**Financial Knowledge and Financial Market Participation**

**1. Introduction**

The stock market index measured bythe S&P 500 index has ended the eighth consecutive year with positive returns with a geometric average of 14.3% per annum between 2009 and 2016. Meanwhile,the proportion of Americansallocating non-retirement accounts in stocks, bonds, mutual funds and other securities continues to decline: from 34% in 2009 to 32% in 2012 and 30% in 2015(Financial Industry Regulatory Authority, 2016). This observationcontradictstraditional financial theory which postulates that equityownership is positively associated with the equity premium regardless of investor’s risk preferences (Campbell, 2006). It is estimated that the welfare cost of nonparticipation in equity ownership is about 2% of annual consumption (Cocco et al., 2005).

Using the most recent survey data from the 2015 Financial Capability Survey I explore variables related to *financial market participation*of American adults. Increased financial sophistication of financial instruments over the last decades has led to an increase in the variety of alternative securities (compared to traditional individual stock and stock mutual fund investments) such as Exchange Traded Funds (ETFs) that can provideequity exposure often at a lower cost. In addition, there are instruments such as Real Estate Investment Trusts (REITs), derivatives and convertible bonds.The former has high correlation with equity securities.The latter allows achievement of indirect exposure to equities. Thus, in this study, I will use a broad definition of risky assets.In addition to stocks and stock mutual funds I include bonds, ETFs, commodities and other securities.

This paper contributes to the existing literature through inclusion of additional factors affecting saving and investment decisions such as risk-taking attitudes and time preferences as well as financial literacy having controlled for socio-economic and demographic covariates.Furthermore, exploiting information on personal finance education requirements implemented in United States high schools, and implementing instrumental variable estimation, I will attempt to make causal inferences about the effect of financial literacy on financial market participation.

Withoutassuming causal claims I find a strong positive correlation between financial literacy and financial market participation. I also find that investors’ risk willingness and time preferences are important factors in explainingthe non-participation puzzle. Individuals with lower risk aversion and longer investment horizon are more likely to participate in financial markets.

The paper is organized as follows. Section 2 reviews literature relevant to the topic. Section 3 describes data, model and methods that are used. Results are presented in Section 4. Robustness of results is checked in Section 5. Section 6 summarizes key findings and discusses some limitations.

**2. Related Literature**

Lack of stock ownership by households, often referred as the stock market non-participation puzzle, was first identified by Haliassos and Bertaut (1995). They did not find supportive evidence favoring risk aversion, heterogeneity of beliefs, persistence habit and borrowing constraints explanations of the puzzle, but suggest that it can be explained by inertia and deviation from expected-utility maximization decisions.

A growing body of empirical literature seeks to identify factors that determine households’ decision to participate in the financial markets. Recent works suggest that the households’ decision to hold stocks is influenced by social interaction (Hong et al., 2004), economic shocks, future expectations and stock market literacy (Balloch et al., 2014), trust (Guiso et al., 2008), financial literacy (Van Rooj etal., 2011), genetics (Barnea et al., 2010), political orientation (Kaustia and Torstila, 2011) and intelligence quotient (Grinblatt, 2011).

One should consider the potential endogeneity problem associated with the measure of financial literacywhen studying stock market participation(Lusardi and Mitchell, 2014). Measures of financial literacy, whichareusually constructed as an index from correct answers to financial literacy questions, suffer from two issues: measurement error and reverse causality. The first stems from the fact that some of the correct answers to financial literacy question maybe a result of guessing, while the latter comes from the observation that exposure to financial markets tend to increase financial literacy. As a result, without controlling for an endogenous financial literacy index,one cannot estimate a clear cause-effect relationship between financial market participation and financial literacy.

Several authors have attempted to use instrumental variables estimation to address endogeneity in financial knowledge measures. Van Rooj et al.(2001) using data from the 2005 De Nederlandsche Bank’s Household Survey find that households with less financial knowledge are less likely to hold stocks. Van Rooj et al. employed generalized method of moments (GMM) and instrumental variables estimation to account for the endogeneity problem of thefinancial knowledge measure. They used economics education, daily exposure to economics, and financial experience of siblings and parents as instruments for financial knowledge. However, the model failed exogeneity tests, implying that the OLS and GMM IV estimates are not statistically different.

Arrondel et al. (2015) study stockholding decisions of households in France uses Heckman’s two-step approach. They first modeled decision to participate in the stock markets, and then conditional on participation, the portfolio share in stocks and mutual funds investments. They find positive correlation between stock ownership, and financial literacy and financial information acquisition through press reading. However, Arrondel et al. (2015) find no relationship between financial literacy and portfolio allocation in stock investments once the stock ownership decision is made, while financial literacy is strongly associated with the share of stock investments in the portfolio.

A recent study by Bianchi (2017) used panel data from French financial institutions to study portfolio decisions. He discovers that more financially literate households outperform less financially literate peers after accounting for portfolio risk. He discovers that the most literate individuals on average earn 0.2% higher annual returns after accounting for risk compared to the least literate. Financially literate households tend to invest a larger share of their portfolio in risky assets when market returns expectations are higher as well as rebalance portfolios more actively. Bianchi (2017) do not to claim causal effects due to assumed endogeniety of the financial literacy index.

Several studies, however,do find convincing exogenous instruments to make causal inferences about the impact of financial literacy on the decision to hold stocks. Christiansen et al. (2008) use a panel data set for Danish data, and with information on opening of a new university as an instrument they find that economics education positively impacts participation in stock markets. They propose that economics education provides informational advantages about understanding investment opportunities and reduce the cost of stock market participation. The study of financial decisions of Russian individuals by Klapper et al. (2012)instrumented financial knowledge using the number of public and private universities and the number of newspapers in circulation in the area. They also find that financial literacy positively affects stockholding decisions. In summary, this paper addresses the following two research questions:

(1) Do more financially literate individuals have a higher propensity to hold financial assets as compared to less financially literate counterparts?

(2) What are other important determinants of financial market participation?

**3. Methods**

**3.1 Data**

To address my research questions I use respondent-level survey data from the State-by-State survey from the 2015 National Financial Capability Study (NFCS), which was conducted by the Financial Industry Regulatory Authority (FINRA) Investor Education Foundation. The 2015 State-by-State Survey is drawn from a non-probability quota panel determined from select online panels that consist of recruited individuals who participate in online surveys.

The survey includes about 500 respondents from each state, and District of Columbia, and 1,000 respondents from larger states: CA, IL, NY, and TX.The initial sample in 2015 State-by-State survey consists of 27,564 nationally representative adults in the U.S. For the purpose of this study, observations for most control variables containing “don’t know” and “prefer not say” responses are excludedfrom the data set.As a result, a final sample consists of22,447 observations.

 For the high school personal finance mandate instrument I use a database compiled by researchers from Montana State University and the Federal Reserve Board with support from FINRA Investor Education Foundation. It contains information on statemandatesof personal finance and economics education between 1970 and 2014 for all 50 states and the District of Columbia. The database provides information on whether economics or personal finance is delivered as a separate course or incorporated into another related course, whether completion of the course is required for graduation, and the number of required course credits. I use the date when the personal finance class is required or recommended to be offered either as a standalone course or incorporated into an existing course. Figure 1 provides information on the year when economics and personal finance class mandates where implemented by all states from 1970 to 2014.

