

Effect of Personal Financial Knowledge on College Students' Credit Card Behavior

Cliff A. Robb and Deanna L. Sharpe

Analysis of survey data collected from 6,520 students at a large Midwestern University affirmed that financial knowledge is a significant factor in the credit card decisions of college students but not entirely in expected ways. Results of a double hurdle analysis indicated that students with relatively higher levels of financial knowledge were not significantly different from students with relatively lower levels in terms of the probability of having a credit card balance. Contrary to expectations, those with higher levels of financial knowledge had significantly higher credit card balances. Overall, the present findings highlight the complex nature of the relationship between personal financial knowledge and credit card behavior.

Key Words: college students, credit card use, personal financial knowledge

Introduction

In the late 1980s, credit card companies began targeting college students in an effort to expand market share. Students were encouraged to become credit card customers through direct mail promotions, on- and off-campus advertising, and on-campus recruitment (O'Connell, 1994; Susswein, 1995). A number of researchers have documented the subsequent rapid expansion of credit card ownership and use on college campuses from the late 1980s through the 1990s (Kara, Kaynak, & Kucukemiroglu, 1994; Nellie Mae, 2002; Manning & Kirshak, 2005). In 1990, slightly over half (54%) of all undergraduate students held at least one credit card. By 2001, over three-quarters (83%) of all undergraduate students had one or more credit cards (Nellie Mae, 2002). These fundamental changes in how and to whom credit cards are marketed have resulted in credit cards becoming a way of life for today's college student (Lyons, 2004; Manning & Kirshak, 2005).

As the percentage of college students with credit cards grew, the concern that credit card companies were taking unfair advantage of a vulnerable population also increased. In essence, the credit market among college students was considered imperfectly competitive. The signed credit contract was not seen as an agreement between equals.

Rather, credit card companies were viewed as enticing inexperienced and unsuspecting students to sign agreements that they did not fully understand, placing them at risk of overspending and developing financial difficulties. As a result, concerned groups encouraged university and college campuses to limit the access that credit card vendors had to their student population (Brobeck, 1992; Davies & Lea, 1995).

Recent research findings suggest that college students may not be at risk to the extent initially feared, however. Although some students do have difficulty with credit, in general, college students are at least as responsible as their age peers in managing credit card use and credit card debt (Braunsberger, Lucas, & Roach, 2004; Draut & Silva, 2004). Commensurate with their low earnings and financial inexperience, card limits and balances are relatively low among college students, usually averaging a few thousand dollars (U.S. General Accounting Office, 2001). After reviewing several studies of credit card debt levels of college students, Lyons (2004) concluded that the majority of college students are not amassing excessive debt, and over one half of college-aged credit card holders pay their balance in full each month.

Cliff A. Robb, Ph.D., Assistant Professor, Department of Consumer Sciences, University of Alabama, 304 Adams Hall, Tuscaloosa, AL 35487, crobb@ches.ua.edu, (205) 348-1867

Deanna L. Sharpe, Ph.D., CFP®, Associate Professor, Personal Financial Planning Department, University of Missouri, 239 Stanley Hall, Columbia, MO 65211, sharped@missouri.edu, (573) 882-9652

Questions remain, however, as to what factors enable college students to manage credit card use despite their relative inexperience in the credit market. Economic theory proposes that consumers require knowledge to make utility maximizing choices. The purpose of this study was to examine the role that knowledge of personal finance concepts and principles may play in college students' decision to revolve a credit card balance and in the level of balance revolved. In this study, credit card revolvers were defined as respondents who did not pay their credit card balance in full at the end of the month. Study findings can broaden the understanding of factors influencing student credit card use and may be useful for consumer educators and policy makers that are interested in helping college students learn how to manage credit effectively.

Review of Literature

Credit Card Usage Among College Students

Demographic Trends:

A number of recent studies have examined the characteristics, attitudes, and behaviors of college students who use credit cards (see Lawrence, Christofferson, Nester, Moser, Tucker, & Lyons, 2003 as well as Lyons, 2004 for a review of this research). These studies reveal some general trends about college students and credit card use. Gender differences in credit card use exist. Female students were more likely than male students to have a credit card (Armstrong & Craven, 1993; Lawrence, et al., 2003). Typically, they also held more debt than male students (Micomnaco, 2003). In prior research, females have tended to display lower scores than males on measures of personal financial knowledge (Chen & Volpe, 1998, 2002; Jones, 2005; Lusardi & Mitchell, 2005; Borden, Lee, Serido, & Collins, 2008).

Evidence suggests that there is little difference in terms of credit card ownership based on college students' ethnicity. In a study of Louisiana college students, Lawrence et al. (2003) noted that 45% of card holders were Caucasian, 23% were African American, 19% were Asian, about 6% were Hispanic and the remainder were Native American or other race and ethnicities. These percentages reflected the race and ethnic distribution in the overall student body, suggesting that ethnicity was not a factor in distribution of credit card holders on that campus. There is some prior research, however, that indicated that minority students are more likely to be financially at risk when compared with other students (Lyons, 2004).

Parental income is a key indicator of a student's accustomed lifestyle, social class, resources and opportunity to learn about management of money. According to one report, about 14% of students came from families with an annual household income under \$50,000 (Draut & Silva, 2004). Draut & Silva (2004) found that students from lower income households were more likely to develop relatively high credit card balances (\$7,000 or more) as compared with their peers. These findings suggest that perhaps such students did not have as much experience in financial markets as their peers from middle- and high-income families.

Several studies have linked attitudes toward credit with credit behavior in several studies. Higher affective credit attitude scores (using measures such as "my credit card makes me feel happy," or "I like using my credit card") have been associated with students carrying an outstanding balance on multiple cards (Hayhoe, Leach, Turner, Bruin, & Lawrence, 2000). Similarly, Xiao, Noring, and Anderson (1995) and Joo, Grable, and Bagwell (2003) found that a positive attitude toward credit cards was associated with card ownership and use. Chien and DeVaney (2001) noted a positive connection between attitudes towards credit and the likelihood of carrying a balance. After examining credit card attitudes among undergraduates in Britain and America, Yang, James, and Lester (2005) concluded that affective and behavioral attitude scores were the strongest predictors of the number of credit cards owned. Interestingly, they noted that those who had more positive attitudes toward money in general also exhibited greater obsession with money.

