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Josina Genetti

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The Cost of Not Knowing: Observing How Financial Literacy Affects Amount of Retirement Saving

Josina Genetti

Major: Economics

Faculty Advisor: Todd Yarbrough

Dyson College of Arts and Sciences: Economics Department

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Abstract

The area of retirement research is focused on answering the question, "Are individuals saving

enough, and if not, how do we encourage higher saving?". Previous research within this field

often uses a lifecycle model to project individuals saving habits. This paper explores the direct

effect of financial literacy on retirement savings within America using an ordinary least squared

regression model and cross sectional data from the Survey of Consumer Finances. The study is

carried out in two (2) parts. First, a regression is completed using the full sample of participants

in the 2016 year survey. Following this, four (4) separate regressions are carried out using the

same dependent and independent variables but only using participants based on their age

groups. The age groups used are 35–44, 45–54, 55–64. The model controls for common

influences on retirement savings including income, education, marital status, and gender.

Results showed that increased financial literacy has upward pressure on retirement savings at

the 99th confidence interval in the full model and across all age groups.

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The Cost of Not Knowing: Observing How Financial Literacy Affects Amount of Saving

Retirement is a concern that almost all Americans face at one time or another. While this issue is of individual concern, it also has wide-reaching effects on the domestic economy because it affects the amount of spending the government is liable to spend on programs such as Medicare and Medicaid. According to the Government Accountability Office, in 2015 only 29% of individuals 55 years or above had retirement savings or a defined benefit plan. Of these 29%, the average savings of an individual between 55-64 years old was $104,000, not including defined benefit plans (GOA, 2015). While recommended saving amounts at any given age are dependent on many factors such as housing equity, even under the most positive projections, individuals should have at least $221,000 at retirement.

Because of its integration into many critical parts of the economy, large amounts of research has already been conducted on this topic, with varying conclusions being reached. Some researchers have concluded that, because of reduced expenses in retirement years through the lack of things such as child expenses (Scholz and Seshadri, 2006), individuals can project lower income during their retirement years. Other arguments for this point of view include the idea that retirees have more time for cost-cutting activities such as couponing or discount shopping (Aguiar and Hurst 2005) and are more open/able to downsize in regards to living accommodations.

While these facts may be true, counter research has shown that American retirees face increasingly high costs for medical accommodations such as surgeries, prescription drugs, and eventually, nursing homes (Skinner 2007). Additionally, programs such as social security are in

danger of being cut, and with the rise of popularity in Defined Contribution (DC) retirement

plans (Byrne et. al. 2006), individuals have a larger responsibility to make smart and forward

thinking decisions regarding their retirement. This problem has come amid a rising national

debt, currently at over $21 Trillion according to the National Debt Clock, and a government

looking for areas to shave off the budget. Many politicians including the current Vice President

Mike Pence (2017) have identified health care entitlements as the best option for this saying ". .

. I[i]t's the health care entitlements that are the big drivers of our debt, so we spend more time

on the health care entitlements - because that's really where the problem lies, fiscally

speaking."

The rising responsibility on the individual has been acknowledged by an increase in

investment vehicles such as Target Date Funds (TDF's) which are a type of actively managed

fund that re-balances to become less risky the closer to the target (retirement) date (Chang et.

al 2014). This does provide a more simplified way for individuals to handle retirement but are

not widely offered for the younger age groups, a common trend for many retirement resources.

It is these generations who are facing additional difficulties in the face of growing student debt

levels, stagnant wages, and housing prices rising back to pre-2008 recession levels. They also

face the reality of being apart of the "sandwich generation", or the generation who is expected

to take care of both their children and parents financially.

Research has shown that two of the most efficient ways to maximize retirement

savings are to start saving early or retire later (Munnell, Orlova, and Webb 2013). However, it is

becoming increasingly difficult to begin saving for retirement early due to the lack of options in

retirement vehicles. Over the past several decades, companies have steadily been switching

from defined benefit retirement plans to defined contribution plans (Saad-Lessler, 2015). This is

because defined contribution plans expose companies to less liability in regards to their

employees' retirement as well as the growing trend of job hopping throughout one's career.

This consequently places the responsibility of managing one's own retirement into the hands of

the employees across all industries, a problematic situation considering only 12% of surveyed

workers felt "very confident" that they were able to make the correct decisions when it came

to investing and managing their retirement account (Larrimore et al. 2014).

