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Young Generation's Mobile Payment Adoption Behavior: Analysis Based on an Extended UTAUT Model

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Abstract: Younger generations comprise an essential segment for the mobile payment market to prosper. However, empirical evidence of the drivers/barriers of the young generation's adoption of mobile payment has been inconclusive. This study intends to advance the body of knowledge on this subject based on the extended Unified Theory of Acceptance and Use of Technology (UTAUT), incorporating the young generation's risk perception and bonus/rewards provided by the mobile-pay firms. To this end, 295 samples with the majority being more tech-savvy, namely generation Y and generation Z, were collected from an online survey in Taiwan. The empirical results in this study demonstrate the uniquely positive effect of social influence on the young generations' behavioral intention to adopt mobile payment. While behavioral intention and promotional activities are the drivers of the young generation's actual usage of mobile payment, perceived risks are found to exert a negative impact, reflecting the risk-averse preferences of the young generation in Taiwan. The ignorable moderation effect of gender, on the other hand, suggests the absence of a gender gap in the use of mobile payment among the young generations. The findings in this research have important implications for the development of promotion programs motivating the young generation's adoption of mobile payment.

1. Introduction

The development of mobile devices and e-commerce has driven the growth of the mobile payment market worldwide. It was predicted that the transaction value in the mobile payment segments will reach US$4769 billion in 2020, with a compound annual growth rate (CAGR) of 12% between 2020 and 2023 [1]. In response to the emergence of online shopping, which relies on mobile payment services, more firms are entering the mobile payment-related market. The critical role of mobile payment can be witnessed under these growing developments.

In recent years, the Taiwanese government has actively popularized the adoption of mobile payments. To optimize environmental fundamentals, several measures were implemented [2]. For instance, a financial regulatory sandbox law that allows more leeway for field-testing financial services was enacted in 2017 [3]. While the user penetration rate of mobile payment services rose from 39.7% in 2016 to 62.2% in 2019, there is still considerable room for growth compared to the existing huge credit card market. Like in other parts of the world, the largest group of potential adopters of this new payment option is the young generation, who are more comfortable with different online payment alternatives [4], which thereby constitutes one crucial segment of the market for business to prosper [5]. Nonetheless, what the pros or cons are of mobile payment from the viewpoint of the young generation in Taiwan is still an unanswered question. The major focus of the

present study, therefore, is to gain insights into factors affecting the young generation's behavioral intention and the actual usage behavior of mobile payment. Past studies on the drivers/barriers of the young generation's mobile payment usage have been inconclusive. Taking the young generations in Taiwan as an example, this study provides a significant complement to the delineation of the young generation's intention and use of mobile payment. With a projected CAGR of nearly 23.70%, the Asia-Pacific mobile payment market is predicted to be the fastest-growing segment in the world mobile payment market during 2018–2026 [6]. A better understanding of the driving/deterring factors of the young generation's mobile payment adoption can help the service practitioners and researchers in designing promotion strategies to make the new payment mode broadly acceptable to the largest group of potential adopters. Therefore, the findings in this research can render important implications for the development of cost-effective market communication strategies in the Asia-Pacific mobile payment market.

The behavioral model this study is based on is an extension of the unified theory of acceptance and use of technology (UTAUT). The extended UTAUT includes perceived risks and promotional activities as additional determinants of the actual usage of mobile payment. The young generation differs from other generations in terms of "systematic differences in values, preferences and behavior that are stable over time" [7], p. 245. However, limited attention has been devoted to the understanding of the young generation's risk preferences. In order to advance the body of knowledge on this subject, this study extends the UTAUT model to include perceived risks in the delineation of the young generation's behavior. Perceived risk is one important dimension in shaping the behavioral intention and usage of mobile payment [8–10]. Similar to the focus on consumers' risk perception, one line of previous studies is to stress psychological concerns including trust [11–13], distrust [14], perceived security risk [15], and perceived financial, privacy, and performance risks [16] in modeling consumers' intention to use online services. It is found that trust of the mobile service provider and mobile technology [11] and the mobile payment vendor [12] are key factors influencing intention to use mobile payment. A similar conclusion applies to the consumer's online repurchase behavior [13]. In light of the important role of both trust and distrust in influencing the decision to adopt IT-enabled exchange mode, some authors [14] investigated the effects of trust and distrust through the use of "functional neuroimaging (fMRI) tools to complement psychometric measures of trust and distrust" [14]. Neuroscience has also been applied to investigate the consumer's neural response to risky and secure e-payments [15] and how consumers process online risks [16]. The authors [15] found that consumers' choice of payment systems is determined by the consumer's neural response.

Financial incentives in different forms, monetary and/or nonmonetary rewards, have been found to be effective in attracting and attaining customers in the process of product or service promotion [17,18]. There were only a handful of studies providing empirical evidence to support the effect, especially that of monetary rewards offered by mobile pay companies, on the usage of this new payment alternative. In a very recent research addressing the pull, push, and mooring factors of mobile payment users' switching behavior, it was found that monetary rewards provided by mobile payment applications pull the users to switch [19]. Targeted on young US adults, some authors [20] found cashback and discount to impact positively the intention to adopt near field communication (NFC) mobile payment. In addition to monetary rewards, this study considers two other forms of nonmonetary rewards offered by the mobile payment companies, including bonus points and gifts with targeted amounts of purchase. By emphasizing the influence of promotion strategies on the young generation's mobile payment adoption, the present study makes a significant complement to the literature devoted to the modeling of technology acceptance behavior.

Additionally, this study adds to the literature on mobile payment by assessing the gender moderating effects among the young generation. When it comes to behavioral analysis of information communication technology (ICTs) adoption, it is important to

recognize variations in terms of drivers/barriers between different demographic groups, namely, female vs. male [21], and young vs. old [22]. Gender as a moderator has been examined in the context of adopting mobile internet [23], mobile payments [24–26], mobile banking [27,28], and mobile apps [29], etc. Although the effects of some UTAUT constructs on the adoption behavior were shown to be moderated by gender [23–25,30,31], the gender moderation effect was not observed in some cases, for example, [26,28,29]. One possible explanation for the diverse results may be due to not taking into account the possible interplay of the two demographic characteristics—gender and age. By focusing our attention on the young generation, this study provides a more concrete examination of the role of gender in moderating the relationships between determinants and adoption behavior.

