Financial Literacy and Economic Outcomes

David Puelz* **Robert Puelz†**

Abstract

We explore the relationship between financial literacy and self-reported economic outcomes using survey data from the United States. Our dataset includes several measured covariates of the survey individuals, and we use a new econometric technique developed by Hahn et al. (2018) to control for the appropriate confounders. We report treatment effect estimates describing the relationship between literacy and economic outcomes.

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*The University of Chicago. Email: david.puelz@chicagobooth.edu
†Southern Methodist University. Email: rpuelz@mail.cox.smu.edu

1. Introduction

Is financial literacy associated with a household achieving more financial happiness? There is natural presumption that basic literacy is good and gradations of increasing financial literacy are better. Interest and education in financial literacy in the United States has become widespread and institutionalized by the Federal Reserve that has taken an active role in creating financial information for individuals.[1]. Books on personal finance, investing, and wealth creation have become as ubiquitous as books on health and weight loss.

One objective of investing in financial knowledge is clear: a household will have a better chance at optimizing their living standard if they are financially adept. Specialized knowledge appears to be important and just being educated does not enable competence about personal finance. Mitchell and Lusardi (2015) find that increased education and financial literacy are positively correlated, yet they find that less than 50% of college-educated students can successfully answer three key financial literacy questions and less than 64% of students with a post-graduate education can answer all three questions correctly. Perhaps "interventionist" activity is needed. Campbell (2016) has argued that important questions about financial regulations surrounding household finance are ripe for the attention of economists because there is not much known about how regulatory costs would be offset by their benefits.

There is a large body of more recent research summarized by Hastings et al. (2013) and Lusardi and Mitchell (2014) that trace many of the key questions around a more financially literate populace to education choices, the timing of education delivery during an individuals life-cycle, public policy prescriptions, and regulatory intervention. What is less well understood is the link to address the question whether whether being personally financially literate matters to economic outcomes? Anecdotally, it is nearly impossible to argue that some personal financial knowledge is unimportant to a household's economic outcomes, however individuals rely on the specialist knowledge of others to diagnose illnesses, construct legal documents, even to prepare a good meal. We heed the call of others to strengthen our understanding of the connection between financial competence and financial outcomes.[2]

We begin by isolating economic outcomes from behaviors for the data generated from FINRA's complete 2015 National Financial Capability Survey study. We identify five survey questions that reveal actual respondent outcomes. Further, we categorize a number of good and and bad financial practice behaviors and include numerous other respondent and household factors that are plausibly related to economic outcomes, and isolate the financial literacy treatment. In this study we are interested in two questions:

1. Is there a systematic relationship between individuals who experiences a negative financial outcome and their financial literacy?

[1] As an example of financial education sources the U.S Treasury department has compiled a list. See https://www.treasury.gov/resource-center/financial-education/Documents/OFE-CFAP-Resources.pdf, and the Chicago FED lists educational offerings of banks in the system. See https://www.chicagofed.org/region/community-development/cedric/federal-reserve-financial-education-initiatives

[2] As noted by Lusardi and Mitchell (2014), p. 34, "Though it is challenging to establish a causal link between financial literacy and economic behavior, both instrumental variables and experimental approaches suggest that financial literacy plays a role in influencing financial decision making, and the causality goes from knowledge to behavior." Two noteworthy contributions along this path are Calvet et al. (2007) and Agarwal et al. (2009)

2. Is financial literacy separable? For instance, is being financially literate on one topic related to different economic outcomes on other topics?

Answers to these questions are obtained by utilizing the work of Hahn et al. (2018) who call on recent research in treatment effect estimation and machine learning. Hahn et al. (2018) describe a data-driven approach to identify confounders and mitigate treatment effect estimation bias. They propose jointly modeling the treatment and response $Y, Z \mid \mathrm{X}$ by first modeling the treatment variable as a function of covariates $Z \mid \mathrm{X}$, and then modeling the response $Y \mid Z, \mathrm{X}$. The first likelihood provides information on the propensity of being treated as a function of covariates, and the second utilizes this information to mitigate endogeneity when estimating the partial effect of Z on Y. Importantly, their procedure provides a way to "shrink-away" irrelevant covariates using Bayesian shrinkage priors. This is a key feature because only *one model* with all available covariates needs to be specified, and the data will select the meaningful ones. This approach has valuable benefits for problems related to the analysis of financial literacy where the literacy treatment variable is correlated with economic outcomes Y and covariates X.

We find .....

