FINANCIAL SERVICES REVIEW

Financial Services Review 30 (2022) 107–124

# Financial literacy and its impact on the credit card debt puzzle

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**Abstract**

The credit card debt puzzle is not well understood. Households exhibit inefficient behavior when they have sufficient liquid assets to pay off their credit card balance, but do not. Based multinomial regression analyses of the 2016 Survey of Consumer Finances, the study discovered that households that display this behavior are more likely to have lower financial literacy than convenience users. The findings suggest financially literate households are less likely to display irrational behavior regarding the credit card debt puzzle. © 2022 Academy of Financial Services. All rights reserved.

*JEL classifications:* G530; J24; G510

*Keywords*: Behavioral life-cycle; Credit card debt puzzle; Financial literacy; 2016 survey of consumer finances

## 1. Introduction

Household credit card use is widespread. Comparing all debt across households, credit card debt is the debt type most extensively used by households (Bricker et al., 2017). Over 70% of U.S. households have a credit card (Bucks, Kennickell, Mach, & Moore, 2009). There are two main groups of credit card users: those users who pay off their balance at the end of each month, commonly called convenience users, and those who carry a balance from month to month. These households that carry a balance from month to month are known as revolving credit card users (Kim & DeVaney, 2001). According to the 2016

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Survey of Consumer Finances, 44% of families carry a balance on their credit cards. Since 2013, the median and mean balance both decreased by 3% balance (Bricker et al., 2017).

Within the revolving credit card users, there is a group of users, solvent revolvers, who have enough liquid assets to pay the balance of their credit cards but choose not to pay it off. Bi (2005) finds that 58% of revolving credit card users have liquid assets (liquid assets include monetary assets including checking, saving, and money market accounts and call accounts) totaling more than their credit card balance. Credit cards typically charge high interest rates on a revolving balance and liquid accounts (like checking and money market accounts) accrue low (if any) after-tax interest. Based on the interest rates, it is inefficient for a household to maintain a revolving balance. Previous studies that have investigated this irrational behavior call this the credit card debt puzzle or the co-holding puzzle (Bertaut, Haliassos, & Reiter, 2009; Gathergood & Weber, 2014; Haliassos & Reiter, 2005; Laibson, Repetto, & Tobacman, 2001).

Many studies research the credit card debt puzzle; however, few combine human capital theory and behavioral life cycle theory. The purpose of this paper is to study the effect of financial literacy on credit card debt treatment. It is hypothesized that households that have higher financial literacy will be less likely to display this puzzling behavior.

## 2. Literature review

Literature suggests a planner or doer framework is often a way to explain irrational behavior. The behavioral life cycle theory puts forward that a household is composed of two dueling selves, the planner and the doer. The planner is the forward-thinking, rational self while the doer is myopic and focused on current consumption (Shefrin & Thaler, 1988). The household makes decisions to satisfy both the planner and doer and may display conflicting and inefficient behaviors, such as the credit card debt puzzle. Several studies attempted to explain the credit card debt puzzle, or solvent revolving credit card use, with several distinct factors such as financial human capital, precautionary savings motives, and self-control. Gross and Souleles (2002) find that revolving high credit card balances while simultaneously holding liquid assets stem from behavioral explanations, not lack of liquidity.

### *2.1. Human Capital*

The planner/doer model suggests the planner will reduce consumption in the current period by exerting a level of willpower. Because willpower is costly, the planner will resort to other techniques to reduce the consumption of the doer. Some of these techniques include mental accounting and rule-setting (Shefrin & Thaler, 1988). In the planner/doer model, the level of human capital can impact financial decisions. Becker (1964) describes human capital as an individual's stock of knowledge, health, skills, or values. It is a function of goods, services, time, and the individual's current stock of human capital. Human capital is often improved through learning, maturity, and experiences. In the realm of finance, individuals can improve their human capital by taking financial courses to improve their ability to understand and

make effective financial decisions. Individuals can also improve their financial human capital through experiences like using credit cards or taking out a home mortgage. Households with an elevated level of financial knowledge and experience are considered financially literate or financially sophisticated; these households can make more effective financial decisions than households with a lower level of financial literacy or financial sophistication.

Financial literacy gives the household the potential to improve their ability to make better financial decisions. The households with a higher level of financial sophistication tend to be aware of the consequences of their decisions. Bertaut et al. (2009) suggests that financially sophisticated households would be convenience users of credit cards as well as benefit from floating and other advantages of credit cards.

Although, some financially sophisticated households display characteristics that are not sophisticated. For example, Haliassos and Reiter (2005) find that in the shopper/accountant model, the shopper is not fully financially sophisticated. The accountant/shopper model is like the planner/doer model.

### *2.2. Mental accounting and precautionary savings motives*

To control the doer, the planner creates mental accounts to reduce the temptation to spend from them. Households divide assets, expenditures, and income into distinct categories or mental accounts. An economist would state that these accounts are substitutable, but they are not (Thaler, 1999). The household views the mental accounts, either assets or expenses, as different things, and marginal propensity to consume from these accounts are different. For example, households save money in an emergency fund account to prepare for an uncertain event. The household uses framing to earmark these accounts for difference purposes. Households that save in liquid accounts for emergencies or unexpected events do not believe the assets are substitutable for other assets or expenses.

