Research Paper

# Adoption and Use of Payments in Thailand: The Role of Demographic Attributes

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## Abstract

This paper empirically examines the role of demographic attributes on the adoption and use of payment instruments in Thailand. I estimate the model of payment adoption and usage, using the data from the 2017 Thailand's Payment Survey. The estimation results suggest that demographic attributes, in particular, age, level of education, and income, are the important determinants towards the instruments holding and usage of Thai consumers. In addition, the abilities to access financial services and to possess an innovative device like smartphone play major roles in predicting the consumer's decision in the adoption stage. Having adopted more number of payment instruments can possibly lead to the lower use of cash for payment.

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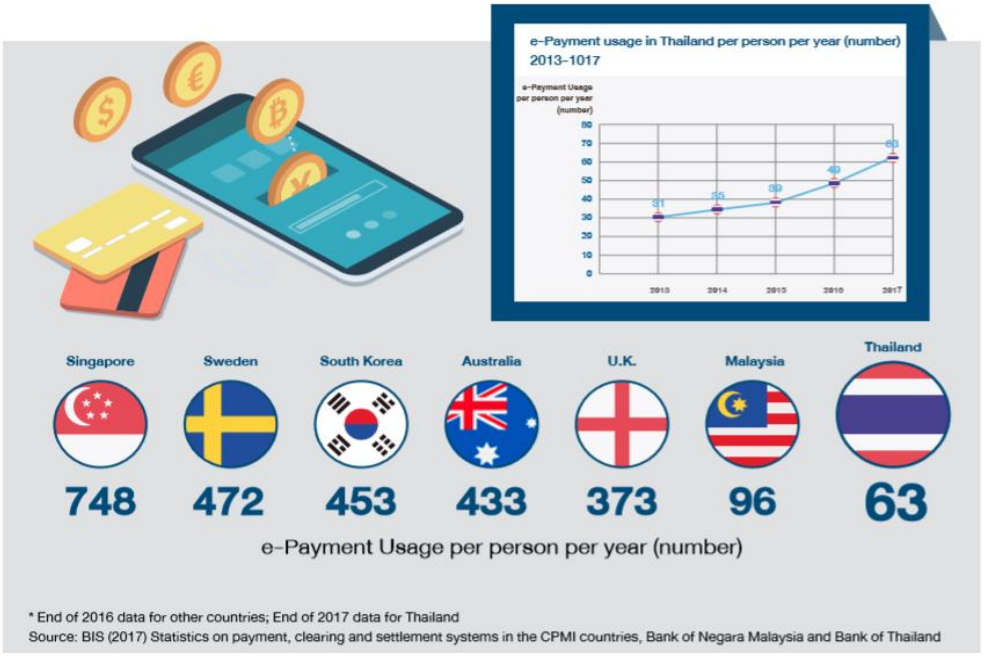
# 1. Introduction

In the world that people do not use a barter system for exchange goods and services, payment instrument has become an important tool for making payment transactions among people and businesses in society. Although traditional paper money is still a dominant payment method in several countries, the rapid development of technology and the disruptive coming of Financial Technology have resulted in the introduction of new innovative payment instruments together with the transformation of consumer's payment choices from paper-based to electronic form.

In Thailand, in consequence of the payment infrastructure improvements driven by the central bank and strong collaboration among stakeholders, Thai consumers are able to gently shift their payment patterns to utilize more advanced payment instruments including debit card, credit card, e-Money, internet banking, and mobile banking. According to the Payment Systems Report 2017, e-Payment usage of Thai people rose significantly from 31 times in 2013 to 63 times in 2017. Nevertheless, this annual number of transactions per person is still far below those of the advanced economies as shown in Figure 1.

**Figure 1:** Number of e-Payment usage in Thailand and some developed countries




*Source:* Payment Systems Report 2017, Bank of Thailand.

To understand this phenomenon, it would be better to investigate factors from both the demand and supply sides. However, due to some constraints on the supply-side data collection such as the acceptance of merchants towards payment instruments or measurement of intrinsic cost of payment adoption and use, demand-side exogenous variables are used more frequently in order to examine the change in the payment behavior of consumers. There is a pool of researches provided evidences that individual's

demography is one of the key factors influencing their payment behaviors (See Kennickell and Kwast (1997); Carow and Staten (1999); Stavins (2001); Kolodinsky et al. (2004); and Borzekowski, Kiser, and Ahmed (2008)).

This paper attempts to determine the effect of demographic characteristics on the adoption and use of payment instruments in Thailand, as the results can portray better understanding on the drivers of payment behavior for relevant authorities prior to initiating payment policies. To estimate the relationship, the paper employs the Heckman selection model applied by Schuh and Stavins (2010). Based on a micro-level data from the Survey on Perception and Consumer Behavior towards the Use of e-Payment in Thailand in 2017 (hereafter "2017 Thailand's Payment Survey"), there are six payment instruments, namely, cash, ATM card, debit card, credit card, internet banking, and mobile banking, used in the model.

The estimation results indicate that the adoption of non-cash payment instruments in Thailand potentially rises with the demographic attributes, including the level of education, income, working conditions, together with the smartphone and bank account possessions while declining with age. At the same time, the use of payment instruments are also found to be affected by some of the abovementioned characteristics, but with lower statistical significances.