In addition, this increased responsibility on the individual introduces behavioral

economic factors to retirement savings choices such as present bias. Present bias refers to an

individuals to give stronger weights to outcomes that are closer to the present time versus

those further in the future. In the framework of retirement savings, this converts to individuals

potentially choosing present consumption over future consumption. Related to this is the

economic term intertemporal choice. This defines the concept of individual's current decisions

affecting what options are available to them in the future. Again, when thinking about it in

regards to retirement, by saving or investing money for retirement in the present, it reduces

current consumption causing their utility to potentially decrease. However, this restraint leads

to the growth of the lump sum of money available for retirement, therefore increasing the

amount of consumption, and potential utility, in the future.

A study done by Saad-Lessler (2015) evaluated U.S citizens' preparedness for retirement

and found that 55% of Americans nearing the age of retirement (defined as between 55 and 64

years old) would be almost totally reliant on social security or would have to source their

retirement in other means. This includes alternatives such as working full or part-time late into

their life, taking on a large of credit card debt, economizing on housing options, or relying on children or family.

This paper will evaluate the factors which affect non-employee managed retirement investments, defined as "totalsave" in two parts: first using the total participants in the 2016 survey and then separating based on age brackets to determine changes in explanatory values across brackets. The variable of interest "finlit", is a categorical variable which evaluates an individual's financial understanding of topics such as time value of money, inflation, and diversification. This study finds that respondents who answered more financial literacy questions correctly saved more for retirement in the full model and across all age-groups.

1. Review of Literature

The main ideas throughout the retirement research community revolve around two linked topics: are individuals saving enough for retirement, and if not, what are the logical steps that can be taken to resolve the problem.

One area of concern which supports that individuals are not saving enough for retirement is the reality of diminishing social security. As one of the three legs of the retirement stool (Social Security, Personal Savings, Pension), it has been recognized as a concerning and rising problem for future retirees if not remedied. Saad-Lessler, Ghilarducci, and Bahn (2015) observe the decreasing amount of employer-sponsored retirement plans available to employees. The paper states that "Between 1999 and 2011, the availability of employer-sponsored retirement plans in the United States declined by eight percentage points, from 61 percent to 53 percent." This amount is recognized to vary based on company size, industry,

and whether or not it is unionized. The latter especially is seen to minimize the decrease in employer-sponsored retirement plans. It is also noted that even individuals who receive employer-sponsored plans could be disadvantaged depending on whether it is a defined contribution (DC) or defined benefit (DB) plan.

While a DB plan is managed by the employer, a DC plan is managed by the employee and therefore more dependent on the financial literacy of the individual. Saad-Lessler, Ghilarducci, and Bahn (2015) argue that those with DC plans are only minutely better off than those with no retirement plan at all due to the potential lack of knowledge or initiative to invest their own money.

Despite there not being a complete consensus on the future of retirees, it seems probable that many will be retiring later or not at all. Given this, the second major question in retirement savings must be addressed: what are the logical steps that can taken to minimize this problem. One area of discussion which has been championed as a preventative solution is increasing the populations' financial knowledge, or literacy. Financial Literacy contributes to making sound financial decisions because it depicts one's understanding and ability to apply financial knowledge. Therefore, lack of financial literacy can lead to decisions related to over-borrowing, taking on high-interest rate mortgages, and not saving or investing money throughout a working career for retirement.

Henager (2016) identifies the rising awareness of financial literacy, or lack thereof, since The Great Recession. Unlike previous research, Henager examines the impact of better financial literacy across numbered age groups rather than generational age groups in both short and long term financial behavior. The results show support that, in the general public as well as

across ages from 18 to over 65, increased financial literacy have positive effects in short and long term behavior. In addition, this research notes that "crystallized intelligence", or information gathered from experience, increases with age while "fluid intelligence", or the ability to manipulate and draw relationships between old and new information, decreases with time. Since financial literacy as one's ability to understand and apply personal finance knowledge, it stands that middle aged individuals, who are using a mixture of crystallized and fluid intelligence, make the most productive financial decisions.

One barrier to utilizing financial education to positively encourage individuals to behave responsibly when making financial decisions is our understanding of how these behaviors are influenced and formed. In other words, what is the most effective way to teach financial literacy, and what we consider a financially literate person. A study by the Federal Reserve (Hilgert, 2003), found that those who acquired their financial knowledge from personal sources such as friends, family, or individual experiences were 63% more likely to score highly on a financial literacy index. This is likely because the proximity to the results of said financial decisions is taken as more "real", which falls in line with financial theories such as mental accounting in which people will be less free with their spending using cash than credit due to the proximity and immediate loss of the cash.

