

XIV

Volume XIV, Number 2, November 2011

Journal of Applied Economics

Andrew K.G. Tan
Steven T. Yen
Yiing Jia Loke

Credit card holders, convenience users and
revolvers: A tobit model with binary selection and
ordinal treatment



UCEMA

Edited by the Universidad del CEMA
Print ISSN 1514-0326
Online ISSN 1667-6726

**CREDIT CARD HOLDERS, CONVENIENCE USERS AND REVOLVERS:
A TOBIT MODEL WITH BINARY SELECTION
AND ORDINAL TREATMENT**

ANDREW K.G. TAN*

Universiti Sains Malaysia

STEVEN T. YEN

The University of Tennessee

YIING JIA LOKE

Universiti Sains Malaysia

Submitted April 2010; accepted January 2011

This paper studies the characteristics of credit card holders in Malaysia and distinguishes between convenience users and revolvers. A Tobit model with binary selection and ordinal treatment is developed to accommodate the data feature that debts are incurred only among card holders and the endogeneity of card holding in card debt. Results from a stratified sample in Malaysia indicate that age, household size, income, education, loan commitments, and current-account ownership play a role in card holding. Age, loan commitments, previous card holdings, current-account ownership, and bad debt history affect the probability and level of card debt. Multi-card holders are more likely to be credit revolvers than convenience users.

JEL classification codes: D12, D14, E51

Key words: credit card, revolving credit, sample selection, treatment effect

* Andrew K.G. Tan (corresponding author): School of Social Sciences, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia; email atan@usm.my. Steven T. Yen: Department of Agricultural and Resource Economics, The University of Tennessee, Knoxville, TN 37996-4518, USA; email syen@utk.edu. Yiing Jia Loke: School of Social Sciences, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia; email yjloke@usm.my. We are grateful to the editor and the editorial staff of the journal for editorial assistance and two anonymous referees for helpful comments. Research support from the Universiti Sains Malaysia Short-Term Grant (Grant No: 306-PSOSIAL-639119) is acknowledged. The usual disclaimer applies.

I. Introduction

In recent years, increased credit card (henceforth, card) borrowing and bankruptcies due to card debts have become a major concern shared by many countries in the Asian region. For example, South Korea underwent a major transformation from a relatively debt-free country to one with an average of US\$27,000 in debt per household from 1997–2003, with about 4 million consumers defaulting on card debt and household loans during this period. This figure represented nearly 10% of the country's population, causing an impact of more than US\$375 billion in household debt (Ridley 2004). China reported a 133% increase of two-month overdue card debt in the first half of 2009 (CNN 2009), while Macao's card delinquency rate increased from 0.29% in the second quarter of 2008 to 1.17% in the second quarter of 2009 (Monetary Authority of Macao 2009). In Singapore, bad card debt write-offs increased by approximately 34% between the years 2005 and 2009 (Monetary Authority of Singapore 2009). Meanwhile, in Malaysia, the current outstanding card balance increased by 61.9% from RM14.5 billion (US\$4.3 billion) to RM23.6 billion (US\$7.0 billion) between 2005 and 2009, while non-performing card loans fell by 27.4% from RM743.70 million (US\$220.68 million) in 2005 to RM569.4 million (US\$168.96 million) in 2009.¹

With the rising trend of card borrowings worldwide, many studies have addressed the issues of card debt and borrowing. Kim and DeVaney (2001), Lee and Kwon (2002), Min and Kim (2003), Bertaut et al. (2008), Castronova and Hagstrom (2004), King (2004), and Johnson (2004; 2007) are among those who discuss the use of credit cards as a financing tool from various perspectives. The majority of these studies are on consumers and card holders in the United States of America (USA), which has a relatively large credit card consumption base. By contrast, studies on credit cards in Asia are scarce. Although there are studies on card usage in Malaysia (Sharaff 1998; Hasbalaila 2001; Ramayah et al. 2002), these articles do not examine the factors that affect card debt behavior.

This paper contributes to the growing body of empirical literature on the use of credit cards. Attention is focused on examining the characteristics of card holders who use it primarily as a medium of transaction (henceforth, convenience users) or as credit/borrowing facilities (revolvers). Further, while recent studies in the USA no longer address card holding, this issue is of relevance for developing countries such as Malaysia where the credit card market is expanding rapidly.

¹ The approximate exchange rate as of 21 January 2010 was US\$1.00 = RM3.37.

Despite the aggressive campaigns to promote ownership and uses of credit cards, rapid increases in the number of cards in circulation do not imply an increasing number of card holders. The number of cards in circulation has increased significantly, by about 293% between 2000 (2.8 million) and 2009 (11.0 million), compared to the 90% increase between 1991 (1.08 million) and 1998 (2.05 million). This increasing number of cards only reflects multiple holdings of cards by individuals as the number of cards per capita increased from 0.13 in 2000 to 0.39 in 2009 (BNM 2009).² In other words, while many in Malaysia are averse to credit cards, another segment of the society comprises users of multiple cards.

Hence, building on existing credit card studies, this paper extends the existing empirical literature in several ways. First, given the objective of the study to understand card ownership and the characteristics of card holders in debt, a sample was drawn from the general population of consumers, comprising individuals who may or may not have a credit card(s). A card holder also may or may not accrue a card debt. To accommodate this special sample design and the resulting data feature of censored card debt among card holders, as well as the potential endogeneity of card holding in card debt, a Tobit model with binary sample selection and ordinal treatment is developed. Second, this study takes into account card holders' regulatory knowledge of the terms and conditions imposed by the card issuers. This is based on the assertion that financial literacy could augment one's personal financial management (Chen and Volpe 1998; Hilgert and Hogarth 2003; Fox et al. 2005). On the other hand, Brito and Hartley (1995) have found that card holders can be irrational. This is due to the notion that despite their awareness of the high cost of borrowing through a credit card(s), individuals could still persist in maintaining outstanding card debts. To our knowledge, no studies have addressed this "knowledge" factor in card usage. Third, credit cards provide easy access to credit or financial liquidity in the short term period. Therefore, consumers burdened with multiple loan commitments may be more likely to finance their monthly financial needs with a credit card. However, little is known regarding how different loan portfolios would affect card debts. Hence, various types of loan holdings, namely holdings of housing loan, student loan, car loan and personal loan, are taken into consideration in the current card debt model. Last, despite the rapid growth of card spending and debts in the Asian countries, little is known about the characteristics of Asian card holders.

This paper represents one of the first attempts to econometrically determine the roles of socio-demographic characteristics and financial/credit consumption tendencies

² In comparison, the average number of cards held by a credit card holder in the USA in 2008 is 3.5 cards while the average number of credit cards per capita is 2.7 cards (Foster et al. 2010).

in card ownership and debt holdings in Malaysia. Specifically, by developing an econometric model to accommodate the unique data feature, the paper aims at addressing the following issues: (i) the likelihood of holding a credit card, (ii) the likelihood of card debt conditional on card holding, and (iii) the level of card debt incurred.

The rest of the paper is organized as follows. In section II, we provide a brief description of the credit card scenario in Malaysia. Section III details the theoretical framework and the Tobit model with binary selection and ordinal treatment developed to accommodate the unique data feature that debts are incurred only among card holders and the endogeneity of card holding in card debt. Description of the data from the survey, variable definitions, and descriptive statistics of the variables in the statistical model are presented in Section IV. Section V discusses the estimation results and marginal effects of explanatory variables, while concluding remarks and some policy implications are provided in Section VI.

II. Credit cards in Malaysia

Credit cards were first introduced in Malaysia in the 1970s. At present, the principal card holder must earn a minimum income of RM18,000 (US\$5,300) per annum and be 18 years old and above in order to qualify for a supplementary or principal credit card.

Card holders must pay a minimum of 5% of their monthly transactions or RM50 (approximately US\$15), whichever is higher. Prior to 1 July 2008, all outstanding balances are charged a flat rate of 18% interest per annum. In an effort to encourage prompt settlement, tiered interest rate was introduced on 1 July 2007 and card issuers started monitoring card holders' payment settlement behavior henceforth. Card holders who promptly settle the minimum payment due for 12 consecutive months are charged only 13.5% per annum (1.125% per month) while those who settle the minimum payment due for at least 10 months in a 12 months cycle are charged 16.0% per annum (1.833% per month). Card holders not meeting either of these requirements are charged 17.5 % interest rate per annum (1.458% per month). In light of the weak economic conditions in 2009, these interest rates are the newly revised figures since 31 March 2009 (ABM 2009).³

³ While the finance charges in terms of minimum monthly payment and interest rates on outstanding balances are standardized for all credit card issuers in Malaysia, these charges vary across credit card issuers in the USA. The credit card issuers in the USA revise the rates according to the card holder's payment settlement behaviour.