2. Literature Review

It is well-documented that U.S. citizens have low levels of financial knowledge and make financial "mistakes. Calvet et al. (2009) created an index of financial sophistication from mistakes related to under diversification, risky share turnover and the disposition effect and find that less sophistication is related to individuals with less wealth, smaller family size, less education and less financial experience.[3] Choi et al. (2011) found that more than a third of employees do not take advantage of an employer match to a 401(k) plan when it is clearly to their benefit to do so.[4] Keys et al. (2016) found that 20% of households do not refinance their mortgage even when it is to their benefit. Recently, Agarwal et al. (2017) found the individuals who opt for points in their mortgages, a poor financial choice in their analysis, are less responsive to interest rate changes and preferred refinancing behavior.ec 40 23.

The literature suggests that investments in financial education may not be helpful in solving the problem of poor financial choices, contrary to intuition. Willis (2008) confronts the idea that financial education is inherently a good idea by taking the view that the modern day financial regulation-through-education policy model imposes costs on those aspiring to be financial literate that are significantly higher than the benefits from the financial literacy gained.[5] Policymakers who promote financial literacy as important intend, at least partly, to have the individual bear responsibility for the management of his or her financial future.

[3]Odean (1998) defined the disposition effect as the tendency for investors who hold losers to hold them too long, and investors who own winners to have sold them too quickly.

[4]Choi et al. (2011) sample included employees who were older than 59.5 who were unconstrained by withdrawal penalties: they could have simply withdrew employer contributions but chose not to take advantage of it. Even among a subsequent experiment, the researchers find conclude that low financial literacy and poor choice about a matching contribution are positively related.

[5]See Willis (2008), p. 204. Willis interprets policymakers promotion of financial literacy as an ineffective substitute for financial regulation that places too high a burden on non-expert consumers.

Indeed, Willis (2011) asserts that financial regulation replaced by financial education is a fundamental fallacy.[6] The individual would always be chasing the details of new product innovation and once the consumer shortens their information disadvantage, Willis argues that the industry would outmaneuver them. Willis (2011) notes that empirical work to date is replete with evidence that biases, heuristics, and other nonrational influences circumvent good financial decision-making. Lusardi et al. (2017) develop a model that includes the prospect of financial knowledge investment, and illustrate conditions under which less investment is preferred. The implication is that if financially literate consumers do not make better financial decisions, then personal investments in financial knowledge are best not incurred.

If education would not be helpful, then how do consumers plan well for their financial futures? Calcagno and Monticone (2015) offer a different perspective. They start with a premise that those who are less financially literate may benefit from more personal finance advice or derive more value from a financial advisor. They construct a theoretical model that considers an advisor who has the ability to sell investments and is compensated by a proportional commission linked to the size of the investment, and a customer who may be asymmetrically informed about the investments attributes. Considering incentives, penalties and information costs, their model predicts that those who are better informed are more likely to invest in risky assets and utilize a financial advisor. Indeed, the authors use bank survey data from Italy to find empirically that utilization of financial advisors is higher among those who are already financially literate, and that financial literacy is positively related to the probability of investing in risky assets.[7] In a different yet relevant study, Balasubramnian and Brisker (2016) used 2012 NFCS survey data and an instrumental variables approach to mostly corroborate Calcagno and Monticone's empirical results. Balasubramnian and Brisker defined advisors by their role with a survey participant (e.g., Investment advisor, Debt Counselor, Tax advisor and so forth) if such a relationship existed at all.[8] The researchers found a positive relationship between working with an investment financial advisor and financial literacy, although they found a negative relationship for those who worked with a debt consolidation advisor.

The literature to date supports the conclusions that households error in their decision-making, more highly educated individuals are not inclined to be better at making financial decisions, and that investments in financial literacy have low payoffs. More sophisticated individuals may be more inclined to hire financial advisors, but is that a good idea, and do individuals of any sophistication level know there are differences in how advisors are paid and the incentives that drive their recommendations? There are good reasons for consideration of a third-party who can force guidance on consumers in the spirit of the arguments presented by Campbell (2016). The promotion for more financial literacy, however delivered, suggests that not enough is yet known about whether financial literacy can create good economic outcomes. We supplement the mistakes literature by taking a different tack. That is, among those individuals who are most financially literate, do they have financial outcomes that we can describe

[6] See Willis (2011) p. 429.

[7] Almenberg and Dreber (2015) link financial literacy and investing in the stock market with the intent to explore how investing varies between men and women when financial literacy is controlled. The authors measure financial literacy by identifying basic and advanced financial skills. While the authors find that men have higher probabilities of investing in the stock market, controlling for financial literacy skills reduces the probability differences between men and women substantially, and makes a "gender gap," inconsequential.

