

**FINANCIAL SERVICES REVIEW**

Volume 28

Number 4

(2020)

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28 (4) 273–350  
(2020)

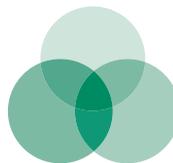
# FINANCIAL SERVICES REVIEW

The Journal of  
Individual Financial Management

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**Financial Services Review** is the journal of the Academy of Financial Services, published in collaboration with the Financial Planning Association. Membership dues of \$125 to the Academy include a one-year subscription to the journal. Financial Planning Association members receive digital access to the current volume/issue of the journal.

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# Financial Services Review

**The Journal of Individual Financial Management**

Vol. 28, No. 4, 2020

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**Publication information.** *Financial Services Review* is co-published quarterly by the Academy of Financial Services, and the Financial Planning Association. Institutional subscription price is \$100. Personal subscription price is \$125 and is available by joining the Academy of Financial Services. Further information on this journal and the Academy of Financial Services is available from the website, <http://www.academyfinancial.org>. Postmaster and subscribers should send change of address notices to Stuart Michelson, Academy of Financial Services, Stetson University, School of Business, 421 N. Woodland Blvd., Unit 8398, DeLand, FL 32723.

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Printed in the USA

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## From the Editor

This issue contains **Volume 28 - Issue 4** of *Financial Services Review (FSR)*. This issue is our special issue on Financial Literacy. We thank the many authors that submitted articles for consideration for this issue. Interest in this area of financial planning has been tremendous. In fact the reception was so well received, we will have an additional financial literacy issue in 2021. I would like to thank my co-editor, Terrance Martin at Utah Valley University for his wonderful insight and assistance on this special issue.

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 Literacy, Attitudes, and Financial Satisfaction: An Assessment of Credit Card Debt-Taking Behavior of Australians” is coauthored by Muhammad S. Tahir, Daniel W. Richards, and Abdullahi D. Ahmed, all at RMIT University, Melbourne, Victoria, Australia. The authors examine the relative strength of the association of financial literacy, attitude towards balancing spending and savings, and financial satisfaction with credit card debt-taking behavior using the 2016 wave of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. They find that higher financial literacy is associated with less credit card debt. Based on their results, they advise policy-makers to include components in the financial literacy curricula which encourage savings attitude to reduce problematic debt-taking.

The second article “Can Financial Literacy Education Reduce the Use of Medicaid and SNAP?” is coauthored by Abdullah Al-Bahrani, Northern Kentucky University, Darshak Patel, University College of Dublin, Ireland, and Jamie Weathers, Western Michigan University. The authors explain that policies supporting financial literacy education are promoted as a way to decrease reliance on social safety nets. The assumption is that low levels of financial literacy translate to lower economic outcomes and thus to increased dependence on social programs. The authors use the 2018 National Financial Capabilities Study to investigate the possible relationship between high school mandated financial literacy education and social program participation and find no evidence of such a relationship.

The third article, “Financial Literacy: Profiling a Successful High School Outreach Program” is coauthored by Greg Filbeck, Penn State Behrend, Jason Pettner, C.S. McKee,

and Xin Zhao, Penn State Behrend. During 2018-2019 the CFA Society Pittsburgh launched a high school financial literacy campaign resulting in significant improvements in financial behavior, subjective and objective financial knowledge, and self-esteem. In analyzing the results the authors find a disconnect between actual and perceived financial knowledge. They found that students exhibit gains in all aspects after completing the program. The sub-categories with the lowest pre-survey scores or female students show the greatest improvements in the post-survey. Students with lower GPAs experienced greater improvement in financial behavior and objective knowledge, while higher GPA students improved more in subjective knowledge.

The final article, “The Association between Financial Risk and Retirement Satisfaction” coauthored by Blain M. Pearson and Michael Guillemette, both at Texas Tech University. The authors posit that a higher level of risky financial assets that a retiree holds may produce higher returns, resulting in utility gains. They test this hypothesis using a variable constructed measuring retirees’ ratio of risky assets to total assets (risk ratio). They examine the association between the risk ratio and retiree utility using a retirement satisfaction variable from the 1992-2014 waves of the Health and Retirement Study. They find that increases in retirees’ risk ratio is associated positively with increases in their retirement satisfaction.

Thank you to those who make the journal possible, especially the referees and contributing authors. 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*

Terrance Martin  
Co-editor, Special Topics Issue on Financial Literacy

# Financial literacy, attitudes, and financial satisfaction: an assessment of credit card debt-taking behavior of Australians

Muhammad S. Tahir<sup>a,\*</sup>, Daniel W. Richards<sup>b</sup>, Abdullahi D. Ahmed<sup>c</sup>

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## Abstract

Unpaid credit card debt can be problematic; people should avoid it where possible. Unlike prior studies, this article examines the relative strength of the association of financial literacy, attitude toward balancing spending and savings, and financial satisfaction with credit card debt-taking behavior by analyzing the 2016 wave of the Household, Income and Labor Dynamics in Australia (HILDA) Survey. We find that higher financial literacy is associated with less credit card debt. However, incorporating the other factors reduces this relationship. Our results advise policy-makers to include components in the financial literacy curricula that encourage savings attitude to reduce problematic debt-taking. © 2020 Academy of Financial Services. All rights reserved.

*JEL classification:* G51; G53; G40; D14; D10

*Keywords:* HILDA; Financial literacy; Credit card debt; Financial satisfaction; Savings attitude

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## 1. Introduction

Credit cards provide convenient shopping facility enabling consumers to utilize their future income. However, in case of future income volatility, the repayment might be delayed allowing financial institutions to charge high interest on the due amount. Recent research

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undertakings highlight factors associated with credit card debt. Gorbachev and Luengo-Prado (2019) show that those with savings in low-interest liquid assets and no credit card debt are more financially literate than those who simultaneously hold low-interest liquid assets and high-interest credit card debt. Lin, Revindo, Gan, and Cohen (2019) find that those who prefer to make payments using a card are more likely to have more credit card debt as compared with those who use other modes of payments. They find that a person's attitude towards money is more related to credit card debt than the person's demographic factors, including gender, education level, and employment type. In this article, we extend research on credit card debt. We explore the relative strength of the association of financial literacy, attitude towards balancing spending and savings, and financial satisfaction with credit card debt-taking behavior in Australia.

Credit card use is topical in Australia because the Australian Securities and Investments Commission (ASIC, 2018) explicates that credit card debt is continuously rising. According to the Australian Bureau of Statistics (ABS), 74% of Australian households held debt in 2015–2016 (ABS, 2017b) and credit card debt was the most common type of household debt with 55% of households holding it. According to the ASIC (2018), more than 14 million credit card accounts (with 21.4 million cards) exist in Australia at June 2017 with a total outstanding balance of almost \$45 billion. Out of the total outstanding balance of \$45 billion, the overdue amount is \$31.7 billion being eligible for interest charges. Accordingly, financial institutions charged almost \$1.5 billion in annual fees and late payment surcharges to the credit card users in 2016–2017 (ASIC, 2018). The ASIC (2018) shows that 18.5% of credit card holders are in a problematic condition due to either severe/serious delinquency or having persistent debt or low repayments. From 2003–2004 to 2015–2016, the ABS (2017a) found an increase of 41% in the credit card debt of middle and high wealth households and a 25% increase in the credit card debt of low wealth households.

Households, like businesses, can access many types of debt including mortgages, personal loans, credit card debt, student loans, vehicle loans, and so forth (Cassells, Duncan, Kelly, & Ong, 2015). Understandably, not all types of debt have a negative impact on households. In the academic literature, a method of distinguishing whether a debt is problematic is whether it has been collateralized (secured by an asset) or not (Berger, Collins, & Cuesta, 2016; Harari, 2018; Tippett, 2010). Dunn and Mirzaie (2016) contend that non-collateralized debt is more stressful for households than collateralized debt. When households do not have any collateral to surrender, lenders or collection agencies can adopt aggressive behavior in collecting debt, and this increases stress felt by households (Dunn & Mirzaie, 2016). Among non-collateralized debt types (that include credit card debt, student loans, pay day loans etc.), Dunn and Mirzaie (2012, 2016) argue that credit card debt is relatively more stressful and problematic due to the added penalties (high interest rates) in addition to the aggressive behavior of the collection agencies. Furthermore, debt taken beyond the means to repay it also becomes stressful and problematic (Cecchetti, Mohanty, & Zampolli, 2011). This implies that non-collateralized debt (especially credit card debt) and over indebtedness should be avoided as they can have negative consequences such as exorbitant repayments and interest costs that become burdensome for households to meet. Other

negative consequences of problematic debt and over indebtedness include health problems (Jacoby, 2002), mental-illness leading to the attempt of suicide (Turunen & Hiilamo, 2014), depression and psychological disorder (Richardson, 2013), heart malfunction, ulcers, and migraine headaches (Jarl, Cantor-Graae, Chak, Sunbaunat, & Larsson, 2015). Therefore, this article specifically researches credit card debt-taking because it is a problematic type of debt-taking.

Credit cards facilitate purchasing of household goods with the option of “buy now, pay later.” However, when income is volatile, households often utilize savings to meet their consumption needs (Kaplan & Violante, 2014). A risky income stream and fewer savings may result in an increased credit card repayment liability. An overdue credit card amount often leads to a high associated interest charge. Research shows that those who have fewer savings and are less financially satisfied, are more vulnerable to economic shocks and tend to access more credit (Reyers, 2019). Further, those who are less financially literate and are not aware of the credit market terms, are most likely to take on credit card debt. Research associates low financial literacy with a high probability of taking on debt (Brown, Grigsby, van der Klaauw, Wen, & Zafar, 2016; Disney & Gathergood, 2013; Norvilitis et al., 2006; Ottaviani & Vandone, 2018). However, to our knowledge, little research is published that empirically explores the relative weight of the association of financial literacy, attitude towards balancing spending and savings, and financial satisfaction with credit card debt-taking behavior. Unlike prior studies, this study researches the relative weight of the association and analyzes the 2016 wave of Household, Income, and Labor Dynamics in Australia (HILDA) Survey, which reflects Australian household financial behavior and many other household characteristics.<sup>1</sup>

In our empirical analysis, we find a negative association between financial literacy and credit card debt-taking behavior. In the sensitivity analysis, where we include respondents’ attitude towards balancing spending and savings and respondents’ financial satisfaction, the association between financial literacy and credit card debt-taking behavior remains negative. A comparison of the various factors using the average marginal effects (AMEs) reveals that attitude toward spending and savings has the strongest relationship with credit card debt-taking behavior, followed by financial satisfaction and financial literacy, respectively. This implies that financial literacy has a relatively weaker magnitude of relationship with credit card debt-taking behavior, yet remains a significant factor to have an association with credit card debt-taking behavior. Furthermore, the analysis shows that the concept of simple interest (one of the five financial literacy concepts) has a highly negative association with credit card debt-taking behavior. The research has policy implications suggesting that financial education has some, but limited association. Financial literacy curricula that include financial behaviors, such as attitude towards balancing spending and savings will be more influential at reducing credit card debt-taking behavior.

The rest of the article reviews relevant prior studies, explains the data and method of data analysis, presents empirical results, discusses these results, and concludes with a direction for future research.

## 2. Literature review

### 2.1. *Financial literacy and financial decisions*

As debt-taking is a part of household financial decisions, our review includes studies that are related to explaining the relationship between financial literacy and financial decisions. Literature specifically related to credit card debt-taking behavior is considered, but few studies focus on this.

Remund (2010, p. 284) provides a synthesized definition of financial literacy in the following words:

“Financial literacy is a measure of the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate, short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions.”

This definition addresses that financial literacy helps to improve household financial decisions (Alhenawi & Elkhail, 2013). One research avenue has been to investigate if financial literacy is related to improved financial planning for retirement. Lusardi and Mitchell (2007) survey those who are above 50 years of age to know about their financial literacy skills and retirement preparedness. They find that most of the respondents who are unable to answer the basic financial literacy questions are unprepared for their retirement. As a result, they conclude that being financially illiterate may be a reason behind retirement unpreparedness. Martin and Finke (2014) find that the use of a financial planner has a large impact on retirement preparedness. Moreover, van Rooij, Lusardi, and Alessie (2011) analyze if financial knowledge and retirement planning are associated with each other. They utilize data from the Netherlands and find a strong positive association between financial knowledge and retirement planning.

Financial literacy is related to other apt financial behaviors. Worthington (2006) uses Australian data to explore the association of demographic, socioeconomic, and financial factors with the financial literacy of Australian households. Among other results, he finds a positive association between higher levels of mortgage debt and financial literacy. In addition, he also finds a positive association between higher levels of household savings and financial literacy. Similarly, Davutyan and Öztürkkal (2016) study Turkish households and find that an increase in literacy level increases the probability of saving more for unseen future needs and, therefore, reducing the use of debt in emergency situations. Moreover, Grinstein-Weiss, Spader, Yeo, Key, and Freeze (2012) contend that financial literacy plays a pivotal role in shaping the future financial behavior of individuals. They find that those who are taught financial literacy and financial skills because their childhood are more likely to avoid loan delinquency in the future. Alhenawi and Elkhail (2013) analyze data from the United States and find that those who acquire financial knowledge through formal academic experience secure developed financial planning skills. However, their results also suggest that those who accumulate financial knowledge over time do not have good financial planning skills.

Lusardi and Tufano (2015) develop a survey to test debt literacy skills. They survey individuals from the United States and report a low debt literacy level of the respondents. They

further contend that those who do not know the concept of compound interest are more likely to be overindebted. The results are consistent after controlling for demographic factors as well. Furthermore, Huston (2012) uses data of American consumers to analyze the relationship between financial literacy and the cost of borrowing via mortgage loans and credit cards. Their results suggest that financial literacy skills equip a consumer with the ability to minimize the cost of borrowing for both mortgage loans and credit cards.

Some studies specifically investigate an association between financial literacy and credit card debt. Norvilitis et al. (2006) study college students from the United States and find that lack of financial knowledge is related to the credit card debt. Brown et al. (2016) use American data of young consumers and find that financial education improves repayment behavior and decreases debt dependence. Robb (2011) studies credit card usage behavior of American students and concludes that those with high financial knowledge use their credit cards more responsibly. In summary, extant of the literature suggests that individuals are more likely to engage in high-cost credit and problematic debt (especially credit card debt) when they are less exposed to the credit market terms (e.g., simple interest, compound interest etc.).

Worthington (2013) states that the concept of financial literacy has been unknown to Australians until the end of the 20th century. However, with the start of the 21st century, efforts were started to make Australians financially literate. State-level interventions were also introduced, and the Australian government initiated the *national financial literacy strategy* (NFLS) in 2011. The motive of the government initiatives was to equip Australians with financial literacy skills enabling them to efficiently manage their finances and make informed financial decisions. However, the use of credit cards and credit card debt are still rising in Australia (ASIC, 2018). While research also reports a low level of financial literacy among Australians (Ali, Anderson, McRae, & Ramsay, 2014), we explore the association between financial literacy and credit card debt-taking behavior in Australia. We expect that high financial literacy will be related to less credit card debt-taking behavior in Australia. We test the following hypothesis:

*Hypothesis 1:* Financial literacy negatively relates to credit card debt-taking behavior.

## 2.2. *Financial literacy, attitude towards balancing spending and savings, financial satisfaction, and financial decisions*

Prior research describes some factors other than financial literacy that could be more relevant to financial decisions. García (2013) critically reviews prior studies and concludes that financial literacy is an important phenomenon to learn, but the prior beliefs, mental abilities, and cognitive factors dominate financial decision-making. Fernandes, Lynch, and Netemeyer (2014) conduct a meta-analysis of 168 papers covering 201 prior studies. They find that financial literacy and financial behavior are strongly positively associated with each other. However, when the behavioral factors are incorporated in an empirical analysis, the effect size of financial literacy on financial behavior diminishes dramatically. They include five types of financial behaviors in their study (1) saving for an emergency fund, (2) understanding how much is needed for retirement, (3) having a good credit score, (4)

assessing credit and checking fees, and (5) adopting a positive savings or investment behaviors. Fünfgeld and Wang (2009) survey 1,282 individuals from Switzerland. The first part of their analysis identifies savings attitude and spending attitude as financial behavioral factors. The second part of their analysis finds that the savers make financial decisions analytically by comparing and calculating the risk before making any financial decision. They define savings attitude as an attitude towards savings for future emergency needs. Shih and Ke (2014) use data from Taiwan and explore the relationship between attitude towards money and financial decision-making. Their empirical findings show that those who have an attitude of savings and financial planning make risky financial decisions. Like other studies, they also focus on one's attitude towards savings and planning to meet future financial needs.

Soman and Cheema (2002) state that people either utilize their current income in the future in the form of savings or utilize future income in the present. One way to utilize future income in the present is the use of credit cards as credit cards allow people to “buy now, pay later.” If a person uses a credit card and faces income shock, she or he will be unable to make timely repayment. Households may utilize their savings to smooth their current consumption pattern when experiencing income volatility (Reyers, 2019). However, Soman and Cheema (2002) argue that easy access to credit facilities allows people to think that they would have comparable earnings in the future and would make timely repayment. Here, a need to adjust current spending and saving patterns arise to avoid being in future debt. Those who spend more and do not keep a balance between spending and saving end up, usually, struggling with timely repayments. Hence, this argument suggests an association between spending and savings attitude and credit card debt-taking behavior. Most studies in the literature measure savings attitude as an attitude towards savings for unseen future circumstances. Unlike prior research, our focus is on one's attitude towards balancing spending and savings. Essentially, we test the following hypothesis:

*Hypothesis 2:* A person's attitude towards balancing their spending and savings negatively relates to their credit card debt-taking behavior.

Another important factor with a relationship to financial decisions is financial satisfaction. Xiao, Sorhaindo, and Garman (2006) use data from the United States to research consumer financial behavior. Their findings suggest that a lower credit card debt is associated with increased financial satisfaction. Contrary to Xiao et al. (2006), Zhang and Kemp (2009) use data from the University of Canterbury, New Zealand. Their empirical analysis suggests that there is no association between student debt and student life satisfaction. Students seem satisfied irrespective of whether they have debt or not. However, Solis and Ferguson (2017) analyze student data from the United States and conclude that students with loans and credit card debt are more likely to be financially dissatisfied. Brown and Gray (2016) conclude similar results for consumers by analyzing the HILDA survey. Their empirical analysis finds a negative association between all types of debt and financial satisfaction. Similarly, we expect in this article a negative association between financial satisfaction and credit card debt-taking behavior.

*Hypothesis 3:* Higher financial satisfaction negatively relates to credit card debt-taking behavior.

In the context of our study, we expect that both financial literacy and the other factors (attitude towards balancing spending and savings and financial satisfaction) are related to reduced credit card debt-taking behavior. However, we also expect that the relative weight of the association of the other factors with credit card debt-taking behavior is greater than financial literacy.

### 3. Data

We use a nationally representative dataset of Australia namely HILDA. HILDA survey is a household panel survey that observes a change in the characteristics and behaviors of the same sample over time (Watson & Wooden, 2010). Commenced in 2001, 18 waves of HILDA have been released to the date. Initial details of HILDA are documented by Wooden, Freidin, and Watson (2002). We use wave 16 for this article. The data for wave 16 were collected in 2016 and access was granted in 2018. Wave 16 contains a special module of financial literacy measures along with other regular modules, making it apt for this study. The financial literacy skills were not tested in HILDA before wave 16 or after. Hence, it makes this study cross-sectional.

Table 1 lists five items used to measure the financial literacy skills of the respondents. These are objective questions with one correct answer. Similar worldwide research studies have also used these measures (Cude, Chatterjee, & Tavosi, 2019; Kadoya, Khan, Hamada, & Dominguez, 2018; Lusardi & Mitchell, 2007, 2011, 2013; van Rooij et al., 2011). Table 2 shows the percentage of valid correct responses. Most of the respondents (85.5%) correctly answer the question related to simple interest, while the concept of inflation got the lowest percentage of correct responses (70.4%). Furthermore, it is important to note that those who got assistance to answer these questions are excluded. Additionally, we treat “don’t know” as an incorrect answer because these questions imply a correct response.

Next, we create the “financial literacy” variable by adding the correct responses of these five questions for each participant as applied in prior studies (Ali, Rahman, & Bakar, 2015; Xiao & O’Neill, 2016). This transformed variable depicts the levels of financial literacy, where “0” represents that the respondent has answered incorrectly to all the five questions, while “5” depicts that respondent has answered all the questions correctly. Table 3 below shows the distribution of financial literacy skills among the respondents. This table excludes the missing values, and it shows that around 44% of respondents have answered all the financial literacy questions correctly. This is low in comparison to the average percentage of high financial literacy for OECD countries that was 62% (OECD, 2016).

To measure the attitudes of respondents towards balancing their spending and savings, wave 16 of HILDA contains the item with the description “I do a good job of balancing my spending and savings.” This item is measured on a 7-point Likert scale with option 1 = *strongly disagree* while 7 = *strongly agree*. This item has 1,725 missing respondents (refused/not stated/multiple responses/not asked) out of 17,694 total respondents, which is only about 9.75% of the total.