In addition to the interest on outstanding balances, card issuers in Malaysia also impose late payment charges at 1% of the minimum payment. Card holders are given a 20-day interest-free period to enjoy all retail transactions, provided all outstanding balances from the previous month have been fully settled. In an effort to promote responsible credit card usage, Bank Negara Malaysia (the central bank of Malaysia) stipulated that beginning 1 July 2008, card holders who made only minimum or partial payments on their outstanding balances will no longer enjoy the 20-day interest-free period for new retail transactions. To further “promote prudent spending”, the government of Malaysia has recently tabled in the 2010 Budget to impose a RM50 (US\$14.84) service tax on each principal credit and charge card and RM25 (US\$7.42) for supplementary cards (Loh and Bedi 2009). However, while such annual per-card taxes may lower the demand for cards in circulation amongst those who do not rely on it as a borrowing tool, it is argued that individuals who do so are expected to continue subscribing to multiple cards in financing their expenditures (MARC 2009).

It is worth noting that there appear to be mixed signals on the severity of card debt status in the country as statistics show a sharper increase in total card purchases than total outstanding card balances. For example, while non-performing card loans decreased by 20.6% from RM743.7 million (US\$220.68 million) in 2005 to RM590.4 million (US\$175.19 million) in 2008, there was an increase of 45% in bad card debts cases (from 733 cases to 1,065 cases) during the period. This scenario is further exacerbated by the fact that as of May 2009, 50% of the 3,548 Malaysians who were declared bankrupt due to card debts comprise younger card holders aged 30 years and below (Ng 2009). This further highlights the importance of understanding the factors determining the probability and level of card debt in the country.

III. Theoretical framework and econometric model

A. Theoretical framework

The primary function of a credit card is to facilitate transactions. Viewed from this perspective, the demand for a card by a consumer represents the demand for shopping services. Following Kinsey (1981) and Min and Kim (2003), in appealing to the household production theory of minimizing the full cost of producing a given level of shopping service (e.g., Michael and Becker 1973), both the consumer demand for credit cards (C) and card debt (D) can be specified as

$$\begin{aligned} C &= f(I, S, F, L), \\ D &= g(I, S, L, K), \end{aligned} \tag{1}$$

where I is household income; S , consumer socio-demographics; F , financial status; L , debt status; and K , financial knowledge on the credit card terms and conditions. As noted by Kinsey (1981), income is a proxy for wages. As wages increase, less time and more expensive mediums of exchange or more skill would be used to achieve the same level of shopping service. Credit cards are assumed to be the least time-intensive medium of exchange. Socio-demographics of the consumer include age, occupational status, household size, gender, education, marital status and location of residence. Financial status includes home ownership and current account possession to proxy for consumer's financial collateral. Number of cards is added in the card debt equation as a financial status variable in place of home ownership and current accounts. Debt status is represented by the number of loan commitments and type of loan portfolio held by consumers. Meanwhile, financial knowledge is measured by the card holder's knowledge on its terms and conditions and is included in the card debt equation.

B. Econometric model

An individual may own no card, one card, or multiple cards. In addition, card debts are observed among card holders only, and some card holders do not accrue card debt. Further, card holding may potentially be endogenous in the card debt equation. To accommodate the special sample design and data feature, we develop a statistical model, whereby these zero and positive outcomes in card debt among card holders and ordinal endogenous explanatory variable can be accommodated with a Tobit (censored regression) model, subject to a binary sample selection and with an ordinal "treatment". In the following, observation subscripts are suppressed for brevity. Card holding (C), an ordinal outcome, is characterized by an ordered probit model

$$C = j \text{ if } \mu_{j-1} < z'\alpha + u \leq \mu_j, \quad j = 0, \dots, J, \quad (2)$$

where z is a vector containing all explanatory variables (see equation 1) with conformable parameter vector α , u is a random error term, and the μ 's are threshold parameters parameterized such that $\mu_{-1} = -\infty$, $\mu_0 = 0$, $\mu_J = \infty$, and μ_1, \dots, μ_{J-1} are estimable.⁴

⁴ Although card number is an integer, the distribution is highly skewed with excessive zeros and extreme counts (as high as 12 cards). The excessive zeros, skewed distribution, and sporadic extreme counts are difficult to accommodate with a (any) count distribution. Further, selection and treatment effect models

The ordered probability model governs the selection outcome such that card debts are observed when card holding is positive ($j = 1, \dots, J$) and, subject to card holding, dummy endogenous variables h also appear in the censored equation for card debt (D) as treatments:

$$\begin{aligned} D &= 0 && \text{if } C > 0 \text{ and } x'\beta + h'\gamma + v \leq 0, \\ D &= x'\beta + h'\gamma + v && \text{if } C > 0 \text{ and } x'\beta + h'\gamma + v > 0, \\ D &= \text{unobserved} && \text{if } C = 0, \end{aligned} \quad (3)$$

where x is a vector of all explanatory variables (see equation 1), $h = [h_2, \dots, h_J]'$ is a vector of dummy variables such that $h_j = 1$ if $C = j$ (for $j = 2, \dots, J$) and zero otherwise, and β and γ are conformable parameter vectors. The card number categories (h) capture the nonlinear effect of card number on card debt. The error terms (u, v) are assumed to be distributed as bivariate normal with zero means, variances ($1, \sigma^2$), and correlation ρ . Note that although card debt for non-users is zero by definition, treating such zero values as “unobserved” allows us to distinguish between the non-users ($C = 0, D = 0$) and card holders who did not incur debt ($C > 0, D = 0$).

Denote the univariate standard normal probability density function (pdf) as $\phi(\cdot)$, the cumulative distribution function (cdf) as $\Phi(\cdot)$, and the bivariate standard normal cdf with correlation ρ as $\Psi(\cdot, \cdot, \rho)$. Then, maximum-likelihood (ML) estimation can be carried out by maximizing the sample likelihood function

$$\begin{aligned} L &= \prod_{C=0} [1 - \Phi(z'\alpha)] \times \prod_{C>0, D=0} \prod_{j=1}^J \left\{ \Psi\left(\mu_j - z'\alpha, \frac{-(x'\beta + h'\gamma)}{\sigma}, \rho\right) - \Psi\left(\mu_{j-1} - z'\alpha, \frac{-(x'\beta + h'\gamma)}{\sigma}, \rho\right) \right\}^{1(C=j)} \\ &\times \prod_{C>0, D>0} \sigma^{-1} \phi\left(\frac{D - (x'\beta + h'\gamma)}{\sigma}\right) \prod_{j=1}^J \left\{ \Phi\left(\frac{(\mu_j - z'\alpha) - \rho(D - x'\beta - h'\gamma)/\sigma}{(1 - \rho^2)^{1/2}}\right) \right. \\ &\left. - \Phi\left(\frac{(\mu_{j-1} - z'\alpha) - \rho(D - x'\beta - h'\gamma)/\sigma}{(1 - \rho^2)^{1/2}}\right) \right\}^{1(C=j)} \end{aligned} \quad (4)$$

where $1(\cdot)$ is a binary indicator function. By restricting the error correlation (ρ) at zero, the likelihood function is separable in two sets of parameters (α, μ) and (β, γ, σ), which can be estimated separately: by an ordered probit model for card number

are generally more difficult to develop with a mixed count and continuous distribution than the Gaussian distribution. For parsimony, we top code the card number at 5 and model the card number as an ordinal variable. Ordered probability models are found to perform better than count data models with excessive zeros and sporadic high counts such as the number of cigarettes smoked (Kasteridis et al. 2010).

(C) with the whole sample, and a Tobit model for card debt (D) using the truncated sample of card holders ($C > 0$). Thus, non-random sample selection and endogeneity of the treatment variable C can be affirmed by testing for significance of the error correlation (ρ), by a Wald test or likelihood-ratio test.