When households use mental accounting for expenses, especially with credit cards, they decouple the payment from the consumption. Once the bill is received, the purchase is mixed with other purchases. Thaler (1999) states that it is hard for the consumer to attribute the balance to any purchase: therefore, the consumer carries a balance from month to month. Because households have mental accounts, they will not view accounts used for savings as available to pay off credit card balances since these accounts are not substitutable.

Uncertainty and precautionary savings motives play a role in mental accounting. Telyukova and Wright (2008) propose that households stay solvent revolvers to maintain sufficient liquid assets for uncertain future events. Bi and Hanna (2006), Druedahl and Jørgensen (2018), and Gorbachev and Luengo-Prado (2019) find that households will display the credit card debt puzzle when precautionary savings motives are present.

### *2.3. Self-control*

Although the planner creates mental accounts to control the doer, the individual must exhibit self-control. An individual displays self-control issues by either postponing action (e.g., procrastination) or by consuming immediately (e.g., no willpower to wait). Households that display self-control issues either consume all their resources without saving

or paying debt or putting off making critical decisions. One study shows that in an accountant/shopper household, the accountant would choose not to pay off the credit card balance to impose control over the shopper (Bertaut et al., 2009). By reducing the available limit on the credit card, the shopper is unable to consume more. Gathergood and Weber (2014) show that the likelihood of displaying the credit card debt puzzle, or co-holding, increases with self-assessed impulsiveness.

Other studies have identified other behavioral factors that affect solvent revolving credit card use. Credit attitude and bankruptcy history are often considered when households exhibit credit card debt puzzle. First, Chien and DeVaney (2001) find that a positive credit attitude was related to a higher credit card balance. Rutherford and DeVaney (2009) find that those households that had a positive attitude toward credit are less likely to be convenience users.

## 3. Theory and conceptual framework

Other studies evaluate how the credit card debt puzzle, and the relevant behavioral factors are related, however few focus on the intersection of financial knowledge and behavior. This study uses a combination of the behavioral life-cycle hypothesis and human capital theory to focus on how behavioral factors and human capital influence the likelihood of being a solvent credit card revolver.

Like the life-cycle hypothesis, the behavioral life-cycle hypothesis (Shefrin & Thaler, 1988) puts forward that to maximize utility, a household will shift resources in periods where the marginal utility of consumption is low to periods where the marginal utility of consumption is high. A good example of this is when households save during the working years for consumption during retirement years. Unlike the traditional life-cycle hypothesis, the behavioral life-cycle hypothesis posits that households have a dual preference framework where they are both planners (long-term) and doers (short-term). The planner preference is when households make rational decisions regarding when to shift resources to maximize utility. The planner focuses on long-term decisions to maximize utility. The doer preference, or short-term preference, is when households succumb to temptation to consume in the current period. The three behavioral factors, self-control, mental accounting, and framing are what make the behavioral life-cycle hypothesis different from other life-cycle models.

Self-control refers to the household's temptation to make immediate consumption decisions, rather than saving for future consumption. For the doer, immediate consumption is always a tempting alternative to future consumption. There is discomfort for the doer associated with postponing current consumption; therefore, the planner will enforce saving devices and rules of thumb to deal with self-control issues for various situations. These are types of external rules that households use to plan for future consumption. Households also use internal rules, like refusing to borrow for current consumption, to maintain self-control.

Mental accounting refers to placing wealth into different non-substitutable accounts. The typical breakdown of mental accounts is current income, current assets, and future income (Shefrin & Thaler, 1988). Households use mental accounting to restrict the doer from bringing future resources into the current period. The way a household frames the different mental accounts determines the temptation to spend from each account. Each account has a different

level of temptation associated with spending from it. The marginal propensity to consume from the current income account is much higher than the marginal propensity to consume from the future income account. Temptation plays an important role in the household's decision to spend or save.

By carrying a credit card balance, the doer is bringing consumption into the current period. The households that are solvent (i.e., households who have enough liquid assets to pay off their balance but do not) are not displaying the planner behavior but are displaying the doer behavior. In contrast, convenience users are keeping future resources in future periods by paying off the balance while still benefiting from the advantages of using a credit card.

In addition to the behavioral life-cycle hypothesis, human capital theory also plays a part in solvent revolving credit card use. Human capital is an individual's knowledge, health, skills, or values and is often described as a function of goods, services, time, and the individual's current stock of human capital. A household's level of human capital impacts its ability to make efficient financial decisions. Households with a higher level of financial human capital (i.e., financial sophistication) have the potential to improve the ability to make effective and efficient financial decisions.

## 4. Hypotheses

Based on the theoretical framework, the concepts developed for this paper include human capital, mental accounting/precautionary savings motives, self-control factors, and other lifecycle control factors. The concepts serve as control factors to explain why households display puzzling behavior that is inefficient. The hypotheses are as follows:

H01: Higher levels of financial literacy will reduce the likelihood of revolving credit card debt even when financially solvent.

H02: Mental accounting behaviors will increase the likelihood of revolving credit card debt even when financially solvent.

H03: Self-control issues will increase the likelihood of revolving credit card debt even when financially solvent.

## 5. Method

### *5.1. Data and sample*

The data used were from the 2016 Survey of Consumer Finances (SCF), a triennial survey, which is sponsored by the Federal Reserve Board and collected by the National Organization for Research at the University of Chicago (Board of Governors of the Federal Reserve System, 1998-2013). The SCF collects detailed information on the finances of U.S. households. The 2016 SCF included 6,248 households in the public data set. The 2016 SCF contains five implicates to deal with missing data. The total number of observations with all

five implicates is 31,240 observations. For this study, we only used the first implicate and because this study only analyzes those households that have a credit card, the final sample is limited to 4,725 observations. We created an additional subsample (N-2360) by censoring the data to only solvent revolvers and convenience users to assess credit use decisions among the most financially literate respondents (answered all financial literacy questions correctly).