Hayhoe, Leach, and Turner (1999) developed a scale measure of money attitudes using survey participant's responses to statements about feelings, knowledge, and behavior related to credit cards and debt. Evaluating the relationship between this measure and college student credit card behavior, they found that students' scores regarding money attitudes of obsession and retention and affective credit attitudes distinguished between the students who did and did not have credit cards (Hayhoe et al., 1999). Attitudinal scores also distinguished between students who had less than three credit cards and those with four or more and were significant predictors of who, among students with cards, would carry four or more credit cards.

There seems to be some "class rank" effects in credit card behavior. A study by Nellie Mae (2002), a nonprofit stu-

dent loan provider, found slightly more than half of freshmen (54%) had a credit card. Freshmen also had the lowest average number of cards (2.5) and average debt (\$1,533). The numbers of cardholders rose with class rank, however. Ninety-two percent of sophomores had a card; for seniors the percentage was ninety-six. From sophomore to senior year, the average number of cards held was successively larger, changing from 3.67 to 4.50 to 6.13, respectively. Average debt levels were larger for higher levels of class rank as well. The average debt of seniors (\$3,262) was more than double that of freshmen (Nellie Mae, 2002).

Similar to seniors, 96% of graduate students reported owning at least one card; on average, they had 6 credit cards. At \$7,831 per student in 2003, the average credit card debt of graduate students was much higher than that of undergraduates. The average level of credit card debt among graduate students in 2003 was almost \$3,000 higher than reported in 1998 (Nellie Mae, 2007). One in four graduate students with credit card debt in 2003 had balances between \$6,000 and \$15,000, about the same proportion observed in 1998. Fifteen percent had a balance over \$15,000, over twice the proportion seen in 1998 (Nellie Mae, 2007).

Lyons (2004) analyzed responses from a random sample of University of Illinois undergraduate and graduate students who had completed a survey related to financial issues in 2001 to determine the probability of being at risk of credit misuse or mismanagement as measured by four specific outcomes or behaviors: having \$1,000 or more in outstanding credit card balances, being late on payments by two months or more, having reached the limit on credit cards, and rarely or never paying off credit card balances. Lyons (2004) concluded that financially at-risk students were more likely than other students to receive need-based financial aid, have \$1,000 or more in other outstanding debt, or to have acquired their card by mail, at a retail store or as the result of a campus solicitation.

Graduating students leave college and university campuses with an average debt burden of \$20,402 for education and credit card debt combined (Nellie Mae, 2002). Financial experts have expressed concern that credit card debt coupled with student loan debt could create serious financial burdens for college students near and post graduation (Bianco & Bosco, 2002; College Board, 2005). These concerns have only intensified in recent years as rising tuition costs have consistently outpaced increases in financial aid available per student (College Board, 2005). University

administrators who were contacted as part of a study on student credit card use commissioned by the General Accounting Office have acknowledged that there may be a relationship between various financial concerns, including mishandling of credit, and persistence to graduation (GAO, 2001).

Financial Knowledge

There are two lines of research on financial knowledge. In one group of studies, participants answered questions related to general financial knowledge (Markovich & DeVaney, 1997; Chen & Volpe, 1998; Avard, Manton, English, & Walker, 2005; Jones, 2005). The questions used in these studies related closely to the topics typically covered in an introductory personal finance course. The second group of studies used specific financial knowledge as a proxy for financial literacy (Warwick & Mansfield, 2000; Joo et al., 2003; Braunsberger et al., 2004). These studies generally asked individuals to report particular facts about their own credit cards (e.g. APR, fees, etc.). There is strong evidence from both lines of research that suggests, regardless of how financial knowledge is operationalized, college students do not possess a high degree of financial knowledge (Markovich & DeVaney, 1997; Chen & Volpe, 1998; Warwick & Mansfield, 2000; Avard et al., 2005; Jones, 2005).

Chen and Volpe (1998) administered a 36 question survey dealing with various aspects of personal financial knowledge to college students. The average score of correct responses was close to 53%, not a passing score on a typical grading scale. They noted significant degree-type and class rank effects. Business majors tended to score better than non-business majors. Students with more years of college had higher financial knowledge scores than students with fewer years of college. Other researchers have also found that college freshmen have low scores on tests of financial knowledge. Avard et al., (2005) found that college freshmen were able to answer only about 35% of financial knowledge questions correctly. Using a six-question scale of credit knowledge to evaluate financial knowledge, Jones (2005) reported that, on average, incoming freshmen gave correct answers only 56% of the time.

Among existing studies, the ability of a cardholder to report his or her annual percentage rate (APR) is one of the most commonly used measures of specific financial knowledge. The federal law mandating reporting of the APR was passed in 1968. Since that time, awareness of APRs has grown considerably (Durkin, 2000; Hogarth

& Hilgert, 2002). Ironically, despite increased awareness of this measure, research indicates that few consumers seem to understand how to use the APR to make effective financial decisions (Lee & Hogarth, 1999). Similar results have been found for the college population, as Chen and Volpe (1998) discovered that 67% of the college students surveyed could not correctly answer a multiple-choice question regarding the APR.

Liebermann and Flint-Goor (1996) suggested that prior knowledge of an issue is one of the most important factors influencing information processing. Evidence regarding the relationship between financial knowledge and financial behavior has been mixed, however. Results vary depending on how financial knowledge has been measured, what behaviors have been studied, and what populations have been analyzed (Mandell, 2004; Peng, Bartholomae, Fox, & Cravener, 2007).

Findings of some studies suggest that life-cycle stage may influence the perceived salience of personal financial instruction. Mandell (2004) noted that having a savings account has been associated with higher savings knowledge among high school students. Ironically, however, using credit cards has been associated with lower credit knowledge among this age group. Peng et al. (2007) noted that both high school and college students that completed a personal finance course displayed improved savings rates following a personal finance course. But, participation in a college level personal finance course was also associated with improved investment knowledge, an effect not noted among high school participants. In the workplace, there is evidence that targeted instruction, such as retirement planning education, has a significant influence on financial behavior (Todd, 2002; Bernheim & Garrett, 2003).