Effects of additional card(s) on card debt can be evaluated by calculating treatment effects, based on the following conditional mean of D :

$$\begin{aligned}
 E(D|C = j, D > 0) &= x'\beta + h'\gamma + \sigma \left\{ \Psi[\mu_j - z'\alpha, (x'\beta + h'\gamma)/\sigma, -\rho] - \Psi[\mu_{j-1} - z'\alpha, (x'\beta + h'\gamma)/\sigma, -\rho] \right\}^{-1} \\
 &\times \left\{ \phi\left(\frac{x'\beta + h'\gamma}{\sigma}\right) \left[\Phi\left(\frac{(\mu_j - z'\alpha) + \rho(x'\beta + h'\gamma)/\sigma}{(1-\rho^2)^{1/2}}\right) - \Phi\left(\frac{(\mu_{j-1} - z'\alpha) + \rho(x'\beta + h'\gamma)/\sigma}{(1-\rho^2)^{1/2}}\right) \right] \right. \\
 &\left. - \rho \left[\phi(\mu_j - z'\alpha) \Phi\left(\frac{(x'\beta + h'\gamma)/\sigma + \rho(\mu_j - z'\alpha)}{(1-\rho^2)^{1/2}}\right) - \phi(\mu_{j-1} - z'\alpha) \Phi\left(\frac{(x'\beta + h'\gamma)/\sigma + \rho(\mu_{j-1} - z'\alpha)}{(1-\rho^2)^{1/2}}\right) \right] \right\}, \quad (5)
 \end{aligned}$$

which follows from a simple extension of the conditional moment in Rosenbaum (1961), from single truncations to double truncations in the bivariate normal distribution. Using (5), the treatment effects on card debt of owning k cards relative to ℓ cards are

$$\Delta y_{k\ell} = E(D|C = k, y > 0) - E(D|C = \ell, y > 0), \quad \text{for } k > \ell. \quad (6)$$

Average treatment effects for the treated (ATT) are calculated as the average of the measure in (6) among card holders with positive debt, for each pair of (k, ℓ).

To explore further the effects of explanatory variables, we examine the conditional mean in (5) as well as the marginal probabilities of card holding

$$\Pr(C = j) = \Phi(\mu_j - z'\alpha) - \Phi(\mu_{j-1} - z'\alpha), \quad j = 0, 1, \dots, 5, \quad (7)$$

and the probabilities of positive debt, unconditional and conditional on card holding:

$$\Pr(D > 0) = \Pr(u > -z'\alpha, v > -x'\beta - h'\gamma) = \Psi[z'\alpha, (x'\beta + h'\gamma)/\sigma, \rho], \quad (8)$$

$$\Pr(D > 0|C > 0) = \Psi[z'\alpha, (x'\beta + h'\gamma)/\sigma, \rho] / \Phi(z'\alpha) \quad (9)$$

Note that, similar to the case of a double-hurdle model (Blundell and Meghir 1987), the probability (8) depends on both sets of regressors (z and x) because two hurdles have to be overcome (*viz.*, to own a card and to incur a debt) for positive debt to occur. The conditional probability (9) depends on both sets of regressors

for the same reason. Marginal effects can be obtained by differentiating (or differencing, in the case of a discrete explanatory variable) equations (5) and (7)–(9).

IV. Data and variables

A. The survey

The data used for this study were obtained from a primary survey conducted from May to June 2008 in three major cities (Penang, Kuala Lumpur, and Johor Bahru) in the Northern, Central, and Southern part of Peninsular Malaysia. A total of 1,200 respondents participated in the survey but due to incomplete information for some observations, a final sample of 938 respondents is used in the analysis. Based on the Malaysian Population and Housing Census 2000 (Department of Statistics Malaysia 2001), the sample was stratified by age brackets, ethnic groups, and gender for the three cities to reflect the population of the cities. Card holders and non-holders who fulfill the age, ethnic, and gender strata were randomly selected for the survey.

A face to face interview was administered on each participant based on a prepared questionnaire. While the possibility of response bias was expected given the type of financial information elicited, enumerators were trained to dissipate these concerns by affirming that they are university students and information gathered from the surveys were strictly for academic research purposes only.

B. The variables

The dependent variable is the average amount of card debt in Ringgit Malaysia (RM) in the level equation. Average debt here refers to the respondent's average monthly unpaid card balance in the past 12 months. The endogenous variable is an ordered variable indicating the number of cards held, top-coded at 5 (see Footnote 4). This variable is used as the dependent variable in the selection equation and the corresponding category dummy variables (h , see equation 3) are used in the censored debt equation. Given the lack of empirical credit card studies in Malaysia, choice of explanatory variables for card holding and card debt are guided by the theoretical framework in equation (1). In addition, the empirical studies by Delener and Katzenstein (1994), Duca and Whitesell (1995), Durkin (2000), Chien and DeVaney (2001), Lee and Kwon (2002), Min and Kim (2003), Castronova and Hagstrom (2004), King (2004), Johnson (2004; 2007), and Bertaut et al. (2008), among others,

are drawn upon. The discussion of the variables used focuses only on variables that differ from existing literature.

With the exception of ethnicity, measurements of the other key socio-demographic variables are similar to the existing literature. Lee and Kwon (2002) categorized the sample ethnicity into various racial/ethnic groupings such as Whites, Hispanics, Blacks, and other non-Whites while Min and Kim (2003), Castronova and Hagstrom (2004) and Bertaut et al. (2008) considered two broad racial category variables, namely Whites and Non-whites. Meanwhile, Malaysia provides an ideal opportunity to study these issues as its multi-ethnic population comprises three major ethnic groups: Malay (56%), Chinese (26%) and Indian (7%), along with numerous other indigenous groups (11%) (Department of Statistics Malaysia 2001). As such, cultural, religious and other socio-demographic differences amongst each of these different ethnic groups may influence credit consumption patterns.

Kim and DeVaney (2001) and Min and Kim (2003) used number of cards owned to analyze the effects of access to credit on card debt. As a card holder's credit limit expands along with card holdings, the number of cards held is also taken into account in the current study to examine if increases in number of cards (credit limit) will tempt card holders into deeper card debts. In order to accommodate the potential nonlinearity of card number on card debt, we include a set of card number category variables (versus a single card number variable).

Debt status is represented by the number of loan commitments, type of loan portfolio holdings and bad debt history. Number of loan commitments is captured in the card ownership equation while the latter two are taken into account in the card debt equation. As card holders are able to draw onto the credit facilities of a credit card to smoothen their liquidity over time, the number of loan commitments owned by a respondent is included to examine its effect on the likelihood of holding a card. This premise is supported by Kinsey (1981) who found that individuals with loan commitments are more likely to hold more cards. Debt status is captured in different ways in the card debt model. For example, Kim and DeVaney (2001) measures debt status in terms of the total amount of household debt. This paper utilizes the holdings of various loan portfolios, such as housing loan, student loan, car loan and personal loan, as measurement of loan commitments on card debt holdings. It is posited that these loan portfolios, with different characteristics such as loan tenure and average loan amount, may affect holdings of card debt in varying manners. Lee and Kwon (2002) measured bad debt history in terms of whether the consumer was ever turned down in a loan application or given a lower loan amount than applied while bad debt history in Bertaut et al.

(2008) was defined as late payment of more than 60 days for revolving credit and previous filing(s) for bankruptcy. These studies consistently found a direct relationship between bad debt history and the likelihood of being in card debt. Respondents in the current study were asked if they had faced any difficulties in loan repayment either in terms of a late payment(s) or loan default(s) in the past three years. This excludes the incidence of being denied credit or being on tight budget.

Lack of financial literacy or financial education can have an adverse effect on an individual's financial management (Chen and Volpe 1998; Hilgert and Hogarth 2003; Fox et al. 2005). Alternatively, card holders may be ignorant of the cost of credit via credit cards. In essence, they underestimate their tendency to be in card debt as they did not expect to use the card as a borrowing tool. Further, some card holders may fail to learn from their past debt mistakes and therefore may not bother to find out about the cost of credit (Ausubel 1991; Canner et al. 1992; Calem and Mester 1995). We therefore explore the influence of card holders' specific knowledge of the terms and conditions on card debt. Respondents were asked a set of three questions on their knowledge of the number of interest free days that card holders are entitled to, the minimum payment that card holders must pay, and the charges imposed on cash advance facilities. Responses were then coded into three categories indicating no knowledge, marginal knowledge, and full knowledge. Consistent with existing notions that support financial education for better financial planning and management, it is hypothesized that card holders' knowledge will have an inverse effect on card debt.

Interest rate was included by Kinsey (1981), Min and Kim (2003), Castronova and Hagstrom (2004), and Johnson (2004; 2007) as a proxy for price, while Chien and DeVaney (2001), Kim and DeVaney (2001), and Lee and Kwon (2002) excluded the variable. In this paper, interest rate is also not included and is held constant. This is because card holders in the current sample experienced the same 18% interest rate per annum at the time of the survey (April to May, 2008), while the tiered interest rate only came into effect on 1 July 2008.