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**3.2 Modeland Variables Description**

Our model will have the following linear form:

*Financial Market Participationi =* $α$*+ β*Financial Literacy*+* $\sum\_{}^{}γ\_{i}X\_{i}$ *+ εi*

The dependent variable is:

**Financial market participation:** a dummy variable is built from the following question: *Not including retirement accounts, do you [does your household] have anyinvestments in stocks, bonds, mutual funds, or other securities?*The variable takes value of 1 if a person holds non-retirement investments in stocks, bonds, mutual funds or other securities, and 0 otherwise.

The independent variables are:

**Financial literacy:** an index comprised of the correct answers to six basic and advanced financial literacy questions, if a person answers correctly to all six questions he/she scores 6, and 0 if no questions are answered correct. Survey design allows for‘Don’t know’ and ‘Prefer not to say’ responses.Such responses are treated as incorrect answers. Figure 2 summarizes financial literacy questions.

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The other spending/saving related and economic and demographic covariates (Xi) are:

**Risk preferences:** A measure of individual risk preference is constructed based on response to self-reportedassessment of willingness to take the risk when making financial investments. Exact wording of the question is: *When thinking of your financial investments, how willing are you to take risks?*Choices of answers vary from 1 if not at all willing to 10 if very willing to take risk. A dummy variableproxy for risk takerscreated from assigns 1 to individuals who chose 8,9 or10, and 0 otherwise. The proxy for medium risk-taker is constructed by assigning 1 from those individuals who chose 5,6 or 7 answers, and 0 otherwise. Following this construct, individuals with the highest degree of risk aversion are the reference group.

**Time preference/Investment horizon:** This variable used the survey question regarding the most important time period individuals consider when making saving and spending decisions. I believe that this is a good variable that proxies time preferences and most importantly investment horizon that plays a role when making financial decisions such as decision to hold risky assets. Investors with longer investment horizon have a stronger ability to take the risk and hold assets that provide capital appreciation and therefore participate in financial markets. Nicolae and Philip (2014) have found a strong positive relationship between the decision to hold stocks and time preference.

Respondents were asked the following question: *In planning or budgeting your [household’s] saving and spending, which of the following time periods is most important to you [and your household]?*

An indicator for individuals with *medium term investment horizons*include respondents who consider the next 5 to 10 years when making saving and spending decisions, individuals with a *long term* investment horizon include those who consider the period longer than 10 years. The reference category captures investors with *short term investment horizon* who consider next year and the next few years as being the most important.I expect that individuals with medium term investment horizon will be more likely to participate in financial markets than peers with shorter term horizon, while individuals with long term horizon are expected to participate greater than both medium- and short-term investors.

**Income:** There is no measure of wealth in the data set; hence, income will be used as a proxy for wealth. Wealth is considered one of the most important determinants of participation in financial markets as fixed costs such as one-time entry or ongoing participation costs may pose constraints on participation in financial markets. Campbell (2006) states that payment of fixed costs more easily justifiable as mean of increasing returns for individuals with larger portfolios. Hence, I expect that financial market participation will have positive relationship with level of income.

The annual income variable in the survey data set is divided into eight groups. I will aggregate data on annual income into four groups: less than $25,000; at least $25,000 but less than $50,000; at least 50,000 but less than 100,000; and $100,000 and more.

**Demographics:** Age, gender, race, education level, marital status and number of children are found to be important determinants of stock ownership in previous research (Halliassos and Bertaut,1995; Guiso et al, 2002; Campbell, 2006). I will also include indicator showing whether individual is self-employed following Heaton and Lucas (2000) who find that individuals facing high entrepreneurial risk are less like to hold stocks. Also, a dummy variable for retired respondents is added to account for possible dis-saving behavior predicted by the Life-Cycle Hypothesis. Van Rooj et al. (2001)have employed similar reasoning when including indicator for retired individuals, although no statistically significant relationship between stockholding decision and retirement was found.

**3.3 Descriptive Statistics**

*Financial Literacy*

The proportion of people answering correctly to each of the six questions is reported in the Figure 3 below. Most respondents demonstrate a good understanding of basic numeracy and mortgages. About four out of five respondents correctly answer question about basic interest compounding (Interest compounding I) and similar proportion know how mortgage payments are structured (Mortgage). Good knowledge of mortgage payment structure can be partly explained by large exposure of American households to mortgages when financing their homes. In fact, 65.3% of respondents (or their partner/spouse) in the survey own their homes, and 60.2% of them still have outstanding mortgage loans. About two third of respondents correctly answered the basic question on inflation and real interest rates. Only about half of the respondents know thefundamental risk diversification concept in portfolio management. In contrast, only 37% are able to correctly answer the more advanced question on interest compounding. Furthermore, respondents demonstrate very limited knowledgeof bond mechanics as only about one-third know the relationship between bond prices and interest rates.

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Figure 4is a rudimentary test of the research hypothesis. It reports a financial literacy index (score), which represents the number of correct answers and ownership of non-retirement investments in financial market securities. It can be noticed that financial markets participation is positively associated with the number of correctly answered questions. Only about 10.5% of individuals are able to provide correct answers to all the questions, while 63.5% of them have non-retirement investments. In contrast, 28.1% of individuals that correctly answer only the half of the given questions participate in financial markets.

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Figure 5 summarizes the descriptive statistics for the variables that will be used in our econometric model.

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**3.4 Diagnostic tests**

**3.4.1 Functional form**

All variables in this regression are used in level form. This is dictated by the construct of the data set as most variables in the regression model are binary variables. Furthermore, the Regression Specification Error Test (RESET) for general specification proposed by Ramsey (1969) is performed. Thenull hypothesis stating that the model is correctly specified is rejected at 1% critical level, which implies possible model misspecification. The null hypothesis is rejected if there is measurement error in independent variable or there is an issue of simultaneity or reverse causality. As it will be discussed later, the measure of financial literacy potentially suffers from both problems. Furthermore, Ramalho and Ramalho (2012) propose that models with a binary dependent variable can fail the RESET test due to the presence of heteroscedasticity.RESET test is designed to identify nonlinearities in the model, however, the fact that all the controls are in binary form limits implementation of either quadratic or logarithmic functional forms.

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**3.4.2 Heteroscedasticity**

Any regression model involving adichotomous dependent variable inherently suffers from heteroscedasticity of residuals. Given that the variance of a bivariate variable is p­*x*(1-p), where p -

probability of event occurrence, and (1-p) is the probability of event nonoccurrence, the homoscedasticity assumption will be violated unless p will be the same for all individuals. Both White’s and Breusch-Pagan tests confirm the presence of hetersocedasticity. The null hypothesis of homoscedastic errors can be rejected at 5% critical level (See table below). To account for the problem of heteroscedasticity of the disturbance term, heteroscedasticity-consistent robust standard errors will be used.

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**4. Results**

Figure 8 reports results from six OLS regressions and robust standard errors (in parentheses). It is important to note at this point that the analyses performed here report only the relationship between financial market participation and the independent variables. No causal inferences are assumed. From the regression results shown in Column (1) we can observe that financial literacy correlates positively with financial market participation. The absence of additional covariates that are positively correlated with both financial literacy and financial market participation overestimate the magnitude on financial literacy index. In fact, introduction of income reported in Column (2) significantly reduces the magnitude of the relationship, while the coefficient remains positive and statistically different from zero at a 5% level. Thus, households with higher levels of income have higher probability of holding non-retirement investments. Campbell (2006) provides one explanation for increase in participation with wealth stating that “a larger portfolio is more likely to justify the payment of a fixed cost to increase return’ such as one-time entry costs.”

