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Financial Sophistication and Credit Card Behaviors Revision

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ABSTRACT

The present study explored consumers' use of credit cards with an emphasis of the role that financial knowledge plays in behavior. Both objective and subjective measures of subjective financial knowledge were included in predictive models of seven unique credit card behaviors. Behaviors explored included comparing cards during the acquisition phase, paying off cards in full, revolving a balance, making minimum payments, paying late payment fees, paying over the limit fees, and taking cash advances. Results indicated that financial knowledge was a useful predictor of behavior, though different knowledge types were more or less effective as predictors depending on the behavior analyzed. An additional series of analyses was conducted controlling for emergency saving ownership. Implications are discussed.

Keywords: Financial knowledge, credit cards, financial sophistication, consumer behavior

I. Introduction

An abundance of empirical research has considered how consumers make financial decisions in the context of increasingly sophisticated financial markets. Theoretically, individuals' understanding of financial markets and instruments should directly impact subsequent market behaviors and decisions. In general, the literature has borne this out, noting strong associations between knowledge and effective money management (Babiartz & Robb, 2013; Collins, 2007; Haynes-Bordas, Kiss, & Yilmazer, 2008; Hilgert, Hogarth, & Beverly, 2003; Lusardi & Mitchell, 2011; Robb, 2011; Robb & Woodyard, 2011; Scott, 2010). In many of these studies, greater levels of financial knowledge were associated with more positive financial behaviors, such as having emergency

savings, credit card use, and retirement preparedness. Notable findings have been identified for measure of objective financial knowledge as well as for measures of subjective financial knowledge, with some studies indicating that subjective knowledge may be a more effective predictor of some financial behaviors (Robb & Woodyard, 2011; Xiao, Tang, Serido, & Shim, 2011). Accordingly, a number of studies have further highlighted negative behaviors among less financially sophisticated consumers (Ausubel, 1991; Lusardi, 2008; Soman & Cheema, 2002). However, research indicates that the observed associations between knowledge and behavior are not necessarily automatic (Braunstein & Welch, 2002). This is often contributed to the complex nature of financial decision-making (and decision-making processes in general) as knowledge may be one of many salient factors in the decision process.

Knowledge itself is a complex concept, as studies have articulated differences between objective and subjective financial knowledge across a number of financial decision-making domains (Allgood & Walstad, 2013; Robb & Woodyard, 2011; Robb, Babiartz, Woodyard, & Seay,

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2015; Xiao et al., 2011). Some research has indicated that subjective knowledge may be more important as a predictor of certain financial behaviors (Robb & Woodyard, 2011; Xiao et al., 2011). However, more recent studies have considered adjusting the empirical model to account for objective knowledge relative to one's subjective knowledge to provide a more nuanced picture of financial sophistication as it relates to behaviors (Allgood & Walstad, 2013; Robb et al., 2015; Xiao, Chen, & Chen, 2014).

II. Review of Literature and Theoretical Background

Credit card utilization has long been a topic of interest to researchers and policy makers in the area of consumer finance, due not only to their ubiquity (Stango & Zinman, 2009), but also for the size of the industry, as revolving consumer debt was over \$937 billion based on data from the Federal Reserve (2016). There is a strong body of research detailing connections between financial knowledge and credit card use, particularly among college student populations (Borden et al., 2008; Chen & Volpe, 1998; Cude et al., 2006; Robb, 2011; Robb & Sharpe, 2009; Xiao et al., 2011). Much of this interest was driven by exponential growth of credit cards among college students, though recent trends indicate changing patterns of credit card use and ownership in the wake of the CARD Act (2009). Interestingly, data from earlier studies of financial literacy suggest that college students are not much different from other adult populations (Braunsberger, Lucas, & Roach, 2004).

A number of studies have explored the connection between financial knowledge and credit card behavior among samples of the adult population (Allgood & Walstad, 2013; Gross & Souleles, 2002; Heidhues & Koszegi, 2010; Mottola, 2012; Ricaldi, 2015). Gross and Souleles (2002) raised the question of whether credit card balances were not more often reflective of behavioral rather than liquidity issues. In effect, naïve consumers might be inclined to rely on credit cards more easily, even in cases where alternative (possibly less costly) resources exist to meet a given need. This argument has found some support in later studies, as less sophisticated

(less literate, or naïve) consumers have been noted as being more likely to over-borrow and to subsequently pay penalties (Heidhues & Koszegi, 2010). Ricaldi (2015) identified less knowledgeable consumers as being more likely to be solvent revolvers (or those having available funds that could be applied to revolving debt). In an exploration of gender differences in financial literacy, Mottola (2012) also noted significant differences in credit card use habits based on financial knowledge when comparing males and females. Data indicated that observed gender-based differences in credit card use might be explained by knowledge differentials, and that literacy improvements may result in more profound changes for women.