### *5.2. Dependent variables*

The dependent variable is constructed by categorizing credit card users into one of three categories. First, solvent revolvers are credit card users have liquid assets greater than or equal to the balance still owed on their main credit card after the last payment was made to the account. The total liquid assets are derived from the Federal Reserve Board definition in the net worth code. From this definition, liquid assets include money market accounts, checking accounts, savings accounts, call accounts, and prepaid cards. Next, insolvent revolvers are credit card users have liquid assets less than the balance still owed on their main credit card after the last payment is made to the account. Last, convenience credit card users do not have an outstanding balance on their main credit card. To answer our research questions, we create an unranked three level categorical variable of credit card user, and dichotomous variables to for each credit card user type.

### *5.3. Independent variables by concept*

Based on the behavioral life-cycle hypothesis and human capital theory, four concepts were identified: human capital/financial literacy, mental accounting/precautionary savings motives, self-control factors, and other lifecycle control factors. Independent variables operationalized these concepts.

The human capital concept explains the household's potential to make effective decisions. Households that do not have a strong base in financial human capital (i.e., financially literate) tend to make suboptimal financial decisions (Bertaut et al., 2009). Because the purpose of this study is to evaluate the impact of financial literacy on solvent revolvers, human capital is the focus of the study. The human capital concept was measured by two independent variables: financial literacy and education. Financial literacy represents a type of human capital specific to personal finance while education represents a general type of human capital. The variables that make up this concept moderate the financial decisions made by the households to not pay off their credit card balance even when the household has the financial liquidity to do so.

Our primary independent variable is this concept is financial literacy. Respondents who participated in the 2016 SCF were asked three financial literacy questions. The questions stated in the survey include:

1. Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?

3. Buying a single company's stock usually provides a safer return than a stock mutual fund.

In prior studies, researchers like Lusardi and Scheresberg (2013) use these same questions to construct their proxy for financial literacy. If a respondent answered all the above questions correctly, they are classified as financially literate and coded 1. If the respondent did not answer all questions correctly then they are coded 0. The second variable included in the human capital concept is the level of education for the head of household. The level of education was categorized as noncollege degree (including less than high school, high school degree, and some college) and college degree.

The mental accounting concept relates to how the planner controls the doer's consumption by using various mental accounts. Past literature shows that households maintain solvent revolving due to mental accounting and the framing of the different accounts. With the behavioral life-cycle hypothesis, households do not view mental accounts as substitutable. Households do not tend to use emergency savings accounts to pay off credit card balances if they are not in an emergency situation. The variables that make up this concept represent why the household will maintain liquid assets more than their credit card balance and maintain their status as a solvent revolver.

Mental accounting is measured by six independent variables. The first variable, having an emergency fund. If the household indicated they have savings for a subjective emergency fund, they are coded as 1 and 0 otherwise. The second variable, saving for unemployment, is constructed by combining two variables: if the household stated they had a savings motive for unemployment and if they expect their future income will decrease in comparison with prices in the next year. The variable is coded as 1 if the household had a motive to save for unemployment and 0 otherwise. The third variable, saving for illness, was constructed by combining two variables: if the household stated they had a savings motive for in case of illness or future medical expenses and if they have a poor health status. The variable is coded as 1 if the household had a motive to save for illness and 0 otherwise. The fourth variable is the household's ability to borrow $3,000 from friends or relatives in an emergency. The variable is coded as 1 if the household was able to borrow and 0 if the household was not able to borrow from friends or relatives. The fifth variable is if either the head of household or the spouse is self-employed. The variable is coded as 1 if self-employed and 0 if not self-employed. The last variable is the proxies whether a household owns liquid accounts. If a household report owning a liquid account such as a checking account, we code that as a 1 or 0 otherwise.

The self-control concept is included since households have limited time to make financial decisions. Households display self-control issues regarding financial decision making. Self-control plays a role in the household's susceptibility to give in to temptation to spend/consume during the current period. The self-control concept is comprised of past payment history, bankruptcy history, credit attitude, likelihood to increase spending with increased asset value, and unwillingness to decrease spending with a decrease in asset value. The first variable is the past payment history of all loans, mortgages and credit cards made during the past year. The variable is coded as 1 for those households who made payments on schedule or had no payments and 0 for those who were behind or missed payments. Past literature shows that a household maintains solvent revolving due to credit attitude and bankruptcy history. The household's credit attitude is measured by their feelings about using credit. The

variable is coded as positive if the household feels credit is a good idea, ambivalent if the household feels credit is good in some ways and bad in others, and negative if the household feels credit, is a bad idea. The ambivalent credit attitude group is the reference group for the regression analyses. Last, bankruptcy history is coded 1 if the household has ever filed for bankruptcy, or 0 if they have never filed for bankruptcy.

As a further proxy for the self-control concept, include two variables that represent spending and consumption when faced with positive or negative changes in income or financial assets. The variables, likelihood to increase spending if assets increase and unwillingness to reduce spending if assets decrease, are operationalized as dichotomous variables and coded as 1 if they report doing the action and 0 if otherwise.

The lifecycle factors concept is included since households make decisions based on being in various stages of the lifecycle. The variables that make up this concept represent why the household will maintain liquid assets more than their credit card balance and maintain their status as a solvent revolver.