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Inclusion of additional educational controls in Column (3) further reduces the degree of association of financial literacy and stock market participation. Positive and statistically significant coefficients on education covariates are consistent with the notion that additional years of schooling reduce informational barriers of investing in risky assets such as understanding risk-reward trade-offs, opening accounts and executing trades (Hong et al., 2004), or simply helps “overcoming the barrier to stockholding erected by ignorance and misperceptions.” (Haliassos and Bertaut, 1995, p. 1122).

Column (4) includes additional demographic controls. Before including risk aversion indicators we find evidence of gender gap in financial market participation. Men are 4.9% more likely to hold outside retirement investments than women. However, the coefficient on gender changes to close to zero and loses statistical significance after inclusion of self-reported measures of risk attitudes (See results Column (5)). This result is consistent with Almenberg and Dreber (2015) who find that gender differences in stock market participation disappear once it is controlled for risk taking. In addition, it follows that individuals who are more willing to take risk are more likely to invest in risky assets. The coefficient on the financial literacy index has decreased by 2 basis points with inclusion of risk aversion measures.

Column (6) reports the final model which includes an additional set of control variables to capture the time preferences of respondents. The probability of financial market participation is positively associated with time preference. The model shows that individuals who prioritize medium and longer investment horizons have a higher probability of making investments in financial market securities. The coefficient on the financial literacy measure remains statistically significant after controlling for the large set of individual characteristics. This suggests that financial knowledge is one of the important determinants of financial markets participation.

**5. Robustness checks**

 **5.1 Sensitivity Analysis**

 In this part, I modify the initial regression model (see Column (6) of Figure 8) by excluding variables with coefficients that are statistically indistinguishable from zero to examine how the results change. Column 1 in Figure 9 summarizes estimates of the regression when controls for gender and number of financially dependent children are excluded from the original model. Exclusion of statistically insignificant variables has an immaterial effect on the original model results. There is no change in goodness of fit and variables that are significant in the original model are still statistically different from zero at a 5% critical level. Coefficients on financial literacy and time preference covariates have marginally increased by 10 basis points.

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 One may reasonably argue that many individuals achieve exposure to financial markets via employment-based and other retirement accounts which usually also have tax advantages. Thus, it can be argued that retirement accounts are substitutes to non-retirement accounts. To test this proposition, I include an indicator for possession of retirement accounts provided by employer or other non-employment related retirement accounts, or both (retirement variable). Column 2 in Figure 10 shows regression output where the retirement variable is added to the original model. The coefficient on retirement accountis positive, statistically and economically significant. The model predicts that people who hold retirement accounts are 18.7% more likely to invest in non-retirement accounts, which suggest that retirement investments are a complement to non-retirement investments rather than a substitute. The inclusion of the retirement accounts indicator led to a slight decrease in the marginal effect of the financial literacy index, from 2.8% to 2.3%, while the effect still remains statistically different from zero. Hence, without considering the impact of retirement accounts, the model was overestimating the true effect of financial literacy. This can be explained by the fact that there is a positive correlation between financial literacy and possession of retirement accounts as well as positive correlation between investments via retirement accounts and non-retirement accounts.

The survey contains a question: “How confident are you that you could come up with $2,000 if an unexpected need arose within the next month?”. The question assesses the financial fragility or buffer funds availability.Liquidity constraints may halt people from investing in risky assets. People may face temporary liquidity constraint irrespective of income or socio-demographic status. Only 42% of the respondents in the full sample responded that they are certain that they can come up $2,000 in the next month. I limit the sample to only these individuals to examine if the effect of financial literacy is affected when only individuals with spare money are considered. Restricted sample results for the original model and the model with retirement accounts are presented in Columns 3 and 4 of Figure 9 respectively.In column 3, the effect of financial literacy index on financial market participation decreases to 2.6% compared to 2.8% in initial model, the marginal impacts of risk aversion increases coefficients increases, while the effects of investment horizon declines. Introduction of retirement investments to the restricted model (Column 4) leads to reduction of the marginal effect of financial literacy to 2.2% while the retirement investments enter equation with positive and statistically significant effect (20.6%). There is a modest decline in the coefficients of the variables capturing risk aversion and investment horizon effects compared to the restricted model without retirement account, but marginal effects are still higher compared to the original model (Column 6 in Figure 8). One possible explanation for these results might be that individual investment related characteristics such as risk aversion and investment horizon are more important for investors that do not face liquidity constraints.

**5.2 Tackling Endogeneity: IV Approach**

One of the major challenges that researchers facewhen studying the effect of financial literacy on stock ownership is endogeneity due to both reverse causality and measurement error problem. First, while it is believed that financially literate people are more likely to invest in stocks, it is also true to say that experience obtained from participation in the stock market as well as degree of participation conditional on participation will enhance financial literacy of investors. Second, construction of a financial literacy index from correct answers to survey questions is inheritably noisy as some correct answers might be due to simple guessing. Hence, in the presence of the endogeneity the coefficient on financial literacy index is biased and no causal inferences can be made.

To address this problem I employ Two-Stage Least Squares Instrumental Variables estimation (2SLS IV), where instrumental variable Z should meet the following two criteria:

1. *Must be exogenous:Cov(Z,ϵ) = 0.* That is,the instrumental variable should not be correlated (or correlated via its effect on financial literacy) with financial market participation;
2. *Must be correlated with the endogenous variable (financial literacy)*:*Cov(Z,Financial Literacy) ≠ 0* . That is, the instrumental variable should have a strong statistical relationship with financial literacy

Several studies find that personal finance education mandates in the U.S. high schools lead to improved financial decision-making. Bernheim et al. (2001) find that exposure to high school financial curricula stimulates personal saving behavior. Brown et al. (2014) apply a difference-in-difference study on three states (Idaho, Georgia and Texas) where personal finance mandates were implemented. They discover that young people who are exposed to such mandates have improved credit behavior given by better credit scores and lower delinquency rates on credit cards.

Motivated by these studies I attempt to instrument the financial literacy index using high school mandates. First, it is believed that enactment of personal finance mandates are driven by pure political motives rather than being dictated by the needs of the general public(Bernheim et al., 2001). Therefore, it is plausible to assume that personal finance mandates are exogenous and not correlated with financial market participation. Second, I expect that exposure to financial curriculum in high school should enhance overall financial knowledge, although the effect of the mandates is expected to decline as people age.

Personal finance mandates in the U.S. take two basic forms. One type of mandate is when a state requires schools to offer personal finance classes, and second when a state requires students to take personal finance classes. In either case many states allow incorporation of personal finance curriculum into another related class such as economics or business. Cole et al. (2015) find no relationship between course offering requirements and financial decision-making. I will use the indicator for a stricter mandate, which requires students to take standalone personal finance class, or a class that incorporates personal finance education.