On the basis of their research, Chen and Volpe (1998) argued that a person's level of financial knowledge tends to influence their opinions and affect their financial decisions. Their study was among the first to establish a link, albeit a tenuous one, between knowledge and behavior among college students. Individuals with higher levels of financial knowledge were more likely to make good financial decisions in a hypothetical situation (Chen & Volpe, 1998). Focus group data analyzed by Cude, Lawrence, Lyons, Metzger, LeJeune, Marks, and Machtmes (2006) suggested that students who scored higher on a financial fitness test were more likely to report paying their balance in full each month and were less likely to own a credit card as

compared with students who had lower scores on the test. Research among secondary school students has suggested that financial education has a positive effect on financial competency (Langrehr, 1979; Tennyson & Nguyen, 2001). Among the general population in the United States, strong correlations have been found between a person's composite score of financial knowledge and an index of credit management behaviors (Hilgert, Hogarth, & Beverly, 2003).

Not all researchers would concur, however, that there is a significant link between financial knowledge and behavior. Using a six-question scale to measure financial knowledge, Jones (2005) did not find a significant relationship between knowledge and college student credit card debt behavior. Similarly, in research by Borden et al. (2008), no significant relationship was found between financial knowledge and effective or risky financial behaviors.

In summary, inconsistencies from the available literature make it difficult to draw strong conclusions regarding the relationship between financial knowledge and behavior. The present analysis utilized components of previous knowledge measures and built on the previous research by directly comparing a theoretical measure of personal financial knowledge to an observable financial behavior.

Theoretical Framework

According to the life-cycle hypothesis, individuals strive to have a constant consumption path through life (See Ando & Modigliani (1963) for a formal discussion of this hypothesis). In youth and old age when income tends to be limited, dissaving occurs. Saving occurs in midlife when income is relatively higher. In this context, college student use of debt instruments, including credit cards, could be considered a rational decision given their significantly higher expected earnings path as compared with high school graduates (Baum & Payea, 2004; Kidwell & Turrisi, 2000; Norvilitis & Santa Maria, 2002).

Although the life-cycle income hypothesis suggests why borrowing can be a rational decision, it does not specify the means by which borrowing might occur. Borrowing can be envisioned as a two-step process. The decision of whether or not to borrow is the first step in that process. Once a decision is made to borrow, the next step is to decide how much to borrow, taking the cost of borrowing into consideration. Assuming a rational decision-making process, individuals seek to equate the marginal costs with the marginal benefits of any given decision.

College students may choose from a variety of debt instruments as a means of funding consumption during college. The options include, but are not limited to, student loans, bank loans, loans from family members, as well as credit cards. In terms of real costs (as measured by the interest rate), credit cards are one of the most expensive borrowing alternatives available if a balance is revolved (i.e., carried over from one month to the next, thus incurring an interest charge). So while it may be considered rational for college students to utilize debt instruments, it could also be argued that credit cards are a relatively inefficient means of borrowing given their high interest rates and required minimum payments. Given the relative inefficiency of credit cards, it would be expected that among college students who have a credit card, those who had greater knowledge of the credit market would be less likely to carry a balance on their cards and more likely to use other lower-cost forms of borrowing.

Analysis of the borrowing decision is complicated by the need to both have and understand credit market information. Difficulties can arise when this information is complex, incomplete, or otherwise not sufficient for making effective market decisions. For example, student loans can offer college students a less costly form of borrowing than credit cards. But, total costs of a student loan may be rather difficult to ascertain as they occur in the future and will depend to some extent on future payback behavior as well as type of loan obtained (e.g., subsidized versus unsubsidized). In addition, transaction costs for student loans are relatively high. College students making a comparison may conclude that carrying a credit card balance is cheaper simply because the current and future cost of credit can be ascertained and the present transaction costs to use a credit card are relatively low, overlooking the fact that high interest rates can make credit cards the costlier option.

Empirical findings suggest that there are significant benefits to search in credit markets (Lee & Hogarth, 1998). What is not understood, however, is the extent to which college students understand these benefits of search. If college students lack knowledge of the operation of credit markets, it is also likely that they would not fully understand the costs associated with borrowing via credit cards. Ausubel (1991) argued for consumer irrationality in the attainment of credit cards, as individuals forgo extensive search based on the belief that the card will only be used as a convenience tool. But, is this truly irrational behavior, or the result of a lack of full market information? If college students lack key information to effectively weigh the costs and benefits as-

sociated with a given decision to use credit, can they make rational decisions in the credit market?

Economic decision-making theory underscores the importance of product knowledge in making effective consumer choices. This study extended prior research by analyzing the influence that general financial knowledge may have on credit decision-making and behavior. Specifically, this study examined the role that financial knowledge plays in college students' choices to have a credit card balance and in the amount of balance held, controlling for factors that other studies of college student credit card use have found to be influential. In this study, financial knowledge was defined as an individual's understanding of important concepts related to personal finance, and was operationally defined in the present analysis as a respondent's score on six questions dealing with different aspects of personal finance.

Theoretically, greater financial knowledge should enhance understanding of all costs associated with using credit cards; whereas, a lack of knowledge of financial markets and instruments makes it difficult to judge actual costs. In this study, it was hypothesized that:

H1: A higher level of financial knowledge is negatively related to whether one carries a revolving balance.

H2: Among those with a revolving balance, a higher level of financial knowledge is associated with a lower reported balance.

Method

Data and Sample

An invitation to participate in an Internet based survey was sent via electronic mail to a population of just over 25,000 undergraduate, graduate, and professional students at a large Midwestern university in the United States. The survey consisted of 83 questions that gathered information on credit card attainment and use, general demographic data, consumer attitudes toward credit, online spending habits, and labor force participation. A drawing for three \$150 gift certificates was held as a participation incentive. A total of 6,520 students completed the survey, for a response rate of roughly 24%. Once the data were cleaned, a usable sample of 3,884 college students was obtained. The drop in the number of cases was largely due to incomplete survey responses. Distribution of demographic characteristics for the reduced sample roughly mirrored that of the student population, except that the student sample had more female respondents than were present in the overall student body (65.8% vs. 51.5%).