C. Descriptive statistics

Tables 1 and 2 present the definitions and sample statistics of all variables used. As shown in Table 1, of the 938 respondents, 536 (57%) do not hold a card and are considered non-debtors. Among the 402 (42.9%) card holders, 218 (54.2%) do not have any card debt while 184 (45.8%) bear an average card debt of about RM1316.

Table 1. Definitions and sample statistics of dependent and endogenous variables

Variable	Definition	Full sample	Card holder	Card debt
Debt	Average monthly unpaid credit card balances in the past 12 months (credit card debt) in RM	258.22 (1,033.04)	602.51 (1,511.85)	1,316.35 (2,015.86)
No card	Holding 0 card	57%	-	-
One card	Holding 1 card	13%	31%	258.20
Two cards	Holding 2 cards	14%	33%	594.66
Three cards	Holding 3 cards	7%	17%	885.29
Four cards	Holding 4 cards	4%	10%	321.95
Five or more cards	Holding 5 or more cards (see Footnote 5)	4%	10%	1,516.67
Sample Size		938	402	184

Note: Standard deviations in parenthesis.

About 60% of the total respondents are from the middle-low income households (RM1000–3999), 26% from the low income households (RM0–999), 12% from the middle-high income households (RM4000–7999), and only 2% are high income earners (RM8000 and above). In comparison, the official breakdown of income groups in Malaysia suggests 7.3% of households with monthly income between RM0–999, 59.0% between RM1000–3999, 20.4% between RM4000–6999, and 13.2% with RM7000 and above (Economic Planning Unit Malaysia 2010).

While the majority of middle income earners are card holders (70% of cardholders are middle-low income earners and 21% are middle-high income earners), the majority of low income earners do not hold any card (they represent 41% of the non-holders). No such differences in card ownership are noted among the high income earners. The majority of card debtors are from the middle-low income group, which may consist of revolvers who use their cards as a borrowing tool.

As Table 2 indicates, while the average age of card holders is slightly older (36.51 years old) than non-holders (34.80 years old), those with card debt (35.43 years old) are slightly younger than those without debt (37.42 years old). The average household size is 4 persons, irrespective of card holding status and card debt amount (zero or otherwise). The sample from the three cities of Penang, Kuala Lumpur, and Johor Bahru consists of 44% Malays, 44% Chinese, and 12% Indian or others (reference group). In comparison, the total population for the three cities is composed of 44.3% Malays, 43.9% Chinese, and 11.8% Indians or others (Department of Statistics Malaysia 2001). Hence, these sample proportions correspond to those of the population of the three states.

Table 2. Definitions and sample statistics of explanatory variables

Variable	Definition	Full Sample		Card holder		Card debtor	
		No	Yes	No	Yes	No	Yes
Income status							
Low income	Monthly household income RM0-999 (ref. group)	0.26	0.41	0.06	0.08	0.04	0.04
Mid-low income	Monthly household income RM1000-3999	0.60	0.53	0.70	0.65	0.75	0.75
Mid-high income	Monthly household income RM4000-7999	0.12	0.04	0.21	0.23	0.20	0.20
High income	Monthly household income ≥ RM8000	0.02	0.01	0.03	0.04	0.02	0.02
Socio-demographic variables							
Age	Age of respondent in years	35.53 (11.60)	34.80 (12.47)	36.51 (10.26)	37.42 (10.37)	35.43 (10.04)	35.43 (10.04)
Age ≤ 25	Age 25 years old and below	0.24	0.32	0.12	0.11	0.15	0.15
Age 26-35	Age between 25 and 35 years old	0.34	0.29	0.42	0.40	0.45	0.45
Age 36-56	Age between 36 and 56 years old (ref. group)	0.37	0.33	0.43	0.46	0.39	0.39
Age ≥ 57	Age 57 years old and above	0.05	0.06	0.02	0.03	0.02	0.02
Male	Gender is male	0.51	0.49	0.54	0.53	0.55	0.55
Malay	Ethnicity is Malay	0.44	0.56	0.28	0.16	0.42	0.42
Chinese	Ethnicity is Chinese	0.44	0.30	0.63	0.76	0.48	0.48
Indian	Ethnicity is Indian/others (ref. group)	0.12	0.15	0.09	0.08	0.10	0.10
Primary	Primary/grade school as highest level of education (ref. group)	0.07	0.20	0.04	0.05	0.03	0.03
High school	Secondary as highest level of education	0.46	0.51	0.39	0.37	0.42	0.42
Tertiary	Tertiary as highest level of education	0.47	0.39	0.57	0.59	0.55	0.55
White collar	White collar occupation (management, executive, teacher, financial planner, businessman, sales, service works, administrators, clerical)	0.72	0.66	0.80	0.78	0.83	0.83

Table 2 (continued). Definitions and sample statistics of explanatory variables

Variable	Definition	Full Sample		Card holder		Card debtor	
		No	Yes	No	Yes	No	Yes
Blue color	Blue collar occupation (skilled/ production workers, technicians, hawkers) (ref. group)	0.18	0.16	0.20	0.16	0.17	0.15
Unemployed	Unemployed (not working, housewife, student, retiree)	0.09	0.04	0.14	0.04	0.06	0.02
Household size	Number of persons in household	4.32 (2.05)	4.08 (1.98)	4.49 (2.09)	4.08 (1.98)	4.17 (2.08)	3.99 (1.85)
Kuala Lumpur	Resides in Kuala Lumpur	0.35	0.39	0.32	0.39	0.37	0.42
Penang	Resides in Penang	0.35	0.36	0.34	0.36	0.40	0.32
Johor Bahru		0.30	0.25	0.34	0.25	0.23	0.27
Financial status							
Home owner	Owns current home	0.58	0.69	0.49	0.69	0.70	0.67
Current	Owns a checking account(s)	0.11	0.21	0.04	0.21	0.26	0.15
Debt status							
Loan commitments	Number of loan commitments	1.33 (1.33)	1.86 (1.86)	0.93 (0.93)	1.86 (1.86)	1.39 (1.57)	2.42 (1.00)
House loan	Has housing loan	0.37	0.52	0.25	0.52	0.50	0.55
Student loan	Has study loan	0.17	0.13	0.20	0.13	0.13	0.13
Car loan	Has car loan	0.44	0.58	0.32	0.58	0.50	0.68
Personal loan	Has personal loan	0.11	0.12	0.09	0.12	0.06	0.20
Bad debt history	Experienced difficulties in debt repayment, bad debt or loan default in past 3 years (excluding being denied credit or having a tight budget)	0.14	0.16	0.13	0.16	0.06	0.28

Table 2 (continued). Definitions and sample statistics of explanatory variables

Variable	Definition	Full Sample		Card holder		Card debtor	
		No	Yes	No	Yes	No	Yes
Financial knowledge							
No knowledge	Has no knowledge of credit card terms & conditions (no correct answer to three questions: about interest free days, minimum payment, charges on cash advance facilities) (ref. group)	0.79	0.50	-	0.53	0.46	0.46
Marginal knowledge	Has marginal knowledge on credit cards terms & conditions (1-2 correct answers)	0.18	0.43	-	0.41	0.45	0.45
Full knowledge	Has full knowledge on credit cards terms and conditions (3 correct answers)	0.03	0.07	-	0.06	0.09	0.09
Sample size		936	402	536	218	184	184

Note: Standard deviations in parentheses.

Further, while the overall average number of loan commitment is 1.33 loans per person, the average numbers of loan commitments among card holders (1.86 loans per person) and card debtors (2.42 loans per person) are higher than non-holders (0.93 loan per person) or non-card debtors (1.39 loans per person). Of those who currently have card debt, 28% encountered difficulties in debt repayment in the past three years, compared to only 6% among those who currently do not have any card debt. Approximately 43% of card holders have marginal knowledge of the cards' terms and conditions, while only 7% are fully knowledgeable. Half of the card holders (50%) are completely ignorant of such terms and conditions.

In addition to the sample statistics presented in Table 2, among the 402 card holders, 171 (42.5%) expressed that the most important reason for holding a card is for its convenient payment function while 52 (13.8%) hold a card for its credit facilities. Further, among current non-holders, 80 (14.9%) respondents expressed an intention to apply for one in the next 12 months. Of these non-holders, 40 (50%) cited convenience of paying with credit card while 16 (20%) cited access to credit as the most important driver for applying for a card. Interestingly, among the 536 non-holders, the two most popular reasons for not owning a credit card are fear of excessive spending (226, 42.2%) and dislike for the "buy now, pay later" concept (156, 29.1%).