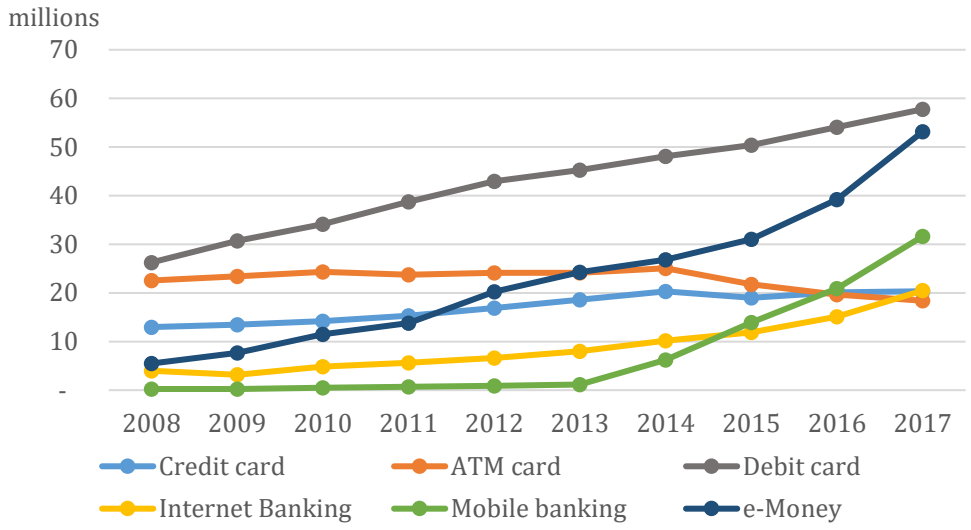
The body of this paper is structured as follows. Section 2 summarizes the current adoption and use of payment instruments in Thailand and reviews the existing literature pertaining to demographic attributes and consumer's payment behavior. Section 3 discusses the survey data and methodology employed in this paper. Section 4 provides estimation results and illustrates the impact of demographic attributes on the adoption and use of payment instruments in Thailand. Finally, Section 5 summarizes the conclusion and policy implication.

## 2. Background

### *2.1. Overview of payment instruments adoption and use in Thailand*

In Thailand, retail payments have developed significantly in recent years due to the technological advancement in the financial sector. New innovative payment methods have been promoted to support the consumers. Although the majority of Thai people and businesses still use cash for their transactions, they are progressively familiar with electronic payment instruments overtime. As shown in Figure 2, there is a significant growth in the number of debit card. On the contrary, ATM-only card adoption has declined since 2014 after having a flat trend for seven years, probably because some banks did not offer ATM-only card to their consumers, instead, they preferred to propose debit card with functions same as ATM card. In addition, consumer adoption of innovative payment instruments including electronic money (e-Money), internet banking, and mobile banking also rose steadily during this ten-year period.

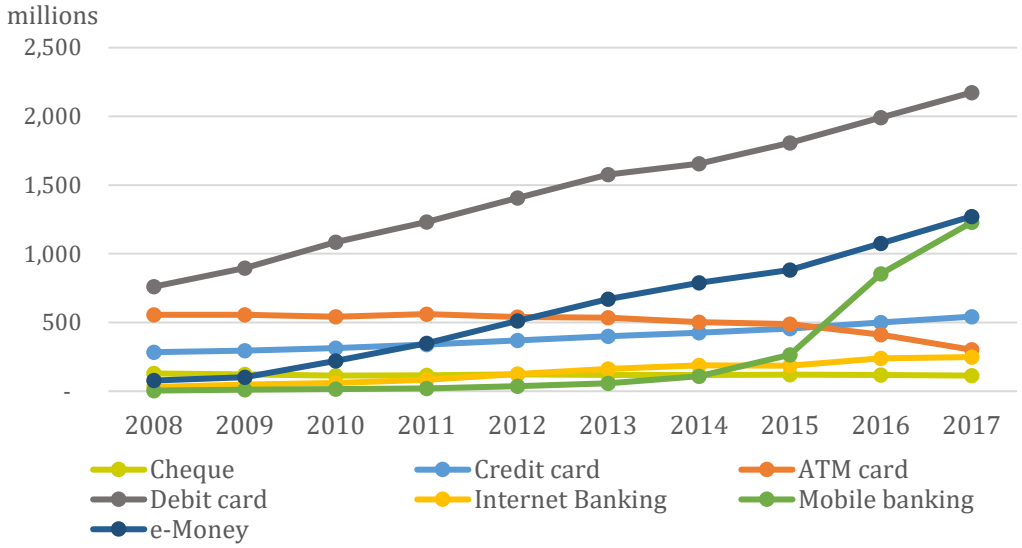
**Figure 2:** Number of payment Instruments adopted by Thai consumers (2008–2017)




*Source:* Bank of Thailand.

Regarding the use of non-cash payment instruments, Figure 3 presents the total volume of transactions made by seven non-cash payment instruments between 2008 and 2017. Debit card recorded as the most regularly use; nevertheless, most transactions were for cash withdrawal purpose. E-Money usage has also grown steadily, possibly because there are more service providers entering the markets to offer services that fit with the consumers' lifestyles. Furthermore, due to the popularity of smartphone usage and variety of services through mobile applications, since 2015, it can be seen that the volume of mobile banking transactions has jumped dramatically and become one of the most important payment choices in Thailand.

**Figure 3:** Total volume of transactions made by non-cash payment instruments (2008-2017) – Million Transactions




*Source:* Bank of Thailand.

*2.2. Literature Review*

Over the past few decades, the relationship between demographic attributes and consumer payment behaviors has been explored by researchers in both academia and central banks. Overtime, the existing literature suggested that socio-demographic characteristics have played important roles in the consumers' decisions towards the payment instrument adoption and its usage.

In the early stage, numerous studies related to the payment behavior seemed to be conducted based on U.S. information. Samples from the triennial Survey of Consumer Finances (SCF) were usually applied. Similarly, the U.S. central bankers including Kennickell and Kwast (1997), Stavins (2001) and Klee (2006) showed that there was the link between individuals' characters and the use of payment methods. Using data in 1994, Kennickell and Kwast (1997) concluded that an individual's financial assets and education positively encouraged the use of electronic instruments at financial institutions, but age and income had varied effects. However, Stavins (2001) argued that consumer's net worth contrarily affected the use of some electronic payments and age had a positive impact on all payment instruments use when she applied the 1995 SCF. To observe a trend of non-cash payment instruments ownership and usage by examined more than one period of time (1995, 1998, and 2001), Klee (2006) illustrated that the U.S. households held and used more payment instruments (multihoming behavior) overtime. Furthermore, the use of electronic payments like a debit card and direct payment rose significantly with income and education but dropped among elderly cohorts. Kim et al. (2005) applied the 2001 SCF and expressed that not only individual's demographic attributes significantly determined the probability of internet banking adoption, but other factors such as experiences towards other banking innovations and computer usage also had impacts.