One of the most comprehensive analyses of credit card use behavior among adults in the United States was conducted by Allgood & Walstad (2013), as they identified five separate credit card behaviors: always paying a card balance in full; revolving a balance; making only the minimum payment; late payment fees; and over the limit fees. In addition to exploring a number of credit card habits, the authors took advantage of the fact that the 2009 National Financial Capability Study (NFCS) offered two separate measure of financial literacy. Whereas some of the questions dealt with objective financial knowledge, there was also a question designed to assess individuals' subjective financial literacy. Findings from the combined measure of financial knowledge indicated significant behavioral differences among the four groupings, with the most dramatic differences noted when those in the high objective-high subjective category were compared with those in the low objective-low subjective category.

The present paper is strongly influenced by the previous work of Allgood and Walstad (2013) and Robb et al. (2015). Utilizing the first (2009) and second (2012) waves of the NFCS, six (6) core credit card behaviors are analyzed along with a measure of individuals' search behavior. In addition to the five behaviors explored by Allgood and Walstad (2013), we consider consumer utilization of the cash advance feature. Allgood and Walstad (2013) argued that cash advance behavior is distinct from other credit card behaviors and may not be as influenced by consumers' financial knowledge (and thus exempt from their study). Cash advances are often needed in times when cash is short and a need is immediate, much like title loans or payday loans (though this feature may often be less costly than these alternatives based on annualized

percentage). Work by Robb et al. (2015) indicated that financial knowledge is strongly related to these borrowing behaviors, particularly when controlling for financial sophistication and objective need. For example, individuals who scored low on the objective knowledge measure but high on the subjective measure (classified as over-confident in their financial knowledge) were far more likely than even the least sophisticated consumers (those scoring low in both knowledge dimensions) to utilize payday loans or other high cost borrowing alternatives in the market. This effect was magnified when individuals' objective need for financial relief was assessed, as over-confident consumers who reported having an emergency fund were even more likely to report utilization of alternative financial services. The present paper includes cash advance behavior in light of these previous findings on overconfidence, as similar mechanisms are hypothesized to be at work. The concept of objective need is further explored with other credit card behaviors as a part of this work, as a series of models were run controlling for emergency fund ownership.

The present analysis also adds a dimension of consumer activity related to credit card acquisition. The question of whether consumers made comparisons when searching for their most recent card assessed the degree to which consumers were aware of product differences in credit markets, and is somewhat suggestive of overall willingness to engage in search activities in financial markets. Since consumers in America experienced a different economic climate in 2012 relative to 2009 (the year of the first survey wave and the focus of previous research on credit card behavior), data from the two periods can be compared to assess whether the link between knowledge and behavior appears to be generally consistent across the two waves of data (data are not longitudinal so it is not possible to examine the consistency for actual respondents from 2009 to 2012).

Assumptions regarding how consumers interact with their environment are an important component for consideration here. Under the Neoclassical economic framework, consumers are utility maximizers who effectively weigh all relevant costs and benefits when making choices. Thus, use of credit cards is a reflection of this maximization process, and decisions to revolve occur in cases where cards are truly the most efficient (or least cost) option available to consumers. Late payment or over the limit penalties are theoretically reflective of true need. This

framework assumes perfect information on the part of consumers, and some theorists have challenged this assertion in recent years in favor of a more forgiving definition of rationality (Simon, 2000). Under a framework of "bounded" rationality, consumers remain forward-looking utility maximizers, but may be hindered in terms of their available knowledge, mental processing ability, or outcome expectations. Individual knowledge becomes an extremely relevant factor in this framework. Credit card decisions are further complicated by timing factors, as individuals must make reasonable forecasts of future resources and utility to effectively utilize these tools. The present study considers card use decisions in the context of bounded consumer rationality, acknowledging that different levels of knowledge may be an influential factor for consumer behaviors. Prior research has raised issues regarding how credit cards might prove challenging for more naïve consumers, as less sophisticated users may be inclined to greater levels of consumption (Feinberg, 1986) or view credit limits as an implicit signal of what is affordable (Soman & Cheema, 2002). Based on the previous findings from the credit card literature and assumptions of bounded rationality, the following hypothesis was considered:

Hypothesis 1: More knowledgeable consumers (defined as those scoring high the objective measure) will demonstrate more favorable credit card behaviors relative to less knowledgeable consumers.

As noted in the review of literature, objective knowledge is but one component of the decision making process. Previous research incorporating subjective financial knowledge indicated that peoples' self-assessment of what they know can have strong predictive power in analyses of financial behavior. Based on these findings, the following hypothesis was developed:

Hypothesis 2: More confident consumers (those scoring high on the subjective measure) will demonstrate more favorable credit card behaviors relative to less confident consumers.

In many cases, the first two hypotheses are limited in that they only approach each dimension of financial

knowledge separately. More recent studies have indicated that the dynamic relationship between the two is worth exploring in more detail, as the real impact of high objective knowledge may be influenced by the level of one's subjective knowledge and vice versa. Previous studies have noted particularly concerning findings among consumers who have low levels of objective knowledge, but high levels of subjective knowledge (over-confident). As a result, the following hypotheses were postulated:

Hypothesis 3: Consumers scoring high on the measure of subjective knowledge and low on the measure of objective knowledge will demonstrate less favorable credit card behaviors relative to the least sophisticated consumers (those scoring low on both measures).