V. Estimation results

A. Parameter estimates

For ML estimation, the model is identified without exclusion restrictions. However, to avoid over-burdening the functional form for parameter identification, some exclusion restrictions are useful, as are the case with other sample selection models (e.g., Heckman 1979). As such, variables that are solely used on the selection equation include home ownership, number of loan commitments and ownership of current account. Variables such as the various loan portfolios (housing loan, student loan, car loan and personal loan), bad debt history and regulatory knowledge are included in the level equation only.

As home ownership represents collateral and financial status of an individual, it can affect the success of a card application. However, home ownership may have little role in the level of card debt among card holders, while possessing a housing loan may be of more relevance. As credit cards provide credit facilities, it is possible that those with loan commitments may utilize such facilities to smoothen their

financing needs. In addition, number of loan commitments is included in the selection equation while in the level of the debt model, we make an *a priori* assumption that different loan portfolios with varying characteristics may affect the level of debt instead. Given that current account holders may enjoy overdraft facilities, it is expected that current account holdings may adversely affect the likelihood of card holding by virtue of being a substitute non-cash payment method. Regulatory knowledge also enters the level of card debt equation only as it is relevant to the usage of card and not card holding. Last, bad debt history is more likely to affect debt level than card holding since the latter is dependent on current liquidity needs instead of debt behavior.

ML estimation is carried out by programming the likelihood function and analytic gradient in Gauss, and the results are presented in Table 3. Nearly two thirds (11 out of 18) of the explanatory variables are significant in the card holding equation, whereas significance in the card debt equation is more sparse, with about one third (8 out of 27) of the variables significant. The sparse significance in the card debt equation may be related to the relatively small number (184) of individuals with card debts. All threshold parameters are positive and significant at the 1% level, suggesting that the ordered probit model is successfully delineating the categories in card number. An insignificant threshold parameter would have suggested consolidation of the card number categories, and a negative threshold parameter estimate would have suggested misspecification in the model. Importantly, the error correlation coefficient (ρ) is significant at the 1% level of significance, suggesting presence of non-random sample selection into card holding and endogeneity of card number in the card debt equation.⁵ The negative error correlation suggests unobserved factors affect card number and card debt in opposite directions. Although there is no way to know the unobservables, we can control for them by imposing correlation of the error terms. Once selection bias on both observables and unobservables have been taken into account the treatment coefficients capture the true effects of card number on card debt. The significance of this error correlation also suggests the importance of the selection model, and that failure to accommodate such sample selection can lead to inconsistent parameter estimates. It also suggests the models for card number and card debt should be estimated jointly and not separately as described above under zero correlation.

⁵ Based on the log-likelihood values for the unrestricted model (-1945.453) and restricted (-1950.932) models, the restricted (independent) model is also rejected ($LR = 10.96$, $df = 1$, p -value = 0.0009).

Table 3. Maximum-likelihood estimation of Tobit model for card debt with binary selection and ordinal treatment

Variables	Card holding		Card debt (in RM100)	
	Estimate	S.E.	Estimate	S.E.
Mid-low income	0.978***	0.162	-15.845	11.077
Mid-high income	1.352***	0.194	-25.330**	12.617
High income	0.691**	0.341	-10.848	13.248
Age / 10	1.219***	0.323		
Age ² / 1000	-1.392***	0.406		
Age ≤ 25			6.824	7.914
Age 26-35			4.351	4.254
Age ≥ 57			-1.015	11.199
Male	-0.060	0.095	2.812	3.831
Malay	-0.103	0.159	6.769	6.548
Chinese	0.798***	0.155	-18.286**	7.275
High school	0.573***	0.205	0.484	9.592
Tertiary	0.762***	0.219	-8.959	10.115
White collar	0.071	0.133	5.763	5.539
Unemployed	0.309	0.237	-12.323	12.717
Household size	-0.065***	0.023	-0.080	1.018
Kuala Lumpur	0.004	0.112	2.573	4.196
Penang	0.073	0.120	-6.750	4.952
Home owner	0.016	0.104		
Current	0.433***	0.132		
Two cards			13.470***	5.174
Three cards			26.318***	6.997
Four cards			25.767***	9.050
Five or more cards			49.897***	10.066
Loan commitments	0.281***	0.033		
House loan			-7.095*	4.182
Student loan			-10.335	7.608
Car loan			1.837	3.932
Personal loan			0.821	4.545
Bad debt history			9.419**	4.419
Marg. knowledge			0.914	3.392
Full knowledge			3.259	6.474
Constant	-4.604***	0.683	13.156	20.314

Table 3 (continued). Maximum-likelihood estimation of Tobit model for card debt with binary selection and ordinal treatment

Variables	Card holding		Card debt (in RM100)	
	Estimate	S.E.	Estimate	S.E.
σ			27.012***	2.732
μ_1 (thresholds)	0.511***	0.044		
μ_2	1.157***	0.065		
μ_3	1.623***	0.079		
μ_4	2.068***	0.102		
ρ (error correlation)	-0.592***	0.112		
Dhryme's R^2	0.103			
Log likelihood	-1945.453			

Note: Asterisks indicate levels of significance: *** = 1%, ** = 5%, * = 10%. Dhryme's (1986) R^2 is the square of the correlation between observed and predicted values of the dependent variable (y), using the truncated (positive) sample.

On goodness of fit, Dhryme's (1986) R^2 measure, parallel to the coefficient of determination in conventional regression models, is calculated at 0.10, which suggests a fairly reasonable fit for a cross sectional sample.

B. Marginal effects of explanatory variables

Marginal effects of explanatory variables on the probability of card holding, probabilities of card debt (conditional and unconditional on card holding), and levels of card debt (conditional on card holdings) are presented in Tables 4, 5 and 6, respectively.

Income contributes to the probabilities of card holding and, to an extent, the probability of card debt, conditional on card holding. Relative to an individual with low income, the probabilities of holding 5 or more cards are 2.32% and 5.45% higher for the middle-low and middle-high income groups, respectively. There is a 23.64% lower probability of a high income individual not holding a card, followed by 7.53% and 9.19% higher probabilities of holding 1 and 2 cards, respectively, compared to a low income earner (Table 4). These outcomes are perhaps due to the current income eligibility requirement, whereby only those with income levels above RM1500 are eligible for a credit card. Meanwhile, the probability of being in debt, conditional on card holding, by a middle-low income individual is 9.26% higher than one in the low income category (Table 5). Coupled with earlier findings that the majority of card debtors are in the middle-low income group, these results

Table 4. Marginal effects of explanatory variables on the probabilities of card holding

Variables	Probability ($\times 100$) of number of cards					
	0	1	2	3	4	≥ 5
Income status						
Mid-low income	-35.06 (4.85)	9.11 (1.98)	13.41 (2.03)	6.71 (1.17)	3.52 (0.73)	2.32*** (0.63)
Mid-high income	-49.29 (5.98)	8.83 (2.08)	17.64 (2.31)	10.77 (1.89)	6.59 (1.50)	5.45*** (1.64)
High income	-23.64* (12.85)	7.53** (3.03)	9.19* (4.96)	3.99 (2.74)	1.87 (1.51)	1.06 (1.06)
Socio-demographic variables						
Age / 10	-9.13 (2.27)	1.56 (0.43)	3.46 (0.89)	2.06 (0.60)	1.19 (0.38)	0.85*** (0.31)
Male	2.37 (3.77)	-0.41 (0.65)	-0.90 (1.43)	-0.54 (0.85)	-0.31 (0.50)	-0.22 (0.35)
Malay	3.67 (5.75)	-1.14 (1.72)	-1.44 (2.26)	-0.63 (1.02)	-0.30 (0.49)	-0.16 (0.28)
Chinese	-31.00 (5.67)	3.88** (1.72)	11.06 (2.44)	7.45 (1.41)	4.70 (0.96)	3.90*** (0.93)
High school	-20.47 (6.47)	6.03** (2.48)	7.99 (2.58)	3.65 (1.08)	1.77 (0.56)	1.04*** (0.37)
Tertiary	-27.99 (7.02)	7.16 (2.56)	10.80 (2.84)	5.40 (1.31)	2.81 (0.78)	1.82*** (0.55)

Table 4 (continued). Marginal effects of explanatory variables on the probabilities of card holding

Variables	Probability ($\times 100$) of number of cards					
	0	1	2	3	4	≥ 5
White collar	-2.79 (5.21)	0.53 (1.04)	1.07 (2.01)	0.61 (1.13)	0.34 (0.63)	0.24 (0.43)
Unemployed	-12.27 (9.36)	1.70 (1.15)	4.53 (3.35)	2.92 (2.35)	1.77 (1.55)	1.36 (1.30)
Household size	2.56 (0.91)	-0.44** (0.18)	-0.97 (0.35)	-0.58 (0.22)	-0.33** (0.14)	-0.24** (0.10)
Kuala Lumpur	-0.16 (4.41)	0.03 (0.80)	0.06 (1.68)	0.04 (0.98)	0.02 (0.55)	0.01 (0.39)
Penang	-2.89 (4.76)	0.48 (0.81)	1.09 (1.79)	0.66 (1.08)	0.38 (0.63)	0.28 (0.46)
Financial status						
Home owner	-0.64 (4.11)	0.11 (0.71)	0.24 (1.56)	0.14 (0.93)	0.08 (0.53)	0.06 (0.38)
Loan commitments	-11.14 (1.31)	1.91 (0.45)	4.22 (0.60)	2.52 (0.41)	1.45 (0.31)	1.04*** (0.26)
Current	-17.11 (5.06)	1.64 (0.57)	6.05 (1.71)	4.32 (1.50)	2.78** (1.11)	2.33** (1.13)

Note: Asymptotic standard errors in parentheses. Asterisks indicate levels of significance: *** = 1%, ** = 5%, * = 10%.