[8] 53.4% of Balasubramnian and Brisker's sample used one of the defined advisors.

as good?

3. The Study

The NFCS survey provides reasonable proxies of economic outcomes based on answers given by respondents to survey questions sprinkled through out the questionnaire.[9] We identified five questions used in the 2015 National Financial Capability Study, that are representations by respondents about their current financial circumstance.[10] They are the following:

1. "Overall, thinking of your assets, debts and savings, how satisfied are you with your current personal financial condition?"

2. "In the last 12 months, have you [or your spouse/partner] taken a hardship withdrawal from your retirement account(s)?"

3. "Are you concerned that you might not be able to pay off your student loans?"

4. "In a typical month, how difficult is it for you to cover your expenses and pay all your bills?"

5. "How strongly do you agree or disagree with the following statement? - I have too much debt right now"

Using respondent responses to each of these five questions we call on Wittkowski et al. (2004) who provide.....

3.1. The Data and Initial Analysis

We start with the full data set from the 2015 NFCS study made available to us from FINRA. There are 27,564 observations and 149 variables. In our approach, we require complete data across 117 covariates and dummy variables which limits the total number of observations to 997.

3.1.1. Dependent Variable

Our dependent variable of interest is an economic outcome index that is created from the responses to the economic outcome questions which are summarized in Tables 1 and 2. Questions 1,4, and 5 are measured on integer scales from 1 to 10, 1 to 3, and 1 to 7, respectively. The mean, minimum, and maximum values are displayed in 1. Questions 2 and 3 are binary variables, so we display their summary statistics in Table 2.

[9] Generally, the economic outcome for a household at any point in time is its economic net worth; that is, assets including household human capital less debt.

[10] Studies were conducted in 2009, 2012 and 2015. See http://www.usfinancialcapability.org.

Table 1: Responses to questions used to construct the economic outcome (dependent) variable: Summary statistics for quantitative variables across the NFCS sample of 997 observations.

	Q1	**Q4**	**Q5**
mean	6.7	2.3	5.1
min	1	1	1
max	10	3	7
s.d.	2.5	0.7	1.8

Table 2: Responses to questions used to construct the economic outcome (dependent) variable: Summary statistics for binary variables across the NFCS sample of 997 observations.

	Q2	**Q3**
% No	72%	58%
% Yes	28%	42%

These five questions comprise our measures of economic outcomes for individuals in the sample. In Section 3.2, we discuss how we combine this information from multiple outcomes into a single, meaningful measure.

3.1.2. Independent Variable

The measure for financial literacy is the total number of correct answers to six financial literacy questions included in the 2015 survey and reported in Table 3 – these answers are used to construct our independent variable of interest.[11] In the final sample, the mean number of correct answers is **3.86** and in Figure 1 is a column chart of the percentage of correct answers for each of the six financial literacy questions.

[11]The interest rate, inflation and risk questions were designed by Olivia Mitchell and Annamaria Lusardi. See Lusardi and Mitchell (2014). According to the 2015 NFCS national report, the Rule of 72 question was added as an additional interest rate question to " to test the concept of interest compounding in the context of debt."

Figure 1. Proportion of correct answers for each of the six financial literacy questions displayed in Table 3.