Apart from the SCF, the subsequent literature that used different sources of data still exhibited consistent results. Schuh and Stavins (2010 and 2013) employed the new survey, the Survey of Consumer Payment Choice (SCPC), and included payment attributes such as cost, convenience, safety, and privacy into the model. They argued that demographic attributes were important determinants on the adoption and use of payment instruments; nevertheless, the use of payment instruments was better explained by the payment characteristics than the demographic characteristics (see also Connelly and Stavins (2015)). Borzekowski and Kiser (2008) came with data from the 2004 Michigan Surveys of Consumers and provided evidence that age, education, and gender could substantially affect the use of payment instruments in the market. Using data from the National Financial Capability Study (NFCS) conducted by the FINRA Investor Education Foundation in 2012, Garrett et al. (2014) also suggested that older people are less likely to adopt mobile payment technology.

In addition, the papers that relied on samples collected outside the U.S. also showed a similar relationship between demography and consumers' decision on the use of payment instruments. Jonker (2007) studied consumer payment behavior towards the use of cash, debit card, e-purse, and credit card in the Netherlands and found that gender,

age, income, academic level, and residential location were the essential effects (see also Arango et al. (2015) with data in Canada). Bagnall et al. (2016) studied the use of cash payment methods across seven advanced economic countries by using data from each country's payment diary survey. Regardless of the countries, interestingly, they found similar results that the demographic characteristics including education and income negatively affected the cash usage while age showed the same direction.

## 3. Data Descriptions and Models

### *3.1. Data*

The data used in this paper is from the 2017 Thailand's Payment Survey administered by the Bank of Thailand in collaboration with the Institute for Population and Social Research, Mahidol University. A total of 10,805 respondents with the age between 18 and 89 years old were randomly selected from every province throughout the country for a face-to-face interview.

Basic socio-demographic characteristics of respondents such as age, educational level, income, occupation, and so forth together with their perception and knowledge on the payment methods were contained in the data. Also, the survey asked some detailed information about the adoption and use of payment instruments, including one paper-based instrument: cash; four card-based payment instruments: ATM card, debit card, credit card, and e-Money card; two electronic banking (e-banking) payment instruments: internet banking and mobile banking; and one network-based instrument: electronic wallet (e-Wallet). Nevertheless, in the question regarding the number of payment transactions made by each payment method on a monthly basis, transactions of e-Money card and e-Wallet were not available. In this paper, therefore, six alternative payment instruments; cash, ATM card, debit card, credit card, internet banking, and mobile banking, are used to estimate in the model.

One advantage of this survey data is that it also contained information regarding the financial access and ownership of the mobile device of each consumer. Having access to the bank account, consumers have the potential to adopt the instruments that link with the bank account while consumers who have smartphones possibly decide to adopt new technological payment instruments. So, adding these two individual-level factors in the adoption model may provide an intuitive prediction beyond previous studies.

### *3.2. Summary statistics*

Table 1 illustrates the percentage of adoption of five payment instruments by Thai consumers. Overall, about 62% of respondents reported possession of an ATM card while less than 10% of Thai consumers answered that they have a debit card or a credit card (9% and 5% respectively). Concerning the new electronic method of payment, the adoption rate of internet banking was approximately 14% and around one-fifth of the sample have adopted mobile banking.

**Table 1**
Adoption of payment instruments by Thai consumers (percent of consumers)

| | | ATM | DBC | CDC | iBK | mBK |
|---|---|---|---|---|---|---|
| Total | | 61.67 | 9.03 | 5.40 | 14.08 | 20.14 |
| Age | 18-39 | 72.06 | 13.99 | 6.96 | 11.17 | 23.38 |
| | 40-60 | 62.34 | 7.23 | 5.59 | 11.80 | 14.59 |
| | 61-89 | 36.92 | 2.29 | 1.46 | 26.00 | 26.16 |
| Education | Junior high school or lower | 50.56 | 3.78 | 1.75 | 15.86 | 17.95 |
| | High School | 74.07 | 10.76 | 4.56 | 7.47 | 15.04 |
| | Diploma or higher | 83.47 | 23.57 | 17.70 | 15.60 | 32.42 |
| Marital Status | Single | 65.71 | 13.11 | 6.27 | 13.72 | 24.36 |
| | Married | 61.47 | 7.87 | 5.37 | 13.39 | 18.03 |
| | Widowed | 43.98 | 2.58 | 0.72 | 24.79 | 25.36 |
| | Divorced | 70.15 | 11.44 | 9.45 | 7.96 | 14.93 |
| | Separated | 61.74 | 6.96 | 6.09 | 10.43 | 15.65 |
| Gender | Female | 62.45 | 9.51 | 5.71 | 15.12 | 21.76 |
| | Male | 60.81 | 8.51 | 5.05 | 12.94 | 18.38 |
| Region | Central | 60.30 | 14.88 | 10.82 | 14.79 | 21.08 |
| | Northern | 62.79 | 6.59 | 3.65 | 10.07 | 17.41 |
| | Northeastern | 61.87 | 8.55 | 3.72 | 14.99 | 17.53 |
| | Eastern | 67.54 | 9.11 | 6.10 | 14.96 | 24.47 |
| | Western | 58.02 | 8.73 | 4.63 | 13.19 | 20.59 |
| | Southern | 59.18 | 9.08 | 6.43 | 17.14 | 23.57 |
| Urban Area | Urban | 63.46 | 9.85 | 6.33 | 14.34 | 21.05 |
| | Rural | 59.83 | 8.20 | 4.45 | 13.81 | 19.22 |
| Financial Status | < 3,500 THB | 46.80 | 4.23 | 1.07 | 18.81 | 21.34 |
| | 3,501-10,000 THB | 60.80 | 6.41 | 2.49 | 11.26 | 15.25 |
| | 10,001-30,000 THB | 73.51 | 15.05 | 9.79 | 12.95 | 24.21 |
| | 30,001-100,000 THB | 71.06 | 13.50 | 13.50 | 13.70 | 21.47 |
| | > 100,000 THB | 85.64 | 23.08 | 23.08 | 14.36 | 30.25 |
| Occupation | Employed | 87.89 | 23.5 | 19.59 | 12.83 | 29.57 |
| | Agricultural Sector | 56.31 | 3.74 | 2.19 | 13.48 | 15.35 |
| | Retired | 43.47 | 5.38 | 3.33 | 23.48 | 26.13 |
| | Self-employed | 68.33 | 15.01 | 7.95 | 13.92 | 23.84 |
| | Unemployed | 65.02 | 9.24 | 3.63 | 15.18 | 24.09 |
| | Student | 66.01 | 11.21 | 1.96 | 10.32 | 21.35 |

*Source:* 2017 Thailand's Payment Survey
*Note:* ATM – ATM card; DBC – debit card; CDC – credit card; iBK – internet banking; mBK – mobile banking.