Other solutions to the retirement crisis have been examined as summed up in Munnell, Orlova, and Webb (2012) who created a model which sought to identify the levers which held the most power over retirement income. Among these levers were asset allocation, age of retirement, age at which one begins saving, and housing equity. The article argued that asset allocation was among the least influential of the levers despite the heavy emphasis that

financial advisors and media place on it. Instead, it showed that the age in which you retire is the most important factor as well as the age in which you begin saving. This is because of two main reasons: larger time frames allow more compounding and there is more recovery time for any potential financial setbacks. Additionally, the paper notes that a large factor which impedes on retirement savings are penalties for pulling money out early. An example of this exists in social security which takes 5/9 of one percent for every month before the normal retirement age of 66. Taking benefits early is most likely a sign of an individuals inability to properly smooth their consumption over the span of their lives. This takes forethought and must be looked at from a preventative lens, such as increasing financial literacy or starting to save early.

Another major factor in the discussion of retirement saving is the differential between low versus high earning individuals. Dynan (2004) confirms the idea of the permanent income hypothesis first proposed by Friedman in 1957. This dictates that one's consumption patterns are determined by one's permanent income (expected long term income) instead of their current or temporary income. It also explains why people save, as they expect their labor income to decrease at some point in time. Dynan's study came to support this theory through the use of three separate data sources: The Consumer Expenditure Survey, the Survey of Consumer Finances, and the Panel Study of Income Dynamics. In addition it came to two other important conclusions: those with higher incomes had a larger marginal propensity to save and those who had higher saving rates when young did not also have higher dissaving rates when older which has been suggested in the past. Instead, the study points to higher levels of "bequeathing" instead.

In conclusion, previous research in this field has shown that there exists a lack of support for individuals in their retirement savings path. With the decrease in offered defined benefit plans and the uncertainty of social security, the responsibility for managing one's retirement is now more upon the individuals shoulders than before. As such, supplemental information should be provided to assist in properly understanding this new responsibility. If financial literacy shows a positive relationship with being active in investing for retirement, than financial education should be supported by governments and private institutions.

2. Methodology

The Survey of Consumer Finances

This paper uses the Survey of Consumer Finances which is a cross-sectional survey distributed by the Federal Reserve in cooperation with the Department of Treasury and University of Chicago. The original survey, given in 1983, was created to measure financial wealth as well as financial decisions within households. Since this period, it has been conducted every 3 years with panel data taken for the 1983 (re-surveyed in 1986 and 1989) and 2007 (re-surveyed in 2009) surveys.

The survey has been adapted since its inception in 1983; further information on specific questions that were added or removed are available on the Federal Reserve's website. In addition to the standard survey, a Survey of Pension Providers (SPP) was distributed in 1983 and 1989. The 2016 data set was used as it reflects the most recent information available. The 2016 survey contains 6,500 household interviewed with a total of 31,240 observations.

This survey was chosen based on its use within other economic literature as well as the size of the survey pool and the number of questions. The SCF covers a wide range of topics including those relating to demographics, assets, debts, income, spending habits, and financial behavior. It should be noted that this survey is voluntary, so if there is a trend in demographics who did not respond to the survey, they would likely not be reflected in this data set.

One major benefit of the Survey of Consumer Finances is the comprehensive list of questions geared towards understanding the reasoning behind the respondent's decisions to hold assets or accrue debt, commonly termed as "attitudinal" questions. They include questions that evaluate risk aversion, saving habits, income expectations, and financial literacy. The latter is based on a set of three (3) questions:

1.   **"Do you think that the following statement is true or false: Buying a single company's stock usually provides a safer return than a stock mutual fund?"**

      a.   **True**

      b.   **False**

2.   **"Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After five years, how much do you think you would have in the account if you left the money to grow?"**

      a.   **More than $102**

      b.   **Exactly $102**

      c.   **Less than $102**

3.   **Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After one year, would you be able to buy:**

      a.   **More than today**

      b.   **Exactly the same as today**

      c.   **Less than today**

The variable of interest in this study is the performance of an individual on a financial literacy questionnaire (finlit). The relationship between the number of financial literacy questions (as outlined above) answered correctly on the amount saved by a household is tested using a cross-sectional data and a simple linear regression. This variable was chosen because, unlike income or college education, there are ways to implement programs which can increase financial literacy

The financial literacy questions in the Survey of Consumer Finances are similar to other questionnaires that evaluate financial literacy such as the University of Michigan's Health and Retirement Survey (HRS), and focus on evaluating one's understanding of diversification, time value of money, and basic economic ideas such as how inflation affects holdings.

Other factors which have been shown in previous literature to have affects on retirement saving have been controlled for, as described in Table 1. The model is tested for multicollinearity using the variance inflation factor (VIF) test and is shown to have none. Due to a risk of heteroskedasticity, the model is run using robust standard errors.