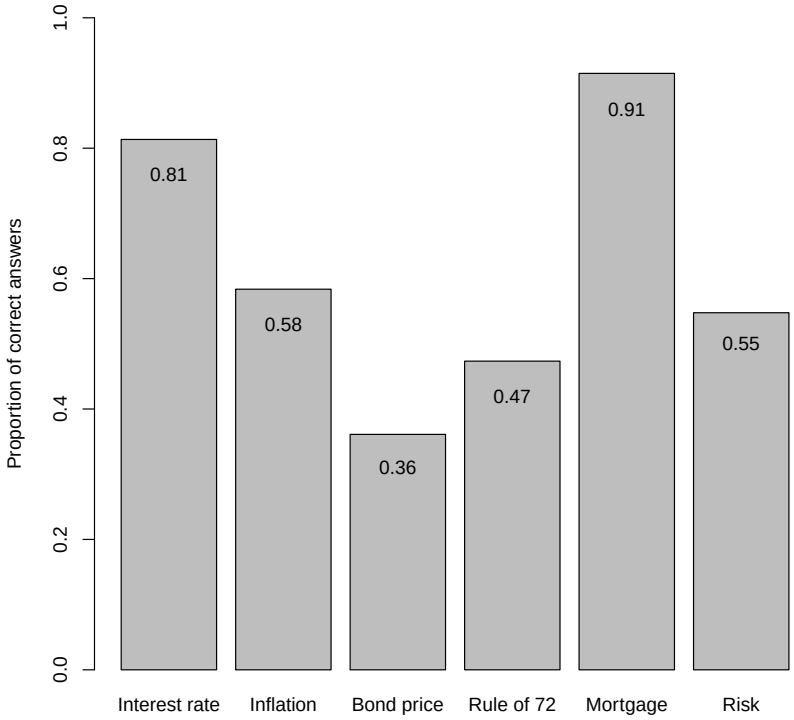


Table 3: Financial Literacy Questions

Concept addressed	**Question**
Interest rate	Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?
Inflation	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?
Bond price	If interest rates rise, what will typically happen to bond prices?
Rule of 72	Suppose you owe $1,000 on a loan and the interest rate you are charged is 20% per year compounded annually. If you didnt pay anything off, at this interest rate, how many years would it take for the amount you owe to double
Mortgage	15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. Measurement Level: Nominal
Risk	Buying a single company's stock usually provides a safer return than a stock mutual fund.

3.1.3. Additional Control Variables

Generally, descriptive statistics of the NFCS data have been reported by many researchers including the NFCS itself, and we follow accordingly for the data used in this paper.[12] For discussion, we segregate the controls into socio-economic factors and financial behaviors. The socio-economic factors are numerous and include information about the respondent's age, education, and marital status along with the other variables listed in Table x.

Age of respondent Gender Ethnicity Education level State of residence Marital status Living arrangement (did we use just one) Children who are financially dependent Household Income category AM21 - have you served in the military AM22 - has spouse served in the military Current work status Spouses work status Rate your current credit report - J32 M20 - do you have financial education M21_1 M21_2_2015 etc are when was financial education received

In Tables 4 and 5 we present a listing of variables associated with the survey questions and answers that are indicative of financial behaviors that we categorize as good practice and bad practice. We undertake this exercise to more easily frame the analysis as it relates to an economic outcome.

Table 4: Good practice financial behaviors

NFCS Data Label	Description
J5	Do you have emergency funds that can cover 3 months of expenses?
J6	Are you saving for your children's college education?
J31	Does household have a budget?
J33_2	I set long-term financial goals and try to achieve them
F2_1	Over the past 12 months have you always paid your credit card in full?
C5	Do you or your spouse regularly contribute to a thrift plan, 401(k) or IRA

[12] See http://www.usfinancialcapability.org/results.php?region=US.

Table 5: Bad practice financial behaviors

NFCS Data Label	Description
B4	Do you overdraw from your checking on occasion?
B30	How often do you use a reloadable prepaid debit card
E15	How many times have you been late with your mortgage payment?
E20	Do you owe more on your home than it is worth?
F2_2	Over the past 12 months have you carried a balance and were charged interest?
F2_3	Over the past 12 months, in some months I paid the minimum payment only
F2_4	Over the past 12 months, I incurred credit card late fee
F2_5	Over the past 12 months, I was charged an over the limit fee for exceeding my credit line
F2_6	Over the past 12 months, I used my card for a cash advance
G25_1	In the past 5 years, how many times have you taken out an auto title loan?
G25_2	In the past 5 years, how many times have you taken out a payday loan?
G25_4	In the past 5 years, how many times have you used a pawn shop?
G25_5	In the past 5 years, how many times have you used a rent-to-own store?

3.2. Statistical Methodology and Estimates

Our initial methodological step is to construct a single economic outcome index for each observation in the sample that, subsequently, is used in a model to estimate the relationship between literacy and economic outcome. We want to roll-up the answers to the five questions discussed and summarized in Tables 1 and 2 in the appropriate manner. These variables are both continuous and binary and provide information on the economic health as well as perceived future economic health of the respondents. Answers to these questions are certainly correlated. Thus, there is overlapping information present in each variable. We want capture the relevant variation among the original five variables into a single economic outcome variable. [13]

Variables are assembled into a 997×5 matrix $\mathbf{Y}$ and Principal Component Analysis (PCA) is performed. The number of observations is reduced by the need to include only those observations for which there is complete information. PCA rotates the original data matrix $\mathbf{Y}$ into an orthogonal space to produce:

