



## **Electronics Payment Decisions of the Indonesian Urban Households: A Nested Logit Analysis of the Effects of the Payment Characteristics**

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### **ABSTRACT**

Despite the dominance of cash method, electronic transactions have emerged in urban Indonesia. Existing studies focused on the macro impact of such transaction in developed countries. Limited attention has been paid to study consumers' preference of payment method at micro level due to attributes of payment method associated with consumer preferences. This study attempts to analyze household's decision associated with preference of electronic payments using data of 936 urban households in six municipalities in Jakarta and East Java, focusing on the effect of payment system characteristics on the preferred payment method. Nested logit model is employed as the household's decision can be assumed to follow a sequential process. The results indicate that payment method's attributes such as security, cost, reward and acceptance, have significant impact on electronic payment preference. It should be noted that debit card and credit transfer users are the most sensitive to a change in unit of security, cost and acceptance, and credit card users are more likely affected by the changes in reward. Other empirical findings include that the ease of access to the banking infrastructure and number of minimarkets increases the preference of electronic payments. In addition, the choice is highly dependent on age, education, occupation status and income. Moreover, the empirical analysis explicitly modeled the pattern of correlations among alternatives by a nested logit model and the inclusive value of 0.661 also proofed that the decision making process is occurred in sequence. This implies that one payment method is more likely to compete with another payment method of the same electronic payments than the payment methods of cash payment alternative. In conclusion, this study confirms attributes that are influential to further induce household's use of electronic payment methods.

**Keywords:** Payment System, Household Behavior, Electronic Payment

**JEL Classifications:** D1, E42

### **1. INTRODUCTION**

There has been a growing interest in the use of electronic payment system in the economy. Existing studies on the use of a payment method mainly adopted the money demand model for transaction (Baumol, 1952; Tobin, 1956). The studies generally focused on the macro impacts of electronic payments and were carried out in many countries, such as The United States (Dotsey, 1988), Belgium (Duca and Whitesell, 1995) as well as in European countries (Rinaldi, 2001) and Snellman et al. (2001). However, the studies on the payment method use are relatively limited. This is mainly due to the data limitation at the individual level. The highlights on micro level analysis are predominantly important

due to the fact that the household decisions to own and use a medium of payment are complex. Its complexity occurs because households face a "trade off" between the various quality attributes and the cost to be borne.

Several previously conducted micro studies merely focus on a payment method or one to one comparison of electronic payment methods such as debit card (Borzekowski and Kiser, 2008), credit card (Sprenger and Stavin, 2008), E-money (Fujiki and Tanaka, 2009) or internet banking services (Xue et al., 2012). More complex studies comparing one or multiple payment methods were conducted by Borzekowski and Kiser (2008), Bounie and François (2006) and Arango, Huynh, and Sabetti (2011). Borzekowski and

Kiser (2008), conducted more complex studies comparing one or multiple payment methods, Bounie and François (2006) and Arango, Huynh, and Sabetti (2011)). Furthermore, the scope of the existing studies regarding the contributing factors in utilizing a payment method tended to highlight the influence of demographic and financial characteristics (Bounie and François (2006); Stavins, 2001), the adoption of technology, as well as the transaction characteristics (Hayashi and Klee, 2003). The study focus on the impact of the payment methods attribute is very limited. According to Lancaster (1966) and Ladd and Suvannunt (1976) stated that all products possess measurable attributes relevant to the choices which individuals made among different collections of products. Thus, preferences for products are indirect in the sense that products are valued because they provide the attributes sought.

This study contributes to the key empirical studies analyzing the relationship between the attributes of payment methods and their preferences. In particular, this study aimed at identifying the attributes of different payment method such as security, ease, speed, cost, reward and acceptance that influence consumers' decisions in determining the choice of electronic payment method using a discrete model (McFadden, 1974). By doing so, this study provides the empirical basis for policy makers to improve the quality of electronic payment attributes so it can become the primary choice for households transactions.

Secondly, the study is able to distinguish the payment decision (between cash payment and electronic payment) and a method of payment (credit transfer, debit card, credit card, e-money/e-banking). Therefore, the study performed a separate examination to analyze the factors that influence both decisions. In contrast to previous typical discrete choice model studies, which assumed that relationship between alternative payment mediums are mutually exclusive (Hayashi and Klee, 2003; Bounie and Francois, 2000), it is argued that there is a relationship between alternative method and the households decision on payment method, following a sequential process. At first, households decide whether they will continue using cash payment or choose to pay with electronic payment. Subsequently, the households then decide which payment method will be ultimately used for transactions. Thirdly, this study used data generated from 936 Indonesian households in 2014. Although a number of similar surveys have been conducted in other countries, studies with household-level analysis are relatively new for developing countries, including Indonesia.

In this paper, we explore the motivations behind household's choice for payment method preference by using nested model of the payment methods attributes, including social economics household and social environment. The estimation results are consistent with the arguments proposed by literatures on payment method use, showing that security, cost, reward and acceptance, and household characteristics stand as the main contributing factors. Meanwhile, the results also signify that the choice of payment including ownership and its use are determined sequentially.

This introduction is followed by literature review outlining the previous studies that discuss the use of payment method. The

methodology section comprises of the conceptual framework of the model, empirical model specification and design of the survey. Lastly, the results and discussion are presented and followed by conclusions and recommendations for further studies.

## 2. LITERATURE REVIEW

Existing studies have generally focused on one aspect of decision or one type of payment method. This study analyzed a more complex approach regarding the use of various payment methods. Specifically, this chapter assesses previous studies on the characteristics of cash and electronic payments (Sub Section 2.1) and the use of payment method (Sub-Section 2.2).

### 2.1. Characteristics of Cash Payment and Electronic Payment Method

The developments in technology and the integration of financial markets have driven the advancement of functions and types of payment method. The function of the payment method is inseparable from the role of money. As money can be used as a medium of exchange for transactions and a store of value (Miskhin, 2007), it also serves as a medium of credit, replacing short-term bank loans. In terms of product characteristics, cash payment method has the following advantages; for example, it has been widely used in the economy, it is trustworthy, it is easy to use, and it has anonymous transactions. Additionally, it is also easily divisible and readily reusable (Goodhart and Krueger, 2001). However, cash payment method is impractical for large transactions, has high damage risk in long circulation, and uses conventional technology (Drehmann et al., 2002). In addition, consumers should also take into account the cost of cash withdrawal from a bank or an ATM machine as well as a loss of income from interest due to holding cash. Capie and Gormez (2000) estimated that the role of cash in future payments will be replaced by high technology method such as credit transfers, debit card and e-money.

Since its introduction in the 1950s, electronic payments continue to grow with a variety of alternative payment methods and characteristics. One of the widely used payment methods is credit transfer (wire transfers). Although the use of credit transfer requires the presence of banks with limited service time, it is preferable for several reasons: (1) Households confidence, (2) it can be used for various types of transactions, (3) the absence of limit for the transaction value, and (4) an alternative when other electronic payment method infrastructure are not available (Beaven and Templeton, 2002).