Dependent Variables

The decision to revolve a balance is a two-step process. First, students decide whether or not to revolve a balance, which may be modeled as a simple yes-no decision. Thus, the first dependent variable in this analysis was dichotomous, set equal to 1 if revolve, 0 otherwise. Second, respondents that choose to revolve a balance must decide how much to revolve. Consequently, the second dependent variable was continuous and conditional on having a balance. This two-step process is best modeled by a double-hurdle approach (Cragg, 1971). Assumptions of ordinary least squares regression are violated in both equations. The dependent variable in the first equation is dichotomous rather than continuous. The dependent variable in the second equation contains a substantial number of zero cases. Tobit can be used in such situations, but this procedure forces parameter signs to be the same at each stage. The double-hurdle model, in contrast, allows signs and significance of the independent variables to differ at each stage of the analysis.

Similar to previous studies of college student credit card usage (Reynolds, Hogarth, & Taylor, 2006), a large percentage of the sample did not carry a balance (identified as non-revolvers in this study), and observations among those that did carry a balance were not normally distributed. For this reason, the log of the credit card balance was utilized in this study.

Independent Variables

Financial knowledge was measured using six questions dealing with general financial practices (see Table A in the Appendix for list of questions). Each question was designed to measure a different aspect of personal financial knowledge. The six questions were drawn from the 2006 Jump\$tart Survey and from research conducted by Chen & Volpe (1998). Questions were selected with the intention of serving as a reflection of the issues that college students might be faced with in a general course on personal finance. The knowledge measure served as part of a larger survey analyzing numerous student financial behaviors and attitudes. Thus, an effort was made to keep the survey at a reasonable length. Individuals' scores ranged between 0 and 6, depending on the number of correct responses that a participant provided. The total number of correct responses was summed to create the independent variable, financial knowledge.

The attitudinal variables - power, anxiety, second guess, and distrust - were constructed using a modified version of

the Money Attitude Scale (MAS) introduced by Yamauchi and Templer (1982). Following the example of Roberts and Jones (2001), Yamauchi and Templer's (1982) time-retention dimension was not used in this study since the sample was limited to college students. Student responses to 20 separate questions about personal financial attitudes were factor analyzed. Similar to research by Roberts and Jones (2001), and more recently Norum (2008), results of the factor analysis indicated four underlying factors existed: power-prestige ($\alpha = .87$), distrust ($\alpha = .78$), anxiety ($\alpha = .72$), and second guess ($\alpha = .61$). Scores for each of the attitudinal measures were reverse coded so that higher scores indicated stronger attitudes (e.g., a higher score on the power-prestige measure indicated an individual who was more likely to view money as a source of power or prestige). The results of the factor analysis are included in Tables B.1-B.4 in the Appendix. The definitions and coding of the remaining independent variables used in this study are outlined in Table C in the Appendix. These variables were selected based on evidence of their importance in previous research.

Results

Descriptive statistics for the entire sample are reported in Table 1. Roughly 66% of respondents had at least one credit card, with a reported average of about 1.4 cards per respondent among cardholders. Respondents were asked to report only those credit cards that were used on a regular basis. Thus, an individual who owned four credit cards but only used two of them on a regular basis should have reported using two credit cards. The present study was concerned with credit card use rather than prevalence of cards among college students.

About a third (38%) of card holders reported having a revolving balance. Among those respondents that had and used credit cards, the average balance carried was \$848.05. Median balance carried was \$0.00 due to the high percentage of individuals who did not revolve a balance. Among those who did revolve a balance, the average amount carried was \$2,238.46, with a median amount owed of \$1,000.00. Average monthly spending on all cards was \$298.93, with a median of \$75.00. Slightly less than half (44.93%) of the sample was able to answer 4 or more of the financial knowledge questions correctly. Mean response on the financial knowledge questions was 3.14 on a scale of 0 to 6.

Average age of respondents was 21.29. A majority of the sample was white (86.28%) and female (65.83%). A little

Table 1. Descriptive Statistics for the Entire Sample, Card Holders and Non-card Holders (N = 3,884)

Variable	Frequency	Variable	Frequency
Own a credit card	65.99%	Financial aid	66.15%
Carry a balance	25.00%	Charge school items*	23.29%
Course in finance	28.73%	Independent	30.90%
Have other debt	18.00%	You pay on cards*	87.09%
Knowledge (# Correct)		Source of card*	
	0 4.97%		
	1 9.71%	Parents	17.17%
	2 16.19%	Direct mail	23.89%
	3 24.20%	Campus source	4.81%
	4 27.01%	Bank	26.08%
	5 16.66%	Store/Retail	14.47%
	6 1.26%	Other	7.93%
White	86.28%	Employed	64.01%
Female	65.83%	Business Major	17.82%
Year in school		Parent's Education	
	Freshman 19.77%		
	Sophomore 18.82%	Less than high school	0.70%
	Junior 18.87%	High school	9.81%
	Senior 20.96%	Some college	21.27%
	Graduate [□] 21.58%	College or more	67.84%
Expected income		Parent's income	
	Low 13.90%	Low	19.75%
	Medium 59.32%	Medium	34.99%
	High 21.81%	High	34.27%
Married	7.60%	Urbanization	
		Urban	12.62%
		Suburban	60.92%
		Rural	26.47%
Continuous Variables		Mean	SD
Average monthly spending		\$197.26 (\$75.00)	375.66
		[\$257.33]	[397.34]
Amount revolved		\$559.62 (\$0.00)	1990.88
		[\$2238.46]	[3479.19]
Number of cards used (max = 8)		0.92	1.01
Age (max = 30)		21.29	2.73
Knowledge (max = 6)		3.14	1.42

Note. * Indicates that N = 2,563 due to the fact that these variables were only applicable to those individuals holding credit cards (1,321 individuals did not report holding credit cards).

[□] Graduate student category consists of professional, medical, and law students.

Median scores for the entire sample are presented in parentheses. Means and standard deviations for only those individuals who reported revolving a balance are presented in brackets.

over 7% of the sample were married. Slightly less than a third of respondents (30.90%) were financially independent. Most had come from a suburban area (60.92%). Class rank was rather evenly distributed across the sample with around one-fifth in each class from freshman to graduate student.