The remainder of this paper proceeds as follows. Section 2 presents the description of the UTAUT model extended to include the constructs of promotional activities and perceived risks and the research hypothesis built on the theoretical foundation. Section 3 introduces the survey data and the empirical framework. Following Section 3 is a discussion of the path analysis and the drivers/barriers of mobile payment use. The final section summarizes the major findings and limitations.

2. Literature Review and Research Hypotheses

The novel feature of the present study is to extend the traditional UTAUT model to include the constructs of promotional activities, perceived financial/privacy risks as well as psychological/social risks. In what follows, we provide a description of each of the construct in the extended UTAUT model and the research hypotheses outlining the structural relationships.

2.1. The UTAUT Model

The UTAUT model identifies four major determinants of behavioral intention and usage: performance expectancy, effort expectancy, social influence, and facilitating conditions [21], while at the same time moderated by gender, age, experience, and voluntariness of use. The model was found to achieve a high level of the explanatory power of 70% with empirical data [21] and, thus, has been applied in wide-ranged of fields [32]. Some recent research, for example, [24,25,33,34], concentrated on applying UTAUT in modeling the adoption of mobile payment services.

2.1.1. Performance Expectancy

Performance expectancy captures the user's perceived gain in job performance when the technology is applied [21]. In general, performance expectancy is composed of five sub-facets: (i) perceived usefulness—the user believes that the adoption of technology improves work efficiency; (ii) extrinsic motivation—users believe that there is an added value in adopting the technology; (iii) job-fit—users think that adopting this technology improves job performance; (iv) relative advantage—users think that adopting this new technology is better than the previous one; and (v) outcome expectation—users expect to have a sense of accomplishment and pleasure after applying the technology.

This study posits the research hypothesis concerning the effect of performance expectancy on behavioral intention as following:

Hypothesis 1. *Performance expectancy positively affects customers' intention to use mobile payments.*

2.1.2. Effort Expectancy

The effort expectancy is defined as "the degree of ease associated with the use of the system" [21], p. 450, and can be divided into three sub-facets, which includes perceived ease of use, complexity, and ease of use. The following hypothesis postulates the relationship between effort expectance and behavioral intention:

Hypothesis 2. *Effort expectancy positively affects customers' intention to use mobile payments.*

2.1.3. Social Influence

Social influence concerns the positive or negative view of the technology held by the individual's social reference group including families, friends, peers, and the individual's expectancy of gaining recognition or acceptance. A couple of studies emphasized social influence, which signifies the effects of peers, young celebrities, and role models [35–41]. The social influence construct, therefore, includes four sub-facets: (i) subjective norm—the influence from others around including the families, friends, such as the degree to which one should or should not take action; (ii) social factors—the influence of culture and social norms on individual behavior; and (iii) image—the user believes that adopting the technology is beneficial to improve one's social image and social relations; and (iv) celebrity endorsement.

The following hypothesis will be tested to examine the effect of social influence on behavioral intention:

Hypothesis 3. *Social influence positively affects customers' intention to use mobile payments.*

2.1.4. Facilitating Conditions

Facilitating conditions are the organizational and technical infrastructure that the individual believes can support the use of technology [21]. Facilitating conditions comprise the perceived behavioral control, facilitating conditions, and compatibility to the technology, which is relevant to the user's personal characteristics such as values and experiences. We derive the following hypothesis accordingly:

Hypothesis 4. *Facilitating conditions positively affect customers' intention to use mobile payments.*

2.2. The Moderating Role of Gender

Factors that affect the behavioral intentions of adopting technology products may differ by gender, which is one of the moderating drivers proposed in the UTAUT model [21]. The adoptions of technology products that were examined in previous research while considering gender as a moderator include mobile internet [23], mobile payments [24–26], mobile banking [27,28], mobile apps [29], and information communication technology (ICT) adoption in the public or private organization [30,31], etc.

In previous research, which aimed at explaining the adoption behavior of new technology, the moderating role of gender varied. In terms of the effort expectancy of the new technology, some research found it to exhibit a greater impact on women's behavioral intentions [23,27,31] whereas some observed a greater effect on men, for example, [25,26,29,42]. Social influence was found to have more effects on men [42] while some authors [24–27] stated a contrary observation. In addition, facilitating conditions affect women more when adopting the Mobile SNS [42] and mobile apps [29], but are not influential in adopting mobile payment services [24,26]. Some UTAUT constructs were shown to be more consistent, such as men place more importance on performance effect [16,23,30,31]. Nonetheless, some previous studies did not observe such gender differences in the adoption of new technologies [28,29].

Based on the previous work, this study proposes the following hypotheses with an intention to investigate the moderating effect of gender:

Hypothesis 5. *Gender moderates the relationships between (a) performance expectancy, (b) effort expectancy, (c) social influence, and (d) facilitating conditions.*

2.3. Extension of UTAUT in Explaining the Actual Adoption Behavior

Most empirical research based on the UTAUT framework hypothesized the crucial role of positive behavioral intentions in determining the actual usage behavior. Under this framework, behavioral intentions impact actual behavior directly, while the four constructs of behavioral intentions are influential to the actual behavior indirectly through their effects on behavioral intentions. This study proposes an extended UTAUT model by incorporating two more psychological facets that may have effects on actual usage behavior in addition to behavioral intentions—users' preferences over promotional bonus/rewards and perceived risks.

The central theme in the UTAUT model concerns the positive association of behavioral intention and actual usage. This linkage has been confirmed by extant works in the past [21,28,43]. On the other hand, the empirical support to the positive effect of facilitating conditions on the actual usage behavior was also provided in the literature [21,28,43]. Accordingly, in this study, we test the following hypotheses:

Hypothesis 6. *Behavioral intention positively affects customers' actual usage of mobile payments.*

Hypothesis 7. *Facilitating conditions positively affect customers' actual usage of mobile payments.*

2.3.1. Promotional Bonus/Rewards

Promotional activities were interpreted widely different among scholars. It was indicated that product or service promotion activities, such as monetary and nonmonetary rewards, were effective in attracting and attaining customers [17,18]. Empirical evidence was found to support the effect of monetary rewards by pulling the users to switch to use mobile payment [19]. Cashback and discount were also confirmed to impact the intention to adopt NFC mobile payment positively [20]. Accordingly, for the purpose of this study, we chose the monetary promotions and nonmonetary promotions as the measure of the promotional activities and the following hypothesis is presented:

Hypothesis 8. *Promotional activities positively affect customers' actual usage of mobile payments.*

2.3.2. Perceived Risks

There is a consensus in the literature of consumer behavior that perceived risk is one important factor in influencing the consumer's decision making. While three risk facets including financial, performance, and security risks were treated as antecedents of mobile shopping behavior [44], perceived performance, financial and privacy risks were found to influence the behavioral intention of mobile payment negatively [8]. Perceived risks were also found to deter the young generation's online shopping behavior [45–47].