Hypothesis 4: More financially sophisticated consumers (defined as those scoring high on both knowledge measures) will demonstrate more favorable credit card behaviors, *ceteris paribus*.

III. Data and Method

Data for the present analysis were taken from the 2009 and 2012 NFCS state-by-state surveys sponsored by the United States' Financial Industry Regulatory Authority (FINRA) Investor Education Foundation. Each of the survey waves collected a unique sample of roughly 500 adults (age 18 or over) from each state, including the District of Columbia, resulting in a pooled sample of 53,655. Given the focus of the present study, data were censored to account for credit card ownership, resulting in a final sample size of 34,451. Each of the survey waves centered on the goal of understanding consumer financial capability in the United States, which was explored through questions on a number of financial topics and behaviors.

For the credit card behaviors of interest, each of the seven (7) selected behaviors was assessed in a binary (yes/no) format. Logistic regression was used to assess the likelihood of consumers responding affirmatively to

each question. A model utilizing an index variable comprising of the sum of indicators of "bad" credit card behaviors was also estimated. In addition to the base models of card behavior controlling for knowledge, a series of analyses was conducted controlling for whether individuals reported having an emergency fund or not. This was of particular interest for behaviors related to late payments, and taking cash advances (liquidity constraint assumptions), but can be explored in the context of all six card use behaviors (credit card search behavior was excluded from this set of analyses). It was believed that the presence of emergency savings would be a signal of available resources, and help further differentiate individuals based on responsible use of credit cards based on objective need.

IV. Dependent Variables: Credit Card Behavior

Individuals' credit card use behavior was assessed by seven statements, with six of those statements asking individuals to reflect on their experience with cards over the past year. Respondents were asked to indicate either yes or no, to each of the following statements: 1) I always paid my credit cards in full; 2) In some months, I carried over a balance and was charged interest; 3) In some months, I paid the minimum payment only; 4) In some months, I was charged a late fee for late payment; 5) in some months, I was charged and over the limit fee for exceeding my credit line; and 6) In some months, I used the cards for a cash advance. In addition, respondents were asked whether they had made comparisons between different cards from more than one company when obtaining their most recent card (yes or no). In addition to the analysis of separate credit card use behaviors, an equally weighted index was created to measure the extent of "bad" behaviors. The index variable was calculated as the sum of indicators for (1) carrying over the credit card balance and paying interest, (2) paying minimum payment only, (3) being charged late fees, (4) being charged over the limit fees, and (5) using credit cards for cash advance.

V. Independent Variables

Objective financial knowledge. Respondents were presented five separate questions designed to assess their objective financial knowledge in the form of product knowledge and numeracy. These questions were structured either in multiple choice (1-3) or true/false (4-5) formats. The questions included in the survey are included below:

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. "If interest rates rise, what will typically happen to bond prices?"
4. "A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less."
5. "Buying a single company's stock usually provides a safer return than a stock mutual fund."

For each of the five questions, individuals were coded according to the number of correct answers they provided, with a possible range from 0-5 for the objective financial knowledge index.

Subjective Financial Knowledge. In addition to the five objective knowledge questions, both waves of the NFCS included a single question asking individuals to assess their own financial knowledge. Specifically, respondents were asked the following question: "On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?"

Financial Sophistication. For the present analysis the objective and subjective financial knowledge scores were further assessed in relation to each other (i.e., the role of subjective financial knowledge was explored controlling for objective knowledge level and vice versa). Four mutually exclusive dummy variables were generated from the data based on individuals' scores on the two knowledge indexes, including: 1) high objective and high subjective knowledge; 2) high objective and low subjective knowledge; 3) low objective and high subjective knowledge;

and 4) low objective and low subjective knowledge. To facilitate development of these four categories, individuals were classified as scoring high or low on each index based on sample median scores. For the NFCS sample, the median objective knowledge score was 3, whereas the median subjective financial knowledge score was 5. Further detail on the breakdown of scores across categories can be found in Robb et al. (2015).

Other Independent Variables (controls). In addition to the knowledge factors discussed above, the present study included a number of sociodemographic and behavioral controls in the analysis. The selected control variables include survey year, age, gender, education level, marital status, number of children, homeownership status, labor force participation, race, health insurance ownership, household income, whether individuals experienced an income shock in the past year, risk tolerance, difficulty paying bills, emergency savings for 3 months, bank account ownership, use of alternative financial services (e.g., payday loans), and state of residence.

VI. Results

A. Descriptive Statistics

Appendix A includes weighted descriptive statistics for the pooled (2009 and 2012) sample, as well as a breakdown for each of the separate waves. Overall, roughly 74% of the surveyed population owned at least one credit card. Among that 74%, a little more than one-third (35%) reported comparing different credit card offers for their most recent card acquisition. More than half (54%) of the respondents reported sometimes revolving a positive balance from one month to the next, whereas the remaining 46% reported always paying their credit card in full. Looking at the more costly credit card behaviors, 37% of cardholders reported paying only the minimum payment sometime, 21% indicated being assessed late payment fees, and about 12% of the sample reported paying over the limit fees or taking a cash advance. The index of bad credit card behaviors averaged at 1.36. Just under half (47.5%) of the sample population indicated having an emergency fund to cover up to 3 months of expenses.