Next, certain banks issue of debit cards, where the specific authorization can facilitate cash withdrawals and transfers (Vassiliou, 2004). Debit card ownership was initially optional for account holders. Nowadays, every bank account holder automatically has a debit card. It requires the availability of automatic teller machines (ATM) and electronic data capturing (EDC). However, there are certain restrictions including the limit to the value of transactions, cost per transaction, and only certain merchants can accept payments by debit card. Massoud and Bernhardt (2002) also stated that the cost of transfer via another network (interchange fee) is quite high for debit card use.

Markose and Loke (2003) conducted Nash game and asserted that the debit card preference fees (including the cost of finding an ATM machine and interchange fee) stand as the most influential factors of the consumer to choose between a cash withdrawal and the use of a debit card.

In contrast to other payment method, credit cards can be used as a short-term loan medium in which cardholders can pay up to the limit of loans (Asokan et al., 2000). Credit card payment is complex because of the free short-term loan contract between the issuing bank and the cardholder is not stated explicitly but granted in the form of an account limit. The mechanism makes the interest rate on credit cards is higher than other loans (Ausubel, 1991).

E-money has similar functions and characteristics to cash and can be used for payments to merchants (Cohen, 2001). E-money is a multi-purpose instrument and facilitates small transactions. However, e-money card acceptance by merchants is still limited at some merchants. Although there is no significant transaction cost, consumers need to top up or reload in ATM machines. In terms of security, e-money can be easily used by an unauthorized person if the card is lost. Information and technology development has driven the use of internet and mobile banking, by facilitating virtual transactions between the customer and the bank (Daniel, 1999). The advantages include the fact that the method can facilitate 24 h banking services. However, the use of internet and mobile banking is prone to counterfeiting actions. In addition, the use of internet and mobile banking needs specialized information technology knowledge.

In conclusion, the payment method has attributes that more advantageous than other payment such as security, speed, cost and reward and acceptance cost, and reward and acceptance. When using cash, household faces the risk of theft, counterfeiting, or loss. Recent studies (Borzekowski and Kiser, 2008) show that speed is a significant driver of consumers' payment choices at the point of sales. The use of payment method involves a variety of costs that depend on transaction frequency and value, such as transaction fees and membership fee. For cash payment household faces the opportunity costs of time spent obtaining cash and interest forgone from carrying cash balances. Household may face per-transaction costs from using debit cards as part of their bank account arrangements, or they may incur interest costs if credit card balances are not paid in full by the due date. To promote card preference, card networks often offer attractive reward programs, such as cash rebates or travel points. Bolt et al. (2005) show that the availability of card payment terminals played a substantial role in the growth of electronic payment use in Norway and the Netherlands.

## 2.2. The Use of Payment Method

The previous studies emulated the two-sided market approach (Baxter, 1983), then, two sided market approach was developed by Katz (2001), Rochet and Tirole (2002) and Wright (2004) in analyzing the interaction of merchants and credit card users. These studies employed the supply side approach in analyzing the efforts of service providers and merchants in receiving transactions with electronic payment methods.

Meanwhile, the previous studies related to the use of payment method from the demand side emphasized on the significance of household demographic characteristics and technological factors (Mantel, 2000; Stavins, 2001; Hayashi and Klee, 2003). Mantel (2000) and Stavins (2001) shows income and certain demographic factors are significant to explain use of electronics payment in United States. In addition, Hayashi and Klee (2003) and Ching and Hayashi (2010) said that the consumers who use internet and computers have a higher probability to use electronic payment method. Other works, Humphrey et al. (2001) try to estimate a model of payment choice from which price and substitution of payment and the result shows that consumers are sensitive to prices.

Lastly, Zinman (2009) also analyzed the influence of demographic factors (age, education, gender, income, and family characteristics) on the selection of a payment instrument in the United States. The study found that the use of debit card and credit cards is negatively correlated with the age and positively correlated with the level of consumer education. While cash payment is considered relatively unsafe, debit card payment method is seen as a modern and easy to use method. Then, Loix et al. (2005) found that gender had insignificant influence on the use of credit cards and e-money, their study showed identical results in Belgium. It is evident that female consumers used debit cards more frequently than male ones. This study would enrich the previous studies as it includes the payment method attributes in the model.

The discrete choice model (McFadden, 1974) is widely used for choice behavior analysis, including a choice of payment method. The simplest form is the binary probability model that has been widely used to compare two choices of payment method (cash and electronic payment). Jonker (2007) estimated that the payment options in Netherlands used probit model but Fujiki and Tanaka (2009) used the probit models to estimate the probability of adopting new payment technologies. While Hayashi and Klee (2003) used a binomial logit to measure the influence of technology on payment options, while Arango et al. (2011) employed a bivariate model and the logit model in determining the factors that influence the use of cash and points of sales.

The binary logit models can describe the revealed preference yet assuming no variation among the payment methods. As a result, Borzekowski and Kiser (2008) did a comparison between the use of debit cards and other payment methods using logit rank order. In addition, some studies had tried to compare several payment options, such as payment media using logit multinomial approach (Bounie and Francois, 2006; Klee, 2008). However, its assumptions stated that the consumer's decision on payment method conducted simultaneously and the error term is Independent of Irrelevant Alternative caused the model cannot explain the variations in the payment and individual characteristics (Ben-Akiva and Lerman, 1985). This study use the nested model to overcome the restrictive requirement of the multinomial logit methodology to have distinct and independent alternatives.

### 3. METHODOLOGY

#### 3.1. Model

An alternative approach to consumer choice and demand theory is characteristics theory, assumes that utility is generated by the characteristics or attributes which goods or services possess (Lancaster, 1966; Ladd and Suvannunt, 1976). However, the households do not have knowledge about such attributes and judge the quality of particular payment methods. Discrete choice model can solve the key issue to deal with how to specify unobserved payment attributes. The discrete choice model allocates household payment usages to alternative payment methods. It does so by comparing the utilities of all alternative payment methods. The hypothesis underlying the model is that when faced with a choice of situation, a household's preferences toward each alternative can be described by an attractiveness or utility measure associated with each payment method alternative. In this study, a household chooses among five alternatives (representing one cash payment alternative and four electronics payment alternative). Based on the microeconomic theory of utility maximisation, a household would always select the alternative which provides him/her the greatest profit (usually called utility). In mathematical form, a household *i* would choose alternative *j* in choice set *C* if:

$$U_{ij} > U_{ik}, \quad \forall j \in C, \quad j \neq k \quad (1)$$

This utility function incorporates the attributes of the payment method alternatives (such as security) as well as the household characteristics (such as age or education)<sup>1</sup>. Utilities, however, can not be observed or measured directly. Furthermore, many of attributes that influence household utilities can not be observed and must be treated as random. Consequently, the utilities themselves in models are random, meaning that choice models can give only the probability with which alternatives are chosen, not the choice itself.

The effects of the payment method attributes to preference were assessed using the McFadden's random utility framework (McFadden, 1974). This model states that each household chooses one option among several discrete alternatives available at a certain level of probability. The derivation of the choice probability of households among various alternatives payment method is presented below.

