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The editor of *Financial Services Review* wishes to thank the Stetson University, School of Business, for its continuing financial and intellectual support of the journal.

Aims and Scope: *Financial Services Review* is the official publication of the Academy of Financial Services. The purpose of this refereed academic journal is to encourage rigorous empirical research that examines **individual behavior** in terms of financial planning and services. In contrast to the many corporate or institutional journals that are available in finance, the focus of this journal is on individual financial issues. The Journal provides a forum for those who are interested in the individual perspective on issues in the areas of Financial Services, Employee Benefits, Estate and Tax Planning, Financial Counseling, Financial Planning, Insurance, Investments, Mutual Funds, Pension and Retirement Planning, and Real Estate.

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FINANCIAL SERVICES REVIEW

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From the Editor

This issue contains **Volume 29 - Issue 4** of *Financial Services Review* (*FSR*). I would like to thank the board and members of the Academy of Financial Services for their continued support. I continue to work in broadening the scope of articles, while still focusing on individual financial management and personal financial planning. I encourage authors to reach out when discussing implications of their findings in a more comprehensive way. As such, all articles in the Journal more appropriately relate to financial planning issues.

The lead article "Financial (il)literacy versus Individual's behavior; evidence on credit card repayment patterns" is coauthored by Gustavo Barboza at Loyola University of New Orleans; Paola Bongini at University of Milano-Bicocca and Monica Rossolini at University of Milano-Bicocca. The authors investigate the role that financial (il)literacy and personal traits on financial behavior. They assess the implications of revealed lack of financial knowledge on financial behavior regarding credit card use in comparison with two other cohorts; cohort one answering correctly, and cohort two failing to answer correctly. Their empirical findings indicate that among personal-traits overspending results in lack of payment in full in credit card deb, and these effects dominate any gains derived from financial literacy. Additionally financial literacy appears to only play a marginal role avoiding month-to-month credit card debt. Financial knowledge derived from parents has a strong positive effect on individuals' financial behavior especially for students characterized by a relevant financial illiteracy. The implications support that early exposure to financial education is strictly preferred and should be promoted at early stages of the educational system.

The second article "Framing the annuity as bequest protection: An experimental test" is coauthored by Ying Yan at Eastern New Mexico State University and Russell N. James III at Texas Tech University. In this article, the authors investigate how framing partial annuitization as a protection for an intended bequest against the risk of asset exhaustion due to unexpected longevity influences the desire to purchase an annuity. Their results indicate that this framing argument does increase interest in purchasing an annuity. The regression results demonstrate that this framing has a larger positive effect for individuals with a greater bequest motive.

The third article, "Financial Literacy to Prevent Poor Borrowing Choices" is coauthored by Terrance Martin at Utah Valley University, Janine K. Sam at Shepherd University, *, and Philip Gibson at Winthrop University. In this article the authors investigate the impact of financial literacy on the decision to access retirement plan loans before retirement or use one or more high-cost lenders. Their results show that being financially literate reduces the likelihood of using high-cost lenders and using retirement-plan loans. Additionally, they find evidence of a negative relation between financial literacy and myopic spending.

The final article, "Improving Collegiate Financial Literacy via Financial Education Seminars" is coauthored by Jonathan Handy at Western Kentucky University, Beth Pontari at Furman University, Thomas Smythe Florida at Gulf Coast University, and Suzy Summers at Furman University.The authors review a personal finance program developed at a private liberal arts university aimed to improve financial literacy. The authors examine program effectiveness at improving students' financial knowledge and confidence in their financial future and find that financial knowledge and confidence improve. Additionally, women (minorities) narrow their financial knowledge and confidence gaps when compared to men (Caucasians). The follow-up analyses show that increases in confidence appear justified in that they are calibrated to increases in knowledge.

Thank you to those who make the journal possible, especially the referees and contributing authors. Over the past year, the following reviewers provided excellent reviews of the articles you enjoyed within the pages of Financial Services Review. I would like to send a special thank you to the many reviewers that have significantly contributed to the quality of our journal by providing timely and thorough reviews of the submissions to our journal.

Please consider submission to the Financial Services Review and rely on the style information provided to ease readability and streamline the review process. The Journal welcomes articles over the range of areas that comprise personal financial planning. While FSR articles are certainly diverse in terms of topic, data, and method, they are focused in terms of motivation. FSR exists to produce research that addresses issues that matter to individuals. I remain committed to the goal of making Financial Services Review the best academic journal in individual financial management and personal financial planning.

Best regards,
Stuart Michelson
Editor *Financial Services Review*

Thank You to all the FSR reviewers over the past year!		
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Financial (il)literacy vs. individual's behavior: evidence on credit card repayment patterns

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Abstract

We explore the role that financial (il)literacy and personal traits have on financial behavior. Using a sample of 156 college students from the United States, we provide unique empirical evidence by specifically differentiating between individuals with higher levels of financial literacy versus individuals declaring not knowing the answers to financial literacy questions and those answering incorrectly. Thus, we assess the implications of revealed lack of financial knowledge on financial behavior regarding credit card use in comparison with two other cohorts; cohort one answering correctly, and cohort two failing to answer correctly. A novelty of our study is that we contrast these results to the behavioral factors of over spending and surprised levels of spending—proxies for personality traits—when using credit card. Our exploratory empirical findings indicate that among personal-traits considered in this study overspending results in lack of payment in full in credit card debt, and more importantly these effects dominate any gains derived from financial literacy. To this extent financial literacy appears to only play a marginal role avoiding month-to-month credit card debt. Furthermore, financial knowledge derived from parents has a strong positive effect on individuals' financial behavior especially for students characterized by a relevant financial illiteracy. The implications of this research support the argumentation that early financial literacy may have the strongest effect in shaping individuals inherent behavior patterns; that is, early exposure to financial education is strictly preferred and should be promoted at early stages of the educational system.

JEL classification: I22; G41

Keywords: Financial literacy; Credit card debt; College students; Financial behavior

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1. Introduction

Issues relating to financial knowledge and individual behavioral patterns are at the core of every individual's economic decision (Thaler & Shefrin, 1981). It is well documented that financially illiterate individuals incur in costly or even improper financial decisions with significant negative spillover effects on other aspects of their life (see Lusardi & Mitchell, 2007; and Van Rooij, Lusardi, & Alessie, 2011, 2012, among others). For instance, previous studies demonstrate (see Lusardi & Mitchell 2014, for an excellent review of the literature) that when young people possessing low levels of financial literacy and combined with a widespread use and easy access to credit cards (especially among college students), results in making the wrong financial decisions; most notably carrying over large balances in credit card debt. As a matter of fact, credit card debt coupled with financial illiteracy is associated with unhealthy behaviors (Adams & Moore 2007; Berg et al., 2010; Lyons & Rogers, 2004), lower academic performance (Pinto et al., 2001), and lower financial well-being (Grable & Joo 2006; Norvilitis et al., 2006; Nelson et al., 2008). The negative effects of poor financial decisions are well stated; however, what causes and fuels this behavior is a much lesser study field.

In this context, the role of personality traits, individual preferences with hyperbolic discounting, and attitudes in influencing financial decision-making have been less investigated to this date in the literature. This is more interesting as these issues are increasingly attracting the attention of psychologists and, and more recently yet to a lesser extent economists (see Brown & Taylor, 2014 and Barboza, 2018, for instance). Similarly, issues relating to one self's perception (i.e., confidence about one's knowledge or ability to conduct financial decision in particular) has been explored in the realm of behavioral economics and finance (Thaler, 1980; Thaler & Shefrin, 1981). However, despite these advances, it is only until recently that the combined elements have become a subject of analysis in conjunction. More specifically the actual financial knowledge showing that overconfident individuals, or those with high self-assessed knowledge but low actual knowledge, have a higher propensity to engage in risky (costly) financial behaviors (Tokar Asaad, 2015; Brown & Taylor, 2014; Chu et al., 2017; Kramer, 2016; Porto & Xiao, 2016; Xia et al., 2014).

On the basis of these considerations and given the importance that financial literacy plays in optimal decision-making processes, our paper aims at studying the relationship between individual behavior and financial (il)literacy. More specifically, we aim at providing robust empirical evidence useful to fill the gap where little attention has been given to study the impact of both financial literacy and of personality traits, preferences and attitudes on overall financial behavior measured as repayment patterns in credit card debt.

Specifically, we hypothesize that regardless to one's financial knowledge level, specific personality traits, such as present-bias preferences or impulse behavior, may negatively impact the financial decision-making processes and overpower the (potential) positive effects from higher level of financial literacy. Secondly, we hypothesize that self-awareness of not possessing a strong financial knowledge (admitted by choosing the Do Not Know option in a financial literacy questionnaire) may lead to more conservative financial

decisions. In turn these decisions could prevent individuals from assuming too much financial risk, resulting in a "correct" or less costly financial decision.

This paper studies credit cards use among college students as we investigate the financial behavior and decisions that college students make in terms of credit card repayment patterns. That is, whether students select to pay the credit card balance in full every billing cycle, or decide to carry a month-to-month balance, either by paying less than the full balance, by only the minimum payment (anchoring) or by falling behind on their payments. We use a sample of 156 college students from the United States and consequently estimate a series of ordered Probit models. Our results provide unique empirical evidence by creating a distinctive differentiation between individuals with higher levels of financial literacy versus individuals declaring not knowing the answers to financial literacy questions and those answering incorrectly. Due to the relevance that perception about oneself has on actual behavior, we bring forth the hypothesis that incorrectly answering financial questions versus answering "I do not know" may have potentially large implications relating to the way individuals react in the face of making—important—financial decisions. Besides, we account for a series of personality traits (namely overspending, anxiety, and mental accounting issues) to test for their effects on financial behavior (credit card repayment). An important finding of our study is that these personality traits may have stronger (negative) effects not easily overcome by higher levels of financial literacy.

As a spoiler alert, our exploratory results find robust evidence indicating that individuals' personal traits are the main driver for individuals to accumulate and carry over a month-to-month balance in their credit card(s). Specifically, attitude towards overspending is the main factor negatively affecting the capability of individuals to repay in full credit card debt every billing cycle. This result is in line and provides statistical support to the importance of mental accounting issues faced by individuals with present bias preferences. We also find, contrary to previous literature (Norvilitis et al., 2006; Robb, 2011; Shim et al., 2009, 2010), that a higher level of financial literacy is not a fundamental and it only controls on the margin for personal traits and attitudes (overspending, lack of self-control, and issues related to poor mental accounting). Furthermore, financial knowledge derived from parents has a strong positive effect on individuals' financial behavior especially for people characterized by high levels of financial illiteracy. Our findings reinforce the evidence of those studies that specifically investigated the relationship between the role of parents and the (mis)use of credit cards by college students (Hancock et al., 2013; Xiao et al., 2011). Our findings may serve policy makers when designing specific policies aimed at avoiding, or reducing, debt traps and socio-economic vulnerability of the borrower.

Our paper contributes to the extant literature in at least three strands. At this point we do not make any claim to make a theoretical contribution to the field. Our contributions are empirical and they are as follows. First, we provide a unique and innovative empirical break down between financial literacy and financial illiteracy. In particular we separate wrong answering to a standard financial literacy questionnaire (five questions in total; see Section 2 for more details on the questionnaire) between incorrect answering and *Do Not Know* responses. The former is classified as an attempt to respond and measures an overconfidence about one's actual knowledge which at the end is revealed to be poor (Overconfidence). Whereas the latter represents a direct answer to not knowing and therefore to not possess overconfidence on his or her

knowledge level. It is relevant to point out that while at present previous research has studied the role of financial literacy (Correct/Incorrect) in decision making, little has been dedicated to study the relation to how much people actually *Do Not Know* or believe they do not know. Therefore, our central contributing focuses on accounting the magnitude and explicit separation between an inaccurate perception of knowledge level leading to incorrectly answering, versus individuals actually not knowing and clearly revealing this lack of knowledge.[1] To the best of our knowledge, we are the first to explore this issue.[2]

Secondly, we study the effect of consumption and spending patterns, as they relate to overspending (present bias) and surprised factors (inadequate mental accounting) as they lead to credit card debt accumulation. The issues at stake here are similar to those first introduced by Thaler (1980) and Thaler and Shefrin (1981) on the different effects that individual mental accounting patterns may have between a planner (sophisticated self) and doer (naïve self). More specifically, the decisions individuals have to make include but are not limited to borrowing money, using credit cards, and adjusting consumption to income flows and avoiding falling prey of present-bias behavior and consequently accumulate a month-to-month balance on their credit card. In this context we then hypothesize that those with higher levels of self-awareness have the knowledge to answer correctly (basic financial literacy questions) or recognize their limitations and face the reality of not knowing the answer, and openly recognizing that by answer Do Not Know. Consequently, here our interest is to uncover the differences between those that are aware of their limitations versus those that are or possess excessive self-confidence, while being wrong. It is in this difference that we expect to reach relevant findings as to why individuals with certain personality traits are more likely to make incorrect and costly financial decisions. We believe this is the first paper that directly addresses this very important and timely issue.

Finally, our third contribution is to study the role of financial literacy in ameliorating negative effects of costly personality traits on credit card repayment patterns. The extant literature assumes that higher levels of financial literacy are a predominantly determinant of superior financial performance. However, while significant contributions have been made in advancing the role of financial literacy, previous works in this field have paid little attention to the role that personality traits (aptitude and attitude) play in financial decision and secondly what the role of financial (il)literacy is in shaping these inherent behavioral patterns.[3]

We organize the rest of the paper as follows. The next section reviews the most relevant literature on financial literacy and personal traits and sets forth our testing hypotheses. The third section describes the research design and the estimation model. The fourth section analyzes estimation results, which are then discussed in the fifth section, while the last section presents some general conclusions and policy recommendations.

2. Literature review

Recently the topic of financial literacy has received increased and extensive attention in the literature. The literature argues in favor of the relevance of adequate and timely financial literacy as paramount on individual decision-making process and their outcomes. In fact, the evidence points out in support of the argument that low levels of financial literacy are not only linked with high levels of personal and household debt (Lusardi & Tufano, 2009;

Moore, 2003; Stango & Zinman, 2009), inadequate retirement planning (Hilgert, Hogarth, & Beverly 2003; Lusardi & Mitchell, 2007), or inadequate stock market participation (van Rooij, Lusardi, & Alessie 2011), but also to poor health (Joo & Garman, 1998) or adverse health choices (Peters et al., 2007) and in general poorer overall life outcomes. In this respect, widespread financial illiteracy among young people is of particular concern for two main reasons. First, as they enter adulthood, a number of important financial decisions are to be undertaken (such as financing college studies; moving away from home; purchasing their first car; using credit cards; saving for retirement; etc.), for which they might not be adequately prepared. Misguided financial decisions in the early stage of their lives could have potentially disastrous consequences (huge debt, a poor credit rating, and inadequate retirement plans) for the remaining of their whole life (Schagen & Lines, 1996; Lusardi, Mitchell, & Curto 2010). Second, a lack of financial literacy seems to impact students' university performance as noted by Kezar and Yang (2010) whom suggest that a student's academic achievement is negatively affected by financial distress, which, in turn, is a more likely outcome in presence of low levels of financial literacy. In particular the literature documents that inadequate financial skills (especially in the area of cash management) result in higher level of stress and even anxiety with significant (negative) impact on academic performance (Kapoor et al., 2006; Razafimahasolo et al., 2016; Xiao et al., 2011). Low financial capabilities generate financial stress and anxiety, which in turn create negative spillover effects into other life dimensions.

In more recent research, particularly in the last decade, the majority of theoretical and empirical literature on financial literacy has addressed and investigated many different topics. These topics cover from the influencing factors that drive financial literacy to the methodological approaches to best treat survey questions that try to effectively measure a latent variable such as financial literacy.

A general agreement has been reached such as on the necessary prerequisites to gauge financial literacy (including the types of knowledge that best motivate and facilitate financial action). It has now become common knowledge that financial literacy among both adults and the young is low; and influenced by socio-demographic factors, such as gender, education, income, employment status, and age. It is also recognized that informal sources of education such as family background and interaction with peers are of particular importance in this regard (see Lusardi & Mitchell, 2014, for a review of theory and empirical evidence). More specifically, individuals' financial literacy seems to be significantly and positively associated with parental educational attainment and with the presence of forms of financial socialization within the family and the group of peers (for instance children observing their parents' saving behavior or receiving a more formal financial education from them). In general, the literature also agrees that young adults receive financial literacy through two main sources, parents and the educational system (Lusardi et al., 2009). In particular, Lusardi et al (2009) note that young adults with college-educated parents tend to have a better understanding of financial concepts. Mandell (1997) provides evidence on the role that proper types of financial education play as a significant factor in achieving financial literacy, while others indicate that much of the financial education is being conducted through business and community organizations, and not through educational institutions (Fox et al., 2005).

However, despite that the role of diversity (e.g., gender, ethnicity, age, and education) has been well documented, including considering different settings and time spans, our understanding of the mechanisms and channels of how these forms of diversity continue to result in significant gaps in financial literacy and consequently results in pervasive effects, remains a conundrum. The quest to find solutions to these differences is far from complete. This challenge is more complicated given the plethora of methodologies used to assess financial literacy. To date, the issue of assessing financial literacy has concentrated on the conceptual definition of this latent variable. Houston (2010) and Remund (2010) provide a thorough literature review that helps frame the issue of the conceptual definition of what financial literacy is or should be. Indeed, financial literacy has been variably defined as specifically referring to a form of knowledge (e.g., Hilgert, Hogarth, & Beverly, 2003), the ability to apply that knowledge (e.g., Mandell, 2008), or good financial behavior (e.g., Moore, 2003). The constructs used to measure financial literacy vary quite substantially according to the different conceptual definitions adopted. In fact, the construct either covers a wide variety of financial topics, including debt, insurance, spending, investments and retirement savings, budgeting, and inflation, or focuses on a few financial issues. Accordingly, the number of questions used to assess financial knowledge levels varies widely, ranging from three to 45 total items.

Across studies, both multiple-choice questionnaires and self-report questions have been employed to measure financial literacy; where the former are knowledge based and the latter assess perceived knowledge. More recently, surveys have been designed to gauge both objective knowledge and perceived knowledge. In general, considerable progress has been achieved in the design of surveys aimed at identifying individual levels of financial literacy through the effort made by the OECD and its International Network on Financial Education (INFE). Jointly they develop and promote a common questionnaire based on the experience of a large number of previous rigorous national and international surveys. The OECD/INFE (2012) report describes the questionnaire's underlying methodology and Kempson (2009) provides further details on this subject.[4] Due to its importance, research on financial literacy has in fact inspired numerous public initiatives at both the national and international level. Several countries now have financial literacy initiatives and strategies in place to increase the levels of financial understanding and knowledge among all citizens.

In contrast, it is not until very recently, that the process of data analysis (i.e., of analyzing the information obtained through questionnaires) has taken a central role in exploring the difference between financial literacy and illiteracy. That is to say, the emphasis has been on what is known but not in what it is not known. In other words, the research focus has been placed on people thinking that they know enough to be correct, but not realizing that they do not know enough to be correct. Due to the large arrays of data sources, it has become necessary to use both bivariate (ordered data from less to more) and multivariate techniques to quantify financial (il)literacy. In general, responses to the stated questions are simply summed to generate an index (score) of financial literacy, which typically ranges between zero and the maximum number of correct answers.[5]

A common practice to most studies is to cluster the "Do Not Know" responding with "incorrect" answers, in opposition to "correct" answers, notwithstanding the fact that it is

also widely recognized that these two types of responses (DNK and Incorrect) might refer to two distinct kind of respondents, with diverse (financial) educational needs. Manton et al. (2006) were the first to signal that college women tend to select "don't know" response more frequently than men, especially on more numerically oriented subjects. In the same vein, Lusardi and Mitchell (2014) pointed out that "one twist on the differences by sex, (. . .) is that while women are less likely to answer financial literacy questions correctly than men, they are also far more likely to say they 'do not know' an answer to a question, a result that is strikingly consistent across countries." However, so far, the common choice throughout the empirical literature is to include them in the same cluster of wrong answers for methodological issues. Exceptions to this practice are two recent papers by Chen and Garand (2018) and Kim and Mountain (2019). Kim and Mountain specifically address the econometric issue of misleading results obtained from ignoring DNK responses and suggest the use of binomial-latent regression models to prevents distortions from DK/RF responses. Chen and Garand (2018) deepen the well-known issue of gender gap in financial literacy, by giving specific attention to DNK answers. In particular, after having ascertained that women may exhibit lower levels of financial knowledge because they lose the opportunity to hazard a guess and arrive at a correct answer based either on partial knowledge or on random chance, they consider the possibility that there are psychological processes at work involving risk acceptance and confidence in financial knowledge that prompt women to give DK responses at a rate higher than men. As a result, they suggest that future research should consider the relative roles of DK and incorrect responses in measuring financial knowledge.

In this study, we follow such a suggestion and aim to contribute to the extant literature by treating respondents, who admit not knowing, differently from those respondents who implicitly consider themselves as knowledgeable but in fact possess a "wrong" knowledge. As a matter of fact, when self-assessed questionnaires are included in multiple choice questionnaire (testing objective knowledge), the evidence indicates that most people are unaware of their own shortcomings, as there is often a substantial mismatch between people's self-assessed knowledge versus their actual knowledge (Lusardi & Mitchell, 2014). This incorrect assessment is also directly related to the research on behavior as presented by Thaler and Shefrin (1981). In particular, we take particular interest in separately scoring "Correct," "Incorrect," and "Do Not Know" answers and conjecture that admitting of not possessing a proper financial knowledge may lead to more conservative financial decisions, that could prevent taking too much financial risk. In addition, we approximate the measures for present bias and mental accounting biases as noted next.

We also take a cue from a growing body of literature acknowledging that the drivers of financial choices are not constraint just by knowledge and the acquisition of basic information. In this new stream of research cognitive biases, individual psychological traits and aptitudes, motivations, and timing of the choice to be undertaken are all examples of the behavioral and psychological constraints that interact with economic decisions in general and financial choices in particular. One specific cognitive bias that has attracted much attention in empirical studies connecting financial decisions, behavioral biases, and financial knowledge is overconfidence on one's actual ability, performance, level of control, or chance of success (Moore & Healy, 2008). Financial confidence, in particular, reflects a self-assessed level of financial knowledge, which may or may not coincide with measured financial

knowledge. Financial literacy overconfidence has been linked to various risky behaviors such as higher stock market participation (Xia et al., 2014), less use of financial advice (Kramer, 2016; Porto & Xiao, 2016) and a preference for direct stock investment rather than in less risky/more diversified mutual funds (Chu et al., 2017) or greater likelihood of engaging in risky (costly) financial behaviors, such as taking out a title-loan, or a short-term payday loan (Tokar Asaad, 2015).

From this perspective, we take particular interest in the literature on behavioral economics which assumes, and dictates consequently, that individuals may acquire debt, adjust repayment capabilities, and adhere to differentiated patterns of repayment away from the neoclassical rational expectations teaching. The general consensus is that rationally behaving individuals have perfect foresight, are rational and apply consistent discounting rules on consumption. On the other hand, the literature on behavioral biases proposes the existence of several factors governing individuals' behavior. Particularly, issues relating to hyperbolic discount functions in consumption – present bias –, naïve behavior, lack of self-control and impatience (Akerlof, 1991; Kuchler 2013; Laibson, 1997; O'Donoghue & Rabin, 1999; Thaler & Shefrin 1981; Thaler 2018, among others) may lead to patterns of consumption, which fueled by easy access to credit cards may result into too much debt accumulation and patterns of procrastination on repayment (Barboza, 2018). Although aware that the psychological literature on personality traits is not confined to and is richer than that just mentioned on behavioral biases, in this study we are interested in highlighting and measuring those individual features that characterize one's pattern of consumption and savings and manifest: (1) in a tendency to overvalue immediate rewards (I buy what I like now, disregarding the issue of affordability of the purchase), while putting less worth in long-term consequences (I will think tomorrow how to find the money to afford the purchase); (2) in a process, known as mental accounting, whereby individual expenses will not be considered in conjunction with the present value of one's total wealth.[6] Instead it is considered in the context of the current budgetary period and the category of expenses, leading to constraints/relaxations of purchases irrespective to the whole—same—fungible resource that is income plus (eventually) personal net worth (Cheema & Soman, 2006; Zhang & Sussman, 2018) and a greater willingness to pay for goods when using credit cards than cash (Prelec & Simester, 2001).

At the same time the procrastination of debt payment can cause pain and anxiety concerns which feedback into the repayment behavior individuals display next period. We follow a recent strand of literature (Andrews & Wilding, 2004; Fiksenbaum et al, 2017; Marjanovic et al., 2013) who define an emotional state, such as financial threat, referring to self-reported fearful-anxious uncertainty regarding one's current and future financial situation. In this study we take particular interest in the effect that higher financial anxiety may have on credit card repayment behavior.

Thus, we propose to study the combined and interaction effects of financial (il)literacy and personality traits, as they relate to credit card repayment patterns. With these considerations in mind, then the backbone of our analysis is driven by the following set of hypotheses.

Hypothesis 1: Higher levels of financial literacy—measured as higher number of correct answers—lead to better repayment rates in credit card debt.

Hypothesis 2: The higher the transgenerational transmission of financial education from parents to children results in improved repayment in credit cards.

Hypothesis 3: Individuals with self-assessed lower level of financial literacy (DK answers) display diverse behaviors (credit card repayment patterns) as opposed to individuals who do not possess basic financial literacy (wrong answers).

Hypothesis 4: Individuals displaying present bias, improper mental accounting and or impulse behavior and financially derived anxiety are less likely to display proper financial behavior (i.e., pay credit cards in full) and consequently carry month-to-month balance.

Hypothesis 5: Positive effects from higher levels of financial literacy could be overpowered by personal traits. This is to say, that financial literacy may or may not be enough to counter inherent negative traits that individuals already possess.

3. Method

3.1. Data and variables

Data for this research comes from a survey administered to three samples of business college students in the United States, attending a Midwest Higher Education University and a Mid-Atlantic University. The survey was paper based and administered in person to a total of 1,149 students. Data were collected in 2015 and the total complete sample size useful for our analysis is of 156 respondents.

The sample is composed as follow: 45.50% are female students and 54,50% are male students; minority represents 21.2% whereas White race students are 78.8% of the sample. In terms of academic status, freshman students are 32.05% of the sample, Sophomore students 8.97%, Junior students are 20.51%, Senior students are 36.54%, and Graduate students only 1.93%.

The main interest of this study is to explore the effects that financial (il)literacy and individual personal traits related to purchasing behavior have on their financial behavior as manifested in credit card repayment patterns. Thus, we measure financial behavior as an individual's credit card repayment pattern and ask questions regarding credit card repayment behavior, such as: Pay if full every month; Pay some in full and then only the minimum required; Pay more than minimum required but not in full; Pay Minimum required; or Pay less than Minimum required. We create the categorical variable used to estimate the ordered Probit model and corresponding probabilities of occurrence.