Descriptive statistics for financial knowledge are pro-

Table 1. Descriptive Statistics for Card Holders’ Financial Knowledge

	Full sample	Has credit card
Financial knowledge (total correct)	2.94	3.18
Financial knowledge (subjective)	5.04	5.21
High Objective, High Subjective	0.19	0.23
High Objective, Low Subjective	0.22	0.25
Low Objective, High Subjective	0.18	0.18
Low Objective, Low Subjective	0.40	0.34

Table 2. Descriptive Statistics for Card Holders’ Financial Knowledge based on Seven Card Behaviors.

	Has credit card and ...						
	Compared credit card offers on latest card acquisition	Always pays credit card balance in full	Sometimes revolves credit card balance	Sometimes pays minimum credit card balance only	Sometimes pays credit card late payment fees	Sometimes pays credit card over-the-limit fees	Sometimes uses credit card cash advance
Financial knowledge (total correct)	3.35	3.34	3.14	2.90	2.89	2.75	2.85
Financial knowledge (subjective)	5.42	5.45	5.07	4.99	4.88	4.91	5.17
High Objective, High Subjective	0.28	0.30	0.19	0.15	0.13	0.11	0.17
High Objective, Low Subjective	0.25	0.23	0.26	0.23	0.25	0.22	0.20
Low Objective, High Subjective	0.21	0.20	0.17	0.19	0.19	0.22	0.26
Low Objective, Low Subjective	0.26	0.26	0.38	0.43	0.44	0.44	0.37

vided in Table 1, and sub-sample comparisons are available controlling for the seven credit card behaviors in Table 2. Consumers who report owning at least one credit card score higher on the measure of objective knowledge and rate their own financial knowledge higher than the full sample, though among cardholders there is significant variation in knowledge scores. Notably, lower objective knowledge is generally associated with more costly credit card behaviors (i.e., paying over the limit fees or making minimum payments). Alternatively, those who compared cards or always paid their balance in full scored the highest on both knowledge measures. Looking at the financial sophistication scores, a much smaller percentage of respondents who reported high cost credit behaviors such as paying over the limit fees are in the high objective-high subjective category, whereas the opposite is true for the low objective-low subjective category.

B. Multivariate Analyses

For the initial analysis, three separate models were

run for each of the seven credit card behaviors in question. Each of the estimated models contained all characteristics listed in the descriptive statistics table (Appendix A) as control variables, as well as a dummy variable indicating the year when the NFCS survey was collected. The critical difference was in how knowledge was controlled for. Model I controlled for objective financial knowledge, model II accounted for subjective financial knowledge, and model III accounted for individuals’ financial sophistication (combined measure). Table 3 presents a summary of the critical knowledge effects from all of the separate analyses (full results for each of the seven variables available upon request). For consumer credit card search behavior (whether they compared cards), the impacts of both objective (model I) and subjective (model II) financial knowledge were consistently positive for this behavior. In the model of financial sophistication, all of the other categories were more likely to compare cards relative to the low-low category. The second set of models in Table 3 assessed whether consumers reported always paying their credit card balance in full. Objective financial knowledge was not significant as a predictor (model I),

though subjective financial knowledge was positively associated with paying cards in full in model II. In model III, each of the sophistication categories was positively associated with paying in full when compared to the low-low reference group.

In looking at whether consumers sometimes revolve a balance, objective knowledge was positively associated with revolving whereas subjective knowledge was inversely related to revolving behavior. Compared to the low-low group, those scoring high on both knowledge measures were less likely to report sometimes revolving. Individuals classified as high objective-low subjective were more likely to report revolving a balance compared to the low-low group, whereas low objective-high subjective respondents were not statistically different. Both objective (model I) and subjective (model II) financial knowledge were inversely associated with the payment of late fees. In model III, all of the sophistication categories were less likely to pay a late fee than those in the low-low knowledge grouping. A similar pattern was noted for paying over the limit fees on cards, as those with either higher objective or subjective knowledge scores were less likely to pay fees of this type (models I and II). In looking at the four sophistication categories, only the high objective-high subjective category was significantly different from the low-low reference category, with those in the high-high being less likely to pay over the limit fees. For cash advance behaviors, objective knowledge alone (model I) was noted as being inversely associated with taking a cash advance, whereas the opposite effect was noted for subjective financial knowledge in model II. Turning to the sophistication categories, only the two mixed categories were significantly different from the reference category of low-low knowledge. Specifically, those with high objective-low subjective knowledge were less likely to employ the cash advance feature, whereas those in the low objective-high subjective category were more likely to take a cash advance.