Assume each household *i* faces a choice between set of *j* alternatives ( $j = 1, 2, \dots, j$ ) with the attributes of the choices described by  $z_{ij}$  and the characteristics of individual described by  $x_i$ . In this case, households are assumed to have different preferences, while alternative payment methods have unobservable attributes (Ben-Akiva and Lehman, 1985). With its random component, utilities in equation (1) can be expressed as:

$$U_{i(\text{payment } j)} = V_{ij} + \varepsilon_{ij} \quad (2)$$

<sup>1</sup> Based on characteristics theory, this utility function is generated by the characteristics or attributes of products. The consumer demand functions for products are affected by characteristics of the products (Lancaster, 1966; Ladd and Suvannunt, 1976).

$$U_{i(\text{payment } j)} = z_{ij}\alpha + x_i\beta_j + \varepsilon_{ij} \quad (3)$$

Where in  $(V_{ij})$  is the observed variables of the household payment options, is the vector of alternative-specific variables,  $\alpha$  is the vector of alternative-specific parameters, is the vector of individual specific independent variables,  $\beta_j$  is the vector of estimated parameters for the individual specific variables and  $(\varepsilon_{ij})$  describes unobserved variables to reflect the different preferences and unobservable attributes of payment methods. Based on the random utility assumption, if a household *i* is given an alternative option of payment methods *j* and *k*, then households *i* will only choose *j* payment if and only utility to choose the  $j(U_{ij})$  is higher than utility of choosing payment  $k(U_{ik})$ , in terms of probability as follows:

$$\begin{aligned} \text{Prob}(i \text{ choose payment } j) &= (U_{ij} > U_{ik}) \quad \forall j, k \in J \quad \text{dan} \quad j \neq k \\ &= (\varepsilon_{ik} - \varepsilon_{ij} \leq V_{ij} - V_{ik}) \end{aligned} \quad (4)$$

For example, it is assumed that unobservable utility component  $\varepsilon_{ij}$  has distribution characteristics, such as (i) independent distribution (ii) identic distribution (iii) a Weibull distribution (Type I Gumbel). Thus the *j* probability alternative choice can be made with multinomial logit form:

$$\text{Prob}(i \text{ choose payment } j) = \frac{\exp(z_{ij}\alpha + x_i^2 j)}{\sum_{j=1}^J \exp(z_{ik}\alpha + x_i^2 k)} \quad (5)$$

Multinomial logit model, which is assumed identical and independent distribution, implies that the ratio of the probability of two alternative options is the independence choice set and the observation utility of other options. In other words, probability choice between two alternative payment methods is not affected by the addition of other payment methods. Multinomial logit model has limitations, particularly if there is a relationship between alternative payment methods. For this reason, this study uses a nested logit model. The advantage of estimating the nested logit is that it allows one to test the appropriateness of the restriction. The nested logit has a closed form in the choice probability. Thus, it is easier to estimate the existing relationships between alternative choices. Intuitively, this model introduces a sequential process of selection.

In this nested models, it is assumed that household utility for each alternative payment option consists of  $U_{mji} = V_{mi} + V_{ji} + \varepsilon_{mi} + \varepsilon_{mji}$  where (1)  $V_{mi}$  and  $V_{ji}$  are observable variable components of household utility functions for the upper structure and lower structure in the form of nest structure. (2)  $\varepsilon_{mi}$  is a random component on the upper level *m*, and (3)  $\varepsilon_{mji}$  is the random component related to *m*<sup>th</sup> alternative and is assumed as independent distribution and identical. With this assumption, the probability of choosing the use of payment method (*j*) is:

$$P(\text{choose } j) = P(\text{choose } j | \text{goes } m) \cdot P(\text{goes } m) \quad (6)$$

Where  $P(j|m)$  is a conditional probability of *j* chosen with nest *m*.  $P(m)$  is marginal probability to choose nest *m*. At the bottom of the structure, the probability conditional follows multinomial equation of the form, such as:

$$P_{j|m} = \frac{\exp(V_j/m)}{\sum_{j \in J} \exp(V_j/m)} \tag{7}$$

and

$$P_m = \frac{\exp(V_m + \theta_m I_m)}{\sum_{m} \exp(V_m + \theta_m I_m)} \tag{8}$$

Where  $I_m = \ln \sum_{j \in J} \exp(V_j/m)$  is inclusive value (McFadden, 1981) which shows the components observed in utility maximization alternative payment options in the nest  $m$  and illustrates the maximum value of the random utility of alternative payments in the nest  $m$  (Ben Akiva and Lerman, 1985). Inclusive value connects the decisions between two stages simultaneously. The nested logit model is consistent with random utility maximization if the condition's inclusive value parameter ( $\theta$ ) is bounded between zero and one.

Components  $V_j$  and  $V_m$  are assumed as linear functions of the independent variable. Equation (2) shows that the decision on the selection of the shift of the upper level (nest  $m$ ) is a function that is not only influenced by the independent variables but also by the inclusive value. It can be used to identify the impacts of changes in the payment attributes at the lower level (nest  $j$ ) to switch the payment method in upper level (nest  $m$ ). Due to cash payment is a generate branch, then the conditional probability equal to one. Hence, the parameter estimates in nested logit used full information maximum likelihood, the entire model is estimated in a single phase, as follows:

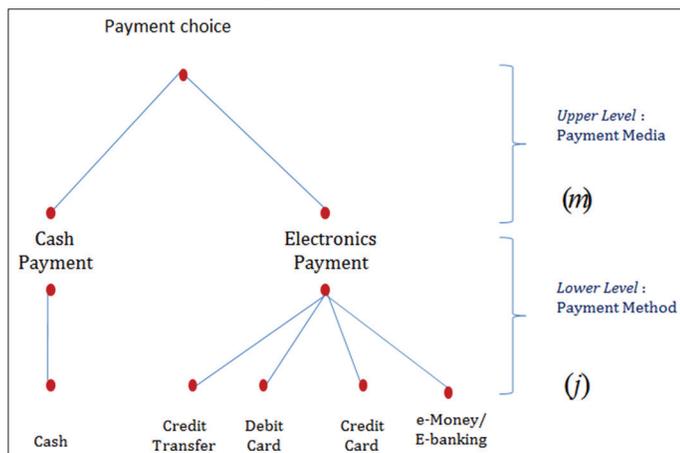
$$\ln L = \sum_{i=1}^n \ln [\Pr(j|m) \cdot \Pr(m)] \tag{9}$$

### 3.2. Empirical Model Specifications

#### 3.2.1. Model specifications

The decision of households to use payment method can be formulated as a sequential process in the form of nested logit. Figure 1 illustrates the nested structure of the use of the payment method. In the first stage (upper level), households will decide whether to use cash payment method or electronic payment method. The next stage, if cash payment method is selected then a choice of payment type, which is available, is cash payment.

**Figure 1:** The structure of nested logit model in the use of payment method



Whereas if the payment is made through the electronic payment, there are 4 alternative payments, namely credit transfer, debit card, credit card and e-money/e-banking.

The upper level predicts the relative probability of choosing cash payment or electronic payment methods. The lower level illustrates the relative conditional probability. It is the probability of selecting alternative method with the conditions of using payment types. The influence of lower level to upper level is showed through inclusive value (log-sum) or expected maximum utility of an alternative payment method in a single nest. The stages of the decision process and the use of payment method are as follows Figure 1.