Table 1 Items of financial literacy in wave 16 of HILDA

Financial literacy concept	Items	Possible responses (correct answer in bold)
Simple interest	“Suppose you put \$100 into a no-fee savings account with a guaranteed interest rate of 2% per year. How much would be in the account at the end of the first year?”	Don't know/refused/ <b>\$102</b> /other value
Inflation	“If the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, would you be able to buy more/the same/less than today?”	Don't know/refused/more/ <b>same</b> / <b>less than today</b>
Risk and return Portfolio choice	“An investment with a high return is likely to be high risk.” “Buying shares in a single company usually provides a safer return than buying shares in a number of different companies.”	Don't know/refused/ <b>true</b> / <b>false</b> Don't know/refused/ <b>true</b> / <b>false</b>
Time value of money	“If by the year 2020 your income has doubled, but the prices of all of purchases have also doubled. In 2020, will you be able to buy more/the same/less than today?”	Don't know/refused/more/ <b>same</b> / <b>less than today</b>

*Note:* Some of these items are based on Lusardi and Mitchell (2007). Each financial literacy question has a correct and incorrect answer(s). A financial literacy measure is developed by taking the sum of correct answers provided by each individual.

Table 2 Respondents of financial literacy items in wave 16 of HILDA

Measuring concept	Correct responses	Wrong responses	Got assistance	Missing values	Correct percentage <sup>a</sup>
Simple interest <sup>b</sup>	14,773	2,506	198	217	85.5
Inflation <sup>c</sup>	12,228	5,152	76	238	70.4
Risk and return <sup>d</sup>	14,569	2,817	137	171	83.8
Portfolio choice <sup>e</sup>	13,325	4,102	91	176	76.5
Time value of money <sup>f</sup>	13,727	3,650	90	227	79.0

<sup>a</sup> Correct percentage is calculated after omitting all those who got someone's assistance regardless of a correct or wrong answer. Moreover, those who replied as "don't know" are treated as wrong answers due to being numerical and general conceptual questions.

<sup>b</sup> Those who correctly answered after getting assistance are 176, while those who wrongly answered after getting assistance are 22.

<sup>c</sup> Those who correctly answered after getting assistance are 51, while those who wrongly answered after getting assistance are 25.

<sup>d</sup> Those who correctly answered after getting assistance are 115, while those who wrongly answered after getting assistance are 22.

<sup>e</sup> Those who correctly answered after getting assistance are 46, while those who wrongly answered after getting assistance are 45.

<sup>f</sup> Those who correctly answered after getting assistance are 66, while those who wrongly answered after getting assistance are 24.

Moreover, respondents are asked to depict their satisfaction level with their financial situation through the item "I am now going to ask you some questions about how satisfied or dissatisfied you are with some of the things happening in your life. I am going to read out a list of different aspects of life and, using the scale on SHOWCARD K13, I want you to pick a number between 0 and 10 that indicates your level of satisfaction with each. The more satisfied you are, the higher the number you should pick. The less satisfied you are, the lower the number. . . c) Your financial situation?". This item has 31 missing respondents (refused/not stated/don't know) out of 17,694 total respondents. This item is measured on an 11-points scale with 0 = *totally dissatisfied* while 10 = *totally satisfied*.

To measure credit card debt-taking behavior, two relevant items in wave 16 of HILDA are; "do you have any credit cards, charge cards or store accounts? do not include debit cards." and "how often is the entire balance on all your credit cards paid off each month?" The first item only asks whether the respondents have a credit card or not. This does not seem relevant since having a credit card does not mean having credit card debt. Instead, the second item explicitly taps the debt-taking behavior of the respondents. Because the focus of this article is on credit card debt-taking behavior, we opt for the second item.

The options available in response to the second item are "(1) pays off entire balance hardly ever/never (2) pays off entire balance not very often (3) pays off entire balance about half the time (4) pays off entire balance most months (5) pays off entire balance always/almost always." We combine the first three options of this item into one category (as "1") and the last two options into the other category (as "0"); thus, making it a binary response variable. The reason for doing this is the variable now tracks the behavior of credit card debt-taking that we specifically research. If a respondent falls into any of the first three options, it implies his or her behavior as incurring credit card debt. Whereas the last two

Table 3 Percentage of respondents in each level of financial literacy (wave 16 of HILDA)

Financial literacy levels	Frequency <sup>a</sup>	Percent
No correct answer	324	1.91
One correct answer	577	3.40
Two correct answers	1,283	7.55
Three correct answers	2,631	15.48
Four correct answers	4,692	27.61
Five correct answers (High financial literacy)	7,487	44.06
Total	16,994	100.0

<sup>a</sup> Missing values are excluded.

options depict that the respondent avoids having credit card debt. As stated earlier in the introduction section of this article, the researchers report credit card debt as a most stressful and problematic type of household debt (Dunn & Mirzaie, 2012, 2016; Richards, Ahmed, & Tahir, 2019). The debt becomes more problematic and burdensome when monthly balances linger on and are not paid off. The initial valid percentage of respondents in the raw dataset (before cleaning and filtering of the whole dataset) falling into the “0” category (not taking on credit card debt) is 74.4%, while those who fall into the other category named as “1” (taking on credit card debt) is 25.6%. It shows that one out of every four individuals is entering into a credit card debt arrangement in Australia.

In our analysis, we control for demographic factors to analyze if the association between the main variables of interest remains the same. Specifically, we include age, gender, marital status, employment status, and educational status. Gender, marital status, employment status, and educational status are included as dummy variables having two categories each as males and females, those who are currently in a registered marriage and those who are not in a registered marriage, those who are full time or part time employed and those who are not working, and those who have earned bachelor/graduate diploma/postgraduate degree and those who have earned year 11 or below/year 12/certificate III or IV/advanced diploma degree, respectively. In our analyses, we include age as a continuous variable. In addition, we include the age-squared variable to examine the quadratic relationship of age to credit card debt-taking behavior.

Finally, as each variable consists of some missing respondents, we removed all the missing respondents from the data and created a cleaned and filtered dataset where we included only those respondents who responded to each of our interested variables. The variable with the most missing responses is credit card debt-taking behavior. In wave 16, this variable had 8,136 missing respondents (refused/not stated/don’t know/not asked) out of 17,694 total respondents. After omitting missing responses from other variables, 6,661 respondents remained out of a total of 17,694.

The sample of 6,661 individuals consists of 51.6% females, 60.3% married, and 89.9% are employed full time or part time. Moreover, 40% are identified as having earned bachelor/graduate diploma/postgraduate degree, while 60% are identified as having earned year 11 or below/year 12/certificate III or IV/advanced diploma degree. Furthermore, the minimum age of respondents is 15 and the maximum age is 92 with a mean value of 45. The average income of sample individuals is \$66,092.

## 4. Methodology

The binary nature of the dependent variable allows using a binary logit model to test the relationship between the variables (Kennedy, 2003; Long & Freese, 2006). Appendix 1 shows the relevant econometrics equations of a binary logit model. The results of the binary logit model can only indicate a positive or negative relationship between the variables as we cannot interpret the estimated coefficients. To interpret the magnitude of the relationship, we often calculate the odds ratio. An odds ratio can be interpreted as an expected change in the odds of the dependent variable due to a 1-unit change in the independent variable. However, we can also calculate the standardized odds ratio of logistic regression that is relatively easier to interpret as compared with the odds ratio. A standardized odds ratio states the odds ratio from a one standard deviation change in the independent variable.

In addition to calculating the odds ratio and standardized odds ratio, we also calculate AMEs. An advantage of calculating the AMEs is that the values of the AMEs can be interpreted to compare the relative strength of each variable (Mussida & Sciulli, 2019; Stewart, 2007; West & Worthington, 2014). Therefore, the computation of the AMEs aligns with the motive of this article, that is, to test the relationship of financial literacy, attitude towards balancing spending and savings, and financial satisfaction with credit card debt-taking behavior, and to explain the relative strength of the association of each variable.

We use the statistical analysis program “Stata” to use a binary logit model. We ran the analyses in three phases. First, we only include financial literacy in the model. Second, we add attitude towards balancing spending and savings in the model. Finally, we include financial satisfaction in the model. We also control for demographic factors in all the models. In each of the phases, we run two models. The first model of each phase includes financial literacy accumulated score variable, whereas the second model of each phase includes five financial literacy concepts as separate dummy variables. This activity would help us to identify the relative association of five financial literacy concepts with credit card debt-taking behavior. The five financial literacy concepts are simple interest, inflation, risk and return, portfolio choice, and the time value of money.

There is a twofold purpose of running analyses in three phases. First, we analyze if the association between financial literacy and credit card debt-taking behavior changes over the phases. Second, we analyze the relative strength of each variable in each phase.

## 5. Results

### 5.1. Descriptive statistics

The following figures show different types of descriptive comparisons between variables for the filtered sample of 6,661 individuals. Fig. 1 below shows the distribution of credit card debt-taking among males and females. Our data contain 28% of males and around 33% of females with credit card debt-taking. Next, Fig. 2 shows the percentage of males and females who correctly answered each of the five financial literacy questions. Fig. 2 identifies

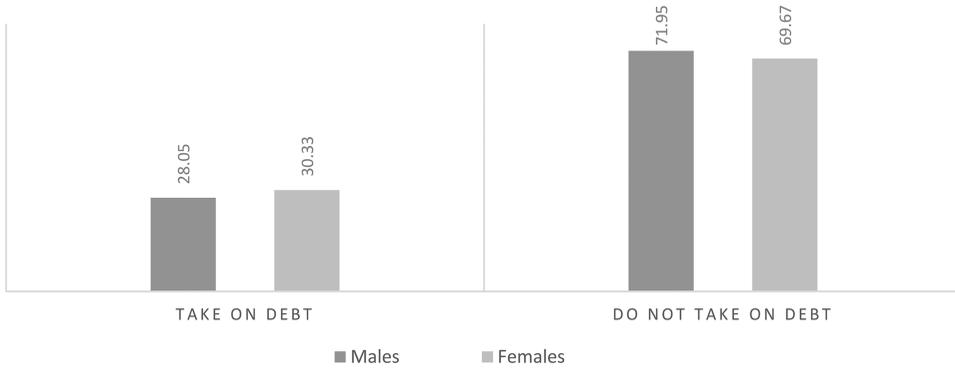


Fig. 1. Percent comparison of credit card debt-taking behavior by males and females.

that most of the males (97.89%) and females (90.21%) could correctly answer the concept of simple interest, while the least percentage of the correct answer of males relates to the concept of the time value of money (85.52), whereas the least percentage of the correct answer of females relates to the concept of inflation (73.77).

Fig. 3 shows the percentage of respondents who take on debt and could correctly answer each of the five financial literacy questions. According to Fig. 3, most percentage of those who take on debt (91.58) could correctly answer the concept of simple interest, while the lowest percentage (76.32) could correctly answer the concept of inflation. Next, Fig. 4 shows that most of the respondents could correctly answer the concept of simple interest regardless of the degree they have earned.

Fig. 5 and Fig. 6 take into account the correct response rate of all (five) financial literacy questions. Fig. 5 below shows that 44% of respondents with zero financial literacy score have credit card debt. In contrast, 26% of respondents who correctly answered all five questions are identified as those who take on debt. These descriptive statistics indicate that financially illiterate people are relatively more inclined to credit card debt as compared with financially literate people. Next, for a comparison purpose, we make seven blocks of age as below 25 years, 25–34, 35–44, 45–54, 55–64, 65–74, and above 74. Fig. 6 shows that those who are below 25 years of age contain least percentage of respondents who could correctly answer all the five financial literacy questions, whereas the age (in years) block 55–64

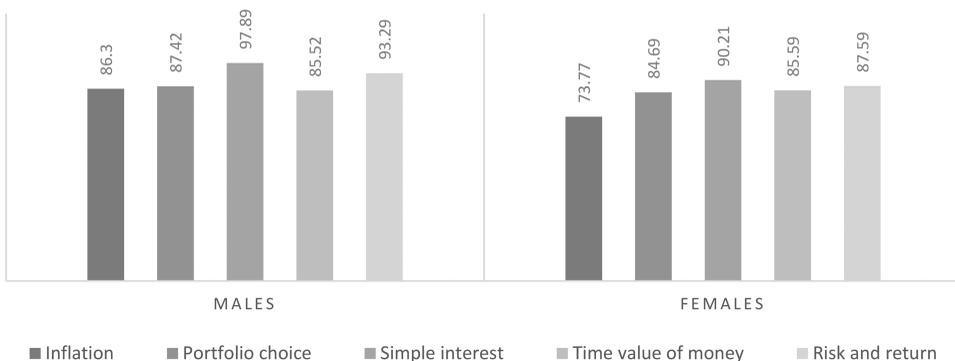


Fig. 2. Percent comparison of correct answers to the financial literacy concepts by males and females.



Fig. 3. Percent of those take on debt and could correctly answer the questions relating to the financial literacy concepts.

contains most of the respondents who are highly financially literate. The young generation in Australia is not highly financially literate and may require financial literacy education.

Finally, Fig. 7 shows the age comparison of those who have credit card debt. Our data indicate that those who are between 25 and 34 years of age are relatively more inclined to credit card debt as compared with other age groups. The overall trend in Fig. 7 explicates that debt increases up to a certain age, then it decreases.

### 5.2. Correlation analysis

Table 4 below shows the pairwise correlation analysis. Credit card debt-taking behavior is negatively correlated with financial literacy, attitude towards balancing spending and

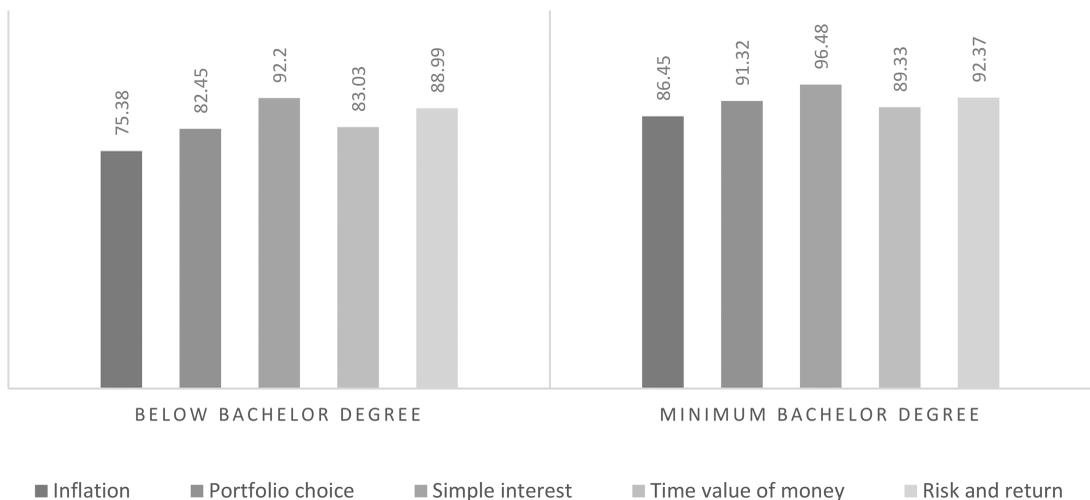


Fig. 4. Percent comparison of correct answers to the financial literacy concepts by education status.

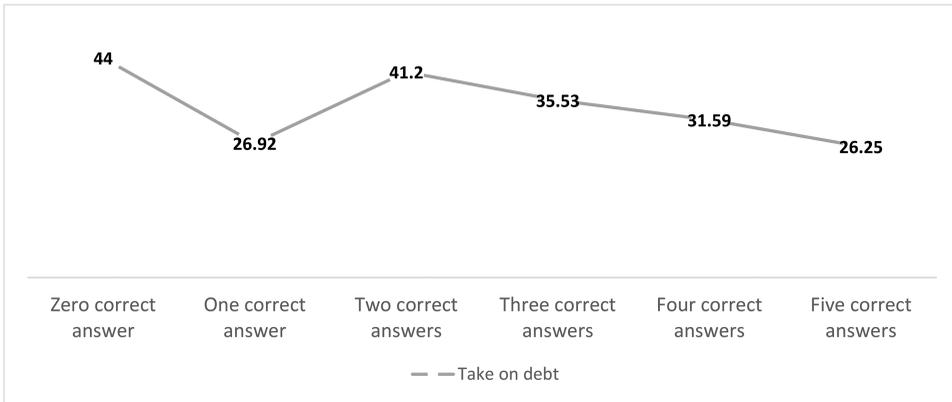


Fig. 5. Levels of financial literacy and percentage comparison of those who take on debt.

savings, and financial satisfaction as expected from the literature review. Among demographic factors, employment status is uncorrelated with attitude towards balancing spending and savings, problematic debt-taking, and age. Furthermore, gender is uncorrelated with attitude towards balancing spending and savings and age, while less correlated with credit card debt-taking behavior. All other variables are statistically significantly correlated with each other.

5.3. Empirical association of financial literacy, attitude towards balancing spending and savings, and financial satisfaction with credit card debt-taking behavior

Table 5, Table 6, and Table 7 show the results of empirical analyses after controlling for demographic factors. Table 5 below contains the analysis of the financial literacy variable, Table 6 adds attitude towards balancing spending and savings variable, and Table 7 adds the financial satisfaction variable. The first model of each table contains financial literacy

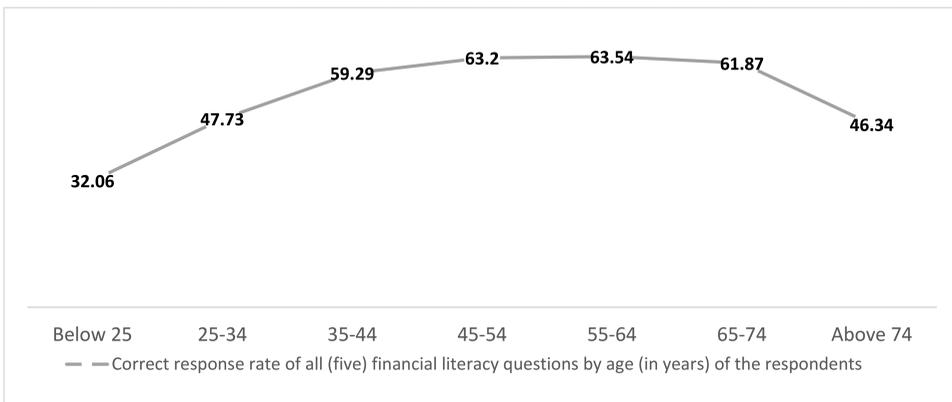


Fig. 6. Percent comparison of correct answers to the financial literacy concepts by age (in years).

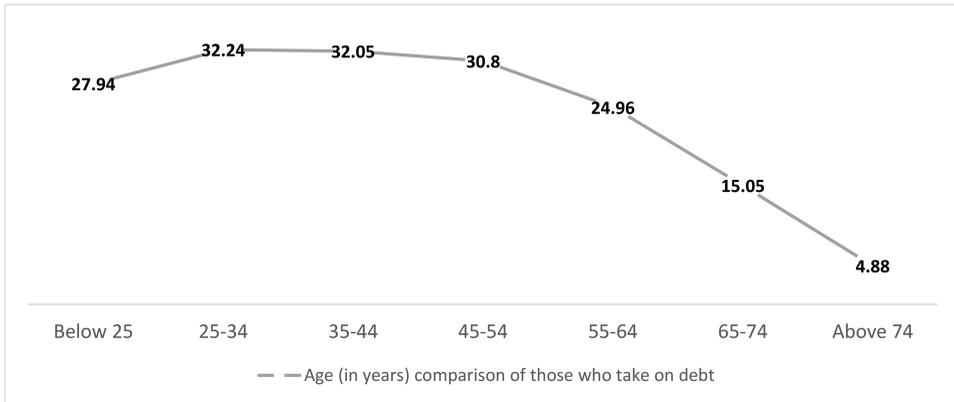


Fig. 7. Percent comparison of those who take on debt by age (in years).

accumulated score variable, whereas the second model of each table contains five financial literacy concepts as separate dummy variables.

Table 5 below shows the results of the two models. The first model contains only financial literacy variable, and it negatively relates to credit card debt-taking behavior at the statistical significance level. This analysis supports Hypothesis 1. It implies that those who are financially literate are less likely to have credit card debt. The odds ratio of financial literacy indicates that for a 1-unit change in financial literacy, the log odds of credit card debt-taking behavior are expected to change by a factor of 0.914, holding all other variables unchanged. The standardized odds ratio indicates that for a one standard deviation increase in financial literacy score, one could expect 0.920 factors change in the log odds of credit card debt-taking. Unlike the odds ratio and standardized odds ratio, the AMEs provide ease in the interpretation as the values of the AMEs of each variable are comparable to know the relative strength of the association. The AME of financial literacy in the first model of Table 5 can be interpreted as a higher financial literacy score decreases the probability of having credit card debt by 1.8%.

The second model adds dummy variables of each financial literacy concept. The analysis shows that two of the five dummy variables (simple interest and risk and return) negatively relate to credit card debt. The other three financial literacy dummy variables are statistically insignificant. The AMEs imply that those who have knowledge about simple interest and risk and return concepts are less likely to have credit card debt by 6.4% and 3.8%, respectively.