More than a quarter of the sample (28.73%) had taken a personal finance course. Eighteen percent of the sample respondents were business majors. Roughly 14% of the sample expected to earn less than \$30,000 upon graduation, whereas a quarter of the sample (25%) expected to earn between \$30,000 and \$39,000 upon graduation. Over a third of the sample (34.78%) expected to earn between \$40,000 and \$59,999, whereas the remaining respondents expected to earn \$60,000 or more. Roughly a third had parents with incomes between \$49,999 and \$99,999 (34.99%) or \$100,000 or more (34.27%). About two-thirds of the respondents (67.84%) had parents that had earned a college degree or higher.

A majority of the respondents received some form of financial aid (66.15%) and were employed (64.01%). Respondents obtained their credit cards from a variety of sources, with most having gotten them from either a bank (26.08%) or direct mail (23.89%) source. Commensurate with previous research, on average, the credit card balance carried by respondents was relatively low (\$848.05). At \$298.93, average monthly spending was also relatively low. As suggested by the previous literature, the students sampled appeared to be generally responsible in their use of credit cards (Lyons, 2004). Roughly 62% of the respondents paid their cards in full each month, and 81% reported balance levels of between \$0 and \$1000. Roughly 9% of the sample reported holding a balance of \$3,000 or more, however, suggesting that there were still many students who could be considered as financially at-risk.

The SAS® QLIM (Qualitative and Limited Dependent Variable Model) procedure was used to conduct the double-hurdle analysis. Results of this analysis are presented in Table 2. In the first stage, factors affecting the decision to have a balance are modeled as a probit equation; the dependent variable was set equal to 1 if have a balance, 0 otherwise. In the second stage, maximum likelihood analysis was used to evaluate the influence of various factors on the level of balance carried among those with a balance. Marginal effects associated with the variables for the first stage of the double-hurdle analysis are presented in Table 3.

Interestingly, which variables were significant depended on the stage of the analysis, and the sign of the effect was not always consistent across stages. Contrary to the initial hypothesis, the financial knowledge measure was not significantly related to whether or not individuals reported carrying a revolving balance. This result was largely supportive of findings presented by Jones (2005). However, among revolvers (respondents who carry a credit card balance), increased knowledge was associated with carrying a larger log balance. This finding was contrary to the initial hypothesis that more knowledgeable students would have lower log balances.

Consistent with prior research, being financially independent was positively related to carrying a revolving balance, and was associated with higher log balances. Lyons (2004) noted a strong association between financial independence and being financially at-risk (independent students were more likely to be delinquent, have cards that were maxed-out, and to not pay their balance in full).

Contrary to prior research, there were no significant differences in balance behavior based on gender in either stage of the analysis. Previous research by Lyons (2004) suggested that females had a greater likelihood of being delinquent on their cards as compared with males. As compared with other races, being white was associated with a lower likelihood of carrying a revolving balance. However, white students were not found to be significantly different from other races in terms of the amount revolved. This is somewhat supportive of the prior literature, which generally suggested that minority students are more likely to engage in less responsible or riskier credit card behaviors (Allen & Jover, 1997; Monro & Hirt, 1998; Lyons, 2004).

When compared with graduate students, juniors and seniors were found to be more likely to revolve a balance, though no differences were noted for freshmen or sophomores relative to graduate students. Among revolvers, graduate students and seniors had the highest debt levels; all other class ranks had relatively lower log balance levels. These findings were consistent with those presented by Nellie Mae (2002). Interestingly, income expectations did not have a significant influence at either stage of the analysis. Specifically, no statistical differences were noted based on the annual income individuals expected to receive once they had completed college and begun to work full time. Those who received financial aid were more likely to carry a revolving balance, though there were no significant differences in terms of the log balance revolved based on

Table 2. Results from the Double-Hurdle Analysis, Credit Card Balance as the Dependent Variable

<i>Parameter</i>	Stage 1: Probit analysis (N = 2,368)		Stage 2: Maximum likelihood analysis (N = 894)	
	<i>Coefficient</i>	<i>St. error</i>	<i>Coefficient</i>	<i>St. error</i>
Intercept	-0.523*	0.262	6.100***	0.519
Knowledge	0.007	0.024	0.119***	0.035
Female	0.058	0.068	-0.030	0.104
White (vs. Other)	-0.389***	0.086	-0.018	0.132
Year in school (Graduate student omitted)				
Freshman	-0.138	0.122	-1.005***	0.204
Sophomore	0.153	0.106	-0.963***	0.162
Junior	0.286**	0.099	-0.409**	0.151
Senior	0.442***	0.089	-0.270	0.145
Financially independent	0.316***	0.076	0.298**	0.118
You pay on cards	0.414***	0.115	-0.070	0.237
Expected income (Middle income omitted)				
Low expected income	-0.017	0.087	-0.010	0.125
High expected income	-0.089	0.072	0.014	0.109
Origin of cards				
Bank	0.212**	0.071	0.376***	0.106
Campus	0.220*	0.112	0.490***	0.152
Parent	-0.144	0.079	0.201	0.130
Direct mail	0.283***	0.073	0.735***	0.114
Retail/Store	0.176**	0.070	0.191*	0.101
Other	0.105	0.094	0.349**	0.136
Financial aid	0.137*	0.065	0.167	0.105
Charge school items	0.236***	0.068	0.247*	0.102
Parent's education (College or more omitted)				
High school or less	0.221*	0.096	0.310*	0.137
Some college	0.251***	0.071	0.211*	0.109
Married (vs. single)	-0.017	0.101	0.451***	0.140
Course in personal finance	-0.040	0.064	-0.005	0.096
Business major	-0.173*	0.081	-0.117	0.127
Parent's income (Middle income omitted)				
Low income	0.027	0.077	-0.089	0.108
High income	0.041	0.068	0.083	0.104
Attitudes				
Power	-0.004	0.007	-0.005	0.011
Anxiety	-0.068***	0.013	-0.011	0.022
Second guess	0.071***	0.015	0.044	0.025
Distrust	-0.029***	0.006	-0.036***	0.011
Employed	0.278***	0.066	0.114	0.119
Other debt	0.353***	0.070	0.286**	0.111
Time preference composite	-0.061	0.071	-0.151	0.098
Rho	0.091	0.226	–	–
Sigma	–	–	1.233***	0.033