Equation 2 through 8 from above were used for nested logit payment methods choice model. The following empirical model is specified to determine the factors affecting choice of payment method preference (detailed definitions are described in Table 1A : Variables' Definition):

$$\text{Choice} = \alpha_0 + \beta_1 \text{Security} + \beta_2 \text{Ease} + \beta_3 \text{Speed} + \beta_4 \text{Cost} + \beta_5 \text{Reward} + \beta_6 \text{Acceptance} + \beta_7 \text{Transaction Cost} + \beta_8 \text{Sex} + \beta_9 \text{Gender} + \beta_{10} \text{Age} + \beta_{11} \text{Education} + \beta_{12} \text{Marriage} + \beta_{13} \text{HH member} + \beta_{14} \text{Working} + \beta_{15} \text{Income} + \beta_{16} \text{Mobilephone} + \beta_{17} \text{Banking Acces} + \beta_{18} \text{Minimarket}$$

Where  $\alpha_0$  is an optional alternative specific constant that can capture the influence on choice of unobserved attributes relative to specific alternatives (Hensher et al., 2005). The  $\beta$ 's represent the coefficients on the vector of attributes, household characteristics and social environment.

The nested logit estimates the coefficients of the RUM by comparing characteristics of the chosen option with those of rejected options. If a payment's characteristics are systematically more prevalent in the chosen payment than in the rejected ones, it is judged to positively affect the choice of a payment method. A set of payment's choice set consist of every payment method with probability of being chosen exceed zero. According to the popular payment method in Indonesia (BI, 2014), five payment methods are available. The choices of payment methods for household including cash, credit transfer, debit card, credit card and e-money/e-banking. Not all methods of payment are available for all households. An electronic payment considered available either if the household own the account/card.

In practice, the choice set contains every payment method with probability of being chosen is large enough to be practically significant. There are no rigorous analytic methods for assigning choice sets to payment. The assignment must be based mainly on the experience and judgment of the analyst. For this study, given the number of payment methods a household chooses to own, the household decides how much payment to do on the basis of the payment characteristics, household characteristics and social environment. These factors determine payment choice potential, the likely choice of value and preferences towards payment methods alternatives. The model system can be stated mathematically. Given a household owning a payment method, the share of transaction value that household will use in each transactions can be expressed as a preference of choice of household payment methods (Klee, 2006; Ching and Hayashi,

2010). In discrete choice model, the calculation of the share of value for each respondent based on the reported value of use of cash, credit transfer, debit card, credit card and e-money/e-banking. The responses allow us to construct measures of choice of payment method preference. In the model, dependent variable is equal to 1 if the household used a payment method, a larger percentage of value of use payment methods than other payment methods. For example, a household is defined to choose debit card (debit card = 1) if the percentage of value of debit use is the largest of other payment methods. Descriptive statistics shows nearly half (40.69%) of the household prefer to use debit card than other payment methods. About 12.85% of the household reported to use credit transfer and 8.24% use credit card. The last, about 34.69% is reported that they prefer to use cash payment.

This study uses nested logistics regressions, to test the impact of the attribute of payment methods on payment use, while controlling the social economics and social environment factors. The model shows whether and to what extent these factors influence the use of payment. Explanatory variables are grouped into three categories: Attributes of payment methods, social economics and social environment variables.

The payment method attributes we include in each specification are security, ease, speed, cost, reward and acceptance. We include transaction cost in the type of choice of households who use payment method because we were unable to get complete information on the full costs of preference (purchase/ownership price, membership fee and so on) for payment method in our sample. Based on a priori knowledge from literature and previous work on payment choice (Hayashi and Klee, 2003; Zinman, 2009), household characteristics include the head of household's gender, age, education, marriage, number of household member, occupation and household income. For controlling, we include social environment variable, mobilephone ownership, banking access and number of minimarket in the household residential location.

### 3.3. Data

#### 3.3.1. Survey design

Data ownership and use of domestic payment method in Indonesia is very limited. In this study, the data was obtained from a survey of media ownership and the use of payment at household level in December 2015. This survey adopted consumer choice survey conducted by the Federal Reserve of Boston (Foster et al., 2011). In general, the survey was conducted to gather following information: (1) The level of household ownership on payment method (cash, credit transfers, debit cards, credit cards, e-money/e-banking), (2) The level of use- how households use owned payment method for payment of economic transactions, (3) The assessment of attributes - households assess payment method attributes, and (4) the demographics - information on the socio-economic characteristics. The methodology is described as follows.

To ensure the variation of the ownership and use of payment methods, the survey was carried out by probability sampling method from Indonesian household population. The sample of households was selected from two (2) provinces with the

largest population on Java, namely Jakarta and East Java (30% of the Indonesia's household population). These provinces have relatively high population growth and density (14.694 people per km<sup>2</sup> in Jakarta and 784 people per km<sup>2</sup> in East Java in 2010). In addition, both provinces have the highest number of electronic transactions (91.23% volume and 79.23% value) in Indonesia (BI, 2014).

The sampling frame used considered the probability selection, completeness, current time, accuracy, and non-duplication. The sampling frame consists of three types: (1) The first stage sampling frame, which contains a list of cities, was equipped with the information on the value of GRDP and the number of non-cash transactions, (2) the second stage sampling frame, which used a list of clusters in selected districts, was equipped with stratification based on the concentration index of household sectors classification (agriculture, manufacturing and service), and (3) the third stage sampling frame used a list of households in selected cluster.

Based on the sampling frame, the stages of sampling method were carried out as follows: First, choosing 6 municipalities/districts in two provinces, namely DKI Jakarta (East Jakarta, West Jakarta, and North Jakarta) and East Java (City of Surabaya, Surabaya Regency, and Malang); second, determining the number of clusters corresponding to the allocation for each stratum in six districts/municipalities systematically; third, collecting household list as the candidates of selected respondents in each cluster. From this process, 10 households were randomly selected. Furthermore, a number of samples in this survey refer to Cohren (1988) and the scholars recommended the multivariate study sample sizes ranging from 300 to 500 with a margin of 0.5 error. Considering the things above, the number of samples in this survey was set at 936 respondents.

To improve the accurate estimate of payment method use, this survey used a typical period for the payment amount made by respondents. This approach illustrates the average value of transactions. Hence, it is assumed that the data collected is able to capture the behavior of respondents spending more consistently. Moreover, the approach was also able to eliminate the unusual events to avoid bias.

### 3.4. Ownership and Use of Payment Methods

Method payment ownerships based on whether households have various payment methods such as cash, bank credit transfers, debit card, credit card, e-money/e-banking. Households that have a saving account automatically have a bank credit transfer facility and debit card. However, the payment method through e-banking is optional. The ownership of payment method is sometimes not based on the requests of households, but as a consequence of account ownership (debit card) as well as offers or promotions made by the bank (credit cards and e-money). The percentage of payment method ownership can be seen in Figure 2.

Cash holdings reached 100.00% as it is assumed that each sample household had cash for household expenditures. Every owner of a bank account had credit transfer (72.10%), but not all owners

had debit card (68.00%). As the new payment method, household ownership of the credit card amounted to 18.53%.