Table 6 below adds the attitude towards balancing spending and savings variable in the analysis. The results are comparable to Table 5 above. In the first model of Table 6, we note the same statistical significance level of financial literacy variable as noted in the first model of Table 5 above. The AME of financial literacy in the first model of Table 6 can be interpreted as a higher financial literacy score decreases the probability of having credit card debt by 1.5%, which is 0.3 percentage points lower than the one in Table 5. Further, the second model of Table 6 shows that the dummy variables of simple interest and risk and return concepts are statistically significant. The AMEs imply that those who have knowledge about

Table 4 Pairwise correlation analysis of variables

	1	2	3	4	5	6	7	8	9
1. Financial literacy	0.045***								
2. Attitude towards balancing spending and savings	0.060***	0.357***							
3. Financial satisfaction	-0.078***	-0.316***	-0.352***						
4. Credit card debt-taking behavior	-0.155***	-0.018	-0.033***	0.025*					
5. Gender	0.147***	0.139***	0.059***	-0.076***	-0.018				
6. Age	0.148***	0.060***	0.162***	-0.097***	-0.181***	0.093***			
7. Income	0.828***	0.016	0.115***	-0.006	-0.181***	-0.011	0.146***		
8. Employment status	0.084***	0.064***	0.159***	-0.096***	-0.028*	0.199***	0.049***	-0.028*	
9. Marital status	0.181***	0.040**	0.123***	-0.150***	0.085***	-0.063***	0.181***	0.054***	0.087***
10. Education status									

\*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ .  $N = 6,661$ .

Table 5 Binary logistic regression analysis of credit card debt-taking behavior: phase 1

	Model 1		Model 2	
	AME	OR	AME	OR
Financial literacy	-0.018**	0.914** (0.028)		
Inflation			-0.004	0.981 (0.072)
Portfolio choice			-0.029	0.860 (0.068)
Simple interest			-0.064**	0.720** (0.083)
Time value of money			0.026	1.141 (0.093)
Risk and return			-0.038*	0.825* (0.076)
Female	0.005	1.028 (0.061)	0.002	1.009 (0.061)
Age	0.027***	1.147*** (0.019)	0.028***	1.149*** (0.019)
Age-squared	-0.0003***	0.998*** (0.000)	-0.0003***	0.998*** (0.000)
Income	-0.000001*	1.000* (0.000)	-0.000001*	1.000* (0.000)
Age * Income	0.00000001	1.000 (0.000)	0.00000001	1.000 (0.000)
Employed	0.223	1.121 (0.107)	0.022	1.117 (0.107)
Married	-0.081***	0.663*** (0.039)	-0.080***	0.665*** (0.039)
Minimum bachelor degree	-0.124***	0.530*** (0.033)	-0.124***	0.530*** (0.033)
Constant		0.096*** (0.034)		0.102*** (0.037)
N	6,661		6,661	
Pseudo R <sup>2</sup>	0.047		0.048	
χ <sup>2</sup> value	375.04***		388.26***	
Pearson χ <sup>2</sup>	6956.26**		6966.99**	
				SOR
				0.992
				0.949
				0.925**
				1.047
				0.945*
				1.005
				5.910***
				0.138***
				0.620*
				1.192
				1.034
				0.819***
				0.732***

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

AME = average marginal effects; OR = odds ratio; SOR = fully standardized odds ratio. Standard errors in parentheses.

Table 6 Binary logistic regression analysis of credit card debt-taking behavior: phase 2

	Model 1		Model 2	
	AME	OR	AME	OR
Financial literacy	-0.015**	0.917** (0.030)		
Inflation			0.924**	
Portfolio choice				0.971 (0.075)
Simple interest				0.869 (0.072)
Time value of money				0.732* (0.089)
Risk and return			0.029	1.181 (0.101)
Attitude towards balancing spending and savings				0.800* (0.078)
Female	-0.080***	0.637*** (0.013)	-0.080***	0.637*** (0.013)
Age	0.006	1.035 (0.065)	0.002	1.012 (0.064)
Age-squared	0.023***	1.141*** (0.019)	0.024***	1.144*** (0.020)
Income	-0.0003***	0.998*** (0.000)	-0.0003***	0.998*** (0.000)
Age * Income	0.000000003	1.000 (0.000)	0.0000001	1.000 (0.000)
Employed	0.026	1.000 (0.000)	0.024	1.000 (0.000)
Married	-0.067***	1.154 (0.116)		1.147 (0.115)
Minimum bachelor degree	-0.112***	0.0686*** (0.042)	-0.066***	0.689*** (0.042)
Constant		0.533*** (0.035)	-0.112***	0.532*** (0.035)
N	6,661	0.663 (0.255)	6,661	0.692 (0.271)
Pseudo R <sup>2</sup>	0.118		0.120	
χ <sup>2</sup> value	947.90***		961.87***	
Pearson χ <sup>2</sup>	6684.97		6712.74	

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

AME = average marginal effects; OR = odds ratio; SOR = fully standardized odds ratio. Standard errors in parentheses.

Table 7 Binary logistic regression analysis of credit card debt-taking behavior: phase 3

	Model 1		Model 2	
	AME	OR	AME	OR
Financial literacy	-0.015**	0.915** (0.030)	-0.011	0.937 (0.074)
Inflation			-0.032*	0.824* (0.070)
Portfolio choice			-0.044*	0.769* (0.097)
Simple interest			0.037*	1.249* (0.111)
Time value of money			-0.037*	0.803* (0.081)
Risk and return			-0.058***	0.706*** (0.015)
Attitude towards balancing spending and savings			-0.054***	0.721*** (0.013)
Financial satisfaction			0.007	1.043 (0.068)
Female	0.011	1.067 (0.068)	0.019***	1.121*** (0.020)
Age	0.018***	1.116*** (0.020)	0.019***	1.121*** (0.020)
Age-squared	-0.0002***	0.999*** (0.000)	-0.0002***	0.999*** (0.000)
Income	-0.0000004	1.000 (0.000)	-0.0000003	1.000 (0.000)
Age * Income	-0.0000000003	1.000 (0.000)	-0.000000001	1.000 (0.000)
Employed	0.060***	1.430*** (0.151)	0.058***	1.421*** (0.150)
Married	-0.033**	0.819** (0.052)	-0.032**	0.825** (0.053)
Minimum bachelor degree	-0.098***	0.557*** (0.037)	-0.097***	0.558*** (0.037)
Constant		3.632** (1.479)		3.580** (1.486)
N	6,661		6,661	
Pseudo R <sup>2</sup>	0.163		0.165	
χ <sup>2</sup> value	1312.29***		1328.87***	
Pearson χ <sup>2</sup>	6644.34		6677.47	
				SOR
				0.974
				0.935*
				0.939*
				1.081*
				0.937*
				0.590***
				0.542***
				1.021
				4.301***
				0.212***
				0.878
				0.968
				1.112***
				0.910**
				0.751***

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

AME = average marginal effects; OR = odds ratio; SOR = fully standardized odds ratio. Standard errors in parentheses.

simple interest and risk and return concepts are more likely to avoid credit card debt by 5.5% and 4.0%, respectively, when attitude towards balancing spending and savings is controlled in the model. Moreover, the attitude towards balancing spending and savings variable is highly statistically significant in both the models of Table 6 supporting Hypothesis 2. The AME shows that if a person shows a one-point positive attitude towards balancing their spending and savings, it would decrease their likelihood of having credit card debt by 8%. Moreover, the comparison of the AMEs reveals that the relative strength of the attitude towards balancing spending and savings variable (AME =  $-0.080$ ) is higher than that of the financial literacy score variable (AME =  $-0.015$ ).

Table 7 below adds the financial satisfaction variable in the analysis. The results are comparable to Table 5 and Table 6 above. The financial literacy variable in the first model of Table 7 shows no change in the statistical significance level, nor in the AME value. It implies that the financial satisfaction variable does not have any effect on the relative strength of the financial literacy variable towards credit card debt-taking. However, the second model of Table 7 shows that, unlike the results of Table 5 and Table 6, the dummy variables of portfolio choice and time value of money are statistically significant. The results further show a positive association of the time value of money dummy variable. It implies that those who know the concept of time value of money, are more likely to have credit card debt when the financial satisfaction variable is incorporated in the model.

Moreover, in both the models of Table 7, the financial satisfaction variable is highly statistically significant. This analysis supporting Hypothesis 3. The AME shows that if a person indicates a one-point increase in their financial satisfaction level, it would decrease their likelihood of having debt by 5.4%. Furthermore, the attitude towards balancing spending and savings variable is still highly statistically significant in both the models of Table 7 as similar to the models of Table 6. The AME shows that if a person shows a one-point positive attitude towards balancing their spending and savings, it would decrease their likelihood of having credit card debt by 5.8%, which is 1.2 percentage points lower than the one in Table 6. However, the relative strength of the attitude towards balancing spending and savings variable is still higher than the other main variables of interest in both the models of Table 7.

Among the demographic factors, those who are married and earned minimum bachelor degree are less likely to have debt, while the results for gender, employment status, and income variables are mostly insignificant across the models. The results for the interaction term of age and income are not statistically significant across all models. Furthermore, age is positively associated with problematic debt-taking. However, the quadratic relationship for age in relation to credit card debt-taking behavior is negative. According to Grable, Lyons, and Heo (2019), this statistical position of age and age-squared variables suggests an inverted U-shaped downward relationship with the credit card debt-taking behavior supporting the descriptive statistics shown in Fig. 7 of this article.

In the case of binary logistic regression, adjusted  $R^2$  is replaced by pseudo  $R^2$ , which is not as same as the former (Long & Freese, 2006). Nonetheless, a comparison of pseudo  $R^2$  across the models can indicate the explanatory value of each model relative to another. The second model of Table 7, where all the variables are included in the model, has the highest pseudo  $R^2$  value of 0.165 among the six models presented in Table 5,

Table 6, and Table 7. The least pseudo  $R^2$  value of 0.047 is noted in the first model of Table 5 where only financial literacy is included in the model. Furthermore, the  $\chi^2$  value is highly significant across the models of all the tables implying that the regression models are significant as a whole. In addition, we test for the issue of multicollinearity using the variance inflation factor (VIF) and find that all VIFs are below the threshold of 10 that guarantees no multicollinearity issue (Kennedy, 2003). We append the VIF results in Appendix 2 below.

Across the analyses presented above, we had a sample size of 6,661 individuals that is about one-third of the original sample of 17,694 individuals surveyed in the 2016 wave of the HILDA survey. This reduction in the sample size was the result of filtering the dataset and omitting the retired respondents from the analyses. However, we run additional two models (as similar to those presented in Table 7) without filtering the dataset for a purpose to check the robustness of the existing results. This analysis incorporates 8,542 individuals. The sample consists of 52% females, 62% married, and 70% are employed full time or part time. Moreover, 36% are identified as having earned bachelor/graduate diploma/postgraduate degree, while 64% as having earned year 11 or below/year 12/certificate III or IV/advanced diploma degree. Furthermore, the minimum age of respondents is 15 and the maximum age is 98. The average income is \$60,150. Overall, the age and income average of this sample is different from the sample included in the main results because we include retired respondents in this robustness check. We append the results in Appendix 3 below. The statistical significance of the variables in Appendix 3 is similar to those in Table 7. It implies that the main results of this article are robust implying that the filtering of the dataset and omitting the retired respondents in the main results do not influence our conclusion.

In addition to these analyses, we analyze if financial literacy is associated with attitude towards balancing spending and savings and financial satisfaction. Though the correlation analysis (see Table 4 above) shows that there is a positive association between financial literacy, attitude towards balancing spending and savings, and financial satisfaction. However, we empirically analyze this relationship and control for demographic factors. Our analysis reveals that financial literacy is neither associated with attitude towards balancing spending and savings ( $p > .05$ ) nor with financial satisfaction ( $p > .05$ ) when we control for demographic factors. These results indicate that the concept of financial literacy is independent of the other two concepts. The results are omitted for brevity.

## 6. Conclusion

Existing research reports a low financial literacy level in Australia (Ali et al., 2014). In response to the financial literacy survey of Bourova, Anderson, Ramsay, and Ali (2018), only 30.9% of respondents could answer all the financial literacy questions correctly. The Australian government has been making efforts to equip Australians with financial literacy skills to give households superior financial knowledge to make better judgments and enable them to make informed financial decisions. However, the financial services regulator in

Australia, the ASIC (2018), states that the credit card debt is still rising in Australia and it is also the most common type of household debt in Australia (ABS, 2017b). The relevant existing literature revealed that credit card debt is relatively, as compared with other non-collateralized types of debt, a more stressful and problematic type of household debt. This issue motivated this research, and we expected that an increase in financial literacy level may be relevant to a reduced credit card debt-taking behavior in Australia. In addition, in contrast to the literature that includes savings for emergency needs as a measure of savings attitude, we analyzed the attitude of individuals towards balancing spending and savings. We hypothesized that those who keep a balance between their spending and savings are more likely to avoid credit card debt. We also expected a relationship between the financial satisfaction level of a person and their credit card debt-taking behavior.

Our contributions to the literature are many fold. Unlike prior studies, we analyzed the relative weight of the association of financial literacy, attitude towards balancing spending and savings, and financial satisfaction with credit card debt-taking behavior. We used the 2016 wave of a nationally representative dataset namely the HILDA survey. In our analysis, we, first, included a variable of accumulated financial literacy scores and then five dummy variables for each financial literacy concept to separately analyze their relationship with the credit card debt-taking behavior. We undertook analyses in different phases. We, first, included only financial literacy variable, then we added attitude towards balancing spending and savings and financial satisfaction, respectively. The purpose was to analyze whether the significance level of financial literacy and the magnitude of its relationship with the credit card debt-taking behavior remains the same or does change. This also helped us to examine the consistency and robustness of the relationship among the key variables.

Our analyses support all hypotheses of this article. In all the phases of analyses, financial literacy remained negatively significant to show a relationship with credit card debt-taking behavior. However, the magnitude of the relationship decreased when other factors were included in the model. Moreover, the comparison of the AMEs revealed that attitude towards balancing spending and savings has more relevance to the reduced credit card debt-taking behavior, followed by the financial satisfaction variable and then financial literacy. This implies that financial literacy has a relatively weaker magnitude of relationship with credit card debt-taking behavior, yet a significant factor to have an association with credit card debt-taking behavior. Among the five financial literacy concepts, the concept of simple interest showed a highly negative association with credit card debt-taking behavior.

Our results suggest that prior financial knowledge has a relatively weaker magnitude of association with financial decisions. Instead, attitude towards money matters more than the prior financial knowledge. The results are comparable with the prior studies. Fernandes et al. (2014) find that the incorporation of factors other than financial literacy in analyzing the relationship between financial literacy and financial behavior diminishes the effect size of financial literacy. Moreover, García (2013) shows that prior beliefs, mental abilities, and cognitive factors dominate the decision-making process. Our results partially support this conclusion because the magnitude of the association of financial literacy diminishes when other factors are included. However, the relevance of financial literacy does not disappear

suggesting some importance for the role of financial literacy in credit card debt-taking behavior.

In our results, the relevance of attitude towards balancing spending and savings and credit card debt-taking behavior is twofold. First, we show that those who keep a balance between spending and savings have relatively less probability of having credit card debt. Second, we argue that people with a higher credit limit tend to spend more because they think that their future income will cover their credit card debt (Soman & Cheema, 2002).

Our results have an important implication for policies on improving the financial literacy of households in Australia. The research suggests that education of this nature will have some, but limited relevance. Curricula that focus on financial behaviors and attitude towards personal finance will be more relevant to reduced problematic debt-taking. In this regard, although the Australian government has already designed a new website of financial capability that includes contents related to improving attitude towards personal finance, but there is still room for improvement as there is a global emergence of the concept of financial wellbeing.<sup>2</sup> Kempson, Finney, and Poppe (2017) explain the shift of focus from financial literacy to financial capability, and from financial capability to financial wellbeing. Further, in light of the importance of attitude towards balancing spending and savings, people need to be educated through focused media campaigns that promote an environment of not to overspend and keep a balance between spending and savings. Moreover, although the ASIC is continuously reviewing and regulating the credit card market, but there is a need to regulate the media advertisements of financial institutions where they promote their financial products and attract consumers to open a credit card account. The financial services regulating institutions should continuously monitor the media advertising strategies of financial institutions and make people aware of any possible “debt-trap.” Finally, as credit cards are a source of utilizing future income, financial institutions should set a credit limit after keeping in view the future income of consumers. Some interventions must be introduced in case of any possible economic shock that could disturb the spending and savings attitude of consumers.

Our research has some limitations that future researchers may wish to address. We could not conclude a causal relationship between the variables because we used a cross-sectional dataset. Future researchers may conduct a longitudinal analysis to see if the suggested relevance turns into a causal relationship. Further, future analyses may include more relevant behavioral and personality factors such as self-control, future-oriented behavior, and non-impulsive behavior to conclude a relationship with credit card debt-taking behavior. As we used a secondary dataset for this article, we were unable to capture the influence of external factors that remained unobserved and might have a larger influence on the attitude and behavior of individuals/households. For instance, education from parents or society norms might have more relevance with the behavior of households that may affect their financial decisions. Moreover, although we used popular measures of financial literacy, but different measures could produce different results. A guide for future researchers may be to subjectively measure financial literacy and analyze if the same results pop-up. Finally, financial capability and financial wellbeing are emerging concepts in the field of personal finance that may have relevance with reduced credit card debt-taking behavior.

## Notes

- 1 “This article uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this article; however, are those of the author and should not be attributed to either FaHCSIA or the Melbourne Institute.” (Summerfield et al., 2017).
- 2 <https://financialcapability.gov.au/>

## Acknowledgment

This research article is a part of the project funded by the Think Forward Initiative (TFI). The technical report submitted to the TFI can be viewed here: <https://www.thinkforwardinitiative.com/research/addressing-the-challenge-of-problematic-debt-australia-and-eurozone>. The authors would like to thank the editor(s) and three anonymous reviewers for their comments on this article. The authors believe that the comments received have improved the readability and quality of the article. In addition, the corresponding author would like to thank his fellow PhD candidates at RMIT University (Melbourne) for reviewing the article and providing constructive feedback.

## Appendix 1: Equations of binary logit regression

The main dependent variable of this study—problematic debt-taking—is a binary variable. This variable was coded to “0” for those who pay off their monthly credit card balance each month (that means not take debt) and coded to “1” for those who are unable to pay off their monthly credit card balance each month (demonstrating debt-taking behavior). The binary nature of the dependent variable allows using a binary logit model to test the relationship between the variables (Kennedy, 2003; Long & Freese, 2006). The results of the binary logit model can only indicate a positive or negative relationship between the variables as we cannot interpret the estimated coefficients. To interpret the magnitude of the relationship, we often calculate the odds ratio, which can be defined as:

$$\sigma(t) = \frac{e^t}{e^t + 1} = \frac{1}{1 + e^{-t}} \quad (1)$$

where,  $t$  is the linear combination of all the explanatory variables of the study and  $e$  represents their exponential value. In this article, we have financial literacy, attitudes towards spending and savings, financial satisfaction, and demographic factors as explanatory variables. The inclusion of explanatory variables is:

$$g(p(x)) = \ln\left(\frac{p(x)}{1 - p(x)}\right) = \beta_0 + \beta_1 x \quad (2)$$

This equation interprets the probability of the dependent variable equaling or approaching to a specific “case,” where  $x$  represents the list of explanatory variables as described above.

Moreover, the above equation states that the logit (log odds – natural log of the odds) is as same as the linear regression equation. This model can also be transformed into the following equation after taking the exponential values of both sides.

$$\left( \frac{p(x)}{1 - p(x)} \right) = e^{\beta_0 + \beta_1 x} \quad (3)$$

In the case of the logistic function, the odds of the dependent variable being equal to a case are interpreted and the exponential value truly represents the odds as shown by the following equation:

$$\text{Odds} = e^{\beta_0 + \beta_1 x} \quad (4)$$

#### Appendix 2 Variance inflation factor (VIF) of the variables of interest

Variable	VIF
Credit card debt-taking behavior	1.22
Financial literacy	1.10
Attitude towards balancing spending and savings	1.22
Financial satisfaction	1.30
Female	1.10
Age	1.10
Income	1.12
Employment status	1.07
Marital status	1.08
Education achieved	1.13

Appendix 3 Robustness check

	Model 1		Model 2	
	AME	OR	AME	OR
Financial literacy	-0.014**	0.909** (0.028)	-0.008	0.944 (0.071)
Inflation			-0.030*	0.817* (0.065)
Portfolio choice			-0.038*	0.770* (0.088)
Simple interest			0.025*	1.187* (0.096)
Time value of money			-0.030*	0.813* (0.078)
Risk and return			-0.049***	0.718*** (0.014)
Attitude towards balancing spending and savings	-0.049***	0.718*** (0.014)	-0.050***	0.711*** (0.012)
Financial satisfaction	-0.050***	0.712*** (0.012)	0.011	1.078 (0.065)
Female	0.014	1.097 (0.066)	0.013***	1.092*** (0.015)
Age	0.013***	1.089*** (0.015)	-0.0001***	0.999*** (0.000)
Age-squared	-0.0001***	0.999*** (0.000)	0.0000002	1.000 (0.000)
Income	0.0000001	1.000 (0.000)	-0.00000001	1.000 (0.000)
Age * Income	-0.00000001	1.000 (0.000)	0.078***	1.701*** (0.148)
Employed	0.079***	1.709*** (0.148)	-0.032***	0.805*** (0.048)
Married	-0.033***	0.800** (0.048)	-0.084***	0.565*** (0.036)
Minimum bachelor degree	-0.084***	0.565*** (0.036)		4.883*** (1.725)
Constant		4.869*** (1.685)		
N	8,542		8,542	
Pseudo R <sup>2</sup>	0.191		0.193	
χ <sup>2</sup> value	1836.35***		1852.07***	
Pearson χ <sup>2</sup>	8377.92		8416.29	

\*\*\*p < .001, \*\*p < .01, \*p < .05.