**Table 2**
Use of payment instruments by adopters (percent share)

| | | Cash | ATM | DBC | CDC | iBK | mBK |
|---|---|---|---|---|---|---|---|
| Total | | 92.94 | 7.30 | 2.05 | 3.57 | 2.16 | 5.16 |
| Age | 18-39 | 88.96 | 8.65 | 2.27 | 3.14 | 4.99 | 8.52 |
| | 40-60 | 94.32 | 7.02 | 1.63 | 3.64 | 1.42 | 3.49 |
| | 61-89 | 98.75 | 2.44 | 2.29 | 7.45 | 0.06 | 1.78 |
| Education | Junior high school or lower | 96.59 | 5.26 | 0.74 | 4.08 | 3.61 | 1.77 |
| | High School | 90.39 | 9.54 | 1.63 | 2.49 | 3.69 | 7.41 |
| | Diploma or higher | 84.40 | 9.05 | 2.89 | 3.74 | 6.81 | 9.65 |
| Marital Status | Single | 90.20 | 8.12 | 2.07 | 3.79 | 4.11 | 7.81 |
| | Married | 93.59 | 7.23 | 2.05 | 3.32 | 1.65 | 4.16 |
| | Widowed | 98.08 | 3.82 | 1.50 | 5.20 | 0.05 | 0.84 |
| | Divorced | 92.90 | 6.40 | 2.89 | 4.18 | 2.56 | 5.73 |
| | Separated | 95.00 | 5.54 | 0.58 | 7.69 | 0.00 | 1.95 |
| Gender | Female | 92.60 | 7.24 | 1.86 | 2.94 | 2.33 | 5.32 |
| | Male | 93.30 | 7.25 | 2.30 | 4.35 | 1.94 | 4.96 |
| Region | Central | 90.64 | 8.13 | 3.81 | 4.65 | 3.01 | 6.22 |
| | Northern | 95.05 | 5.69 | 1.45 | 2.84 | 2.00 | 4.89 |
| | Northeastern | 95.61 | 4.71 | 1.10 | 2.92 | 1.51 | 2.48 |
| | Eastern | 92.00 | 6.27 | 1.85 | 3.36 | 2.75 | 7.83 |
| | Western | 91.04 | 9.64 | 1.43 | 4.18 | 2.11 | 7.96 |
| | Southern | 89.57 | 12.24 | 2.50 | 3.32 | 2.28 | 4.43 |
| Urban Area | Urban | 91.84 | 8.05 | 2.38 | 4.08 | 2.70 | 5.70 |
| | Rural | 94.04 | 6.49 | 1.65 | 2.84 | 1.58 | 4.56 |
| Financial Status | < 3,500 THB | 96.67 | 5.10 | 0.92 | 4.29 | 0.44 | 1.68 |
| | 3,501-10,000 THB | 94.79 | 6.15 | 0.93 | 2.12 | 0.86 | 3.24 |
| | 10,001-30,000 THB | 89.88 | 7.84 | 2.35 | 3.41 | 4.11 | 7.88 |
| | 30,001-100,000 THB | 86.36 | 11.48 | 3.85 | 5.20 | 5.53 | 9.88 |
| | > 100,000 THB | 80.06 | 16.02 | 2.66 | 2.39 | 11.08 | 9.94 |
| Occupation | Employed | 85.64 | 9.24 | 2.48 | 3.29 | 7.03 | 8.21 |
| | Agricultural Sector | 96.44 | 5.31 | 0.42 | 3.61 | 0.57 | 1.61 |
| | Retired | 96.50 | 5.31 | 2.54 | 3.97 | 0.74 | 1.52 |
| | Self-employed | 88.64 | 9.44 | 2.42 | 3.85 | 4.15 | 9.71 |
| | Unemployed | 89.92 | 8.70 | 3.85 | 3.81 | 2.94 | 7.05 |
| | Student | 89.76 | 9.24 | 1.67 | 1.74 | 2.66 | 6.32 |

*Source:* 2017 Thailand's Payment Survey

When breaking down by demographic attributes, adoption rates of most of the payment instruments seem to have relationships with several demographic variables, in particular, age, education, financial status, degree of urbanization, and occupation. Card-based instruments tend to be increasingly adopted by cardholders who are young, more educated, have higher income, and being employed. Women in the sample reported a bit

higher holding rates of all five payment instruments than men, but it cannot be clearly seen a correlation with marital status or geographical region. Besides, respondents who live in an urban area have generally adopted five payment instruments more than those in the upcountry.

In the case of the usage, Table 2 presents the use of each payment instrument conditional on the adoption as a percent share of all monthly payment transactions. As mentioned in Schuh and Stavins (2010), an individual share is the ratio of the number of transactions made by each payment instrument over the total number of transactions made by all payment instruments in a typical month. This share is then averaged across all adopters of each payment instrument. The summation in each row is not equal to 100 because the only share among adopters is provided.

In general, cash is aggressively used for payments since almost 93% of transactions was made by cash. ATM card ranks as a second popular payment method used among Thai adopters, with about 7% of total transactions. Despite the least rate of adoption of a credit card, interestingly, the use of this method was higher than that of a debit card and internet banking, with approximately 3.5% to 2% shares of payment used.

Consumer choices on the use of payment instruments are also correlated with a range of individual demographic characteristics. The use of an ATM card and new technological payment methods, like internet banking and mobile banking, is growing with better educational level, financial status, and declining in age. In contrast, cash is used more by those who are older, obtain lower education, earn lower income, and live in a rural area. Credit card use is rising in age while debit card use is higher for more educated people, but randomly affected by income, marital status, geographical region, and occupation. Men reported the higher share of payment use than women for most of the instruments excluding two online banking. The urban area of residence is only one variable that positively impacts the use of all six instruments.