Perceived risks can be constructed based on four facets: performance risk, financial risk, psychological risk, and social risk [48]. Some authors [49] proposed another facet of physical risk, which was further extended to include privacy risk [24]. A comprehensive structure of perceived risks is composed of six dimensions: performance, financial, social, psychological, time, and privacy risks [50]. This study uses six indicators to measure perceived risks: (i) performance risk—the degree of expectation gap after using the product; (ii) financial risk—in addition to the price for consumption, consumers worry that they will be charged with additional expenses; (iii) social risk— consumers worry that they will not be recognized by others after purchasing the product; (iv) psychological risk—consumers worry that using this product will detriment their original values; (v) time risk—consumers are concerned about the time cost; and (vi) privacy risk—consumers worry that their personal information may be used illegally.

Perceived risks are expected to have a negative impact on the behavioral intention and are stated in the following hypothesis:

Hypothesis 9. *Perceived risks negatively affect customers' actual usage of mobile payments.*

2.4. Gender Moderation in Explaining the Actual Adoption Behavior

The effects of factors affecting the actual usage of adopting technology products may differ by gender. In terms of the association between facilitating conditions and actual usage behavior, facilitating conditions affect women more when adopting the Mobile SNS [42] but are not influential in adopting mobile payment services [24]. In addition, previous studies have shown diverse results regarding men's and women's reactions to promotional deals [17,51]. For instance, men are found to be less responsive when stores offer promotions by lowering prices [51]. However, it could be the case that the cashback bonus neither attracts male nor female credit card users [17]. Finally, gender was pinpointed to be an important moderator that found that women tend to be more risk-averse and rely on trusts [24,25].

Based on the previous work, this study proposes the following hypotheses with an intention to investigate the moderating effect of gender:

Hypothesis 10. *Gender moderates the relationship between (a) facilitating conditions, (b) promotional bonus/rewards, (c) perceived risk, and the actual usage of mobile payment.*

3. Data and Method

3.1. Data Collection

The sample was drawn from an online survey conducted in Taiwan in November 2018, after running a pilot testing to clarify wording and eliminate the items that were not identifiable in the questionnaire. The online survey was created using the Google form and posted on social media including Facebook, Instagram and Twitter to invite participants to fill out the questionnaire. Consumers that have a mobile device and can afford to bind a credit card or bank account to the mobile payment services, regardless of their actual use, are the targeted population in this research. This enables us to understand the factors that drive the young generation's mobile payment adoptions.

In addition to the socio-demographic information of each respondent, the main contexts of the survey questions are composed of three parts: questions based on each construct of the UTAUT model; promotional activities; several dimensions of perceived risks (PR), including the financial/privacy risks (FR), and psychological/social risks (SR), with a total of 26 questions in the questionnaire. The questionnaire uses a 5-point Likert scale method to explore the study, ranging from 1 (strongly disagree) to 5 (strongly agree), respectively. The items used to measure each construct are listed in the Appendix A (Table A1).

A total of 307 samples aged from 17 to 55 were collected in the survey. Note that most of the samples are between the ages of 16 and 38, namely generation Y and generation Z, the majority of which are more tech-savvy. For instance, although the user penetration rate of Internet is generally high, more than 94% for all age cohorts in 2018, people under 50 years old have significantly better digital awareness than the elder cohorts. To focus on examining young generations, 12 observations older than 38-year-old were excluded. The remaining 295 samples were used for the analysis in the study.

3.2. Empirical Model

The Partial Least Square-Structural Equation Model (PLS-SEM) is used to analyze structural relationships between each of the UTAUT constructs and the behavioral intention. A probit model is then used to explore the factors influencing the young generation's actual usage of mobile payment. The role of gender in moderating the relationships between different constructs and behavioral intention or actual usage is further examined.

3.2.1. Partial Least Square-Structural Equation Modelling (PLS-SEM)

The PLS-SEM model estimates latent variable scores as linear combinations of their associated manifest variables [52]. As the estimates are assumed to be the substitutes for the manifest variables, this method portrays the variance that can explain the endogenous latent variables [53]. Since the process of estimating PLS-SEM relies on a series of ordinary

least squares (OLS) regressions, it does not require a large sample size to reach high levels of statistical power [53]. As the path estimations in the PLS-SEM can vividly illustrate the concept of the UTAUT model, it is favored by many scholars to examine the relationships among the hypothesized constructs [30,54–56].