Table 1 presents a combination of payment method owned by the household for each household. The last column shows the number of households in the sample for each set of payment method combinations. The combination of cash, bank credit transfer and debit card were the most popular one (45.30%). The combination that has only e-money/e-banking showed the smallest portion (5.55%). Meanwhile, the number of households that have all the options of payment media reached 6.84%. Nonetheless, the households that only have cash and have no electronic payment method amounted to 28.53%. The remaining 3.35% is a combination between five payment methods.

From the use of payment method, on average, every household used payment media 47.83 times per month. Cash was the most common payment method used in both frequency and value. Cash dominated and was the preferred option of the household sample. Figure 3 shows that the average frequency of cash use reached 87.83% with the value of transactions reached to 43.99% of the total value of payment. However, in terms of transaction value, nearly 56% of total transactions had been replaced by electronic payment method. Debit card was the most widely used electronic payment method with a frequency of 6.47% and 28.85% of the total value of household expenditure per month. E-money card was commonly used for small transactions despite the relatively higher frequency (1.48%). However, it constituted as the smallest transaction (0.58%) compared with the rest of electronic payment method.

### 3.5. Perception Payment Characteristics

Differences in quality attributes such as the level of payment security, the ease, speed, cost, reward and acceptance affect

payment options as shown in Table 2. For each payment method, respondents were asked to report their perception of the security, ranging from “risky” to “secure” (security was asked in terms of the likelihood of theft, fraud or loss); speed, ranging from “slow” to “speed;” cost, ranging from “cheap” to “expensive;” reward, ranging from “a little” to “many;” and perception of acceptance, ranging from “always” to “never.” They were also asked to report how much they typically use each payment method. The results of the survey showed that household perceive payment methods to be the speediest and have most rewards (59.60% and 58.60% of respondents state that payment methods are speed and a lot of rewards. Then, the level of ease and acceptance had the same relative value, namely 52.8% and 54.3%. However, the assessment of the cost was the least attribute chosen by households which amounted to 43.3%.

### 3.6. Socio-economic Conditions of Household

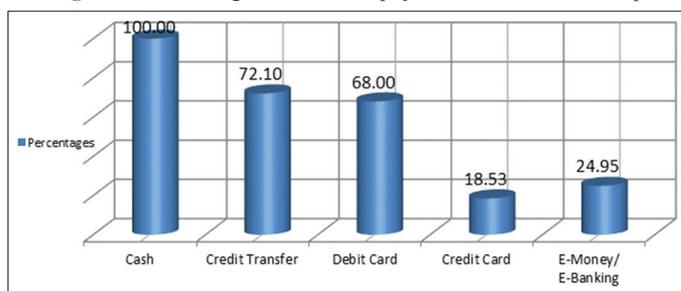
Table 1B states that, base on the 1000 targeted household respondents, the number of questionnaires filled from interviews was 982 households. After the data validation process, the selected respondents reached 936 households. In general, the respondents are dominated by male adult and middle-income respondents.

The survey showed that the head of the household sample was dominated by male 86.7%, higher than the female household head with a total of 13.3%. The average age of household head reached 45.8 years. In addition, education is also assumed to have a strong influence on the choice of payment. Education was calculated based on the formal education attained by the head of the household. While 41.9% of respondents completed secondary education, 31.1% of respondents only completed basic education (primary school), Moreover, 27% of households in the sample was highly educated (University or College).

The head of household who worked full time in service sectors showed higher payment transactions. The number of respondents who worked full-time was 56.8% with employment respondents worked in the services sector (62.35%), agriculture (13.37%) and manufacturing (24.28%). Nearly 69.3% worked in the formal sector, such as Civil Servants/Army, employees/workers, professionals, and entrepreneurs workers. Meanwhile, the rest of the respondents, worked in the informal sectors.

The socio-economic characteristic which determined the choice of payment media was the income level. The households with higher incomes tend to have a large fund allocation in the transaction. Within this survey, the household income variables were measured

Figure 2: Percentage of household payment method ownership



Source: Survey results of payment method choices 2014

Table 1: Combinations ownership set of household payments

Ownership options	Payment method					Total owner (%)
	Cash	Credit transfer	Debit card	Credit card	e-money/e-banking	
OwnershipSet 1	1	0	0	0	0	267 (28.53)
OwnershipSet 2	1	1	0	0	0	31 (3.31)
OwnershipSet 3	1	1	1	0	0	424 (45.30)
OwnershipSet 4	1	1	0	1	0	65 (6.94)
OwnershipSet 5	1	1	0	0	1	52 (5.55)
OwnershipSet 6	1	1	1	1	1	64 (6.84)
OwnershipSet 7	Others					33 (3.35)

Description: 1 shows payment method ownership. Source: Survey Results (2014)

by using a household expenditure per month. The amount of household income varied from Rp. 630.000 to Rp. 41 million per month, with an average family income of Rp. 4.758.335 per month. The households with an income of Rp. 2-3 million per month constituted the largest number of households (30.37%). On the contrary, the lowest household group (20.00%) is on the income group 3-5 million per month.

The next hypothesis is presuming that the size of household members will affect the allocation of household expenditures and payments. The average size of family member was 4.86 people. In terms of access to banking infrastructure, 36.5 household respondents stated that they can get access to the banking infrastructures such as an ATM machine, Bank offices, and the merchant that provides EDC.

### 4. ANALYSIS AND DISCUSSION

#### 4.1. Estimation Results

The estimation results in the nest of payment method are presented in Table 4. In general, the model estimation shows good results. This is shown by the value of the pseudo-R<sup>2</sup> = 0.809 and the relationship between method options and independent variables proved to be significant. In addition, the estimated value at the rate of nest inclusive payment method is 0.661 (located on the values 0 and 1) and is statistically different from both zero and one at the 5% significance level. This indicates that the choice of payment methods has nesting structures and the model is consistent with the hypothesis of stochastic utility maximization. In addition, based on the validation of the model by comparing the actual condition

**Table 2: Payment method attributes and socio-economic characteristics of households as independent variables**

Variable	n	Mean±SD
Security (ref = not security)	936	0.530±0.498
Ease (ref = difficult)	936	0.528±0.499
Speed (ref = slow)	936	0.586±0.420
Cost (ref = cheap)	936	0.430±0.495
Reward (ref = less)	936	0.596±0.490
Acceptance (ref = non acceptable)	936	0.543±0.498
Transactions cost	936	5.569±2.686
Sex (ref = female)	936	0.781±0.413
Age	936	45.315±13.791
Education	936	0.392±0.488
Marriage (ref = not married)	936	0.560±0.496
Household member	936	4.005±1.824
Occupation (ref = not occupation)	936	0.693±0.491
Income	936	4.758±4.543
Mobilephone ownership (ref = none)	936	0.643±0.478
Access on Bank Infrastructure (ref = difficult)	936	0.602±0.489
Number of minimarket	936	5.47±3.952

**Table 3: Estimation results**

Actual	Prediction				Total
	Credit transfer	Debit card	Credit card	Emoney/e-banking	
Credit transfer	66	45	1	1	117
Debit card	19	344	9	3	371
Credit card	2	10	63	2	77
E-money/e-banking	2	8	3	18	31
Total	89	407	77	24	596

(observed outcomes) and predicted outcome, it shows that the predicted results are acceptable Table 3.