The concept is measured using age, race, gender, marital status, income, and net worth. First, age is coded categorically as under 35, between 35 and 55, and over 55. Race is separated into four categories, Black, White, Hispanic, and Other. Next, gender and marital status are included in the analysis. Gender is coded as male or female and male is the reference category for the regression analyses. Marital status is coded as married or not married. The married category is the reference group. Next, household income is a continuous variable. Income is logged to see the magnitude and its effect in each of the regressions. Last, net worth is a continuous variable. Household net worth is logged to see the magnitude and its effect in each of the regressions.

### *5.4. Empirical models*

To answer the research questions, we use a combination of multinomial logistic regressions (MLR) and binary logistic regressions (BLR). MLR is used due to the structure of the dependent variable. Recall, the dependent variable is constructed by categorizing credit card users into one of three *unranked* categories: convenience users, solvent, and insolvent revolvers. We present four MLR models, specification A–D. In Specification A, we regress the human capital concept on the dependent variable. In Specification B, we include mental accounting to the previous model. We then add the self-control and estimate Specification C. In the final MLR model, we include life cycle factors to all previous three concepts. The final model uses a restricted sample that includes only convenience users and solvent revolvers who are financially literate; therefore, a BLR is used. The model seeks to explain why households remain solvent revolvers when they have the financial resources and financial sophistication to be convenience users.

### *5.5. Analysis of data*

Descriptive statistics were conducted to look at the characteristics of households. To generalize the findings back to the U.S. population, the descriptive statistics are weighted using a weight variable provided by the Federal Reserve (Lindamood, Hanna, & Bi, 2007). Since

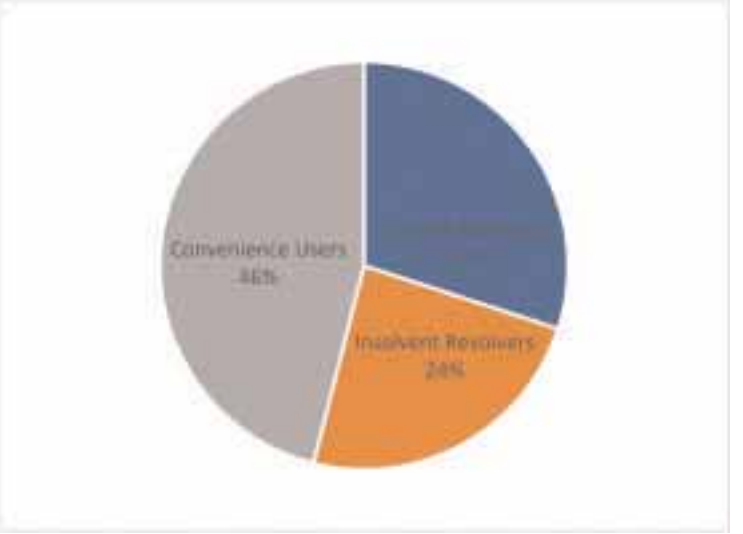


Fig. 1. Shows distribution of sample by type of credit card user type.

the dependent variables are unranked and categorical multinomial and binary logistic regressions are used to estimate the likelihood of the dependent variables occurring given the set of independent variables. The regression analyses are not weighted (Lindamood et al., 2007).

## 6. Results

### *6.1. Descriptive statistics*

Since the descriptive statistics are weighted, the reported percentages, means, and standard errors represent all U.S. households. Fig. 1 shows the distribution of credit user groups in the full sample. Convenience users account for 46% of the sample, while insolvent and solvent revolvers make up 30% and 24%, respectively. Fig. 2 presents a pie chart that shows the distribution of the sample by the number of financial literacy questions that were answered correctly. From the pie chart only 50% of the respondents in our sample were able to answer all three questions correctly. For our research, we consider respondents that answered all questions correctly as financially literate. Fig. 3 separates the credit user group by financially literate or not financially literate. Financially literate respondents are more likely to be convenience users and less likely to be solvent revolvers. See Table 1A for frequency distributions and Table 1B for mean and median of the full sample and by type of credit ser for other independent variables included in our models.

### *6.2. Regression*

Table 2 provides multinomial logistic regression results for four specifications of our empirical model. Recall that the dependent variable is credit card user type with three levels: solvent revolver, insolvent revolver, and convenience user. Convenience user is the base

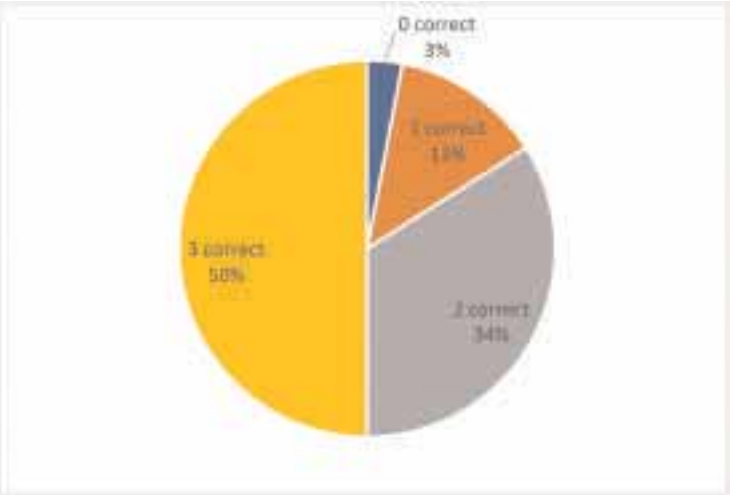


Fig. 2. Presents a pie chart that shows the distribution of the sample by the number of financial literacy questions that were correct.