The survey also includes a combination of questions related to personal traits and financial (il)literacy elements. Regarding financial literacy we post five financial literacy questions to students (see Fig. 1 for details) that tests the basic financial concepts traditionally tested in the financial literacy literature since Lusardi and Mitchell (2007) proposed them: inflation, time value of money, diversification, and interest rate compounding.

The survey also includes a set of questions designed to capture specific personality traits. These variables serve as proxies to assess individuals' time preferences (present bias issues),

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

1. More than $102
2. Exactly $102
3. Less than $102
4. Don't know

Question 2: Imagine that the interest rate on your savings account is 2% per year and inflation is 5% per year. After one year, how much would you be able to buy with the money in this account?

1. More than today
2. Exactly the same
3. Less than today
4. Don't know

Question 3: Assume a friend inherits US $ 10,000 today and his sibling inherits US $ 10,000 three years from now. Who is richer because of the inheritance?

1. My friend
2. His sibling
3. They are equally rich
4. It depends
5. Don't know

Question 4: Suppose that in 2012, your income has doubled and the prices of all of the goods and services that you consume have also doubled. In 2012, how much were you able to buy with your income (assuming that you did not change your spending habit)?

1. More than you did in 2011
2. Exactly the same
3. Less than you did in 2011
4. Don't know

Question 5: What do you think of the following statement "Buying a single company stock usually provides a safer return than a stock mutual fund."?

True False Don't know

***Note**: Correct answers are Q1=1; Q2=3; Q3=1; Q4=2; Q5=False*

Fig. 1. Financial literacy questions.

issues relating to mental accounting, and potential issues relating to procrastination and lack of commitment. Based on the review of the literature we argue that these topics may manifest in turn in behavioral delays on credit card repayment, as purchase may be in excess to monthly repayment capabilities. Therefore, to further understand individuals' decision-making process, subjects were asked if they were surprised at the end of the billing cycle with the balance the credit cards has reached, and secondly if they have engaged in purchases knowing that they did not have money to pay it in full when the balance was due. We define these two variables as ***Surprised*** and ***Overspending***, respectively. In both cases, our tentative hypothesis is to expect that the higher the level of ***Surprised*** and the higher the amount of ***Overspending*** lead to a worsen in credit card repayment patterns in the next billing cycle.

To identify one's personal attitude toward debt repayment we include the variable ***Anxiety*** where the variable takes the values according to the following scale: 1= *not anxious at all* and 5 = *extremely anxious*. In our survey, students self-report the level of their financial anxiety answering to a specific question of the survey. Anxiety is in relation to how the person feels when he or she has to pay the credit card bill at the end of the billing cycle.

Finally, in addition to financial literacy questions our survey also considers a financial education question. In particular we analyze the role that parents may play in the buildup of the financial literacy levels of their children. The survey asks whether their parents were the primary source of financial education and we define a dummy variable ***FePar*** when parents are reported as the main source of financial education. In line with the transgenerational effect found elsewhere (Barboza, Smith, & Pesek 2016), we argue that if parents are the main source of financial education, parents' financial experiences serve as a mechanism to develop knowledge spillover effects and possibly avoiding painful self-experiences that could result in lower levels of financial-based anxiety and translate onto better credit card repayment patterns.

Based on the number of correct answers to the financial literacy questions, we first proceed to construct the cumulative number of Total Correct Answers. The number of correct answers is thus the actual level of financial literacy (that we called Financial literacy rate), as it is presented in most of the extant literature. We take particular interest in the objective separation between Correct, Incorrect, and Do Not Know answers. Therefore, we construct the variable total number of incorrect answers given by each individual, and call it Financial Illiteracy Level A. Finally, we construct the total number of answers under the Do Not Know category. As noted earlier, we want to emphasize that answering incorrectly is different than answering Do Not Know. Correspondingly, answering DNK is labeled as Financial Illiteracy Level B. We argue that those answering incorrectly (Incorrect) have attempted to answer assuming that they have an adequate level of knowledge; however, clearly failing to achieve a correct answer. On the other hand, those answering I Do Not Know (DNK) openly acknowledge that they are not prepared to even attempt answering recognizing a higher level of financial illiteracy with no fear to state it as such. The fundamental difference is that the DNK group may be less ready to engage in financial decision-making processes, as their self-awareness indicates a clear lack of preparation. Conversely, those responding incorrectly (Level A) implicitly assume knowing the answer but failing. The potential implications of the separation of answering not correctly into these two distinctive groups could be relevant in understanding the implications of different levels of financial illiteracy. We also

Table 1 Financial (il)literacy indicators per question

	Correct	Do Not Know	Incorrect
Compound interest	70.3%	6.0%	23.7%
Inflation	66.8%	16.1%	17.1%
Inheritance	33.5%	3.1%	63.3%
Purchasing power	77.2%	8.2%	14.6%
Risk	51.0%	40.1%	8.9%

provide a decomposition of answers (under the three categories) by question as these relate to different financial concepts.

3.2. Descriptive statistics

Table 1 presents a summary of results from the questionnaire. These results indicate that a large majority of individuals answer correctly questions on Compound interest, Inflation and Purchasing Power. A large number of students were not capable of answering correctly the question regarding Inheritance. In terms of the inflation question, a relative similar proportion of individuals answer DNK or incorrectly. For the risk question a significant number of students responded DNK. In general, the data appears to indicate that DNK answering is a prevalent issue. In addition, a large number of student answer incorrectly. The combination of both levels of financial illiteracy confirms the prevalence of wide spread lack of financial knowledge.

When we look at the cumulative answering (see Table 2, below), we observe that 5% of the population are not capable of answering any question correctly. By the same token, only 12% of the individuals are capable of answering all questions correctly. In addition, a large proportion of individuals answer DNK to one and two questions. When combined with those also answering incorrectly one to two questions, we are able to observe a large proportion of the population struggling with about 50% of the questions asked. In general, this evidence indicates that financial illiteracy is highly present among the population under study. This statistic is in line with previous literature and with most recent valuations made across the U.S. population (see Lusardi & Mitchell 2014). Table 3 disassembles financial literacy rate by demographics. The interpretation of the results thus indicates that females are more likely to answer correctly since people able to provide five correct answers are mainly females (62.5%); this is a result that contradicts the empirical evidence found in the literature for the United States (Borden et al. 2008; Chen & Volpe, 2002; Danes & Tahira, 1987; Lusardi,

Table 2 Financial (il)literacy indicators (total answers)

No. of answers	Correct	Do Not Know	Incorrect
0	4.9%	52.9%	22.1%
1	10.0%	31.4%	41.9%
2	18.0%	9.2%	25.9%
3	27.4%	3.1%	7.6%
4	27.7%	2.2%	1.5%
5	11.9%	1.0%	1.0%

Table 3 Financial literacy rate by demographics

Financial literacy rate	Gender mean	AS mean	Age	Race
0	0.333	1.939	20.152	0.697
0.2	0.313	2.119	20.373	0.731
0.4	0.430	2.421	20.554	0.777
0.6	0.492	2.415	21.196	0.837
0.8	0.478	2.595	21.978	0.892
1	0.625	2.838	23.213	0.938

Source: Demographic variables are defined as follows. Gender ***G*** is a dummy variable taking value of 1 if female and 0 otherwise. Academic Status-***AS*** is the 1 = Freshman, 2 = Sophomore, 3 = Junior, 4 = Senior, and 5 = Grad Student. ***Race*** is 1 if White and 0 if minority. ***Age*** is expressed in years at the time of the survey. **FLITRATE** is the percentage of correct answers provided, based on a five question questionnaire as presented in Figure 1.

Mitchell, & Curto, 2010; Markovich & DeVaney, 1997) where it is argued that females possess lower levels of financial literacy. However, outside the United States, this is not a standard evidence (Bongini et al, 2016; Koshal et al., 2008; Wagland & Taylor, 2009) when specifically studying Business Students.

In addition, older students are more likely to answer correctly, as well as upper classmen or classwomen. Among different academic status graduate students provide at least three correct answers and the 33% of students answers correctly to all the financial literacy questions. This interpretation of the results speaks in favor of the educational process. As expected, one can argue that attending college should increase knowledge in field specific subjects, financial literacy being one of them. Finally, the evidence does indicate that minorities are at a disadvantage and more likely to answer incorrectly or do not know. This last piece is in agreement with the extant literature.

Table 4 below presents some basic descriptive statistics on the variables used in the empirical estimation section. A full description of each variable and its corresponding coding could also be found there. With these considerations in mind, we then proceed to outline the model specification and the corresponding model estimations expectations and restrictions.

3.3. The model

As we research the effects of personal traits and financial literacy on financial behavior, the basic model description has the following general specification:

$$y_i^* = x_i^{'}\beta + \varepsilon_i \tag{1}$$

where ε_i are assumed independent and identically distributed random variables as usual, $x_i^{'}$ is the matrix of explanatory variables (financial (il)literacy and personality traits), β is the vector of coefficients to be estimated, and y_i^* is unobserved yet described by the answers to our survey questions relating to credit card repayment habits.

In fact, we code students' responses on credit card repayment capability using a discrete categorical scale as follows: 1 = *pay if full every month*, 2 = *pay some in full and other only*

Table 4 Descriptive statistics of variables by category, description, and coding

Category	Description	Code	Median	Mean	*SD*	Max	Min	Obs
Demographics	Academic status (F = 1, S = 2, J = 3, Sr = 4, Grad = 5)	AS	3	2.673	1.311	5	1	156
	Gender (female = 1)	G	0	0.455	0.512	2	0	156
	Age	AGE	20	20.603	2.853	42	18	156
	Race (minority = 0)	RACE	1	0.788	0.410	1	0	156
Financial education and literacy	Parents are main source of financial education	FEPAR	1	0.628	0.485	1	0	156
	Numbers of correct answers	TotCor	3.00	2.878	1.262	5	0	156
	Numbers of incorrect answers	Tot_Inc	1.00	1.391	1.032	5	0	156
	Number of “Do Not Know” answers	TotDK	1.00	0.731	0.868	4	0	156
Behavioral	Level of anxiety on repayment capacity	Anx	2	2.019	1.116	5	1	156
	Frequency of payment on credit card	Rfreq	1	1.622	1.012	4	1	156
	Surprised on CC balance level	Surp	1	0.878	0.918	3	0	156
	Frequency of overspending	Overspd	0	0.462	0.822	3	0	156
	Number of credit card	NCC	1	1.564	1.061	6	1	156

Source: Demographic variables are defined as follows. Gender ***G*** is a dummy variable taking value of 1 if female and 0 otherwise. Academic Status-***AS*** is the 1 = Freshman, 2 = Sophomore, 3 = Junior, 4 = Senior, and 5 = Grad Student. ***Race*** is 1 if White and 0 if minority. ***Age*** is expressed in years at the time of the survey. Financial Literacy, Education, and related variables include the following. **TotCOR** is the number of financial literacy question answers correctly; **TotDK** is the number of answers with a "Do Not Know" answer; and **Tot_INC** is the number of incorrect answers. For each individual the sum of TOTCOR + TOTDK + TOT_INC = 5. The Financial Literacy Rate-***FLitRate*** measures the percentage of correct answers out of the five literacy knowledge questions. Anxiety-***Anx*** is the level of anxiety reported on a scale from 1 = no anxiety to 5 = extremely anxious in relation to his or her capacity to repay your credit card monthly bill. ***FEPar*** takes a value of 1 if parents are the main source of financial education, 0 otherwise. ***RFreq*** defines the repayment behavior on credit cards. The variable takes the values of 1 = Pay in Full; 2 = Pay more than minimum, but carry month-to-month balance; 3 = Pay off some credit cards, but pays minimum on the rest; 4 = Pay minimum in all; 5 = Pay less than minimum in all. 6 = 1 = Parents pay in full will be the assumption. ***Surprised*** defines the level of surprise the individual reports on how high of a balance is on the monthly statement. The variable takes the values of 0 = never, 1 = Rarely, 2 = Sometimes, 3 = Frequently. ***OverSpd*** defines the behavior of the individual regarding the individual knowing that she or he use the credit card knowing that she or he did not have money to pay when the bill came due. The variable takes the values of 0 = never, 1 = rarely, 2 = sometimes, 3 = frequently. Finally, **NCC** is a count variable measuring the number of credit cards an individual possesses.

minimum required, 3 = *pay more than minimum required but not in full*, 4 = *pay Minimum required*, 5 = *pay less than Minimum required*. Therefore, our dependent variable (***Rfreq***) takes discrete values along the scale 1 to 5. Notice that ***Rfreq*** of values ranging from 2 to 5 results in accumulation of month-to-month balance, with the risk of incurring high financial costs related to interest rates and possibly other assessed fees.

In consideration of the ordinal nature of the dependent variable, the most appropriate model to use is an ordered Probit model. The main difference among the models regards the financial literacy variable. Due to our interest to test for both knowledge and lack of knowledge, we decompose the responses given by individuals between correct, incorrect and do not know classifications, per our discussion in the previous section. In the first model we consider as Financial literacy variable the number of correct answers. In the second model we consider the number of questions where the students said that he does not know the answers, and in the last model we consider the number of incorrect answers. Furthermore, because each of the financial literacy questions measures knowledge of different financial issues (more or less directly related to our dependent variable, i.e., credit card repayment), we also proceed to conduct estimations by question.[7] Thus, we propose to estimate the impact of each financial issue on the financial behavior under investigation: our intuition is that some questions may be more relevant (have a larger impact) and the separation of effects may yield relevant results, when understanding credit card repayment patterns.

In all the specifications, we consider all the personality trait variables and the presence of financial education from parents; plus, as control variable we include the total number of credit cards possessed by our sample students (NCC). This latter variable proves to be very much correlated to the usual demographics variables (age, gender, race, and academic status) used as controls; we choose to use NCC as our single control variable because the number of observations suggested to contain the number of covariates.[8]

We then proceed to incorporate interaction effects between the overall scores of financial literacy, financial illiteracy Level A (Incorrect) and Level B (DNK), in relation to the financial education from parents and personality trait variables. In addition, and due to the possibility of endogeneity in the data, we conduct Hausman testing as a robustness indicator. The argument regarding endogeneity is justified as the possibility of a self-selection problem in terms of the characteristics of those selecting to apply and obtain a credit card. However, the counter argument indicates that in the U.S. market, young adults need to apply for credit cards as a requirement to begin building their credit history and create a credit score. Due to this apparent controversy, we apply the endogeneity testing.

4. Results and discussion

Estimations are presented in Table 5 where each of the three models is further decomposed to study the impact of each financial issue included in the financial literacy index on credit card repayment behavior of individuals.

When looking at the coefficients (sign and magnitude) of the total number of questions answered (Correctly, Incorrectly, and DNK, respectively) we observe that correct/DKN hold

Table 5 Consumer behavior and financial decision making process with credit card repayment as dependent variable

	Model 1 Correct answers		Model 2 Incorrect answers		Model 3 Do Not Know answers	
	1.1	1.2	2.1	2.2	3.1	3.2
Financial educ parents	−0.939	−0.973	−0.930	−0.969	−0.912	−0.888
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Anxiety	0.143	0.124	0.158	0.141	0.163	0.159
	(0.18)	(0.25)	(0.13)	(0.18)	(0.12)	(0.11)
Surprised	0.143	0.130	0.141	0.133	0.182	0.175
	(0.28)	(0.33)	(0.25)	(0.27)	(0.16)	(0.17)
OverSpending	0.533	0.533	0.506	0.497	0.509	0.511
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
NCC	0.161	0.156	0.164	0.169	0.135	0.144
	(0.08)*	(0.10)*	(0.04)**	(0.04)**	(0.13)	(0.08)*
Financial literacy questions						
Total answers	−0.150		0.222		−0.022	
	(0.10)*		(0.03)**		(0.88)	
Compound interest		−0.017		0.020		−0.051
		(0.95)		(0.94)		(0.91)
Inflation		−0.385		0.501		−0.014
		(0.12)		(0.05)**		(0.97)
Inheritance		−0.107		0.163		−0.184
		(0.68)		(0.47)		(0.41)
Purchasing power		−0.046		0.118		−0.125
		(0.87)		(0.72)		(0.82)
Risk		−0.139		0.297		0.022
		(0.55)		(0.35)		(0.92)
Pseudo R^2	0.209	0.212	0.212	0.217	0.197	0.199
Obs	158	157	156	156	156	156
LR statistic	65.06	65.71	65.59	67.29	61.10	61.66
Probability (LR stat)	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Akaike info criterion	1.674	1.726	1.681	1.722	1.710	1.758
Schwarz criterion	1.848	1.979	1.857	1.976	1.886	2.012
Hannan-Quinn criterion	1.744	1.829	1.753	1.825	1.782	1.861

Note: ***, **, * statistically significant at the 1%, 5%, and 10% level, respectively.

both a negative sign, while only Correct being statistically significant at the 10% level of confidence. The negative sign indicates that higher levels of literacy and/or declaring DKN result in better repayment patterns. Higher financial literacy having a positive impact on repayment is an expected outcome (confirming Hypothesis 1); however, the second component (DNK) is clearly a puzzling result. Notice that higher levels of financial literacy are only marginally statistically significant at the 10%. Regarding incorrect answering (financial illiteracy) the result is statistically significant and with the expected positive sign. This result supports the hypothesis that lack of financial literacy creates a negative effect on individuals' financial performance, resulting in an accumulating month-to-month balance in their credit card debt (Hancock et al., 2013; Robb, 2011; Xiao et al., 2011). Furthermore, results in

Models 2.1 and 3.1 clearly indicate that individuals responding incorrectly are significantly more likely to incur in poor credit card repayment behavior. The estimated coefficient is larger than the Correct counterpart and holds a positive sign and has a higher level of statistical significance. Perhaps the most revealing result of the estimations in Table 5 is the support to our third hypothesis that Incorrect answering and DNK answering have different implications on Credit Card repayment patterns. That is, the common practice in previous research to cluster any answering that is not correct as incorrect, seems to be not an appropriate way to understand the effects of different levels (A and B) of financial illiteracy. In summary, our findings confirm Hypothesis 1: higher levels of financial literacy (measured as higher number of correct answers) lead to better repayment rates in credit card debt but also Hypothesis 3 individuals with self-assessed lower level of financial literacy (DKN answers) display diverse behaviors (credit card repayment patterns) as opposed to individuals who do not possess basic financial literacy (wrong answers).

Our findings also confirm Hypothesis 2 and to a lesser extent Hypothesis 4. First, we observe that the variable **FePar,** being the main source of financial education, is highly significant in all models and negatively associated with repayment habits. This result indicates that individuals that receive their education from parents are more likely to have better repayment behavior on her or his credit card.[9] This result also confirms the importance of parental involvement in kids overall financial education aspects. Our findings confirm Hypothesis 2: the higher the transgenerational transmission of financial education from parents to children results in improved repayment in credit cards.

With respect to personality traits also control for the presence of personality trait (Surprised, Anxiety, and Overspending) our estimates highlight that individuals' capability to repay their credit cards is driven by the use factor and only marginally by the knowledge component. In all the models, the role of Overspending impacts negatively the capability to repay credit card debt. The other variables, Anxiety and Surprised, are not statistically significant. As a consequence, our Hypothesis 4 is partially confirmed, at least with respect to present-bias preferences. Recall that overspending is the response to individuals actually buying when they knew a priori that he or she would not have enough money to repay the credit card at the end of the billing cycle. We argue, thus, that the overspending coefficient serves as a measure of present bias behavior as well as an indicator of lack of self-control. This lack of self-control becomes a materialized purchase due to the availability of credit cards. If the individual were not to have a credit card, he or she could not complete the purchase. While this may seem obvious, it is relevant to point out that this behavior clearly results in increased financial costs of the purchases, as individuals know ahead of time that they will incur in a rolling debt. Notice also that the estimated coefficient value for Overspending is consistent across all alternative models, even when controlling for financial (il)literacy.

Finally, the NCC yields the expected positive sign indicating that individuals having more credit cards are more likely to hold a month-to-month balance: in our estimations an increase in the number of credit cards made the capacity of repayment worse. As hypothesized earlier, a higher number of credit cards may be the result of maxing out of credit on one card and consequently apply for more; or using new credit cards to transfer balances (at promotional interest rates).

Due to the possible gains in understanding individuals' behavior on credit card repayment patterns we proceed with a further decomposition of the financial (il)literacy by question. First, notice that under the Correct model (1.2), all five questions have the expected negative sign (answering correctly results in better credit card repayment patterns) even though none individually is statistically significant. In contrast, model (2.2), yields opposite signs in all five questions in relation to the Correct model version. These differences in results are consistent with expectations, and apparently strong enough to explain the overall positive sign of the total number of incorrect answers. Lastly, the DNK model (3.2) provides results that are more congruent with the correct estimations than the incorrect estimations; thus providing further evidence in favor of the hypothesis that clustering incorrect with do not know is not an appropriate way to understand different levels of financial illiteracy.

However, given the results from the alternative estimations in Table 5, we confirm that the role of financial literacy, or lack of, appears not to dominate behavioral/personal traits (Hypothesis 5). This is to say, that financial decisions seem to be made primarily along pattern of behavioral traits and financial education from parents; and in this context only marginally ameliorated by financial education. Assuming that these results are consistent and robust (after accounting for possible sample issues) then, they indicate that while financial literacy is an important or fundamental element for all individuals to learn, behavioral variables drive the accumulation of credit card debt and result in less than optimal repayment. In this respect, we confirm the findings of Xiao et al. (2011) who, applying the Theory of Planned behavior to investigate risky credit behavior among college students, found that behavioral intentions were the single most important factor in whether students make responsible credit decisions (risky borrowing behavior, risky paying behavior, and holding credit card debt). Under these conditions, it then becomes relevant to explore the drivers of overspending.

Given the robustness of the personal trait variables, in conjunction with the lack of strong statistical significance of the financial literacy estimates, several possible scenarios come to mind. For instance, we can argue as mentioned above that behavioral traits are just too strong and clearly individuals have a hard time controlling them. Particularly, issues relating to present-bias, preferences and gaps in mental accounting are strong and present. In addition, one can argue that this behavior may be prevented or ameliorated with early intervention in the form of exposure to financial literacy. That is, there is the possibility that students in our sample may be receiving financial education too late in life, and thus personality traits are harder to counterbalance. This interpretation is compliant also with the relevance of financial education transmitted by parent in ameliorating the credit card repayment.

4.1. Interaction effects

The results thus far have provided very useful information in the advancing the understanding of the relationship between financial (il)literacy and personality traits into credit card repayment decisions. However, the relationships may also be shaped by the presence of interaction effects deriving from Financial (il)literacy and the behavioral or personality variables. As noted, we uncover that personality traits are dominant in the decision individuals

make, particularly overspending (+) and Financial Education deriving from parents (−). In this context, and given the strong interest in the effects that financial (il)literacy may have on financial decision making, we proceed to compute and report the alternative models including interaction effects between Financial (il)literacy and financial education from parent and all four behavioral variables. The results are presented in Tables 6, 6a, and 6b, for Correct, Incorrect (Level A), and DNK (Level B), respectively.

The first set of estimations in Table 6 corresponds to the Financial Literacy-Correct answering sample. In these estimations, we observe that all previous results hold, overspending having a negative effect and worsening repayment, increased the number of credit cards also worsening repayment. FEPAR has a significant effect improving credit card repayment when the level of financial literacy is low whereas higher financial literacy resulting in better repayment patterns and lower chance of accumulation month-to-month debt when students did not receive financial education from their parents. In addition, the interaction effect of Financial Literacy and FEPAR has a positive and statistically significant coefficient: when students receive education from parents the positive effect of financial literacy disappears. Notice also that the Akaike information criterion (AIC) for the interaction model is lower than the corresponding model in Table 5 without the interaction. This is to say that the interaction model specification is preferred. In addition, none of the other interaction effects prove to be statistically significant, and therefore the models are inferior.

For the second set of interaction models, reported in Table 6a, for the Level of Financial Illiteracy Type A, we also observe results that are in accordance to the estimations reported in Table 6. However, under the interaction effect Model 1, the level of FEPAR is now not statistically significant, despite holding the expected sign. When the financial illiteracy is low the role of financial education from parents is not significant in improving the credit card repayment. The increase in the number of total incorrect answers results in credit card repayment worsening. When we interact Financial illiteracy and education from parent the coefficient is negative and statistically significant the 5% level of confidence. Our intuitive interpretation of this effect is that for student characterized by high level of financial illiteracy the education received from parents is fundamental in improving the credit card repayment. Notice that as it was the case for the Financial Literacy models, all other interaction effects are not statistically significant and the AIC values are also higher. We argue that the Model 1 is the preferred model.

For the third estimations, where Financial Illiteracy is measured through DNK answers (Table 6b), we observe that the interaction effects model for FEPAR and Financial Illiteracy Level B is significant and holds a negative sign. Our intuitive rationale for the coefficient in this model is that students that mainly answered DNK are able to improve their credit card repayment habits if they received proper financial education from parents. In addition, it is relevant to point out that the Financial Illiteracy coefficient is not statistically significant (as it was in Model 3.1–Table 5), but it now present a reversal of sign. In addition, the AIC for Model 1–Table 6B is lower than the corresponding model in Table 5, without interaction effects. Thus, we preferred the interaction model specification in this regard. As it was with other models, interaction effects for all other variables are not statistically significant. Our findings do not confirm completely Hypothesis 5. We do not detect that positive effects from higher levels of financial literacy could be overpowered by personal traits. Furthermore,

Table 6 Consumer behavior with credit card repayment frequency as dependent variable (Correct answers)

	Correct answers models with interaction effects				
	1	2	3	4	5
Financial educ parents	−2.145 (0.001)***	−0.934 (0.001)***	−0.936 (0.001)***	−0.927 (0.001)***	−0.939 (0.001)***
Anxiety	0.125 (0.24)	0.238 (0.40)	0.140 (0.18)	0.144 (0.17)	0.144 (0.17)
Surprised	0.120 (0.37)	0.135 (0.31)	0.147 (0.27)	0.395 (0.13)	0.144 (0.28)
OverSpending	0.577 (0.001)***	0.533 (0.001)***	0.439 (0.10)*	0.528 (0.001)***	0.530 (0.001)***
NCC	0.171 (0.06)*	0.162 (0.08)*	0.155 (0.09)*	0.167 (0.07)*	0.081 (0.75)
Financial literacy questions					
Total answers	−0.410 (0.001)***	−0.086 (0.67)	−0.174 (0.11)	−0.042 (0.75)	−0.191 (0.21)
Interaction effects of financial literacy with					
Parents financial education	0.428 (0.02)**				
Anxiety		−0.032 (0.72)			
Overspending			0.035 (0.69)		
Surprised				−0.097 (0.26)	
NCC					0.026 (0.73)
Obs	158	158	158	158	158
Pseudo R^2	0.227	0.209	0.209	0.213	0.209
LR statistic	70.692	65.192	65.223	66.346	65.175
Probability (LR stat)	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Akaike info criterion	1.651	1.685	1.685	1.678	1.686
Schwarz criterion	1.844	1.879	1.879	1.872	1.879
Hannan-Quinn criterion	1.729	1.764	1.764	1.757	1.764

Note: ***, **, * statistically significant at the 1%, 5% and 10% level, respectively.