*** $p < .001$. ** $p < .01$. * $p < .05$.

Table 3: Marginal Effects for each of the Independent Variables on the Probability of Revolving a Balance (Probit)

<i>Parameter</i>	<i>Marginal Effect</i>
Knowledge	0.002
Female	0.018
White (vs. other)	-0.123***
Year in school (Graduate student omitted)	
Freshman	-0.044
Sophomore	0.049
Junior	0.091**
Senior	0.140***
Financially independent	0.099***
You pay on cards	0.131***
Expected income (Middle income omitted)	
Low expected income	-0.005
High expected income	-0.028
Origin of cards	
Bank	0.067***
Campus	0.071*
Parent	-0.045
Direct mail	0.090***
Retail/Store	0.056**
Other	0.033
Financial aid	0.043**
Charge school items	0.075***
Parent's education (College or more omitted)	
High school or less	0.071*
Some college	0.081***
Married (vs. single)	-0.005
Course in personal finance	-0.013
Business major (vs. others)	-0.055*
Parent's income (Middle income omitted)	
Low income	0.009
High income	0.013
Attitudes	
Power	-0.001
Anxiety	-0.022***
Second Guess	0.022***
Distrust	-0.009***
Employed	0.088***
Other debt	0.112***
Time preference composite	-0.019

*** $p < .001$. ** $p < .01$. * $p < .05$.

the receipt of financial aid. This outcome was consistent with previous findings that have noted that the receipt of financial aid was associated with less responsible or riskier credit card behaviors (Munro & Hirt, 1998; Lyons, 2004). As compared with all other majors, business majors were less likely to revolve a balance, though major did not have any significant influence in stage two of the analysis. No differences in credit card use behavior were found based on whether or not individuals had taken a course in personal finance. In general, research findings regarding the impact of course experience have been mixed. While some researchers have suggested that course experience has a positive influence on behavior (Bernheim, Garrett, & Maki, 2001; Lyons, 2003), other research suggests that education courses have little to no real influence on behavior (Mandell, 2006).

Examining the parental factors, likelihood of revolving a balance appeared to be higher among those whose parents have lower levels of education. Individuals whose parents have a college degree or greater were less likely to revolve a balance as compared with individuals whose parents had a lower level of education. Students whose parents had only some college or a high school degree or less tended to have higher log balances among revolvers. Parental income was not a significant factor in credit card use behavior at either stage of the analysis. Research by Draut and Silva (2004) suggested that students from lower income (less than \$50,000 annual income) households were more likely than their peers to develop serious credit card debt.

Employed students were more likely to revolve a balance, though the level of the log balance they revolved was not significantly different from those who did not work. The presence of other forms of debt (excluding financial aid or credit card debt) was positively associated with carrying a revolving balance, and higher log balances overall.

Although marital status had no significant influence on the likelihood of revolving, married individuals were noted as carrying larger log balances as compared with single individuals. These findings are largely supported by previous research, as both Lyons (2004) and Jones (2005) noted higher levels of debt among married college students, all else equal.

Significant differences existed for students' money attitudes. Specifically, higher scores on the anxiety and distrust measures were associated with a lower probability of revolving a balance, while higher scores on the second

guess measure were associated with a higher probability of revolving a balance, all else equal. For the second stage of the analysis, higher scores on the distrust measure were associated with lower log balances, though no other significant differences were noted based on attitudes.

Some interesting differences were noted based on how cards were obtained. Because the categories were not mutually exclusive, no single category could serve as a reference group for analysis. Still, the relative influence of holding a specific card type on willingness to carry a balance could be assessed. Findings indicated that possession of a card obtained from a local bank source, campus source, direct mail solicitation, or a retail source was associated with a greater probability of revolving a balance. Note, the magnitude of these effects varied significantly: direct mail cards were associated with a 9% increase in the likelihood of individuals carrying a revolving balance as compared with a 6.7% increase associated with bank cards, 5.6% with store cards, and 7.1% with campus cards. In terms of the real log balance revolved, bank, campus, mail, retail, and other card types were all associated with larger log balance amounts, with the largest effect (.735) being associated with direct mail cards. No significant effects on the probability of revolving a balance or on log balance revolved was noted based on the possession of credit cards obtained from a parent.

Discussion

The results underscore the complexity of the relationship between personal financial knowledge and credit card use behavior. Results of this analysis indicate that some association between personal financial knowledge and college student financial behavior does exist, though the relationship does not behave as hypothesized. H1 is not confirmed. Higher levels of financial knowledge were not significantly related to the decision to revolve a balance in the present sample. Previous studies among the general population suggested that increased financial knowledge was associated with improved credit use behavior (Hilgert et al., 2003). Thus, higher scores on measures of financial literacy should result in a greater likelihood of individuals following recommended financial practices (Hogarth & Hilgert, 2002; Cude et al., 2006).

In general, data regarding financial knowledge and practices among the college student population are mixed. Although Jones (2005) found no link between financial knowledge and behavior, findings from Cude et al. (2006) suggested differently. Different findings may be largely

attributable to variation in specific behaviors analyzed, or in measures of knowledge employed. The present analysis introduces a new measure of general personal financial knowledge. This measure was designed to assess a variety of different areas within the realm of financial knowledge.

Although H2 posits that more knowledgeable individuals will be likely to carry lower log balances, the opposite effect is noted. Among revolvers, level of balance revolved is, in fact, positively related to financial knowledge. The cross sectional nature of this study does not allow the direction of relationship to be distinguished. It is not clear whether more knowledgeable individuals rationally choose to revolve a greater balance due to some unmeasured reason, or whether those individuals that have greater debt are more likely to seek out financial knowledge as a result. Longitudinal data would be needed to better identify cause and effect.