AME = average marginal effects; OR = odds ratio; SOR = fully standardized odds ratio. Standard errors in parentheses.

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# Can financial literacy education reduce the use of Medicaid and SNAP?

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## Abstract

In recent decades, we have seen an increase in both the complexity of financial markets and the expectations of individual responsibility for people’s financial decision-making. Policies supporting financial literacy education are promoted as a way to decrease reliance on social safety nets. The assumption is that low levels of financial literacy translate to lower economic outcomes and, thus, increased dependence on social programs. We use the 2018 National Financial Capabilities Study to investigate the possible relationship between high school mandated financial literacy education and social program participation and find no evidence of such a relationship. © 2020 Academy of Financial Services. All rights reserved.

*JEL classifications:* A21; G53; I26; I38

*Keywords:* Financial literacy; Social programs; Financial literacy education

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## 1. Introduction

The relationship between financial literacy and financial outcomes has been a topic of interest in recent decades. Studies examining this relationship have focused on financial behaviors such as retirement planning (Lusardi, 1999; Lusardi & Mitchell, 2011b), savings (Lusardi, 2008), student loan consumption (Stoddard & Urban, 2020), and the utilization of high-cost borrowing (Harvey, 2019). The evidence consistently indicates that an increase in

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financial literacy is associated with an increase in the quality of financial decision-making and, consequently, better financial and economic outcomes. This has led to the presumption that mandating financial literacy education will reduce dependence on social safety net programs.

State and federal officials have proposed high school financial literacy education mandates as a policy tool to help increase financial well-being, which encompasses a range of financial behaviors, including potential reliance on social programs. As of 2017, 25 states had mandated some form of financial literacy education in high school (Stoddard & Urban, 2020) and this focus on providing personal finance instruction continues to evolve. In 2018, 29 states and Puerto Rico introduced new or modified legislation concerning financial literacy education.<sup>1</sup> In 2019, this number grew to 42 states plus the District of Columbia and Puerto Rico.<sup>2</sup> Our objective is to examine the impact of financial literacy education mandates in high school on social program participation.

We are able to reduce the selection issues typical in this research because individuals required to participate in financial literacy education do not select into their programs. Our methodology relies on the assumption that these individuals are required to participate in high school. This is similar to the approach taken by Stoddard and Urban (2020), though our approach differs in that we do not rely on state mandates to determine participation in financial literacy education, because high school requirements are possible even when the state does not mandate it.<sup>3</sup> We are able to identify participation in mandated financial literacy education at the individual level. We estimate social program participation rates of those required to participate in financial literacy education, and compare them to those who choose to participate, and to those who do not receive financial literacy education.

We find no evidence of a relationship between mandated financial literacy courses and participation in social programs. Individuals mandated to participate in financial literacy education are as likely to receive social assistance as those who choose to take a course, and those who do not participate at all. However, we do find that financial literacy levels in the top quintile are less likely to participate in social programs. Our control variables are strong predictors of social program participation, and include demographic variables such as age, income, and state of residency. Our findings support the results of previous studies examining Earned Income Tax Credit participation and financial knowledge (Chetty, 2015; Chetty, Friedman, & Saez, 2013).

## **2. Financial education, literacy, and behaviors**

The shift toward individual responsibility in financial decision-making, coupled with the increased complexity of financial tools, has increased awareness of the role that financial literacy plays in determining optimal financial outcomes. Further, an established positive relationship between financial literacy and financial behaviors has prompted increased advocacy for financial literacy education that focuses on personal finance. Researchers are evaluating state mandates to measure their efficacy in changing financial behaviors. While the quality of these evaluations can suffer from endogeneity, some do indicate causal links between financial education and outcomes.

Using a synthetic control, Brown et al. (2014) find increased credit scores in states that mandate financial literacy education. Similarly, using a difference-in-difference methodology, Stoddard and Urban (2020) find that students who graduate from high schools in states with financial literacy mandates, while no more likely to attend college, make better choices when taking out student loans and other low-cost debt.<sup>4</sup> Harvey (2019) demonstrates that individuals residing in states that mandate financial literacy education are less likely to use alternative financial services (AFS) such as check-cashing, rent-to-own financing, pawn shop services, auto title loans, tax refund anticipation loans, and payday loans. Additional evidence indicates that formal financial education results in positive long-term financial behaviors as well (Wagner & Walstad, 2019).

Mandated financial literacy programs oblige individuals to receive the education ostensibly necessary to improve financial decision-making. However, it is important to differentiate the effect of financial education on financial literacy from its effect on financial behaviors. Similarly, we must acknowledge the heterogeneity of financial education itself, as it can vary in quality, source, length, delivery method, scope, timing, and so forth. Kaiser and Menkhoff (2017) undertook a meta-analysis of 126 studies, which confirmed a strong positive impact of financial education on financial literacy, a much lesser (but also statistically significant) effect of financial education on financial behaviors, and a positive correlation between its effects on both financial literacy and financial behaviors. Thus, the link from financial education to improved financial behavior appears to be mediated by financial literacy.

Higher returns are expected of financially literate individuals due to superior financial decisions. For example, financial literacy is positively associated with both the ownership of stocks in asset portfolios (Christelis, Jappelli, & Padula, 2010; Van Rooij, Lusardi, & Alessie, 2011) and the selection of lower-cost funds (Hastings & Tejada-Ashton, 2008; Hastings & Mitchell, 2020; Hastings, Mitchell, & Chyn, 2011). Lusardi and Tufano (2015) partnered with a market research firm to design a survey, develop their own set of financial literacy questions, and collect data from 1,000 U.S. residents via telephone in 2007. They used data concerning debt from surveys such as the Health and Retirement Study (HRS), the Rand American Life Panel (ALP), and the Survey of Consumers, but no data regarding financial literacy existed at the time of their study. They find that an increase in financial literacy is inversely related to the use of high-cost debt and high fees. They attribute 30% of the fees collected by credit card companies to financial ignorance. Additionally, Lusardi and Mitchell (2011b) find that increased financial literacy is positively correlated with deliberate long-term planning and, consequently, higher retirement wealth. Overall, variations in financial literacy explain 30-40% of the inequality in retirement wealth (Lusardi, Michaud, & Mitchell, 2017).

Although there is consensus on the positive impact of financial education on financial literacy, Al-Bahrani, Weathers, and Patel (2019) find variation in returns to formal financial literacy education by race, whereby white individuals exhibit significantly higher financial literacy scores than minorities, all else being equal. Beyond potential curriculum bias, the scope and timing of financial education are crucial to its effectiveness. “Teachable moments,” or education aimed at altering a specific financial behavior, prove more effective than comprehensive financial education (e.g., Miller et al., 2015; Zhan, Anderson, & Scott,

Table 1 Summary statistics

	Full sample		Social program participants		Non-participants		T stat
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
<i>Financial literacy (#)</i>							
Social program participation	0.34	0.47	1.00	0.00	0.00	0.00	
Required course	0.06	0.24	0.06	0.24	0.06	0.24	0.142
Optional course	0.03	0.17	0.03	0.17	0.03	0.17	0.015
Financial literacy score (%)	46.8	28.3	40.1	26.9	50.3	28.5	16.11
Age	45.6	17.5	43.4	15.2	46.7	18.4	8.386
0 Correct	0.12	0.32	0.16	0.37	0.10	0.30	-8.963
1 Correct	0.18	0.38	0.21	0.41	0.16	0.37	-5.726
2 Correct	0.24	0.42	0.26	0.44	0.22	0.42	-3.271
3 Correct	0.24	0.43	0.23	0.42	0.24	0.43	1.590
4 Correct	0.16	0.37	0.11	0.31	0.19	0.39	9.653
5 Correct	0.06	0.24	0.03	0.17	0.08	0.27	9.235
<i>Race/ ethnicity</i>							
White	0.71	0.45	0.68	0.47	0.73	0.45	4.457
Black	0.12	0.32	0.15	0.35	0.10	0.30	-6.712
Hispanic	0.10	0.30	0.10	0.31	0.10	0.30	-0.614
Asian	0.03	0.18	0.02	0.15	0.04	0.19	3.578
Other	0.04	0.19	0.04	0.20	0.04	0.19	-1.642
<i>Number of dependents</i>							
No children	0.40	0.49	0.33	0.47	0.44	0.50	10.52
Children, no dependents	0.29	0.45	0.23	0.42	0.32	0.47	8.596
1 Child	0.14	0.35	0.18	0.38	0.13	0.33	-6.762
2 Children	0.09	0.29	0.14	0.34	0.07	0.26	-10.19
3 Children	0.04	0.21	0.07	0.26	0.03	0.17	-9.573
4 or more children	0.03	0.16	0.05	0.22	0.01	0.12	-10.70
<i>Income brackets</i>							
Income 0 to 15K	0.24	0.43	0.40	0.49	0.15	0.36	-27.13
Income 15 to 25K	0.22	0.42	0.28	0.45	0.20	0.40	-8.563
Income 25 to 35K	0.23	0.42	0.19	0.39	0.25	0.44	7.307
Income 35 to 50K	0.31	0.46	0.14	0.34	0.40	0.49	25.97
<i>Education level</i>							
< High school	0.05	0.22	0.09	0.29	0.03	0.18	-11.94
High school	0.27	0.44	0.28	0.45	0.27	0.44	-0.881
GED	0.12	0.32	0.14	0.35	0.10	0.30	-5.476
Some college	0.30	0.46	0.30	0.46	0.29	0.46	-0.320
Associates	0.10	0.30	0.09	0.29	0.10	0.31	1.808
Bachelors	0.13	0.33	0.08	0.27	0.15	0.36	9.943
Graduate/professional	0.04	0.19	0.02	0.15	0.05	0.21	5.688
<i>Employment</i>							
Self employed	0.07	0.25	0.07	0.26	0.07	0.25	-0.868
Full time employment	0.26	0.44	0.14	0.35	0.32	0.47	18.49
Part time employment	0.12	0.32	0.13	0.33	0.11	0.32	-1.434
Homemaker	0.10	0.30	0.16	0.36	0.07	0.26	-12.72
Student	0.05	0.21	0.03	0.18	0.06	0.23	5.143
Disabled	0.10	0.30	0.21	0.41	0.05	0.21	-24.92
Unemployed	0.09	0.28	0.12	0.32	0.07	0.25	-8.006
Retired	0.22	0.41	0.14	0.35	0.26	0.44	11.99
N	8,657		2,972		5,685		

2006). Further, Kaiser and Menkhoff (2017) report less beneficial outcomes from mandated financial education relative to optional financial education, even after controlling for teachable moments. These findings bring into question the equity of results from financial literacy program mandates (i.e., formal financial literacy education).

We use non-public use data from the 2018 National Financial Capability Study (NFCS) to examine the relationship between the use of social safety nets, financial literacy, and participation in mandatory financial education. The non-public use data set also provides useful information concerning control variables, including a continuous measure of age, racial/ethnic classification, number of dependents, income, education level, and employment status.

### 3. Data

The NFCS survey data includes the “Big Five” measure of financial literacy, which is a resource frequently used by researchers in this field (e.g., Al-Bahrani, Weathers, & Patel, 2019; Harvey, 2019; Lusardi, 2019). It also includes information as to whether participation in financial literacy education was required, giving us the ability to isolate the effect of mandated financial literacy education from financial literacy education that students have chosen to receive. Further, analysis of the high school data allows us to compare three possible participation categories: no exposure to financial literacy education in high school, chosen exposure in high school, and mandatory exposure in high school.

The non-public use dataset has 27,091 observations, with 500 respondents per state and oversampling in California, Illinois, New York, and Texas. Because social program participation has an income consideration, we further restrict our sample to those making \$50,000 or less per annum, and who are younger than 80 years of age. We also exclude individuals selected for financial education in college or through an employer, to mitigate measurement noise. Our final sample comprises 8,657 survey respondents. The social program participants comprise 34% of this sample.<sup>5</sup> Table 1 shows the summary statistics of the variables used in our analysis.

The historical national average proportion of correct responses to the Big Five questions in the United States is 60% (three correct answers). In the 2018 data, the national average score is a statistically significant three percentage points lower than the 2015 data, while our subsample has an average financial literacy score of 47% (approximately two correct answers).<sup>6</sup> Studies indicate a positive relationship between income and financial literacy; thus, we expect our restricted sample—in the lower part of the income distribution—to exhibit a lower score than the national average.

Six percent of our sample was required to take a financial literacy course in high school. However, financial literacy mandates are relatively new, with most states introducing requirements only after 2000 (Stoddard & Urban, 2020). Fig. 1 shows the proportion of people required to participate in financial literacy education by birth year. Required high school financial literacy courses are most commonly undertaken by those aged 18–23. This is a limitation of the data, because the mandate measure is correlated with age and, if age is correlated with participation in social programs, our results may be biased.

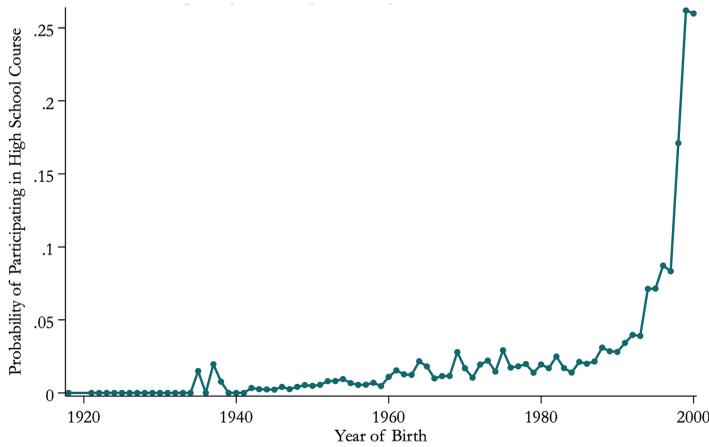


Fig. 1. Participation rate in required high school financial literacy course by year of birth.

We find no statistical difference in the mandated financial education rates between the social program participant and non-participant samples. However, the samples differed in almost all other categories. Social program participants are more likely to have more children, lower income levels, and be disabled or unemployed. Additionally, social program participants had lower financial literacy scores (see Fig. 2). There is evidence that financial education provides fewer benefits to the less advantaged (e.g., Fernandes et al., 2014; Kaiser & Menkhoff, 2017) and, more recently, a meta-analysis solely using randomized control trials (RCTs), finds no difference in outcomes arising from financial education interventions for low-income individuals (Kaiser et al., 2020). However, none of these studies examined social program participation as an outcome.

Fig. 3 shows financial literacy scores across the age distribution by financial education type. As expected, the sample required to take a financial literacy course scores highest;

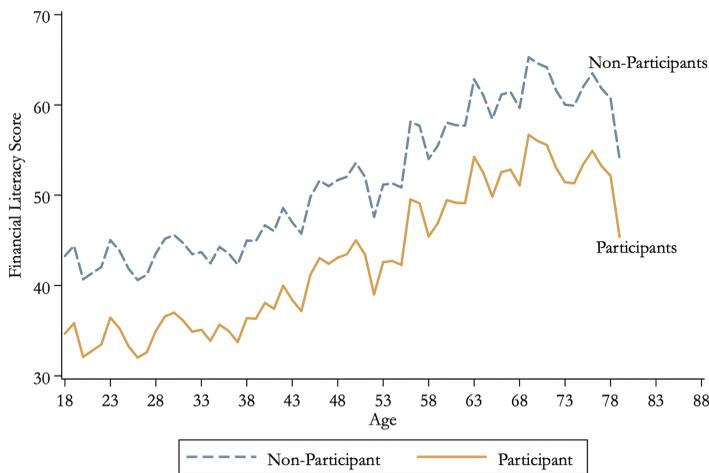


Fig. 2. The average financial literacy score plot across the age distribution, comparing participants and non-participants in social programs.

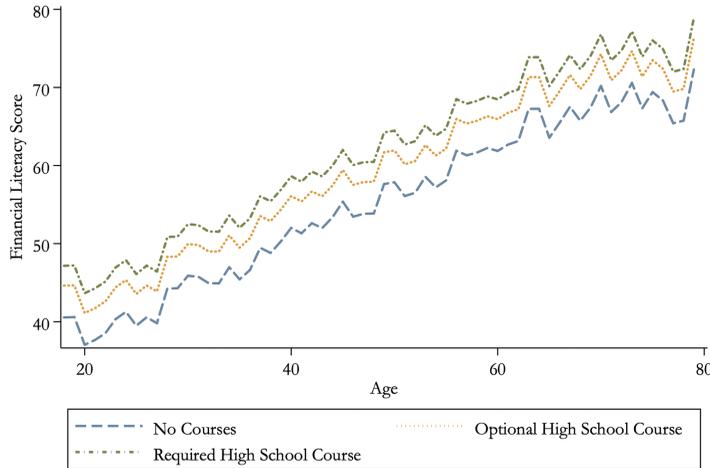


Fig. 3. Illustrated plot of the mean financial literacy score across the age distribution for each of the financial literacy education options. Financial literacy scores are positively related to exposure to financial literacy education. Required participation in financial education is associated with higher financial literacy scores relative to optional participation.

second highest are those enrolled in an optional course, and the lowest scores are exhibited by those with no formal financial education. Thus, there is a correlation between financial education and exhibited financial literacy. This relationship is also observed across the age distribution; however, we do see that financial literacy scores increase with age for all financial education types.

While non-participants in social programs have higher financial literacy scores (see Fig. 2), we find no differences in social program participation rates across the age distribution when we compare those required to complete a financial literacy course, those who chose to complete a

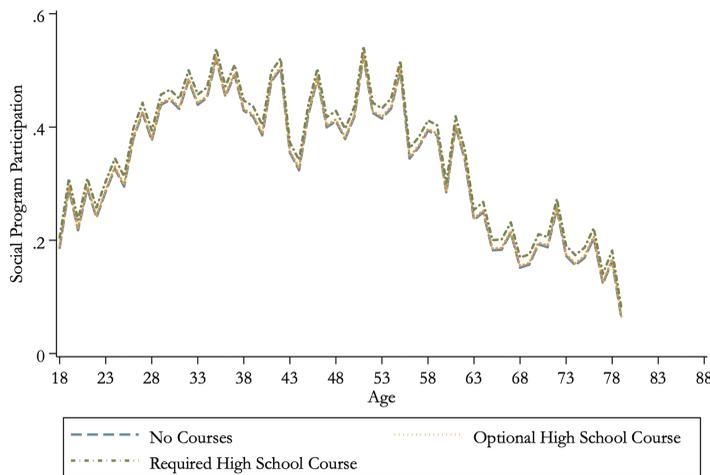


Fig. 4. Plot illustration of the marginals of predicted probability of participating in social programs across the age distribution for each of the financial literacy education options.

financial literacy course, and those who did not participate at all (see Fig. 4). In summary, there are many identifiable differences between social program participants and non-participants, but participation in high school financial education does not appear to be one of them.

#### 4. Methodology

To identify the consequences of mandated financial literacy education on social program participation, we specify a linear probability model:

$$Y_{i,s} = \beta_0 + \lambda'X_i + \delta'F_i + \varphi'L_i + \gamma_s + \varepsilon_i$$

Our dependent variable  $Y_{i,s}$  is the social program participation of individual  $i$  in state  $s$ . We include the demographics and predictors of social program participation (identified in Table 1) in vector  $X_i$ . The variables of interest are  $F_i$  and  $L_i$ . Variable  $F_i$  is a vector of dummy variables that identify whether the respondent received (a) mandatory financial literacy education, (b) optional financial literacy education, or (c) no financial literacy education. Variable  $L_i$  is a vector of dummy variables indicating the financial literacy of individual  $i$  based on his or her responses to the Big Five financial literacy questions. This allows us to hold financial literacy constant and separate it from the impact of mandatory financial education. Previous studies measuring the impact of financial education mandates neglect to control for financial literacy and include only variable  $F$ .<sup>7</sup> Our approach allows us to isolate the impact of mandatory financial education and reduce selection bias in financial literacy education.

We include a state fixed effects model to control for state-level variation in social program participation using  $\gamma$ . Chetty et al. (2013) document that participation in the Earned Income Tax Credit (EITC) varies by state and zip code and find that variation is due to differences in knowledge about social programs. However, Chetty (2015) documents observed participation rates approaching eligibility rates in 2008, as more people became aware of the programs. We limit our analysis to participation in the Supplemental Nutrition Assistance Program (SNAP) and Medicaid, because we found that EITC participation rates are equal to eligibility rates in 2018. Both SNAP and Medicaid are federal programs, but their eligibility is determined by state-level requirements. Therefore, variations in program participation rates could be due to state-level differences.

#### 5. Results

The results of the linear probability model are presented in Table 2. Although all variables identified in Table 1 are included in our regressions, we report only the coefficients for the financial education types, age, race/ethnicity, and financial literacy scores for brevity.