### *3.3. The Model*

This paper is aimed at studying the effect of demographic attributes on the adoption and use of payment instruments in Thailand. The model for estimation here is based on Schuh and Stavins (2010), who applied the Heckman two-step selection model (known as "Heckit") in the payment literature. With this technique, the adoption and the use models are estimated, simultaneously.

- Stage1: Payment adoption

In the first stage, a probit regression model for each payment method is used to measure the probability of payment instruments adoption. The dependent variable is a binary variable, taking a value equal to 0 or 1 depending on the holding of payment instruments:

$$A_{ij} \equiv \begin{cases} 1, & \text{if a respondent } i \text{ holds a payment instrument } j, \\ 0, & \text{otherwise,} \end{cases}$$

where $j \in$ {ATM card, debit card, credit card, internet banking, and mobile banking}. Note that the regression of cash is not estimated in this stage, as cash is generally adopted by all respondents.

The explanatory variables comprise a range of demographic variables including age, education, marital status, regions of residence, and urban area, together with financial variables including financial status, and working status of respondent *i*. In addition, variables related to a smartphone possession and a bank account ownership are also added into a model. The summary of regression variables definition and their classification are presented in Table A1 in the appendix. The selection model of payment instrument adoption specification employed here as:

$$\begin{aligned}\Pr(A_{ij}=1) = \Phi\,(&\beta_0 + \beta_1 age_i + \beta_2 educ_i + \beta_3 marital_i + \beta_4 female_i \\ &+\beta_5 region_i + \beta_6 urban_i + \beta_7 financial_i + \beta_8 occu_i \\ &+\beta_9 smartphone_i + \beta_{10} bankacc_i) + \varepsilon_{ij}^{A}. \end{aligned} \quad (1)$$

- Stage2: Payment use

In step two, the linear regression model (OLS) is employed for the payment use estimation. The use of payment instruments, a dependent variable, is measured by dividing the number of monthly payment transactions of each *j* instrument by entire payment transactions made by consumer *i* with all instruments each consumer own,

$$U_{ij} \equiv \frac{n_{ij}}{N_i},$$

where $j \in$ {cash, ATM card, debit card, credit card, internet banking, and mobile banking}.

A similar set of independent variables in the adoption stage excluding smartphone and bank account possessions together with a cluster of dummy variables specified a number of other payment instruments adopted by consumer *i* are included in the regression model. Since the use of payment instruments is based on the prior adoption of those instruments and this may lead to the problem of sample selection bias, to follow the Heckit procedure; thus, the inverse Mills ratio (IMR) computed in the adoption stage is also added for the purpose of controlling concurrent decisions of consumers towards those two stages.

The selection model of the use of payment instruments is determined below:

$$\begin{aligned}U_{ij} = &\beta_0 + \beta_1 age_i + \beta_2 educ_i + \beta_3 marital_i + \beta_4 female_i + \beta_5 region_i \\ &+\beta_6 urban_i + \beta_7 financial_i + \beta_8 occu_i + \beta_9 other0_i + \beta_{10} other1_i \\ &+\beta_{11} other2_i + \beta_{12} other3_i + \beta_{13} other4_i + \beta_{14} IMR_{ij} + \varepsilon_{ij}^{U}. \end{aligned} \quad (2)$$

# 4. Estimation Results

*4.1. Adoption results*

Table 3 summarizes the first-stage probit regression results from the adoption selection model (1). The first row of the table specifies the dependent variables in the model. The first one, from the left, is the clustered non-cash payment instrument while the decomposition of payment instruments is shown in the next five columns.

Overall, the effects of demographic attributes and financial variables in determining the adoption of non-cash payment instruments are consistent with previous empirical studies. Consumers who are young, have high educational level, being female, earn higher income and have jobs have more tendency to adopt non-cash payment instruments. In addition to prior researches, possession of smartphone and bank account also show a positive influence on the adoption.

When paying more attention to each payment instrument, age profile is negatively significant in the adoption of ATM card, debit card, and mobile banking: younger consumers are more likely to adopt those three instruments. Credit card and internet banking, on the contrary, are more likely to be adopted by older people. Compared to men, Thai women seem to adopt more credit card, internet banking, and mobile banking while there is no significant effect of gender in the adoption of ATM card and debit card. Marital status appears to have a random impact on the adoption of every payment methods.

Education has a very strong impact on the adoption of all five payment instruments. Consumers with a higher academic degree are more likely to be cardholders. However, the effect of education on the adoption of e-banking payment instruments seems to be unclear as the findings show that consumers with high school certificates are less likely to adopt internet banking and mobile banking, but those in the highest education cohort, diploma or higher, indicate more probability.

Another significant determinant affecting the adoption of payments is the geographical region. Compared to the Central, where Bangkok, the capital city, is included, consumers who live in the other five regions of the country are significantly less likely to adopt debit card and credit card. However, those in four regions except Southern are more likely to hold ATM card. For the e-banking instruments, it is marginally seen the effect of the region on the adoption. The results also show that urban consumers hold more ATM card and credit card.

The effect of an individual's financial status is another significant determinant to the adoption of payment instruments. Consumers with lower income are less likely to adopt ATM card, debit card, credit card, and mobile banking than members in the control group, but there is no significant effect of income on the adoption of internet banking. Pertaining to the impact of working status, people who are employed tend to have a higher probability to own every payment instrument referred in this paper.

Smartphone and bank account ownership also show significant effects on the adoption of all payment instruments. For the card-based payment instrument adoptions, positive impacts are found. In the meantime, the results indicate negatively significant impacts on the adoption of internet banking and mobile banking. This may be because consumers have less confidence in the safety of new online-based systems and lack of literacy regarding the use of these kinds of payment instruments which possibly affect the adoption decision.

*4.2. Use results*

The Heckman second-stage OLS regression results from the use model (2) are presented in Table 4. Pertaining to the use of clustered non-cash payment instrument, similar demographic determinants as shown in the first stage; age, education, and income level are still statistically significant. Degree of urbanization also affects the use of the electronic payment method. More remarkably, the findings suggest that the probability of using non-cash payment method seems to decline heavily when people hold cash (87.6%).

While looking through the payment instrument individually, the use results seem to be in accordance with those of the bunched instrument. Older people are more likely to use cash and credit card, whereas the younger generation appears to make payment transactions using ATM card, debit card, and mobile banking.