Finally, the last panel of Table 3 reports estimation results from the proportional-odds ordered logistic regressions that utilize the sum of “bad” behaviors as the dependent variable. Findings pointed to the negative effects of both subjective and objective financial knowledge on the level of unfavorable credit card behaviors. Results for the measures of financial sophistication indicated that, compared to low-low category, both groups of respondents characterized by high objective knowledge were less in-

clined to engage in “bad” behaviors, and there was no statistically significant difference between the reference category and respondents in the high objective-low subjective group. Compared to the low objective-low subjective category, the magnitude of the negative effect on the sum of unfavorable behaviors was the highest for the high-high category.

C. Multivariate Analyses, Reduced Sample

As noted in the methods section above, each of the six selected credit card behaviors was also explored in a separate model with the analysis sample reduced to individuals who reported having emergency saving. Results for the critical knowledge effects are presented in Table 4. In the first analysis (pay balance in full), the significant effect of knowledge was noted for all models. Both the objective and subjective knowledge was positively associated with paying cards in full regularly, and all groups of financial sophistication showed greater likelihood of paying balance in full than the low subjective-low objective knowledge category. Among the respondents who have resources available in the form of an emergency fund, the sign associated with the effect of objective knowledge on revolving a card balance changed from positive to negative. Additionally, for the measures of financial sophistication, those categorized as high objective-low subjective were no longer significantly different from the reference group. Whether individuals made the minimum payment or not was not changed when controlling for emergency fund ownership. Objective financial knowledge was no longer significant as a predictor of late payment behavior once the estimation samples were limited to individuals with emergency accounts. In addition, the high objective-low subjective category was not significantly different from the low-low group. Over the limit fee behavior displayed a somewhat different effect, as subjective knowledge was found to be not significant in the modified model. Being part of the high objective-low subjective grouping was inversely associated with paying over the limit fees among individuals with emergency fund holding. Subjective financial knowledge was not statistically significant as a predictor of cash advance behavior in the models where emergency fund ownership was controlled for, and those in the high objective-low subjective grouping were no

Table 3. Results Summary for Logistic Regressions of Credit Card Behaviors.

	Model I		Model II		Model III	
	N = 35,837		N = 35,628		N = 35,628	
	Odds	Coeff.	Odds	Coeff.	Odds	Coeff.
Dependent Variable: Compared Offers						
Objective Knowledge	1.088	0.085 ^{***}				
Subjective Knowledge			1.192	0.175 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					1.601	0.471 ^{***}
High Obj.-Low Sub.					1.265	0.235 ^{***}
Low Obj.-High Sub.					1.488	0.397 ^{***}
Dependent Variable: Always Pay Balance in Full						
Objective Knowledge	1.012	0.012				
Subjective Knowledge			1.108	0.102 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					1.302	0.264 ^{***}
High Obj.-Low Sub.					1.087	0.083 [*]
Low Obj.-High Sub.					1.313	0.272 ^{***}
Dependent Variable: Sometimes Revolve						
Objective Knowledge	1.037	0.037 ^{***}				
Subjective Knowledge			0.941	-0.061 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.838	-0.176 ^{***}
High Obj.-Low Sub.					1.060	0.058 [†]
Low Obj.-High Sub.					0.953	-0.049
Dependent Variable: Sometimes Pay Minimum Only						
Objective Knowledge	0.915	-0.089 ^{***}				
Subjective Knowledge			0.965	-0.036 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.719	-0.330 ^{***}
High Obj.-Low Sub.					0.810	-0.211 ^{***}
Low Obj.-High Sub.					0.961	-0.039
Dependent Variable: Sometimes Pay Late Payment Fees						
Objective Knowledge	0.954	-0.047 ^{***}				
Subjective Knowledge			0.864	-0.147 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.632	-0.458 ^{***}
High Obj.-Low Sub.					0.924	-0.079 [*]
Low Obj.-High Sub.					0.794	-0.230 ^{***}
Dependent Variable: Sometimes Pay Over the Limit Fees						
Objective Knowledge	0.938	-0.064 ^{***}				
Subjective Knowledge			0.944	-0.058 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.739	-0.302 ^{***}

High Obj.-Low Sub.			0.931	-0.072
Low Obj.-High Sub.			1.068	0.065
Dependent Variable: Sometimes Take Cash Advance				
Objective Knowledge	0.932	-0.070 ^{***}		
Subjective Knowledge			1.046	0.045 ^{**}
Financial Sophistication (Ref: Low-Low)				
High Obj.-High Sub.			0.945	-0.057
High Obj.-Low Sub.			0.885	-0.123 [*]
Low Obj.-High Sub.			1.311	0.271 ^{***}
Dependent Variable: Sum of "Bad" Behaviors (Proportional-odds Ordered Logit)				
Objective Knowledge	0.969	-0.032 ^{***}		
Subjective Knowledge			0.934	-0.068 ^{***}
Financial Sophistication (Ref: Low-Low)				
High Obj.-High Sub.			0.755	-0.281 ^{***}
High Obj.-Low Sub.			0.934	-0.068 [*]
Low Obj.-High Sub.			0.961	-0.040

Significance levels are: *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$. All models additionally include control variables for respondent's age, gender, education, marital status, number of children, home ownership, labor force participation, race, health insurance coverage, household income, recent experiences of income shocks, attitude towards taking financial risks, indicators of financial difficulties, having emergency savings, having a bank account, and indicators for recent utilization of alternative financial services such as auto title loans, payday loans, tax refund anticipation checks, pawn shops, or rent-to-own stores.

longer significantly different from the reference category of low objective-low subjective knowledge. Finally, the role of objective and subjective knowledge on the amount of "bad" credit card behaviors was similar in the sample of respondents with emergency savings and the full sample.