The path model that connects variables and constructs is depicted in Figure 1. In order to validate the proposed model, we use a two-step bootstrap approach [57]. The first step assesses the measurement model to ensure an adequate level of scale reliability, convergent validity and discriminant validity. In the second step, we continue to evaluate the hypothesized relationships of the inner model through the bootstrap method with 5000 replications.
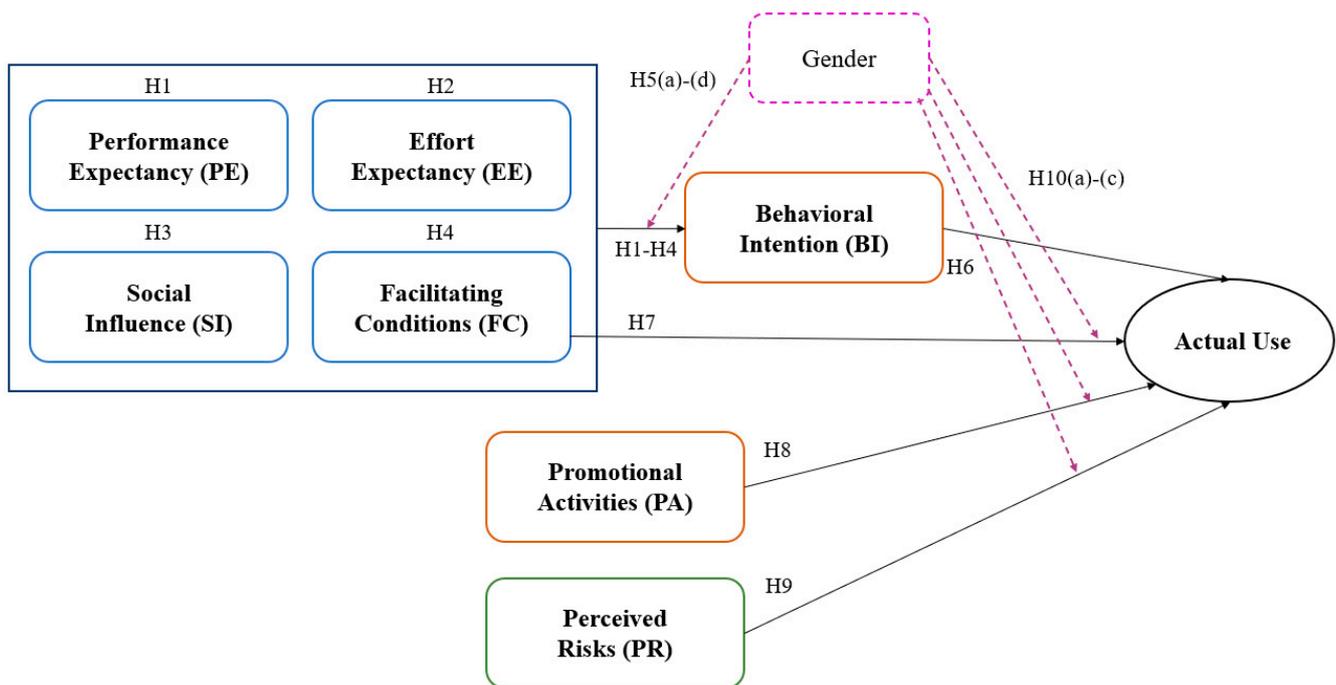

Figure 1. Proposed theoretical model.

3.2.2. Probit Model

While the path coefficients are estimated by OLS (ordinary least squares) regressions in the PLS-SEM algorithm, it would be problematic to use a binary variable to measure an endogenous construct. This is explained by the fact that OLS requires the endogenous latent indicator scores to be continuous [53]. Therefore, assuming the error term ε_i follows a standard normal distribution, we apply the probit model in the further analysis of factors determining the actual use of the mobile payment in this study.

Let BI, FC, and PA denote the behavioral intentions, facilitating conditions and promotional bonus/rewards respectively. The socio-economic characteristics and perceived risks are denoted by vectors **X** and **PR** respectively. In order to capture the effect of celebrity endorsement on the young generation's actual use of mobile payment, the variable denoted as *CE* is incorporated as one of the determinants of actual use. The probit model with the dichotomous dependent variable, y_i, which indicates the actual usage of mobile payment service, 1 = actual usage and 0 otherwise, is specified as the following:

$$BI_i = \mathbf{X}_i \boldsymbol{\beta} + \varepsilon_i \tag{1}$$

$$y_i^* = \alpha_1 * BI_i + \alpha_2 * FC_i + \alpha_3 * PA_i + \mathbf{PR}_i \boldsymbol{\gamma} + \omega * CE_i + u_i \tag{2}$$

$$P(y = 1 | BI, FC, PA, \mathbf{PR}, CE, \boldsymbol{\alpha}, \boldsymbol{\gamma}, \omega) = \Phi(y_i^*) = \int_{-\infty}^{y_i^*} \phi(t)dt \tag{3}$$

In the above equation, the latent variable describing the utility associated with mobile payment usage is denoted by y_i^*. The standard normal density function and its cumulative probability density function are denoted by $\phi(\cdot)$ and $\Phi(\cdot)$, respectively.

The marginal effect of each of the determinants in the actual use equation is measured by holding all other predictors at the sample average. Take behavioral intention as an example, the marginal effect of behavioral intention is calculated as

$$ME_{BI} = \frac{\partial\Phi(g_i(BI, FC, PA, \mathbf{PR}, CE; \alpha, \boldsymbol{\gamma}, \omega))}{\partial BI} = \phi(g_i(BI, FC, PA, \mathbf{PR}, CE; \alpha, \boldsymbol{\gamma}, \omega))\alpha_1 \quad (4)$$

3.3. Descriptive Statistics

Respondents' socio-demographic characteristics are presented in Table 1. The mean age of the samples is 24.6 years old, and most of them are concentrated in the 16 to 22 years old (24.75%) and 23 to 30 years old (63.73%). This study divides the monthly salary income into five ranges, which are 0 yuan, NT\$0 to \$10,000, \$10,001 to \$23,000, \$23,001 to \$50,000, and more than 50 thousand dollars. Of the samples, 42.03% possess more than \$23,000, which approximates to the monthly basic wage issued by the Ministry of Labor of Taiwan in early 2019 (\$23,100).

Table 1. Socio-demographic characteristics of the respondents.

Variables	Frequency	Percentage
Gender		
Male	150	50.85%
Female	145	49.15%
Age		
16–22	73	24.75%
23–30	188	63.73%
31–38	34	11.53%
Salary		
0	41	13.90%
0–10,000	73	24.75%
10,001–23,000	35	11.86%
23,001–50,000	124	42.03%
50,000 and above	22	7.46%
Job		
Others	30	10.17%
Secondary sector	40	13.56%
Service industry	80	27.12%
Student	145	49.15%
Education		
High School and below	7	2.37%
College or University	187	63.39%
Graduate School and above	101	34.24%

The vocational classification in the original questionnaire includes 12 categories, namely wholesale and retail; other service industries; finance and insurance; unemployed; military personnel, civil servants, and teachers; homemaker; information communication; agriculture, forestry, fishery, and animal husbandry; electronics; manufacturing; students; and medical industry. It is important to note that the vocational classification in Taiwan is based on the "full-time" basis. That is, the ones that regard themselves as students are those who are full-time students and, thus, hold only a part-time job. The possible exceptions may be the Executive Master of Business Administration (EMBA) students who are both full-time workers and students. However, for the EMBA students, they will not choose "student" as their job category since they are full-time workers. We then divide them into four major categories, which are the salaried employees from the secondary sector (13.56%), service industry (27.12%), others (10.17%), and student (49.15%). Finally,

the sample comprises 63.39% college and university educational attainment and 34.24% graduate school or higher. The respondents with a high school degree or below account for only 2.37% of the overall sample.

