also has several practical implications. First, our study indicated that electronic payment service providers should pay close attention to four factors – trust, compatibility, relative advantage, and image – because they all strongly and positively impact customers' behavioral intention. These firms should look for opportunities to nurture their customers' trust in mobile payment services. Trust not only directly affects a customer's behavioral intention but also indirectly influences the intention by shaping a customer's perceptions of risk and relative advantage. Perceived compatibility exerts the greatest impact on intention to use mobile payment services. Thus, service providers should carefully consider the issues of compatibility to ensure that their offering meets their customers' current values, needs, and lifestyles. Perceived relative advantage and image are also critical determinants of mobile payment services adoption. Providers should consider using tactics to increase the perceived relative advantage and develop campaigns that leverage the power of image with relative demographic groups.

Second, the salient and negative effects of perceived risk and cost on intention implies that the two negative valences play an important role in dampening customers' mobile payment services adoption decision. Electronic payment firms should do their best to reduce customers' perceptions of risk and cost. For instance, training and trial activities, disclosure of security and privacy assurances, and satisfaction guarantee policies are all trust-building measures that can alleviate their customers' perceptions of risk and cost.

Third, the results of this study also suggest that trust in Internet payment methods has both a direct impact on initial trust and a moderating effect on three critical relationships within the mobile environment. Electronic payment service providers should consider that the trust-building process encompasses the Internet as well as mobile relationships. Building and maintaining trust in the Internet environment not only benefits the current environment, but also has an extensional valence across environments.

Finally, service providers should understand the different behaviors among different groups of customers in mobile payment services adoption and take different measures to manage them. For instance, for workers, emphasis should be given to reinforcing customers' compatibility perceptions between adopting mobile payment services and their existing behavioral patterns and habits. Providers therefore should employ tailored strategies to promote their mobile payment services to highly targeted customer groups.

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Appendix A. Scales and items

Construct (Abbr.)	Definition	Source
Trust in Internet payment (ONT)	Internet payment always provides accurate financial services. Internet payment always provides reliable financial services. Internet payment always provides safe financial services.	[7]
Initial trust in mobile payment (MOT)	Mobile payment always provides accurate financial services. Mobile payment always provides reliable financial services. Mobile payment always provides safe financial services.	[7]
Perceived cost (PEC)	It would cost a lot to use mobile payment services. There are financial barriers (e.g., having to pay for handset and communication time) to my using mobile payment services.	[21]
Perceived risk (PRI)	I would not feel totally safe providing personal private information over the mobile payment system. I'm worried about using mobile payment services because other people may be able to access my account. I would not feel secure sending sensitive information across the mobile payment system.	[10]
Relative advantage (REA)	Mobile payment has more advantages than Internet or off-line payment because services are not limited by location and time. Mobile payment is more convenient than Internet or off-line payment. Mobile payment is more efficient than Internet or off-line payment. Mobile payment is more effective than Internet or off-line payment in managing a payment account.	[7]
Compatibility (COM)	Using mobile payment services is compatible with all aspects of my work. I think that using mobile payment services fits well with the way I like to work. Using mobile payment services fits into my work style.	^a
Image (IMG)	People around me who use mobile payment services have more prestige than those who do not. People who use mobile payment services have a high profile. Using mobile payment services is considered a status symbol among my friends.	^b
Intention to use (INT)	Assuming I have access to the mobile payment services, I intend to use it. Given that I have access to the mobile payment services, I predict that I would use it.	

^a Adapted from G. Moore, I. Benbasat, Development of an instrument to measure the perceptions of adopting an information technology innovation, *Information Systems Research* 2 (3) (1991) 192–222.

^b Adapted from V. Venkatesh, F. Davis, A theoretical extension of the technology acceptance model: four longitudinal field studies, *Management Science* 46(2) (2000) 186–204.

Appendix B. Factor loadings

Factor	REA	IMG	ONT	PRI	MOT	COM	PEC	INT
REA1	0.728	−0.024	0.155	0.258	0.054	0.200	−0.030	0.215
REA2	0.879	0.087	0.071	0.081	0.044	0.135	0.005	0.122
REA3	0.859	0.170	0.089	0.005	0.105	0.127	−0.035	0.100
REA4	0.732	0.227	0.051	−0.078	0.259	0.123	0.035	0.052
IMG1	0.165	0.887	0.038	0.014	0.141	0.085	−0.008	0.130
IMG2	0.141	0.931	0.055	−0.017	0.105	0.087	0.009	0.102
IMG3	0.086	0.911	0.046	−0.037	0.066	0.121	0.002	0.115
ONT1	0.155	0.035	0.845	0.059	0.167	0.186	0.058	0.091
ONT2	0.090	0.023	0.853	−0.013	0.240	0.189	0.039	0.071
ONT3	0.057	0.076	0.851	−0.082	0.240	0.119	0.039	0.006
PRI1	0.070	−0.024	−0.015	0.864	−0.026	0.011	0.144	−0.053
PRI2	0.064	0.022	0.003	0.890	−0.078	−0.025	0.105	−0.044
PRI3	0.033	−0.038	−0.031	0.875	−0.055	0.006	0.134	−0.015
MOT1	0.178	0.108	0.269	−0.056	0.782	0.255	−0.016	0.211
MOT2	0.148	0.146	0.335	−0.049	0.790	0.215	−0.017	0.171
MOT3	0.158	0.162	0.297	−0.130	0.769	0.263	0.010	0.120
COM1	0.175	0.124	0.246	−0.029	0.224	0.732	0.056	0.217
COM2	0.188	0.100	0.156	0.043	0.173	0.813	−0.050	0.065
COM3	0.222	0.132	0.187	−0.023	0.258	0.735	−0.012	0.216
PEC1	0.023	0.012	0.101	0.189	0.026	0.035	0.890	0.005
PEC2	−0.044	−0.009	0.012	0.184	−0.037	−0.049	0.892	−0.075
INT1	0.285	0.212	0.091	−0.060	0.217	0.211	−0.056	0.798
INT2	0.193	0.208	0.082	−0.085	0.211	0.236	−0.043	0.827
Eigen-value	3.0	2.8	2.6	2.5	2.3	2.2	1.7	1.7
Variance %	13.0	12.1	11.4	10.9	10.2	9.7	7.2	7.2
Cumulative	13.0	25.1	36.5	47.4	57.5	67.2	74.4	81.6

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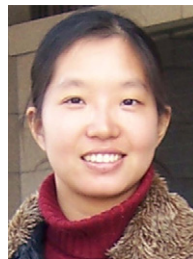
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