Regressions (1) and (2) use our full sample, and provide results on the probability of social program participation without inclusion of financial literacy scoring ( $L_i$ ) (left-hand

Table 2 Linear probability model estimating the participation in social programs

	Full sample		Sub-sample (18–25 years)	
	(1)	(2)	(3)	(4)
Did not take a financial literacy course	Omitted		Omitted	
Took an optional financial literacy course	−0.015 [0.027]	−0.011 [0.027]	−0.034 [0.052]	−0.030 [0.052]
Took a required financial literacy course	−0.015 [0.019]	−0.008 [0.019]	0.041 [0.030]	0.042 [0.031]
Age	−0.001* [0.000]	−0.000 [0.000]	0.015** [0.006]	0.014** [0.006]
White	Omitted		Omitted	
Black	0.052*** [0.015]	0.044*** [0.015]	0.020 [0.036]	0.018 [0.037]
Hispanic	−0.021 [0.016]	−0.027* [0.016]	0.006 [0.034]	0.007 [0.034]
Asian	−0.080*** [0.027]	−0.084*** [0.026]	−0.013 [0.057]	−0.017 [0.057]
Other	0.001 [0.024]	−0.001 [0.023]	−0.079 [0.053]	−0.077 [0.053]
0 Correct	Omitted		Omitted	
1 Correct	−0.002 [0.016]		−0.002 [0.037]	
2 Correct	−0.005 [0.016]		0.066* [0.035]	
3 Correct	−0.014 [0.016]		−0.005 [0.039]	
4 Correct	−0.060*** [0.018]		−0.027 [0.045]	
5 Correct	−0.088*** [0.023]		0.010 [0.064]	
Controls included <sup>a</sup>	Yes	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes	Yes
Observations	8,657	8,657	1,369	1,369
Adjusted $R^2$	0.27	0.27	0.19	0.19

\* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .001$ . Standard errors in brackets.

<sup>a</sup> Controls included, but not reported for brevity, are number of dependents, income, and employment status.

column of each panel) and with inclusion of financial literacy scoring (right-hand column), respectively. We find no difference in the significance of financial education in relation to participation in social programs when the purported confounder, financial literacy, is included. Further, in model (2), we find that answering four and five of the Big Five financial literacy questions correctly is associated with a 6.0% and 8.8% decrease, respectively, in the probability of participation in social programs. Therefore, policymakers' assumption that individuals with higher financial literacy scores are less likely to participate in social programs is supported. However, this result is not causal.

When we test for returns to financial education, we find no statistical evidence that those required to take a financial education course are less likely to rely on social

programs. Similarly, those choosing to take financial literacy education courses are as likely to participate in social programs as those who do not participate in any course. Therefore, we find no evidence that mandating financial literacy education at the high school level is related to financial behavior changes in the context of social program participation.

Given the relatively recent growth of financial education mandates, we test models (1) and (2) on the younger population (18–25 years old) in our sample in regressions (3) and (4), as shown in Table 2. We still find no statistical association of financial education courses with social program participation, but we do see significance appear on the age covariate. The probability of social program participation is associated with an approximate 1.5% increase as age increases from 18 to 25 years, whereas in the full sample—model (1)—an increase in age is associated with a decreased probability (0.1%) of social program participation. This is not a surprising result, given participants likely progress toward financial autonomy from the ages of 18 to 25. We also find a shift in significance when we include the financial literacy scores in regression (4), from a significantly smaller association with social program participation when four or five literacy questions are correctly answered to an increased association with social program participation when only two literacy questions are answered correctly. This may be a distribution effect in this age subsample since the number of our observations falls from 8,657 in models (1) and (2) to 1,369 in models (3) and (4).

## 6. Limitations

According to Fernandes et al. (2014), the impact of financial literacy education on financial behaviors has been inconclusive. Our research also finds no evidence supporting changes in financial behaviors via financial literacy education mandates. While those who score higher on financial literacy assessment are less likely to participate in social programs, it is important to note that their financial knowledge may be derived from places other than high school, including life experiences and informal education. The limitation of our research is that we rely on self-reported identification of class requirements. A common issue in this field of research is that there is no standard definition of financial literacy and financial literacy curriculum.

Additionally, the survey data we use classifies individuals as having experienced a required financial education course, a voluntary course, or no financial education course. Readers should be careful when interpreting the experiment, as these were not random assignments. This research would therefore be classified as a kind of “non-equivalent control group” quasi-experiment (Shadish, Cook, & Campbell, 2002). It is important, though, to distinguish this form of selection from “self-selection” whereby people self-select the treatment they receive. Our study used several controls to address the differences between the participants in the different groups that existed before their differential treatment. However, there is a possibility that the significance of social program participation could be impacted by these pre-existing differences that may have not been accounted for by the control variables.

## 7. Conclusion

Our research examines whether mandated financial literacy education is related to financial reliance on social programs such as Medicaid and SNAP. We use the 2018 iteration of the NFCS data, which includes information on individual social program participation, the circumstances of respondents' high school financial literacy education, and a measure of financial literacy via scoring on the Big Five questions. This data also allows us to differentiate between required financial education, optional selection of financial education, and those with no formal financial education at the high school level.

We find that high financial literacy scores are inversely related to participation in social programs. Scoring four or five out of five on the Big Five questions is associated with reduced participation in social programs. However, our results find no evidence that mandated financial literacy education is related to reduced social program participation. Given the expectation that financial literacy programs would prove a worthwhile investment, we encourage more research into the curriculum design, bias, timing, scope, and delivery method of financial education.

## Notes

- 1 <https://www.ncsl.org/research/financial-services-and-commerce/financial-literacy-2018-legislation.aspx>.
- 2 <https://www.ncsl.org/research/financial-services-and-commerce/financial-literacy-2019-legislation.aspx>.
- 3 School districts may identify their own graduation requirements beyond state minimums.
- 4 Student debt composition is measured using data from National Postsecondary Student Aid Study (NPSAS)—1999, 2003, 2007, and 2011.
- 5 They either received Medicaid and/or enrolled in SNAP in the prior 12 months. This data is only available as combined information and, therefore, cannot be disentangled.
- 6 In Table 1 we show summary statistics for both the percentage calculation and the number of correct responses.
- 7 We replicate this approach in regressions (1) and (3) in Table 2.

## Acknowledgment

We are grateful to the Institute of the Study of Free Enterprise (ISFE) for their support of this research. This research received a summer research grant in 2018. A version of this paper is made available to the participants and attendees of the 2019 ISFE Summer Research Conference.

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# Financial literacy: profiling a successful high school outreach program

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## Abstract

The CFA Society Pittsburgh launched a high school financial literacy campaign resulting in significant improvements in financial behavior, subjective and objective financial knowledge, and self-esteem. Before the campaign, male students and students with higher grade point averages (GPAs) show better objective knowledge. In addition, we find disconnect between actual and perceived financial knowledge. Students exhibited gains in all aspects after completing the program. The subcategories with the lowest pre-survey scores or female students show the greatest improvements in the post-survey. Students with lower GPAs experienced greater improvement in financial behavior and objective knowledge, while higher GPA students improved more in subjective knowledge. © 2020 Academy of Financial Services. All rights reserved.

*JEL classifications:* G53

*Keywords:* Financial literacy; Survey; Outreach; Education

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## 1. Introduction

Based on the results of multiple academic studies, a significant lack of financial literacy exists across nearly all demographics. While financial literacy statistics are important, the implications of a lack of financial literacy and numeracy are far reaching due to their impact on financial decisions. As a result, the potential implications of financial literacy and

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numeracy will be explored in depth. In this paper, we demonstrate the effectiveness of introducing a program to improve financial literacy and numeracy for high school students.

According to Remund (2010, p. 278), “Financial literacy is a measure of the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate, short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions.” To gauge financial literacy, studies use many different knowledge-based questions; however, the overall concepts remain relatively consistent across financial literacy surveys. Three common fundamental financial knowledge concepts include interest rates, inflation, and risk diversification.

Numeracy is an important component of financial literacy that literature often relates to financial behavior. Estrada-Mejia, de Vries, and Zeelenberg (2016, p. 53) define numeracy as “the ability to understand and use numerical information.” Numeracy is closely related to multiple aspects of financial decision making.

This study extends prior research on the effectiveness of financial literacy education by providing direct evidence from a financial literacy campaign launched by the CFA Society Pittsburgh. The study is based upon data collected from a financial literacy campaign of 53 high schools, across seven states, during the 2017-2018 academic year. The financial literacy education campaign materials were created using the book *The Missing Semester* (Kabala & Natali, 2013) as the main resource and curriculum. Before starting the course, students were given a pre-survey to test their baseline in four major areas: subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem. Following the completion of the course, students were administered a post-survey to test changes in the four major areas. To anonymously track the progress of students, they were assigned a unique student ID code. The results display significant improvement in all areas of interest. Each area of interest improves at a statistically significant level of at least 5% after the financial literacy campaign, indicating an effective effort at improving financial literacy.

## 2. Literature review

Since the effects of financial literacy are evident and the high percentage of financial illiteracy has been proven, steps must be taken to improve financial literacy. Green and Riddell (2012) analyze data gathered from the Canadian component of the *International Adult Literacy and Life Skills Survey* (IALSS), which sought to measure the skills of adults in Canada. The survey asked skill-based questions that focused upon four cognitive skills: prose literacy, document literacy, numeracy, and problem solving. Regression analysis reveals an increase of 3.4% in literacy and numeracy scores for an additional year of schooling. They also find that completing an extra 4 years of education results in a 24% increase in literacy, which increases a person’s literacy from the median to the 80th percentile.

Although understanding financial concepts is vital to financial behavior, possessing high financial self-esteem and confidence is an essential key to successful financial decisions. Using data collected on 12,686 individuals by the U.S. Bureau of Labor Statistics tracked over a 30-year period, Tang and Baker (2016) create four main variables: financial behavior,

self-esteem, objective, and subjective financial knowledge and covariates. Their results indicate a direct and indirect relationship of self-esteem on multiple financial behaviors. As a result, the effect of self-esteem is statistically significant; thus, self-esteem is a factor of financial behavior. Their results indicate that to improve financial behavior, subjective knowledge must be at least a portion of a financial education curriculum because objective knowledge by itself does not have a complete positive impact on financial behavior.

An important facet of self-esteem is the extent to which a person's confidence becomes greater than their actual knowledge. Overconfident individuals have the tendency to overestimate their own knowledge, leading to a higher risk of engaging in costly and risky financial behaviors (Asaad, 2015). Asaad discovers confidence is an important fragment of financial literacy, but also finds that perceived knowledge without actual knowledge increases the risk of suboptimal financial decisions. McCannon, Asaad, and Wilson (2016) conduct a study based on subjects playing an experimental trust game (Berg, Dickhaut, & McCabe, 1995) and completing a risk assessment, background questionnaire, and financial literacy quiz. Results of the risk assessment and financial literacy quiz were decomposed to generate overconfidence as a variable. They find a statistically significant relationship between overconfidence and trusting investments. Although the actual financial literacy in the United States has declined over the past 5 years, Lin, Bumcrot, Ulicny, Lusardi, Mottola, Kieffer, and Walsh (2016) find the percentage of U.S. citizens who have a high-self assessment has actually increased. Thus, efforts to improve financial behavior must address the going-concern of overconfidence.

Recent studies have identified the ability to increase financial literacy through education at the university level. Gerrans and Heaney (2019) study the effects of financial literacy following an undergraduate personal finance course at an Australian University. After completing the course, students showed improvements in both objective and subjective financial literacy.

### *2.1. Gender gap in financial literacy*

Several studies have found the existence of a financial literacy gender gap. In particular, Cupák, Fessler, Schneebaum, and Silgoner (2018) find that women score lower than men on financial literacy, with a more pronounced gap in developed countries. Additionally, Preston and Wright (2019) examine the financial literacy gap in Australia. While the “human capital variables” (age and education) were not significant in explaining the gap, “labor market variables” (including sector and occupation) were significant in explaining the gap. While these findings identify an initial gender gap in financial literacy, Gerrans and Heaney (2019) find female students benefit the greatest from financial literacy education.

## **3. Need for economic education**

According to the 2015 National Report Card, financial literacy education in high school is insufficient. On a scale from “A” to “F,” twenty-six states received grades of C, D, or F (Pelletier, 2015). An “A” grade (five states) requires the schools to offer a one-semester personal finance course as a graduation requirement. A “B” grade (20 states) requires the schools to include personal finance education within a required course, whether as a stand-

alone course or part of another course. A “C” grade (11 states) requires schools to offer personal finance topics in schools, but does not mandate students take the course. A “D” grade (three states) means that the state has a “modest levels” of personal finance in its academic standards. Finally, an “F” grade (12 states) goes to states with nearly no financial educational requirements, meaning that a student can graduate high school without an introduction to any financial literacy concepts. Because formal education has a statistically significant relationship with literacy and numeracy (Green & Riddell, 2012), the lack of high school financial education is a potential factor of low financial literacy scores.

Although the effects of financial literacy education are highly debated, research conducted by Filbeck and Zhao (2018) illustrates that financial literacy initiatives have a positive impact on both financial knowledge and behavior. They find that teaching financial concepts to high school students had a profound and statistically significant effect on both subjective financial knowledge and financial behavior for the students involved in the survey. Based upon previous research conducted, perceived knowledge may differ from actual knowledge (Asaad, 2015; Lin et al., 2016; McCannon et al., 2016). In addition, Tang and Baker (2016) prove that self-esteem and subjective knowledge have a statistically significant effect on financial behavior. As a result, further research could incorporate subjective education as a piece of the financial initiative, as well as financial knowledge questions that analyze both perceived and actual financial knowledge.

This article extends the work of Filbeck and Zhao by including objective assessments about acquisition of financial knowledge based on educational outreach. Our hypothesis is as follows:

*Hypothesis 1:* The financial literacy outreach program, which targets subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem, will result in statistically significant improvement for participating students.

In our article, we first analyze baseline pre-survey responses in financial behavior, subjective and objective financial knowledge, and self-esteem of high school students participating in a financial literacy outreach program developed by the CFA Society Pittsburgh. We use path analysis to assess the strength of direct and indirect links between these four aspects of financial literacy and other control variables. Next, by comparing matched pre- and post-survey results, we analyze the impact of the financial literacy outreach program in financial behavior, subjective and objective financial knowledge, and self-esteem. We first use a paired *t* test to compare the matched pre- and post-survey results. Then, we use regression analysis to analyze how the improvements in these four aspects of financial literacy in the post-survey are impacted by control variables.

#### 4. Data sample

The CFA Society Pittsburgh has been active in financial literacy outreach since 2010. Over 50 individuals serve on the financial literacy committee, which directs curricular development and training efforts. Each year, representatives from the Society participate in Act

48 training sessions across the state of Pennsylvania as well as offering to provide an hour-long presentation on core financial literacy concepts on request. The number of high schools participating grew rapidly starting in 2015. In 2018, the State Treasurer of Pennsylvania endorsed the program and encouraged all Pennsylvania high schools to participate. That same year, representatives from the CFA Society Pittsburgh led a session for the National Association of State Treasurers in Providence, Rhode Island, in an effort to further expand outreach across more states. The CFA Society Pittsburgh provides participating schools with instructional materials for a semester-long equivalent course based on *The Missing Semester* (Kabala & Natali, 2012). Each school determines the best way to deliver their programs (e.g., weekly for a semester, or daily lessons over fewer weeks). Schools are supplied with PowerPoint resources to accompany the book, along with a web-based portal (available through CFA Society Pittsburgh website) of best practices and exercises, submitted from previous participating schools. In addition, members of the financial literacy committee extend an invitation to present to the students in the classroom for a day. The financial literacy member uses a PowerPoint presentation developed by the financial literacy committee, which gives a broad overview of the main topics discussed within the curriculum, while allowing students to ask questions relating to financial literacy subject material or real-world applications. Committee members and other teachers act as a resource for the participating schools throughout the semester, to provide any assistance or feedback about the curriculum.

For the 2018-2019 school year, a total of 78 high schools, spread across seven states (California, Michigan, New Jersey, Pennsylvania, West Virginia, Wisconsin, and Wyoming) with 173 classes/teachers, were invited to participate in both a pre- and post-survey to examine the effectiveness of financial literacy education. Through our partnership with the CFA Society Pittsburgh, ACT 48 training in Pennsylvania, multiple Intermediate Units, the Pennsylvania State Treasurer, and other connections with individual teachers, we established our subset of participating teachers. We offered each teacher financial literacy materials and access to the CFA Society Pittsburgh portal for free, in exchange for their participation in our survey. After gathering the list of enrolled teachers, we assigned each a unique class code. Links for a pre- and post-surveys were provided to the participating teachers. Within the introductory email, instructors were given directions to assign each student with a unique ID number, allowing pre- and post-surveys to be matched for analysis. Participating schools agreed to administer the presurvey before any instructional delivery. Post-surveys were to be completed within a week after completion of the last instructional unit on financial literacy.

The distributed survey was designed as an extension of the work conducted by Filbeck and Zhao (2018) with the addition of six objective financial knowledge questions. The full pre-survey and post-survey can be found in Appendixes A and B, respectively. Of the original population, 1,613 students from 31 participating schools and two states (Pennsylvania and New Jersey) completed pre-surveys. A total of 1,050 post-surveys were completed by students from 23 schools in Pennsylvania (91.2%) and New Jersey (8.8%).

Table 1 reports the descriptive statistics for the full sample and the test sample. The full sample consists of 1,613 students completing the pre-survey, while the matched test sample includes 829 students who submitted both a pre- and post-survey. The matched sample totals show attrition in the survey process of approximately one-half, despite attempts to minimize

Table 1 Sample description

	Grade				Total		
	9th	10th	11th	12th			
Panel A. Whole sample							
Male							
English	4	4	23	64	95		
Math	18	13	59	171	261		
Science	8	20	51	147	226		
Social Studies	24	22	59	171	276		
Female							
English	12	10	47	155	224		
Math	9	14	43	116	182		
Science	6	11	34	170	221		
Social Studies	9	4	22	93	128		
Total	90	98	338	1,087	1,613		
Panel B. Test sample							
Male							
English	3	1	12	31	47		
Math	11	7	33	75	126		
Science	4	14	31	69	118		
Social Studies	12	14	34	84	144		
Female							
English	6	3	27	81	117		
Math	6	8	27	61	102		
Science	1	11	16	82	110		
Social Studies	6	4	15	40	65		
Total	49	62	195	523	829		
Panel C. School district characteristics							
	Mean	Standard deviation	Percentile				
			Min	25	50	75	Max
Population	31,522.95	35,083	6,208	11,382	18,412	37,567	148,678
Poverty	9.6%	5.9%	3.3%	5.9%	8.2%	11.3%	25.8%
Pct_college	29.5%	14.8%	11.2%	16.3%	29.8%	41.2%	57.8%

*Note:* Number of students across different grade level and different favorite subjects for the whole sample (Panel A) and the test sample (Panel B). Panel C shows the school district characteristics: Population is the population in the school district. Poverty is the poverty rate in the school district. Pct\_college is the percentage of residents who have attained bachelor degree or higher.

the loss through a series of six reminder emails to participating teachers during the period of the program. Based on feedback from teachers, failure of students to complete post-surveys were primarily associated with a failure of completion of the financial literacy program or a failure of teachers to oversee students in the completion of the post-survey. We also had 221 instances of students filling out post-surveys who previously did not complete a pre-survey. Of the full sample, 1,425 (88%) students are in their junior or senior year; in the test sample, 718 (87%) students are in their junior or senior year. Female students account for approximately 47% in both the full sample and the test sample. Regarding their favorite subjects, students within the full sample favored science (28%) and math (27%), a trend which

continued to the test sample with math and science as the favorite subjects both at 27.5%. Favorite subject is included in our survey to determine whether academic interest area plays a significant role in financial literacy educational outreach.

Appendixes A and B show the pre- and post-survey questions addressed by program participants in order to assess financial knowledge (both objective and subjective questions), financial behavior, and self-esteem. Lusardi and Mitchell (2014) point out that a substantial mismatch exists between individual's self-assessed (subjective) financial knowledge and their actual knowledge. The survey design is consistent with Hastings, Madrian, and Skimmyhorn (2013), who argue that financial literacy should focus on competences that individuals need. The organization of the survey is constructed in a way that assesses the four major keys to financial success: financial self-esteem, perceived (subjective) financial knowledge, financial behavior, and objective financial knowledge with numeracy. The financial behavior and subjective financial knowledge test financial self-esteem and perceived financial knowledge by gauging the student's self-reported understanding.

Questions are broadly categorized into two types: financial knowledge (subjective and objective) and financial behavior. The only difference between pre- and post-survey questions are in the objective financial knowledge questions—the same concepts are tested with different questions. Objective financial knowledge questions are asked in a manner that contains a right or wrong answer. Each objective financial knowledge question contains at least one wrong answer and a choice of "I Don't Know." The questions are based upon five major categories of financial literacy: risk diversification, compound interest, credit, numeracy (interest), and inflation. The questions are analyzed using two methods: correctness and willingness to answer. The first method of correctness assigns a 1 for each correct answer and 0 for any other answer. The second method to measure willingness assigns a 1 for an answer of I Don't Know and 0 for any other answer. The second method is used to measure financial self-esteem as measured by the amount of questions answered with I Don't Know. Improved self-esteem occurs as students become less likely to answer I Don't Know and instead select an answer that could be correct or incorrect, showing greater confidence after completing financial literacy education.