Table 2 presents the descriptive statistics of each latent construct by gender. Females have significantly higher scores on promotional activities and perceived risks, particularly in terms of financial/privacy risks than males. That is, the promotional bonus provided by mobile payment attracts females more than males. However, females are also more likely to worry about personal and financial information to be illegally used when using mobile payment. Meanwhile, men's scores on effort expectancy and facilitating conditions are significantly greater than women's, which indicates that men tend to pick up the new mobile payment services more easily than women. The above is in line with our current hypothesis that gender may moderate the effect of each factor on the adoption of mobile payment, either positively or negatively.

Table 2. Descriptive statistics of each construct, by gender.

Variable	All Sample		Female		Male		Difference
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
UTAUT							Ha: diff < 0
PE	4.05	0.82	4.09	0.76	4.01	0.88	0.081
EE	3.88	0.88	3.76	0.91	4.00	0.82	−0.235 **
SI	2.96	0.91	2.97	0.87	2.96	0.95	0.013
FC	4.07	0.84	3.96	0.88	4.19	0.77	−0.223 **
							Ha: diff > 0
PA	3.99	0.70	4.04	0.63	3.93	0.76	0.114 *
PR	3.38	0.85	3.46	0.77	3.29	0.93	0.169 **
FR	3.92	0.98	4.08	0.88	3.76	1.06	0.318 ***
SR	2.94	0.86	2.93	0.80	2.95	0.93	−0.023

Note: *, ** and *** denote significant at the 10%, 5%, and 1% significance level.

4. Results

4.1. Reliability and Validity

We proceed in two steps to apply PLS-SEM with the bootstrap approach to validate the proposed model [57]. In the first step, the measurement model was assessed by evaluating the reliability and validity of the construct measures, which demonstrate the quality of the survey and are often times tested at the initial stage of conducting a questionnaire. It is shown in Table 3 that all constructs were tested to ensure an adequate level of scales reliability using Cronbach's α and average variance extracted (AVE).

Table 3. Reliability and factor loadings.

Latent Constructs	Cronbach's Alpha (α)	Average Variance Extracted (AVE)
PE	0.880	0.705
EE	0.917	0.757
SI	0.805	0.581
FC	0.656	0.744
PA	0.733	0.650
PR	0.879	0.585
BI	0.909	0.917

All latent constructs in this study are greater than 0.7, which satisfies the rule of thumb of validity [58]. Specifically, these values ranged between 0.656 for facilitating conditions and 0.917 for effort expectancy for satisfaction. By the same token, the AVE value ranged from 0.581 (social influences) to 0.917 (behavioral intention), which are all above the threshold value of 0.50 suggested by [53]. Finally, to ensure the convergent validity within each construct, only the item with factor loadings statistically significant

and above 0.50 were kept in the sample [53]. Eight minor items with low factor loading were removed from the indicators to ensure the correlations between the observed items and the latent factors.

To evaluate the discriminant validity, which favors a low correlation and a significant difference between the different facets, the square root of the AVE of each latent construct (diagonal figures) and its inter-correlation estimates (off-diagonal) are presented in Table 4. The highest value of inter-correlation estimates was less than 0.557, which is below its maximum cutoff of 0.85 [59]. Additionally, the squared root of the AVE of each construct (the diagonal values) is greater than its correlations with other constructs (the off-diagonal values) to achieve satisfactory discriminant validity [52,53]. These validated the construct reliability as well as validity in the research.

Table 4. Discriminant validity.

Latent Constructs	PE	EE	SI	FC	PA	PR	BI
PE	0.840						
EE	0.545	0.870					
SI	0.481	0.267	0.762				
FC	0.379	0.557	0.236	0.863			
PA	0.409	0.363	0.273	0.275	0.806		
PR	−0.339	−0.281	−0.067	−0.240	−0.008	0.765	
BI	0.090	0.066	0.126	0.046	0.008	−0.084	0.958

After the assessment of model reliability and validity, we continue to evaluate the hypothesized relationships of the inner model. PLS-SEM does not have a standard goodness-of-fit statistic due to its distribution-free assumption; the assessment of the model's quality relies on the coefficient of determination (R-squared, with the ranges from 0 to 1 representing predictive accuracy) and path coefficients [57]. We also applied the bootstrap method [57] with 5000 replications to compute the standard error of each parameter and test its significance in H1 to H4. To compare the structural relationships across gender, we also used the bootstrap-*t* test to validate its significance. Table 5 presents the results of the PLS-SEM.

Table 5. Estimation results of the proposed UTAUT model.

PLS-SEM			
Hypothesized Paths	**Path Coefficients**	***p*-Value**	**Conclusions**
H1: PE → BI	0.026	0.749	Not significant
H2: EE → BI	0.025	0.805	Not significant
H3: SI → BI	0.107 *	0.078	Supported H3
H4: FC → BI	−0.003	0.971	Not significant
Comparison of structural relationships across gender (with bootstrap method)			
Hypothesized paths	**Male**	**Female**	**Absolute difference**
H5(a): PE → BI	−0.106	0.133	0.238
H5(b): EE → BI	0.203 *	−0.089	0.292
H5(c): SI → BI	0.212 **	0.095	0.117
H5(d): FC → BI	0.034	0.062	0.028

Note: The model used the bootstrap method with 5000 replications; *, ** and ** denote significant at the 10% and 5% significance level respectively.

4.2. The Actual-usage Model

Based on the behavioral framework depicted in Figure 1, we estimate the probit model with behavioral intention, facilitating condition, promotion activities, the two types of perceived risks and celebrity endorsement as the explanatory variables in order to examine the determining factors of the young generation's actual usage behavior. Since the effect of each determinant may be different for the two gender groups, we also include an interaction

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term of gender and each of the determinants into the probit model. Maximum likelihood estimates from the probit model are reported in Table 6.

Table 6. Maximum likelihood estimates of the probit model.