D. Discussion and Conclusions

Credit cards remain a critical tool for consumers in a modern economy, offering easy access to short term borrowing at a reasonable cost. However, these tools can be troublesome for consumers if they are not used effectively, and costs can quickly become a financial burden if consumers are not mindful of their spending habits. Conceptually, the seven credit card behaviors explored can be divided into two categories. One category can reasonably be considered as positive credit card use behaviors, and it includes comparison shopping for cards as well as always paying off the balance in full each month. The other category can be viewed as more negative credit card behaviors, as they entail the accrual of additional costs for consumers in the forms of interest or penalties. This category includes sometimes revolving a balance, making only the minimum payment, paying late fees, paying over the limit fees, and utilization of the cash

advance feature.

The data provided strong support for Hypothesis 1, as more knowledgeable consumers (from an objective knowledge standpoint) were noted as engaging in more positive credit card use behaviors. Hypothesis 2 was partially supported, as consumers scoring higher on the measure of subjective knowledge generally engaged in better credit card behaviors. This finding was largely consistent with previous findings suggesting that subjective financial knowledge may be a critical predictor of positive financial behavior (Robb & Woodyard, 2011; Xiao et al., 2011). The positive impact of subjective knowledge was noted across behaviors with the exception of cash advance behavior. In Table 3, those with higher subjective financial knowledge were more likely to report taking a cash advance (subjective knowledge did not remain significant as a predictor of cash advance behavior when controlling for possessing of emergency funds).

Some support was noted for Hypothesis 3, though the weight of the evidence would favor a rejection or modification of this hypothesis. More confident consumers (this includes both categories with high scores on the subjective measure) were more likely to engage in search and to always pay their balance in full relative to the low-low grouping, which ran counter to the assumptions of hypothesis 3. There was some interest in seeing

Table 4. Results Summary for Logistic Regressions of Credit Card Behaviors among Respondents who have Emergency Funds. (N = 16,941)

	Model I		Model II		Model III	
	Odds	Coeff.	Odds	Coeff.	Odds	Coeff.
Always Pay Balance in Full						
Objective Knowledge	1.057	0.055 ^{***}				
Subjective Knowledge			1.140	0.131 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					1.402	0.338 ^{***}
High Obj.-Low Sub.					1.190	0.174 ^{***}
Low Obj.-High Sub.					1.305	0.266 ^{***}
Sometimes Revolve						
Objective Knowledge	0.948	-0.053 ^{***}				
Subjective Knowledge			0.919	-0.084 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.738	-0.304 ^{***}
High Obj.-Low Sub.					0.930	-0.073
Low Obj.-High Sub.					0.938	-0.064
Sometimes Pay Minimum Only						
Objective Knowledge	0.839	-0.176 ^{***}				
Subjective Knowledge			0.952	-0.050 [*]		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.607	-0.500 ^{***}
High Obj.-Low Sub.					0.686	-0.378 ^{***}
Low Obj.-High Sub.					0.953	-0.048
Sometimes Pay Late Payment Fees						
Objective Knowledge	0.959	-0.042				
Subjective Knowledge			0.809	-0.212 ^{***}		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.578	-0.549 ^{***}
High Obj.-Low Sub.					1.043	0.042
Low Obj.-High Sub.					0.753	-0.283 ^{**}
Sometimes Pay Over the Limit Fees						
Objective Knowledge	0.812	-0.208 ^{***}				
Subjective Knowledge			1.077	0.075		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.660	-0.416 ^{**}
High Obj.-Low Sub.					0.758	-0.277 [†]
Low Obj.-High Sub.					1.104	0.099
Sometimes Take Cash Advance						
Objective Knowledge	0.906	-0.099 ^{***}				
Subjective Knowledge			1.059	0.057		
Financial Sophistication (Ref: Low-Low)						
High Obj.-High Sub.					0.869	-0.140
High Obj.-Low Sub.					0.897	-0.108
Low Obj.-High Sub.					1.255	0.227 [†]

Dependent Variable: Sum of “Bad” Behaviors (Proportional-odds Ordered Logit)

Objective Knowledge	0.912	-0.092 ^{***}		
Subjective Knowledge			0.916	-0.87 ^{***}
Financial Sophistication (Ref: Low-Low)				
High Obj.-High Sub.			0.684	-0.380 ^{***}
High Obj.-Low Sub.			0.872	-0.127 ^{***}
Low Obj.-High Sub.			0.947	-0.055

Significance levels are: *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$. All models additionally include control variables for respondent's age, gender, education, marital status, number of children, home ownership, labor force participation, race, health insurance coverage, household income, recent experiences of income shocks, attitude towards taking financial risks, indicators of financial difficulties, having a bank account, and indicators for recent utilization of alternative financial services such as auto title loans, payday loans, tax refund anticipation checks, pawn shops, or rent-to-own stores.