reference for the MLR models discussed. All four concepts provide some value in explaining an individual's approach to credit card use. From Specification A, we see the impact of only human capital on the estimation of the likelihood of choosing between the three types of credit card use. In comparison to convenience users, financially literate individuals 46% less likely to be solvent revolvers and 54% less likely to be in insolvent revolvers. Similarly, college graduates with at least a bachelor's degree are 58% less likely to be either solvent or insolvent revolvers. In Specification B, we consider mental accounting factors in our estimation. Financially literate individuals remain less likely than not financial literate individuals to be solvent and insolvent revolvers of credit card debt, 42% and 39%, respectively. Turning to mental accounting factors, we see statistical significance from five of our six factors. Respondents with an emergency fund, are 45% less likely to be a solvent revolver and 80% less likely to be an insolvent revolver when compared with a convenience use. We observe a similar trend among the self-employed respondents as they are 32% less likely to be a solvent revolver and 52% less likely to be an insolvent revolver relative to convenience users who are not self-employed. Mixed results are observed for those who own liquid accounts, can borrow, and save for unemployment. For example, among respondents with

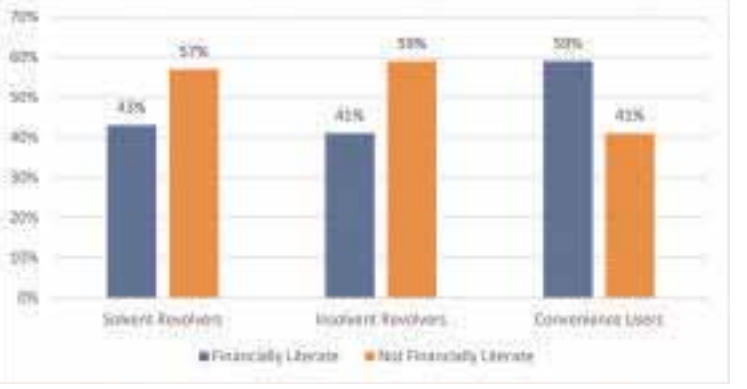


Fig. 3. Separates the credit user group by financially literate or not financially literate.

Table 1A Frequencies of independent variables (full sample and by credit user group)

| | Full sample (%) | Insolvent revolver | Solvent revolver | Convenience user |
|---|---|---|---|---|
| | | Human capital | | |
| Financially literate | 50.00 | 42.00 | 43.00 | 59.00 |
| College degree | 43.00 | 30.39 | 35.23 | 54.43 |
| | | Mental accounting/precautionary savings motives | | |
| Have emergency fund | 58.40 | 30.73 | 59.25 | 72.36 |
| Saving for unemployment | 3.42 | 3.45 | 3.99 | 3.04 |
| Saving for illness | 5.62 | 4.80 | 6.08 | 5.74 |
| Ability to borrow from friends/relatives | 27.97 | 40.18 | 26.43 | 22.58 |
| Self employed | 14.71 | 11.66 | 15.54 | 15.76 |
| Have liquid accounts | 63.02 | 46.70 | 70.48 | 66.67 |
| | | Self-control | | |
| Payment history | | | | |
| On time/no payment | 89.25 | 79.04 | 87.02 | 96.07 |
| Behind | 10.75 | 20.96 | 12.98 | 3.93 |
| Credit attitude | | | | |
| Positive | 27.35 | 27.79 | 30.38 | 25.2 |
| Ambivalent | 44.38 | 45.74 | 43.19 | 44.45 |
| Negative | 28.24 | 26.48 | 26.43 | 30.35 |
| Bankruptcy history | 12.29 | 22.07 | 15.44 | 5.08 |
| Spending attitude | | | | |
| Likely increase | 21.76 | 26 | 21.57 | 19.67 |
| Unwilling to reduce | 28.58 | 25.67 | 26.02 | 31.81 |
| | | Lifecycle factors | | |
| Age | | | | |
| Under 35 | 18.47 | 18.45 | 23.12 | 15.21 |
| 35 to 55 | 36.59 | 45.53 | 40.95 | 29.02 |
| Over 55 | 44.93 | 35.62 | 35.92 | 55.77 |
| Gender | | | | |
| Male | 76.15 | 69.73 | 75.12 | 80.20 |
| Female | 23.85 | 30.27 | 24.88 | 19.80 |
| Married | 53.99 | 48.1 | 50.91 | 59.12 |
| Race | | | | |
| White | 76.51 | 70.55 | 69.25 | 84.43 |
| Black | 11.93 | 16.02 | 18.05 | 5.74 |
| Hispanic | 9.19 | 14.59 | 10.80 | 5.28 |
| Other | 4.51 | 2.09 | 4.82 | 5.59 |

*Note*. Statistics derived from weighted analysis of one implicate. *Source:* 2016 Survey of Consumer Finances.

the ability to borrow, we estimate a 66% increase in the likelihood of being an insolvent revolver but no statistical difference in being a solvent revolver when compared with convenience user who could not borrow from a relative. As another example, liquidity plays an interesting role on the impact of credit card user type. Owning a liquid account result in a 50% increase in the likelihood of being a solvent revolver, but a 36% decrease in the likelihood of being an insolvent revolver relative to convenience users that did not own liquid accounts.