Variable	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
BI	0.385	*	0.376	*	0.381	*	0.380	*	0.383	*	0.390	*
	(0.21)		(0.21)		(0.21)		(0.21)		(0.21)		(0.21)	
FC	0.264		0.288	*	0.270		0.275		0.267		0.258	
	(0.17)		(0.17)		(0.17)		(0.17)		(0.17)		(0.17)	
FR	−0.265	**	−0.276	***	−0.272	**	−0.263	**	−0.268	**	−0.262	**
	(0.10)		(0.11)		(0.11)		(0.10)		(0.11)		(0.11)	
SR	−0.226	**	−0.219	**	−0.222	**	−0.219	**	−0.220	**	−0.228	**
	(0.10)		(0.10)		(0.10)		(0.10)		(0.11)		(0.10)	
PA	0.228	*	0.223	*	0.234	*	0.223	*	0.227	*	0.229	*
	(0.13)		(0.13)		(0.13)		(0.13)		(0.13)		(0.13)	
CE	0.202		0.204		0.204		0.205		0.203		0.178	
	(0.18)		(0.18)		(0.18)		(0.18)		(0.18)		(0.21)	
Gender *FC			−0.022									
			(0.04)									
Gender *PA					−0.013							
					(0.04)							
Gender *FR							−0.021					
							(0.04)					
Gender *SR									−0.008			
									(0.06)			
Gender *CE											0.050	
											(0.21)	
Constant	−0.212		−0.230		−0.226		−0.229		−0.222		−0.203	
	(0.94)		(0.95)		(0.95)		(0.95)		(0.95)		(0.95)	
LR chi2(6)	69.98	***	70.29	***	70.09	***	70.26	***	70.00	***	70.04	***
Control:												
Gender	yes		yes		yes		yes		yes		yes	
Age	yes		yes		yes		yes		yes		yes	
Education	yes		yes		yes		yes		yes		yes	
Job	yes		yes		yes		yes		yes		yes	
Salary	yes		yes		yes		yes		yes		yes	

Note: Robust standard errors are in the parenthesis. *, ** and *** denote, respectively, significant at the 0.1, 0.05, and 0.01 significance levels.

The likelihood ratio chi-square test statistics are significant for all six models, indicating each model is jointly significant. Under different specifications, the results indicate that after controlling for the respondent's socio-economic characteristics, behavioral intention, and promotional activities (including monetary and non-cash bonus/reward) contribute positively to the probability of the young generation's adoption of mobile payment in Taiwan. The two types of perceived risks, financial/privacy risks (FR) and psychological/social risks (SR), on the other hand, are found to significantly lower the probability of mobile payment usage. There is not enough evidence, however, to support the effect of celebrity endorsement (CE) on the young generation's usage of mobile payment.

5. Discussion

One of the major purposes of this study is to examine the structural relationships between the UTAUT constructs and the young generation's behavioral intention to use mobile payment. There are a couple of characteristics that distinguish the young generations, generations Y and Z, from the older generations before them. One of the unique characteristics of the young generation is tech-savvy since they grew up with new technologies and rely heavily on the Internet for their daily lives and work [60]. Considering the unique characteristics of the young generations, this study focuses on examining: (1) if all the four UTAUT constructs—performance expectancy, effort expectancy, social influence, and

facilitating conditions—are key determinants of the young generation's intention to use mobile payment; and (2) if not, which of the four constructs shape the young generation's intention to use mobile payment. The empirical investigations conducted in the present study, therefore, reinforce the applicability of the UTAUT model in predicting the young generation's intention to use mobile payment.

Among the four UTAUT constructs (Table 5), only the social influence construct has a significantly positive effect on Taiwanese young generation's behavioral intentions to adopt mobile payment ($\beta = 0.107$, $p < 0.10$). The result supports the hypothesized effect of social influence on the young generation's behavioral intention, as stated in H3. This result is in line with previous findings of the positive influence of parental role model [35] and family/peer influence [5,36,38] on the young generation's purchasing or usage of mobile technology. It was indicated that in countries where information systems have been well developed, generation Y are "followers of social norms, especially those in their circles of peers" [5], p. 738. This also accords with the observation that generations Y and Z, which our sample is formed of, have a high level of social influence in trying the new technology services such as the tablet [22] and use of financial services [38]. The managerial implication of this finding reinforces the need to take into account the effect of social influence in designing promotion programs motivating the young generation's adoption of mobile payment.

The moderating roles of gender on the behavioral intention to adopt mobile payment as reported in the lower part of Table 5 indicate a stronger social influence impact on men's intention to use the mobile payment services, which corroborates the finding in the context of applying mobile SNS [34]. Besides, we observe a positive impact of effort expectancy among men, which is in line with [25,26,29,42]. However, no particular path was found to significantly affect female consumers. Although the UTAUT construct diversely affected men and women, gender was not found to moderate the UTAUT constructs significantly since none of the differences in the absolute value is different from zero. These results are in agreement with findings that gender does not moderate the young generation's behavioral intention [26,29]. In the UTAUT literature of mobile payment, the moderator effect of gender in the structural relationships has been inconclusive [26]. Understanding if gender moderates the structural relationship between UTAUT constructs and the young generation's intention to use mobile payment in Taiwan can provide important managerial insights into the marketing strategies of the mobile-pay firms.

Celebrity endorsement has been studied within the context of social influence in affecting consumers' purchase intention [37,39–41]. For instance, some authors [40,41] demonstrated that female customers are more attracted to celebrity endorsement of products. Under the consideration that celebrity endorsement may be some important factor for the young generation, we separate celebrity endorsement from other social influence factors to examine its path relationship with social influence. The path coefficients of celebrity endorsement, peers/families and image are 0.287 ($p < 0.01$), 0.593 ($p < 0.01$), and 0.323 ($p < 0.01$), indicating their significantly positive effect on the social influence construct. Contrary to the finding that celebrity endorsement does not directly affect consumer's intention to purchase online [61], the results in this study suggest that product endorsement from celebrities has a significantly positive effect on young consumers' intention to adopt mobile payment services. One of the marketing strategies in Taiwan's mobile payment market is the product endorsement from young celebrities. The findings in this study confirm that celebrity endorsement is an effective way to increase potential users' intention to use mobile payment.

In order to gain a better understanding of the young generation's actual usage behavior, we calculate the average marginal effects of each of the determining factors in the probit model. The marginal effects (Table 7) measure the influence of each of the determinants on the probability of actual usage holding all other predictors at the sample average.

Table 7. The marginal effect estimates of the probit model.