Despite these unexpected results, the measure of financial knowledge used in this study does appear to be somewhat useful in analyzing college students' use of debt. A number of previous studies indicated that no clear relationship existed between financial knowledge and credit card use behavior among college students (Jones, 2005; Borden et al., 2008). Using the measure of personal financial knowledge in this study, however, there appears to be some relationship between personal financial knowledge and credit card balance behavior.

As to why results other than those hypothesized were obtained, it is possible that the students choosing to respond to a survey on credit card use differ in some systematic way from the students who declined to participate. In addition, a number of sample responses were not usable, introducing the possibility that differences may exist between respondents who completed the survey and those who did not. To the extent that self-selection has occurred, results of this study would be biased. Similarity in demographics between the sample and the campus population would tend to discredit this potential explanation, however. It is also possible that aspects of financial need or financial attitudes not entirely captured in the measures used in this analysis could contribute to carrying a higher balance. Certainly, this unexpected outcome warrants further investigation.

It should be noted that the measure of personal financial knowledge used in this study is experimental. To date, no generally accepted measure of financial knowledge exists. Although the measure used in this study has fairly good

reliability, it has not been tested against multiple samples to assess its validity. Future research needs to focus on developing a well-tested, scientific measure of personal financial knowledge to facilitate consistent and valid research.

Several interesting findings may be noted from this study. Although research to date has been somewhat inconclusive, it seems reasonable to expect that having a course in personal finance or being a business major would help students gain knowledge of the cost and consequences of credit use. But, only the latter was a significant factor in predicting whether or not students hold a revolving balance. Neither of these variables was correlated with the amount of balance revolved in this study. Preliminary analysis confirmed that having a course in personal finance, having a business major, and one's level of financial knowledge were not collinear measures. It may be that while a broad survey course in personal finance introduces students to general financial management principles, the volume of material typically presented may make it hard for students to identify specific items to apply to their life circumstances, especially if they are not at a "teachable moment" for some applications. Due to the repetition of financial concepts and principles across courses, business majors may become relatively more proficient in understanding broad principles of the financial market, which may, in turn, influence their use of debt instruments in the market.

Certainly, the conclusion here should not be that personal finance courses are ineffective in transmitting financial knowledge to college students. Rather, the findings of this study suggest that future research on financial knowledge should investigate specific kinds of financial knowledge, as well as where and how that knowledge is gained.

It became evident during the analysis that the personal financial course variable used in this study was limited. In both this and many prior studies, little to nothing is known about the timing, purpose, and specific content of the personal finance course that the student completed. For example, was the course designed to introduce students to a specific area of personal finance, or was it a survey level course that covered a broad range of topics? Was the course taken in high school or in college? Did the student have opportunity to complete applications such as financial calculations or a case analysis? Was the course a requirement or an elective? Future analyses should probe deeper into the characteristics of the personal finance course taken by a student to help identify which characteristics make such a course successful or not in encour-

aging students to adopt effective and productive financial management behavior.

More also needs to be understood about the role that parents play in influencing students' decisions about credit card use. Students whose parents had a high school education or less or some college are significantly more likely to carry a credit card balance as compared with students whose parents had a college education. Are parents with lower levels of education less likely than parents with a college degree to instruct their children in financial operations? If that is so, why?

The fact that students who are financially independent, make their own credit card payments, receive financial aid, are employed, have other debt, and are significantly more likely to carry a credit balance suggests that at least some students may be using credit to compensate for low levels of financial resources. In recent years, financial aid has not kept pace with rising college tuition costs (College Board, 2005). Receipt of financial aid suggests that students need support in order to attend college. If this aid cannot cover the full expenses associated with a college education, some students may use credit cards as an alternative source of funding. The potential use of higher cost credit card debt to either substitute for or augment other lower cost means of credit (e.g., student loans) warrants further investigation. If this is happening, solutions would point to expanding relatively low cost credit rather than expanding financial instruction.

Conclusion

This study used data collected from students at a large Midwestern university to evaluate the role that financial knowledge plays in the credit card decisions of college students. A contribution of this study is the use of an empirical model that permits the sign and significance of factors associated with college students' choices to have a credit card balance to differ from those associated with choice of the amount of balance held.

Results indicate that the relationship between financial knowledge and actual behaviors is not as clear as hypothesized, although there does appear to be a significant relationship between the two factors. Contrary to expectations, those with higher levels of financial knowledge had significantly higher credit card balances. Longitudinal data are needed, however, to identify the direction of cause and effect in this relationship.

Research findings imply that the factors influencing credit card use among college students may be more complex than previous research might suggest. Use of a double-hurdle model indicates that the factors related to credit card use do not necessarily share the same sign and significance as factors associated with level of credit card balance among those who choose to revolve. Research findings also imply that it may be somewhat naïve to assume that students must be protected from the pitfalls of credit misuse by limiting access to cards rather than assuming students are rational decision makers and endeavoring to help them make informed choices regarding credit use.

Finding an effective means of delivering personal financial information seems critical. Having taken a personal finance course was not a significant factor in having a credit card balance or on the level of balance. This finding supports that of Mandell (2006), who concluded that financial education in high school has no long-term influence on individuals' financial behavior. However, contrary results have been presented by Bernheim et al. (2001) who found evidence that financial education was correlated with higher rates of saving and higher net worth later in life.

Results for this study imply that exposure to a personal finance course may not always help students make specific, personal financial decisions. Timing of taking such a course and student readiness for learning the material may also have an effect. Students may benefit from targeted, unbiased information that is readily available to them when they perceive a need for it. Perhaps such information could be posted on a web site sponsored by a department offering courses in personal finance, by Extension, or by the University financial aid office.

In the study of student credit card use, it is critical to understand students' financial choices in the broader context of their location in the lifecycle; prior learning about money and credit by precept and example, especially in the home; cultural norms; expectations for their future; and knowledge of and access to low cost credit. Results of this study suggest that financial knowledge and behavior are related, but the nature of the relationship warrants further investigation. Among revolvers, high levels of debt are associated with greater knowledge. But, given the cross sectional nature of this study, no conclusions regarding causality could be drawn. More remains to be understood about these factors to help consumer educators identify the specific aspects of financial knowledge that will help college students make effective decisions regarding use of

credit cards. Future analysis should focus on developing a consistent measure of financial knowledge. In addition, future research should examine the relationship between financial knowledge and a variety of financial behaviors other than credit card use, as there could be significant variation in the degree of influence that financial knowledge has on these various behaviors.