Table 6a Consumer behavior with credit card repayment frequency as dependent variable (Incorrect answers)

Financial illiteracy Level A	Incorrect answers models with interaction effects				
	1	2	3	4	5
Financial educ parents	−0.283 (0.45)	−0.940 (0.001)***	−0.922 (0.001)***	−0.942 (0.001)***	−0.919 (0.001)***
Anxiety	0.132 (0.20)	0.222 (0.13)	0.149 (0.15)	0.163 (0.11)	0.160 (0.13)
Surprised	0.142 (0.25)	0.149 (0.23)	0.144 (0.24)	−0.051 (0.79)	0.146 (0.23)
OverSpending	0.537 (0.001)***	0.506 (0.001)***	0.612 (0.001)***	0.498 (0.001)***	0.488 (0.001)***
NCC	0.185 (0.02)**	0.164 (0.04)**	0.154 (0.05)**	0.167 (0.04)**	0.271 (0.01)***
Financial literacy questions					
Total answers	0.530 (0.001)***	0.348 (0.21)	0.280 (0.04)**	0.076 (0.63)	0.368 (0.03)**
Interaction effects of financial literacy with					
Parents financial education	−0.434 (0.05)**				
Anxiety		−0.054 (0.60)			
Overspending			−0.061 (0.45)		
Surprised				0.123 (0.22)	
NCC					−0.080 (0.16)
Obs	156	156	156	156	156
Pseudo R^2	0.223	0.213	0.213	0.216	0.215
LR statistic	69.172	65.870	66.050	66.981	66.590
Probability (LR stat)	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Akaike info criterion	1.671	1.692	1.691	1.685	1.688
Schwarz criterion	1.867	1.888	1.887	1.881	1.883
Hannan-Quinn criterion	1.751	1.772	1.771	1.765	1.767

Note: ***, **, * statistically significant at the 1%, 5%, and 10% level, respectively.

Table 6b Consumer behavior with credit card repayment frequency as dependent variable (Do Not Know answers)

Financial illiteracy Level B	Do Not Know answers models with interaction effects				
	1	2	3	4	5
Financial educ parents	−0.560 (0.05)**	−0.914 (0.001)***	−0.916 (0.001)***	−0.913 (0.001)***	−0.908 (0.001)***
Anxiety	0.183 (0.09)*	0.130 (0.37)	0.167 (0.12)	0.163 (0.12)	0.165 (0.12)
Surprised	0.147 (0.27)	0.180 (0.16)	0.185 (0.15)	0.184 (0.28)	0.184 (0.15)
OverSpending	0.519 (0.001)***	0.510 (0.001)***	0.551 (0.001)***	0.509 (0.001)***	0.504 (0.001)***
NCC	0.130 (0.15)	0.136 (0.13)	0.138 (0.13)	0.134 (0.14)	0.108 (0.34)
Financial literacy questions					
Total answers	0.275 (0.20)	−0.106 (0.71)	0.023 (0.89)	−0.018 (0.93)	−0.098 (0.69)
Interaction effects of financial literacy with					
Parents financial education	−0.548 (0.07)*				
Anxiety		0.041 (0.74)			
Overspending			−0.073 (0.61)		
Surprised				−0.003 (0.98)	
NCC					0.046 (0.70)
Obs	156	156	156	156	156
Pseudo R^2	0.209	0.198	0.198	0.197	0.198
LR statistic	64.674	61.214	61.359	61.101	1.722
Probability (LR stat)	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Akaike info criterion	1.700	1.722	1.721	1.723	1.722
Schwarz criterion	1.896	1.918	1.917	1.918	1.917
Hannan-Quinn criterion	1.779	1.802	1.801	1.802	1.801

Note: ***, **, * statistically significant at the 1%, 5%, and 10% level, respectively.

financial knowledge derived from parents has a strong positive effect on individuals' financial behavior especially for people characterized by a relevant financial illiteracy.

Based on the findings from the interaction effects models, and the corresponding superiority of Models 1, in Tables 6, 6a, and 6b, we decided to use these series of models to compute the marginal effects and corresponding Probabilities. We present the overall probabilities for each model in Table 7, followed by the computation of the marginal changes in the overall probabilities when the independent variables change by one unit. It is also relevant to note that the estimated probabilities are computed at the mean value of the independent variables. For the especial case of the FEPAR variable (dummy 1,0) we compute the marginal effects by taking the difference between the overall probabilities when FEPAR = 1, minus FEPAR = 0.

There are several interesting results that spring out the analysis of Table 7. For instance, the first element to notice is that all probabilities are very similar across alternative models of financial (il)literacy with the probability to paying in full being in the range of 67.27 (DNK answers – Level B) to 68.82% (Incorrect answers – Level A), with 67.55% (Correct answers). And the rest of probabilities being almost identical for the other ranges across models. In other words, when evaluated at the mean values, we observe very little discrepancies across alternative models, when the only difference is based on the level of financial (il) literacy. This result on itself is surprising, as one would expect that different levels of financial (il)literacy would yield much larger differences in repayment patterns.

Secondly, when we look at the changes in probabilities due to variations in RHS variables, we now observe potentially large differences across models. The first effect to study here is that of FEPAR. Notice that the effect of this dummy variable has a significant marginal effect on the probability of repaying in full and has the largest effect of all variables. In this sense, we also observe that those suffering the most from Level B financial illiteracy are the group that would benefit the most with an increase learning deriving from their parents. The counter result indicates that those suffering from Level A financial illiteracy would still benefit from further interaction with their parents as the main source of financial literacy but with the smallest effect among the three possible groups. In addition, the counter result of variations in the FEPAR variable indicate that both Level B Financial Illiteracy and those answering correctly would be the groups that would suffer the most in their repayment capabilities should FEPAR were not to be the main source of financial literacy as reflected by the negative sign of the probability changes for the remaining categories.

The fourth element that we pay attention in this analysis is the effect of changes in the level of overspending. In this case, we observe that changes in overspending have the second largest effect of all variables. More specifically, an increase of one unit in overspending (following the stated categories in the descriptive statistics) have a negative effect in repayment capabilities of about 20% decrease in repayment in full; and incidentally an increase in all other repayment categories with paying less than full balance every month being the most affected. In this sense, a marginal change in overspending patterns, results in a large increase in month-to-month debt accumulation and falling behind in repayment patterns. Furthermore, this negative effect is larger than an increase in financial literacy as we will discuss next.

Financial literacy has been championed as the main way to improve financial decision-making process, and specifically research studying credit card debt emphasize on its

Table 7 Probabilities and marginal effects, for model with interaction effects

	Prob ($y = 1\|x$)/∂P1/∂x	Prob ($y = 2\|x$)/∂P2/∂x	Prob ($y = 3\|x$)/∂P3/∂x	Prob ($y = 4\|x$)/∂P4/∂x
Financial literacy model	67.55%	19.67%	7.69%	5.09%
Parents financial educ	0.313	−0.116	−0.091	−0.106
Over spending	−0.207	0.087	0.060	0.060
NCC	−0.061	0.026	0.018	0.018
Correct answers	0.147	−0.062	−0.043	−0.043
Interaction effect	−0.154	0.064	0.045	0.045
Level A - Financial illiteracy	68.82%	19.14%	7.32%	4.72%
Parents financial educ	0.295	−0.055	−0.085	−0.095
Over spending	−0.190	0.082	0.055	0.053
NCC	−0.065	0.028	0.019	0.018
Incorrect answers	−0.187	0.081	0.054	0.052
Interaction effect	0.154	−0.067	−0.044	−0.043
Level B - Financial illiteracy	67.27%	19.25%	7.84%	5.64%
Parents financial educ	0.348	−0.120	−0.098	−0.130
Over spending	−0.187	0.075	0.054	0.059
NCC	−0.047	0.019	0.013	0.015
Do Not Know answers	−0.099	0.040	0.028	0.031
Interaction effect	0.198	−0.079	−0.057	−0.062

Source: Marginal effects only reported for Model 1 Table 6, 6a, and 6b. y = 1 refers to pay in full, y = 2 refers to pay less than full but more than minimum, y = 3 refers to pay minimum, and y = 4 refers to pay less than minimum.

importance. While we do not dispute the inner importance of financial literacy in improving decision making, our results indicate that financial literacy plays a secondary role, when controlling for individuals' personality traits and consequent behavior. In particular, marginal effects analysis from Table 5, indicate that an increase in the number of correct answer in the financial literacy questionnaire result in a positive improvement (pay in full) in repayment patterns on the approximate amount of 14.7%. While a significant improvement, this amount is not enough to counterbalance the negative effects of behavior. By the same token, the negative effect of increased financial illiteracy is decomposed in a worsen repayment capability (away from full repayment every month) of 18.7% for Level A and 9.9% for Level B. It is relevant to point out that those overestimating their financial knowledge, yet answering incorrectly, are at the highest risk of falling behind and carry a month-to-month balance. In addition, it comes as a relative surprise that those suffering from Level B illiteracy are less likely to carry an increase negative probability of repayment in full when answering more DNK to the financial literacy questions. In this context, it becomes evidence that individuals with a lack of financial literacy Level A and personality traits dominated by overspending are highly more likely to fall behind, as reflected by the estimated values of the Prob y = 2, 3, and 4 categories.

A generalization of the results also indicate that the estimated probabilities and corresponding marginal effects are lower for the Level B financial illiteracy individuals than the other two groups. For Level B, it appears that they benefit the most from increased interaction with their parents (FEPAR), and recur less to more credit cards and consequently have a lower negative effect on repayment as the number of credit cards is increased. Thus, it appears that not knowing about financial literacy (DNK) makes them act in a more cautious way in relation to credit card use.

Furthermore, the robustness of the personality traits manifestation in the form of overspending are statistically consistent across all estimated models. In this context, it is more relevant to note that the estimated marginal effects of changes in this behavioral variable are also consistent even after controlling for the different levels of financial literacy and financial (il)literacy Levels A and B. In other words, our estimated probabilities and related marginal changes of increases in overspending seem to be independent of financial literacy. This result, as far as we are aware of, is unique and not present in the extant literature. As such, we argue that financial literacy has a limited impact on modifying personality traits and related behavior. It appears, that early intervention and an increase in financial literacy at early stages in life, primarily through parental education, may have the largest offsetting effects to personality traits leading to poor financial decision making.

5. Conclusions

The empirical evidence in this paper demonstrates that financial behavior, measured in terms of credit card repayment patterns, is affected more by personal traits than by financial literacy. This is to say, that financial decisions are made mainly based on personal traits or behavioral factors. Behavioral variables, such overspending, drive the accumulation of credit card debt and result in less than optimal repayment. Financial knowledge derived from

parental interaction with children seems to be the form of financial knowledge most relevant in positively influencing credit card repayment. Individuals with self-assessed lower level of financial literacy (DNK answers) display diverse behaviors (credit card repayment patterns) as opposed to individuals who do not possess basic financial literacy (wrong answers) even after controlling for cognitive or personal trait factors.

In our context, it appears that financial literacy has a limited positive benefit in shaping financial decisions. Previous evidence is mixed on this specific issue: although there is ample evidence supporting that higher financial knowledge translate into less risky credit card use (Norvilitis et al., 2006; Robb, 2011; Shim et al., 2009, 2010), other researches have reported greater financial knowledge was associated with lower fear about using credit cards and greater levels of debt (Borden et al. 2008; Lyons & Rogers, 2004; Robb & Sharpe, 2009). One possible explanation for these mixed results could depend on how financial knowledge is operationalized and measured. For instance, our study levers up the traditional financial literacy questions developed by Lusardi & Mitchell (2014) while Robb (2011) uses a financial knowledge score specifically designed to uncover specific knowledge about credit card use. Different results could be related to imprecise measurement of a latent variable such as financial knowledge.

Results from the parsimonious model specification also indicate the presence of robust behavior patterns along personality traits. Present-bias behavior, overconfidence and lack of control seem to be the main drivers of credit card use, and consequently of credit card repayment.

Now, with the existent data, we can measure the impact of behavioral differences while controlling for financial (il)literacy, but we cannot measure the possible gains in behavioral actions/responses due to increases in financial literacy. It is important to acknowledge this caveat in our study to both avoid incorrect data interpretation, and to set the future research agenda as we move forward. In essence, the long-term goal of the financial education or literacy movement is to provide mechanisms to positively affect economic behavior that currently result in costly and inefficient financial decisions. This is so, as financial behavior is highly determined by preferences, and these preferences may or may not be a function of financial literacy. If financial literacy does affect individuals' preferences and decision-making processes then one would expect that higher levels of financial literacy result in a series of benefits such as: increased saving, wiser investment decisions, lower to no month-to-month credit card debt, higher wealth accumulation, and higher retirement savings. Our findings are useful for policy makers to implement policies able to avoid, or reduce, deb trap and socio-economic vulnerability of the borrower. For instance, it appears that early intervention in terms of financial education may provide the necessary means to control endogenous costly personality traits. Once the personality trait has fully developed alternative means of positively impacting financial decision making might need to be implemented. As Xiao et al. (2011) highlight, financial education programs should target the multiple psychological processes that lead to changes in attitude and the enhancement of self-confidence, that is, they should target and develop students' positive financial intentions.

Finally, while being outside the scope of this study, further research on the subject of financial anxiety and its relation to credit card behavior will need to be explored, particularly the determination of the causality between credit card repayment habit and financial anxiety.

The tentative hypothesis states that higher financial anxiety should result in worse credit card repayment; thus, future research could analyze in more depth the role of psychological aspects and personality traits, in particular financial anxiety, in the process of financial decision-making, that is the possibility and cause-effect that higher credit card balance may fuel anxiety and result in a freeze effect where individuals may not improve repayment.

Notes

1 In several studies, most individuals report having higher believed level of financial literacy than actual correct scoring on financial literacy questionnaire/surveys. See recent studies by GFLEC at George Washington University center for some examples (Almenberg et al., 2016).
2 In a recent papers Kim and Mountain (2019) suggest a specific statistical approach (binomial-latent regression models) to specifically tackle the issue of group differences that are hidden in DK/RF responses.
3 Aptitude is different from attitude: while attitude is a way of looking at an issue or an object, a mental position or way of thinking about an issue (in our case financial matters), the concept of aptitude is akin to natural or acquired talent or ability, inclination, predisposition. In this sense, aptitude for financial matters could be learn through financial education as reflected by higher levels of financial literacy.
4 The questionnaire has been successfully used to capture the financial literacy of diverse populations since it was first piloted in 2010 as part of the first OECD international financial literacy and financial inclusion measurement exercise. In 2018, an updated version was released that takes into consideration the changes in the financial landscape and the evolving state of knowledge; therefore, including questions related to digital financial services and crypto-assets, trust, integrity and financial consumer protection.
5 More recent studies have applied factor analysis (van Rooij, Lusardi, & Alessie, 2011). It is widely acknowledged, however, that more work, developed through rigorous psychometric analysis is needed (Bongini et al., 2015, 2016; Knoll & Houts, 2012).
6 For a comprehensive survey on personality psychology and economics the interested reader can refer to Almlund, Duckworth, Heckman, and Kautz (2011) and to Brown and Taylor (2014) for a specific application that analyzes the relationship between personality traits and financial decision-making focusing on unsecured debt and financial assets.
7 While the topics of "time value of money," "inflation," and "interest rate compounding" do represent basics knowledge to make informed choices when deciding to pay in full or accumulating a month-to-month balance, the issue of risk diversification is less strictly correlated.
8 Estimations for the NCC variables as the dependent variable, with demographic characteristics as RHS variables, are available from the authors upon request. We conducted the same estimations with demographics instead of NCC, and obtained

very similar results, without affecting the estimated coefficients of the other variables.

9 Recall that credit card repayment behavior is measured in a reverse scale, where the lowest value implies repayment in full, and higher values otherwise.

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Framing the Annuity as Bequest Protection: An Experimental Test

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Abstract

Bequest motives are commonly cited as a barrier for annuitization. This paper tests how framing partial annuitization as a protection for an intended bequest against the risk of asset exhaustion due to unexpected longevity influences the desire to purchase an annuity among a sample of 2,160 participants. The results indicate that this framing argument does increase interest in purchasing an annuity. Regression results demonstrate that this framing has a larger positive effect for individuals with a greater bequest motive. The relationship between annuitization framing and bequest motive demonstrated by this experiment has important practical and theoretical implications. © 2021 Academy of Financial Services. All rights reserved.

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Keywords: Annuities; Estate planning; Bequest motive; Framing effects

1. Introduction

Longevity risk is a risk that a person lives longer than expected and has insufficient wealth to support his or her planned consumption expenditures. A life annuity is an insurance instrument that converts wealth into a lifetime income stream. It can insure people against longevity risk and can serve as a valuable part of retirees' investment portfolios (Lockwood, 2012). However, relatively few people annuitize any of their wealth

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(Peijnenburg et al., 2016). Franco Modigliani (1986) referenced this "annuity puzzle" in his Nobel Prize acceptance speech and indicated that there are substantial reasons for people to annuitize at least part of their wealth.

Bequest motives are a common explanation for this annuity puzzle. Annuity benefits will end at the death of the annuitants; therefore, they are not bequeathable wealth. Economists and researchers indicate that this non-bequeathable characteristic may potentially reduce or even eliminate the desire for annuitization (Bernheim, 1991; Bütler & Teppa, 2007; Yaari, 1965). Bequest motives, or proxies for such, have been measured in a variety of ways such as the presence of children, bequest expectations, or the self-reported importance of leaving a bequest. Typically, researchers do find a negative association between a bequest motive and purchasing a life annuity (Bernheim, 1991; Bütler & Teppa, 2007; Yaari, 1965).

This paper examines the effects of framing an annuity as bequest protection on intentions to purchase an annuity and how these effects are impacted by the bequest motive. The estimations of regression models show that framing the annuity as an inheritance protection did increase interest in using an annuity. Further, it did so to a much stronger degree for people who first reported having a relatively higher bequest motive. This was true both when measured as the change in estimated numerical probability of using an annuity (multiple linear regression model) and when measuring the binary outcome of whether or not interest in an annuity increased (probit regression model). The increase in the interest in annuitization grew more strongly for those with a higher bequest motive, even when controlling for other factors such as the personal longevity estimations, education, income, age, and gender. A higher bequest motive leads to a greater impact from bequest protection framing of an annuity.

2. Literature review

2.1. The annuity puzzle

People face significant longevity risk in the United States (Lockwood, 2012) in part due to generally increasing life expectancy (Knell, 2018). According to data from the World Bank, the average U.S. life expectancy for males increased from 46.3 to 79 between 1900 and 2018 and the average life expectancy for females increased from 48.3 to 84 between 1900 and 2018 (The World Bank, 2019). About one-fifth of 65-years-olds will live to age 90 and beyond (Lockwood, 2018). Therefore, retirees should be increasingly concerned about the need to hedge longevity risk.

The economic literature provides theoretical and empirical evidence that life annuities bring substantial welfare improvements to retirees (Cox & Lin, 2007; Scott, 2008). An immediate annuity can bring a lifetime income stream for retirees and help them maximize retirement spending (Scott, 2008). Moreover, Scott (2008) suggests partial annuitization should be an optimal strategy for typical retirees and recommends that retirees convert 10-15% of wealth to a life annuity in the retirement period.

However, few retirees annuitize any of their wealth. Among people who are eligible for defined benefit pension plans, a form of an annuity, when the plans offer a lump-sum option, about 50% to 75% of these benefits are taken as a lump-sum (Banerjee, 2013). This is true

even if the lifetime benefit is the default option and retirees have to spend great time on complex paperwork to get the lump-sum distribution (Banerjee, 2013; Benartzi, Previtero, & Thaler, 2011; Mottola & Utkus, 2008). Williams and James (2019) found that only 4% of retirees were receiving income from a commercial annuity other than traditional pension plans. Thus, the propensity to annuitize is low in the United States (Peijnenburg et al., 2016). Unwillingness to annuitize is not a unique behavior for Americans. For example, an analysis using Japanese data also reports similarly low propensity to voluntarily annuitize wealth (Purcal & Piggott, 2008). This widespread resistance to annuitization is known as the "annuitization puzzle" (Modigliani, 1986). In other words, annuities are underutilized.

2.2. Bequest motives

Researchers have used various explanations for this annuitization puzzle. The low demand could result from the public pension system. Retirees may have sufficiently hedged the longevity risk with annuities provided by the public pension system, such as Social Security (Brown, 2001, 2003). Others argue that the annuity market is not actuarially fair (Brown & Poterba, 2000; Donnelly, 2015; Lockwood, 2012; Pecchenion & Pollard, 1997), and that rates are unattractive due to the issue of adverse selection (Abel, 1985; Finkelstein & Poterba, 2004; Mitchell & McCarthy, 2002). Still others argue that individuals self-insure using other assets or resources (Laferrère, 2012; Vidal-Meliá & Lejárraga-García, 2006).

However, the most common explanation for the annuitization puzzle is the bequest motive. Several authors conclude that the bequest motive could be a barrier that might reduce the demand for a life annuity (Bernheim, 1991; Friedman & Warshawsky, 1990; Lockwood, 2012, 2018; Purcal & Piggott, 2008; Yaari, 1965). This is because annuitized wealth is not bequeathable (Lockwood, 2018). Annuity benefits end at the death of the annuitant.

2.2.1. The economics of annuities as bequest protection

As Yaari (1965) pointed out, although a bequest motive might prevent annuitization of all assets, it should not prevent annuitization of any assets, that is, partial annuitization. Longevity risk can result in all assets being completely exhausted due to living expenses incurred during an exceptionally long life. This would result in the elimination of any intended bequest. Annuitization can protect against this risk. As Davidoff et al. (2005, 1589) explain, "partial annuitization can reduce the variation in the bequest." Thus, partial annuitization should be attractive to people who have a bequest motive (Davidoff et al., 2005). Those with a bequest motive should hold a portfolio which combines annuity wealth and bequeathable wealth to maximize the marginal utility of both bequests and consumption (Yaari, 1965).

Although theoretically sound, this concept may be sufficiently complex such as to require explanation for a lay audience. Financial advisors may be able to bridge this complexity gap between economic theory and practical advice by framing the annuity as a way to protect the heirs' inheritance.

2.2.2. Framing in behavioral finance

Frame dependence references circumstances in which people tend to make different choices as the result of changes in phrasing or comparison salience, even though the relevant objective facts remain the same (Baker & Nofsinger, 2010). In behavioral finance, examples of such effects include gain/loss framing (Kahneman, Knetsch, & Thaler, 1991), narrow/broad framing (Barberis, Huang, & Thaler, 2006), mental accounting (Thaler, 1985), and many others (Baker & Nofsinger, 2010). Past experiments have shown that framing can influence decisions in retirement planning in general (Choi et al., 2004) and annuity decisions in particular (Agnew et al., 2008; Salisbury & Nenkov, 2016). For example, Salisbury and Nenkov (2016) found that people were more interested in purchasing annuities described with life words than identical annuities described with "death" words. Agnew et al. (2008) found that annuities became more attractive when alternative investments were framed negatively. After reviewing evidence of the annuity puzzle, Brown (2007) recommends that future annuity research should focus more on such behavioral explanations.

2.2.3. The psychology of annuities as bequest protection

Another argument for the potential power of bequest protection framing for annuities comes from past research connecting annuities and personal mortality salience. Terror Management Theory, as well as a parallel utility maximization economic model (James, 2016), predict that personal mortality salience (such as that triggered by death reminders) will generate two responses: avoidance and pursuit of lasting social impact (a.k.a., symbolic immortality; Pyszczynski, Greenberg & Solomon, 1999). Salisbury and Nenkov (2016) identified that annuities, which can be thought of as a bet on one's own mortality timing, do indeed serve as a death reminder that triggers mortality salience.

The avoidance response will tend to reduce interest in annuities, simply because they are a death reminder. Fitting with this response, Salisbury and Nenkov (2016) found that people were more interested in purchasing annuities described as paying "if the annuity holder lives up to different ages" (life framing) than in purchasing annuities described as paying "depending on the age when the annuity holder dies" (death framing; Salisbury & Nenkov, 2016, p. 423).

However, the resistance to annuities goes beyond simple avoidance of a death reminder. The second response to mortality reminders predicted by theory is pursuit of lasting social impact (a.k.a., "symbolic immortality"). This is the idea that although a person will die, some part of them—their name, family, community, values, and so forth—will live on. A bequest motive can be the financial expression of this psychological desire. Thus, annuities serve as a death reminder, increasing the motivation to leave a bequest, but simultaneously offer a financial benefit that disappears at death.

Confirming this idea, Williams and James (2019) found that higher levels of personal mortality reminders generate a greater preference for an annuity paying lower income but with a bequest provision—a form of life insurance. Such product combinations (life annuity plus survivor bequest benefits) "solve" the desire for bequests. And indeed, Lockwood (2012) estimates that about three-fourths of commercial annuities owned by recent retirees have some provision that passes money to heirs after death.

However, these product combinations may not be optimal for financial outcomes. The need to protect against longer than expected life span (annuity benefits) need not be

accompanied by a need to protect against shorter than expected life span (life insurance benefits). The current experiment tests an alternative approach. Rather than coupling the annuity with financial products offering actual bequest benefits, partial annuitization is simply verbally framed as a form of bequest protection. If effective, this approach would provide the opportunity to communicate the benefits of a life annuity in a way that matches underlying psychological mechanisms, but without the need to combine it with other, potentially unnecessary, financial products.

2.3. Hypotheses

Hypothesis 1: Framing an annuity as a protection for bequest goals will increase individuals' interest in using an annuity in retirement.

Hypothesis 1A: Framing an annuity as a protection for bequest goals will increases individuals' interest in using an annuity in retirement to a relatively greater extent for those who were relatively more focused on leaving wealth to heirs (i.e., who had expressed a stronger bequest motive).

Hypothesis 1 predicts that framing partial annuitization as protecting an inheritance for heirs will increase interest in using an annuity in retirement. Hypothesis 1A predicts that the effect of this framing will be more powerful on those who have expressed a relatively greater bequest motive. Those who have expressed a relatively greater focus on leaving wealth to heirs should logically be particularly influenced by this framing. Finding this to be true would also lend support to the idea that increased interest resulting from framing the annuity as bequest protection was arising through the proposed mechanisms, rather than, for example, simply through generalized experimenter demand (Zizzo, 2010). In other words, the effect of the framing would not be due solely to respondents changing their response to match what they believe to be the answer desired by the experimenters, but would actually relate to the respondent's underlying bequest motive.

3. Data and results

3.1. Sample

Participants were recruited from adults in the United States via Amazon's Mechanical Turk (MTurk) platform with the headline description "University survey of opinions on retirement planning." Clicking on this generated the following description, "Survey of retirement planning opinions. We are conducting an academic survey about opinions on retirement planning options. This takes around 10 minutes (includes minimum timed responses and written text requirements) and it is intended to advance research about people and their retirement planning, so please make sure you can commit the time. At the end of the survey, you will receive a unique 'completion code' to paste into the box below to receive credit for taking our survey."