Variable	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
BI	0.122	*	0.119	*	0.120	*	0.120	*	0.121	*	0.123	*
	(0.06)		(0.06)		(0.06)		(0.06)		(0.06)		(0.06)	
FC	0.083		0.091	*	0.085		0.087		0.084		0.082	
	(0.05)		(0.05)		(0.05)		(0.05)		(0.05)		(0.05)	
FR	−0.084	***	−0.087	***	−0.086	***	−0.083	**	−0.085	***	−0.083	**
	(0.03)		(0.03)		(0.03)		(0.03)		(0.03)		(0.03)	
SR	−0.071	**	−0.069	**	−0.070	**	−0.069	**	−0.069	**	−0.072	**
	(0.03)		(0.03)		(0.03)		(0.03)		(0.03)		(0.03)	
PA	0.072	*	0.070	*	0.074	*	0.070	*	0.072	*	0.072	*
	(0.04)		(0.04)		(0.04)		(0.04)		(0.04)		(0.04)	
CE	0.064		0.064		0.064		0.065		0.064		0.056	
	(0.06)		(0.06)		(0.06)		(0.06)		(0.06)		(0.06)	
Gender*FC			−0.007									
			(0.01)									
Gender*PA					−0.004							
					(0.01)							
Gender*FR							−0.007					
							(0.01)					
Gender*SR									−0.003			
									(0.02)			
Gender*CE											0.016	
											(0.07)	

Note: Robust standard errors are in the parenthesis. *, ** and *** denote, respectively, significant at the 0.1, 0.05, and 0.01 significance levels.

The marginal effect estimate of behavioral intention indicates stronger behavioral intention results in an approximately 12% increase in the young generation's actual usage of mobile payment. Among all the determinants of actual usage, the marginal effect of behavioral intention is found to be the most sizable. One of the main themes of the UTAUT is the strong structural relationship between behavioral intention and actual behavior. The findings in this study provide evidence to the validity of the extended UTAUT model in explaining generation Y's and generation Z's mobile payment usage.

The marginal effect estimate of facilitating conditions depicting the impact of infrastructure support exhibits a positive influence on the young generation's mobile pay usage. The effect, however, is not significant. In comparison, the positive influence of financial incentives offered by the mobile payment companies, which include cash back rewards, bonus points and gifts with targeted amounts of purchase, is about the same size as the facilitating conditions but statistically significant. This result has important implications for increasing the adoption rate of mobile payment since the young generation is the largest group of potential users of this new payment mode. The bonus/rewards offered by credit card companies were found to induce the shift to its use [62]. Some authors found a similar positive effect of cash back and discounts on Alipay users of various ages [19] and for the US young adult's NFC mobile payment adoption [20]. It is worth noting that while the study of the impact of financial incentives on NFC mobile payment adoption [20] was the first attempt with a focus on the young generation, this study is in turn one of the handful studies providing empirical evidence to delineate generation Y and Z's adoption of mobile payment. The findings in this study provide solid evidence to support the view that the reward of cash/bonus may be one of the cost-efficient strategies to promote the use of mobile payment among young adults, which, thus, highlight the effect of financial incentives in the growing Asia-Pacific market.

According to the results in Table 7, the two constructs capturing financial/privacy risks and psychological/social risks are found to significantly dampen the young generation's probability of mobile payment adoption. The result, therefore, suggests the risk-averse preferences of Taiwan's young generation. Some authors [8] pointed out that despite the vast interests in examining the negative influence of perceived risk on the prevalence of

mobile payment, there were limited attentions on the sources of risks perceived by the consumers. There are four sources of perceived risks considered in the present study: financial, privacy, psychological, and social risks. The estimates of marginal effect indicate a stronger effect of the first two facets on the probability of mobile payment use. According to the "Mobile Payment Consumer Survey and Analysis" by the Institute of Industrial Information (MIC) of the Council of Information Technology in 2017, the top two factors affecting Taiwanese mobile payment use are security concern (83.3%) and discount offered by the mobile payment firms (49.5%). The findings of a stronger effect of financial/privacy risk in this study concur with the dominant importance of perceived risks revealed by the nationally representative survey. Accordingly, the result further highlights the need for a more secure mobile payment network and policy in targeting the potential users of mobile payment in the future.

Celebrity endorsement is found to contribute positively to the young generation's actual usage of mobile payment. Nonetheless, the effect is not statistically significant. Some authors [63] concluded that the effect of celebrity endorsement depends largely on the nature of the product. Some previous studies of Indian teenagers [63] concluded that in the case of products or services that require high involvement, celebrity endorsement may not create favorable results [63]. The result in this study concurs with that conclusion.

The gender moderating effect is estimated by including the interaction terms as the independent variables in the probit model. Models 2–6 in Tables 6 and 7 list the coefficient and marginal effect estimates from the probit model considering the moderation effect of gender. None of the interaction terms are statistically significant in Tables 6 and 7, indicating that there does not exist a significant difference between the relationships proposed for different gender groups. The result of insignificant gender moderation effect may be due to the fact that there is a very mild difference in the mobile payment usage by gender exists in Taiwan. In a survey of internet usage in Taiwan, 24.6% of males and 25.5% of females reported the use of mobile payment [64]. There is a broad agreement that gender is one dimension explaining the differences in the acceptance or adoption of internet-related products or services based on TAM (technology acceptance model) or UTAUT. The finding of insignificant gender moderation effect does not concur with the moderating role of gender featured in previous studies of mobile payments [24,25]. However, our finding is consistent with some previous studies of gender differences in computer and/or internet usage in Taiwan. It was found in previous research that an increase in age contributes significantly to the gender differences in the ICTs, which in turn suggests a much smaller gender gap among the young generations [65].

In comparison, the mean scores of perceived risks (Table 8) reveal that among the four risk facets, the young generation is more concerned with financial/privacy risks. A further comparison of the driving and deterring factors of generation Y's and generation Z's mobile payment use yield some interesting results. According to the group statistics of perceived risks by the two young generations (Table 8), the statistics indicate that on average, generation Z's concern of overall risk is stronger than that of generation Y. Moreover, it is interesting to find the presence of significant mean differences in psychological and social risks between generations Y and Z. On average, generation Z is found to be characterized with higher degree of anxiety, insecurity, and possible rejection associated with the usage of mobile payment.

Table 8. Mean scores of perceived risks.