To construct an instrument I will use a recently compiled database by FINRA (2015) on state-mandated personal finance education, which contains statistics from 1970 to 2014. Since the data set provides with no information about the state where respondents have received high school education I will be assuming that the state of current residence is the same as the state where they have graduated high school. I will match the personal finance mandate in place at the state when respondents were 18 and exclude respondents without high school education from the sample. Following this approach exposure to personal finance requirement at school can be derived for respondents up to age 62. Furthermore, additional information from the data set has been used to attempt to correct measurement error from assuming that state of residence is the same as the place where the respondent obtained high school degree. Specifically, the survey asks respondents whether they have been offered any financial education in high school, college or workplace. If they answer yes, further follow-up questions are asked to determine where they have received financial education. Figure 9 combines relevant survey questions and personal finance mandates adjusting to match respondent age and state of potential high school graduation. Accuracy of the instrument can be approximately measured by the percentage of responses that are consistent with the personal finance mandate. That is, if the personal finance class is required to be taken, we should expect individuals to answer yes to the question about attainment of financial education during high school. However, only 449 out of 2,226 individuals predicted by the instrument (20.2%) responded that they have received financial education in high school. In contrast, in states where personal finance mandate is not required, the match is 86.3% (11,618/13,456). In the former case mismatch can be attributed to the fact that individuals are more likely to forget and answer that they have not taken a high school class on personal finance. In the latter case it can simply be explained by the fact that students might have taken an elective class covering finance in high school in states without personal finance requirement. It is also possible that the assumption that a person’s current state of residence approximates the state where high school was attended may not be valid, and creates additional noise and measurement error. Furthermore, there is no possibility check if cells that have matched state mandate predictions with survey response truly represent personal finance requirement treatment or not treatment, or simply coincidence. For example, respondents who have received financial education in high school do not necessarily have to be in the states that have personal finance mandate in place as they can take such class if it was offered but not mandated. Respondents who have taken a personal finance class when it was not required by state or they forget that such class has been taken are not going to representative of the effect of true high school mandate. To account for this, I will exclude observations where there is a mismatch between the instrument’s prediction and survey response question and hence final sample for 2SLS IV estimation will consist of 12,067 observations(see table below).

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Figure 11 reports 2SLS IV results both when only personal finance mandate is used as an instrument (Model 1) and when both personal finance mandate and its interaction with age are included as instruments (Model 2).

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In Model 1, the coefficient on personal finance education in the first stage regression is positive and statistically significant, while the second stage results show that financial literacy has a strong and statistically significant effect on financial market participation. Inclusion of an additional instrument in Model 2 improves the R squared of the first regression from almost zero to 0.108. Interaction of personal finance mandate with age has a statistically significant negative effect of financial literacy, while the impact of state personal finance requirement has almost tripled holding age and other factors constant. The marginal effect of financial literacy on financial market participation is lower compared to Model 1 results, however, it is still positive, statistically significant and considerably larger than the OLS estimate. These results are consistent with the findings of other studies that have obtained IV financial knowledge estimates that are significantly larger than OLS estimates (see Christiansen et al. (2008), Lusardi and Mitchell (2008), Fornero and Monticone (2012), van Rooij et al. (2012), Behrman et al. (2012)). Lusardi and Mitchell (2014) explain that attainment of larger than OLS estimate when employing IV approach may suggest that individuals who are exposed to instruments might have larger response rates or indicate measurement error. Alternatively, Lusardi and Mitchell claim that it may simply mean that OLS estimates underestimate the ‘true’ effect of financial literacy.

In Model 1, the first stage regression Kleinbergen-Paap F-statistic which is used in the presence of heterscedasticity robust standard errors is greater than 10 which is above the threshold recommended by Staiger and Stock (1997) to avoid weak instruments bias. In Model 2, however, the Kleinbergen-Paap F-statistic is 9.92 which given critical values estimated by Stock and Yogo (2005) can only reject the null hypothesis that the maximum relative bias due to weak instruments is 20%. On the other hand, inclusion of two instruments in Model 2 allows testing for exogeneity of instrument condition. Hansen J-test indicate that over-identifying restrictions cannot be rejected, which implies that personal finance mandates are exogenous and do not correlate with financial market participation. Hausman (1978) suggest that OLS and 2SLS estimates can be compared to find if differences are significant to conclude that the instrumented variable is in fact endogenous. In Model 2, the null hypothesis from the endogeneity test cannot be rejected at 5% critical level, which suggests that both OLS and IV estimates are consistent, but the IV estimate is inefficient.

**5.3 Alternative Models: Logit and Probit**

The OLS has three major shortcomings. First, predictions or fitted values are not bound by 0 and 1. Second, as it has already been mentioned residuals are heteroscedastic by construct unless the probability of owning non-retirement accounts is the same for all individuals, which is probably not the case. Third, the OLS assumes that marginal effects are the same for all values of independent variables. Logit and Probit models can be used to overcome these disadvantages of the OLS estimation. Figure 12 below presents average marginal effects from Logit and Probit models. Marginal effects of financial literacy on financial market participation from both Logit and Probit models are similar and slightly larger than estimate obtained from comparable OLS regression (Column 6 in Figure 8). Control variables in both Logit and Probit models have the same sign and statistical significance as in OLS model.

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Furthermore, goodness of fit measured by pseudo R squared from Logit and Probit regressions is similar up to three decimal points. Another measure of goodness of fit for models with dichotomous outcome variables *percentage of correct predictions* is only marginally different in OLS, Logit and Probit models and equal to 73.36%, 73.31% and 73.34%.

Hence, it can be concluded that both Logit and Probit regression results are not significantly different from OLS results and estimates are still biased without controlling for endogeneity of financial literacy measure.

**6. Summary**

In this paper I found that that financial knowledge is positively associated with financial market participation. No causal claims about the effect of financial knowledge are made because the financial knowledge measure is potentially endogenous. Nevertheless, we can still make causal inferences about the impact of risk aversion and time preferences on financial market participation. Irrespective of the estimation approach I find that investors with longer investment time horizons are more likely to invest in financial market securities. Furthermore, in line with standard portfolio theory I find that probability to invest in financial market securities is positively associated with willingness to bear investment risks. Logit and Probit estimates do not differ significantly from OLS regression results, and cannot be used as a measure to account for potential endogeneity problem. 2SLS IV estimation results are mixed at best. Inclusion of two instruments significantly improves goodness of fit and allows testing instrument exogeneity. But there is potential weak instrument bias suggesting that OLS and 2SLS estimates are not significantly different. Furthermore, adjustments to personal finance mandate measure to account for mismatch between actual data and insights from relevant survey questions as well as the assumption that respondents are living in the states where they have graduated high school casts plausible doubts about the validity of the instrument.

Although the data set that has been used has a rich set of explanatory variables, it should also be stated almost all variables are dichotomous, limiting variability of the data. Further research can be focused to properly address the endogeneity problem associated with the measure of financial knowledge. High school mandates on personal finance education can be a good instrument for financial literacy if it would be possible to accurately differentiate individuals that were affected by the state mandate.

The results from obtained in this study have major policy implications. Government should stimulate educational programs aimed at enhancing consumer financial literacy as well as make current and prospective investors aware of the equity premium.

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**Appendix**

|  |
| --- |
| Figure 1. State-mandate personal finance and economics course offering requirements from 1970 to 2014, by state. |
|  | Personal Finance | Economics |
| Alabama | No Policy | 1989 |
| Alaska | No Policy | 1997 |
| Arizona | 2005 | 2005 |
| Arkansas | 2005 | 2005 |
| California | None | 1989 |
| Colorado | 2009 | 2009 |
| Connecticut | No Policy | No Policy |
| Delaware | No Policy | 1995 |
| Florida | 2014 | 1986 |
| Georgia | 2007 | 1976 |
| Hawaii | No Policy | 1995 |
| Idaho | 2007 | 2001 |
| Illinois | <1970 | 2000 |
| Indiana | 2008 | 2008 |
| Iowa | 2011 | 2011 |
| Kansas | 2012 | 2006 |
| Kentucky | None | 2000 |
| Louisiana | 2005 | 2000 |
| Maine | No Policy | <1970 |
| Maryland | No Policy | No Policy |
| Massachusetts | No Policy | 1997 |
| Michigan | 1998 | 1997 |
| Minnesota | No Policy | 2000 |
| Mississippi | No Policy | 2005 |
| Missouri | 2010 | 2007 |
| Montana | No Policy | 1998 |
| Nebraska | No Policy | 2003 |
| Nevada | No Policy | 1999 |
| New Hampshire | 1993 | 1993 |
| New Jersey | 2011 | 2011 |
| New Mexico | No Policy | <1970 |
| New York | 1996 | 1988 |
| North Carolina | 2007 | 2003 |
| North Dakota | 2011 | 2002 |
| Ohio | No Policy | No Policy |
| Oklahoma | 2014 | No Policy |
| Oregon | 2013 | 1997 |
| Pennsylvania | No Policy | 2008 |
| Rhode Island | 1980 | 1980 |
| South Carolina | 2009 | 2000 |
| South Dakota | 2006 | 2006 |
| Tennessee | 2011 | 1989 |
| Texas | 2007 | 2005 |
| Utah | 2008 | No Policy |
| Vermont | 2010 | 2000 |
| Virginia | 2014 | 2014 |
| Washington | 2000 | 2000 |
| West Virginia | No Policy | No Policy |
| Wisconsin | No Policy | 1998 |
| Wyoming | 2002 | 2002 |
| District of Columbia | No Policy | No Policy |
| Source: Urban , C. (2015), State Mandated Financial Education, Montana State University |