There were 2,206 respondents who participated in the survey on October 18, 2019 with 2,160 responding to all questions used in the following analyses. The study was approved by

Table 1 Key variables question text

Annuity chance (pre and post)	Imagine that you are 65 years old and beginning retirement. You have some retirement savings through your employer retirement plan and are deciding how to manage using that money in the coming years. You have the option to put your retirement savings into an annuity that will give you monthly payments each year you live. When you put your savings into an annuity, you pay a lump sum of money upfront. In return for that lump-sum investment, you receive a series of regular monthly payments each year you live. Please rate the percentage likelihood that you might consider purchasing an annuity as part of your retirement planning. Likelihood of purchasing an annuity: [0–100 slider bar]
Agree framing argument (yes = 1)	One benefit to annuities is that they can protect an inheritance for heirs. No matter how long you live, you will have lifetime income, so you won't be forced to spend away your other investments or assets just to have regular income. Does it make sense to you how having guaranteed lifetime income from an annuity can provide protection of an inheritance for your heirs? __ Yes, that makes sense __ No, that doesn't make sense __ I'm not really sure
Bequest motive	Preceding question: Suppose you were age 65 and had saved $1 million to use during retirement in addition to social security. Your investments will return an inflation-adjusted amount of 5% (e.g., $50,000 from $1 million) per year. Which of the following spending plans would you prefer? — (page break) — On a scale from 0 to 100, how much did you consider your desire to leave money to your heirs when making the spending choice on the last question? Considered leaving an inheritance: [0–100 slider bar]
Mortality salience	To what extent have you been thinking about death in the past several minutes? Never [1] Very Rarely [2] Rarely [3] Occasionally [4] Frequently [5] Very Frequently [6] Please rate your level of agreement with the following statement: The tasks in this survey reminded me of death. Very Strongly Agree [6] Strongly Agree [5] Agree [4] Disagree [3] Strongly Disagree [2] Very Strongly Disagree [1] To what extent did the tasks in this survey evoke thoughts of death? Never [1] Very Rarely [2] Rarely [3] Occasionally [4] Frequently [5] Very Frequently [6]
Chance live to 100	On a scale from 0% to 100%, what are the chances that you will live to age 100 or older? Probability of living to 100: [0–100 slider bar]

Table 2 Descriptive statistics

Variable	Mean (*SD*)	Min	Max
Age	44.973 (16.061)	19	85
Male	0.509 (0.500)	0	1
Income	54.912 (34.108)	10	150
Education years	15.525 (1.995)	9	19
Annuity chance (Pre-Framing)	49.635 (27.179)	0	100
Annuity chance (Post-Framing)	53.992 (27.685)	0	100
Annuity interest increased	0.493 (0.500)	0	1
Annuity interest decreased	0.231 (0.421)	0	1
Agree framing argument	0.789 (0.408)	0	1
Bequest motive	54.390 (34.571)	0	100
Chance live to 100	31.010 (29.007)	0	100
Mortality salience	11.460 (3.525)	3	18
n	2,160		

the institutional review board for human research protection program of the second author's affiliated institution.

3.2. Variables

Table 1 reports the question text used to generate the key variables used in the following analyses. Reports of education level were converted to number of years of education as follows, nine for "less than high school diploma," 12 for "high school diploma," 14 for "some college or associates' degree," 16 for "bachelor's degree," and 19 for "graduate degree." Categorical reports of income were converted to $10,000 (for less than $10,000 category), category midpoints of $15,000, $25,000, $35,000, $45,000, $55,000, $65,000, $75,000, $85,000, $95,000, and $125,000, and finally $150,000 for greater than $150,000.

In the following regressions, socio-demographic control variables were also included. More years of education may be associated with greater financial literacy (Van Rooij, Lusardi, & Alessie, 2011). This might increase the likelihood of understanding the bequest protection argument, but also increase the likelihood of having already considered the argument before the framing intervention. Alternatively, high education may be associated with disagreement with the framing claim resulting from acceptance of an alternative investment strategy, such as replacing annuities with mutual fund investments and protecting an inheritance by accumulating sufficient wealth to provide for any income needs (Pang & Warshawsky, 2010). Income is also associated with financial sophistication and may impact the acceptance of the framing argument (Van Rooij, Lusardi, & Alessie, 2011).

The longer one expects to live, the more relevant the bequest protection argument becomes. A standard annuity involves a bet on one's longevity. Thus, a simple measurement of subjectively anticipated longevity—the chance one will live to age 100—is included. Age is included as it has been associated with both financial literacy and the confidence in one's beliefs about financial products (such as annuities) and may impact the influence of a framing argument (Finke, Howe, & Huston, 2017). Gender is

Table 3 OLS regression with dependent variable: Annuity chance (Post-Framing)

Variable	Parameter estimate (*SE*)	*p*-Value
Intercept	10.793 (2.8989)	0.0002
Annuity chance (Pre-Framing)	1.0902 (0.0376)	<0.0001
Annuity chance (Pre-Framing) SQ	−0.0026 (0.0004)	<0.0001
Bequest motive	0.0560 (0.0090)	<0.0001
Mortality salience	0.1453 (0.0869)	0.0948
Male	−1.9764 (0.6082)	0.0012
Income	−0.0160 (0.0093)	0.0867
Education years	−0.2583 (0.1597)	0.1060
Age	−0.0432 (0.0192)	0.0241
Chance live to 100	0.0155 (0.0109)	0.1536

Note: n = 2,160; R^2 = 0.7505. OLS = ordinary least squares.

included as some research has found females to be more risk averse than males when they make financial decisions in general (Jianakoplos & Bernasek, 1998) and with regard to annuities in particular (Agnew et al., 2008). As such, females may respond more favorably to the framing of an annuity as a hedge against a risk of total bequest depletion.

Table 2 reports sample means, standard deviations, minimums, and maximums. The average respondent age was 45 with 51% of respondents being male. Average years of education was 15.5, and average income was $55,000 per year.

3.3. Hypothesis 1: Results

Table 1 indicates that the mean percentage likelihood of purchasing an annuity as part of retirement planning (Annuity Chance) increased following the bequest protection framing statement. A two-tailed paired t test finds that this difference is statistically significant at $p < .0001$. Additionally, the percentage likelihood of purchasing an annuity as part of retirement planning increased following the bequest protection framing statement for 49.3% of respondents but decreased for only 23.1% of respondents. Both findings support Hypothesis 1.

These two outcomes measure the change in likelihood of using an annuity in two different ways. The pre versus post comparison of probability changes measures the magnitude of the change. This is important but is also subject to the effects of outliers where very large changes take place. However, using a dummy variable for any increase in probability is not subject to these outlier effects, as all positive changes are measured as a "1" regardless of magnitude. Thus, it is useful to look at both forms of outcome measurements and this will be repeated in the following regression analyses.

3.4. Hypothesis 1A: Results

Table 3 reports results for an ordinary least squares regression where the dependent variable is the percentage likelihood of purchasing an annuity as part of retirement planning

Table 4 Probit analysis with dependent variable: Annuity chance increased

	Parameter estimate (*SE*)	Pr > χ^2
Intercept	0.0348 (0.2497)	0.8892
Bequest motive	0.0037 (0.0008)	<0.0001
Mortality salience	0.0109 (0.0079)	0.1654
Male	−0.1157 (0.0553)	0.0363
Income	−0.0008 (0.0009)	0.3208
Education years	−0.0012 (0.0145)	0.9316
Age	−0.0061 (0.0017)	0.0004
Chance live to 100	0.0006 (0.001)	0.5650

Note: n = 2,160.

following exposure to the bequest protection framing argument. The regression controls for the percentage likelihood reported before the bequest protection framing and reflects the change (pre vs. post) in this reported percentage likelihood. In addition, the regression controls for the square of the percentage likelihood reported before the bequest protection framing. This is included because the dependent variable, Annuity Chance (Post-Framing), is constrained to be between 0 and 100. As the initial percentage, a.k.a. Annuity Chance (Pre-Framing), increases, the possible magnitude of an increase resulting from the framing falls, suggesting a nonlinear relationship (e.g., if the likelihood of using an annuity was 99% before the framing, there is little opportunity for increasing this likelihood). The results confirm this nonlinear relationship as both the linear and squared term are highly significant.

The increase resulting from the bequest protection framing argument is greater for those who had expressed a greater bequest motive at $p < .0001$. This result supports the second hypothesis (1A). An additional possible relationship is that the bequest protection framing might be more powerful for those experiencing greater mortality salience. Terror management theory suggests that those experiencing greater mortality salience will have an increased interest in making a lasting social impact. Bequest protection framing should appeal to this increased interest by showing the potential benefits of partial annuitization for heirs. Contemplation of annuities has been found in past research to generate mortality salience (Salisbury & Nenkov, 2016), making this potential relationship particularly relevant for the current experiment. Additionally, bequest motive was measured before the annuity questions while mortality salience was measured after the annuity questions. Thus, the level of experienced mortality salience, controlling for bequest motive, would be sensitive to changes generated by the annuity questions themselves. Table 3 shows a weak positive relationship between mortality salience and the increase in annuity interest following the bequest protection framing intervention. However, this relationship is significant only at $p < .10$.

Table 4 reports results from a probit analysis measuring whether or not the probability of purchasing an annuity at retirement increased following the bequest protection framing argument. Unlike the analysis reported in Table 3 this analysis is not affected by large outliers, such as where the reported percentage changed from 0 to 100 or vice-versa. Nevertheless, the coefficient for bequest motive is still positive and significant at $p < .0001$. This confirms

Table 5 Probit analysis with dependent variable: Agree with framing argument

	Parameter estimate (standard error)	$Pr > \chi^2$
Intercept	0.7593 (0.2819)	0.0071
Bequest motive	0.0038 (0.0009)	<0.0001
Mortality salience	0.0355 (0.0090)	<0.0001
Male	−0.0054 (0.0627)	0.9311
Income	−0.0001 (0.0009)	0.8822
Education years	−0.0262 (0.0163)	0.1085
Age	−0.0054 (0.0019)	0.0041
Chance live to 100	0.0036 (0.0011)	0.0014

Note: n = 2,160.

that the relationship identified in Table 3 is not driven only by large outliers but reflects a general tendency among the respondents. Thus, the likelihood that interest in an annuity will increase to some extent following the bequest protection framing also increases as bequest motive increases. This result further supports the second hypothesis (1A).

The direction and significance of the relationship with age and gender remains consistent with the results reported in Table 3. However, the relationship with mortality salience becomes nonsignificant (p = .1654).

The primary interest in this analysis was to explore the results from introducing a bequest protection framing argument on interest in purchasing an annuity as part of retirement planning. Bequest protection framing may fail to have an effect because respondents disagree with the bequest protection argument. However, it may also fail to have an effect even if respondents agree with the bequest protection argument. This could result from respondents having already considered such a justification before its introduction in the framing argument or because other unmeasured factors make such a justification irrelevant for the respondent. Thus, Table 5 reports results from an additional measurement of the effectiveness of this framing argument: whether respondents agree that the argument itself makes sense. This measurement of the power of the bequest protection framing argument also shows a positive association with bequest motive ($p < .0001$). Thus, those with a higher bequest motive are more likely to agree that the bequest protection framing argument makes sense.

One difference as compared with the previous outcome measurement is that mortality salience is a highly significant predictor ($p < .0001$) of agreeing with the bequest protection framing argument. This may be because the increased desire for making a lasting impact resulting from mortality salience may increase acceptance of the argument describing such an impact. Future investigation of this relationship may be critical as previous research shows contemplating annuity purchases increases mortality salience (Salisbury & Nenkov, 2016). Thus, a framing argument that works particularly well in the presence of mortality salience may be particularly effective in a real-world application. However, in the present experiment this relationship may arise because acceptance and understanding of the bequest protection argument actually generates mortality salience. Future experimental research may be able to disentangle this relationship more precisely.

4. Discussion

This research examines bequest motives and annuitization in a new way. It examines an intervention framing an annuity as a protection for inheritance goals from longevity risk. In the presence of other assets intended to be left as a bequest, annuitization can be viewed as protecting those assets against consumption due to a person's excessive longevity. Thus, in the absence of (partial) annuitization, these assets might be completely exhausted due to living expenses incurred during an exceptionally long life. This bequest protection frame presents the annuity as a downside protection for inheritance goals.

We hypothesized that this framing intervention would encourage interest in using annuities in retirement. The results are consistent with this hypotheses that framing matters. On average, introducing the bequest protection framing intervention increases interest in using an annuity in retirement. Additionally, regression models showed that a greater bequest motive leads to a more positive effect of the bequest protection framing intervention on the predicted likelihood of using an annuity in retirement. Thus, the impact of the intervention is likely not due exclusively to generalized experimenter demand effects. This result matches economic arguments for partial annuitization as benefitting heirs by reducing bequest volatility but suggests a necessary role for the advisors to explain this justification.

This bequest protection framing may represent an additional, practical approach to addressing the annuitization puzzle (Bernheim, 1991; Bütler & Teppa, 2007; Yaari, 1965). This preliminary evidence suggests a potential method to directly address previous findings of a negative association between bequest motives and annuitization (Bernheim, 1991; Bütler & Teppa, 2007; Yaari, 1965). Without special framing, this negative association is obvious. Annuity wealth is not bequeathable. Therefore, people who have a bequest motive may be less likely to purchase life annuities. However, bequest protection framing appears to most strongly influence those who have higher bequest motives.

Developing a method, such as that tested here, to address these bequest motive objections may be particularly important because the act of annuity contemplation may actually increase bequest motives. Past research has shown that annuity contemplation generates mortality salience (Salisbury & Nenkov, 2016) and also that mortality salience generates an increased desire for lasting social impact, a.k.a., pursuit of symbolic immortality (James, 2016; Pyszczynski, Greenberg, & Solomon, 1999). This results in the outcome, demonstrated by Williams and James (2019), that increasing mortality salience increases interest in annuities that pay less income but include bequest benefits relative to those that pay more income with no such bequest benefit. However, this outcome is unlikely to be an ideal financial planning choice. The current reframing approach offers the advantage that no product changes are needed to increase the acceptability of the annuity choice.

Of course, the present experiment measures responses to a hypothetical question about an annuity purchase decision to be made at age 65. It does not measure actual purchase behavior. Behavioral intentions can differ from actual behavior. However, because this analysis focuses on the *change* in behavioral intentions, the results can be instructive even in the presence of imprecise measurements or additional barriers between intentions and action.

4.1. Financial planning practice implications: Client conversations

Economic theory demonstrates that partial annuitization may be ideal even for those individuals with a strong bequest motive. Partial annuitization reduces the volatility of a bequest by providing protection against reduction or exhaustion of the bequest assets due to income needs resulting from longevity risk. The current results suggest that this argument, when presented in nontechnical terms, can be persuasive to the general public.

However, the argument is not uniformly attractive. It is more compelling for some people than others. In particular, the argument is more compelling for those who begin with a higher bequest motive. Additionally, this framing is more effective among women and those who are younger.

Determining bequest motive need not be a complicated task for the advisor. Some clients may bring up such concerns when annuities are discussed. In this study, bequest motives were measured by the response to the question, "how much did you consider your desire to leave money to your heirs when making the [retirement] spending choice on the last question?" Similarly simple questions may also elicit the relevant motivations from clients. Where such bequest motives exist, the bequest protection framing for annuities may be particularly effective.

4.2. Financial planning practice implications: Client annuity usage

The results presented here have two practical implications for client choice of annuity products. First, the results can be helpful where annuities are an appropriate financial option for clients. The results demonstrate the effectiveness (especially for certain people) of a bequest protection framing argument. Second, the results can be helpful where the typical form of annuities (annuities with survivor benefits) are less than optimal. Where Williams and James (2019) showed that annuities producing less income and greater bequest benefits become more attractive with increased mortality salience, this research shows that it is not necessarily required to change the product to include more bequest benefits, but it can work to simply change the product framing to highlight the otherwise unrealized bequest benefits.

4.3. Annuity advantages

Finding a cost-free way to encourage the use of annuities—without the addition of potentially unnecessary life-insurance-like bequest benefits—can be potentially beneficial for clients. The first reason is the risk. Compared with investing in the stock market, the risk of investing in annuities is relatively low and the annuity lifetime income or certain period income is guaranteed. For example, the sequence of returns risk, which could have a significant impact on retirees' portfolios, does not arise with annuities but does occur with investing in the stock market.

A Monte Carlo simulation shows the impact from this sequence of returns risk. The simulation assumes a retiree with an initial investment of $500,000 dollars, average returns for

stock market of 6% (annually), a standard deviation of return of 20%, a time horizon for investment of 20 years, and the amount added to the investment portfolio of $15,000 at the end of each year. In 10,000 iterations, the ending portfolio (mean $2,192,524; median $1,633,929; standard deviation $1,966,518) varies widely from the fifth percentile outcome of $465,544 to the 95th percentile outcome of $5,722,992. If the investors suffers a "bad time" at the beginning of the investment period, that is, negative returns at the beginning of the investment period (e.g., caused by an economic crisis or other global issues), the investors might suffer a huge initial loss with regard to the investment portfolio. If retirees have such a loss in their investments, their assets might be completely exhausted, and they may not have sufficient wealth for their retirement. However, the returns for annuity investments are stable and the annuity income is typically guaranteed. For example, in the above simulation, placing 10% ($50,000) of the initial investment into a fixed twenty-year guaranteed annuity with a lower (4%) return increases the fifth percentile outcome by 30% but decreases the 95th percentile outcome by only 3%.

Compared with the stock and mutual fund market, the bond market is a closer alternative to annuities for retirees. However, bond investors still have to face many risks, such as credit risk (bonds may not pay as expected), inflation risk (as the inflation rate increases, the coupon income values becomes less), reinvestment risk (investors may not be able to find a similar bond investment option after existing bonds mature), and liquidity risk (bonds may be unavailable to meet short-term financial goals). Thus, if retirees only invest in stock, mutual funds, and bonds, they have greater risk for meeting their short-term and long-term financial goals. Having an annuity could help retirees have lifetime income or certain period income, which could be a protection for their financial goals and reduce risk (including systematic risk from overall market returns and unsystematic risk from individual investment selection). Therefore, annuities could improve retirees' welfare and could be valuable for retirees' portfolios.

4.4. Annuity disadvantages

Despite the previous advantages, the reality of annuity pricing may reduce the advantages compared with theoretical potential.There is adverse selection with regard to the mortality risk in the annuity market (Blake, 1999). This is the risk that only individuals who think they will live longer than the average for the population based on their own medical and family histories will choose to purchase annuities. And also, conversely, those who know of a major mortality risk factor will not ever purchase an annuity (i.e., sick people do not buy annuities). However, insurance companies do not have the same access to this information with the same degree of reliability as do annuity purchasers (Blake, 1999). Therefore, there is asymmetric information between the annuity insurance company and prospective annuitants. Insurance companies may not be able to perfectly distinguish the prospective annuitants who have heavier mortality risk (insurance companies make money) from those who have lighter mortality risk (insurance companies lose money). However, companies realize that people who voluntarily purchase an annuity have a lighter mortality risk than the typical person of the same age. Thus, pricing for all prospective annuitants will reflect this reality, potentially making the annuity (in

practice) a poor investment choice for those with a typical life expectancy. Once this is combined with the need for paying commissions, advertising, and profits, the theoretically advantageous annuity may become practically less attractive.

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Financial Literacy to Prevent Poor Borrowing Choices

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Abstract

Working Americans face the new reality of having to fund and manage their retirement while facing rising levels of indebtedness. A basic level of financial knowledge is essential to make good long-term financial decisions. Using the 2015 National Financial Capacity Study, we investigate the impact of financial literacy on the decision to access retirement plan loans before retirement or use one or more high-cost lenders. Our results show that being financially literate reduces the likelihood of using high-cost lenders and using retirement-plan loans. Furthermore, we find evidence of a negative relation between financial literacy and myopic spending.

JEL classifications: G4; D14; D12

Keywords: Financial literacy; Retirement plan loans; Retirement planning; High-cost borrowing

1. Introduction

The use of defined contribution (DC) plans for retirement savings accumulation has increased significantly over the last 30 years. Today, DC plans cover 90 million Americans, with retirement assets totaling $6.7 trillion. Acknowledging the long-run solvency issues facing the social security system in the United States, it is important and logical to assume that DC plans along with other tax-advantaged retirement accounts such as Individual Retirement Accounts (IRAs) will be the main source of retirement wealth for Americans in the future. The widespread adoption of plans such as a 401(k), leaves a growing number of

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American workers with the responsibility of individually funding and managing this critical source of retirement income. Munnell and Webb (2015) found that individuals ten years or less from retirement had a combined average of only $111,000 in their DC plans.

A possible explanation for such a modest average retirement savings balance, as outlined by Munnell and Webb (2015), is the American retirement savings system's liquidity. In the United States—more than any other developed country—plan participants may access their retirement savings at any point during their life cycle (Beshears, Choi, Hurwitz, Laibson, & Madrian, 2015). Specifically, retirement plan participants may take a plan loan or hardship withdrawal against their retirement assets while working.[1]

Total U.S. Non-housing consumer debt reached $4 trillion at the end of 2016 (New York Fed, 2017). The higher the level of debt on household balance sheets, the more likely households will be negatively impacted by economic shocks, such as a drop in income or change in home prices. To meet shortfalls while experiencing liquidity constraints, some American households have turned towards high-cost lenders such as payday and title loan providers. The Pew Charitable Trust reported that 12 million Americans spent $9 billion in payday loan fees and another $3 billion on auto title loans on an annual basis.

The potential liquidity provided by retirement accounts and high-cost lenders is a double-edged sword that offers short-term financial reprieve in the presence of an income shock, and the possibility of a loss of utility during present and future periods such as retirement (Argento et al., 2015). Using data from the National Financial Capacity Study (NFCS) 2015 State-by-State Tracking dataset, in this paper we study the use of two alternatives to conventional borrowing: retirement plan withdrawals ("leakage") and accessing high-cost lenders. Further, we investigate the impact of financial literacy on either accessing retirement savings before retirement or using high-cost lenders. We also study how financial literacy relates to optimal liquidity.

While prior research associated with financial literacy have focused on retirement readiness from a wealth perspective, we offer an insight into household liquidity and debt management. Thus, we make a notable contribution to the current literature on financial literacy. We created a measure of financial literacy and statistically linked the lack of financial knowledge to increased leakages via retirement plan loans, in addition to the inappropriate use of nonconventional borrowing. To our knowledge, this is the first study to explore this important topic.

The remainder of the paper is organized as follows. We provide a review of the current literature in Section 2. In Section 3, we present the data and a description of how we derived our final sample. In Section 4, we highlight the univariate analysis of our final sample. We then present our empirical results in Section 5. In Section 6, we discuss our main findings and discuss our conclusions and policy implications.

2. Literature review

The life-cycle hypothesis states that households attempt to maintain a constant present value of marginal utility of consumption over time to maximize expected lifetime utility

(Modigliani & Brumberg, 1954). This consumption smoothing can be achieved by transferring money from periods where the marginal utility of consumption is low, to periods where it is higher (i.e., borrowing when earnings are low—high marginal utility of consumption, saving when earnings are high—low marginal utility of consumption, and dissaving in retirement). Households may need to withdraw funds from their retirement account(s) due to income shocks or special financial needs such as expenses associated with housing, college funding, a medical crisis, or meeting household needs after a job loss or change in occupation (Argento, Bryant, & Sabelhaus, 2015; Butrica, Zedlewski, & Issa, 2010; Brady, 2011; Copeland, 2009). An extensive review of the current literature on financial literacy and its impact on savings, investments, and debt management reveals that many individuals in the United States and worldwide are unfortunately financially illiterate (Lusardi & Mitchell, 2014).

Individuals need sufficient financial knowledge to make informed decisions in the present to maximize their chances for positive future outcomes; including the ability to recognize when they have made financial mistakes. Current research provides ample evidence that financial mistakes are frequently made by individuals who exhibit low financial sophistication levels. Bernheim (1998) demonstrated that financial literacy had a positive impact on retirement wealth accumulation. Lusardi and Mitchell (2007) indicated that individuals with low financial sophistication levels are less likely to think about retirement. According to van Rooij, Lusardi, and Alessie (2007), individuals with low financial literacy levels are less likely to participate in the stock market. Hastings and Tejeda-Ashton (2008) found that individuals with low financial sophistication levels are more likely to invest in mutual funds with high fees.

It appears that American consumers, on average, are not using credit optimally. Lusardi and Tufano (2015) indicated that individuals with low financial knowledge levels are more likely to struggle with debt management, incurring higher fees, and using high-cost lenders. Credit card debt revolvers often hold credit card debt while simultaneously holding low-interest liquid assets and retirement assets. This is a clear example of mental accounting and suboptimal credit use, a behavioral combination that conflicts with utility maximization (Bertaut & Haliassos, 2006). Disney and Gathergood (2012) used United Kingdom household data to show that consumer credit customers underestimate borrowing costs. The authors also revealed that individuals who borrow on consumer credit tend to exhibit lower financial literacy. Campbell (2006) highlighted a lower likelihood of refinancing mortgages during low-interest-rate periods among less educated and lower-income individuals. Gerardi, Goette, and Meier (2013) provided evidence of a positive relation between low financial literacy and subprime mortgage adoption, as well as mortgage default.

Agarwal, Skiba, and Tobacman (2009) examined a group of payday loan and credit card users. The authors found that even in the presence of a more cost-effective liquidity option (a credit card), 66% of their sample still took out a payday loan. Tang and Lu (2014) used the NFCS as well as hypothetical debt scenarios to compare loan costs in funding consumption. They found that households were able to save up to 130% by switching from high-cost lenders such as payday loan companies to 401(k) plan loans. Tang and Lu (2014) concluded that consumers view 401(k) plan loans as a last resort when their liquidity is constrained. Since loans from retirement plans carry lower interest rates than traditional sources of

consumer loans, plan loans may be a more optimal choice (Tang & Lu, 2014; Utkus & Young, 2011). Also, using the NFCS, Lusardi and Scheresberg (2013) examined high-cost borrowing methods and concluded that more financially literate individuals are less likely to have engaged in high-cost borrowing. The authors of that paper argue that (lack of) financial literacy plays an important role in explaining why individuals have used high-cost lenders such as payday loans. Tang and Lu (2014) showed the impact of optimal use of 401(k) plan loans on household balance sheets, but failed to consider the role of financial literacy in explaining why respondents were not utilizing 401(k) plans in periods of high marginal utility (high need) and low liquidity. Lusardi and Scheresberg (2013) made a powerful argument showing a negative relation between financial literacy and high-cost borrowing, but did not consider a comparison with low-cost borrowing. We contribute to the literature by investigating financial literacy and optimal borrowing choices.

3. Data

We use the 2015 NFCS State by State Tracking Dataset. The NFCS was commissioned and funded by the Investor Education Foundation of the Financial Industry Regulatory Authority (FINRA, 2009). The research objectives of the NFCS were to benchmark key indicators of financial capacity and evaluate how these indicators vary with underlying demographic, behavioral, attitudinal, and financial literacy characteristics. Consistent with surveys on financial capability that have been done in other countries (Atkinson, McKay, Kempson, & Collard, 2007), the NFCS looks at multiple indicators of both financial knowledge and capacity, including how individuals manage their resources, how they make financial decisions, the skill sets they use in making decisions and the search-and-information elaboration that goes into making these decisions.