Table 5. Marginal effects of explanatory variables on probabilities of card debt

Variable	Conditional on card holding		Unconditional on card holding	
	Estimate	S.E.	Estimate	S.E.
Income status				
Mid-low income	9.26**	4.14	-6.70	15.76
Mid-high income	8.18	5.24	-14.52	16.14
High income	7.02	7.76	-3.90	19.23
Socio-demographic variables				
Age / 10	4.63***	1.52	3.90**	1.55
Age ≤ 25	4.72	5.61	10.37	12.24
Age 26-35	2.94	2.85	6.46	6.23
Age ≥ 57	-0.64	7.02	-1.41	15.42
Male	0.74	2.87	3.24	5.65
Malay	1.50	3.93	9.10	10.14
Chinese	1.86	4.00	-13.24	9.43
High school	10.27***	3.90	11.33	12.58
Tertiary	7.39**	3.70	0.21	12.46
White collar	5.14	3.79	9.81	7.84
Unemployed	-2.62	6.90	-10.54	13.37
Household size	-1.36*	0.75	-1.22	1.50
Kuala Lumpur	1.90	3.24	4.15	6.34
Penang	-3.12	3.59	-8.61	7.07
Financial status				
Home owner	0.32	2.081	0.274	1.763
Current	9.51***	3.306	7.091***	2.547
Debt status				
Loan commitments	5.65***	0.792	4.77***	0.98
House loan	-4.78*	2.796	-10.50*	6.06
Student loan	-6.54	4.424	-14.37	9.63
Car loan	1.27	2.715	2.79	5.97
Personal loan	0.57	3.178	1.25	6.98
Bad debt history	6.83**	3.345	15.01**	7.34
Financial knowledge				
Marg. knowledge	0.63	2.355	1.39	5.17
Full knowledge	2.30	4.703	5.06	10.31

Note: All probabilities are multiplied by 100. Asterisks indicate levels of significance: *** = 1%, ** = 5%, * = 10%.

Table 6. Marginal effects of explanatory variables on card debt, conditional on card holdings

Variable	Credit card debt level, conditional on number of card(s), in RM				
	1	2	3	4	≥ 5
Socio-demographic variables					
Age / 10	89.77* (47.76)	118.70** (54.19)	91.99** (36.80)	72.98 (46.93)	60.39 (296.82)
Chinese	-552.05* (350.38)	-177.75 (200.35)	-142.57 (156.82)	-107.95 (122.75)	-89.01 (101.80)
Financial status					
Current	196.46* (101.86)	240.33** (107.64)	186.02** (75.20)	147.64*** (54.35)	121.92*** (42.51)
Debt status					
Loan commitments	109.57*** (38.63)	144.87*** (40.32)	112.28*** (26.36)	89.08* (50.82)	73.71 (258.48)
House loan	-344.57 (222.86)	-227.93* (139.06)	-178.64* (104.26)	-139.62* (78.80)	-115.42* (64.07)
Bad debt history	506.76** (257.54)	341.30* (175.55)	267.54* (139.49)	208.66* (112.06)	171.86* (94.99)

Note: Asymptotic standard errors in parentheses. Asterisks indicate levels of significance: *** = 1%, ** = 5%, * = 10%. Results for non-statistically significant variables were not reported for brevity purposes.

for income suggest that the bulk of credit revolvers are more likely to be encountered amongst these middle-low income earners. However, the overall insignificance of income on the level of card debt appears to debunk the misconception that lower income card holders are more susceptible to card debt traps.

Age contributes to the probabilities of cardholding only for holdings of 5 cards or more. For every additional 10 years in age, the probability of owning 5 or more cards increases by 0.85% (Table 4). The probabilities of card debt, conditional and unconditional on card holding, increase by 4.63% and 3.90%, respectively, for every 10 year increase in age (Table 5). In terms of level of card debt, each additional 10 years in age result in additional RM89.77, RM118.70, and RM91.99 in card debt, conditional on holding 1, 2, or 3 cards, respectively (Table 6). These results imply that age has a positive effect on card holding, perhaps because older individuals are more likely to meet the income eligibility requirement and have a stronger employment history than younger individuals. However, contrary to the perception that younger individuals are less disciplined in financial management, the finding here suggests that older card holders are more likely to be in debt and also in deeper debt compared

to their younger cohort. These older individuals are revolving their credit limits and are less disciplined than their younger cohort in cards usage. A possible reason for this age factor may be the larger financial commitments among the older individuals.

Ethnicity is a statistically significant determinant of the probability of card holding as the Chinese are more likely to hold 1 (3.88%) and 5 or more (3.90%) cards, respectively, compared to an individual of Indian/other descent (Table 4). On the other hand, Chinese consumers have RM552.05 lower card debts conditional on holding one card compared to their Indian/other ethnic cohort (Table 6). This implies that although Chinese consumers may have a higher likelihood to own multiple cards, they are most likely convenience users who treat their cards as a transaction medium. This is in light of the results that the level of debt amongst Chinese card holders is significantly lower than those of Indian/other descent. The Malays are not found to be more likely to hold a card or be in deeper debt than the Indians and others.

Education is a positive factor in card holding. Compared to individuals with primary education, an individual with high school (tertiary) education has a 1.04% (1.82%) higher probability of holding 5 or more cards, and a 6.03% higher probability of holding one card (Table 4). In addition, education has significant effects on the probability of card debt, conditional on card holdings, as those with high school (10.27%) and tertiary (7.39%) education are more likely to incur card debt than those with primary/grade school education (Table 5). The results indicate that better educated individuals are more likely to own a larger number of cards and have higher probabilities to incur card debt. These outcomes may be attributed to the greater purchasing power among the better educated individuals. Thus, any policy measure to address this issue should be cognizant that education *per se* may not be sufficient to overcome the problem of card revolvers in debt. Psychological and counseling assistance, as well as other types of support mechanisms, may also be required in tandem.

While household size has statistically significant effects on the probability of card holding (Table 4) and the probability of card debt conditional on card holding (Table 5), it does not affect the level of card debt conditional on card holding (not presented). In essence, with each additional member in the household, the probabilities of holding 1, 4 and 5 or more cards decrease by 0.44%, 0.33%, and 0.24%, respectively. Amongst individuals who own a card, each additional household member lowers the probability of card debt by 1.36%. This result suggests that despite additional household members contributing to greater financial commitments, individuals could be more cautious of holding additional cards even though they could serve as a tool to provide relief for possible financial constraints and are also more responsible in their usage of credit card.

Owning a housing loan lowers the probability of card debt amongst card holders (4.78%) and among the general population (10.50%) (Table 5). Additionally, compared to an individual without a housing loan, the level of card debt for house loan borrowers, conditional on holding 2, 3, 4, and 5 or more cards, are lower by RM227.93, RM178.64, RM139.62, and RM115.42, respectively (Table 6). These findings imply that consumers with widespread borrowings, such as housing loans, may be judicious with their spending and are less likely to be in card debt.