The survey consists of 21 overall questions: four financial behavior, six objective financial knowledge, and 11 subjective financial knowledge. Financial behavior and subjective financial knowledge questions are rated on a 5-point scale ranging from 1 = strongly disagree to 5 = strongly agree. The four financial behavior questions are "I like to save money more than I like to spend it," "I have a checking and/or a savings account," "I have conversations with my parents regarding personal finance," and "I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)". Subjective financial knowledge questions involve perceived understanding of financial concepts, and include questions such as "I understand how to establish a financial plan," "I think financial literacy is important for my future," and "I understand the process by which my parents/guardians make financial decisions." The final six objective knowledge questions test financial self-esteem and objective financial knowledge by assessing correctness of answers and willingness to select an answer other than I Don't Know.

## 5. Test results

First, *t* test and path analysis are used to analyze the pre-survey results of the full sample. Following the pre-survey analysis, we run *t* test and regressions to compare pre- and post-survey results within the test sample.

### 5.1. Pre-survey results

For the *t* test of the pre-survey responses, two student characteristics are present: gender and GPA. Each characteristic divides the full sample into two groups. Gender is broken into a subgroup for females and males. The median GPA of the whole sample divides the students into a higher GPA or lower GPA group.

The response differences between groups are shown in Table 2. The average responses are compared with the individual subgroups of gender and GPA to determine if the characteristics exhibit a statistically significant effect. The gender characteristic identifies the effect of a student being a female versus a male (gender), as well as the effect of a student having a high GPA versus low GPA. The data shows no statistically significant effect of GPA on subjective financial knowledge. However, consistent with Cupák et al. (2018), female students tend to have lower subjective financial knowledge compared with male students (statistically significant at the 1% level). For financial behavior, students with a high GPA tend to be better financially behaved (statistically significant at the 1% level). In objective financial knowledge, females tend to score lower in correctness, while students with high GPAs tend to score higher in correctness (both significant at the 1% level). Similarly, for self-esteem, females tend to answer I Don't Know more often, while students with higher GPAs are less likely to select I Don't Know (both statistically significant at the 1% level).

### 5.2. Pearson correlation and path analysis

Table 3 reports Pearson correlations between financial behavior and self-esteem (IDK), subjective, and objective financial knowledge. Financial behavior, objective and subjective knowledge are significantly correlated with each other. IDK is significantly negatively correlated with the other three measures of financial literacy, which indicates a positive correlation of self-esteem level and the other three measures of financial literacy. Naturally, due to the setup of the self-esteem measure, we find a  $-0.77$  correlation between IDK answers and objective knowledge.

Next, following Tang and Baker (2016), we use path models to analyze the relationship between characteristics and four financial literacy measures. We choose path analysis, as it forces us to specify relationships among all of the independent variables. This results in a model showing causal mechanisms, through which independent variables produce both direct and indirect effects on a dependent variable. All causal relationships between variables must go in one direction only, for path models. To identify the impact, we assign the dependent variable as Behavior (Subjective, IDK), which is the total score for financial behavior questions (subjective questions, objective questions with I Don't Know answers).

Table 2 Differences based on student characteristics: Pre-survey results

	Average response	Female	Higher GPA
<b>Panel A. Subjective financial knowledge questions</b>			
2. I understand how to establish a financial plan.	3.039	-0.204***	-0.023
3. I think financial literacy is important for my future.	4.365	0.021	0.186***
6. I understand the process by which my parents/guardians make financial decisions.	3.358	-0.143***	-0.093*
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.	3.086	-0.066	0.144**
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.	2.743	-0.259***	-0.160**
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.	3.428	0.001	-0.053
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.	3.287	-0.284***	-0.259***
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.	3.015	-0.219***	-0.123**
12. I know what a Roth IRA is and how it works from a taxation standpoint.	1.951	-0.181***	-0.095*
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.	3.148	-0.167***	0.005
14. I know how to plan financially for retirement.	2.621	-0.283***	-0.050
Total score for subjective financial knowledge	33.893	-1.622***	-0.381
<b>Panel B. Financial behavior questions</b>			
1. I like to save money more than I like to spend it.	3.505	-0.013**	0.219***
4. I have a checking and/or a savings account.	4.381	0.034	0.186***
5. I have conversations with my parents regarding personal finance.	3.418	0.012	0.283***
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.).	4.083	-0.010	0.318***
Total score for financial behavior	14.746	0.122	1.231***
<b>Panel C. Objective questions (Correct Answers)<sup>a</sup></b>			
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.619	-0.124***	0.094***
2. If you invest \$100 in a Roth IRA and earn 10% per year for 3 years, how much would it be worth at the end of three years.	0.289	-0.108***	0.073***
3. If you use a credit card in January for a total of \$300, which payment option will result in the lowest amount of overall interest paid.	0.493	-0.075***	0.135***
4. Suppose you decide to buy a BMW for \$50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?	0.429	-0.142***	0.167***
5. In the future, the cost of things you buy doubles AND your income also doubles. How much will you be able to buy in the future in comparison to today?	0.557	-0.066***	0.173***
6. Suppose you have \$30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?	0.530	-0.054**	0.235***
Total score for objective questions (Correct Answers)	2.916	-0.570***	0.877***

(continued on next page)

Table 2 (Continued)

	Average response	Female	Higher GPA
Panel D. Objective questions ("I Don't Know" Answers) <sup>b</sup>			
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.263	0.121***	-0.012
2. If you invest \$100 in a Roth IRA and earn 10% per year for 3 years, how much would it be worth at the end of three years.	0.345	0.176***	-0.086***
3. If you use a credit card in January for a total of \$300, which payment option will result in the lowest amount of overall interest paid.	0.340	0.040*	-0.065***
4. Suppose you decide to buy a BMW for \$50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?	0.295	0.137***	-0.064***
5. In the future, the cost of things you buy doubles AND your income also doubles. How much will you be able to buy in the future in comparison to today?	0.186	0.052***	-0.071***
6. Suppose you have \$30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?	0.287	0.074***	-0.123***
Total score for objective questions ("I Don't Know" Answers)	1.717	0.599***	-0.421***

Note: Shows the differences of pre-survey student responses on financial knowledge and financial behavioral questions across different gender and GPA for the whole sample. Gender is broken into a Sub-group for females and males. The median GPA of the whole sample divides the students as a higher GPA or lower GPA group. The gender characteristic identifies the effect of a student being a female versus a male, as well as the effect of a student having a high GPA versus low GPA.

\*\*\*, \*\*, \* indicate statistical significance at 0.01, 0.05, and 0.10 level, respectively.

<sup>a</sup> Improvement is indicated by a positive difference and *t*-stat (more people selecting the correct answer).

<sup>b</sup> Improvement is indicated by a negative difference and *t*-stat (less people selecting "I Don't Know").

Table 3 Shows the correlation coefficients between financial behavior and self-esteem (IDK answers), objective and subjective financial knowledge

	Subjective	Behavior	Objective	IDK answers
Subjective				
Corr	1.000			
p-value				
Behavior				
Corr	0.334***	1.000		
p-value	<0.0001			
Objective				
Corr	0.277***	0.245***	1.000	
p-value	<0.0001	<0.0001		
IDK answers				
Corr	−0.361***	−0.249***	−0.771***	1.000
p-value	<0.0001	<0.0001	<0.0001	

\*\*\* \*\* \* indicate statistical significance at 0.01, 0.05 and 0.10 level, respectively.

Three path models are used to test the effect of financial behavior scores (Behavior), subjective financial knowledge scores (Subjective), and I Don't Know answers in the objective questions (IDK). In all three path models, we include gender (Female), grade level (Sophomore, Junior, and Senior), favorite subject (English, Math, and Science), GPA and favorite learning method (Learning by doing [LBD], Listening, Discussing, and Visual) as independent variables. Control variables LBD, Listening, Discussing, and Visual allow for direct testing of instructional preferences of students which may impact success of the financial literacy program (Amagir, Groot, van den Brink, & Wilschut 2018). Detailed definitions of variables are listed in Appendix C.

Also, to explore whether the school district of participating classes has any effect on the pre-survey results, we include three school district characteristics as control variables. Specifically, for each participating school, we collect its school district census data from <https://censusreporter.org/>. We exclude private schools, virtual, finance knowledge learning centers, and chartered schools from the whole sample as these schools are hard to determine their school districts. For each public high school, we collect its school district data on its population, poverty rate and percentage of residents who attained bachelor or higher degrees. Also, because the average number of students who participated in the pre-surveys from each school is 20 with a median value of one (ranges from 1 to 225 students per school), we removed school districts with less than 20 student participants. This process reduces our whole sample from 1,613 to 1,441 pre-surveys with available school district data. Summary statistics of school district data are reported in Panel C of Table 1.

Table 4 illustrates the results from these models. Path (1) uses Behavior as the dependent variable. The results show students of higher grade level (sophomore, junior, and senior), with high subjective financial knowledge, higher level of self-esteem, as well as a high GPA, have a higher probability to be better behaved financially. Both the subjective financial knowledge coefficient and self-esteem measure (IDK) are statistically significant at the 1% level, implying that a student who possesses more subjective knowledge and higher self-esteem are more likely to exhibit better financial behavior. On school district characteristics,

Table 4 Regressions on student characteristics: Pre-survey results

	Path (1)		Path (2)		Path (3)	
	Dep. Var.: Behavior		Dep. Var.: Subjective		Dep. Var.: IDK	
	Coefficient	<i>t</i> -Value	Coefficient	<i>t</i> -Value	Coefficient	<i>t</i> -Value
IDK	−0.093	−3.53***	−0.330	−13.43***		
Objective	0.010	0.38	0.032	1.18		
Subjective	0.296	11.91***				
Female	0.042	1.59	−0.035	−1.28	0.172	6.38***
Sophomore	0.062	1.82*	−0.037	−1.04	−0.024	−0.65
Junior	0.205	4.22***	−0.066	−1.31	−0.043	−0.82
Senior	0.294	5.66***	−0.074	−1.36	−0.133	−2.37**
GPA	0.150	5.72***	−0.046	−1.68*	−0.142	−5.18***
English	−0.024	−0.80	0.039	1.27	0.036	1.12
Math	−0.015	−0.51	0.015	0.49	−0.025	−0.78
Science	−0.031	−1.04	0.020	0.64	−0.027	−0.83
LBD	0.043	1.70*	0.066	2.52**	−0.015	−0.55
Listening	−0.005	−0.20	0.066	2.49**	−0.060	−2.18**
Discussing	−0.005	−0.20	0.059	2.29**	−0.008	−0.28
Visual	0.047	1.86*	−0.029	−1.09	0.048	1.77*
Log(Population)	0.019	0.72	0.079	2.91***	−0.038	−1.34
Poverty	−0.130	−3.72***	0.034	0.92	0.065	1.74*
Pct_College	0.041	1.22	0.008	0.24	−0.029	−0.80

*Note:* Table 4 Shows the regression results on student characteristics of the whole sample. Behavior (objective, subjective, IDK) is the total score for financial behavior questions (subjective questions, objective questions with correct answers, objective questions with “I Don’t Know” answers). Female is a dummy variable that is equal to 1 if the student is a female student and 0 otherwise. Sophomore (junior, senior) is a dummy variable that is equal to 1 if the student is a sophomore (junior, senior), and 0 otherwise. English (math, science) is a dummy variable which is equal to 1 if the student’s favorite subject is English (math, science), and 0 otherwise. LBD (listening, discussing, visual) is a dummy variable that is equal to 1 if the student chooses learning by doing (listening, discussing with peers, features visual support) as favorite instruction method, and 0 otherwise. GPA is a student’s grade point average. Log(population) is the log of the population in the school district. Poverty is the poverty rate in the school district. Pct\_college is the percentage of residents who have attained bachelor degree or higher.

\*\*\*, \*\*, \* indicate statistical significance at 0.01, 0.05, and 0.10 level, respectively.

results show school districts with higher poverty rate are more likely to have worse financial behavior (statistically significant at the 1% level).

The second model (Path 2) uses Subjective (representing the measure for subjective knowledge) as the dependent variable. The results show female students with low GPAs are more likely to have lower subjective financial knowledge. Additionally, students who prefer the learning styles of learning by doing (LBD), listening, or discussing are more likely to exhibit greater subjective financial knowledge (all statistically significant at the 5% level). The negative coefficient of IDK (statistically significant at the 1% level) shows that a student who has higher level of self-esteem is also more likely to be subjectively knowledgeable in finance. The insignificant coefficient of Objective (representing the measure for objective knowledge) shows the positive linkage between subjective and objective financial knowledge, which is consistent to the results of Tang and Baker (2016) who find disconnect between subjective and objective knowledge when comparing actual and perceived financial

knowledge. Students in larger school district are more likely to be more subjectively knowledgeable in finance (statistically significant at the 1% level). One possible explanation for this finding is that students who live in larger school districts may be exposed to more financial knowledge/concepts.

The third model (Path 3) uses *IDK* (representing the measure of self-esteem) as the dependent variable. Female students exhibit lower self-esteem scores, while junior or senior students who prefer learning by listening are more likely to have higher self-esteem. On school district characteristics, results show school districts with high poverty rate are more likely to have lower level of self-esteem (statistically significant at the 10% level).

Overall, our results are consistent with Tang and Baker (2016) and suggest that self-esteem plays a statistically significant role in each of the remaining three variables being studied: objective knowledge, subjective knowledge, and financial behavior.

The results in Table 4 need to be interpreted with caution due to the possible endogeneity issues among four financial literacy measures and omitted variable problem. We cannot completely rule out the broader theoretical concern of a reverse causality among these variables although our Hausman test statistics for endogeneity cannot reject the null hypothesis of no measurement error. As for omitted variable bias issue, some variables such as subjective knowledge and self-esteem measure may potentially cause omitted variable bias. Future studies can test and expand upon our results by incorporating additional control variables when data are available.

### 5.3. Post-survey results

We compare the results of the pre- and post-survey using our test sample of 829 matched students. We define improvement in several ways. For subjective financial knowledge and financial behavior, we define gains as the post-survey scores minus the pre-survey response scores. For objective financial knowledge questions, we define gains in financial knowledge as the difference between the post-survey scores and the pre-survey response. To gauge financial self-esteem, we define confidence gains as a decrease in the responses of *I Don't Know* in the post-survey minus the pre-survey. We run univariate tests on the gains in our test samples and subsamples.

Table 5 illustrates the *t* test results by question and overall score for each of the four characteristics measured: subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem. The results show a profound, statistically significant improvement across all areas measured, with 24 of 25 questions showing total score improvement as statistically significant at the 1% level. As a result, the data shows financial literacy educational efforts can lead to better student results in financial literacy understanding and behavior.

Within subjective financial knowledge, all questions result in statistically significant improvement at the 1% level. The biggest gains come from understanding of Roth IRA (gain of 1.682) and retirement (1.401). Seven of the 12 questions result in a greater than 25% improvement. The biggest gain in financial behavior derives from conversations with parents on personal finance (gain of 0.033). These results closely mirror the research of Filbeck and Zhao (2018), who find the largest growth within the same three questions.

Table 5 T-test results between pre- and post-survey

	Pre	Post	Diff	T-stat
<b>Panel A. Financial subjective knowledge questions</b>				
2. I understand how to establish a financial plan.	3.047	4.000	0.953	21.62***
3. I think financial literacy is important for my future.	4.391	4.692	0.280	10.30***
6. I understand the process by which my parents/guardians make financial decisions.	3.369	3.832	0.463	11.32***
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.	3.119	3.865	0.745	16.35***
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.	2.723	3.832	1.109	23.76***
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.	3.418	4.199	0.777	17.05***
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.	3.258	4.150	0.893	19.83***
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.	2.998	3.877	0.878	19.25***
12. I know what a Roth IRA is and how it works from a taxation standpoint.	1.875	3.555	1.682	32.35***
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.	3.110	4.148	1.036	22.41***
14. I know how to plan financially for retirement.	2.555	3.950	1.401	28.28***
Total score for financial subjective knowledge	33.780	43.677	9.897	29.17***
<b>Panel B. Financial behavior questions</b>				
1. I like to save money more than I like to spend it.	3.531	3.809	0.279	6.97***
4. I have a checking and/or a savings account.	4.380	4.268	0.043	1.06
5. I have conversations with my parents regarding personal finance.	3.468	3.799	0.330	7.55***
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)	4.060	4.481	0.421	10.78***
Total score for financial behavior	14.795	16.334	1.539	13.41***
<b>Panel C. Objective questions (Correct Answers)<sup>a</sup></b>				
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.250	0.693	0.053	2.53**
2. If you invest \$100 in a Roth IRA and earn 5% per year for 3 years, how much would it be worth at the end of 3 years.	0.367	0.487	0.202	10.03***
3. If you use a credit card in January for a total of \$500, which payment option will result in the lowest amount of overall interest paid.	0.351	0.729	0.245	12.55***
4. Suppose you decide to buy an Audi for \$50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?	0.306	0.555	0.131	6.18***
5. In the future, the cost of things you buy doubles BUT your income remains the same. How much will you be able to buy in the future in comparison to today?	0.190	0.766	0.194	9.92***
6. Suppose you have \$40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid?	0.306	0.714	0.182	9.01***
Total score for objective questions (Correct Answers)	2.936	3.944	1.007	15.88***

(continued on next page)

Table 5 (Continued)

	Pre	Post	Diff	T-stat
Panel D. Objective questions (“I Don’t Know” Answers) <sup>b</sup>				
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.640	0.052	-0.198	-12.42***
2. If you invest \$100 in a Roth IRA and earn 5% per year for 3 years, how much would it be worth at the end of 3 years.	0.286	0.138	-0.229	-12.50***
3. If you use a credit card in January for a total of \$500, which payment option will result in the lowest amount of overall interest paid.	0.484	0.078	-0.273	-15.69***
4. Suppose you decide to buy an Audi for \$50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?	0.424	0.110	-0.196	-10.76***
5. In the future, the cost of things you buy doubles BUT your income remains the same. How much will you be able to buy in the future in comparison to today?	0.571	0.072	-0.118	-7.93***
6. Suppose you have \$40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid?	0.532	0.104	-0.202	-11.64***
Total score for objective questions (“I Don’t Know” answers)	1.770	0.555	-1.215	-18.81***

Note: Table 5 Shows the *t*-test results of student responses to financial behavior and knowledge questions before and after the financial literacy educational efforts for the test sample.

\*\*\*, \*\*, \* indicate statistical significance at 0.01, 0.05, and 0.10 level, respectively.

<sup>a</sup>Improvement is indicated by a positive difference and *t*-stat (more people selecting the correct answer).

<sup>b</sup>Improvement is indicated by a negative difference and *t*-stat (less people selecting “I Don’t Know”).

Table 6 *T*-test results between pre- and post-survey for different subsamples

	Financial behavior			Subjective questions			Objective questions		
	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
Panel A. Subsamples by gender									
Male	14.797	16.246	1.449***	34.492	43.535	9.043***	3.173	4.041	0.868***
Female	14.792	16.431	1.640***	32.987	43.835	10.848***	2.673	3.835	1.162***
Panel B. Subsamples by grade level									
Freshman	14.143	15.918	1.776***	35.694	44.082	8.388***	2.878	3.980	1.102***
Sophomore	14.565	16.387	1.823***	34.903	43.774	8.871***	2.887	3.952	1.065***
Junior	14.340	16.294	1.954***	33.010	44.340	11.330***	2.782	3.970	1.188***
Senior	15.053	16.381	1.328***	33.758	43.379	9.621***	3.006	3.930	0.924***
Panel C. Subsamples by GPA									
Lower than median GPA	14.251	16.028	1.777***	33.749	43.375	9.625***	2.568	3.699	1.131***
Higher than median GPA	15.389	16.668	1.279***	33.814	44.008	10.193***	3.339	4.211	0.872***
Panel D. Subsamples by preferred instructions methods									
Learning by doing	14.956	16.491	1.535***	33.738	44.002	10.263***	2.969	4.044	1.075***
Listening	14.752	16.238	1.486***	34.227	43.467	9.240***	2.934	3.826	0.891***
Discussing with peers	14.756	16.261	1.505***	34.185	43.519	9.333***	2.919	3.878	0.959***
Features visual support	14.968	16.440	1.472***	33.680	43.984	10.305***	2.975	4.049	1.074***
Interactive with websites	14.667	16.262	1.596***	34.191	44.018	9.827***	3.218	4.040	0.822***
Panel E. Subsamples by favorite subjects									
English	14.494	16.165	1.671***	33.890	43.616	9.726***	2.451	3.506	1.055***
Math	15.140	16.654	1.513***	33.675	44.333	10.658***	3.175	4.053	0.877***
Science	14.596	16.136	1.539***	33.645	43.193	9.548***	3.061	4.013	0.952***
Social studies	14.866	16.373	1.507***	33.876	43.569	9.694***	2.919	4.086	1.167***

*Note:* Shows the *t*-test results of student responses to financial behavior, subjective and objective questions before and after the financial literacy educational efforts for different subsamples.

\*\*\*, \*\*, \* indicate statistical significance at 0.01, 0.05 and 0.10 level, respectively.

Additionally, both objective financial knowledge and self-esteem exhibit statistically significant improvements across the board. The biggest gains from objective financial knowledge are credit (gain of 0.245) and compounding interest (gain of 0.202). The biggest improvements in self-esteem also stem from credit (0.273 improvement) and compounding interest (0.229 improvement). The results show a link between confidence to answer a question (self-esteem) and correctness (objective financial knowledge).