^a This is the only statistic that is calculated for the entire pooled NFCS sample, other statistics are calculated for credit card holders only.

whether this subjective financial knowledge could be a negative in cases where objective knowledge was lacking (i.e., cases of possible overconfidence). Analysis of consumer use of high cost borrowing instruments like payday loans and auto-title loans suggested that overconfidence could be particularly concerning (Robb et al., 2015). Among many of the negative card behaviors (revolve a balance, minimum payment, and pay over the limit fees), no significant differences were noted between those in the low objective-high subjective category and the low objective-low subjective classification (thus favoring a rejection of H3). Further, more confident consumers were noted as being less likely to pay late payment fees. Support for H3 was noted when looking at cash advance behavior. The results do generally suggest that a distinction be made between cash advance behavior and the other credit card use measures, as the cash advance results were consistent with data from consumer use of alternative financial services (Robb et al., 2015). In the case of cash advance behavior, consumers with low objective but high subjective knowledge are 31% more likely to use this card feature. This is generally supportive of hypothesis 3, and previous explorations of consumer overconfidence with regard to borrowing (Robb et al., 2015), and raises some questions regarding how consumers might classify these different borrowing decisions.

It was hypothesized (H4) that more sophisticated consumers would be more likely to display favorable behaviors (and thus less likely to display costly behaviors), and the results are generally supportive of this assertion. Consistent with the prior findings on card utilization (Allgood & Walstad, 2013), the least knowledgeable (low objective-low subjective) consumers were consistently more likely to demonstrate the least favorable behaviors

when compared to those in the high objective-high subjective category, with utilization of cash advances serving as the one exception. For the model of cash advance behavior, no significant differences were noted between the two extreme categories, however, those in the low objective-high subjective category were more likely to report taking a cash advance compared to the least sophisticated group.

Overall, the initial analysis of credit card use behaviors does not provide as straightforward a picture of knowledge and behavior as has been noted for other financial behaviors. There is a general picture of behavioral improvements associated with higher levels of both objective and subjective knowledge, though the results reinforce earlier assertions that multiple knowledge dimensions may be at work in consumer behavior, and simple models of objective financial literacy may provide an incomplete picture. This narrative is confirmed by estimations that utilize the index of “bad” behaviors, as both objectively- and subjectively-assessed knowledge variables were negatively correlated with the extent of unfavorable behaviors. However, the overconfident consumers (low objective-high subjective knowledge) were not statistically different from consumers with the least amount of both objective and subjective knowledge.

When controlling for emergency saving as a rough indication of financial security, there are some notable differences in the output for four of the six credit card models. Whether individuals always pay their balance in full or sometimes make only the minimum payment were not substantively different for the restricted sample. Among those who reported having emergency funds, objective knowledge was inversely associated with revolving a balance (representing a sign change from the initial

model of all respondents). In other cases, certain knowledge measures transitioned from being significant to being not significant (as was the case for objective knowledge in the model of late payments and subjective knowledge in the models of paying over the limit fees and taking cash advances). Interestingly, when looking at cash advance behavior the story of overconfidence from the original models was reinforced by the results for the restricted sample, as those with low objective-high subjective knowledge were 25% more likely to indicate taking a cash advance.

The present study provides further evidence of the complex association between knowledge and behavior, while also providing some support for the assertion that more knowledgeable consumers experience better outcomes in terms of reported financial behavior. The critical distinction made in this manuscript has to do with exactly how knowledge is defined, as simply having greater objective financial knowledge may not be as effective a predictor of outcomes and behaviors as more sophisticated measures that acknowledge the multi-dimensional nature of this construct. By accounting for both objective and subjective knowledge in an exploration of various unique credit card use behaviors, a more complete understanding of the nuances of consumer decision-making can be achieved. The present findings are not suggestive of consumer overconfidence being a significant concern with regard to most credit card behaviors. Rather, findings are consistent with previous models indicating that naïve consumers are at the most risk for credit card abuse (Ausubel, 1991; Soman & Cheema, 2002). The addition of subjective knowledge provides a more detailed framework from which consumer naiveté can be explored.

Overall, the findings suggest that boosting consumer confidence along with objective knowledge may be beneficial, and that programs that focus exclusively on improving objective knowledge may be limited in their impact on consumers. As noted, the findings do appear to vary based on the behavior being explored as the particular knowledge measures employed had notably different associations when considering cash advance behavior. For cash advance behavior (and presumably other behaviors like it) it appears to be critical that consumers have an accurate understanding of their own financial knowledge to ensure effective financial decision-making, particularly in light of the findings when controlling for emergency saving account ownership.