The 2015 State by State Tracking Dataset pools 2009, 2012, and 2015 NFCS State-by-State surveys. For this paper, we only use the 2012 and 2015 pooled cross-sections. The new State-by-State Tracking Dataset provides some benefits not derived in a single-period cross-section. The observations are random and independent of each other at different points in time. Consequently, serial correlation of residuals should not be an issue in the regression analysis. Combining both waves of data results in a sample size of 53,703 respondents.

To ensure a sufficient number of respondents for the analysis, African Americans, Hispanics, Asian Americans, and adults with less than a high school education are oversampled.

3.1. Sample

To ensure the internal validity of our results, we restricted our sample to respondents who reported having a retirement plan through their current or previous employer, and were able to choose the asset allocation of their retirement accounts. We also included respondents who reported having non-employer sponsored plans such as IRAs. To identify respondents who are in the accumulation stage of their life cycle, we further restricted our attention to

respondents who have a full-time job or are self-employed between the ages of 25-54. This resulted in a final sample of 10,560 respondents.

3.2. Measuring financial literacy

Our primary predictor variable is financial literacy. Respondents who participated in the 2012 and 2015 NFCS were asked five financial literacy questions. For the purposes of the study, we use the three most likely to be related to our research. The questions as stated in the survey include:

1. Suppose you had $100 in a savings account and the interest rate was 2% per year. After five 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 one year, how much would you be able to buy with the money in this account?
3. Buying a single company's stock usually provides a safer return than a stock mutual fund.

The first two questions were initially introduced in the 2004 Health and Retirement Study by Lusardi and Mitchell (2011). Subsequently, van Rooij, Lusardi, and Alessie (2011) presented the question on bond pricing for a study carried out by the Dutch Central Bank Household Survey.

In prior studies, researchers have used the answers to some or all of these questions as proxies for financial sophistication (Huston et al., 2012) by producing indices or other linear combinations (Allgood & Walstad, 2013). Lusardi and Scheresberg (2013) use these same questions to construct their proxy for financial literacy.

3.3. Other key variables

3.3.1. Retirement plan loan

To capture defined-contribution leakage, this study uses two questions provided in the 2012 and 2015 NFCS. The first question used asks, "in the last 12 months, have you (or your spouse/partner) taken a loan from your retirement account(s)?" If respondents answered 'yes' to the question, they were assigned '1' and if no, '0'. Within the sample examined, 16% of respondents indicated taking a loan from their retirement account in the last 12 months.[2]

3.3.2. High-cost and inappropriate borrowing

The survey includes a set of questions related to high-cost borrowing behavior. Respondents were asked a series of questions about using any high-cost borrowing options in the past five years. The high-cost borrowing options included auto title loans, payday loans, advance tax refunds, rent-to-own consumer purchasing, and pawn shops. We focus on three areas known for excessive fees and high interests: payday loans, title loans, and

pawnshops. If a respondent answered yes, they were assigned a '1', if not a '0'. We then create a high-cost-of-borrowing variable that captures whether a respondent had used any of these types of loan options. We also create dummy variables to proxy for other forms of suboptimal borrowing, such as cash advances on credit cards, maxing out credit cards, and overdrafts on bank accounts.

3.3.3. Other control variables

The empirical literature shows that both household and market factors affect life-cycle behavior. If households forecast an increase in income, they may dissave to meet consumption needs; if households anticipate a drop in income, they may save more and consume below optimal consumption–more so if borrowing constraints persist. Additionally, households with children may dissave to meet current consumption needs relative to households without children. Homeownership is another factor that affects households' life-cycle behavior. The nature of homeownership is to act as a forced savings mechanism, which reduces a family's consumption over the mortgage term. Health condition is another household characteristic that affects life-cycle behavior. If an individual has poor health with no health insurance, he/she may save more in anticipation of a health shock; contrastingly, households with members in good health can consume at higher levels.[3] We also control for the effects of overspending on saving behavior by identifying those households that indicated spending more than their income within the previous 12 months.

4. Descriptive results

Table 1 provides the frequency distribution of the full sample and by household groups. We can observe that most individuals with retirement plan loans incur high-cost borrowing (HCB), and only 22% are financially literate. HCB also varies with age; among those in the early stage of their careers (age 25–34), the probability of using HCB is 44%. Furthermore, as age increases, the use of HCB decreases. We also see that HCB varies with income. The highest percentage of HCB users are earning between $50,000 and $74,999.

Table 2 shows the frequency distribution of respondents' financial capacity and improper borrowing in the full sample and by household groups. We observe that individuals who do not have a retirement plan loan demonstrate greater financial capacity in other areas of their financial lives. For instance, the majority of them have a positive cash flow and an emergency fund. It is important to note that 68% of HCB are homeowners compared with the 45% who are not catgorized as HCB. This is a potential indication that owning property could lead to financial constraints, especially if the homeowner is not prepared for a sudden drop in income. We observe that individuals with retirement plan loans engage in other forms of borrowing, with 34% maxing out their credit cards, and 34% having a cash advance loan. In contrast, the proportion of individuals who do not have a retirement plan loan and engage in HCB, is small. Results also show that 27% of HCB maxed out their credit cards, 32% have cash advances, and 48% reported having a recent bank overdraft. Among those who did not engage in HCB, 4% maxed out their credit cards, 6% had cash advances, and 14% recently experienced a bank overdraft.

Table 1 Frequency distributions for the weighted full sample and by household groups

Variable	Full $N = 10{,}560$	Retirement plan loan $N = 1{,}523$	No retirement plan loan $N = 9{,}037$	High-cost borrowing $N = 2{,}336$	No high-cost borrowing $N = 8{,}224$
Loan decision					
Plan loan (low cost)	16%	—	—	35%	9%
High-cost borrowing	24%	55%	19%	—	—
Financial literacy					
(All correct)	22%	12%	24%	10%	26%
(Total correct)	3.37	2.73	3.50	2.72	3.59
Gender					
Male	63%	64%	63%	66%	62%
Female	37%	36%	37%	34%	38%
Race					
Whites	63%	57%	56%	35%	53%
Non-Whites	37%	43%	44%	65%	47%
Age					
25–34	30%	41%	28%	44%	25%
35–44	33%	32%	33%	33%	33%
45–54	37%	27%	39%	23%	42%
Married	66%	71%	65%	64%	66%
Income					
Less than 15k	1%	2%	1%	2%	1%
15k–24,999	2%	3%	2%	4%	2%
25,000–34,999	6%	7%	6%	10%	5%
35,000–49,999	12%	11%	12%	15%	11%
50,000–74,999	24%	24%	24%	28%	23%
75,000–99,999	20%	22%	20%	20%	21%
100,000–149,999	23%	21%	23%	15%	25%
150,000+	12%	11%	12%	7%	14%
No. of children					
Zero	41%	28%	44%	29%	45%
One	23%	28%	22%	26%	22%
Two	24%	28%	23%	28%	23%
Three	8%	10%	8%	11%	7%
Four+	4%	7%	3%	5%	3%

(continued on next page)

Table 1 (Continued)

Variable	Full $N = 10,560$	Retirement plan loan $N = 1,523$	No retirement plan loan $N = 9,037$	High-cost borrowing $N = 2,336$	No high-cost borrowing $N = 8,224$
Employment status					
Self	9%	11%	9%	10%	9%
Full	91%	89%	91%	90%	91%
Financial risk tolerance					
Lowest risk	7%	6%	7%	7%	7%
Risk class 2	14%	11%	15%	11%	15%
Risk class 3	25%	18%	27%	19%	27%
Risk class 4	35%	28%	37%	31%	37%
Highest risk	18%	38%	14%	32%	13%

Table 2 Shows the weighted frequency distributions of respondents' financial capacity and improper borrowing in the full sample and by household groups

Variable	Full $N = 10{,}560$	Retirement plan loan $N = 1{,}523$	No retirement plan loan $N = 9{,}037$	High-cost borrowing $N = 2{,}336$	No high-cost borrowing $N = 8{,}224$
Financial capacity					
Cash surplus	49%	35%	51%	36%	53%
Emergency fund	57%	52%	58%	51%	59%
Drop in income	22%	50%	16%	42%	15%
Home owner	75%	79%	74%	68%	45%
Health insurance	95%	95%	95%	91%	96%
Improper borrowing					
Maxed credit card	9%	34%	5%	27%	4%
Cash advance	12%	34%	8%	32%	6%
Bank overdraft	22%	55%	16%	48%	14%

Table 3 shows correct answers to the financial literacy questions by the full sample and household groups. Panel B highlights the distribution by loan type. We note that 84% of the total sample answered the interest question correctly, 68% answered the inflation question right, and 62% correctly answered the diversification question. Most individuals characterized as HCB with a plan loan correctly responded to the interest rate question. However, only 44% of individuals with a plan loan correctly answered the inflation and the diversification question. Similarly, only 45% of the HCB group correctly answered the inflation and the diversification question. We note that among individuals who do not engage in HCB nor have a plan loan, 88% answered the interest rate question correctly, 75% answered the inflation question correctly, and 67% answered the risk diversification question right.

Table 3 Shows correct answers to the financial literacy questions by the full sample and household groups. Panel B highlights the distribution by loan type

Panel A

	Full	Plan loan	No plan loan	High-cost borrowing	No high-cost borrowing
Interest rate question	84%	70%	87%	72%	88%
Inflation question	68%	44%	73%	45%	75%
Risk diversification question	62%	44%	65%	45%	67%
N	10,560	1,523	9,037	2,336	8,224

Panel B

	Full	Both high-cost and plan loan	High-cost only	Plan loan only	Neither
Interest rate question	84%	59%	78%	84%	89%
Inflation question	68%	25%	56%	67%	76%
Risk diversification question	62%	32%	53%	58%	68%
N	10,560	790	9,037	733	7,491

Table 4 Binary logistic regression on the likelihood of taking a retirement plan loan

Variable	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*
Intercept	0.26	***	0.27	***	0.19	***	0.09	***	0.09	***
Financial literacy (all correct)	0.37	***	0.39	***	0.42	***	0.46	***	0.56	***
Socio-demographic										
Male			1.25	***	1.07		1.15	**	1.15	**
White			0.78	***	0.83	**	0.83	**	0.83	**
35–44			0.74	***	0.81	**	0.80	**	0.81	**
45–54			0.64	***	0.73	***	0.71	***	0.72	***
Married			1.15	*	1.20	**	1.10		1.10	
25,000–34,999			0.76		0.86		0.93		0.94	
35,000–49,999			0.74	*	0.85		0.96		0.98	
50,000–74,999			0.73	*	0.81		0.96		0.98	
75,000–99,999			0.82		0.87		1.18		1.21	
100,000–149,999			0.75		0.79		1.20		1.22	
150,000+			0.72	*	0.70	*	1.20		1.21	
One			2.00	***	1.84	***	1.62	***	1.61	***
Two			1.87	***	1.72	***	1.48	***	1.47	***
Three			1.83	***	1.67	***	1.38	**	1.38	**
Four+			2.43	***	2.16	***	1.72	***	1.72	***
Home							1.10		1.09	
Full							1.07		1.06	
Financial risk										
Risk class 2					0.99		1.06		1.05	
Risk class 3					1.01		1.17		1.18	
Risk class 4					1.11		1.27	*	1.27	*
Highest risk					3.22	***	3.15	***	3.10	***
Financial capacity										
Drop in income							3.58	***	4.31	***
Emergency fund							0.65	***	0.63	***
Cash surplus							0.66	***	0.66	***
Health insurance							1.37	**	1.36	**
Fin lit*drop in income									0.56	***
Year 15	0.94		0.91		0.83	**	0.89	*	0.89	*
R^2	0.05		0.09		0.13		0.21		0.21	

Note: Binary logistics regression. Reference variables not included in regression: age 25–34, income lower than $25,000, no financially dependent children, self-employed, lowest risk tolerance. ***$p < .01$, **$p < .05$, *$p < .1$.

5. Empirical results

5.1. Financial literacy and retirement plan loans

Table 4 provides the logistic regression results, displaying the likelihood of respondents stating that they used a retirement-plan loan in the past 12 months. The first column of our table shows that those who are financially literate are 63% less likely to have a plan loan. In column 2, we add a set of demographic characteristics, such as a household's estimated annual income and the number of children who financially depend on this income, gender, ethnicity, and age. We observe that financial literacy reduces the likelihood of taking out a plan loan by 61%. We also find that the use of plan loans varies strongly with gender, as males are 25% more likely to have a plan loan compared with females. Moreover, being white decreases the likelihood of having a plan loan by 22% relative to nonwhites. We also observe a strong relationship between age and the likelihood of having a plan loan. As individuals get older, the odds of taking a retirement plan loan decreases. With regards to children, the presence of dependents within a household increases the odds of taking a retirement loan. In column 3, we add a set of variables that measure the level of risk tolerance. We find that respondents with the highest risk tolerance level are 222% more likely to have a plan loan than those in the lowest risk tolerance class.

Within the fourth column, we complete our model by taking into account financial capacity. Therefore, we include variables that would provide some protection against an income or wealth shock. These variables include having an emergency fund, positive cash flow, and health insurance. Our results suggest that individuals who have an emergency fund are 35% less likely to take a loan plan. Likewise, individuals with a positive cash flow are 34% less likely to borrow from their retirement account. Conversely, individuals who experience an income drop are 258% more likely to have a loan plan than those that have not reported one. Respondents who have health insurance are 37% more likely to have a loan plan than those who do not have health insurance. This could be attributed to the presence of a high deductible health insurance plan. Unfortunately, we are unable to compare different forms of health insurance due to data limitations. The negative relation between financial sophistication and the likelihood of having a plan loan is significant. We find that financial sophistication reduces the likelihood of having a plan loan by 44%. In column 5, we add interaction terms to see if financial literacy can offset the effects of a drop in income. We find that being financially literate and reporting a decline in income reduces the likelihood of having a plan loan by 44%, compared with those who are not financially literate.

5.2. Financial literacy and HCB

Table 5 provides logistic regression results on the likelihood of respondents stating that they engaged in HCB. The first column accounts for HCB in general. We see that financial literacy reduces the likelihood of engaging in HCB by 58%. We observe that as income increase, the odds of accessing a high-cost loan decrease. Similar results are found as the number of financially dependent children within a household increases. Those who own their

Table 5 Binary logistic regression on the likelihood of high-cost borrowing

	Using high-cost borrowing		Using auto title loans		Using a pawn shop		Using payday loan	
Variable	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*
Intercept	0.92		0.12	***	0.35	***	0.37	***
Financial literacy (all correct)	0.42	***	0.34	***	0.37	***	0.30	***
Socio-demographic								
Male	1.29	***	1.40	***	1.47	***	1.35	***
White	0.76	***	0.91		0.81	**	0.63	***
35–44	0.74	***	0.61	***	0.71	***	0.70	***
45–54	0.58	***	0.49	***	0.52	***	0.50	***
Married	0.99		1.18	**	0.88		1.00	
25,000–34,999	0.86		0.84		0.70	*	0.97	
35,000–49,999	0.66	**	0.72	*	0.53	***	0.89	
50,000–74,999	0.65	**	0.59	**	0.58	***	0.77	
75,000–99,999	0.54	***	0.63	**	0.43	***	0.65	**
100,000–149,999	0.40	***	0.54	**	0.30	***	0.56	**
150,000+	0.31	***	0.50	**	0.24	***	0.44	***
One	1.79	***	1.61	***	2.06	***	2.07	***
Two	1.99	***	1.79	***	2.15	***	2.30	***
Three	2.42	***	1.60	***	2.59	***	2.58	***
Four+	1.81	***	1.93	***	2.02	***	2.56	***
Home	0.68	***	1.14		0.80	**	0.62	***
Full	1.12		1.20		0.96		1.19	
Financial risk								
Risk class 2	1.03		1.35		1.14		0.81	
Risk class 3	1.13		1.47	**	1.40	**	1.06	
Risk class 4	1.46	***	2.26	***	1.76	***	1.53	**
Highest risk	3.08	***	5.00	***	4.06	***	3.88	***
Financial capacity								
Drop in income	2.60	***	3.08	***	2.89	***	3.39	***
Emergency fund	0.76	***	1.11		1.13	*	0.63	***
Cash surplus	0.69	***	0.71	***	0.69	***	0.72	***
Health insurance	0.61	***	0.46	***	0.58	***	0.66	***
Year 15	1.03		1.30	***	1.12	*	0.98	
R^2	0.26		0.27		0.28		0.31	

Note: Binary logistics regression. Reference variables not included in regression: age 25–34, income lower than $25,000, no financially dependent children, self-employed, lowest risk tolerance. ***$p < .01$, **$p < .05$, *$p < .1$.

home are 32% less likely to engage in HCB. Consistent with the expectation that a drop in income might lead someone to participate in HCB, we find that a decline in income increases the likelihood of engaging in HCB by 160%, relative to respondents with stable or increasing incomes. Accounting for financial capacity, we see that having an emergency fund decreases the likelihood of HCB by 24%. Likewise, the presence of a positive cash flow and health insurance reduces the likelihood of HCB.

Column 2 provides results from a logistic regression on the likelihood of respondents stating that they have an auto title loan. We observe a strong negative relation between financial literacy and having a title loan. Financial literacy reduces the likelihood of having a title loan by 66%. Respondents with a recent drop in income are more than twice as likely to have an auto title loan than respondents with no such income shock. Having a cash surplus reduces having a title loan by 29%, and having health insurance reduces the likelihood of having that type of loan by 54%. Column 3 provides results from the logistic regression analysis, showing the likelihood of respondents using Pawn Shops in the past five years. The likelihood of taking a loan from a Pawn Shop decreases by 63% with financial literacy. Individuals who experience a drop in income are 189% more likely to have a pawn shop loan. Having a positive cash flow reduces the likelihood of taking a loan from a Pawn Shop by 31%. Similarly, having health insurance reduces it by 42%.

Column 4 then provides results from a logistic regression on the likelihood of respondents stating that they have a payday loan. Financial literacy decreases the likelihood of having a payday loan by 70%. As expected, those who experience a drop in income are 239% more likely to access a Pawn Shop loan than respondents whose income remained stable.

5.3. Financial literacy and improper borrowing

Table 6 provides results from six binary logistic regression analyses displaying the likelihood of a respondent engaging in improper borrowing. Specifically, we focus on the likelihood of evidence of myopic spending such as taking a cash advance on a credit card, incurring a bank overdraft, or maxing out a credit card. We then included an interaction term (financially literate*drop in income) and reran the analyses using our empirical models.

Results presented in column 1A shows that financial literacy reduces the likelihood of maxing out credit cards by 63%. Those who have a drop in income in the last year are 189% more likely to max out their credit cards, while a positive cash flow reduces the likelihood by 31%. In column 1B, we observe the relation between our interaction term and the likelihood of maxing out credit cards. Even when faced with an income shock, we find that being financially literate reduces the likelihood of maxing out credit cards by 38% compared with non-financially literate individuals. As shown in column 2A, financial literacy reduces the likelihood of having a bank overdraft by 43%. Individuals who experience a drop in income are nearly three times as likely to have an overdraft. Having an emergency fund decreases the likelihood of overdraft by 53%, and a positive cash flow reduces the likelihood by 52%. In column 2B, we add interaction terms to account for the effects of an income drop plus financial literacy on the likelihood of having an overdraft. We see that when faced with a

Table 6 Binary logistic regression on the likelihood of three forms of inappropriate borrowing

Variable	Maxed CC		Maxed CC w/ interactions		Overdraft		Overdraft w/ interactions		Cash adv on CC		Cash adv on CC w/ interactions	
	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*
Intercept	0.35	***	0.13	***	0.40	***	0.38	***	0.18	***	0.17	***
Financial literacy (all correct)	0.37	***	0.48	***	0.57	***	0.67	***	0.44	***	0.52	***
Financial literacy (all correct)	0.37	***	0.48	***	0.57	***	0.67	***	0.44	***	0.52	***
Socio-demographic												
Male	1.47	***	1.04		0.96		0.96		1.24	**	1.24	**
White	0.81	**	0.83	**	0.80	***	0.79	***	0.81	**	0.81	**
35–44	0.71	***	0.67	***	0.91		0.92		0.71	***	0.72	***
45–54	0.52	***	0.46	***	0.68	***	0.69	***	0.68	***	0.69	***
Married	0.88		1.05		1.09		1.09		0.78	**	0.78	**
25,000–34,999	0.70	*	0.67	*	0.77		0.78		0.91		0.92	
35,000–49,999	0.53	***	0.70	*	0.79		0.80		0.89		0.90	
50,000–74,999	0.58	***	0.55	**	0.74	*	0.76	*	0.75		0.76	
75,000–99,999	0.43	***	0.60	**	0.81		0.83		0.70	*	0.71	*
100,000–149,999	0.30	***	0.63	**	0.77		0.79		0.67	**	0.67	**
150,000+	0.24	***	0.48	**	0.65	**	0.65	**	0.56	**	0.56	**
One	2.06	***	1.52	***	1.55	***	1.54	***	1.49	***	1.49	***
Two	2.15	***	1.74	***	1.69	***	1.68	***	1.76	***	1.76	***
Three	2.59	***	1.60	**	1.74	***	1.75	***	1.61	***	1.61	***
Four+	2.02	***	2.46	***	2.28	***	2.27	***	1.82	***	1.82	***
Home	0.80	**	1.18	*	0.98		0.97		1.21	**	1.20	**
Full	0.96		1.02		1.01		1.01		0.75	**	0.75	**
Financial risk												
Risk class 2	1.14		1.28		1.37	**	1.37	**	1.21		1.21	
Risk class 3	1.40	**	1.55	**	1.41	**	1.42	**	1.36	*	1.36	*
Risk class 4	1.76	***	1.75	**	1.62	***	1.61	***	1.92	***	1.91	***
Highest risk	4.06	***	5.11	***	3.16	***	3.10	***	4.56	***	4.52	***
Financial capacity												

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Table 6 (Continued)

Variable	Maxed CC		Maxed CC w/ interactions		Overdraft		Overdraft w/ interactions		Cash adv on CC		Cash adv on CC w/ interactions	
	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*	Odds ratio	*p*
Drop in income	2.89	***	4.10	***	2.83	***	3.45	***	2.43	***	2.78	***
Emergency fund	1.13	*	0.69	***	0.47	***	0.47	***	0.85	**	0.83	**
Cash surplus	0.69	***	0.59	***	0.48	***	0.48	***	0.63	***	0.62	***
Health insurance	0.58	***	0.68	**	0.97		0.96		0.79	*	0.78	*
Fin lit*drop income			0.62	**			0.58	***			0.60	**
Year 15	1.12	*	0.89		0.92		0.91	*	1.01		1.00	
R^2	0.26		0.27		0.22		0.23		0.19		0.20	

Note: Binary logistics regression. Reference variables not included in regression: age 25-34, income lower than $25,000, no financially dependent children, self-employed, lowest risk tolerance. CC = credit card; adv = advance.

***$p < .01$, **$p < .05$, *$p < .1$.

decline in income, financially literate individuals are still 42% less likely to have an overdraft.

In column 3A, we observe a strong negative relation between financial literacy and the likelihood of taking a cash advance; those who are financially literate are 56% less likely to do so. Males compared with females are 24% more likely to get a cash advance loan, and Whites are 19% less likely than non-whites. Respondents indicating a drop in income in the last 12 months are 143% more likely to have to take a cash advance loan than those with stable incomes. Individuals who report having an emergency fund are 15% less likely to take cash advance than those who have no such funds, and those who have a positive cash flow are 37% less likely relative to those who have a deficit in spending. In column 3B, we add interaction terms to account for the effects of having both a drop in income and financial sophistication simultaneously. We observe that individuals with financial literacy and a decrease in income are 40% less likely to take a cash advance loan.

5.4. Financial literacy and loan choice

Table 7 provides the results of a multinomial logistic regression. The dependent variable is loan type with four levels: high-cost loan and plan loan, high-cost loan only, plan loan only, and no loan. 'Plan loan only' is the base reference for this table and the rest of this section. In comparison to having only a retirement plan loan, financially literate respondents are 65% less likely to have taken a high-cost loan and a retirement plan loan, 20% less likely to have taken only a high-cost loan, but are 58% more likely to have neither loan type relative to non-financially literate respondents. In column B, we include an interaction variable, financial literacy*drop in income. We observe that financial literacy appears to exert a moderating effect on decision-making, even when individuals are faced with a decline in income. Financially literate respondents with a recent drop in income are 52% less likely to take out a high-cost loan alternative such as a payday loan, in addition to a retirement plan loan. Recall that in column A, a drop in income was strongly associated with choosing to have both types of loans.

6. Conclusion

In an era of higher debt levels, working Americans bear greater responsibility for saving for retirement, while being at odds with traditional lenders. Using data from the NFCS 2015 State-by-State Tracking Dataset, in this paper, we study the use of two alternatives to conventional borrowing: retirement plan loans (defined as "leakage") and high-cost lenders. Furthermore, we investigate the impact of financial literacy on either accessing retirement savings before retirement or using high-cost lenders. We also touch on how financial literacy relates to optimal liquidity in a mental accounting context.