Table 1B Mean and median statistics of independent variables (full sample and by credit user group)

| | Full sample | Insolvent revolver | Solvent revolver | Convenience user |
|---|---|---|---|---|
| | | Mean | | |
| Net worth | $912,469.96 | $157,114.26 | $413,347.22 | $1,638,477.82 |
| Log net worth | 12.19 | 11.2428 | 11.7480 | 12.8805 |
| Household income | $123,934.20 | $65,830.40 | $100,734.04 | $169,748.06 |
| Log HH income | 11.11 | 10.8058 | 11.1073 | 11.2755 |
| | | Median | | |
| Net worth | $ 180,180.00 | $60,500.00 | $126,600.00 | $396,700.00 |
| Log net worth | 12.32 | 11.42 | 11.99 | 12.96 |
| Household income | $67,000.00 | $51,000.00 | $68,000.00 | $76,000.00 |
| Log HH income | 11.11 | 10.84 | 11.13 | 11.24 |

*Note.* Statistics derived from weighted analysis of one implicate. *Source:* 2016 Survey of Consumer Finances.

Specification C highlights the impact of human capital, mental accounting, and self-control concepts. Variables in the two previous concepts maintained their statistical significance with similar effect as in Specification B. Being behind on payments and a record of bankruptcy all increase the likelihood of being both a solvent and insolvent revolver when compared with convenience users with opposite characteristics. Respondents with delinquent accounts are more likely to be 230% and 344% more likely to be solvent revolvers and insolvent revolvers respectively in comparison to respondents reporting no delinquencies. Respondents that reported bankruptcy were 203% more likely to be a solvent revolver and 284% more likely to be an insolvent revolver compared with respondents who never filed for bankruptcy. Households whose assets reduced in value and refused to decrease their spending were 21% and 22% less likely to be a solvent or insolvent revolvers when compared with convenience users whose assets did not decrease.

In final MLR model estimation, we include all four concepts to estimate the impact on the dependent variables. By adding lifestyle factor variables, we observe notable changes in the effect of being financially literate, could borrow, being self-employed, and who were unwilling to reduce spending even after asset values declined. As an illustration, we comment on the impact of being financially literate. Households who were able to answer all the financial questions correctly were now only 18% less likely to be a solvent revolver compared with convenience users who were not financially literate. Moreover, there was no statistically significant difference in being an insolvent revolver compared with convenience users who were not financially literate. Of the lifestyle factors included in our analysis, we observe the following results. In comparison to respondents 34 years and younger, older respondents, 55 and over, are 59%% more likely to be solvent and 78% more likely to be insolvent revolvers when being a convenience user is an option. Women are more likely than men to be insolvent revolvers than convenience users. Specifically, the results show that compared with male convenience users, women are 63% more likely to be insolvent revolvers. Comparing unmarried households to married households who report being convenience users, unmarried respondents are 45% less likely to be insolvent revolvers. Income's impact on the credit card user type appears only marginally statistically significant for revolving insolvent debt. A one percentage increase in income decreases the likelihood of being a solvent revolver when

Table 2 Result of multinomial logistic regression results on credit user type (convenience user is the base group)

| Variable | User type | A | *p* | B | *p* | C | *p* | D | *p* |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | SR | 1.09 | | 1.24 | ** | 0.95 | | 34.74 | *** |
| Intercept | IR | 0.92 | | 2.16 | *** | 1.58 | *** | 955.85 | *** |
| | | Human capital | | | | | | | |
| Financially literate | SR | 0.54 | *** | 0.58 | *** | 0.60 | *** | 0.82 | ** |
| Financially literate | IR | 0.46 | *** | 0.61 | *** | 0.64 | *** | 0.94 | |
| College degree | SR | 0.38 | *** | 0.42 | *** | 0.46 | *** | 0.64 | *** |
| College degree | IR | 0.30 | *** | 0.42 | *** | 0.46 | *** | 0.77 | ** |
| | | Mental accounting/precautionary savings motives | | | | | | | |
| Have emergency fund | SR | | | 0.55 | *** | 0.62 | *** | 0.81 | ** |
| Have emergency fund | IR | | | 0.20 | *** | 0.24 | *** | 0.34 | *** |
| Saving for unemployment | SR | | | 1.57 | ** | 1.42 | | 0.84 | |
| Saving for unemployment | IR | | | 1.63 | * | 1.40 | | 0.78 | |
| Saving for illness | SR | | | 0.93 | | 0.97 | | 1.07 | |
| Saving for illness | IR | | | 0.80 | | 0.87 | | 0.80 | |
| Ability to borrow | SR | | | 1.09 | | 1.06 | | 0.88 | |
| Ability to borrow | IR | | | 1.66 | *** | 1.59 | *** | 1.16 | |
| Self employed | SR | | | 0.68 | *** | 0.67 | *** | 1.32 | ** |
| Self employed | IR | | | 0.48 | *** | 0.47 | *** | 1.11 | |
| Have liquid accounts | SR | | | 1.50 | *** | 1.50 | *** | 1.42 | *** |
| Have liquid accounts | IR | | | 0.64 | *** | 0.64 | *** | 0.58 | *** |
| | | Self-control | | | | | | | |
| Behind on payments | SR | | | | | 3.30 | *** | 2.19 | *** |
| Behind on payments | IR | | | | | 4.44 | *** | 2.97 | *** |
| Positive attitude toward credit | SR | | | | | 1.23 | ** | 1.18 | * |
| Positive attitude toward credit | IR | | | | | 1.01 | | 1.08 | |
| Negative attitude toward credit | SR | | | | | 0.88 | | 0.87 | |
| Negative attitude toward credit | IR | | | | | 0.77 | ** | 0.75 | ** |
| Bankruptcy history | SR | | | | | 3.03 | *** | 2.19 | *** |
| Bankruptcy history | IR | | | | | 3.84 | *** | 2.70 | *** |
| Likely to increase spending | SR | | | | | 0.99 | | 1.04 | |
| Likely to increase spending | IR | | | | | 1.11 | | 1.18 | |
| Unwilling to reduce spending | SR | | | | | 0.76 | ** | 0.87 | |
| Unwilling to reduce spending | IR | | | | | 0.75 | ** | 0.79 | ** |
| | | Lifecycle factors | | | | | | | |
| Age 35–55 | SR | | | | | | | 1.77 | *** |
| Age 35–55 | IR | | | | | | | 2.61 | *** |
| Age 55+ | SR | | | | | | | 1.13 | |
| Age 55+ | IR | | | | | | | 1.30 | |
| Female | SR | | | | | | | 1.08 | |
| Female | IR | | | | | | | 1.65 | ** |
| Not married | SR | | | | | | | 0.87 | |
| Not married | IR | | | | | | | 0.50 | *** |
| Black | SR | | | | | | | 2.48 | *** |
| Black | IR | | | | | | | 1.54 | ** |
| Hispanic | SR | | | | | | | 1.52 | ** |
| Hispanic | IR | | | | | | | 1.45 | ** |
| Other race | SR | | | | | | | 0.96 | |
| Other race | IR | | | | | | | 0.34 | *** |
| Log income | SR | | | | | | | 1.08 | |
| Log income | IR | | | | | | | 0.88 | * |
| Log net worth | SR | | | | | | | 0.66 | *** |
| Log net worth | IR | | | | | | | 0.62 | *** |