The *t* test analyzes hypotheses related to the objective financial knowledge questions. Students experienced a positive gain in correct responses of 1.007 (statistically significant at the 1% level), which represents an improvement of 34%. Furthermore, the mean total score for the test sample increased to almost four. At a statistically significance level of 1%, we reject null hypothesis and conclude that students are more likely to be more financially knowledgeable after completing financial literacy education.

Additionally, students experience an increase in financial self-esteem, as measured by the amount of questions answered with I Don't Know. Students experienced an improvement in the number of I Don't Know responses of 1.215 (statistically significant at the 1% level), representing an improvement in financial self-esteem to answer the question. As a result, we reject null hypothesis and conclude that students are less likely to answer I Don't Know and have greater confidence after completing financial literacy education.

Table 6 reports the *t* test results for different subgroups, which show statistically significant improvement across all subgroups at the 1% level, indicating a significant improvement after completing the financial literacy program. Within the objective knowledge category, female students and students with low GPAs exhibit greater improvement, a positive sign in learning potential, as these characteristics are more likely to lead to lower initial financial literacy (Tables 2 and 4 findings). Consistent with Gerrans and Heaney (2019), female students experience a greater improvement in financial behavior, financial knowledge, and objective knowledge in comparison to their male peers.

Next, we run regression analysis to examine how student characteristics and other control variables affect their knowledge and behavior gains. Table 7 reports the regression results. Panel A reports the regression results on student characteristics and school district characteristics after controlling for fixed effects of classes. Specifically, the class fixed effects allow the class dummy variable to differ for each class and control for the variations across classes. Because we include school district characteristics as control variables, and these data are the same in the same school district, we cluster the standard errors at the school district level. The dependent variable is Diff\_BEHAV (Diff\_SUBJ, Diff\_OBJ, Diff\_IDK), which is the difference between the students' pre- and post-study scores (post- minus pre-) for the financial behavior (subjective, objective) questions. All the other variables are defined the same as in Table 4 and listed in Appendix C. We also add Pre\_BEHAV, Pre\_SUBJ, Pre\_OBJ, and Pre\_IDK in the regressions to test whether student gains in financial knowledge and behavior are affected by their presurvey knowledge and behavior. A negative coefficient for Diff\_IDK indicates an improvement in self-esteem, as it means that students answer I Don't Know less in the post-survey and select more answers that are correct or incorrect. The results show that students who are less knowledgeable or exhibit inferior financial behavior gain most in the study. Similarly, students in school districts with higher poverty experience a statistically significant gain in financial behavior. This finding is encouraging as Kaiser and Menkhoff (2017) indicate that financial education is often less effective for lower (low and lower-middle) income clients (economics) due to lack of relatability to topics such as handling of debt, a fact also noted by Fernandes and Lynch (2014). Our differing results may be attributable to the manner in which the curriculum from the CFA Society Pittsburgh directly addresses relatability in the context of typical, high-school appropriate, smaller cost purchases. Such an approach is consistent with Stolper and Walter (2017) as they point out that the opportunity to relate financial literacy to various demographics in the context of their spending behavioral is key to program success. Female students improve by a greater amount in financial knowledge across both subjective and objective questions. Students in school districts with a higher poverty improve more in financial behavior. Female students are more likely to experience an increase in self-esteem (statistically significant at the 1% level). The improvement is consistent with our findings in Table 6 and the findings of Gerrans and Heaney (2019), which both find that female students benefit more from financial literacy education.

Next, we include other control variables such as favorite subjects and learning style and use fixed effect regressions controlling for classes differences. Because there are no school district data included in these regressions, we cluster standard errors at the class level. Panel B of Table 7 reports the regression results. We use the same dependent variables as in Panel

Table 7 Shows the regression results of the test sample

	Model (1)		Model (2)		Model (3)		Model (4)	
	Dep. Var.: Diff_BEHAV	Z-stat	Dep. Var.: Diff_SUBJ	Z-stat	Dep. Var.: Diff_OBJ	Z-stat	Dep. Var.: Diff_IDK	Z-stat
	Coefficient		Coefficient		Coefficient		Coefficient	
Panel A. Regression Results after controlling for fixed effect of classes, with standard errors clustered at school district level								
Intercept	2.762	1.27	14.56	1.20	3.807	2.48**	-2.309	-1.54
Female	0.341	1.57	1.812	2.10**	0.287	1.66*	-0.435	-3.01***
Sophomore	0.336	0.73	1.152	0.41	0.006	0.006	-0.216	-0.54
Junior	0.186	0.55	3.100	1.40	0.070	0.28	-0.183	-0.55
Senior	-0.431	-1.55	1.766	0.82	-0.047	-0.15	-0.029	-0.08
GPA	-0.315	-2.02**	0.723	1.39	-0.096	-0.93	0.128	1.19
Log(Population)	-0.153	-0.79	-1.147	-0.77	-0.245	-1.55	0.093	0.53
Poverty	7.361	1.93*	6.223	0.23	-0.714	-0.24	-0.117	-0.04
Pct_College	2.419	1.23	4.490	0.33	-0.028	-0.02	0.067	0.04
Panel B. Regression results after controlling for fixed effect of classes, with standard error clustered at class level								
Intercept	10.349	10.40***	35.368	12.02***	2.130	5.96***	0.891	4.03***
Pre_BEHAV	-0.688	-12.80***	-0.836	-12.83***	-0.647	-16.23***	-0.818	-25.49***
Pre_SUBJ							0.068	1.19
Pre_IDK							-0.307	-1.39
Female	0.151	0.94	0.660	0.97	-0.001	-0.01	-0.307	-0.63
Sophomore	0.538	1.16	0.074	0.04	-0.031	-0.10	-0.116	-0.30
Junior	0.360	0.66	0.846	0.59	0.099	0.51	-0.056	-0.30
Senior	0.254	0.56	-0.222	-0.16	-0.036	-0.18	-0.173	-3.73***
GPA	0.256	1.87	0.444	1.44	0.199	2.00**	0.297	2.08**
English	-0.071	-0.36	-0.260	-0.33	-0.387	-2.88***	0.185	2.13**
Math	0.180	0.59	0.600	0.67	-0.121	-0.72	0.117	1.05
Science	-0.150	-0.63	-0.356	-0.44	-0.094	-0.57	-0.185	-1.79*
LBD	0.305	1.37	1.089	2.10**	0.303	3.00***	0.043	0.62
Listening	-0.146	-0.74	-0.366	-0.55	-0.188	-1.96**	0.083	0.99
Discussing	-0.111	-0.45	-0.351	-0.51	-0.105	-0.78	0.083	0.99
Visual	0.107	0.61	0.821	1.45	0.250	2.24**	-0.116	-1.39

Note: Panel A reports the regression results on student characteristics and school district characteristics after controlling for fixed effect of classes, with standard errors clustered at the school district level. Panel B reports the regression results on student characteristics after controlling for fixed effect of classes, with clustered standard errors. Diff\_BEHAV (pre\_SUBJ, pre\_IDK) is the student's total score for the financial behavior (knowledge, objective) questions. Diff\_BEHAV (diff\_SUBJ, diff\_IDK) is the difference between the student's pre- and post-survey scores for the financial behavior (knowledge, objective) questions. Female is a dummy variable which is equal to 1 if the student is a female student, and 0 otherwise. Sophomore (junior, senior) is a dummy variable which is equal to 1 if the student is a sophomore (junior, senior), and 0 otherwise. English (math, science) is a dummy variable which is equal to 1 if the student's favorite subject is English (math, science), and 0 otherwise. LBD (listening, discussing, visual) is a dummy variable which is equal to 1 if the student chooses learning by doing (listening, discussing with peers, features visual support) as favorite instruction method, and 0 otherwise. GPA is a student's grade point average. Log(population) is the log of the population in the school district. Poverty is the poverty rate in the school district. Pct\_college is the percentage of residents who have attained bachelor degree or higher.

\*\*\*, \*\*, \* indicate statistical significance at 0.01, 0.05 and 0.10 level, respectively.

A. We also add Pre\_BEHAV, Pre\_SUBJ, Pre\_OBJ, and Pre\_IDK in the regressions to test whether student gains in financial knowledge and behavior are affected by their pre-survey knowledge and behavior. The results show that students who are less knowledgeable or exhibit inferior financial behavior gain most in the study. Students whose favorite instruction method is learning by doing tend to gain more in subjective financial knowledge. Students with a high GPA, whose favorite subject is not English, whose favorite instruction method is learning by doing or visual tend to gain more in objective financial knowledge. Students with lower self-esteem gain the largest amount of self-esteem. Additionally, students with higher GPA and students that prefer learning by doing experience the largest self-esteem gain (statistically significant at the 1% and 10% level, respectively).

## 6. Conclusions

This research study investigates the effectiveness of a high school financial literacy campaign to significantly improve financial literacy in four areas: subjective financial knowledge, financial behavior, objective financial knowledge and self-esteem. The financial literacy campaigns within the study were launched by the CFA Society Pittsburgh based upon the book *The Missing Semester*.

Initially, the result of the pre-survey, taken by students before beginning the financial education program, are analyzed using a *t* test. The results show students with higher GPAs are more likely to display better financial behavior and objective financial knowledge than students with lower GPAs. Students with lower GPAs exhibit greater perceived knowledge (subjective financial knowledge) in the concepts of loans and cost-benefit analysis; however, the same students exhibit lower actual knowledge (objective financial knowledge) in the same categories. This finding is consistent with previous literature that shows a disconnect between actual and perceived knowledge, as well as a connection between poor financial understanding and negative debt implications (e.g., higher debt and higher borrowing costs). Similarly, male students are more likely to exhibit better objective financial knowledge, while female students are more likely to exhibit lower financial self-esteem.

Subsequently, logistic regressions test the relationship of subjective financial knowledge, financial behavior, and objective financial knowledge. The results further display the link between gender and initial financial knowledge, as females score lower on pre-survey objective and subjective financial knowledge. In addition, higher GPA has a statistically significant effect on better financial behavior and objective financial knowledge, but worse subjective knowledge, reinforcing the findings about the disconnect between actual and perceived knowledge. Furthermore, self-esteem is shown to play a statistically significant impact on both actual and perceived knowledge. Students with higher self-esteem exhibit higher financial behavior, subjective financial knowledge, and objective financial knowledge (significant at the 1% level), signifying that self-esteem is an important part of the financial literacy equation. Additionally, the initial positive link between objective and subjective financial knowledge is eliminated when we added the additional regression variable, self-esteem, which further emphasizes the importance of self-esteem. This finding is consistent

with Tang and Baker (2016), which introduces the importance of self-esteem on financial behavior. Students in school districts with lower income levels exhibit lower financial behavior and objective financial knowledge, while students in school districts with smaller populations score higher in subjective financial knowledge.

To test the effectiveness of the financial literacy program, we then conducted a *t* test between results of the pre- and post-survey, taken after completion of the course. The *t* test analyzes the four major topic areas previously listed. Total scores for financial behavior, subjective knowledge, objective knowledge, and self-esteem improve by 29.3%, 10.4%, 34.3%, and 68.6%, respectively. Students experience a statistically significant improvement of an average 35.7% in all four topic areas at the 1% level. Within subjective financial knowledge, the largest gains result from the concepts of Roth IRA and planning for retirement. Financial behavior shows the largest improvement in having personal finance conversations with parents. Objective financial knowledge and self-esteem improve the most for the concepts of compound interest and credit.

Overall, the characteristics with the lowest pre-survey scores show the greatest improvements in the post-survey scores. Within gender, females exhibit the highest improvement in all four of the categories. Also, students with lower GPAs experience greater improvement in financial behavior and objective knowledge, while students with higher GPAs improve more in subjective knowledge. Students who prefer learning by doing and visual support experience the most improvement, while students whose favorite subject is English or social studies experience the largest improvement.

Based upon the analysis, statistically significant gains in subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem lead us to the conclusion that the CFA Society Pittsburgh financial literacy program is successful at increasing students' chances of financial success. Therefore, the analysis shows the program continues to be successful at attempting to confront the financial literacy crisis. As the program continues to improve and expand, we look forward to expanding the sample size and reach of the financial literacy efforts, especially to states where students may receive no mandated financial education during high school. As financial analysts, society will increasingly be looking to our profession to reduce the impact of financial illiteracy and to make a positive difference in our fiduciary duties for investor education.

Our study has obvious limitations. First, we do not control for the manner in which content is presented in the classroom—does it make a difference whether the program is spread out over an entire system or conducted in longer sessions over a shorter time period. We also do not control for the number of hours spent delivering the content. Future research efforts will focus differences in program delivery. Additionally, we did not introduce a true control group for comparison, as we did not want to jeopardize the main purpose of our program, giving students the tools for a better financial future, just to provide a control group.

Our primary recommendation, based on the experience of CFA Society Pittsburgh, is for financial professionals to consider taking a more active role in financial literacy outreach. Who better to lead these efforts than those who are trained to understand its importance?

## Appendix A: Presurvey

State:  
School:  
Teacher:  
Student ID:  
Gender:  
GPA:  
Grade:

Favorite subject in school:

English  
 Math  
 Social Studies  
 Science

Questions:

1. I like to save money more than I like to spend it.
2. I understand how to establish a financial plan.
3. I think financial literacy is important for my future.
4. I have a checking and/or a savings account.
5. I have conversations with my parents regarding personal finance.
6. I understand the process by which my parents/guardians make financial decisions.
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.
12. I know what a Roth IRA is and how it works from a taxation standpoint.
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.
14. I know how to plan financially for retirement.
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)

Learning Preferences: I am able to master material when instruction includes:

1. Learning by doing/manipulating objects
2. Listening
3. Discussing with peers
4. Features visual support (e.g., powerpoint slides)
5. Interactive with websites

## Objective Questions:

1. Is it safer to put your money into one investment or put your money into multiple investments?
  - a. One Investment
  - b. Multiple Investments
  - c. I Don't Know\*
  
2. If you invest \$100 in a Roth IRA and earn 10% per year for 3 years, how much would it be worth at the end of three years.
  - a. More than \$130
  - b. Exactly \$130
  - c. Less than \$130
  - d. I Don't Know\*
  
3. If you use a credit card in January for a total of \$300, which payment option will result in the lowest amount of overall interest paid.
  - a. The Full Amount (\$300)
  - b. The Minimum Payment Required
  - c. Paying nothing (\$0)
  - d. I Don't Know\*
  
4. Suppose you decide to buy a BMW for \$50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?
  - a. More than \$10,000
  - b. Exactly \$10,000
  - c. Less than \$10,000
  - d. I Don't Know\*
  
5. In the future, the cost of things you buy doubles AND your income also doubles. How much will you be able to buy in the future in comparison to today?
  - a. Less
  - b. The Same
  - c. More
  - d. I Don't Know\*
  
6. Suppose you have \$30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?
  - a. 10 years at \$350 per month

- b. 15 years at \$270 per month
- c. 20 years at \$230 per month
- d. I Don't Know\*

\*Survey respondents were required to answer the question, so I Don't Know answer allows students to select non correct/incorrect answer

### **Appendix B: Post-survey**

State:  
School:  
Teacher:  
Student ID:

Questions:

1. I like to save money more than I like to spend it.
2. I understand how to establish a financial plan.
3. I think financial literacy is important for my future.
4. I have a checking and/or a savings account.
5. I have conversations with my parents regarding personal finance.
6. I understand the process by which my parents/guardians make financial decisions.
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.
12. I know what a Roth IRA is and how it works from a taxation standpoint.
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.
14. I know how to plan financially for retirement.
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)

Learning Preferences: I am able to master material when instruction includes:

1. Learning by doing/manipulating objects
2. Listening
3. Discussing with peers
4. Features visual support (e.g., powerpoint slides)
5. Interactive with websites

## Objective Questions:

1. Which is less risky: Investing your money into one investment or multiple investments?
  - a. One Investment
  - b. Multiple Investments
  - c. I Don't Know\*
  
2. If you invest \$100 in a Roth IRA and earn 5% per year for 3 years, how much would it be worth at the end of three years.
  - a. More than \$115
  - b. Exactly \$115
  - c. Less than \$115
  - d. I Don't Know\*
  
3. If you use a credit card in January for a total of \$500, which payment option will result in the lowest amount of overall interest paid.
  - a. The Full Amount (\$500)
  - b. The Minimum Payment Required
  - c. Paying nothing (\$0)
  - d. I Don't Know\*
  
4. Suppose you decide to buy a Audi for \$50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?
  - a. More than \$10,000
  - b. Exactly \$10,000
  - c. Less than \$10,000
  - d. I Don't Know\*
  
5. In the future, the cost of things you buy doubles BUT your income remains the same. How much will you be able to buy in the future in comparison to today?
  - a. Less
  - b. The Same
  - c. More
  - d. I Don't Know\*
  
6. Suppose you have \$40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid?
  - a. 10 years at \$450 per month
  - b. 15 years at \$365 per month

c. 20 years at \$315 per month

d. I Don't Know\*

\*Survey respondents were required to answer the question, so I Don't Know answer allows students to select non correct/incorrect answer

### Appendix C: Variable definitions

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#### Dependent variables

Subjective	Total score for the financial subjective questions in the survey
Objective	Total score for the financial objective questions in the survey with correct answers
Behavior	Total score for the financial behavior questions in the survey
IDK	Total score for the financial objective questions in the survey with “I don't know” answers
Diff_Subj	The difference between the students' pre- and post-study scores (post minus pre) for the financial subjective questions.
Diff_Obj	The difference between the students' pre- and post-study scores (post minus pre) for the financial objective questions with correct answers.
Diff_Behav	The difference between the students' pre- and post-study scores (post minus pre) for the financial behavior questions.
Diff_IDK	The difference between the students' pre- and post-study scores (post minus pre) for the financial objective questions with “I don't know” answers.

#### Independent variables

Gender:	
Female	A dummy variable which is equal to 1 if the student is a female, and 0 otherwise.
Grade level:	
Sophomore	A dummy variable which is equal to 1 if the student is a sophomore, and 0 otherwise.
Junior	A dummy variable which is equal to 1 if the student is a junior, and 0 otherwise.
Senior	A dummy variable which is equal to 1 if the student is a senior, and 0 otherwise.
Favorite subject:	
English	A dummy variable which is equal to 1 if the student's favorite is English, and 0 otherwise.
Math	A dummy variable which is equal to 1 if the student's favorite is Math, and 0 otherwise.
Science	A dummy variable which is equal to 1 if the student's favorite is Science, and 0 otherwise.
Favorite learning style:	
LBD	A dummy variable which is equal to 1 if the student's favorite learning style is learning by doing (LBD), and 0 otherwise.
Listening	A dummy variable which is equal to 1 if the student's favorite learning style is listening, and 0 otherwise.
Discussing	A dummy variable which is equal to 1 if the student's favorite learning style is discussion, and 0 otherwise.
Visual	A dummy variable which is equal to 1 if the student's favorite learning style is visualization, and 0 otherwise.
GPA:	
GPA:	A student's grade point average (GPA).
School district characteristics:	
Log(Population)	The log of the population in the school district.
Poverty	The poverty rate in the school district.
Pct_College	The percentage of residents who have attained bachelor degree or higher.

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# The Association Between Financial Risk and Retirement Satisfaction

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## Abstract

A higher level of risky financial assets that a retiree holds may produce higher returns, resulting in utility gains. To test this hypothesis, a variable is constructed measuring retirees' ratio of risky assets to total assets (risk ratio). Next, the association between the risk ratio and retiree utility is examined using a retirement satisfaction variable from the 1992-2014 waves of the Health and Retirement Study. The findings suggest that increases in retirees' risk ratio is associated positively with increases in their retirement satisfaction. The results and ensuing discussion offer a new perspective for retiree asset management. © 2020 Academy of Financial Services. All rights reserved.

*JEL classification:* D8

*Keywords:* Financial planning; Retirement satisfaction; Risk aversion

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## Introduction

Financing consumption in advanced age is paramount when planning for the transition into retirement. In the absence of non-labor income sources, such as Social Security income, pension income, and annuity income, retirees utilize their saved assets to finance consumption. Saved assets can take varying forms of financial risk, and the traditional “time-horizon” approach to asset management suggests shifting from risky assets to less risky assets when transitioning into retirement. However, risky assets, such as equities, have historically

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provided higher returns when compared with their less-risky alternatives, such as bonds, money market accounts, and CDs. Risky assets have the potential for higher returns and may provide retirees with more income to finance their consumption in retirement, and more income to finance consumption in retirement may lead to a more satisfactory retirement experience.

Retirement satisfaction is affected by many different factors, including a retiree's financial situation (Bonin et al., 2007; Diener et al., 2010; Seccombe & Lee, 1986), marital status (Easterlin, 2003; Van Solinge, 2008), health status (Barfield & Morgan, 1978; Price & Balaswamy, 2009), and pre-retirement feelings about retirement (Elder, 1999; Kimmel, 1978). Planning for retirement, reading about retirement, and exposure to radio or television programs about retirement also are significant correlates of retirement satisfaction (Dorfman, 1989; Taylor-Carter, 1997).