First, we show that one in four Americans are likely to borrow money from high-cost lenders, while one in six turn to their retirement plans for loans. High-cost borrowers and plan loan users display lower levels of financial literacy. When we look specifically at how

Table 7 Multinomial regression on the likelihood of loan type with plan loan only being the reference

Variable	Odds ratio	*p*	Odds ratio	
Financial literacy (all correct)	0.35	***	0.49	***
Financial literacy (all correct)	0.80	**	0.78	**
Financial literacy (all correct)	1.58	***	1.52	***
Socio-demographic				
Male	1.60	***	1.60	***
Male	1.27	**	1.27	**
Male	1.05		1.05	
White	0.86		0.86	
White	0.92		0.92	
White	1.21	**	1.21	**
35–44	0.63	***	0.64	***
35–44	0.81	*	0.81	*
35–44	1.01		1.01	
45–54	0.37	***	0.37	***
45–54	0.66	***	0.66	***
45–54	0.94		0.94	
Married	0.90		0.91	
Married	0.87		0.87	
Married	0.87		0.87	
25,000–34,999	0.90		0.92	
25,000–34,999	0.90		0.90	
25,000–34,999	1.04		1.04	
35,000–49,999	0.67		0.68	
35,000–49,999	0.59	*	0.59	*
35,000–49,999	0.92		0.92	
50,000–74,999	0.68		0.68	
50,000–74,999	0.59	*	0.59	*
50,000–74,999	0.95		0.94	
75,000–99,999	0.52	*	0.53	*
75,000–99,999	0.35	***	0.35	***
75,000–99,999	0.72		0.72	
100,000–149,999	0.41	**	0.41	**
100,000–149,999	0.24	***	0.24	***
100,000–149,999	0.69		0.68	
150,000+	0.33	**	0.33	**
150,000+	0.17	***	0.17	***
150,000+	0.65		0.65	
One	1.49	**	1.49	**
One	1.12		1.12	
One	0.65	***	0.65	***
Two	1.96	***	1.96	***
Two	1.47	**	1.48	**
Two	0.79	**	0.79	**
Three	1.90	**	1.92	**
Three	1.89	***	1.89	***
Three	0.76	*	0.76	*
Four+	1.61	*	1.61	*
Four+	1.09		1.09	
Four+	0.65	**	0.65	**
Home	0.93		0.92	
Home	0.64	***	0.64	***
Home	1.07		1.07	

(continued on next page)

Table 7 (Continued)

Variable	Odds ratio	*p*	Odds ratio	
Full	0.99		0.99	
Full	0.94		0.94	
Full	0.88		0.89	
Financial risk				
Risk class 2	1.68	*	1.68	*
Risk class 2	1.05		1.05	
Risk class 2	1.15		1.15	
Risk class 3	1.87	**	1.89	**
Risk class 3	1.04		1.04	
Risk class 3	1.05		1.05	
Risk class 4	2.25	**	2.25	**
Risk class 4	1.28		1.28	
Risk class 4	0.99		0.99	
Highest risk	4.73	***	4.75	***
Highest risk	1.18		1.19	
Highest risk	0.56	***	0.56	***
Financial capacity				
Drop in income	2.66	***	3.00	***
Drop in income	0.79	**	0.76	**
Drop in income	0.39	***	0.36	***
Emergency fund	1.62	***	1.59	***
Emergency fund	1.44	***	1.44	***
Emergency fund	2.21	***	2.22	***
Cash surplus	0.88		0.87	
Cash surplus	1.09		1.09	
Cash surplus	1.53	***	1.53	***
Health insurance	−0.19		0.82	
Health insurance	−0.78		0.46	***
Health insurance	−0.15		0.86	
Fin lit*drop income			0.48	**
Fin lit*drop income			1.09	
Fin lit*drop income			1.21	
Year 15	1.45	**	1.44	**
Year 15	1.28	**	1.28	**
Year 15	1.37	***	1.37	***

Note: Multinomial logistics regression. The dependent variable is loan type with four levels: high-cost loan and plan loan, high-cost loan only, plan loan only, neither loan. Plan loan only is the based reference. Reference variables not included in regression: age 25-34, income lower than $25,000, no financially dependent children, self-employed, lowest risk tolerance. ***$p < .01$, **$p < .05$, *$p < .1$.

respondents answer each question, plan loan users were more likely to correctly respond to the interest rate question but not the questions on inflation and risk diversification. We observe similar results among high-cost borrowers. Nevertheless, if respondents only used plan loans and failed to use any high-cost loans in the last five years, they were more likely to answer the questions correctly, when compared with respondents that had both types of loans or high-cost loans only. This provides evidence of higher financial knowledge among respondents who only use plan loans.

Our empirical results indicate that individuals using retirement plan loans are more likely to be younger males, to be non-White, to have children, to have seen a recent drop in income, and to have an affinity for financial risk-taking. When determining the likelihood of having a retirement plan loan, income appears to have no effect while having health insurance increases the use of plan loans; however, we provide evidence that users of high-cost lenders are less likely to have incomes at or above $35,000, and less likely to borrow to meet health shocks. Moreover, the findings on the effect of financial capacity on these two loan alternatives show that respondents who report deficit spending and no precautionary savings are more likely to borrow from their retirement plan and/or high-cost lenders. Notably, when looking individually at the three types of high-cost lenders, we observe differences in the effect of having an emergency fund. In comparison with respondents with no emergency funds, those with precautionary savings are less likely to have a payday loan.

When we consider other forms of high-cost borrowing and conduct regression analyses, we find a higher likelihood of maxing out credit cards, having bank overdrafts, and taking cash advances on credit cards. This behavior is specifically displayed among nonwhites, individuals with kids, those with an increased tolerance for financial risk, and those who have had a recent drop in income. Also, homeowners appear more likely to turn to credit cards to meet short-term liquidity needs.

A striking finding across all of our empirical analyses is the strong effect of financial literacy on borrowing decisions. Financial literacy plays a significant role in explaining why individuals use high-cost lenders and retirement plan loans. Specifically, individuals who could answer all of the financial literacy questions correctly (deemed to be "financially literate") were unlikely to turn to high-cost lenders or retirement plans as a loan option. These findings are consistent with Lusardi and Mitchell (2014) and Disney and Gathergood (2012), where both studies highlighted that users of high-cost debt are more likely to lack financial knowledge.

We also find that financial literacy explains myopic spending patterns. The financially literate are unlikely to turn to credit cards and bank overdrafts when faced with income shortfalls. We do not ignore the effect of a recent drop in income on borrowing choices. Noteworthy, we find that financial literacy is a moderating factor even when faced with a loss of income. This is an important finding because it provides evidence that individuals with high levels of financial literacy are unlikely to turn to high-cost borrowers even in the face of an income shock.

The authors of this study acknowledge that retirement plan loans may allow households to increase consumption during periods when they have a liquidity constraint. The higher a respondent's financial literacy level, the less likely they are to use plan loans to smooth consumption, even when faced with an income shock. However, when confronted with a choice of borrowing from either high-cost lenders or retirement plans, financially literate respondents are less likely to choose *any* loan option that includes a high-cost lender, even when faced with an income shock. Tang and Lu (2014) showcased that individuals view retirement plan loans as a last resort. It is apparent from the results of this study that financial literacy may explain reduced plan loan use among individuals with a high level of financial knowledge.

7. Implications

Undoubtedly, saving for retirement and effectively managing debt are involved processes that require financial knowledge. The U.S. retirement savings system provides plan participants with significant liquidity regardless of economic circumstance (Beshears et al., 2015). As such, access to income via retirement saving schemes leads to significant preretirement leakage—even in the face of the 10% penalty and tax liability at one's marginal tax rate (Federal and/or State) of the amount withdrawn. By 2012, 25% of American households had some form of retirement plan leakage amounting to 70 billion dollars annually, while plan participants were only contributing $175 billion (Fellowes & Willemin, 2013). Essentially, for every $1 saved, $0.40 is withdrawn DC plans (Argento, Bryant, & Sabelhaus, 2015).

Plan loans account for a significant amount of the annual defined contribution plan leakage, but plan administrators do not adequately discuss the long-term impact on accumulated retirement wealth (GAO, 2009). Individuals may not be using plan loans to meet economic shocks, but due to time-inconsistent preferences. Individuals who display low financial literacy show evidence of improper borrowing by maxing out credit cards and having bank overdrafts. If we were to add managing a retirement plan loan to this mix, along with a job, defaults are more likely. As such, there appears to be a need for greater financial education in the workplace, particularly among those who opt to use their retirement plans before retirement, to mitigate not just define contribution leakage, but myopic spending. In other words, some individuals might need to take a loan from their retirement account to meet their basic living expenses. However, they should not remove the funds from their account to take a vacation or buy a sports car.

The Pew Charitable Trust reports that annually 12 million Americans spend $9 billion in payday loan fees and another $3 billion on auto title loans. On average, a borrower takes out eight loans per year and pays more in interest payments than the original principal. Additionally, they find that payday loans are not used for unexpected income shocks or unforeseen expenses, but to meet daily living expenses possibly caused by myopic spending. Agarwal, Skiba, and Tobacman (2009) find that even in the presence of more cost-effective liquidity options (a credit card) 66% of their sample still took out a payday loan.

The results of this study indicate that financial literacy can help explain such gross debt mismanagement. From our analysis, it is apparent that most, if not all, of the fees paid to high-cost lenders are from individuals with low levels of financial literacy. Therefore, there is a need for greater financial education and financial literacy among groups more likely to use these types of high-interest loans. Payday and Auto Title Loan companies argue that they provide a service for the underserved. Although we do not argue that they provide a needed service, there is evidence that they are hurting those they claim to help. We agree with the recommendation by the Consumer Financial Protection Bureau to cap repayment levels, and clarify loan terms, but we also add that these lenders can be a catalyst for irresponsible money management.

Notes

1 According to Vanguard's 2016 Defined Contribution Survey, in 2015, 78% of all DC plans allowed plan loans and 84% allowed hardship withdrawals.
2 There are two other forms of defined contribution leakage, namely cashouts and in-service withdrawals. The NFCS allows us to explore in-service withdrawals further.
3 See Yuh and Hanna (2010) for a thorough discussion.

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Improving collegiate financial literacy via financial education seminars

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Abstract

This paper describes a personal finance program (PFP) developed at a private liberal arts university aimed to improve financial literacy. We provide a program overview, with details about recruiting, program structure, and curriculum. Using a multivariate framework, we examine program effectiveness at improving students' financial knowledge and confidence in their financial future. Our findings demonstrate that financial knowledge and confidence improve. Additionally, women (minorities) narrow their financial knowledge and confidence gaps when compared with men (Caucasians) and the control group. Finally, follow-up analyses show that increases in confidence appear justified (vs. misplaced) in that they are calibrated to increases in knowledge.

JEL classifications: G0; G5; I3

Keywords: Financial literacy; Education; Retirement planning; Personal finance

1. Introduction

As this paper was being written, the coronavirus disease 2019 (COVID-19) pandemic was ravaging the globe, bringing with it not only illness but significant economic uncertainty. In

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the United States, state and local governments closed businesses deemed "non-essential." World-wide responses were similar, as countries placed travel restrictions on their citizens and enacted various economic restrictions (https://www.aljazeera.com/news/2020/03/coronavirus-travel-restrictions-border-shutdowns-country-200318091505922.html). The closures brought massive unemployment and income loss.

While much about the pandemic was and remains uncertain, one consistent issue was and is apparent: most individuals and families were unprepared for such an economic shock. One likely explanation for the lack of preparedness is low financial literacy levels, which has been documented in a variety of studies (Lusardi & Mitchell, 2014). It is imperative that tools be developed to improve personal financial literacy and that these tools be implemented quickly and in as many forums as possible.

Although this study began well before the COVID-19 pandemic, the pandemic serves as an important reminder that financial literacy is essential for a highly functioning society. Each day, individuals and households make financial decisions that have greater and further-reaching consequences. Households must manage their consumer credit levels (currently over $4 trillion in the United States, see https://www.federalreserve.gov/releases/g19/current/ as of April 2020), including credit cards, student loans, car payments, and other miscellaneous debt finances, as well as mortgage debt. Households must manage savings and spending decisions and decide what investment types should be utilized. Finally, households must plan for, set aside money for, and make investment decisions about retirement, a responsibility unheard of a generation ago. Therefore, while households are advantaged by increased access to financial markets, they must first have the financial knowledge necessary to interact with such markets or risk potentially drastic financial consequences.[1]

Additionally, individuals must have confidence in their ability to make these decisions effectively and manage their financial future. For example, research (Farrell, Fry, & Risse, 2016) shows that women's confidence in their financial capabilities predicted positive financial behaviors (i.e., they were more likely to have financial products related to saving and investing funds). At the same time, other research suggests that if confidence is overblown and not commensurate with knowledge, this could lead to poor decision making and engaging in costly behaviors (Krueger & Dunning, 1999; Toker Asad, 2015).

Unfortunately, existing research shows that generally, people lack financial knowledge and confidence. For example, the 2004 Health and Retirement Study (HRS) finds that among older individuals, financial knowledge is quite low, with only 34.3% of respondents correctly answering a series of three questions regarding financial calculations, and only 70% answering two of the three questions correctly (Lusardi & Mitchell, 2011). These same three questions have been used in other studies gauging financial knowledge (e.g., the RAND American Life Panel; Lusardi & Mitchell, 2011, 2017; Lusardi, Mitchell, & Curto, 2010). All of these studies report findings similar to the HRS study: financial knowledge in the United States is quite low. For an exhaustive literature review documenting low financial knowledge levels, see Lusardi and Mitchell (2014).

Thus, in our research, we presume that financial knowledge is low and that it needs to improve. As such, the current study explores the effectiveness of a financial education program for graduating seniors at a liberal arts university intended to improve participant financial literacy. The program was developed because the institution had limited offerings of a for-credit Personal Finance

course. On average, there was annual capacity for approximately 25 students in the for-credit course, but it was common for the course to be oversubscribed by 100 or more students. The personal finance program (PFP) was developed to address the gap in offering this kind of course and provide a controlled opportunity to assess its effectiveness in increasing financial literacy.

We define financial literacy as "people's ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions" (Lusardi & Mitchell, 2014). This definition encompasses two critical dimensions: knowledge *and behavior*. Most research focuses on knowledge or attempts to infer behavior from data such as the Survey of Consumer Finances. Or, previous research associates higher knowledge with "better" behaviors (e.g., Fox, Bartholomae, & Lee, 2005; Henager & Cude, 2016; Lusardi, 2008), but due to the correlational nature of that research, the conclusions are inferences at best. To our knowledge, there is no work directly examining programs aimed at improving knowledge and any subsequent behavioral changes that follow. The current study addresses the first step in increasing financial literacy. That is, we measure baseline levels of financial knowledge for a treatment group and a control group, then expose the treatment group to the PFP, and then measure financial knowledge again for both groups.

We also measure changes in confidence level. As described above, there are competing predictions about the potential benefits of increasing confidence along with knowledge. Nonetheless, research seems to agree upon the notion that increased confidence is a benefit, as long as it is matched with increased knowledge. Indeed, Toker Asad (2015) summarized, that "financial literacy initiatives should focus not only on factual knowledge, but on helping individuals achieve a healthy dose of confidence." Thus, we ask participants how confident they are in managing their financial future (not how confident they are in their answers or knowledge) and can assess if this increases alongside actual financial knowledge.

To summarize, the current research gauges the PFP's efficacy in improving financial knowledge and increasing confidence in the ability to manage one's financial future. Using multivariate regression techniques, our analysis finds that program participants improve both financial knowledge and confidence about their financial future, after controlling for other factors that might influence these outcomes for college students. The results suggest that, although PFP and control group participants do not differ in knowledge at baseline, PFP participants show significantly higher financial knowledge levels from the pre- to the post-test, as well higher financial knowledge than control subjects after completing the PFP. The findings for participants' confidence in their ability to manage their financial future are similar; participants are more confident about their financial outlook compared with before the PFP, and the control group shows no change in confidence over time. On the surface, the finding about improved confidence may seem suspect, given that people are often overconfident about their financial future. However, additional analysis demonstrates that seminar participants not only increase their confidence, but that this increase is calibrated with increases in knowledge level, a result not found for the control group.

A particularly encouraging set of findings relate to participant gender and minority classification. According to pre-PFP survey results, and consistent with prior work (Lusardi & Mitchell, 2014 and others), individuals who are female or represent a minority group scored significantly lower on the financial knowledge test. However, participation in the PFP program largely eliminates the knowledge gap between women and men and between

minorities and Whites. Additionally, women and minorities significantly improve their confidence in managing their financial future after completing the PFP.

These findings suggest that this program (1) is a valid tool for improving financial knowledge that others should consider employing and (2) provides evidence that a follow-up study linking increased knowledge and confidence more directly to financial behaviors is worthwhile. As such, the PFP series is the first step in a long-term research program in which students will be surveyed after graduation to ascertain whether students participating in the PFP demonstrate better financial behaviors than students who do not. That research is currently underway.

The remainder of this paper is organized as follows: Section 1 overviews the PFP, including the recruitment process, seminar structures, and curriculum. Section 2 reviews the literature regarding financial knowledge and literacy. Section 3 details the survey instruments used in the study. Section 4 discusses hypothesis development, introduces the empirical model and provides a preliminary analysis of data. Section 5 empirically evaluates the effectiveness of the PFP in a multivariate framework. Section 6 provides conclusions.

2. Section 1: PFP overview and research method

The PFP was developed and has been taught by a team of faculty for seniors at a private liberal arts college over the 2017-2019 period.[2] The program consists of six individual sessions (the curriculum is described below) and is strictly voluntary, with students attending as many or as few sessions as they wish. Programs are normally offered during the fall and spring semesters, one night per week for six weeks in a face-to-face format.

Senior-class student participants are solicited at the beginning of each semester via an email outlining the program content and voluntary time commitment. Additionally, an email is sent to the parents of seniors detailing the program. Only seniors are recruited for the program because they are about to face the challenges of real-world financial choices. Anecdotally, program developers found that seniors begin to take financial issues more seriously as they realize that they will soon be in the "real world." Indeed, students generally report that they sign-up for the program because they believe learning the information is important (i.e., a question on the seminar participant presurvey asks if students are attending because "My parents 'gently' encouraged me," "I heard about it from past participants," or "I recognize that I need to know about these topics." Almost 75% report that they participate because they recognize that they need to know about the topics). Students have approximately two weeks to register and several reminder emails are sent out as the deadline approaches.

From the seniors not participating in the PFP, a control sample is recruited. Before the first seminar session, both control and treatment groups are introduced to the logistics and purpose of the research portion of the program, and are asked to complete two on-line surveys (for students in the PFP, these occur before and after they take the course). The control group receives a survey approximately six weeks after the initial survey. In addition to demographic information, a series of 20 questions is used to assess financial knowledge levels. When participants indicate they want to participate, they complete the presurvey online.

Each PFP session has a lecture format, but students are encouraged to ask questions. Although there is some curriculum variance across program offerings each semester, it is minimal, as the same slides are used during each program offering to maintain curriculum consistency. The curriculum covers budgeting, credit management, risk and return, mutual funds, retirement planning, and risk management (insurance). These topics were chosen based on their relevance to this particular age group and their relationship to the four areas identified by Huston (2010) as being critical to financial literacy. A summary of each module is provided in Appendix. The underlying theme across each module is to develop the students' knowledge necessary to maximize their "net worth" or their "wealth" over their lifetime. This message is stressed at the beginning and end of each session. Additionally, faculty discuss how each topic relates to net worth. Each session begins with a review of the previous week's session and time to ask questions about prior material. Sessions end with a summary of the current week's information, along with more time to ask questions.

Shortly after the last session, students (participants and control students) are asked to voluntarily complete the postsurvey containing approximately 50 questions, including the same questions in the presurvey measuring financial knowledge. Thus, the change in score on this knowledge survey determines the efficacy of the instructional program. Participants and control students receive $10 in compensation for each survey they complete.

3. Section 2: Literature review

The focus of the current study is to test whether students participating in the PFP improve what many prior studies refer to as financial literacy—what we refer to as financial knowledge. Huston (2010) demonstrates that in prior research, terms such as financial knowledge, financial education, and financial literacy have been used interchangeably. Beginning with the National Endowment for Financial Education summit in 2005, a consensus began to develop that financial literacy has two distinct elements: a financial knowledge component *and* the measurement of actions/behavior based on that financial knowledge.[3] In other words, to truly evaluate financial literacy, one must evaluate knowledge *and* behavior. Furthermore, most academic literature measures financial behavior or knowledge independently from one another, or infers a relationship between financial knowledge and current financial behaviors (e.g., see Allgood & Walstad, 2013; Gerardi, Goette, & Meir, 2013; Henager & Cude, 2016). As discussed previously, we distinguish between financial knowledge and financial literacy in this study, focusing on financial knowledge.

Huston and others note that research on financial knowledge inconsistently represents and measures knowledge. Huston (2010) identifies four content areas that have been and should be addressed with financial education: money basics, borrowing, investing, and insurance. Nonetheless, he reports that 35% of studies address only one content area, 40% address two or three areas, but only 25% address all four content areas. The PFP specifically addresses all four content areas leading to a more robust evaluation of financial knowledge. Similarly, researchers (Association for Financial Counseling and Planning Education, 2006; Bosshardt & Walstad, 2014; Huston, 2010; Knoll & Houts, 2012) lament the fact that studies measuring financial knowledge often use widely different questions to measure it. Huston (2010) finds that researchers use three to 45 questions, with most studies using three to five, largely

centered on money basics and investing, to measure knowledge. Knoll and Houts (2012) address this issue and developed a knowledge test of 20 questions from past research that is psychometrically validated using Item Response Theory and covers each content area identified in Huston (2010).[4] We use those same questions for our knowledge test.

4. Section 3: Survey construction

In addition to the knowledge questions from Knoll and Houts (2012), the pre-seminar survey instrument captures demographic information. For the student, we capture gender, race, age, college major, whether the student is a student-athlete, as well as the sources/weights of how they pay for college: grants, loans, parent, or self. In addition to the student demographic data, we collect data about parents. For example, the students provide information about household income, parent educational attainment, and parent profession. The demographic information is not repeated on the post-seminar instrument.

One of the unique benefits of our study design is that the survey poses questions that address a variety of psychological characteristics that may impact whether students choose to participate in the program and that may influence the student's propensity to develop their financial knowledge. Equally important, we ask a series of questions targeted at ascertaining the students' confidence in their post-college financial future, confidence in each of the topics to be covered in the PFP, whether or not the student has experienced any health or financial stress during the period before the seminar, and what the student's overall perception of how satisfied they are with their lives. The questions related to the psychological characteristics and confidence are repeated in the postsurvey instrument.

Our interest in student confidence is intentional. While some prior work indicates that individuals have misplaced confidence in their financial knowledge (e.g., Toker Asad, 2015), our focus is on whether students are confident about their ability to manage their financial future, not confidence in their responses to knowledge questions. We examine whether the PFP has an impact on this type of student confidence.[5] To the extent that the statement "knowledge is power" is true, then the PFP may lead to an improvement in students' perception that they can manage their financial future. Our research design allows us a unique way to assess whether confidence is justified or overblown. If there is an increase in financial confidence without an improvement in financial knowledge, we would be reluctant to classify the program as a success. However, if we see an increase in confidence with a corresponding improvement in financial knowledge, we will be more emboldened to consider this stage of the research successful, warranting further analysis of behaviors.

5. Section 4: Hypothesis development, empirical model, and summary statistics

5.1. Section 4.1: Hypotheses

The primary purpose of the PFP program is to improve college student financial literacy as measured through an evaluative survey and ultimately behaviors. Thus, the foundational

hypothesis is that the program will improve financial knowledge for our participants (treatment) and that no similar increase would be found for the control group (future research will address changes in behaviors after the program.) Specifically:

Hypothesis 1: After participating in the PFP, participants (treatment group) will score higher on the financial knowledge portion of the post-survey than they did on the pre-survey AND non-participants (control group) will show no improvement from the pre- to post-test.

Prior research demonstrates that women have lower financial knowledge levels than men (e.g., Lusardi & Mitchell, 2007; Lusardi & Tufano, 2009; Lusardi et al., 2010). A program that effectively improves financial literacy should do so for all. As such, Hypothesis 2 states:

Hypothesis 2: Female PFP participants will score no differently than male participants on the financial knowledge portion of the post-survey following completion of the PFP, that is, assuming women will score lower on the pre-survey (as has been found in previous research), with exposure to the seminar, female participants will close this knowledge gap with their male PFP peers.

As with gender, prior research shows that minorities exhibit lower levels of knowledge than their peers (e.g., Lusardi & Mitchell, 2007, 2011). A successful program should help close or eliminate this gap if effective. As such, Hypothesis 3 states:

Hypothesis 3: Minority PFP participants will score no differently than White peers on the financial knowledge portion of the post-survey following completion of the PFP program, that is, assuming minority participants will score lower on the pre-survey (as has been found in previous research), with exposure to the seminar, minority participants will close the knowledge gap with their White peers.

PFP is available only to senior undergraduate students. The transition from college into the next phase of life, traditionally either graduate school or into a job environment, requires a significant change in one's level of independent financial decision-making. Those students who perceive themselves to be less prepared for such a transition are likely to face increased anxiety and lower confidence regarding their financial future, which could increase the likelihood of students failing to act on important financial decisions. If PFP effectively improves financial knowledge, then we would predict that confidence in the ability to manage one's financial future may also increase. Note that this confidence metric does not gauge a student's confidence in how they answered the financial knowledge questions, but the student's confidence in their ability to manage their financial future after college. The survey question used to gauge their confidence is "I consider myself to be _____ about managing my personal finances after college," with five responses ranging from "Not at all confident" to "Extremely confident." Based on responses to this question from the pre and post PFP surveys, Hypothesis 4 states:

Hypothesis 4: PFP participants (treatment) will express higher levels of confidence regarding their future financial outlooks in the post-survey relative to the pre-survey, and non-participants (control) will see no such change.

5.2. Section 4.2: Empirical model (see Table 2 for a summary of variable definitions)

A significant strength of this research relative to prior work is the pretest, post-test design with a control group comparison. Thus, the authors utilize a multivariate difference-in-difference regression to analyze the program's effectiveness. The model is as follows:

$$\begin{aligned} FinLitVar = {} & \alpha + \beta_1 PostPFP\,Dummy + \beta_2 Treatment + \beta_3 (Treatment * Pst) \\ & + \beta_4 Gender + \beta_5 (Gender * Post) + \beta_6 Minority \\ & + \beta_7 (Minority * Post) + \Sigma \beta_j Characteristicsj + \varepsilon_i \end{aligned} \tag{1}$$

FinLitVar represents the dependent variable of interest, which is either *KnowScore*, the number of correct financial knowledge questions answered on the student survey, or *Confidence*, a student's confidence level regarding their future financial outlook. *Post* is a dummy variable that equals 1, reflecting survey results submitted after PFP completion and 0 otherwise. Both the treatment group and the control group submit the survey results shortly after the completion of the PFP. *Treatment* is a dummy variable equal to 1 if the survey results are submitted by a student who *did* participate in the PFP program and 0 otherwise. *Gender* represents a student's self-reported gender. Though students were provided options of "transgender," "other," and "prefer not to answer," all participants selected either male or female; thus, *Gender* is a dummy variable equal to 1 if female and 0 otherwise. *Minority* is a dummy variable equal to 1 if the student self-identified as belonging to a minority race and 0 otherwise.

Characteristics represents a series of control variables with the following description. *GPA* is a student's grade point average based on a traditional 4.0 scale at the end of the students' junior year. These are official GPA's provided by the university, not self-reported. When *KnowScore* is the dependent variable, we expect *GPA* to be positive. If higher grades promote self-confidence generally, then *GPA* may be positively correlated with a student's confidence in their ability to manage their financial future. Alternatively, stronger academic students may have a greater appreciation for the significance of these issues that manifests itself in lower confidence. *Loanperc* is the student's self-reported level of student loan debt to total college cost, and *Selfperc* is the amount of education costs being covered by the student, but not in the form of student loans or paid by a parent, both stated as a percentage of total college costs. Each of these measures accounts for financial factors that might be correlated with knowledge and confidence. We argue that students who finance more of their education with debt will have lower knowledge scores and lower levels of confidence in their financial future. We expect the opposite (a positive relationship) with the dependent variables for *Selfperc*.

Income is a categorical variable ranging from one to six, representing ranges of family income, with a minimum category of less than $25,000 and a maximum category of more than $150,000. While prior studies (Lusardi & Tufano, 2009) show respondents with lower incomes have lower levels of financial knowledge, our inclusion of *Income* is a proxy measure since it is not the student's income being measured. However, if lower household incomes mean financial knowledge is not transferred, then the students from these

households may also exhibit lower scores. We expect students from higher earning families to have more confidence in their financial future. *ECNBUSACC* is a dummy variable equal to 1 if the student is majoring in either economics, business administration, or accounting (the university does not offer the full range of business degrees) and 0 otherwise. We expect students from these majors to have higher levels of knowledge and confidence, in part due to their exposure to the seminar contents within their disciplines.