Compared to non-current account owners, a current account holder has 2.78% and 2.33% higher probabilities of holding 4 and 5 or more cards, respectively (Table 4). There is also a higher probability of being in card debt, conditional (9.51%) and unconditional (7.09%) on card holding (Table 5). Further, compared to non-current account holders, the level of debt of current account owners are higher by RM196.46, RM240.33, RM186.02, RM147.64 and RM121.92, conditional on holdings of 1, 2, 3, 4 and 5 or more cards, respectively (Table 6). These results can be rationalized by the fact that although a current account typically grants users access to the use of cheques and possibly overdraft facilities, credit cards act as a handy and complementary payment tool to cheques. In essence, cheques are less widely accepted in retail outlets in Malaysia and are usually used for larger value purchases or planned purchases only. Meanwhile, credit cards are more widely accepted and are commonly used for smaller retail purchases as well as being more suited for unplanned purchases. Moreover, the results also indicate the higher tendency amongst current account holders to utilize their credit cards as a borrowing instrument while revolving their finances.

The number of loan commitments has positive effects on the probability of card holding, probability of card debt, and amount of debt incurred. Specifically, for each additional loan committed, the probability of owning 5 or more cards increases by 1.04% (Table 4), while the probabilities of card debt, conditional and unconditional on card holding, increase by 5.65% and 4.77%, respectively (Table 5). Each additional loan commitment results in additional RM109.57, RM144.87, RM112.28, and RM89.08 in debt, conditional on holding of 1, 2, 3 and 4 cards, respectively (Table 6). In this case, the perception and role of credit card as a tool for quick credit access appear to apply given that credit cards are viewed as being more attractive to individuals with more loan commitments. Indeed, card holders with more loan commitments are more likely to turn to the cards as a mechanism to revolve their finances in order to ease and cushion their financial liquidity. This suggests that it is also easier for card holders to fall into financial debt traps due to the relatively easy access to credit via credit cards compared to personal loans.

It is worth noting that, with the exception of house loans, the other types of loan portfolios do not affect the likelihood or level of card debt. Regardless of the type of loan portfolios, it remains a loan commitment and as shown by the results, it is the number of loan commitments that matters and not the type of loan that ascertains the likelihood of being in debt as well as the amount of debt incurred.

Bad debt history in the previous three years is a significant factor in current debt levels. Compared to individuals without a bad debt history, card holders who experienced difficulties in debt repayment during the past three years are 6.83% (15.01%) more likely to be in card debt conditional (unconditional) on card holding (Table 5). Similarly, the debts of such individuals are higher by RM506.76, RM341.30, RM267.54, RM208.66 and RM171.86, conditional on holdings of 1, 2, 3, 4 and 5 or more cards, respectively (Table 6). These findings corroborate the results of Lee and Kwon (2002), who found that consumers in the USA with bad debt history are more likely to be credit revolvers than inactive card users. These outcomes also suggest that serial borrowers may not be learning from their previous debt experience or mistakes and are inclined to fall into future debt traps easily. Psychological factors may shed some insights on the personalities of such compulsive debtors.

Knowledge of card terms and conditions also has no effect on debt holdings. Thus, *a priori* expectations that a better understanding of the terms and conditions in card uses may help card holders make better informed decisions do not hold. The current findings appear to contradict the argument supporting financial literacy for better personal financial management (Chen and Volpe 1998; Hilgert and Hogarth 2003; Fox et al. 2005). Instead, the lack of knowledge towards card terms and conditions, as well as the notion that the majority of the consumers hold cards because it is a convenient tool, suggests that card holders may not bother to find out about the cost of credit as they did not expect to use their cards as a borrowing tool (Ausubel 1991; Canner et al. 1992; Calem and Mester 1995). Further, the findings also indicate that unlike other consumer loans such as car or housing loans, which are largely planned purchases, the easy credit that comes with credit cards makes unplanned purchases convenient, thus contributing to the problem of impulsive purchases even if one is unable to afford it.

Number of cards contributes significantly to deeper card debt, particularly for holdings of 5 or more cards. Table 7 shows that relative to card holders with 2 cards, a card holder who holds 5 cards are RM606.02 higher in debt. Further, relative to card holders with 4 cards, an additional card (holding 5 cards) contributes to RM847.77 more in card debt.

Table 7. Average treatment effects: effects of credit cards on card debt, in RM

Number of cards	Relative to: number of cards			
	1	2	3	4
2	-222.08 (298.57)			
3	-27.65 (323.08)	194.43 (232.08)		
4	-463.83 (367.52)	-241.75 (250.37)	-436.18 (281.66)	
5	383.94 (380.95)	606.02** (292.51)	411.59 (321.75)	847.77** (332.35)

Note: Asymptotic standard errors in parentheses. Asterisks ** indicate statistical significance at the 5% level.

Overall, a comparison of the present findings to those of other studies, such as those in the USA, yield similar as well as dissimilar outcomes. For example, age, education, income and bad debt history are found to have similar significant effects on the probability and level of card debt in Malaysia. However, the effects of these variables on the probability and level of card debt in the USA differ across studies. While Lee and Kwon (2002) suggested that older card holders tend to be revolvers, Min and Kim (2003) found the opposite. Further, while results of the present study corroborate the findings by Chien and DeVaney (2001) and Kim and DeVaney (2001) that better educated card holders have higher tendencies to own card debt, Lee and Kwon (2002) and Min and Kim (2003) found the reverse to be true as it is the less educated card holders who are more likely to be revolvers.

VI. Concluding remarks

Household size, age, number of loan commitments, ethnicity, income, education level, and current account ownership are found to play significant roles in card holding. While a number of socio-demographic factors such as household size, age, income, and education level can also explain the probability of card debt, only age and ethnicity significantly explain the level of card debt. The consumer's general financial/credit consumption tendencies, such as number of loan commitments, current account ownership, and bad debt history, are relevant in explaining both the probability and level of card debt.

Specifically, individuals of Chinese descent are found to utilize the credit card as a medium of transaction or convenience. This is in light of their higher likelihood

of obtaining a card and lower probability to be in card debt as well as being in lower debt levels. On the other hand, factors associated with being a credit revolver include older multi-card holders with a larger number of loan commitments, current account holders, and those who experienced credit constraints/difficulties in debt repayment/bad debt during the past three years.

It is also interesting to note that financial literacy does not play a role in either the probability or level of card debt. The statistical insignificance of financial literacy in card debt supports the findings by Ausubel (1991), Canner et al. (1992) and Calem and Mester (1995), whereby card holders' lack of interest towards its terms and conditions may be explained by card holders' failure to learn from past debt experience and their underestimation of the tendency to be in card debt.

Our findings have important policy implications, for the central monetary authorities as well as the credit card industry. First, the number of loan commitments has a statistically significant impact on the probability of holding a credit card(s), the probability of being in debt, as well as the level of card debt. In addition, the insignificance of income on the probability and level of card debt amongst card holders debunks the misconception that lower income card holders are more susceptible to card debt traps. As a result, it is suggested that the central bank mandate additional card approval measures by the card issuers, such as existing loan commitments and other financial burdens, in addition to the current age and income eligibility criteria. At present, credit cards are often approved without any consideration of the payback ability or current financial burden of the applicant. More stringent background checks are performed for personal loan approvals instead. Although the advent of such stringent vetting measures may end up as added bureaucratic measures, this would prevent card holders from falling into the potential debt pitfall in the long run.

Second, there exists a direct effect of number of existing card holdings on the level of card debt. The implication of this is that multiple card holders are more likely to be credit revolvers than convenience users. As individuals do not learn from their previous debt experience or mistakes and are inclined to fall into debt traps repeatedly, the central bank might consider regulating the number of card holdings. Such regulations may mitigate revolving credits and decrease card debts. Moreover, while the government of Malaysia has recently imposed a RM50 service tax on each principal credit and charge card in an attempt to promote prudent spending, the effectiveness of this measure may not bring about its desired effect. Since groups of Malaysian consumers are using credit cards as a revolving tool rather than for convenience, such individuals would therefore be willing to pay the additional service tax in order to enjoy the credit facilities offered by credit cards.

Third, as part of market penetration and expansion strategies, card issuers may consider directing advertising campaigns to target groups, such as university and college students or current account holders, given our finding that higher educated persons and current account holders are more likely to hold a credit card(s). Current account holders are also attractive to card issuers given their higher propensity and levels of debt acquirement.

Last, we find that only the Chinese are more likely to own a credit card than individuals of other ethnicity, and that ethnicity does not play a role in the probability and level of card debt. This sparse significance of ethnicity in distinguishing between convenience users and revolvers may indicate that credit consumption goes beyond ethnicity. While there exists a unique multi-ethnic society in Malaysia, such consumers do not differ significantly in their perceptions towards non-cash payments or a “buy today, pay later” lifestyle. Hence, card advertisements and promotions targeting ethnic groups alone may not bring about significant impacts.