The present study is not without limitations. Since the analyses are based on cross-sectional data, true causal effects cannot be determined between consumers' financial knowledge and credit card use. Further, results are limited based on credit card behaviors being self-reported by consumers, as there is potential for misrepresentation of behavior or errors in recall or reporting. The objective measure of knowledge, though widely used in the empirical literature, is limited in scope. The use of five relatively simple questions to judge financial knowledge has been employed by a number of other surveys and studies, but that does not mean that it is the most effective or accurate measure. Additional work needs to be done to refine not only the objective measure, but also subjective assessment metrics to ensure the most accurate representation of financial sophistication.

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Appendix

Table A. Weighted descriptive statistics, sample of credit card holders.

Variable	Pooled surveys	2009	2012
Has a credit card ^a	0.7389	0.7482	0.7287
Compared credit card offers on latest card acquisition	0.3472	0.3423	0.3527
Always pays credit card balance in full	0.4567	0.4182	0.4999
Sometimes revolves credit card balance	0.5407	0.5753	0.5019
Sometimes pays minimum credit card balance only	0.3771	0.4022	0.3488
Sometimes pays credit card late payment fees	0.2177	0.2635	0.1659
Sometimes pays credit card over-the-limit fees	0.1225	0.1572	0.0833
Sometimes uses credit card cash advance	0.1233	0.1314	0.1142
Sum of bad credit card behaviors (previous five dummies)	1.36	1.50	1.19
Financial knowledge (total correct)	3.18	3.20	3.15
Interest correct	0.7999	0.8098	0.7888
Inflation correct	0.6839	0.6919	0.6750
Bond price correct	0.3137	0.3048	0.3238
Mortgage correct	0.8085	0.8064	0.8108
Risk correct	0.5730	0.5918	0.5517
Financial knowledge (subjective)	5.21	5.10	5.33
Objective-subjective financial knowledge assessment:			
High Objective, High Subjective	0.23	0.22	0.25
High Objective, Low Subjective	0.25	0.27	0.22
Low Objective, High Subjective	0.18	0.16	0.21
Low Objective, Low Subjective	0.34	0.35	0.32
Respondent's age:			
18-24	0.0982	0.1058	0.0897
25-34	0.1703	0.1644	0.1769
35-44	0.1705	0.1800	0.1597
45-54	0.1949	0.1964	0.1932
55-64	0.1820	0.1748	0.1901
65 or older	0.1841	0.1785	0.1904
Female	0.5017	0.5068	0.4959
Respondent's education:			
No high school	0.0307	0.0194	0.0433
High school	0.2592	0.2570	0.2617
Some college	0.3981	0.4191	0.3743
College	0.1893	0.1864	0.1925
Post grad	0.1228	0.1181	0.1281
Married	0.6696	0.6632	0.6767
Number of children	0.7091	0.7079	0.7105
Homeowner	0.6864	0.6793	0.6944

Labor force participation:			
Works full-time	0.0815	0.0843	0.0783
Works part-time	0.4051	0.3970	0.4142
Self employed	0.0901	0.0926	0.0872
Homemaker	0.0854	0.0829	0.0882
Student	0.0456	0.0501	0.0405
Disabled	0.0329	0.0306	0.0355
Unemployed	0.0613	0.0682	0.0534
Retired	0.1982	0.1942	0.2028
Minority	0.3039	0.2897	0.3199
Covered by health insurance	0.8578	0.8536	0.8626
Respondent's (household) income:			
Income less than \$15K	0.0822	0.0900	0.0733
At least \$15K and less than \$25K	0.0958	0.1040	0.0867
At least \$25K and less than \$35K	0.1110	0.1185	0.1026
At least \$35K and less than \$50K	0.1595	0.1677	0.1503
At least \$50K and less than \$75K	0.2181	0.2146	0.2221
At least \$75K and less than \$100K	0.1364	0.1307	0.1427
At least \$100 and less than \$150K	0.1255	0.1121	0.1406
\$150K and greater	0.0714	0.0624	0.0817
Income shock	0.3226	0.3771	0.2610
Attitude towards risk	4.77	4.54	5.03
Difficulty paying bills:			
Very difficult	0.1261	0.1391	0.1116
Somewhat difficult	0.4219	0.4352	0.4068
Not at all difficult	0.4520	0.4257	0.4816
Has emergency funds to cover 3 moths expenses	0.4755	0.4408	0.5146
Has a bank account	0.9834	0.9856	0.9809
In the past 5 years...			
has taken an auto title loan	0.0704	0.0575	0.0847
has taken a "payday" loan	0.0887	0.0697	0.1100
has taken a tax refund anticipation check	0.0574	0.0421	0.0746
has used a pawn shop	0.1045	0.0791	0.1332
has used a rent-to-own store	0.0615	0.0441	0.0812

^a This is the only statistic that is calculated for the entire pooled NFCS sample, other statistics are calculated for credit card holders only.