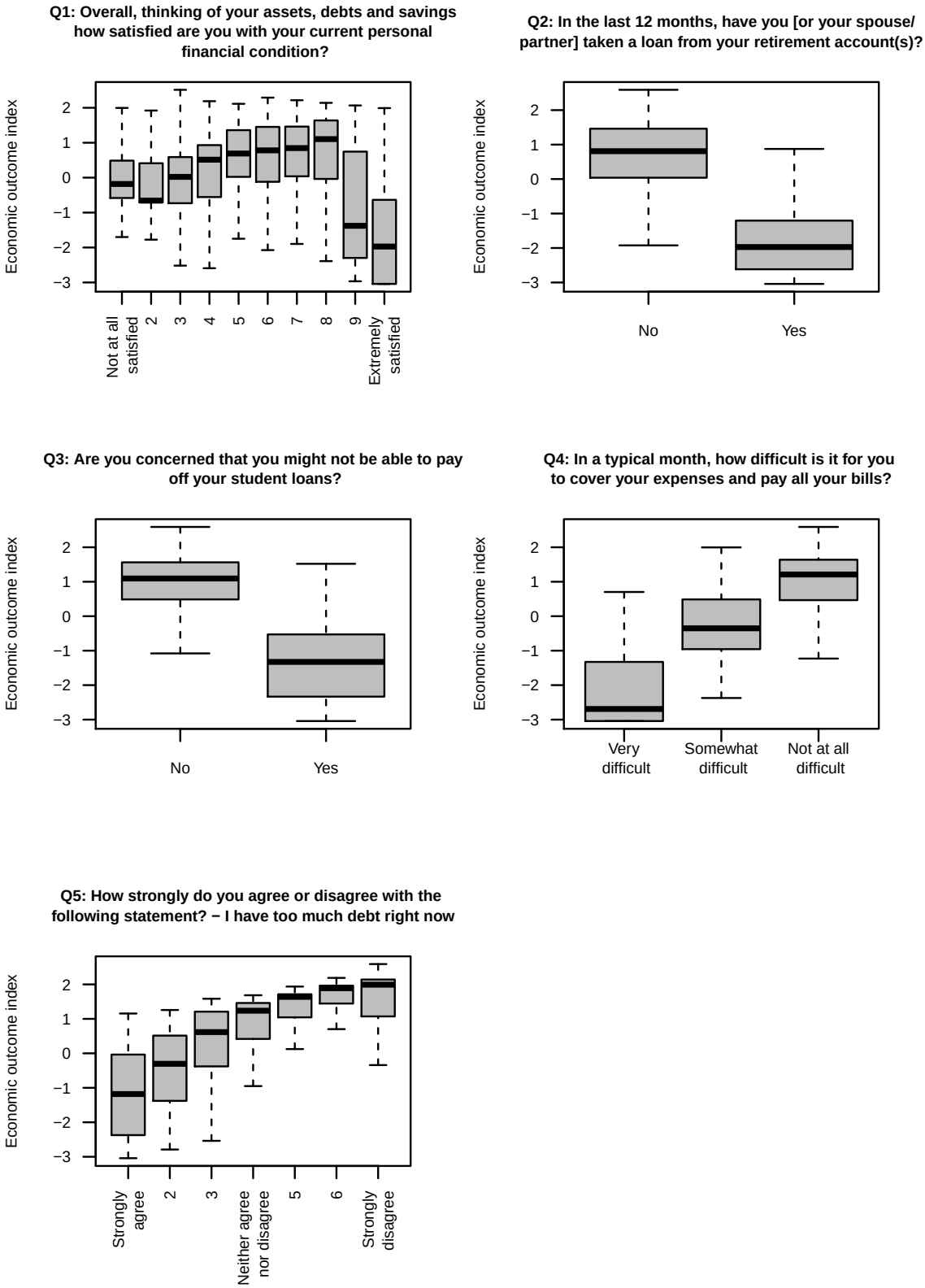
$$\mathbf{Y}^{\text{rot}} = \mathbf{YW} \tag{1}$$

where $\mathbf{W}$ is a 5×5 matrix that contain the eigenvectors of the matrix $\mathbf{Y}^T\mathbf{Y}$. Since the resulting columns of $\mathbf{Y}^{\text{rot}}$ are formed from the eigenvectors, they are uncorrelated with each other by construction.

[13] For example, a person who is not satisfied with her current personal financial condition (Question 1) is also likely to have difficulty paying bills every month (Question 4). We would like to collapse these five questions into a univariate variable that captures the relevant variation among the original five.

The columns of the rotated data matrix $\mathbf{Y}^{\text{rot}}$ (and thus columns of $\mathbf{W}$) represent the data dimensions that successively capture the most variance of the original data. In other words, the first eigenvector given in the first column of

Figure 2. Values of the economic outcome index separated by answers to original financial outcome questions.



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