Education seems to have fewer effects on the use of payment methods compared to that in the adoption stage. Consumers with better educational level do not only use less cash, but they also do make payments by ATM card, debit card, internet banking, and mobile banking, when compared to people with junior high school or lower cohort.

In the case of gender, marital status, and occupation, holding other variables constant, these demographic characteristics seem to have very low effects on the payment use choices of consumers.

Region of residence is statistically significant in the debit card usage: the result shows that debit card is relatively used less in non-Central area, possibly because there are a lower number of Electronic Data Capture (EDC) terminals at point-of-sales in those regions.

Income is another statistically significant determinant towards the use of payment instruments. Cash is used more among consumers with lower income while ATM card and internet banking are used more by the richest cohort.

Apart from the demographic factors, the effect of holding payment instruments on the usage is also estimated. The results seem to be clear only in the case of cash usage. When consumers have more payment instrument choices to use, the share of total transactions made by cash tends to be lower. And this finding is consistent with the expectation specified in the paper of Schuh and Stavins (2013).

**Table 3**
Stage 1: Adoption model - Probit regressions

| | Non-cash | ATM | DBC | CDC | iBK | mBK |
|---|---|---|---|---|---|---|
| **>> Age** *(base group: 18 <= age <=39)* | | | | | | |
| 40 <= age <=60 | -0.050 | -0.076* | -0.112** | 0.155*** | -0.048 | -0.293*** |
| | (0.046) | (0.042) | (0.051) | (0.060) | (0.049) | (0.042) |
| 61 <= age <=89 | -0.158*** | -0.449*** | -0.353*** | -0.049 | 0.331*** | 0.087 |
| | (0.057) | (0.056) | (0.095) | (0.117) | (0.062) | (0.058) |
| **>> Gender** *(base group: Male)* | | | | | | |
| Female | 0.057* | 0.015 | 0.042 | 0.086* | 0.065* | 0.111*** |
| | (0.033) | (0.032) | (0.042) | (0.051) | (0.036) | (0.032) |
| **>> Education** *(base group: Junior high school or lower)* | | | | | | |
| High school | 0.226*** | 0.328*** | 0.258*** | 0.236*** | -0.168*** | -0.102** |
| | (0.048) | (0.045) | (0.058) | (0.075) | (0.057) | (0.048) |
| Diploma or higher | 0.585*** | 0.391*** | 0.615*** | 0.793*** | 0.292*** | 0.390*** |
| | (0.061) | (0.051) | (0.058) | (0.070) | (0.057) | (0.049) |
| **>> Marital status** *(base group: Single)* | | | | | | |
| Married | 0.064 | 0.181*** | -0.053 | 0.053 | -0.153*** | -0.135*** |
| | (0.048) | (0.044) | (0.051) | (0.061) | (0.047) | (0.042) |
| Widowed | 0.177** | 0.218*** | -0.284** | -0.543** | -0.070 | -0.073 |
| | (0.077) | (0.075) | (0.139) | (0.215) | (0.080) | (0.076) |
| Divorced | 0.098 | 0.279** | -0.063 | 0.167 | -0.388** | -0.259** |
| | (0.130) | (0.122) | (0.153) | (0.165) | (0.152) | (0.127) |
| Separated | 0.111 | 0.239 | -0.060 | 0.030 | -0.365* | -0.224 |
| | (0.178) | (0.167) | (0.239) | (0.282) | (0.213) | (0.181) |
| **>> Region** *(base group: Central)* | | | | | | |
| Northern | 0.081 | 0.244*** | -0.436*** | -0.470*** | -0.304*** | -0.049 |
| | (0.064) | (0.059) | (0.073) | (0.085) | (0.068) | (0.060) |
| Northeastern | 0.268*** | 0.278*** | -0.172** | -0.431*** | 0.008 | -0.017 |
| | (0.063) | (0.058) | (0.068) | (0.082) | (0.064) | (0.058) |
| Eastern | 0.142* | 0.380*** | -0.384*** | -0.426*** | -0.029 | 0.119* |
| | (0.073) | (0.068) | (0.079) | (0.090) | (0.072) | (0.065) |
| Western | 0.044 | 0.147** | -0.276*** | -0.454*** | -0.160** | 0.020 |
| | (0.074) | (0.069) | (0.083) | (0.101) | (0.077) | (0.069) |
| Southern | 0.046 | -0.004 | -0.345*** | -0.385*** | 0.097 | 0.145** |
| | (0.065) | (0.060) | (0.073) | (0.083) | (0.065) | (0.060) |
| **>> Urban area** *(base group: Rural)* | | | | | | |
| Urban | 0.019 | 0.072** | -0.008 | 0.107** | 0.031 | 0.009 |
| | (0.033) | (0.031) | (0.042) | (0.051) | (0.036) | (0.032) |