**Figure 1** Financial Literacy Questions

**Interest Compounding I:** *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?*(1) More than $102; (2) Exactly $102; (3) Less than $102; (98) Don’t know; (99) Prefer not to say.

**Interest Compounding II:** *Suppose you owe $1,000 on a loan and the interest rate you are charged is 20% per year compounded annually. If you didn’t pay anything off, at this interest rate, how many years would it take for the amount you owe to double?*(1) Less than 2 years; (2) At least 2 years but less than 5 years; (3) At least 5 years but less than 10 years;
(4) At least 10 years; (98) Don’t know; (99) Prefer not to say.

**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?*
(1) More than today; (2) Exactly the same; (3) Less than today; (98) Don’t know; (99) Prefer not to say.

**Mortgage:** *A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.*(1) True; (2) False; (98) Don’t know; (99) Prefer not to say.

**Bond mechanics:***If interest rates rise, what will typically happen to bond prices?*
(1) They will rise; (2) They will fall; (3) They will stay the same (4) There is no relationship between bond prices and the interest rates; (98) Don’t know; (99) Prefer not to say.

**Risk diversification***: Buying a single company's stock usually provides a safer return than a stock mutual fund?*(1) True; (2) False; (98) Don’t know; (99) Prefer not to say.

|  |
| --- |
| Figure 2. Percentage of correct answers to financial literacy questions |
|   | Interest Compounding I | Interest Compounding II | Inflation | Mortgage | Bond Mechanics | Risk Diversification |
| Percent correct answers | 80.3% | 37.0% | 65.4% | 81.6% | 32.4% | 52.7% |

|  |  |
| --- | --- |
| Figure 3. Financial Literacy Index and Financial Markets Participation |  |
|  | *Number of correct answers to financial literacy questions (out of six questions)* |
|   | 0 | 1 | 2 | 3 | 4 | 5 | 6 | Mean |
| Proportion of respondents | 3.9% | 8.2% | 15.4% | 20.2% | 22.0% | 19.7% | 10.5% | **3.49** |
| Financial market participation | 16.6% | 20.7% | 26.9% | 28.1% | 36.8% | 49.7% | 63.6% | **36.8%** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Figure 4. Descriptive Statistics |  |  |  |  |  |
| **Variable** | **Obs** | **Mean** | **Std. Dev.** | **Min** | **Max** |
| Financial Market Participation | 22447 | 0.368 | 0.482 | 0 | 1 |
| Financial Literacy Score | 22447 | 3.494 | 1.597 | 0 | 6 |
| Risk Aversion |  |  |  |  |  |
| Risk-averse [Reference group] | 22447 | 0.382 | 0.486 | 0 | 1 |
| Risk-medium | 22447 | 0.396 | 0.489 | 0 | 1 |
| Risk-taker | 22447 | 0.222 | 0.416 | 0 | 1 |
| Time Preference |  |  |  |  |  |
| Low [Reference group] | 22447 | 0.675 | 0.468 | 0 | 1 |
| Mid | 22447 | 0.197 | 0.398 | 0 | 1 |
| Long | 22447 | 0.128 | 0.334 | 0 | 1 |
| Gender |  |  |  |  |  |
| Female [Reference group] | 22447 | 0.540 | 0.498 | 0 | 1 |
| Male | 22447 | 0.460 | 0.498 | 0 | 1 |
| Age group |  |  |  |  |  |
| Ages 18-24 [Reference group] | 22447 | 0.108 | 0.310 | 0 | 1 |
| Ages 25-34 | 22447 | 0.185 | 0.389 | 0 | 1 |
| Ages 35-44 | 22447 | 0.165 | 0.371 | 0 | 1 |
| Ages 45-54 | 22447 | 0.180 | 0.384 | 0 | 1 |
| Age 55 and more | 22447 | 0.362 | 0.481 | 0 | 1 |
| Married | 22447 | 0.563 | 0.496 | 0 | 1 |
| Employment status |  |  |  |  |  |
| Full-time student, part-/full-time employed employed, homemaker etc. [Reference  |  |  |  |  |  |
| homemaker, sick, disabled etc. [Reference group]  | 22447 | 0.725 | 0.447 | 0 | 1 |
| Self-employed | 22447 | 0.073 | 0.260 | 0 | 1 |
| Retired | 22447 | 0.202 | 0.401 | 0 | 1 |
| Financially dependent children |  |  |  |  |  |
| None [Reference group] | 22447 | 0.624 | 0.484 | 0 | 1 |
| 1 | 22447 | 0.160 | 0.367 | 0 | 1 |
| 2 | 22447 | 0.136 | 0.343 | 0 | 1 |
| 3 | 22447 | 0.052 | 0.222 | 0 | 1 |
| 4 and more | 22447 | 0.027 | 0.162 | 0 | 1 |
| Educational Attainment |  |  |  |  |  |
| No high school [Reference group] | 22447 | 0.015 | 0.121 | 0 | 1 |
| High school | 22447 | 0.198 | 0.398 | 0 | 1 |
| Some college | 22447 | 0.389 | 0.488 | 0 | 1 |
| Bachelor's | 22447 | 0.248 | 0.432 | 0 | 1 |
| Postgraduate | 22447 | 0.150 | 0.357 | 0 | 1 |
| Income Level |  |  |  |  |  |
| $25,000 and less [Reference group] | 22447 | 0.189 | 0.392 | 0 | 1 |
| between 25,000 and 50,000 | 22447 | 0.252 | 0.434 | 0 | 1 |
| between 50,000 and 100,000 | 22447 | 0.358 | 0.480 | 0 | 1 |
| $100,000 and more | 22447 | 0.200 | 0.400 | 0 | 1 |
| Race |  |  |  |  |  |
| Non-white [Reference group] | 22447 | 0.273 | 0.445 | 0 | 1 |
| White | 22447 | 0.727 | 0.445 | 0 | 1 |