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Appendix A. Personal Financial Knowledge Questions

Question	Potential responses (Correct in bold)
Which of the following credit card users is likely to pay the GREATEST dollar amount in finance charges per year, if they all charge the same amount per year on their cards?***	<ul style="list-style-type: none"> a. Someone who always pays off their credit card bill in full shortly after it is received b. Someone who only pays the minimum amount each month (%)* c. Someone who pays at least the minimum amount each month, and more when they have more money d. Someone who generally pays their card of in full, but occasionally will pay the minimum when they are short on cash e. Don't know
Which of the following types of investment would best protect the purchasing power of a family's savings in the event of a sudden increase in inflation?***	<ul style="list-style-type: none"> a. A twenty-five year corporate bond b. A house financed with a fixed-rate mortgage c. A 10-year bond issued by a corporation d. A certificate of deposit at a bank e. Don't know
Which of the following statements best describes your right to check your credit history for accuracy?***	<ul style="list-style-type: none"> a. All credit records are the property of the U.S. Government and access is only available to the FBI and Lenders b. You can only check your credit report for free if you are turned down for credit based on a credit report c. Your credit report can be checked once a year for free d. You cannot see your credit report e. Don't know
Which of the following loans is likely to carry the highest interest rate?	<ul style="list-style-type: none"> a. A car loan b. A home equity loan c. A credit card loan d. A student loan e. Don't know
Which of the following is TRUE about the annual percentage rate (APR)? [□]	<ul style="list-style-type: none"> a. APR is expressed as a percentage on a semi-annual basis b. APR does not take into account all loan fees c. APR is not an accurate measure of the interest paid over the life of the loan d. APR should be used to compare loans
A high-risk and high-return investment strategy would be most suitable for: [□]	<ul style="list-style-type: none"> a. An elderly retired couple living on a fixed income b. A middle-aged couple needing funds for their children's education in two years c. A young married couple without children d. All of the above because they all need high returns e. Don't know

Note. ** Indicates a question used in the 2006 Jump\$tart questionnaire.

□ Indicates a question modified from Chen and Volpe (1998).

Appendix B.1. Factor 1 – Power/Prestige (Eigenvalue: 4.66)

Factor loading	Item
.773	I behave as if money were the ultimate symbol of success.
.761	Although I should judge the success of people by their deeds, I am more influenced by the amount of money they have.
.741	People I know tell me that I place too much emphasis on the amount of money a person has as a sign of success.
.711	I seem to find that I show more respect to people with more money than I have.
.706	I use money to influence other people to do things for me.
.676	In all honesty, I own nice things in order to impress others.
.646	I must admit that I purchase things because I know they will impress others.

Appendix B.2. Factor 2 – Distrust (Eigenvalue: 3.09)

Factor loading	Item
.671	I argue or complain about the cost of things that I buy.
.661	When I buy something, I complain about the price I paid.
.654	I hesitate to spend money, even on necessities.
.622	I show worrisome behavior when it comes to money.
.614	I automatically say, “I can’t afford it” whether I can or not.
.606	I show signs of nervousness when I don’t have enough money.

Appendix B.3. Factor 3 – Anxiety (2.43)

Factor loading	Item
.732	It’s hard for me to pass up a bargain.
.667	I am bothered when I have to pass up a sale.
.656	I spend money to make myself feel better.

Appendix B.4: Factor 4 – Second Guess (1.82)

Factor loading	Item
.788	After buying something, I wonder if I could have gotten the same for less elsewhere.
.767	It bothers me when I discover I could have gotten something for less elsewhere.
.408*	When I make a major purchase, I have a suspicion that I have been taken advantage of.

Note. * Indicates that the factor loaded almost as strongly on Factor 2, Distrust.

Appendix C. Variable Definitions

Variable	How coded
<i>Financial knowledge</i>	Categorical variable with scores ranging from 0-6
<i>Sociodemographic Variables</i>	
Sex	= 1 if female, 0 otherwise
Race	= 1 if white, 0 otherwise
Freshman	= 1 if freshman, 0 otherwise
Sophomore	= 1 if sophomore, 0 otherwise
Junior	= 1 if junior, 0 otherwise
Senior	= 1 if senior, 0 otherwise
Graduate	= 1 if graduate student, 0 otherwise
Independent	= 1 if financially independent, 0 otherwise
You pay on cards	= 1 if individual pays their own cards, 0 otherwise
Low expected income	= 1 if < \$30,000, 0 otherwise
Middle expected income	= 1 if > \$29,999 and < \$60,000, 0 otherwise
High expected income	= 1 if > \$59,999
Financial aid	= 1 if financial aid received, 0 otherwise
Charge school items	= 1 if school items are charged on cards, 0 otherwise
Employment	= 1 if employed, 0 otherwise
Marital status	= 1 if married, 0 otherwise
Other debt	= 1 if other debts exist, 0 otherwise
Course in personal finance	= 1 if they have had a course, 0 otherwise
Business major	= 1 if business major, 0 otherwise
High school or less	= 1 if parents education is high school or less, 0 otherwise
Some college	= 1 if parents education is some college, 0 otherwise
College	= 1 if parents education is college or more, 0 otherwise
Low parents' income	= 1 if parents income < \$50,000, 0 otherwise
Middle parents' income	= 1 if parents income > \$49,999 and < \$100,000, 0 otherwise
High parents' income	= 1 if parents income > \$99,999, 0 otherwise
Origin of card	
Bank	= 1 if bank card, 0 otherwise
On-campus	= 1 if campus source, 0 otherwise
Parent	= 1 if from parent, 0 otherwise
Mail	= 1 if direct mail, 0 otherwise
Retail/store	= 1 if store card, 0 otherwise
Other	= 1 if other source, 0 otherwise
Attitudinal Variables	
Power	Categorical variable ranging from 7-35
Anxiety	Categorical variable ranging from 3-15
Second guess	Categorical variable ranging from 3-15
Distrust	Categorical variable ranging from 6-30