The next control variable is unique. Students were asked "How much do you think you will need to retire?" Upon initial data examination, a nontrivial number of students chose not to answer the question.[6] After significant thought, the authors hypothesized that the students that did not answer the question may be particularly at risk in terms of their financial knowledge and confidence. *NoRetAns* is a dummy variable equal to 1 if a student did not answer the survey question about the amount needed for retirement and 0 otherwise. We expect an inverse relationship between *NoRetAns* and both dependent variables, *KnowScore* and *Confidence*.

FinServ is a dummy variable equal to 1 if a student responded that either (or both) parent (s) work in the financial services industry. These parents may be more likely to pass on knowledge and develop confidence in their students relative to parents in other professions, so we expect a positive relationship to the dependent variables. Finally, *NeedCog* stands for the psychological construct "Need for Cognition," which captures individual differences in how much people engage in and enjoy thinking, measured by an 18-item scale (see Cacioppo & Petty, 1982). Example items include, "I find satisfaction in deliberating hard and for long hours," and "I only think as hard as I have to – reverse-scored." Each question uses a 5-point Likert scale for answers. So, *NeedCog* can range from 0 to 90. Unlike Lusardi et al. (2010) that control for cognitive *abilities*, our measure captures a student's propensity to be open to learning and deep thinking, factors pertinent to participating in an educational program. We expect students with a higher need for cognition to actively seek knowledge generally and that includes financial knowledge. As such, we expect a positive relationship between *NeedCog* and *KnowScore*. The predicted relationship to *Confidence* is less clear. If a student's need for cognition leads them to seek out information about financial issues, that could lead to more confidence. Conversely, students with a higher need for cognition may recognize the weighty nature of financial topics in a way that leaves them less confident.

In addition to the variables just discussed, the following variables are used when *Confidence* is the dependent variable. *Health* is the sum of the responses (on a Likert 5-point scale) to two questions regarding student health, one that asks if the student has experienced significant emotional or mental health issues in the past month and the other that asks whether the student has experienced significant financial distress in the past month. Students that have experienced high levels of stress may also report less confidence in their ability to manage their financial future. *LifeSat* is the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) that measures subjective global well-being and is a composite measure of five questions, each of which has responses on a 7-point Likert scale. Students with low satisfaction levels are expected to have lower levels of confidence in their financial future.

For our primary analysis, we estimate Eq. (1) using ordinary least squares with a difference-in-difference model to help mitigate the inherent endogeniety based on a student's choice to participate in the PFP. Roberts and Whited (2013) recommend this approach when

the sample has both a treatment and control group, but also when there is a pretreatment and post-treatment measurement of the treatment effect (participation in the PFP), which exactly describes our research design. That is, both treatment and control participants have pre-PFP knowledge scores (confidence scores) and post-PFP knowledge (confidence scores), thereby doubling the number of observations from 161 (158) to 322 (316). With this approach that is able to control for baseline measures of knowledge and confidence, any findings associated with the treatment effect can be unbiasedly attributed to the treatment.

While we use the least squares methodology as our primary statistical technique, we also estimate Eq. (1) for the dependent variable *Confidence* using the ordered probit technique. Because *Confidence* is measured as a value from 1 to 5, the assumption of linear change between values implied by the least squares technique may not hold. To account for the possibility of this nonlinear movement between values, the ordered probit technique is employed as a robustness check. As noted below, the results demonstrate that the variables of interest have the same statistical and directional effects using both techniques; however, we choose to discuss our results in the context of the least squares technique due to its more straight-forward interpretation.

5.3. Section 4.3: Preliminary data analysis

5.3.1. Section 4.3.1. data analysis sample construction

The first delivery of the PFP occurred in fall 2017 and was delivered successively in the spring 2018, fall 2018, spring 2019, and fall 2019 semesters. While over 500 students (program participants and control respondents) initiated a pre-seminar survey over the course of the five semesters, only 161 (158) completed both surveys with all of the required data needed to estimate Eq. (1) above for *KnowScore* (C*onfidence*). In total, for the semesters identified above, there are 10, 2, 17 (15), 12, and 50 (49) control respondents respectively for *KnowScore* (*Confidence*) and 18, 11, 15, 5, and 21 PFP participants, respectively, from the same semesters. As is evident from the usable responses in each semester, statistical analysis required the aggregation of respondents across semesters. However, we do control for any semester differences that might be present by including a dummy variable representing each semester except fall 2017. In no case are the semester dummies statistically significant. We use these samples in the analysis discussed in Tables 2-6. The exception to this is the results in Table 1, which analyzes the characteristics that predict PFP participation, a subject to which we now turn.

5.3.2. Section 4.3.2.: Predicting PFP participation

While our primary interest is in the impact of the PFP on financial knowledge and confidence, a unique characteristic of this program is that students self-select into the program, and it is completely voluntary. As such, we first examine a logit model to determine if there are student characteristics that predict participation. The dependent variable has a value of 1 if the student participates in the PFP and 0 otherwise. The variables used are discussed above. For this analysis, we use all observations (428 total, 222 control respondents, and 206 seminar participants) that have the necessary data to estimate the logit model from pre-seminar survey data. We believe the results may be specific to the population of students served; therefore, we draw no generalized conclusions from the analysis. However, the results are of

Table 1 Logit model predicting PFP participation

Variables	(1) Treatment
KnowScore	−0.0649
	(0.0550)
GPA	−0.157
	(0.288)
Confidence	−0.697***
	(0.139)
Gender	0.620**
	(0.304)
ECNBUSACC	0.687
	(0.369)
Loanperc	−0.287
	(0.823)
Selfperc	1.017
	(2.141)
Minority	−0.803
	(0.447)
Income	−0.141
	(0.0965)
NeedCog	0.0143
	(0.0115)
FinServ	0.351
	(0.319)
NoRetAns	−1.059***
	(0.396)
Recent Emotional/Mental Distress	−0.244**
	(0.1000)
Recent Financial Distress	−0.0988
	(0.124)
LifeSat	0.0603**
	(0.0236)
Observations	428

This table presents results from estimating a logit regression to predict student participation in personal finance program (PFP). The model takes the form:

$$\text{Logit}(P(Y = 1|x_1,\ldots x_k) = [\exp(\beta_0 + \beta_1 x_1 + \ldots + \beta_n x_n)]/[1 + \exp(\beta_0 + \beta_1 x_1 + \ldots + \beta_n x_n)]$$

The dependent variable (Y) is *Treatment* equal to 1 if the student participates in PFP and 0 otherwise. *KnowScore* is a student's score on the 20 question knowledge test before the seminar. *GPA* is the student's GPA at the end of the junior year, on a 4-point scale. *Confidence* is how the student perceives their confidence in their financial future after college and ranges from 1 (*not at all*) to 5 (*extremely*). *Gender* is a dummy variable equal to 1 if the student is a female and 0 otherwise. *ECNBUSACC* is a dummy equal to 1 if the student is an economics, business, or accounting major and 0 otherwise. *Loanperc* and *Selfperc* are the percentage of student college cost paid for with debt or by the student. *Minority* is a dummy equal to 1 if the student identified as a minority and 0 otherwise. *Income* is a variable ranging from 1 (*low*) to 6 (*high*) capturing the student's household income. *NeedCog* is a composite measure ranging from 0-90 that captures a student's propensity to engage cognitive activities. *FinServ* is a dummy equal to 1 if one or both of a student's parents work in the financial services industry and 0 otherwise. *NoRetAns* is a dummy equal to 1 if the student did not answer the question "How much do you think you will need to retire?" and 0 otherwise. *Recent Emotional/Mental Distress* identifies whether the student has experienced significant emotional or mental distress in the previous 30 days and an estimate of the severity, ranging from 1 (*low*) to 5 (*high*). *Recent Financial Distress* identifies whether the student has experienced significant financial distress in the previous 30 days and an estimate of the severity, ranging from 1 (*low*) to 5 (*high*). *LifeSat* is a composite measure ranging from 5-25 that expresses a student's satisfaction with their life at the time of the pre-survey.

Note: Standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$.

Table 2 Summary descriptive statistics

Variables	(1) Matched sample	(2) Treatment only	(3) Control only
Pre KnowledgeScore	14.23 (2.473)	14.19 (2.342)	14.26 (2.581)
Post KnowledgeScore	14.832*** (2.916)	15.343*** (2.513)	14.44 (3.149)
Pre Confidence in Future	2.684 (1.004)	2.357 (0.885)	2,943 (1.021)
Post Confidence in Future	3.184*** (0.843)	3.357*** (0.638)	3.045 (0.958)
GPA	3.439 (0.427)	3.462 (0.435)	3.422 (0.423)
Gender	0.696 (0.462)	0.757 (0.432)	0.648 (0.480)
Loanperc	0.073 (0.149)	0.053 (0.117)	0.088 (0.168)
Selfperc	0.022 (0.076))	0.02 (0.072)	0.024 (0.080)
Minority	0.0683 (0.253)	0.0714 (0.259)	0.0659 (0.250)
Income	4.783 (1.298)	4.786 (1.250)	4.780 (1.340)
ECNBUSACC	0.236 (0.426)	0.243 (0.432)	0.231 (0.424)
NoRetAns	0.0683 (0.253)	0.0714 (0.259)	0.0659 (0.250)
FinServ	0.168 (0.375)	0.157 (0.367)	0.176 (0.383)
NeedCog	62.35 (11.02)	61.76 (11.26)	62.81 (10.88)
Proportion of Sample Control	0.565 (0.497)		
Observations	161	70	91

This table presents summary descriptive statistics for variables in the *KnowScore* and *Confidence* analysis. *KnowScore* is a student's score on the 20 question knowledge test. *Confidence* is the reported measure of a student's confidence in their ability to manage their financial future ranging from 1-5. *Pre* and *Post* identify either the pre-seminar or post-seminar measurement. All of the control variables listed below are captured in the pre-survey and are means for all PFP participants and control respondents that completed both surveys (column 1), the Treatment group separately that completed both surveys (column 2), and the Control group separately that completed both surveys (column 3). *GPA* is the student's GPA at the end of the junior year, on a 4-point scale. *Gender* is a dummy variable equal to 1 if the student is a female and 0 otherwise. *Loanperc* and *Selfperc* are the percentage of student college cost paid for with debt or by the student. *Minority* is a dummy equal to 1 if the student identified as a minority and 0 otherwise. *Income* is a variable ranging from 1 (*low*) to 6 (*high*) capturing the student's household income. *ECNBUSACC* is a dummy equal to 1 if the student is an economics, business, or accounting major and 0 otherwise. *NoRetAns* is a dummy equal to 1 if the student did not answer the question "How much do you think you will need to retire?" and 0 otherwise. *FinServ* is a dummy equal to 1 if one or both of a student's parents work in the financial services industry and 0 otherwise. *NeedCog* is a composite measure ranging from 0-90 that captures a student's propensity to engage cognitive activities. *Proportion of Sample Control* is the percentage of non-participants in the matched sample.

***$p < 0.01$, **$p < 0.05$.

interest because they may help in recruiting efforts for underrepresented or vulnerable groups in the future. The results are presented in Table 1.

Neither a student's pre-seminar financial knowledge score or GPA are correlated with students participating in the PFP. Thus, students who have more financial knowledge, or who generally perform well academically, are no more inclined to participate in the program than those with less knowledge or academic proclivity. However, students who are more confident in their ability to manage their financial future are significantly less likely to participate in the PFP. The coefficient for *Confidence* is negative and statistically significant at better than 1%. One interpretation is students with low levels of confidence in making future financial decisions make a wise choice to attend the PFP. Alternatively, those that choose not to participate in the seminar may have a false sense of confidence (e.g., Toker Asad, 2015). Our measure does not allow us to distinguish between these two alternatives. Of course, attending the PFP and benefitting from it are not the same, but at least those students who

Table 3 Financial *KnowledgeScore* and PFP participation

Variables	(1)	(2)	(3)	(4)
Post PFP Dummy	0.572** (0.250)	1.175*** (0.346)	−0.0401 (0.456)	0.700*** (0.252)
GPA	1.093*** (0.360)	1.092*** (0.358)	1.093*** (0.359)	1.097*** (0.356)
Gender	−0.967*** (0.287)	−0.968*** (0.288)	−1.407*** (0.364)	−0.964*** (0.287)
Loanperc	−0.222 (0.871)	−0.223 (0.873)	−0.222 (0.866)	−0.217 (0.857)
Selfperc	−0.0371 (2.012)	−0.0543 (1.951)	−0.0381 (1.999)	0.0280 (2.012)
Minority	−2.519*** (0.786)	−2.521*** (0.766)	−2.519*** (0.783)	−1.512** (0.684)
Income	0.172 (0.105)	0.172 (0.105)	0.172 (0.105)	0.172 (0.105)
ECNBUSACC	2.083*** (0.279)	2.084*** (0.277)	2.083*** (0.279)	2.083*** (0.278)
NoRetAns	−0.990 (0.717)	−0.956 (0.707)	−0.988 (0.710)	−1.12 (0.665)
FinServ	0.127 (0.346)	0.126 (0.344)	0.127 (0.342)	0.131 (0.349)
NeedCog	0.0456*** (0.0116)	0.0456*** (0.0115)	0.0456*** (0.0114)	0.0456*** (0.0116)
Treatment	0.554 (0.284)	0.0233 (0.337)	0.554 (0.285)	0.55 (0.282)
*Treat*Post*		1.062** (0.494)		
*Gender*Post*			0.880 (0.543)	
*Minority*Post*				−1.995 (1.279)
Observations	322	322	322	322
R^2	0.361	0.370	0.367	0.369

This table presents results from estimating the following equation

$$FinLitVar = \alpha + \beta_1 Post\ PFP\ Dummy + \beta_2 Treatment + \beta_3(Treatment * Post) + \beta_4 Gender + \beta_5(Gender * Post) + \beta_6 Minority + \beta_7(Minority * Post) + \Sigma\beta_j\ Characteristics_j + \varepsilon_i.$$

where *KnowScore* is the dependent variable. *KnowScore* is a student's score on the 20 question knowledge test. For each respondent in our sample there are two observations, one representing the pre-seminar survey responses and the other the post-seminar responses. Post *PFP Dummy* equals 1 if the observation represents the post personal finance program (PFP) knowledge score observation for a student and 0 otherwise. *GPA* is the student's GPA at the end of the junior year, on a 4-point scale. *Gender* is a dummy variable equal to 1 if the student is a female and 0 otherwise. *Loanperc* and *Selfperc* are the percentage of student college cost paid for with debt or by the student. Minority is a dummy equal to 1 if the student identified as a minority and 0 otherwise. Income is a variable ranging from 1 (*low*) to 6 (*high*) capturing the student's household income. *ECNBUSACC* is a dummy equal to 1 if the student is an economics, business, or accounting major and 0 otherwise. *NoRetAns* is a dummy equal to 1 if the student did not answer the question "How much do you think you will need to retire?" and 0 otherwise. *FinServ* is a dummy equal to 1 if one or both of a student's parents work in the financial services industry and 0 otherwise. *NeedCog* is a composite measure ranging from 0-90 that captures a student's propensity to engage cognitive activities. Treatment is equal to 1 if the student participates in PFP and 0 otherwise. *Treat*Post*, *Gender*Post*, and *Minority*Post* are interaction terms between *Treatment*, *Gender*, *Minority*, and *Post PFP Dummy*.

Note: Robust standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$.

are less confident take actions to address their concerns. Women are significantly (at the 5% level) more likely to participate in the program. This finding is encouraging given that women have historically shown lower levels of financial knowledge than men, a result we confirm with pre-PFP data.

Table 4 Financial *KnowledgeScore* and PFP participation

Variables	(1)	(2)	(3)
Post PFP Dummy	0.113 (0.352)	0.510** (0.257)	0.117 (0.351)
GPA	1.091*** (0.359)	1.133*** (0.358)	1.126*** (0.357)
Gender	−1.088*** (0.337)	−0.973*** (0.286)	−1.118*** (0.335)
Loanperc	−0.166 (0.865)	−0.153 (0.870)	−0.0933 (0.862)
Selfperc	−0.184 (1.962)	−0.107 (2.045)	−0.271 (1.998)
Minority	−2.509*** (0.771)	−3.008*** (0.902)	−2.939*** (0.897)
Income	0.169 (0.105)	0.172 (0.104)	0.168 (0.104)
ECNBUSACC	2.078*** (0.277)	2.095*** (0.279)	2.088*** (0.277)
NoRetAns	−0.935 (0.705)	−0.926 (0.743)	−0.879 (0.731)
FinServ	0.135 (0.342)	0.0928 (0.347)	0.107 (0.342)
NeedCog	0.0461*** (0.0115)	0.0445*** (0.0116)	0.0453*** (0.0115)
Treatment	0.0370 (0.339)	0.479 (0.278)	0.0406 (0.342)
*Fem*Treat*Post*	1.196** (0.530)		1.090** (0.532)
*Male*Treat*Post*	0.648 (0.629)		0.427 (0.630)
*Minority*Treat*Post*		2.137** (1.007)	1.889 (0.997)
Observations	322	322	322
R^2	0.372	0.368	0.377

This table presents results from estimating Eq. (1) where *KnowScore* is the dependent variable. *KnowScore* is a student's score on the 20 question knowledge test. For each respondent in our sample there are two observations, one representing the pre-seminar survey responses and the other the post-seminar responses. *Post PFP Dummy* equals 1 if the observation represents the post personal finance program (PFP) knowledge score observation for a student and 0 otherwise. *GPA* is the student's GPA at the end of the junior year, on a 4-point scale. *Gender* is a dummy variable equal to 1 if the student is a female and 0 otherwise. *Loanperc* and *Selfperc* are the percentage of student college cost paid for with debt or by the student. *Minority* is a dummy equal to 1 if the student identified as a minority and 0 otherwise. *Income* is a variable ranging from 1 (low) to 6 (high) capturing the student's household income. *ECNBUSACC* is a dummy equal to 1 if the student is an economics, business, or accounting major and 0 otherwise. *NoRetAns* is a dummy equal to 1 if the student did not answer the question "How much do you think you will need to retire?" and 0 otherwise. *FinServ* is a dummy equal to 1 if one or both of a student's parents work in the financial services industry and 0 otherwise. *NeedCog* is a composite measure ranging from 0-90 that captures a student's propensity to engage cognitive activities. *Treatment* is equal to 1 if the student participates in PFP and 0 otherwise. *Fem*Treat*Post*, *Male*Treat*Post*, and *Minority*Treat*Post* are equal to 1 if the observation represents a female (male, minority), is from the treatment group, and represents the post-seminar survey.

Note: Robust standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$.

Student major has no impact on the choice to participate in the PFP. Neither the proportion of debt or self-funding by the student predicts participation. There is no evidence that minorities are more or less likely to take the PFP. Household income (*Income*), need for cognition (*NeedCog*), and having one or both parents that work in the financial services industry (*FinServ*) are not correlated with student attendance.

Students who did not answer the question about how much they thought they would need to retire (*NoRetAns*) are significantly (at the 1% level) less likely to participate in the program. If, as the authors suspect, the students who meet these criteria are less knowledgeable, yet are more confident in their ability to manage their financial future, then it presents a challenge to identify these students and encourage participation. While experiencing a recent

Table 5 Financial confidence and PFP participation

Variables	(1)	(2)	(3)	(4)
Post PFP Dummy	0.582*** (0.132)	1.267*** (0.184)	0.289 (0.235)	0.535*** (0.133)
GPA	−0.417*** (0.160)	−0.415*** (0.160)	−0.412*** (0.160)	−0.427*** (0.161)
Gender	−0.569*** (0.171)	−0.608*** (0.173)	−0.785*** (0.223)	−0.568*** (0.171)
Loanperc	−0.723 (0.369)	−0.749** (0.377)	−0.724** (0.368)	−0.723** (0.369)
Selfperc	0.997 (0.833)	1.009 (0.794)	0.994 (0.801)	0.972 (0.842)
Minority	0.653 (0.372)	0.634 (0.376)	0.641 (0.375)	0.327 (0.516)
KnowScore	0.0933*** (0.0275)	0.0819*** (0.0283)	0.0894*** (0.0280)	0.0980*** (0.0283)
Income	0.0385 (0.0495)	0.0426 (0.0497)	0.0385 (0.0492)	0.0366 (0.0497)
ECNBUSACC	0.474*** (0.163)	0.526*** (0.167)	0.485*** (0.164)	0.465*** (0.164)
NoRetAns	−0.257 (0.432)	−0.244 (0.448)	−0.264 (0.437)	−0.203 (0.451)
FinServ	0.218 (0.183)	0.228 (0.184)	0.220 (0.183)	0.216 (0.182)
NeedCog	0.0200*** (0.00621)	0.0215*** (0.00620)	0.0204*** (0.00619)	0.0199*** (0.00621)
Health	−0.0645 (0.0430)	−0.0627 (0.0434)	−0.0682 (0.0426)	−0.0687 (0.0429)
LifeSat	0.0148 (0.0155)	0.0166 (0.0154)	0.0140 (0.0155)	0.0152 (0.0154)
Treatment	−0.241 (0.138)	−0.821*** (0.197)	−0.239 (0.139)	−0.244 (0.137)
*Treat*Post*		1.168*** (0.251)		
*Gender*Post*			0.427 (0.274)	
*Minority*Post*				0.685 (0.634)
Observations	316	316	316	316

This table presents results from estimating Eq. (1) where *Confidence* is the dependent variable. *Confidence* is how the student perceives their confidence in their financial future after college and ranges from 1 (*not at all*) to 5 (*extremely*). For each respondent in our sample there are two observations, one representing the pre-seminar survey response and the other the post-seminar response. *GPA* is the student's GPA at the end of the junior year, on a 4-point scale. *Post PFP Dummy* equals 1 if the observation represents the post personal finance program (PFP) confidence observation for a student and 0 otherwise. *Treatment* is equal to 1 if the student participates in PFP and 0 otherwise. *KnowScore* is a student's score on the 20 question knowledge test (pre or post). *Gender* is a dummy variable equal to 1 if the student is a female and 0 otherwise. *Minority* is a dummy equal to 1 if the student identified as a minority and 0 otherwise. *Income* is a variable ranging from 1 (*low*) to 6 (*high*) capturing the student's household income. *ECNBUSACC* is a dummy equal to 1 if the student is an economics, business, or accounting major and 0 otherwise. *NeedCog* is a composite measure ranging from 0-90 that captures a student's propensity to engage cognitive activities. *Loanperc* and *Selfperc* are the percentage of student college cost paid for with debt or by the student. *FinServ* is a dummy equal to 1 if one or both of a student's parents work in the financial services industry and 0 otherwise. *Health* is the sum of the values to the questions of whether the student has experienced significant emotional or mental distress in the previous 30 days and an estimate of the severity and whether the student has experienced significant financial distress in the previous 30 days and an estimate of the severity, with the value ranging from 2 (*low*) to 10 (*high*). *LifeSat* is a composite measure ranging from 5-25 that expresses a student's satisfaction with their life at the time of the pre-survey. *NoRetAns* is a dummy equal to 1 if the student did not answer the question "How much do you think you will need to retire?" and 0 otherwise. *Treat*Post*, *Gender*Post*, and *Minority*Post* are interaction terms between *Treatment*, *Gender*, *Minority*, and *Post PFP Dummy*.

Note: Robust standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$.

financially distressing event is not predictive of participation, students that have experienced a more significant emotional or mental challenge are less likely to participate in the course (at the 5% level). Finally, students who are more satisfied with their lives at the time of the seminar are more likely to take the PFP (at the 5% level). These findings support the idea

Table 6 Financial confidence and PFP participation

Variables	(1)	(2)	(3)
Post PFP Dummy	0.0989 (0.179)	0.549*** (0.131)	0.101 (0.180)
GPA	−0.416*** (0.160)	−0.388** (0.161)	−0.394** (0.160)
Gender	−0.590*** (0.204)	−0.585*** (0.171)	−0.613*** (0.203)
Loanperc	−0.759** (0.378)	−0.679 (0.369)	−0.717 (0.376)
Selfperc	1.030 (0.800)	0.955 (0.848)	0.983 (0.810)
Minority	0.633 (0.376)	0.332 (0.412)	0.396 (0.428)
KnowScore	0.0822*** (0.0283)	0.0859*** (0.0280)	0.0771*** (0.0287)
Income	0.0431 (0.0498)	0.0391 (0.0496)	0.0430 (0.0497)
ECNBUSACC	0.526*** (0.167)	0.503*** (0.166)	0.545*** (0.169)
NoRetAns	−0.248 (0.447)	−0.219 (0.445)	−0.218 (0.457)
FinServ	0.227 (0.184)	0.197 (0.182)	0.212 (0.183)
NeedCog	0.0214*** (0.00622)	0.0200*** (0.00626)	0.0213*** (0.00625)
Health	−0.0625 (0.0435)	−0.0733 (0.0433)	−0.0693 (0.0437)
LifeSat	0.0165 (0.0154)	0.0145 (0.0154)	0.0163 (0.0154)
Treatment	−0.823*** (0.197)	−0.291** (0.139)	−0.826*** (0.197)
*Fem*Treat*Post*	1.148*** (0.263)		1.097*** (0.266)
*Male*Treat*Post*	1.231*** (0.344)		1.121*** (0.326)
*Minority*Treat*Post*		1.464** (0.610)	1.101 (0.618)
Observations	316	316	316

This table presents results from estimating Eq. (1) where *Confidence* is the dependent variable. *Confidence* is how the student perceives their confidence in their financial future after college and ranges from 1 (*not at all*) to 5 (*extremely*). For each respondent in our sample there are two observations, one representing the pre-seminar survey response and the other the post-seminar response. *GPA* is the student's GPA at the end of the junior year, on a 4-point scale. *Post PFP Dummy* equals 1 if the observation represents the post personal finance program (PFP) confidence observation for a student and 0 otherwise. *Treatment* is equal to 1 if the student participates in PFP and 0 otherwise. *KnowScore* is a student's score on the 20 question knowledge test (pre or post). *Gender* is a dummy variable equal to 1 if the student is a female and 0 otherwise. *Minority* is a dummy equal to 1 if the student identified as a minority and 0 otherwise. *Income* is a variable ranging from 1 (*low*) to 6 (*high*) capturing the student's household income. *ECNBUSACC* is a dummy equal to 1 if the student is an economics, business, or accounting major and 0 otherwise. *NeedCog* is a composite measure ranging from 0-90 that captures a student's propensity to engage cognitive activities. *Loanperc* and *Selfperc* are the percentage of student college cost paid for with debt or by the student. *FinServ* is a dummy equal to 1 if one or both of a student's parents work in the financial services industry and 0 otherwise. *Health* is the sum of the values to the questions of whether the student has experienced significant emotional or mental distress in the previous 30 days and an estimate of the severity and whether the student has experienced significant financial distress in the previous 30 days and an estimate of the severity, with the value ranging from 2 (*low*) to 10 (*high*). *LifeSat* is a composite measure ranging from 5-25 that expresses a student's satisfaction with their life at the time of the pre-survey. *NoRetAns* is a dummy equal to 1 if the student did not answer the question "How much do you think you will need to retire?" and 0 otherwise. *Fem*Treat*Post*, *Male*Treat*Post*, and *Minority*Treat*Post* are equal to 1 if the observation represents a female (male, minority), is from the treatment group, and represents the post-seminar survey.