**Table 3** *(Continued)*
Stage 1: Adoption model – Probit regressions

| | Non-cash | ATM | DBC | CDC | iBK | mBK |
|---|---|---|---|---|---|---|
| **>> Income** *(base group: Higher than 100,001 THB)* | | | | | | |
| Lower 3,500 THB | -0.498*** | -0.473*** | -0.414*** | -0.834*** | -0.092 | -0.255** |
| | (0.169) | (0.134) | (0.126) | (0.143) | (0.128) | (0.111) |
| 3,501-10,000 THB | -0.456*** | -0.372*** | -0.390*** | -0.752*** | -0.190 | -0.358*** |
| | (0.167) | (0.132) | (0.116) | (0.124) | (0.125) | (0.107) |
| 10,001-30,000 THB | -0.276* | -0.285** | -0.148 | -0.442*** | -0.075 | -0.178* |
| | (0.168) | (0.131) | (0.112) | (0.116) | (0.123) | (0.105) |
| 30,001-100,000 THB | -0.434** | -0.343** | -0.184 | -0.145 | -0.050 | -0.239** |
| | (0.173) | (0.137) | (0.122) | (0.124) | (0.130) | (0.113) |
| **>> Occupation** *(base group: Employed)* | | | | | | |
| Agricultural sector | -0.703*** | -0.353*** | -0.351*** | -0.376*** | -0.087 | -0.275*** |
| | (0.080) | (0.061) | (0.068) | (0.079) | (0.066) | (0.057) |
| Retired | -0.624*** | -0.415*** | -0.132 | -0.288** | 0.038 | -0.136* |
| | (0.090) | (0.074) | (0.093) | (0.112) | (0.078) | (0.070) |
| Self-employed | -0.581*** | -0.353*** | 0.043 | -0.273*** | 0.040 | -0.052 |
| | (0.082) | (0.061) | (0.059) | (0.067) | (0.063) | (0.054) |
| Unemployed | -0.586*** | -0.181* | -0.215* | -0.399** | -0.055 | -0.160* |
| | (0.118) | (0.103) | (0.129) | (0.173) | (0.112) | (0.097) |
| Student | -0.836*** | -0.399*** | -0.252*** | -0.803*** | -0.221** | -0.326*** |
| | (0.103) | (0.086) | (0.096) | (0.156) | (0.097) | (0.080) |
| Smartphone | 0.300*** | 0.456*** | 0.288*** | 0.264*** | -0.270*** | -0.077* |
| | (0.039) | (0.038) | (0.062) | (0.077) | (0.046) | (0.043) |
| Bankacc | 0.935*** | 1.383*** | 0.813*** | 0.771*** | -0.516*** | -0.326*** |
| | (0.039) | (0.044) | (0.104) | (0.151) | (0.044) | (0.042) |
| Observations | 8603 | 8686 | 8765 | 8766 | 8683 | 8681 |

*Source:* 2017 Thailand's Payment Survey

*Note:* 1) Standard errors in parentheses

2) * p<.10, ** p<.05, *** p<.01

**Table 4**

Stage 2: Use model – OLS regressions

| | Non-cash | Cash | ATM | DBC | CDC | iBK | mBK |
|---|---|---|---|---|---|---|---|
| **>> Age** *(base group: 18 <= age <=39)* | | | | | | | |
| 40 <= age <=60 | -0.039*** | 0.032*** | -0.014*** | -0.008* | 0.007 | -0.008 | -0.035*** |
| | (0.006) | (0.008) | (0.005) | (0.005) | (0.009) | (0.006) | (0.010) |
| 61 <= age <=89 | -0.055*** | 0.031*** | -0.036*** | -0.002 | 0.055*** | -0.004 | -0.021** |
| | (0.009) | (0.012) | (0.009) | (0.012) | (0.019) | (0.008) | (0.011) |
| **>> Gender** *(base group: Male)* | | | | | | | |
| Female | 0.009* | -0.007 | 0.002 | -0.003 | -0.015** | 0.005 | 0.009 |
| | (0.005) | (0.006) | (0.004) | (0.004) | (0.007) | (0.004) | (0.006) |
| **>> Education** *(base group: Junior high school or lower)* | | | | | | | |
| High school | 0.028*** | -0.031*** | 0.022*** | 0.008 | -0.008 | 0.002 | 0.013 |
| | (0.007) | (0.009) | (0.006) | (0.007) | (0.015) | (0.008) | (0.010) |
| Diploma or higher | 0.045*** | -0.033*** | 0.008 | 0.017* | -0.011 | 0.021*** | 0.049*** |
| | (0.008) | (0.010) | (0.007) | (0.010) | (0.027) | (0.008) | (0.011) |
| **>> Marital status** *(base group: Single)* | | | | | | | |
| Married | 0.002 | -0.004 | 0.004 | 0.009* | -0.012 | -0.012** | -0.022*** |
| | (0.006) | (0.009) | (0.006) | (0.004) | (0.008) | (0.005) | (0.008) |
| Widowed | -0.013 | -0.014 | -0.005 | -0.001 | 0.006 | -0.013 | -0.021 |
| | (0.012) | (0.016) | (0.012) | (0.015) | (0.039) | (0.008) | (0.013) |
| Divorced | 0.003 | 0.004 | 0.006 | 0.018 | 0.005 | -0.025 | -0.017 |
| | (0.017) | (0.024) | (0.015) | (0.014) | (0.022) | (0.018) | (0.024) |
| Separated | -0.043* | 0.013 | -0.031 | -0.008 | -0.031 | -0.021 | -0.095*** |
| | (0.025) | (0.034) | (0.023) | (0.024) | (0.040) | (0.025) | (0.034) |
| **>> Region** *(base group: Central)* | | | | | | | |
| Northern | -0.033*** | 0.016 | -0.017** | -0.023*** | -0.016 | -0.005 | -0.015 |
| | (0.009) | (0.012) | (0.008) | (0.008) | (0.017) | (0.008) | (0.010) |
| Northeastern | -0.038*** | 0.020* | -0.022*** | -0.022*** | -0.013 | -0.001 | -0.016 |
| | (0.008) | (0.012) | (0.008) | (0.006) | (0.016) | (0.007) | (0.010) |
| Eastern | -0.024*** | 0.009 | -0.021** | -0.026*** | -0.015 | -0.006 | 0.018 |
| | (0.009) | (0.013) | (0.009) | (0.008) | (0.016) | (0.008) | (0.011) |
| Western | 0.027*** | -0.040*** | 0.026*** | -0.027*** | -0.019 | -0.000 | 0.026** |
| | (0.010) | (0.015) | (0.009) | (0.008) | (0.018) | (0.008) | (0.012) |
| Southern | 0.016* | -0.037*** | 0.034*** | -0.023*** | -0.008 | 0.004 | -0.004 |
| | (0.009) | (0.014) | (0.008) | (0.007) | (0.015) | (0.007) | (0.011) |
| **>> Urban area** *(base group: Rural)* | | | | | | | |
| Urban | 0.015*** | -0.015** | 0.007* | 0.005 | 0.003 | 0.001 | -0.002 |
| | (0.005) | (0.006) | (0.004) | (0.004) | (0.008) | (0.004) | (0.006) |