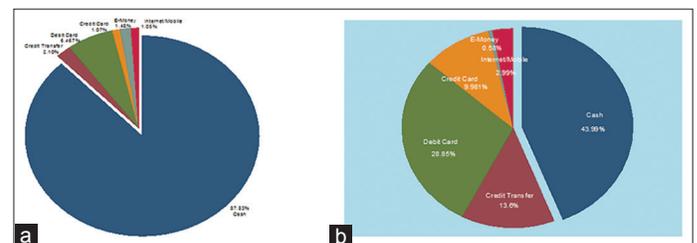
Furthermore, the estimation of the payment option is made by using a cash payment in cash as a baseline. Thus, the estimation result was analyzed related to the baseline. A positive coefficient indicates that the households have a greater probability of choosing a particular payment method. Meanwhile, a negative coefficient means that the probability of household chooses alternative method of such payments decreased. The estimation result is presented based on payment attributes, social economic characteristics and banking infrastructure.

#### 4.1.1. The impacts of payment method attributes

The estimation result indicates that the level of security, cost, reward and acceptance have significant impacts on electronic payment preference. Security, reward and ease transaction of electronic payment methods are expected to increase the probability of households to choose electronic payment method. This finding is consistent with previous studies conducted by Bolt and Chakravorti (2008) and Schuh and Stavins (2010). The reward in the form of rebates, points, cash back and low installment also show positive effects. This condition is found primarily on credit card payment method. These findings support Ching and Hayashi (2010) about reward system in the credit cards and debit cards. However, these findings are in contrast to the study of Bounie and François (2006) who found that facility had insignificant influence on reward payment options in France.

The study also found that transaction costs will reduce the probability of households' choices of the electronic payment method. One of the reasons linked to these findings is the electronic payment method costs are relatively high compared to cash payments. It consists of transaction costs and "transport" fee to find a place where electronic payment method can be done. Households who will choose the payment method have relatively lower transaction costs. This finding is consistent with Bolt and Chakravorti (2008) and Schuh and Stavins (2010).

**Figure 3: Proportion method preference frequency and payments value**



Source: Survey of payment options 2014

Furthermore, the results show that the ease factor is insignificant in the use of electronic payment method. This is because the majority of households (90% of mobile phone owners) are already familiar with the electronic payment technology. This finding also reinforces the studies conducted by Schuh and Stavin (2010) in the United States.

**4.1.2. The impacts of socioeconomic characteristics**

Generally, socio-economic characteristics of households affect the choice in the ownership and use of the payment method. Based on Table 5, it can be argued that age, primary and secondary education, as well as the number of households have negative and significant impacts. These negative coefficients indicate that the use of electronic payment method is dominated by young people who are highly educated (college graduates and above). It is interesting to see that the electronic payment technology is knowledge-based, so the use of payment method highly depends on the level of education. On the other hand, the head of households who are dominated by male worker consumers and higher income workers have positive influence. The positive relationships support earlier findings of similar studies conducted by Arango et al. (2011), Kalkkreuth et al. (2009) and Schuh and Stavin (2010).

As the respondents grow older, the probability of households using the method of credit transfer payments, credit card and e-banking will decrease significantly. These results support Arango, Huynh, and Sabetti (2011), which stated that the older age group prefersto use cash. In addition, the age factor also has an impact on the ability to accept or adapt to new technologies, (Hyytinen and Takalo, 2004). The estimation result also indicates that primary and secondary education significantly reduce the probability of households in the use of all alternative electronic payment methods. This is consistent with the expectation that households with higher education have better awareness and adaptability on technology. Thus, they tend to use various electronic payment methods. These findings are supported by Schuh and Stavins (2010), Bolt and Chakravorti (2008) and Klee (2006).

The size of household members also significantly determines the use of all electronic payment methods, except e-money/e-banking. The greater the number of family members that should be borne by the head of the family, the lower the probability of the household use existing electronic payment methods. Employment status and formal job have positive and significant influence in the choice of electronic payment methods, except for e-money/e-banking – as they both are considered as relatively new payment methods

**Table 4: The estimation of nested logit**

Variable	Credit transfer		Debit card		Credit card		E-money/e-banking	
	Coefficient	P> z	Coefficient	P> z	Coefficient	P> z	Coefficient	P> z
Attribute of payment’s methods								
Aman	0.389	0.045**						
Mudah	0.148	0.330						
Cepat	1.066	0.000***						
Biaya	-1.928	0.000***						
Reward	0.765	0.000***						
Acceptance	0.470	0.016**						
Biaya transaksi	-0.001	0.000***						
Household characteristics								
Gender (ref = female)	1.220	0.040	1.270	0.026	0.513	0.481	3.591	0.017
Age	0.427	0.007	0.532	0.002	0.196	0.026	0.337	0.004
Age2	-0.005	0.000	-0.006	0.000	-0.003	0.023	-0.004	0.003
Middle education	0.075	0.339	0.033	0.067	0.141	0.010	0.185	0.044
Marital status (reff = not married)	0.190	0.749	-0.039	0.944	-0.617	0.334	0.692	0.330
Houshold size	-0.567	0.001	-0.510	0.002	-0.552	0.002	-0.475	0.015
Occupation (reff = not occupation)	1.751	0.003	1.987	0.000	1.244	0.018	0.845	0.033
Income	0.207	0.042	0.144	0.014	0.204	0.047	0.220	0.035
Social environment								
Mobile phone	1.599	0.002	2.476	0.000	1.185	0.018	0.938	0.239
Banking acces	0.773	0.132	1.165	0.017	2.011	0.018	1.376	0.117
Minimarket	0.129	0.107	0.078	0.318	0.156	0.081	0.252	0.006
/ntunai_tau	0.661							
Log likelihood	-353.71							
Wald Chi-square	108.30							
P>Chi-square	0.000	***						

\*P<0.1, \*\*P<0.05, \*\*\*P<0.01

**Table 5: Marginal effects of payment method attributes (own marginal effect)**

Payment method	Attribute				
	Security	Speed	Cost	Reward	Acceptance
Credit transfer	0.034	0.137	-0.126	0.017	0.213
Debit card	0.041	0.165	-0.146	0.215	0.256
Credit card	0.010	0.049	-0.037	0.141	0.051
E-money/e-banking	0.008	0.041	-0.018	0.058	0.067

in Indonesia. By occupation in formal employment sector as civil servants, employees of large and medium-sized businesses, the respondents have a relatively fixed monthly income with a household spending allocation facilitated by billing payment and online banking.

Income is the most significant factor affecting the choice of using all electronic payment methods. It is characterized by a high significance value at one percent significant level. This is understandable because the households with higher incomes will have more demands. Consequently, to meet these needs, the households are more likely to have more transactions which ultimately increase the use of electronic payment methods. These results are also found in previous studies conducted Bolt and Chakravorti (2008), Klee (2006) and Schuh and Stavins (2010).