Note: Robust standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$.

that one's state of mind, including perceived stress and overall well-being predict self-efficacy, or the belief that one can set a goal and enact the necessary behavior to achieve that goal (Bandura, 1977). Enrolling in and completing the PFP required students to respond to the recruiting email, attend sessions, and complete a pre- and post-seminar survey; these

steps require a level of persistence and engagement encouraged by feeling positive about one's life and not feeling overwhelmed by stressful life events.

To summarize, students who participate in the PFP are less confident in their financial future, experience less stress and have a higher level of life satisfaction. Most importantly, the participants and the control group did not differ in pretest knowledge level, or academic ability as measured by GPA, as well as their interest in thinking (Need for Cognition), or whether their parents work in the finance industry.

5.3.3. Section 4.3.3.: Summary descriptive statistics

Table 2 presents summary descriptive statistics of financial knowledge and control variables for the sample. The sample is broken down into three groups. Column (1) reflects participants and control respondents who fully completed both the pre and post surveys. Columns (2) and (3) split the survey sample into those participating (treatment) in the PFP and those not participating (control) in the PFP, respectively, and that completed both surveys. A substantial number of students (over 400) over the course of the three years of the study completed only the presurvey as was described above.

5.4. Participant demographics (only assessed in the pretest)

Results in Table 2 show that seminar participants are (1) reasonably high academic achievers, having an average GPA of 3.4, (2) mostly women, and have (3) minimal student loans and minimal self-funding. Relatively few minorities participated in the study, although the authors suspect that is due, in part, to university demographics. The average study participant is from a relatively wealthy household; *Income* averages approximately 4.7, which is a categorical ranking corresponding with an average family income between $100,000 and $150,000. Just under 25% of study participants were majoring in economics, business, or accounting. Approximately 7% of presurvey responders failed to answer the retirement question and approximately 16% of study participants have a family member in the financial services industry. Regarding need for cognition, on a 90-point scale with 90 suggesting a substantially high need for cognition, study participants show a slightly higher than average need for cognition at around 62.

5.5. Knowledge and confidence scores

Pre-PFP completion survey results of financial knowledge scores show that all respondents correctly answer 14.23 questions out of 20 (see column 1 in Table 2). However, the control group average is 14.26, while that for the treatment group is 14.19 (columns 2 and 3 in Table 2), which is not statistically different. However, after PFP completion, knowledge scores improve significantly for the PFP participants, a change from 14.19 to 15.34—column (2), compared with no statistical change from 14.26 to 14.44 (column 3) for the control group. Additionally, financial confidence metrics also improve in a statistically significant

way for PFP participants (from 2.357 to 3.357—based on a 5-point scale), while there is no change for the control group, where metrics remain largely unchanged (2.943 to 3.045). Equally important, whereas the control (2.943) group's pre-PFP confidence is statistically higher than the treatment (2.348) group's, the treatment (3.362) group's post-PFP confidence is statistically higher than the control (3.045) group.

In summary, the univariate statistics support Hypotheses 1 and 4 (Hypothesis 2 and 3 are not tested here). PFP participants improve both their financial knowledge and their confidence in their financial future while the control group does not. The improvement in confidence is particularly compelling. Before going through the PFP, participants have a lower level of confidence than the control group. However, after completing the program, not only does the treatment group improve their confidence, but it exceeds that of the control group. Combined, the univariate results for *KnowScore* and *Confidence* are promising, and the improvement in confidence seems to be well placed given the improvement in knowledge scores and the lower level of pretest confidence reported than the control group who chose not to participate in the program.

6. Section 5: Multivariate results

6.1. Section 5.1.: KnowScore

The overall interpretation of the univariate results suggests that PFP participation improves both financial knowledge and confidence in the ability to manage one's financial future; the finding that the control group shows no such improvement strengthens the conclusion that these improvements are a product of the program and not due to time or a practice effect (e.g., taking the knowledge test twice). We now more robustly scrutinize our findings using a multivariate framework using Eq. (1) from above. Column (1) of Table 3 presents the baseline model results for our matched sample. In Table 2, there are 161 students (70 treatment and 91 control) who fully responded to both surveys. The sample size here is 322, representing an observation for the pre- and post-survey responses.

Before addressing the hypotheses directly, we briefly discuss the control variables. Neither funding their education with more debt nor more self-funding influences a student's pre- or post-knowledge score. Additionally, students not answering the question regarding the amount needed for retirement, or having parents who work in the financial services industry has any impact on pre- or post-student knowledge scores. However, students with higher GPA's have higher pre- and post- knowledge scores, as do students who are economics, business, or accounting majors, and students with a higher need for cognition. The results for the control variables clearly demonstrate that the factors influencing a student's financial knowledge are multifaceted and not solely linked to typical demographic information; thus, it is important to control for their influence on our results.

The primary variables of interest initially to test our hypotheses are *Post PFP Dummy*, *Treatment*, *Gender*, and *Minority*. The results show that post-seminar (*Post PFP Dummy*) knowledge scores are statistically higher (at the 5% level) than pre-PFP scores. The

coefficient estimate for *Treatment* is positive but not significant. In combination, these results seem to demonstrate that those participating in the PFP improve knowledge more than the control group do not. However, the results for the *Post PFP Dummy* and *Treatment* variables, while in the direction desired, do not completely provide support for Hypothesis 1 because members of the control group are included in the *Post PFP* sample, and the *Treatment* variable includes both pre- and post-results for the treatment group. Column (1) also shows that women have statistically lower scores than men at better than the 1% level, and minorities have statistically lower scores than their Caucasian peers. While the results for our gender and minority variables are consistent with prior research, as presented, they do not adequately address Hypotheses 2 and 3. Currently, the gender result tells us only that women have lower scores than do men, but does not distinguish between treatment and control, nor between pre- and post-scores. The same is true for the minority result.

Column (2) more directly addresses Hypothesis 1 by introducing the interaction term *Treat*Post*, which clearly identifies observations from the post seminar treatment group. The coefficient estimate on the interaction term is positive and statistically significant at the 5% level, indicating the treatment group improves its scores relative to the control group. The result provides strong support for Hypothesis 1.

We now turn our attention to addressing Hypotheses 2 and 3 more directly. In columns (1) and (2), *Gender* and *Minority* are negative and significant at the 1% level; however, the models do not allow us to distinguish between the pre and post-PFP scores. In column (3), we add the additional interaction term *Gender*Post*. The results are similar to those in column (2), but *Gender*Post* is not statistically different from zero, which would not seem to support Hypothesis 2. In column (4), the interaction term *Minority*Post* is not different from zero, suggesting a lack of support for Hypothesis 3.

One problem with the gender (minority) interaction is that while it segregates males from females (minorities from Caucasians) and pre- and post-scores, it includes both treatment and control females (minorities). To more directly test Hypothesis 2 and 3, we introduce three terms, *Fem*Treat*Post*, *Male*Treat*Post*, and *Minority*Treat*Post* that are equal to 1 if the observation represents a female (male, minority), in the treatment group, and corresponds to the post-PFP knowledge score and 0 otherwise. The results are in columns (1 and 2) of Table 4.

While all other results remain consistent, we find that females and minorities in the treatment group significantly narrow the knowledge gap, as *Fem*Treat*Post* and *Minority*Treat*Post* are positive and statistically significant at the 5% level. For women, when combined with the insignificant coefficient estimates on *Treatment* and *Male*Treat*Post*, we can conclude that females close the gap with males if they participated in the seminar, a finding providing support for Hypothesis 2. The results in column (2) are similarly encouraging. *Minority*Treat*Post* is positive and statistically significant, indicating that minorities close the knowledge gap after participating in the PFP. This result is consistent with Hypothesis 3. The results in column (3) show that the results are robust for women when including all of the terms in the model. In contrast, *Minority*Treat*Post* is no longer statistically significant at traditional levels. In the full model presented in column (3), Hypothesis (2) is definitively supported.

6.2. Section 5.2: Confidence

We now turn our attention to examining the impact of the PFP on a student's confidence in their ability to manage their financial future. It is important to note again that this is not confidence in whether one answered the financial knowledge questions correctly, but rather one's confidence regarding their future financial outlook. Earlier, we reported that in a univariate framework, PFP participants had significantly lower confidence than their control group peers before the seminar but that this completely reversed in the post-seminar surveys. We now determine the robustness of those results using Eq. (1). We augment Eq. (1) with *KnowScore*, *Health*, and *LifeSat* as additional control variables with an expectation that students with higher knowledge scores who are more satisfied with their lives currently will be more confident, but students who have recently experienced a higher degree of emotional/mental and financial distress will have lower levels of confidence.

The results for estimating Eq. (1) with *Confidence* as the dependent variable are presented in Tables 5 and 6. We follow a similar pattern of presentation used for *KnowScore*. While not of primary interest, a brief discussion of control variables is valuable as the analysis of confidence in a multivariate framework is new to the literature. Regardless of the model, students who are economics, business, or accounting majors are statistically more confident in their financial future, an expected outcome. Additionally, students with higher knowledge scores and a higher need for cognition have statistically higher levels of confidence in their financial future. The result for knowledge score is "comforting" in that it suggests that the confidence may not be misplaced. The result for *NeedCog* suggests that students who seek out cognitive activities feel they can acquire the skills and information necessary to be successful in their personal financial lives. Students with more of their education financed with debt generally have lower levels of confidence in their future. This finding is expected but indicates that in addition to the financial burden that student debt brings, it has a significant impact on how students perceive they can handle their financial future and likely stress levels. Finally, students with higher GPA's have statistically lower levels of confidence, an unexpected finding.

We now turn to testing Hypothesis 4. In column (1), we present a base model that indicates post-seminar (*Post PFP Dummy*) confidence levels are statistically higher, but that PFP participants (*Treatment*) do not have statistically different levels of confidence when compared with the control group. These findings do not support Hypothesis 4; however, as was the case in column (1) of Table 3, the *Post PFP Dummy* captures both control and treatment respondents, and the *Treatment* variable captures both pre- and post-survey results. To better gauge the effect of the PFP on confidence, we introduce the interaction term *Treat*Post* in column (2) to more precisely isolate the post-treatment group. The coefficient estimate for *Treat*Post* is positive and statistically significant at the 1% level, while *Treatment* is negative and significant, confirming that students in the treatment group have significantly lower levels of confidence *before* the seminar. This confirms the univariate results reported earlier and supports Hypothesis 4. So, seminar participants not only overcome their lack of confidence in their financial future relative to the control group, but their participation leads to significantly higher levels of confidence than the control group after seminar participation.

The coefficient estimates for *Gender* in columns (1, 2) indicate that women report significantly lower levels of confidence (pre and post) in their future, while minorities show no statistical difference from Caucasians. Given the starting point with respect to financial knowledge for women, the finding is expected. In columns (3) and (4), we further examine the relationship between gender (minority) and confidence. In column (3), we add the interaction term *Gender*Post*. The results suggest that women have no difference in post-program confidence levels relative to the preprogram survey. However, the coefficient estimate for *Gender* is still negative and significant, indicating women's confidence is still lower than males. However, as was the case in Table 3, *Gender*Post* groups all women together. As before, in column (4) we add the interaction term *Minority*Post*. The results suggest that there is no significant change in confidence levels in the post-program surveys.

Similar to the analysis in Table 4, we introduce *Fem*Treat*Post*, *Male*Treat*Post*, and *Minority*Treat*Post* to isolate the gender, minority, and treatment effects. Results are presented in Table 6. In column (1), we see that both women and men in the treatment (*Male*Treat*Post* and *Female*Treat*Post*) group have significantly higher levels of confidence after participating in the program, further support for Hypothesis 4. The results in column (1) are important because the coefficient estimate for *Treatment* is negative and significant, consistent with the treatment group being less confident than the control group on the presurvey, but the interaction terms, *Male*Treat*Post* and *Female*Treat*Post*, indicate that while both males and females in the program improve, they do so at levels that are now higher than the control group. We find complementary results in column (2) of Table 6 for minorities in the treatment group; their confidence is significantly higher than the control group, additional support for Hypothesis 4. The results in column (3) show that the results are generally robust when including all of the interaction terms together, although *Minority*Treat*Post* is no longer significant at conventional levels.

6.3. Section 5.3: Robustness tests

In total, our multivariate analysis supports all four of our hypotheses. However, one might argue that the measurement of *Confidence* as a discrete variable ranging from 0 to 5 makes using ordinary least squares inappropriate because the least squares technique assumes a linear change from one value of *Confidence* to another, which may not be true. As such, we also estimate Eq. (1) for *Confidence* using an ordered probit model. The results in terms of statistical significance and directional effect of variables on *Confidence* are unchanged from those presented in Tables 5-6. In total, our analysis is robust to a multivariate framework using alternative estimation techniques.

6.4. Section 5.4: Reconciling results for knowledge and confidence[7]

The results above demonstrate that PFP students see their knowledge scores and their confidence about their ability to manage their financial future rise significantly after seminar participation. The result for *Confidence* is particularly striking; PFP students go from having significantly lower confidence than the control group to having significantly higher

confidence than the control group after seminar participation. Of course, increasing confidence may not be well placed if it is not calibrated to one's financial knowledge. Prior research shows that people who overestimate their skills or knowledge often make poor decisions and suffer negative consequences (e.g., Kruger & Dunning, 1999). Indeed, if students simply believe that by participating in the seminar that they are now better able to handle their financial future, their "improved" confidence may actually result in poor financial choices. In contrast, if students believe they can better handle their financial future because they have more knowledge to apply, this increased confidence may result in more assertive and effective financial behaviors. Indeed, researchers have identified that in addition to knowledge about finance, people must have a sense of financial self-efficacy to act on that knowledge (e.g., Farrell, Fry, & Risse, 2016; Lapp, 2010) to experience long-term financial success and stability. We speculate that our knowledge and confidence findings may represent a kind of financial self-efficacy (i.e., students gain knowledge and believe in their ability to apply that knowledge to positively affect their financial future).

We now make an effort to gauge the "calibration" between student financial knowledge and confidence in their financial future. To do so, we use a simplified linear model of the form:

$$Confidence = \alpha + \beta KnowScore + \varepsilon \tag{2}$$

where we assume that a student's confidence in their financial future is fully explained by their financial knowledge. We recognize that this is a strong assumption, but we believe that this allows us to cleanly evaluate whether participation in the PFP not only increases confidence but does so in a way that tracks increases in knowledge. We should note this calibration could come in multiple forms. For example, we may have students who, before the seminar, have significant confidence in their financial future but do not possess significant financial knowledge, classic overconfidence. In contrast, students that have high levels of financial knowledge may have low levels of confidence, classic under confidence. Ideally, after participating in the PFP, a student's confidence, while having improved, will also be better calibrated to their financial knowledge level, which has also improved.

Thus, the question we examine here is whether seminar participation leads to a better calibration between a student's financial knowledge and confidence. To do so, we examine the residuals from Eq. (2) for the control and treatment groups. If the seminar is useful in better aligning a participant's knowledge and confidence, we expect the residuals for participants to decline from pre to post and the residuals for the control group to remain unchanged.

Before examining residuals from estimating Eq. (2), we use the ratio of *KnowScore* and *Confidence* to gauge whether there is a relative change in values of *KnowScore* and *Confidence* from pre- to post-seminar. The results are presented in panel A of Table 7. For the control group, the ratio of *KnowScore* to *Confidence* before the seminar is 5.657 and remains statistically similar at 5.313 after the seminar. Therefore, any changes in confidence were roughly offset by changes in knowledge scores in a relative sense. In contrast, for the treatment group of seminar participants, the ratio drops from 6.987 to 4.715, statistically significant at better than one percent. From Table 2, we know that both *KnowScore* and

Table 7 Reconciliation of financial knowledge and confidence

Panel A:			
Variables	Pre-seminar ratio	Post-seminar ratio	Difference
Control group	5.657	5.313	−0.344
Treatment group	6.987	4.715	−2.272***
***$p < 0.01$, **$p < 0.05$.			
Panel B:			
Variables	Pre-seminar residual	Post-seminar residual	Difference
Control group	0.735	0.717	−0.018
Treatment group	0.677	0.528	−0.149***

This table presents results examining the relationship between students' knowledge scores as predictors of their confidence in their financial future. In panel A, we examine the ratio *KnowScore/Confidence* to provide intuitive motivation for this discussion. In panel B, we assume that *Confidence* can be completely predicted by a student's *KnowScore*. As such, we estimate the single factor model identified as Eq. (2) in the text:

$$Confidence = \alpha + \beta KnowScore + \varepsilon$$

for both the control and treatment groups both pre- and post-seminar. We then use model parameters to estimate a predicted *Confidence* score, then take the residual between the predicted and actual scores. We then test the differences in residuals for the control and treatment groups between the pre- and post-seminar periods.

***$p < 0.01$, **$p < 0.05$.

Confidence increase for the treatment group. The result in panel A of Table 7 indicates that seminar participant confidence changes much more than knowledge in relative terms. While improved confidence is a desired outcome, it is not if it does not coincide with a similar increase in knowledge level. Seeing oneself as able to manage finances in the future would seem to suggest a willingness and confidence to apply one's financial knowledge.

In panel B of Table 7, we examine the residuals of estimating Eq. (2) for the control and treatment groups pre- and post-seminar. If the seminar simply leads to overconfidence, we would expect the residuals for the treatment group to be higher in the post-seminar survey than in the pre-seminar survey. First, students exhibit overconfidence relative to their financial knowledge. In all four cells of panel B, the residuals are greater than zero. However, in the *Treatment Group* row, residuals are statistically lower for the seminar participants (treatment group) but not the control group. This finding suggests that while PFP participants exhibit overconfidence, even after the seminar, there is better alignment between their financial knowledge and confidence in their financial future after attending the seminar, a finding not reflected in our control sample.

7. Section 6: Concluding remarks

This paper summarizes the PFP, a six-week financial literacy improvement program for senior college students at a private liberal arts college, that focuses on major areas of

personal finance. An empirical analysis of the program shows that the PFP improves financial knowledge, and has a particularly positive impact on female participants. The results for minority participants, while encouraging, are not as robust as for women. Both groups have been consistently shown to possess lower financial knowledge scores. Additionally, participant confidence regarding their future financial outlook significantly improves for all participants: male, female, and minority. Finally, we demonstrate that the improvement in confidence is well placed in that seminar participants demonstrate an improvement in their ability to calibrate their improved confidence to their improvement in financial knowledge. This study extends the previous literature in that the PFP is six-weeks long (that is longer than many other interventions), and the change in knowledge and confidence from before and after the program was compared with a control group. Furthermore, the study measures several individual difference factors, allowing the researchers to utilize multiple regression analysis techniques.

The study is not without its limitations. First, we do not measure changes in student behavior. Our speculation about the connection between increases in knowledge and confidence may lead to increased financial self-efficacy can only be tested if we examine how these increases are reflected in behavior. In other words, we can examine if the combination of more knowledge and confidence predicts acting on that knowledge in financially sound ways. The authors are in the process of collecting follow-up behavioral data on the study participants reviewed here.

Second, our research is limited by the sample we use. Due to the nature of the PFP, participants have been limited to only senior level students at a private liberal arts college, that is, the conclusions drawn from this study are limited to a very specific portion of the population. However, the authors are currently expanding the PFP to other universities and are currently summarizing results obtained from a faculty or staff version of the PFP. Finally, given the demographics of the student population represented, we are hesitant to claim all college seniors will respond in similar ways to the program. More research is needed to validate the curriculum in a more diverse setting. Ultimately, this paper expands upon financial literacy research and outlines a robust tool for addressing financial knowledge and confidence.

Notes

1 One could suggest that the use of a financial advisor could mitigate the need for improved financial literacy. However, Handy and Smythe (2020) and Handy, Smythe, and Ricketts (2020) document that retail mutual fund investors face the potential of being misled into sub-optimal funds by well-intentioned advisors.

2 The program was first developed approximately 10 years ago but was not the focus of research until 2017. No program was offered in Spring 2020 or Fall 2020 due to the onset of the pandemic. A program was provided in Spring 2021 but with an online delivery, which will allow us to examine if delivery method impacts our findings. The program is also being expanded to a new student population, as one of the authors has changed institutions.

3 This is taken from the white paper "Closing the Gap Between Knowledge and Behavior: Turning Education into Action" resulting from the symposium sponsored by the National Endowment for Financial Education.

4 See Knoll and Houts (2012) for the list of questions, or they can be provided by the authors upon request. The Knoll and Houts questions include the core three questions introduced by Lusardi (2008) and seven of the nine additional questions used by Lusardi and Mitchell (2007).

5 We did include a respondent's 'confidence in answers to the knowledge questions' initially. Unlike prior work, in a multi-variate framework, we found either no effect or a positive effect on knowledge.

6 The authors thank Taylor Vahle for her keen observation with respect to this and other points.

7 We would like to thank a reviewer for suggesting this analysis.

Appendix: Summary of personal finance modules

Budgeting session

The budgeting module begins with an explanation of what it means to maximize net worth, and defines what assets and liabilities are. In an effort to capture the students' attention, there is a slide demonstrating approximately how much they might need to live comfortably in retirement. Students are then provided a set of key strategies, that if used, should help maximize wealth (e.g., reduce spending and increase saving). Concepts covered include: the purpose of a budget, steps to creating a budget, the difference between fixed and variable expenses and examples of each, how to estimate expenses, surprises likely to interrupt one's budget that can be planned for (e.g., annual car maintenance), financial record keeping, reviewing/updating one's budget, cash management, and the need to establish an emergency fund. Throughout the session, faculty stress the need to regularly review budgets and that budgets reflect one's stage in life.

Credit management session

This session emphasizes the importance of maximizing wealth by effectively minimizing and managing liabilities. The focus is not that all debt is bad but that it must be used wisely and fit within the budget. Concepts covered include: defining credit, providing examples of consumer credit, discussing credit costs, defining open-end and closed-end credit, providing and discussing an example of amortized loans, a specific look at credit cards and a discussion on how to choose a credit card, a discussion on credit card fraud and protective strategies, credit card uses and misuses, advantages and disadvantages of card use, reasons individuals find themselves carrying high debt levels, and credit-worthiness and credit scores. The discussion of credit scores goes beyond credit usage by explaining how credit scores are being used to set insurance premiums and make employment decisions.

Risk and return session

This module is treated separately for two reasons. First, the authors concluded that the risk/return relationship is one most often "forgotten" and misunderstood by investors, especially those that are not financially inclined (a significant population in these sessions). Second, the principles are essential to getting students to understand the need to invest in capital markets to achieve goals like retirement. This session reminds students of the importance of maximizing wealth and introduces how uncertainty or risk can impact decisions. Concepts covered include: a historical look at risk and return, a formal definition of risk and return, fundamental rules of investing, implications of risk, and diversification (what it is, graphical representation, statistical information, and how to achieve in general).

Mutual funds session

This module is included separately because mutual funds are the primary vehicle that students will likely use to participate in capital markets, and given the growing complexity of fee structures, especially in the advisor-sold channel (see Handy et al., 2020), the authors decided to devote one module to funds. Additionally, the module helps develop and reinforce the principle of diversification. The session emphasizes the importance of asset class diversification. Students learn that mutual funds are one of the most popular asset growth tools. Concepts covered include: defining a mutual fund, discussing the types of mutual funds (load vs. no-load), a significant focus on fund fees, load structure (e.g., A-class, B-class, or C-class), general fund investment types and information on each type including risk profiles, fund families, and how to evaluate mutual fund performance.

Retirement planning session

This session begins by discussing the importance of wealth maximization, especially for this goal. The session covers popular retirement beliefs and myths, the importance of starting to save early, the state of Social Security, defined contribution plans and important terminology, traditional and Roth IRAs, annuities, how to start a retirement account, and 529 college savings plans.

Risk management session

This module is intentionally titled Risk Management instead of Insurance to focus attention on *why* we need insurance—to protect net worth. The session reminds students of the importance of maximizing wealth but introduces them to the need to protect their assets from large loss via risk management. Students learn general insurance terminology (e.g., Coinsurance, deductible, or copay), and are exposed to health insurance, auto insurance, disability insurance, life insurance, and renter's insurance. Emphasis is placed on how insurance needs vary by life stage and insurance coverage should be revisited periodically.

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1. In "Framing the annuity as bequest protection: An experimental test" by Yan and James, the reported experiment tests framing an annuity as:
   a. protection for an individuals' human capital.
   b. protection for an individual's investment performance.
   c. protection for an individual's market risk.
   d. protection for an individuals' inheritance goals.

2. In the article by Yan and James, the authors indicate that an advantage of investing in an annuity compared with investing in the stock market is:
   a. most annuities provide higher rates of return than stocks.
   b. most annuities provide guaranteed income for life.
   c. most annuities provide large life insurance death benefits payable to heirs.
   d. most annuities investments are bequeathable.

3. In the article by Yan and James, what risk to a planned bequest can be reduced through the use of a standard annuity?
   a. The annuity may protect an intended bequest against the risk of asset exhaustion due to consumption resulting from unexpected longevity.
   b. The annuity may protect an intended bequest against the risk of asset exhaustion by providing a death benefit to heirs.
   c. The annuity may protect an intended bequest against the risk of asset exhaustion due to imposition of estate taxes.
   d. The annuity may protect an intended bequest against the risk of asset exhaustion by increasing in value over time.

4. In "Financial (il)literacy vs. Individual's behavior: Evidence on credit card repayment patterns" by Barboza, Bongini, and Rossolini the number of credit cards held indicates:
   a. That individuals having more credit cards are more likely to hold a month-to-month balance, but does not affect capacity of repayment.
   b. That individuals having more credit cards are no more likely to hold a month-to-month balance.
   c. That individuals having fewer credit cards are more likely to hold a month-to-month balance, but does not affect the capacity of repayment.
   d. That individuals having more credit cards are more likely to hold a month-to-month balance and makes the capacity of repayment worse.

5. In Barboza, Bongini, and Rossolini, financial knowledge derived from parental interaction with children:
   a. Has no effect in influencing credit card repayment.
   b. Is the form of financial knowledge most relevant in negatively influencing the child's credit card repayment.
   c. Is the form of financial knowledge most relevant in positively influencing the child's credit card repayment.
   d. Makes it more likely the child will borrow to cover credit card repayment.

MANUSCRIPT SUBMISSIONS and STYLE

(1) Papers must be in English.

(2) Papers for publication should be sent to the Editor: Professor Stuart Michelson, E-mail: smichels@stetson.edu. Electronic (Email) submission of manuscripts is encouraged, and procedures are discussed below.

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