**Table 4** *(Continued)*
Stage 2: Use model – OLS regressions

| | Non-cash | Cash | ATM | DBC | CDC | iBK | mBK |
|---|---|---|---|---|---|---|---|
| **>> Income** *(base group: Higher than 100k THB)* | | | | | | | |
| Lower 3,500 THB | -0.103*** | 0.105*** | -0.086*** | -0.018 | 0.014 | -0.067*** | -0.045** |
| | (0.016) | (0.023) | (0.014) | (0.012) | (0.033) | (0.014) | (0.018) |
| 3,501-10,000 THB | -0.109*** | 0.107*** | -0.091*** | -0.011 | 0.008 | -0.067*** | -0.050*** |
| | (0.015) | (0.023) | (0.013) | (0.011) | (0.027) | (0.014) | (0.019) |
| 10,001-30,000 THB | -0.094*** | 0.095*** | -0.084*** | -0.007 | 0.015 | -0.056*** | -0.026 |
| | (0.015) | (0.023) | (0.013) | (0.009) | (0.018) | (0.013) | (0.017) |
| 30,001-100,000 THB | -0.029* | 0.047** | -0.037*** | 0.001 | 0.029* | -0.044*** | -0.009 |
| | (0.016) | (0.024) | (0.014) | (0.010) | (0.015) | (0.014) | (0.019) |
| **>> Occupation** *(base group: Employed)* | | | | | | | |
| Agricultural sector | -0.018** | 0.017 | -0.018** | -0.008 | 0.011 | -0.012 | -0.012 |
| | (0.008) | (0.011) | (0.007) | (0.008) | (0.017) | (0.008) | (0.012) |
| Retired | -0.020* | 0.026* | -0.017* | 0.007 | -0.008 | -0.003 | 0.004 |
| | (0.010) | (0.014) | (0.010) | (0.009) | (0.017) | (0.009) | (0.013) |
| Self-employed | 0.015* | -0.003 | 0.004 | 0.002 | 0.008 | -0.007 | 0.031*** |
| | (0.008) | (0.011) | (0.007) | (0.005) | (0.011) | (0.007) | (0.009) |
| Unemployed | 0.014 | -0.015 | -0.005 | 0.011 | 0.014 | -0.003 | 0.021 |
| | (0.014) | (0.020) | (0.013) | (0.012) | (0.028) | (0.012) | (0.017) |
| Student | -0.007 | 0.003 | -0.000 | 0.002 | 0.000 | -0.038*** | -0.032** |
| | (0.012) | (0.016) | (0.010) | (0.009) | (0.034) | (0.011) | (0.015) |
| **>> Adoption of other instruments** *(base group: No other payment instruments adopted)* | | | | | | | |
| One | -0.876*** | -0.030*** | -0.801*** | -0.003 | 0.010 | 0.026 | 0.183*** |
| | (0.025) | (0.008) | (0.028) | (0.059) | (0.023) | (0.030) | (0.025) |
| Two | - | -0.053*** | -0.806*** | 0.011 | -0.022** | -0.020** | -0.020 |
| | - | (0.009) | (0.028) | (0.059) | (0.010) | (0.009) | (0.012) |
| Three | - | -0.162*** | -0.811*** | 0.021 | -0.015 | 0.012 | -0.001 |
| | - | (0.017) | (0.029) | (0.059) | (0.010) | (0.008) | (0.013) |
| Four | - | -0.240*** | -0.822*** | 0.029 | 0.000 | 0.000 | 0.000 |
| | - | (0.029) | (0.032) | (0.059) | (.) | (.) | (.) |
| Inverse mills ratio | -0.049*** | 0.286*** | -0.014 | 0.015 | -0.014 | 0.021** | 0.069** |
| | (0.013) | (0.083) | (0.010) | (0.015) | (0.035) | (0.010) | (0.029) |
| Observations | 6546 | 8424 | 5409 | 859 | 536 | 1204 | 1782 |

*Source:* 2017 Thailand's Payment Survey

*Note:* 1) Standard errors in parentheses

2) * p<.10, ** p<.05, *** p<.01

## 5. Conclusion and Policy Implication

The coming of innovation such as smartphone and tablet leads to a significant disruption in the payment landscape as people are able to make transactions instantly anywhere with more efficiency and lower cost through any devices. Moreover, it can be clearly seen from the findings of this paper that Thai consumers who are younger, have higher academic years and being employed tend to hold and use more non-cash payment instruments, possibly because they are more familiar with this disruptive technologies and have better opportunities to access financial services; however, it does not mean that the older cohorts or those who have lower educational level will not be persuaded to become the electronic payment adopters and/or users in the near future.

One possible solution to promote widespread adoption and use of non-cash payment instruments, especially the new payment choice like mobile banking, among the latter group of consumers is to raise the roles of education and financial literacy. Having more knowledge related to payment instruments and financial services will help consumers to truly understand the nature of the products that already provided in the market as well as the way to use them correctly and efficiently. In addition, the implementation of proper payment policies and regulations is an additional important factor because this can nurture consumers' confidences towards the use of payment instruments.

For further studies, more exogenous variables including payment characteristics, consumer perceptions towards each payment method, or other supply-side factors could be incorporated into the model for more comprehensive analysis. Moreover, since this paper is conducted based on a single year survey, the trends of payment instrument adoption and use are unable to examine. Therefore, it would be better if related authorities such as the Bank of Thailand or the Ministry of Finance will continuously undertake the payment survey periodically and provide publicly to foster more works in this area.

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# Appendix

## Table A1

Description of variables used in estimation (Regressors)

| Variable | Description | Classification |
|---|---|---|
| Age | Age of respondents | 18-39; 40-60; 61-89 |
| Educ | Educational level of respondents | Junior high school or lower; High school; Diploma or higher |
| Marital | Marital status of respondents | Single; Married; Widowed; Divorced; Separated |
| Female | Gender of respondents | Male; Female |
| Region | Residential region of respondents | Central; Northern; Northeastern; Eastern; Western; Southern |
| Urban | Area of residence of respondents | Rural; Urban |
| Financial | Income level of respondents | < 3,500 THB; 3,501-10,000 THB; 10,001-30,000 THB; 30,001-100,000 THB; >100,000 THB |
| Occu | Working status of respondents | Employed; Agricultural sector; Retired; Self-employed; Unemployed; Student |
| Smartphone | Smartphone possession reported by respondents | Yes=1; No=0 |
| Bankacc | Bank account ownership reported by respondents | Yes=1; No=0 |
| Other $n_i$ | A number of other payment instruments adopted by consumer $i$ | $n = 0, 1, \dots, 4$ |

*Source:* 2017 Thailand's Payment Survey