In the socio-economic category, there are two variables that do not significantly affect the payment options, namely gender and marital status. Despite the consistent of coefficient signs, the coefficient  $P = 0.330-0.944$  is insignificant. The result is in contrast to Bolt and Chakravorti (2008) and Bounie and François (2006) who found that the gender has significant effects on payment method options. Additionally, marital status does not significantly encourage ownership of electronic payment method.

#### 4.1.3. The impacts of banking infrastructure facilities

Banking infrastructure facilities have significant influence on the choice of electronic payment method preference by households. The estimation result shows that the ease of access to the banking infrastructure positively affects the preference and shows a high level of significance (1%). The result is mainly because of the availability of banking facilities such as a branch office, ATM machines, and EDC which facilitate the electronic payment transactions. The access to the electronic transaction facilities is also associated with the location of residence. Households living in urban areas have better access to electronic transactions and facilities than those living in rural areas (Bounie and François, 2006).

## 4.2. Policy Analysis

The high preference of electronic payments is essential in an economy. To encourage the households to divert the use of cash payments into electronic payments, policies are needed to support an increase in the use of electronic payment methods.

Selecting the households as the policy targets and improving the quality attributes of payment methods can do the approach. The estimation result shows that household characteristics and attributes of payment methods significantly influence the choice of use of payment methods. The challenge is to set the household characteristic priorities and appropriate attributes on payment methods so that the policy can effectively increase the use of electronic payment methods. This study will be used to analyze the effect of marginal reduction in the choice of priorities as a basis for payment method preference.

The marginal effect illustrates the sensitivity of the independent variables on each payment method. Marginal effect calculations will be useful for decision makers as they enable to identify

the effects of characteristic changes on the household choice of payment methods.

#### 4.2.1. The impacts of attribute changes and substitutions of payment method

In order to analyze the impacts of changes in the payment method attributes on electronic payment method use and the substitution of the method of payment, we estimated the marginal effect of payment method attributes in Table 5. The estimation result indicates that changes in the quality attributes on one payment method, such as level of security, convenience, reward and acceptance level, will increase the choice of households to the method and lower the choice of other payment methods. This suggests that the increase in payment method attribute causes the substitution of electronic payment method. For example, the changes in security level of debit cards will increase the household choice by 0.041 and lower the household choice to other methods namely credit transfers, credit card, e-money/e-banking –for,  $-0.025$ ,  $-0.006$ , and  $-0.005$  respectively.

In general, an attribute, which has a strong influence on the increase in method option of payment, is the security level of the facility, followed by rewards. Increasing perception of security and reward could have a large effect in all payment methods. The strong influence of the level of security is because of the extensive publicity of the method dealing with card forgery and data theft in electronic payments. Kosse (2010) analyzed this condition on the impact of crime news in newspapers on the use of debit cards in Netherlands. Yet, the strong influence of changes in reward system occurs because households are rational and take into account the financial benefit of choosing electronic payment methods. Comparing the value of financial rewards in the form of rebates facilities, giving points, free of transaction costs and lowering, the repayment should be incurred in the household decision. This implies that service of security and reward offered by the payment methods would be a key point to increase attractiveness of electronics payment and to improve electronics payment usage.

It should also be noted that debit card and credit transfer users are the most sensitive to a change in unit of security, cost and acceptance, while e-money/e-banking users are less likely affected by the change in the all attributes, although there are variations. Credit card users are relatively sensitive to rewards compared to other attributes. These variations may imply that policymakers are required to apply different strategies in different attribute of payment methods.

Based on the estimation, changes in perception of payment method cost will lead to decrease in the choice of method used. The high cost own marginal effect of demand at debit card (0.146) should be noted (Table 5). This finding indicates that the households are sensitive to changes in perception of cost of payment methods. This argument is in line with Arrango et al. (2011) who found low income group to be highly sensitive to cost of payment use. However, cross marginal effect of perception cost takes a positive sign, suggesting that perception of expensive debit card cost would increase the use of credit transfer, credit and e-money/e-banking 0.135, 0.021, 0.030 respectively (Table 6). Yet, the lowest impact

**Table 6: Marginal effects of payment method attributes (cross marginal effects)**

Cross marginal effect	Payment method			
	Credit tranfer	Debit card	Credit card	Emoney/e-banking
<b>Security</b>				
Credit transfer	-	-0.025	-0.004	-0.003
Debit card	-0.025	-	-0.006	-0.005
Credit card	-0.002	-0.005	-	-0.002
E-money/e-banking	-0.001	-0.004	-0.002	-
<b>Speed</b>				
Credit transfer	-	-0.104	-0.015	-0.009
Debit card	-0.100	-	-0.027	-0.022
Credit card	-0.014	-0.025	-	-0.008
E-money/e-banking	-0.009	-0.021	-0.008	-
<b>Cost</b>				
Credit transfer	-	0.135	0.021	0.012
Debit card	0.136	-	0.034	0.029
Credit card	0.013	0.021	-	0.007
E-money/e-banking	0.013	0.030	0.011	-
<b>Reward</b>				
Credit transfer	-	-0.160	-0.025	-0.015
Debit card	-0.161	-	-0.041	-0.034
Credit card	-0.015	-0.026	-	-0.008
E-money/e-banking	-0.015	-0.035	-0.014	-
<b>Acceptance</b>				
Credit transfer	-	-0.095	-0.014	-0.008
Debit card	-0.092	-	-0.024	-0.019
Credit card	-0.006	-0.008	-	-0.002
E-money/e-banking	-0.008	-0.020	-0.007	-

occured by the changes in perception of e-money/e-banking cost transaction. This is because the debit card was the most widely used card and was generally used for small nominal transaction so it is very sensitive to changes in costs. The use of e-money/e-banking does not charge the cost of acquisition (ownership).

Next, the changes in perception of the level of acceptance of an electronic payment method will have impacts on the reduce use of the other electronic payment methods. The impact is higher in the changes of perception of debit card and credit transfer than other payment. The increased level of acceptance perception is associated with the concept of two-sided market in payment media market. Merchant as a “seller” will accept electronic payment methods if it is more advantageous. Thus, the efforts need to be taken to increase the acceptance level of electronic payment methods.

It can be concluded that the result of the estimation of the payment method attribute changes reveal that the households prefer the security and financial benefits by comparing the level of transaction costs and rewards offered by the payment method preference. In addition, the level of acceptance of the payment method also highly influences the choice of electronic payment method.

**4.2.2. The impacts of changes in household characteristics**

The results of marginal effect due to changes in household characteristics are shown in Table 7. From the result, it can be seen that the gend-er variable which changes in male household head will improve the probability of payment options with the biggest changes occurred in the debit card option. Changes in primary and secondary education level of household heads will reduce the level of payment options. The largest decline occurred in the credit cards

**Table 7: The marginal effect of the payment method preference**

Household characteristics	$\frac{\partial \Pr(y_i = 1)}{\partial x_i^j}$	$\frac{\partial \Pr(y_i = 2)}{\partial x_i^j}$	$\frac{\partial \Pr(y_i = 3)}{\partial x_i^j}$	$\frac{\partial \Pr(y_i = 4)}{\partial x_i^j}$
	Gender	0.165	0.134	0.018
Age	0.046	0.065	0.007	0.013
Education	0.143	0.198	0.028	0.044
Household size	-0.337	-0.483	-0.057	-0.108
Occupation	0.387	0.197	0.252	0.416
Income	0.163	0.219	0.033	0.049
Mobilephone	0.168	0.233	0.382	0.496
Banking Acces	0.171	0.239	0.445	0.525
Minimarket	0.225	0.281	0.061	0.072

(head of household with primary education) and debit cards (head of household with secondary education). This shows that head of households with higher education prefer both payment options. Marginal effect of an increase in the number of family members can reduce the probability of payment methodoptions. Any changes to the family members will reduce the use of electronic payment method with the biggest changes in debit and credit transfer. This is understandable because of the addition of family members will decrease whole family expenditure allocation. Based on this result, the increasing use of electronic payment methods can be focused on young families withless family members.