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| Figure 5. RESET specification test |
| H0: Specification is correct |
| F(3, 22421) | 49.15 |
|  Prob > F | 0.0000 |

|  |
| --- |
| Figure 6. White’s test for heteroscedasticity |
| H0: Homoscedasticity**1. White’s test** |
| Chi2(302) | 2,937.73 |
| Prob > chi2 | 0.000 |
| **2. Breusch-Pagan Lagrange multiplier test** |
| Breusch-Pagan LM statistic:  | 843.8421 |
| Chi2(25) P-value | 0.000 |

|  |  |  |
| --- | --- | --- |
| **Figure 10.****Survey question:** When did you receive that financial education? – In high school | Personal Finance Requirement | **Total** |
| No | Yes |
| No | 11,618 | 1,777 | **13,395** |
| Yes | 1,838 | 449 | **2,287** |
| **Total** | **13,456** | **2,226** | **15,682** |

|  |  |  |  |
| --- | --- | --- | --- |
| Figure 8. Financial literacy and financial market participation |  |  |  |
| Variable | (1) | (2) | (3) | (4) | (5) | (6) |
| Financial Literacy  | 0.079\*\*\* | 0.050\*\*\* | 0.044\*\*\* | 0.032\*\*\* | 0.030\*\*\* | 0.028\*\*\*  |
| (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) |
| Risk Aversion (base group: risk averse) |   |   |   |   |   |   |
| Risk-medium |   |   |   |   | 0.148\*\*\* | 0.145\*\*\* |
|   |   |   |   |   | (0.007) | (0.007) |
| Risk-taker |   |   |   |   | 0.282\*\*\* | 0.280\*\*\* |
|   |   |   |   |   | (0.008) | (0.008) |
| Time Preference (base group: low) |   |   |   |   |   |   |
| Mid |   |   |   |   |   | 0.061\*\*\* |
|   |   |   |   |   |   | (0.008) |
| Long |   |   |   |   |   | 0.133\*\*\* |
|   |   |   |   |   |   | (0.009) |
| White |   |   |   | 0.011\*  | 0.031\*\*\* | 0.027\*\*\* |
|  |   |   |   | (0.007) | (0.007) | (0.006) |
| Male |   |   |   | 0.049\*\*\* | 0.007 | 0.01 |
|   |   |   |   | (0.006) | (0.006) | (0.006) |
| Age group (base group: ages 18-24) |   |   |   |   |   |   |
| Ages 25-34 |   |   |   | -0.041\*\*\* | -0.039\*\*\* | -0.039\*\*\* |
|   |   |   |   | (0.011) | (0.011) | (0.011) |
| Ages 35-44 |   |   |   | -0.071\*\*\* | -0.060\*\*\* | -0.068\*\*\* |
|   |   |   |   | (0.012) | (0.011) | (0.011) |
| Ages 45-54 |   |   |   | -0.051\*\*\* | -0.028\*\*  | -0.041\*\*\* |
|   |   |   |   | (0.011) | (0.011) | (0.011) |
| Age 55 and more |   |   |   | 0.018 | 0.058\*\*\* | 0.045\*\*\* |
|   |   |   |   | (0.011) | (0.011) | (0.011) |
| Married |   |   |   | 0.01 |  0.017\*\*  | 0.018\*\* |
|   |   |   |   | (0.007) | (0.007) | (0.007) |
| Self-employed |   |   |   | 0.079\*\*\* |  0.064\*\*\* | 0.066\*\*\* |
|   |   |   |   | (0.012) | (0.012) | (0.011) |
| Retired |   |   |   | 0.091\*\*\* | 0.100\*\*\* | 0.096\*\*\* |
|   |   |   |   | (0.010) | (0.009) | (0.009) |
| Financially dependent children (base: None) |   |   |   |   |   |   |
| 1 |   |   |   | 0.016\*  | 0.005 | 0.01 |
|   |   |   |   | (0.009) | (0.008) | (0.008) |
| 2 |   |   |   | 0.017\* | 0.002 | 0.011 |
|   |   |   |   | (0.010) | (0.010) | (0.010) |
| 3 |   |   |   | -0.014 | -0.022\*  | -0.014 |
|   |   |   |   | (0.014) | (0.013) | (0.013) |
| 4 and more |   |   |   | -0.007 | -0.015 | -0.005 |
|   |   |   |   | (0.019) | (0.018) | (0.018) |
| Educational Attainment (base: no high school) |   |   |   |   |   |   |
| High school |   |   |  0.045\* | 0.047\*\* | 0.053\*\*\* | 0.051\*\* |
|   |   |   | (0.018) | (0.018) | (0.018) | (0.018) |
| Some college |   |   |  0.062\*\* | 0.070\*\*\* | 0.074\*\*\* | 0.073\*\*\* |
|   |   |   | (0.018) | (0.018) | (0.018) | (0.018) |
| Bachelor's |   |   |  0.141\*\*\* |  0.161\*\*\* | 0.153\*\*\* | 0.149\*\*\* |
|   |   |   | (0.019) | (0.019) | (0.019) | (0.019) |
| Postgraduate |   |   | 0.174\*\*\* |  0.186\*\*\* | 0.177\*\*\* | 0.171\*\*\* |
|   |   |   | (0.020) | (0.020) | (0.020) | (0.020) |
| Income Level (base: $25,000 and less) |   |   |   |   |   |   |
| between 25,000 and 50,000 |   |  0.087\*\*\* | 0.078\*\*\* | 0.079\*\*\* | 0.057\*\*\* | 0.055\*\*\* |
|   |   | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) |
| between 50,000 and 100,000 |   | 0.257\*\*\* | 0.231\*\*\* | 0.233\*\*\* | 0.190\*\*\* | 0.179\*\*\* |
|   |   | (0.009) | (0.008) | (0.009) | (0.009) | (0.009) |
| $100,000 and more |   |  0.428\*\*\* | 0.384\*\*\* | 0.387\*\*\* | 0.322\*\*\* | 0.300\*\*\* |
|   |   | (0.009) | (0.010) | (0.011) | (0.011) | (0.011) |
| Constant | 0.092\*\*\* | -0.007 | -0.058\*\* | -0.073\*\*\* | 0.170\*\*\* | -0.170\*\*\* |
|   | (0.007) | (0.007) | (0.018) | (0.019) | (0.020) | (0.019) |
| R squared | 0.068 | 0.155 | 0.164 | 0.184 | 0.226 | 0.235 |
| R squared adj. | 0.068 | 0.155 | 0.164 | 0.183 | 0.226 | 0.234 |
| P-value test all education controls=0 |

|  |  |
| --- | --- |
|  |  |
| Variable |   |
| Financial Literacy  |  0.029\*\*\* |
|   | (0.002) |
| Risk Aversion (base group: risk averse) |   |
| Risk-medium | 0.146\*\*\* |
|   | (0.006) |
| Risk-taker |  0.284\*\*\* |
|   | (0.008) |
| Time Preference (base group: low) |   |
| Mid | 0.060\*\*\* |
|   | (0.008) |
| Long | 0.132\*\*\* |
|   | (0.009) |
| White | 0.027\*\*\* |
|   | (0.006) |
| Age group (base group: ages 18-24) |   |
| Ages 25-34 | -0.038\*\*\* |
|   | (0.011) |
| Ages 35-44 | 0.039\*\*\* |
|   | (0.011) |
| Ages 45-54 | -0.039\*\*\* |
|   | (0.011) |
| Age 55 and more |  0.045\*\*\* |
|   | (0.011) |
| Married | 0.019\*\*\* |
|   | (0.007) |
| Self-employed | 0.067\*\*\* |
|   | (0.011) |
| Retired | 0.096\*\*\* |
|   | (0.009) |
| Educational Attainment (base: no high school) |   |
| High school | 0.050\*\*\* |
|   | (0.018) |
| Some college | 0.072\*\*\* |
|   | (0.018) |
| Bachelor's | 0.148\*\*\* |
|   | (0.019) |
| Postgraduate | 0.170\*\*\* |
|   | (0.020) |
| Income Level (base: $25,000 and less) |   |
| Between 25,000 and 50,000 |  0.055\*\*\* |
|   | (0.008) |
| Between 50,000 and 100,000 | 0.179\*\*\* |
|   | (0.009) |
| $100,000 and more | 0.301\*\*\* |
|   | (0.011) |
| Constant | -0.166\*\*\* |
|   | (0.019) |
| R squared | 0.235 |
| R squared adj. | 0.234 |
| Number of observations | 22447 |