*Note*. SR = Solvent Revolver. IR = Insolvent Revolver.

Table 3 Binary logistic results on the likelihood of being a solvent revolver

| Variable | Odds ratio | *p* |
|---|---|---|
| Intercept | 23.83 | *** |
| Human capital | | |
| College degree | 0.51 | *** |
| Mental accounting/precautionary savings motives | | |
| Have emergency fund | 0.69 | ** |
| Saving for unemployment | 1.01 | |
| Saving for illness | 0.93 | |
| Ability to borrow | 0.84 | |
| Self employed | 1.15 | |
| Have liquid accounts | 1.35 | ** |
| Self-control | | |
| Behind on payments | 2.14 | ** |
| Positive attitude toward credit | 1.22 | |
| Negative attitude toward credit | 0.82 | |
| Bankruptcy history | 3.67 | *** |
| Likely to increase spending | 1.21 | |
| Unwilling to reduce spending | 0.85 | |
| Lifecycle factors | | |
| Age | | |
| Age 35–55 | 1.17 | |
| Age 55+ | 0.58 | ** |
| Female | 1.06 | |
| Not married | 0.83 | |
| Race | | |
| Black | 4.09 | *** |
| Hispanic | 1.72 | ** |
| Other | 0.83 | |
| Log income | 0.82 | *** |
| Log net worth | 0.90 | *** |

compared with a convenience user by 12%. Net worth's impact is more pronounced, as a one percentage increase in net worth estimates a 34% decrease in the likelihood of being a solvent revolver and a 38% decrease in the likelihood of being an insolvent revolver relative to convenience use of credit cards.

In Table 3, we present binary logistic regression results on the likelihood of being a solvent revolver compared with a convenience user. We use a restricted sample of solvent revolvers and convenience users who are financially literate. The analysis allows us to better understand the factors that affect the decision to revolve debt since solvent revolvers have the knowledge and financial ability to be convenience users. Compared with noncollege graduates, college graduates are 49% less likely to be solvent revolvers. Results show a similar pattern related to having an emergency fund as these households are 31% less likely to be solvent revolvers than households that do not have an emergency fund. Older respondents (55 and older) are 42% less likely than respondents 34 and younger to be solvent revolvers. Contrastingly, having liquid accounts, behind on payments, bankruptcy, and race all increased the likelihood of being solvent revolvers. Bankruptcy filings result in 267%

increase in the likelihood of be a solvent revolver. Black and Hispanic households are 309% and 72% more likely to be solvent revolvers, respectively, compared with white households. Income and net worth are also statistically significant at reducing the likelihood of being a solvent revolver. A one percentage increase in income, decreases the likelihood of being a solvent revolver by 18%. Similarly, a positive one percentage point change in net worth decreases the likelihood of being a solvent revolver by 10%.

## 7. Discussion

The research investigates the effect of financial literacy and other behavioral factors on credit card debt puzzle. There is a limited pool of empirical literature on the credit card debit puzzle. To be more specific, this study aims to evaluate solvent revolving credit card users and their financial literacy compared with insolvent revolvers and convenience users of credit cards. Based on the behavioral life-cycle hypothesis and human capital theory, the results provide an extension of the current literature.