This study represents one of the first attempts at econometrically determining the effects of socio-demographic factors on card ownership and debt behavior in Malaysia. The statistical model we developed addresses the non-random sample selection, endogeneity of card number in card debt, and censoring of card debt among card holders. Data permitting, future studies might repeat this analysis by using longitudinal panel data to assess the robustness of our findings. In addition, the glaring significance of card holder’s past and current credit consumption suggests the possibility of exploring insights from psychology theories, such as theories of self control, to better understand the instant gratification and temptation of consumers to make impulsive purchases or indulge in imprudent spending behavior.

References

- ABM (Association of Banks in Malaysia) (2009), Banks lower credit card interest rates to help consumers to cope with the weakening economic indicators, February 12. http://www.abm.org.my/Banks_Lower_Credit_Card_Interest_Rates_To_Help_Customers_Cope_With_Weakening_Economic_Indicators.aspx. Accessed 2 September 2010.
- Ausubel, Lawrence M. (1991), The failure of competition in the credit card market, *American Economic Review* **81**: 50–81.
- BNM (Bank Negara Malaysia) (2009), Credit cards operation in Malaysia, *Monthly Statistical Bulletin*, Bank Negara Malaysia, November.
- Bertaut, Carol C., Michael Haliassos, and Michael Reiter (2008), Credit card puzzles and debt revolvers for self control, *Review of Finance* **13**: 656–692.
- Blundell, Richard, and Costas Meghir (1987), Bivariate alternatives to the Tobit model, *Journal of Econometrics* **34**: 179–200.

- Brito, Dagobert L., and Peter R. Hartley (1995), Consumer rationality and credit cards, *Journal of Political Economy* **103**: 400–433.
- Calem, Paul S., and Loretta J. Mester (1995), Consumer behaviour and the stickiness of the credit-card interest rates, *American Economic Review* **85**: 1327–1336.
- Canner, Glenn B., and Charles A. Lockett (1992), Developments in the pricing of credit card services, *Federal Reserve Bulletin* **78**: 652–666.
- CNN (Cable News Network) (2009), APEC 2009: Chinese credit card debt mounts, 11 November 2009. <http://edition.cnn.com/2009/BUSINESS/11/10/china.credit.debt/index.html>. Accessed 29 March 2010.
- Castronova, Edward, and Paul Hagstrom (2004), The demand for credit card: Evidences from the survey of consumer finances, *Economic Inquiry* **42**: 304–318.
- Chien, Yi-Wen, and Sharon A. DeVaney (2001), The effects of credit attitude and socio economic factors on credit card and installment debt, *Journal of Consumer Affairs* **35**: 162–179.
- Chen, Haiyang, and Ronald P. Volpe (1998), An analysis of financial literacy among college students, *Financial Services Review* **7**: 107–128.
- Delener, Nejdet, and Herbert Katzenstein (1994), Credit card possession and other payment systems: Use patterns among Asian and Hispanic consumers, *International Journal of Bank Marketing* **12**: 13–25.
- Department of Statistics Malaysia (2001), *Population and housing census of Malaysia 2000*, Department of Statistics Malaysia, Putrajaya, Malaysia.
- Dhrymes, Phoebus J. (1986), Limited dependent variables, in Z. Griliches, and M.D. Intriligator, eds., *Handbook of econometrics*, vol. 3, Amsterdam, Elsevier Science.
- Duca, John V., and William C. Whitesell (1995), Credit cards and money demand: A cross-sectional study, *Journal of Money, Credit and Banking* **27**: 604–623.
- Durkin, Thomas A. (2000), Credit cards: Use and consumer attitudes: 1970–2000, *Federal Reserve Bulletin* September: 623–634.
- Economic Planning Unit Malaysia (2010), *Tenth Malaysia Plan 2011–2015*, The Economic Planning Unit, Prime Minister's Department, Putrajaya, Malaysia.
- Foster, Kevin, Erik Meijer, Scott Schuh, and Michael A. Zabek (2010), The 2008 Survey of Consumer Payment Choice, Discussion Paper 09–10, Federal Reserve Bulletin of Boston Public Policy.
- Fox, Jonathan, Suzanne Bartholomae, and Jinkook Lee (2005), Building the case for financial education, *Journal of Consumer Affairs* **39**: 195–214.
- Hasbalaila, Alias (2001), Consumption behavior: A study on consumer's attitude on spending using credit card and its effect on credit card debt, MBA thesis, Universiti Sains Malaysia, Penang, Malaysia.
- Heckman, James J. (1979), Sample selection bias as a specification error, *Econometrica* **47**: 153–161.
- Hilgert, Marianne A., and Jeanne M. Hogarth (2003), Household financial management: The connection between knowledge and behaviour, *Federal Reserve Bulletin* July: 309–322.
- Johnson, Kathleen W. (2004), Convenience or necessity? Understanding the recent rise in credit card debt, Finance and Economics Discussion Series Paper 2004–47, Board of Governors of the Federal Reserve System, Washington, DC.
- Johnson, Kathleen W. (2007), The transactions demand for credit cards, *The B.E. Journal of Economic Analysis & Policy* **7**. Published as doi: 10.2202/1935-1682.1411 <http://www.bepress.com/bejeap/vol7/iss1/art16>.
- Kasteridis, Panagiotis P., Murat K. Munkin, and Steven T. Yen (2010), A binary-ordered probit model of cigarette demand, *Applied Economics* **42**: 413–426.
- Kim, Haejong, and Sharon A. DeVaney (2001), The determinants of outstanding balances among credit card revolvers, *Financial Counseling and Planning* **12**: 67–78.

- King, Amanda S. (2004), Untangling the effects of credit cards on money demand: Convenience usage vs. borrowing, *Quarterly Journal of Business and Economics* **43**: 57–80.
- Kinsey, Jean D. (1981), Determinants of credit cards accounts: An application of Tobit analysis, *Journal of Consumer Research* **8**: 172–82.
- Lee, Jinkook, and Kyoung-Nan Kwon (2002), Consumers' use of credit cards: Store credit card usage as an alternative payment and financing medium, *Journal of Consumer Affairs* **36**: 239–262.
- Loh, Joseph, and Rashvinjeet S. Bedi (2009), Bank awaits guidelines on credit card tax, *The Star Newspaper*, 1 November 2009. <http://thestar.com.my/news/story.asp?file=/2009/11/1/nation/20091101072143&sec=nation>. Accessed 29 March 2010.
- MARC (Malaysian Rating Corp. Bhd.) (2009), MARC: Credit card tax unlikely to reduce consumer spending. *Daily Express*, October 31, 2009. <http://www.bernama.com/bernama/v5/newsbusiness.php?id=451150>. Accessed 29 March 2010.
- Michael, Robert T., and Gary S. Becker (1973), On the new theory of consumer behavior, *Swedish Journal of Economics* **75**: 378–396.
- Min, Insik, and Jong-Ho Kim (2003), Modeling credit card borrowing: A comparison of type I and type II Tobit approaches, *Southern Economic Journal* **70**: 128–143.
- Monetary Authority of Macao (2009). Report on credit card statistics, 1st half of 2009. Research and Statistics Department, Monetary Authority of Macao, Macao. http://www.amcm.gov.mo/publication/quarterly/Oct2009/CCS_en.pdf. Accessed 29 March 2010.
- Monetary Authority of Singapore (2009), *Monthly statistical bulletin*, August, Macroeconomic Surveillance Department. http://www.mas.gov.sg/resource/data_room/msb/August%202009%20Vol%2030%20No%208.pdf. Accessed 29 March 2010.
- Ng, Suzhen (2009), Credit card debt and you: Under-30s under siege, *The Malay Mail Newspaper*, June 15, 2009. <http://www.mmail.com.my/content/credit-card-debt-and-you-under30s-under-siege>. Accessed 29 March 2010.
- Ramayah, T., Nasser Noor Aizzat Mohd. Nasrudin, and Lim Hee Choo (2002), Card holders' attitude and bank credit card usage in Malaysia: An exploratory study, *Asian Academy of Management Journal* **7**: 75–101.
- Ridley, Scott (2004), Taiwan tackles high credit card default rate. Asia Times Online, August 18, 2004. <http://www.atimes.com/atimes/China/FH18Ad04.html>. Accessed 29 March 2010.
- Rosenbaum, S. (1961). Moments of a truncated bivariate normal distribution, *Journal of the Royal Statistical Society (Ser. B)* **23**: 405–408.
- Sharaff, Syed (1998), Factors influencing the level of credit card usage, MBA thesis, Universiti Sains Malaysia, Penang, Malaysia.