 |  |  |  |  | 0.000 |
| P-value test all income controls=0 |  |  |  |  |  | 0.000 |
| P-value test all risk-aversion controls=0 |  |  |  |  |  | 0.000 |
| P-value test all time preference controls=0 |  |  |  |  |  | 0.000 |
| P-value test all kids controls=0 |  |  |  |  |  | 0.332 |
| P-value test all age controls=0 |  |  |  |  |  | 0.000 |
| Number of observations | 22447 | 22447 | 22447 | 22447 | 22447 | 22447 |
| \*\*\* p<0.001 \*\*p<0.05 \*p<0.10 **Note**. robust standard errors are reported in parenthesis |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Figure 9. Sensitivity analysis |  |  |  |  |
| Variable |  (1) | (2) | (3) | (4) |
| Financial Literacy  | 0.029\*\*\* 0.029\*\*\* | 0.023\*\*\* | 0.026\*\*\* | 0.022\*\*\* |
|   | (0.002) | (0.002) | (0.003) | (0.003) |
| Retirement accounts |  | 0.187\*\*\* |  | 0.206\*\*\* |
|  |  | (0.007) |  | (0.014) |
| Risk Aversion (base group: risk averse) |   |  |  |  |
| Risk-medium | 0.146\*\*\* | 0.132\*\*\* | 0.183\*\*\* | 0.173\*\*\* |
|   | (0.006) | (0.007) | (0.011) | (0.011) |
| Risk-taker | 0.284\*\*\* | 0.261\*\*\* | 0.308\*\*\* | 0.292\*\*\* |
|   | (0.008) | (0.008) | (0.013) | (0.013) |
| Time Preference (base group: low) |   |  |  |  |
| Mid | 0.060\*\*\* | 0.056\*\*\* | 0.041\*\*\* | 0.038\*\*\* |
|   | (0.008) | (0.008) | (0.011) | (0.011) |
| Long | 0.132\*\*\* | 0.124\*\*\* | 0.102\*\*\* | 0.098\*\*\* |
|   | (0.009) | (0.009) | (0.012) | (0.012) |
| White | 0.027\*\*\* | 0.021\*\*\* | 0.016 | 0.014 |
|   | (0.006) | (0.006) | (0.012) | (0.011) |
| Age group (base group: ages 18-24) |   |  |  |  |
| Ages 25-34 | -0.038\*\*\* | -0.064\*\*\* | -0.035 | -0.072\*\*\* |
|   | (0.011) | (0.011) | (0.025) | (0.024) |
| Ages 35-44 | 0.039\*\*\* | -0.098\*\*\* | -0.046\* | -0.092\*\*\* |
|   | (0.011) | (0.012) | (0.025) | (0.025) |
| Ages 45-54 | -0.039\*\*\* | -0.074\*\*\* | 0.000 | -0.048\* |
|   | (0.011) | (0.011) | (0.024) | (0.024) |
| Age 55 and more |  0.045\*\*\* | 0.006 | 0.096\*\*\* | 0.041\* |
|   | (0.011) | (0.011) | (0.024) | (0.024) |
| Married | 0.019\*\*\* | 0.004 | -0.004 | -0.012 |
|   | (0.007) | (0.007) | (0.011) | (0.011) |
| Self-employed | 0.067\*\*\* | 0.085\*\*\* | 0.076\*\*\* | 0.092\*\*\* |
|   | (0.011) | (0.011) | (0.017) | (0.017) |
| Retired | 0.096\*\*\* | 0.095\*\*\* | 0.100\*\*\* | 0.098\*\*\* |
|   | (0.009) | (0.009) | (0.013) | (0.013) |
| Educational Attainment (base: no high school) |   |  |  |  |
| High school | 0.050\*\*\* | 0.029 | 0.073 | 0.051 |
|   | (0.018) | (0.018) | (0.055) | (0.053) |
| Some college | 0.072\*\*\* | 0.044\*\* | 0.092\* | 0.065 |
|   | (0.018) | (0.018) | (0.054) | (0.052) |
| Bachelor's | 0.148\*\*\* | 0.109\*\* | 0.181\*\*\* | 0.146\*\*\* |
|   | (0.019) | (0.019) | (0.054) | (0.052) |
| Postgraduate | 0.170\*\*\* | 0.129\*\*\* | 0.176\*\*\* | 0.142\*\*\* |
|   | (0.020) | (0.020) | (0.055) | (0.053) |
| Income Level (base: $25,000 and less) |   |  |  |  |
| Between 25,000 and 50,000 |  0.055\*\*\* | 0.001 | 0.032 | -0.015 |
|   | (0.008) | (0.008) | (0.020) | (0.020) |
| Between 50,000 and 100,000 | 0.179\*\*\* | 0.099\*\*\* | 0.142\*\*\* | 0.076\*\*\* |
|   | (0.009) | (0.009) | (0.019) | (0.020) |
| $100,000 and more | 0.301\*\*\* | 0.217\*\*\* | 0.234\*\*\* | 0.164\*\*\* |
|   | (0.011) | (0.012) | (0.021) | (0.021) |
| Constant | -0.166\*\*\* | -0.143\*\*\* | -0.095 | -0.104\* |
|   | (0.019) | (0.020) | (0.059) | (0.057) |
| Number of children | No | Yes | Yes | Yes |
| R squared | 0.235 | 0.259 | 0.166 | 0.181 |
| Number of observations | 22447 | 21517 | 10288 | 10288 |