Human capital plays a role in the decision to display the credit card debt puzzle. Hypothesis 1 suggests solvent revolvers will have a lower level of financial literacy than convenience users. Regarding specific financial human capital, solvent credit card revolvers have a lower level of financial literacy than convenience users. However, solvent revolvers should be more financially literate than insolvent revolving users. The findings of this paper support previous literature that solvent revolvers are not necessarily more financially literate than insolvent revolvers but moderating factors such as having a college degree play an important role (Bertaut et al., 2009; Haliassos & Reiter, 2005). Unsurprisingly, insolvent and solvent credit card users are less likely to have college degrees compared with convenience users; as a result, households should seek as much financial knowledge as possible or invest in assistance from a financial planner or counselor when making critical financial decisions.

Several factors in the mental accounting concept seem to have an impact on households' credit card debt use. Hypothesis 2 suggests that solvent revolvers would be more likely to display mental accounting and have higher precautionary savings motives than convenience users. Households that report having an emergency fund are less likely to revolve credit card debt. This finding is inconsistent with previous research that households that display the credit card debt puzzle are more likely to have a precautionary savings motive (Bi & Hanna, 2006; Telyukova & Wright, 2008, Gorbachev & Luengo-Prado, 2019). Self-employed households are less likely to be revolvers in general and less likely to be solvent revolvers. This finding suggests that households that are self-employed use credit cards for convenience purposes. The impact of family and friends was presented in the results. The ability to borrow increased the likelihood to be an insolvent revolver in the MLR models that included human capital, mental accounting, and self-control but not in the full model that includes lifecycle factors that differentiation from convenience users goes away. The ability to borrow allows households who may otherwise be solvent revolvers to be more like convenience users across all models. Last, having liquid accounts provides us with mixed results but highlights a notable difference between the credit card user groups. Households who report

having accounts such as checking and savings which are not earmarked for emergencies are more likely to be solvent revolvers. This finding suggests that households that save liquid assets in different accounts will choose not to pay off their credit card balance with those earmarked funds. Those who use mental accounting will have more liquid accounts compared with convenience users who have the self-control not to spend from fewer accounts.

The self-control factors contribute to the further understanding of the credit card debt puzzle. The variables making up this concept provide positive and negative insights in the likelihood of being a revolver of credit card debt and convenience use. In Hypothesis 3, we put forward that self-control will increase the likelihood of revolving credit card debt. Revolvers would be less likely to pay their bills on time, have a positive attitude toward credit, and have filed for bankruptcy in the past. First, when compared with those who are on time with their loan payments, the households that are behind are more likely to be solvent revolvers and even more so to an insolvent revolver. Next, attitude toward debt provides a surprising result. We reject our hypothesis that a positive attitude toward debt would be a characteristic of solvent revolvers. However, we see evidence that a negative attitude toward credit card debt does affect the decision to be an insolvent revolver. Households that have a history of bankruptcy are more likely to have revolving debt.

In regard to the lifecycle factors, solvent revolvers are more likely to be younger and have a lower household wealth. First, when compared with households under age 35, those households with individuals between 35 and 55 are more likely to be solvent revolvers than a convenience user. Among the most financially literate households, we see a differing effect in the over 55 as they are less likely to be solvent resolvers compared with 35 and younger. Gender plays a role as married females are more likely to be insolvent revolvers of credit card debt. Last, income appears only to be a statistically significant factor among the most financial literate of the sample. In this subgroup, a positive increase can decrease the likelihood of revolving credit card debt by 18%. On the other hand, wealth is a consistent factor in reducing the likelihood of revolving credit card debt.

## 8. Implications

Financial planners and financial counselors have a fiduciary duty to their clients. When providing financial planning to clients, financial professionals should help and educate households on the behavioral factors that impact the client's financial goals. A change in behavior is necessary, especially since revolving credit card users believe it is okay to spend now and pay later. Since self-control factors have such an impact on solvent revolving tendencies, financial planners and counselors should help clients identify debt management issues as well as increase their awareness of the importance of making payments on time. The client would benefit from a change in behavior to maximize utility and avoid making inefficient decisions.

To facilitate the education process for solvent households, there are two steps. One, financial planners and financial counselors must teach the client about behavioral biases that exist when making financial decisions. Two, financial planners and counselors should educate clients about the inefficiency associated with solvent revolving.

The first step is to educate the client about behavioral biases. Since behavioral biases affect most individuals, it is important to know about them to diminish some of the unfavorable effects. Financial planners and counselors can help the consumer develop strategies to control inefficient behavior and implement appropriate behavior. First, the consumer can set up automatic payments toward their credit card balance. This would reduce the credit card balance while decreasing the likelihood of consumers missing or being behind on their payments. A recent study by Middlewood, Chin, Johnson, and Knoll (2018) suggest that clients who automate savings decisions typically have financial skill, but still need focused help from their advisor to set up the automated rules. Next, the planner, counselor, or educator should help the client set realistic goals for paying off the debt and help the client understand their motives for saving. Last, the planner could suggest reallocating high interest rate debt to a lower interest rate debt tool (Greenberg & Hershfield, 2019). The idea of shifting debt to lower interest rate tools is shared by another article on myopia, financial literacy, and the choice between debit and credit (Ricaldi & Huston, 2019). The authors suggest that households that consistently revolve a credit card balance should switch to debit cards. Once the household is accustomed to budgeting techniques and self-control, they should switch to using a credit card as a convenience tool to take advantage of the rewards.

The next step in helping solvent revolvers understand their inefficient behavior is to educate them as to why the behavior is inefficient. Education about interest rates, savings accounts, and the tradeoff between holding a balance on a credit card and paying off the balance using savings is essential. Following these steps can allow financial planners to help clients build wealth instead of exhibiting inefficient behaviors.

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