Many studies have analyzed how risk preference affects utility (Bachmann et al., 2017; Hanna & Chen, 1997; Pratt, 1964; Pålsson, 1996). However, most of these studies assume homogeneity in their sample and do not consider the structural-grouping differences among the population, such as how their results would apply to a retired sample. Analyzing risk preferences and retiree utility minimizes human capital and employment considerations that researchers argue should be considered when measuring risk preferences. For example, individuals with higher levels of human capital are more likely to have higher risk tolerance (Shaw, 1996), suggesting that human capital investment is an inverse function of risk aversion. Thus, the potential for human capital development may affect risk preference, as fully retired individuals will not invest in their human capital for purposes of future labor income.

There are a variety of ways to measure risk preference. One approach is question-derived assessments. However, risk-preference questionnaires may not be reflective of actual investment behavior (Bouchey, 2004; Corter & Chen, 2006; Yook & Everett, 2003). Objective risk tolerance, or an individual's ratio of risky financial assets relative to either their net worth or assets, is another measure used in a variety of studies (Cordell, 2002; Hanna & Chen, 1997; Sung & Hanna, 1996). Relative risk is another measure of risk preference. Relative risk provides a coefficient of individuals' level of risk relative to their total wealth and may be a better measure when conducting a comparative analysis (Dyer & Sarin, 1982).

The goal of this study is to measure the effect of the risk ratio on retirement satisfaction levels. This research question will help shed light on the association between risky asset holdings in retirement, relative to total wealth, and retirement satisfaction. We posit that assets with higher risk also come with the potential for higher returns, and higher returns provide retirees with more income to finance their consumption in retirement. Therefore, we hypothesize that a higher level of risky assets, relative to total wealth, may lead to higher retirement satisfaction.

## **Data**

Longitudinal data that are collected from The Health and Retirement Study (HRS) are used for hypothesis testing.<sup>1</sup> The HRS is a household survey conducted by the Institute for

Social Research at the University of Michigan. The RAND HRS 2014 Fat File (V2A) is used, which includes the 1992–2014 waves.<sup>2</sup>

The sample only includes individuals who are fully retired. To focus solely on retirees, the subset of HRS respondents who answer “retired” when asked, “Are you working now, temporarily laid off, unemployed and looking for work, disabled and unable to work, retired, a homemaker, or what?” Respondents who state anything other than “retired,” as well as incomplete responses, are dropped from the analysis. Respondents who state that they are retired, yet still reported earned income, are also dropped from the sample. This is done to ensure that the sample is fully retired and that the only income that the sample receives is non-labor income. The presence of labor income would add complexities to the analysis that are difficult to control for given the data limitations within the HRS. For example, the riskiness of labor income varies based on factors such as occupation and tenure, and there are either limited or no data available to control for these differences among respondents within the HRS.

Utility is measured as a retiree’s level of retirement satisfaction. Retirement satisfaction is measured using the following question: “All in all, would you say that your retirement has turned out to be very satisfying, moderately satisfying, or not at all satisfying?” Using a Likert method, the observations are coded as 1 (*not at all satisfied* - 3,520), 2 (*moderately satisfied* - 20,234), and 3 (*very satisfied* - 35,640). The average satisfaction score is 2.54. This implies that “very satisfied” individuals were more likely to be found in the data and therefore selection bias might influence the results. The sample size is 17,672 and there are 59,404 observations.

### The risk ratio variable

The risk ratio (RR) variable is constructed by dividing retirees’ stock assets by their total wealth:

$$RR_{it} = \frac{TSEA_i}{\sum_{i=0}^n [(TSEA_i) + (TBEA_i) + (TCA_i) + E(HE_i)]}$$

Where

$TSEA_i$  = Total Stock Equity Assets.

$TBEA_i$  = Total Bond Assets.

$TCA_i$  = Total Market and Non-Market Cash Assets.

$E(HE_i)$  = Summation of all residences – all mortgage liabilities.

Total stock equity assets (TSEA) are considered risky assets, which include the net value of stocks, mutual funds, and investment trusts. Total bond assets (TBEA) include the net value of bonds and bond funds. The market and non-market cash assets (TCA) include the net value of CDs, government savings bonds, T-bills, checking accounts, savings accounts and money market accounts.

Home equity is included as a riskless asset in the denominator. The results may be sensitive to the treatment of whether or not home equity is included as a riskless or risky asset (Hanna et al., 2001; Pålsson, 1996). Home equity is treated as a riskless asset for the reasons noted by Bellante and Green (2004). They suggest that home equity is riskless because the older segments of the U.S. population are more likely to own their homes and carry very little debt. Therefore, the low leverage levels provide a barrier to the effects of home-equity value fluctuations. It should be noted that housing debt has been increasing slightly among older Americans (Lusardi et al., 2018) since Bellante and Green's (2004) study. Additionally, home equity provides a hedge against systemic inflationary risks.

Human capital is a substantial part of an individual's wealth (Schultz, 1961). As noted in Hanna and Chen's (1997) study, human capital should be analyzed as a part of the total wealth portfolio when developing objective risk measures, such as the RR variable. However, human capital estimates are difficult to assess, with many of the methods under heavy academic scrutiny (Chenet al., 2004; Fitz-Enz, 2000; Mulligan & Sala-i-Martin, 2000). Because retirees are analyzed, it is assumed that they will not use their human capital for income nor invest in their human capital. Human capital, therefore, is assumed to have a value of zero for the retirees in the sample.

Retirees may consider their non-labor income sources when deciding on the level of risk of their saved assets. Thus, arguments could be made for the inclusion of the net present value (NPV) of pension, annuity, social security, and other non-labor incomes in the RR total-wealth denominator. The RR variable does not include the NPV of non-labor incomes because non-labor income is controlled for in the quantitative analysis.

## **Other variables**

Dummy variables are created and coded with a value of "1" if the respondent is White, married, or male. A "0" is coded otherwise. Continuous variables are created to measure the retirees' age, non-labor income (income), non-housing wealth (wealth), and years of education. Nominal values are used for income and wealth. A categorical variable measuring health status also is created. The health status variable can take the following values: 1 (poor), 2 (fair), 3 (good), 4 (very good), and 5 (excellent).

Table 1 provides the descriptive statistics of the sample. The average RR is 0.09. The average age of the retirees in the sample is 73. The average income and wealth of the retirees are \$49,720 and \$187,068, respectively. Respondents in our sample are wealthier than average and, therefore, have more resources for consumption, which may be a possible explanation for why the mean retirement satisfaction score is 2.54 out of 3. Therefore, selection bias may be present. The sample includes 87.81% White retirees, 45.74% male retirees, and 61.11% of the retirees are married.

Table 2 provides a further breakdown of the descriptive statistics by retirement satisfaction levels. There is a positive relation between the RR variable and retirement satisfaction. Retirees being "not at all" satisfied, "moderately" satisfied, and "very" satisfied with their retirements have average risk ratios of 0.05, 0.07, and 0.11, respectively. Additionally, there

Table 1 Descriptive statistics of sample

	Mean	Standard error	Min	Max
Risk ratio	0.0905	0.1801	0	0.9999
Satisfaction	2.5405	0.6060	1	3
Age	73.4445	9.2105	50	106.6667
Education	12.6939	2.8713	8	17
White	0.8781	0.3271	0	1
Male	0.4574	0.4982	0	1
Health	3.0764	1.0948	1	5
Married	0.6111	0.4875	0	1
Income	\$49,720	\$85,822	\$0	\$7,307,860
Wealth	\$187,068	\$643,298	\$0	\$42,300,000

Note:  $N = 59,404$  observations from 17,672 retirees.

is a positive relation between being “very satisfied” and higher levels of health, income, and wealth.

### Method

To test the hypothesis, a random-effects ordered probit model is estimated on the unbalanced panel:

$$SAT_{it}^* = \beta_{0i} + \beta_1 RR_{it} + \beta_j DV_{it} + \alpha_i + e_{it}$$

$$SAT_{it} = 1 \text{ if } SAT_{it}^* < \mu_1 \text{ (Not at all satisfied)}$$

$$SAT_{it} = 2 \text{ if } \mu_1 \leq SAT_{it}^* < \mu_2 \text{ (Moderately satisfied)}$$

$$SAT_{it} = 3 \text{ if } SAT_{it}^* \geq \mu_2 \text{ (Very satisfied)}$$

where  $SAT_{it}^*$  is a latent measure of retiree  $i$ 's satisfaction in wave  $t$ . The unknown thresholds,  $\mu_1$  and  $\mu_2$ , are to be estimated.

Table 2 Summary of data by satisfaction measures

	“Not at all satisfied”	“Moderately satisfied”	“Very satisfied”
Respondents	3,530	20,234	35,640
Risk ratio	0.05	0.07	0.11
Health	2.10	2.78	3.34
Years of education	11.70	12.27	13.03
Age	69.90	73.61	73.70
White	0.81	0.86	0.90
Male	0.43	0.44	0.47
Married	0.51	0.55	0.66
Income	\$32,926	\$42,133	\$55,689
Wealth	\$69,911	\$132,131	\$229,867

Note:  $N = 59,404$  observations from 17,672 retirees.

$\beta_0$  represents the y-intercept of the model. The intercept value for individual  $i$  is expressed as  $\beta_{0i} = \beta_0 + e_i$ , where  $i = 1, \dots, N$  and  $E(e_i) = 0$  and  $\text{Var}(e_i) = \sigma_e^2$ . Below is the assumption concerning the composite error component:

$$e_i \sim N(0, \sigma_e^2)$$

$$E(e_i e_t) = 0 \text{ for } i \neq t$$

An ordered probit model is used due to the non-linear nature of the dependent variable. To the authors' knowledge, a reliable computation for a fixed-effects ordered probit model does not currently exist. Thus, a random effects model is utilized. If a fixed-effects estimator becomes available, future research should reconsider this study's findings to better understand how the within subject variation of the RR variable is associated with retirement satisfaction.

$RR_{it}$  represents the risk ratio variable, RR, and  $\beta_1$  is the coefficient associated with  $RR_{it}$ . It is expected that  $RR_{it}$  will result in a positive coefficient for the "very satisfied" category and a negative coefficient for the "moderately satisfied" and "not at all satisfied" categories. A positive coefficient for the very satisfied category would suggest that retirees are more likely to respond very satisfied if the risk of their saved assets is increased. A Granger Causality Test is utilized to test for reverse causality between  $SAT_{it}^*$  and  $RR_{it}$  (Granger, 1969). The results of the test suggest that there are no statistically significant reverse causality issues.

The matrix  $DV_{it}$  contains all of the demographic variables used as control variables in the model, including White, married, male, health, age, income, wealth, and years of education.  $\beta_j$  is the vector of coefficients related to the matrix  $DV_{it}$ . It is expected that higher levels of income, wealth, education, health, and being married will result in positive coefficients for the very satisfied category.

$\alpha_i$  is the unknown intercept for each retiree  $i$ . Average marginal effects provide the magnitudes for each of the effects on observed retirement satisfaction. The error term is assumed to follow a standard normal distribution.

## Results

The average marginal effects from the random-effects ordered probit regression are reported in Table 3. As the  $RR_{it}$  variable increases from 0 to 1, the results suggest that the probability of retirees being very satisfied with their retirement increases by 0.0762. As the RR variable increases from 0 to 1, the results suggest that the probability of retirees being moderately satisfied and not at all satisfied with their retirement decreases by 0.0523 and 0.0239, respectively.

One consideration to note is that a higher RR means that a retiree has a higher percentage of assets held in stocks. Thus, stock returns may be endogenous in the estimated model. To adjust for the potential impact that stock assets may have on the results, annualized nominal

Table 3 Average marginal effects of the risk ratio on retirement satisfaction

	“Not at all”	“Moderately satisfied”	“Very satisfied”
Risk ratio	−0.0239* (0.0038)	−0.0523* (0.0084)	0.0762* (0.0122)
Health (poor as base outcome)			
Fair	−0.0633* (0.0036)	−0.0624* (0.0030)	0.1257* (0.0063)
Good	−0.0959* (0.0036)	−0.1263* (0.0036)	0.2222* (0.0065)
Very good	−0.1181* (0.0037)	−0.1963* (0.0045)	0.3145* (0.0071)
Excellent	−0.1275* (0.0038)	−0.2385* (0.0065)	0.3661* (0.0089)
Male (Female as base outcome)	0.0002 (0.0018)	0.0005 (0.0038)	−0.0007 (0.0056)
White (non-White as base outcome)	−0.0121* (0.0024)	−0.0529* (0.0052)	0.0387* (0.0076)
Married (non-married as base outcome)	−0.0242* (0.0016)	−0.0529* (0.0033)	0.0772* (0.0048)
Education	−0.0042* (0.0003)	−0.0092* (0.0006)	0.0133* (0.0009)
Age	−0.0012* (0.0000)	−0.0026* (0.0001)	0.0039* (0.0002)
Income (10k)	−0.0003* (0.0000)	−0.0006* (0.0001)	0.0009* (0.0002)
Wealth (10k)	−0.0001* (0.0000)	−0.0002* (0.0001)	0.0003* (0.0002)

Note: Significance is defined as follows: \*significant at the one-percent level. Wealth and income means and standard errors reported in \$10,000s.  $N = 59,404$  observations from 17,672 retirees.

S&P 500 returns are included in a new model. The HRS data are biannual and therefore the S&P 500 data are biannual for each wave of the survey (refer to Table 4). The returns analyzed include both the returns generated from asset price changes and dividends.

A sensitivity analysis is conducted by including the series of S&P 500 returns as a variable in the random-effects regression. The average marginal effects are reported in Table 5. The results indicate that as the  $RR_{it}$  variable increases from 0 to 1, the probability of retirees being very satisfied with their retirement increases by 0.0223. As the  $RR_{it}$  variable increases from 0 to 1, the results suggest that the probability of retirees being moderately satisfied and not at all satisfied with their retirement decreases by 0.0135 and 0.0093, respectively. Although these results are still statistically significant, the new model has reduced the magnitude of the  $RR_{it}$  variable. It is important to note that satisfied individuals were more likely to be in the sample, and this possible selection bias might influence the results.

Table 4 S&amp;P 500 returns

Wave (year)	S&P 500 return
Wave 1 (1992)	7.62
Wave 2 (1994)	1.32
Wave 3 (1996)	22.96
Wave 4 (1998)	28.58
Wave 5 (2000)	−9.10
Wave 6 (2002)	−22.10
Wave 7 (2004)	10.88
Wave 8 (2006)	15.79
Wave 9 (2008)	−37.00
Wave 10 (2010)	15.06
Wave 11 (2012)	16.00
Wave 12 (2014)	13.69

Note: Returns include both price changes and dividends generated the S&P 500 Index for the year analyzed.

Table 5 Average marginal effects of the risk ratio on retirement satisfaction including S&amp;P 500 returns

	“Not at all”	“Moderately satisfied”	“Very satisfied”
Risk ratio	−0.0092* (0.0021)	−0.0135* (0.0032)	0.0223* (0.0053)
Health (poor as base outcome)			
Fair	−0.0694* (0.0034)	−0.0461* (0.0020)	0.1116* (0.0051)
Good	−0.1100* (0.0034)	−0.1037* (0.0027)	0.2137* (0.0054)
Very good	−0.1372* (0.0035)	−0.1676* (0.0037)	0.3048* (0.0061)
Excellent	−0.1492* (0.0037)	−0.2077* (0.0059)	0.3569* (0.0083)
Male (female as base outcome)	0.0008 (0.0021)	0.0013 (0.0029)	−0.0022 (0.0052)
White (non-White as base outcome)	−0.0277* (0.0026)	−0.0410* (0.0038)	0.0687* (0.0064)
Married (non-married as base outcome)	−0.0307* (0.0018)	−0.0455* (0.0026)	0.0762* (0.0044)
Education	−0.0050* (0.0003)	−0.0075* (0.0005)	0.0125* (0.0008)
Age	−0.0022* (0.0001)	−0.0032* (0.0001)	0.0054* (0.0002)
Income (10k)	−0.0006* (0.0001)	−0.0008* (0.0002)	0.0014* (0.0003)
Wealth (10k)	−0.0001* (0.0000)	−0.0002* (0.0000)	0.0003* (0.0001)
S&P 500 returns	0.0002* (0.0000)	−0.0003* (0.0000)	−0.0004* (0.0000)

*Note:* Probit model with random effects. Significance is defined as follows: \*significant at the one-percent level. Wealth and income means and standard errors reported in \$10,000s.  $N = 59,404$  observations from 17,672 retirees.

## Conclusions

The only financial resources available to fully-retired individuals are from saved assets and income from sources such as annuities, pensions, and government transfers. Aside from reentering the labor force, retirees have few options to increase their income in retirement. One-way retirees can increase income is from the management of their saved assets. For example, one option available to retirees is to convert their saved assets into non-labor income. Retirees often facilitate this by annuitizing their saved assets. However, this option may not be an optimal solution for retirees with bequest motives. In addition, illiquidity brought about by annuitization may decrease a retiree’s ability to afford larger unexpected expenses, such as the occurrence of a health shock.

Increasing financial risk is potentially another option to increase retiree income. However, traditional asset management approaches advocate for the opposite, suggesting that retirees decrease financial risk in retirement. Most of these arguments are rooted in the traditional time-horizon asset management approach. This approach suggests that when a goal, such as retirement, approaches, individuals should transition their financially risky assets into less-financially risky assets. During the pre-retirement stage of the lifecycle, individuals should reduce risk in response to a decline in human capital. Because human capital resembles a “bond-like” asset, increasing bond exposure as an investor approaches retirement is a theoretically sound decision. The rationale behind glide paths within target date or lifecycle funds fits within this theoretical framework, as these funds reduce equity exposure and increase bond exposure as an individual approaches a retirement date.

Once a retiree exits the labor market, and the present value of future earnings from labor is zero, human capital is no longer a significant asset within a holistic portfolio, and a future reduction in portfolio risk may not be warranted from a theoretical standpoint. Absent human capital, there is not a strong theoretical rationale for the reduction of risk during the

retirement stage of the lifecycle. Instead, retirees should decide how much variation in asset returns and consumption they are willing to accept for a given level of risk. If retirees reduce the ratio of stocks held relative to total financial assets, it may decrease retirement satisfaction. On the other hand, assuming a retiree is willing to accept the risk of higher return variation, increasing the ratio of stocks in a portfolio may increase income for consumption and enhance satisfaction in retirement.

It is important to note that there is a potential downside to increasing portfolio risk for a retiree to achieve higher future returns. Higher portfolio risk should theoretically increase asset return variation, which may lead to greater uncertainty about consumption outcomes in the future. Enhancing portfolio risk may be a satisfactory investment solution if a retiree is willing to accept the possibility of higher consumption uncertainty in exchange for the potential for higher returns. However, if a retiree is not willing to bear additional portfolio risk for greater return potential in the future, then an increase in portfolio risk may not be appropriate. It is important for retirees, and their financial planners, to consider risk tolerance when making investment decisions. In this study, we only consider objective risk preferences in our analyses. Future studies should explore whether controlling for subjective risk preferences alters the association between stockholding and retirement satisfaction.

## Notes

- 1 Health and Retirement Study, (RAND HRS 2014 Fat File (V2A)) public use dataset. Produced and distributed by the University of Michigan with funding from the National Institute on Aging (grant number NIA U01AG009740). Ann Arbor, MI, (2018).
- 2 RAND HRS 2014 Fat File (V2A). Produced by the RAND Center for the Study of Aging, with funding from the National Institute on Aging and the Social Security Administration. Santa Monica, CA (2018).

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1. In “The Association between Financial Risk and Retirement Satisfaction” by Pearson and Guillemette, which of the following arguments was made:
  - a. As retirement approaches, individuals should increase risk in response to a decrease in human capital.
  - b. There is not a strong theoretical rationale for the reduction of risk during retirement.
  - c. All retirees should bear additional portfolio risk for greater return potential in the future.
  - d. Retirees’ objective risk preferences should be considered more than their subjective risk preferences.
2. In Pearson and Guillemette, the authors posit that:
  - a. Increasing financial risk should lead to a reduction in retirement satisfaction because of the resulting increase in income uncertainty.
  - b. Decreasing financial risk should lead to an increase in retirement satisfaction because of the resulting increase in income certainty.
  - c. Financing consumption in retirement is dependent on the retiree’s level of human capital.
  - d. Higher risk comes with the potential for higher returns, and higher returns provide retirees with more income to finance their consumption in retirement.
3. Pearson and Guillemette argue that if retirees reduce the ratio of stocks held relative to total financial assets:
  - a. It may decrease retirement satisfaction.
  - b. It may increase retirement satisfaction.
  - c. There should be an increase in retirement satisfaction only if the decrease in the ratio of stocks is offset by an increase in the ratio of bonds.
  - d. There should be no effect on retirement satisfaction.
4. In “Financial Literacy, Behavioural Factors, and Problematic Debt-Taking: An Empirical Analysis of Relationships in Australia” by Tahir, Richards, and Ahmed which factor was identified as having the strongest relationship with credit card debt-taking behaviour in the paper?
  - a. Financial literacy
  - b. Financial satisfaction
  - c. Attitude towards balancing spending and savings
  - d. Gender
5. In Tahir, Richards, and Ahmed, the authors highlighted that \_\_\_\_\_ is relatively a more stressful and problematic type of household debt?
  - a. Mortgage
  - b. Credit card debt
  - c. Investment loan
  - d. Car loan

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(ISSN: 1057-0810)

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