|  |  |  |
| --- | --- | --- |
| Figure 11. Two-Stage Least Square IV Regressions | (1) | (2) |
| Variable | Second Stage | First Stage | Second Stage | First Stage |
| Financial Literacy  | 0.197\*\* |  | 0.137\*\* |   |
|   | (0.094) |  | (0.068) |   |
| Personal Finance Mandate |   | 0.282\*\*\* |   | 0.797\*\*\* |
|   |   | (0.076) |   | (0.212) |
| Personal Finance Mandate \*Age |   |  |   | -0.019\*\*\* |
|   |   |  |   | (0.007) |
| Risk Aversion (base: risk averse) |   |  |   |  |
| Risk-medium | 0.103\*\*\* | 0.200\*\*\* | 0.115\*\*\* | 0.199\*\*\* |
|   | (0.021) | (0.030) | (0.017) | (0.030) |
| Risk-taker | 0.269\*\*\* | 0.019 | 0.270\*\*\* | 0.019 |
|   | (0.013) | (0.036) | (0.012) | (0.036) |
| Time Preference (base group: low) |   |  |   |   |
| Mid | 0.029 | 0.149\*\*\* | 0.039\*\* | 0.149\*\*\* |
|   | (0.018) | (0.034) | (0.015) | (0.034) |
| Long | 0.091\*\*\* | 0.218\*\*\* | 0.104\*\*\* | 0.217\*\*\* |
|   | (0.025) | (0.042) | (0.020) | (0.042) |
| White | -0.036 | 0.355\*\*\* | -0.015 | 0.355\*\*\* |
|   | (0.035) | (0.029) | (0.026) | (0.029) |
| Male | -0.051 | 0.509\*\*\* | -0.020 | 0.507\*\*\* |
|   | (0.049) | (0.027) | (0.036) | (0.027) |
| Age group (base: ages 18-24) |   |  |   |   |
| Ages 25-34 | -0.043\*\* | 0.009 | -0.046\*\*\* | 0.039 |
|   | (0.018) | (0.054) | (0.016) | (0.055) |
| Ages 35-44 | -0.103\*\*\* | 0.274\*\*\* | -0.090\*\*\* | 0.306\*\*\* |
|   | (0.027) | (0.057) | (0.022) | (0.058) |
| Ages 45-54 | -0.119\*\*\* | 0.491\*\*\* | -0.094\*\*\* | 0.523\*\*\* |
|   | (0.044) | (0.055) | (0.034) | (0.056) |
| Age 55 and more | -0.076 | 0.625\*\*\* | -0.042 | 0.657\*\*\* |
|   | (0.056) | (0.057) | (0.042) | (0.059) |
| Married | -0.000 | 0.072\*\* | 0.004 | 0.072\*\* |
|   | (0.012) | (0.031) | (0.011) | (0.031) |
| Self-employed | 0.060\*\*\* | 0.154\*\*\* | 0.069\*\*\* | 0.157\*\*\* |
|   | (0.023) | (0.049) | (0.019) | (0.049) |
| Retired | 0.036 | 0.112\* | 0.043\*\* | 0.116\*\* |
|   | (0.023) | (0.059) | (0.020) | (0.059) |
| Financially dependent children (base: none) |   |  |   |   |
| One | 0.048\*\*\* | -0.136\*\*\* | 0.040\*\*\* | -0.135\*\*\* |
|   | (0.018) | (0.036) | (0.015) | (0.036) |
| Two | 0.053\*\* | -0.170\*\*\* | 0.043\*\* | -0.169\*\*\* |
|   | (0.021) | (0.039) | (0.017) | (0.039) |
| Three | 0.017 | -0.078 | 0.013 | -0.077 |
|   | (0.020) | (0.054) | (0.018) | (0.054) |
| Four and more | 0.001 | -0.140\* | -0.008 | -0.141\* |
|   | (0.028) | (0.075) | (0.025) | (0.075) |
| Educational Attainment (base: high school) |   |  |   |   |
| Some college | -0.053 | 0.469\*\*\* | -0.024 | 0.471\*\*\* |
|   | (0.045) | (0.035) | (0.034) | (0.035) |
| Bachelor's | -0.037 | 0.905\*\*\* | 0.018 | 0.909\*\*\* |
|   | (0.085) | (0.040) | (0.063) | (0.040) |
| Postgraduate | -0.041 | 1.065\*\*\* | 0.024 | 1.069\*\*\* |
|   | (0.101) | (0.047) | (0.074) | (0.047) |
| Income Level (base: $25,000 and less) |   |  |   |   |
| between 25,000 and 50,000 | -0.001 | 0.217\*\*\* | 0.012 | 0.217\*\*\* |
|   | (0.024) | (0.042) | (0.019) | (0.042) |
| between 50,000 and 100,000 | 0.067\* | 0.408\*\*\* | 0.092\*\*\* | 0.408\*\*\* |
|   | (0.041) | (0.043) | (0.031) | (0.043) |
| $100,000 and more | 0.140\* | 0.755\*\*\* | 0.185\*\*\* | 0.756\*\*\* |
|   | (0.073) | (0.051) | (0.054) | (0.051) |
| Constant | -0.380\*\* | 1.539\*\*\* | -0.282\*\* | 1.508\*\*\* |
|   | (0.151) | (0.059) | (0.111) | (0.060) |
| F-statistic First Stage Regression | 13.6026 | 9.9221 |
| Kleibergen-Paap Wald rk F statistic | 13.60 | 9.92 |
| Exogeneity test p-value | 0.0309 | 0.0825 |
| Hansen J test p-value |   |   | 0.2127 |
| R-squared | 0.0012 | 0.215 | 0.108 | 0.215 |
| Number of observations | 12067 | 12067 | 12067 | 12067 |
| \*\*\* p<0.001 \*\*p<0.05 \*p<0.10 **Note**. robust standard errors are reported in parenthesis |   |

|  |
| --- |
| Figure 12. Logit and Probit Models |
| Variable | Logit | Probit |
| Financial Literacy  | 0.034\*\*\* | 0.034\*\*\* |
| (0.003) | (0.002) |
| Risk Aversion (base group: risk averse) |   |   |
| Risk-medium | 0.188\*\*\* | 0.183\*\*\* |
|   | (0.009) | (0.008) |
| Risk-taker | 0.356\*\*\* | 0.342\*\*\* |
|   | (0.027) | (0.010) |
| Time Preference (base group: low) |   |   |
| Mid | 0.071\*\*\* | 0.070\*\*\* |
|  | (0.009) | (0.009) |
| Long | 0.157\*\*\* | 0.153\*\*\* |
|   | (0.012) | (0.011) |
| White | 0.031\*\*\* | 0.032\*\*\* |
|   | (0.008) | (0.008) |
| Male | 0.010 | 0.011 |
|   | (0.007) | (0.007) |
| Age group (base group: ages 18-24) |   |   |
| Ages 25-34 | -0.048\*\*\* | -0.048\*\*\* |
|   | (0.015) | (0.014) |
| Ages 35-44 | -0.081\*\*\* | -0.083\*\*\* |
|   | (0.014) | (0.014) |
| Ages 45-54 | -0.053\*\*\* | -0.053\*\*\* |
|   | (0.015) | 0.014 |
| Age 55 and more | 0.051\*\*\* | 0.048\*\*\* |
|   | (0.016) | (0.015) |
| Married | 0.018\*\* | 0.018\*\* |
|   | (0.008) | (0.008) |
| Self-employed | 0.082\*\*\* | 0.080\*\*\* |
|   | (0.012) | (0.014) |
| Retired | 0.122\*\*\* | 0.116\*\*\* |
|   | (0.012) | (0.013) |
| Financially dependent children (base: None) |   |   |
| One | 0.012 | 0.011 |
|   | (0.011) | (0.010) |
| Two | 0.017 | 0.014 |
|   | (0.012) | (0.011) |
| Three | -0.016 | -0.019 |
|   | (0.016) | (0.016) |
| Four and more | -0.002 | -0.004 |
|   | (0.023) | (0.022) |
| Educational Attainment (base: no high school) |   |   |
| High school | 0.129\*\*\* | 0.110\*\*\* |
|   | (0.046) | (0.040) |
| Some college | 0.157\*\*\* | 0.137\*\*\* |
|   | (0.043) | (0.038) |
| Bachelor's | 0.252\*\*\* | 0.228\*\*\* |
|   | (0.046) | (0.040) |
| Postgraduate | 0.278\*\*\* | 0.252\*\*\* |
|   | (0.047) | (0.040) |
| Income Level (base: $25,000 and less) |   |   |
| between 25,000 and 50,000 | 0.111\*\*\* | 0.099\*\*\* |
|   | (0.014) | (0.012) |
| between 50,000 and 100,000 | 0.254\*\*\* | 0.240\*\*\* |
|   | (0.013) | (0.012) |
| $100,000 and more | 0.385\*\*\* | 0.367\*\*\* |
|   | (0.015) | (0.014) |
| Pseudo R squared | 0.197 | 0.197 |
| Percent Correctly Predicted | 73.31% | 73.34% |
| \*\*\* p<0.001 \*\*p<0.05 \*p<0.10 **Note**. robust standard errors are reported in parenthesis |