Variable	Full Sample		Generation Y		Generation Z		Difference	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.		
Financial/Privacy risk								
PR1	3.9186	1.066	3.8919	1.096	4.0000	0.972	−0.1081	
PR2	3.8237	1.132	3.8243	1.122	3.8219	1.171	0.0024	
PR3	3.9695	1.083	3.9414	1.093	4.0548	1.053	−0.1134	
PR4	3.9763	1.061	3.9505	1.073	4.0548	1.026	−0.1043	
Mean	3.9220	0.980	3.9020	1.001	3.9829	0.919	−0.0809	
Psychological/Social risk								
PR5	2.3695	1.073	2.2748	1.038	2.6575	1.133	−0.3827	***
PR6	2.5525	1.199	2.4414	1.139	2.8904	1.318	−0.4490	***
PR7	3.0203	1.240	2.9324	1.215	3.2877	1.285	−0.3553	***
Mean	2.6475	0.980	2.5496	0.945	2.9452	1.030	−0.3956	***
Overall risk	3.2847	0.848	3.2258	0.841	3.4640	0.851	−0.2382	**
Obs.	295		222		73			

Note: Robust standard errors are in the parenthesis. *, ** and *** denote, respectively, significant at the 0.1, 0.05, and 0.01 significance levels.

6. Conclusions

The aim of the present research is to examine the factors affecting young generations' behavioral intention and observed the adoption of mobile payment services in Taiwan. Furthermore, whether gender moderates the relationships between different constructs and behavioral intention or actual usage is tested through both path analysis and econometric modeling. Based on 295 samples aged from 16 to 38 collected from an online questionnaire, results from the structural equation analysis under the UTAUT framework reveal that social influence has a significantly positive effect on the young generation's behavioral intention to adopt mobile payment. This result is consistent with previous findings [21,35,42]. The empirical result also suggests that the influence of peers, celebrities, and role models uniquely contributes to the prevalence of mobile payment usage among the young generation. It is also found that the stronger the behavioral intention, the more likely young generations will adopt the services. One of the main themes of the UTAUT is the strong structural relationship between behavioral intention and actual behavior. The findings in this study provide evidence to the validity of the extended UTAUT model in explaining generation Y's and generation Z's mobile payment usage. Past studies on the drivers/barriers of mobile payment usage have been inconclusive. The findings in this study confirm that the reward of cash/bonus may be one of the efficient strategies to promote the use of mobile payment among young adults in Taiwan. The empirical evidence in this study provides a significant complement to the delineation of the effect of financial incentives on the actual use of mobile payment since there exist cultural differences between the young generations in the Western and Eastern societies.

The risk-averse preferences of Taiwan's young generation are revealed in this study since different types of perceived risks significantly lowers the young generation's probability to adopt mobile payment. The result highlights that a more secure mobile payment network and policy should be implemented. Finally, gender is found to neither moderate behavioral intention nor the actual usage. This finding, although being contrary to some previous studies, which are not focused on the young generation, reflects that there exists a relatively small gender gap in adopting ICTs as well as mobile payment services among the young generations in Taiwan. This study has advanced our understanding of the uniqueness of young consumers' behavior in adopting new technological products such as mobile payment services. It is worth to mention that in the study of the usage of mobile banking in Singapore [27], the insignificant moderation effect of risk on mobile banking adoption was attributed to the view of equal relevance of risk held by the two gender groups. Therefore,

users' perception of risk is one important aspect that needs to be addressed in order to deepen the adoption of mobile payment in the future.

The scope of this study is limited in terms of data representativeness. Specifically, as the survey was conducted online, the respondents are more concentrated in the student population. In addition, family background plays a major role in affecting students' habits and tendency to use mobile payment since many of them rely on families' monetary support. Therefore, the respondents' household income is suggested to be taken into consideration. A promising avenue for further research is to explore how the drivers/barriers vary with respect to different subpopulations. The comparison of the moderation role of gender among different age cohorts also deserves further examination. It was indicated that the effect of celebrity endorsement can be addressed from various angles such as gender/personality congruity among users and endorsers [66], celebrity persuasion, and brand-to-celebrity [67]. In this study, the gender of the endorsers, the public image, and the personality of the endorsers were not taken into consideration. Since the endorsement of celebrity is found to be a crucial element of social influence in the present study, further research providing a more comprehensive delineation of the effect of celebrity endorsement may advance the understanding of the targeted potential consumers. Finally, the application of neuroscience to investigate the consumer's neural response to risks has gained attention recently [15,16]. This line of research highlights the need for further research into the effects of psychological concerns, risks, and trust/distrust in explaining the behavioral intention and usage of mobile payment.

Appendix A

Table A1. Measurement Items.

Latent Constructs	Description	Loadings
Performance Expectancy (PE)		
PE1	I think mobile payments complete the transaction faster.	0.693
PE2	I think using mobile payment is more convenient without the need to bring cash or the credit card.	0.838
PE3	I think using mobile payment comprehensively improve transactional efficiency.	0.855
PE4	I feel more pleasant using mobile payments than traditional payments.	0.951
Effort Expectancy (EE)		
EE1	I think the function of mobile payment is easy to understand.	0.956
EE2	I think using the mobile payment interface is quite simple.	0.837
EE3	I think there is no obstacle for me to use mobile payment.	0.762
EE4	I can pick up the mobile payment quickly.	0.913
Social Influence (SI)		
SI1	My family and friends affect my intention to use mobile payment.	0.594
SI2	The celebrity (for example, my favorite idols) endorsements affect my intention to use mobile.	0.829
SI3	I will follow suit to use mobile payments.	0.657
SI4	Using mobile payment will improve my self-esteem.	0.923
Facilitation Conditions (FC)		
FC2	Even if no one taught me how to use mobile payment, I am still able to do so.	0.864
FC3	There are online resources to show me how to use mobile payment.	0.861
Promotional Activities (PA)		
PA1	The monthly cashback rebates provided by mobile payment are attractive to me.	0.871
PA2	The cashback reward points (discounts for the current consumption) provided by mobile payment and the merchants are attractive to me.	0.821
PA3	The freebies provided by mobile payment and the merchants are attractive to me.	0.718
Financial and Privacy Risks (FR)		
PR1	When using mobile payments, I worry that personal information may be used illegally.	0.854
PR2	When using mobile payments, I worry that personal information may be tampered with through the Internet.	0.834
PR3	When using mobile payments, I worry about financial information leakages.	0.860
PR4	When using mobile payments, I worry that there will be wrong deductions or double deductions.	0.728
Psychological and Social Risks (SR)		
PR5	Using mobile payments makes me anxious.	0.683
PR6	Using mobile payments makes me insecure.	0.736
PR7	When using mobile payments, I worry that I would be rejected by the stores.	0.626
Behavioral Intention (BI)		
BI1	I intend to use mobile payments.	0.96
BI2	I would recommend my relatives and friends to use mobile payments.	0.955

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