Increasing the proportion of occupation household heads will enhance electronic payment options, especially debit cards, credit transfers and credit cards. Almost the same effect occurs in marginal effect on the increase in household income. Although increasing impacts on e-money/e-banking payment methods are

relatively large, debit card stands as the most popular option. This condition can occur because the use of current payment methods, such as e-money/e-banking, is still limited to certain types of transactions. Hence, the policy of increasing access to payments for various types of media transactions needs to be done as a further encouragement to the use of electronic payment methods.

Changes on the ease of access to banking infrastructure will increase the choice of all electronic payment methods use. This indicates that the increased availability of banking technology infrastructures in the form of EDC, ATM machines, and the Internet will create significant impacts on the choice of electronic payment methods. Thus, improving access to banking infrastructures, such as additional availability and interconnections between banking technology, needs to be done to provide facilities for the use of electronic payment method.

## 5. CONCLUSION

To sum up, the use of payment via electronic payment methods, such as credit transfers, debit cards, credit cards, e-money/e-banking, has several advantages compared to cash payment method. It is due to the reasons that electronic payment methods have time efficiency, lower cost of cash handling and cash management as well as lower security risk. This paper has shown the impacts of payment attributes and characteristics of the household on the use of payment methods in Indonesia. The estimation results indicate that the use of the payment is determined by a variety of variables. Based on the estimation of the nested logit models, it can be shown that security, cost, reward and acceptance significantly affect the probability use of electronic payment methods. In addition, the marginal effect estimation result indicates that the payment method attributes have major influence on the level of security, reward and transaction costs. It should be noted that debit card and credit transfer users are the most sensitive to a change in unit of security, cost and acceptance, and credit card users are more likely affected by the changes in reward. Besides that, policies to encourage the use of electronic payment method can be done through improving perception of the quality of the three attributes of this payment. The household should be encouraged to have a good knowledge about the electronics payment with education and information campaign. In addition, increasing the quality of security by the use of additional security in electronic payment method can be done with the addition of chips in media card, payment card and transaction recording feedback. Moreover, the industry should be encouraged to undertake the provision of reward facilities. Authorities are also expected to regulate the determination of ownership and transaction costs of electronic payment methods. Furthermore, encouraging the use of all electronic payment methods policies can be done through the addition of banking infrastructures, such as ATM machines, EDC and online access. Interconnection and interoperability between the infrastructures of the payment methods industry players can be considered as an alternative to expand household access to infrastructures. The provision of a complete information through various media channels about the benefits of the electronic payment methods use to increase awareness of the households is equally important.

In terms of socio-economic characteristics of households, age, education, income, and employment status of household heads have increased the probability to use more electronic payment methods with various result. The ease of access to banking significantly affects the use of all electronic payment methods. These variations may imply that policymakers are required to apply different strategies in different attribute of payment methods and social economics characteristics. The estimation result also indicate that the use model of payment methods made via sequential decision (a nested model), as the inclusive value showed the coefficient of 0.661, which remained consistent with utility maximization framework.

Lastly, this study has various limitations. First, the variables related to the physical environmental characteristics of the household, such as banking infrastructure (ATM/EDC machine, acces internet) in urban and rural areas, can be considered as an analytical focus in subsequent studies. Second, the cost of ownership and the use of any payment method can be explored to see the price elasticity of each payment method. Third, the level of technology complexity of each payment method can be considered as the variables affecting use of electronic payment method. Therefore, to accommodate the variation of household characteristics, subsequent studies may be needed to expand the number and geographic locations of the sample. In addition, further studies are recommended to develop the use of a combination of discrete and continuous approach in the choice model since this study only focuses on a discrete approach.

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## APPENDIX

Appendix Table 1A: Variables' definition

Variables	Code	Type	Definition
Dependent variables			
Choice of electronics payment	Choices	Nominal	Y = (1=Credit Transfer, 2=debit card, 3=Credit Card, 4=E-Money/E-Banking) A choice of payment method will be chosen if share of value of preference is higher than other alternatives
Independent variables			
Perception of attribute of payment methods			
Perception of security	Security	Dummy	1 - if the payment's choice is secured, 0 - others
Perception of ease	Ease	Dummy	1 - if the payment's choice is ease, 0 - other
Perception of speed	Speed	Dummy	1 - if the payment's settlement is speed, 0 - others
Perception of cost	Cost	Dummy	1 - if the payment's choice is costly, 0 - others
Perception of reward	Reward	Dummy	1 - if the payment's choice has a lot of reward, 0 - others
Perception of acceptance	Acceptance	Dummy	1 - if the payment's choice is more acceptable than others, 0 - others
Social and economic variables			
Gender	Gender	Dummy	1 - if the respondent is male
Age of household's leader	Age	Nominal	The nominal age of household's leader
Education	Education	Nominal	School of years
Marital status	Married	Dummy	1 - if the respondent is married
Income	Income	Nominal	Total household income (in 000 rupiah)
Number of family members	Household size	Nominal	Number of household's number
Occupation status	occupation	Dummy	1 - if the respondent is a full time worker
Banking infrastructure			
Mobile phone ownership	Mobile phone	Dummy	1 - if the household's leader owns mobile phone/seluler, 0 - others
Access's facilities of banking payments	Banking Acces	Dummy	1 - if the banking payments is accessible, 0 - others
Number of minimarket	Minimarket	Dummy	Number of minimarket in household's resident

Appendix Table 1B: Respondent's characteristic of payment's choices

Characteristic	Population (%)	Total (\$)
Target respondents		1000
Final total respondents		936
Gender		
Male	83.45	77.35
Female	16.55	22.65
Age		
15-24	2.13	8.96
25-34	15.48	15.58
35-44	26.81	24.44
45-54	25.45	24.33
55 above	30.13	26.68
Education		
<Elementary school	56.90	34.72
Middle school	11.64	15.49
High school	23.10	29.17
University	8.36	20.62
Ethnic		
Java	44.89	68.09
Others	55.11	31.91
Residency		
Urban	56.94	79.72
County side	43.06	20.28
Jobs		
Agriculture	30.53	13.37
Manufacturer	18.04	24.28
Services	51.44	62.35
Income		
<Rp. 2 million	22.81	21.88
Rp. 2-<3 million	31.48	21.24
Rp. 3-<Rp. 5 million	20.00	29.46
Rp. 0 > 5 million	25.70	27.43

Source: Survey, 2014