The Variables

Variable Description	Name	Full Model	Age-Group 2	Age-Group3	Age-Group4	Age-Group5
Gender of Household Head (0=F, 1=M)	male	+	+	+	+	+
Marital Status of Head of Household (0=Not, 1=Married)	marital_status	+	+	+	+	+
Number of financial literacy questions answered	finlit	+	+	+	+	+

correctly (scale 0-3)						
Total amount of income of household, 2016 dollars	income	+	+	+	+	+
Education (0=No College, 1=Some or More)	college	+	+	+	+	+
Either head or spouse/partner has any type of account-based plan on a current job (0= No DC, 1= DC)	dcplancj	+	+	-	-	-
Total balance of household loans where the lender is a commercial bank, 2016 dollars	LLOAN1	-	+	+	+	+
Respondent not willing to take financial risk (0=Willing to take risk, 1=Not willing)	nofinrisk	-	-	-	-	-
group1-5: A dummy variable for the age groups as compared against 35-44 age group	group#	-, +, +, +				

Table 1: Variable Description and Expected Coefficients

1. totalsave= β_0 + $\beta_1$male+β $\beta_2$marital_status+β **$\beta_3$finlit**+β $\beta_4$college+$\beta\beta_5$dcplancj+β $\beta_6$nofinrisk+ $\beta_7$group1+ $\beta_8$group3+ $\beta_9$group4+ β_{10}group5 + β_{11}group6+ β_{12}income+ β_{13}LLOAN1+ ε

When choosing from the available surveyed parameters, previous literature was highly consulted. The Y variable, total save, is estimated as the "total value of equity in directly-held stocks, stock mutual funds, and combination mutual funds held by household" plus the "amount in other bond mutual funds" and the "amount in government bond mutual funds" all of which are being measured in 2016 dollars. It is recognized that this is a loose interpretation of saving and that some of these assets could not be included in a formal retirement vehicle. These include savings for college or homes which could be pulled out earlier in one's life than retirement savings. This can result in a decrease of savings that is counterintuitive from what would be expected of accrued retirement savings based on age.

As this study was done in two parts: first regressing all participants of the study and then regressing amongst different age groups, the expectations of coefficients shown in Table1 were done consecutively. Therefore, the flipped expected sign in LLOAN1 and the defined contribution indicator variable are in response to observations found in the original model regression.

Income was chosen due to its relation with the ability to save. Logic would dictate that those who earn more are less concerned with obtaining the basic necessities such as food, water, and shelter, and are therefore actually able to set aside funds for retirement. Dynan, Skinner, and Zeldes (2004), support the positive relationship between household income and the percentage of income saved; as such, we would also expect our coefficient within this study to be positive in both the full model as well as all four age groups. This variable is measured in the dollar denomination of the year the survey is taken, in this case, 2016.

The gender variable is based on the payment structure currently found which suggests men have higher lifetime earning potential than females, as supported by Ruel (2013) using the Survey of Consumer Finances. It is also pointed out within Ruel's paper that the gender of the best financial reporter (BFR) is more likely to be a male. This is reflected in the 2016 data which showed men responding as the head of household 76.7% of the time. This heavy response rate should be noted when running the regression and could inflate the expected positive magnitude of the variable slightly. While it is expected that this coefficient will be positive in all 5 regressions, we would also expect gender to have a stronger magnitude in later age groups, as gender stratification is seen more in upper management than entry positions.

Whether an individual is married was also chosen to control for based on previous literature, specifically the University of Wisconsin-Madison study in 2006 which suggests that marital status has a significant effect on one's ability to meet retirement goals and therefore a positive coefficient within this study. This could have an effect in the future as marriage rates are shown to be trending downward in the United States according to the Center for Disease Control and Prevention.

Education is controlled for as a variable that is shown to be positively correlated with earning potential and therefore is expected to have upward pressure on retirement savings as well. Connected to this, studies such as Tamborini (2017), show that the availability of defined contribution plans to enroll in is less in those who are less educated. To further magnify this, the study shows that of those offered a plan, less-educated individuals are less likely to enroll and, if they do, contribute at significantly lower amounts. This inequality in income earning years is shown even more sharply during the actual retirement years.

The next variable chosen for this paper was whether an individual had a defined

contribution plan. In the SCF, this variable is an indicator variable and therefore does not

provide a dollar amount in which it can be measured, however, given the rise of defined

contribution plans in recent decades, it seemed prudent to include. Additionally, defined

contribution plans would likely be more sensitive to financial literacy levels than defined benefit

plans given the nature of self-investment that comes along with them, giving them an expected

positive coefficients. After the original regression, it was found that the coefficient for defined

contribution was negative. This led to the expectation of age-groups 3,4, and 5 to be negative

as well. Age-group2's expectation remained positive as summary statistics of the data showed a

higher rate of DC plan usage within this generation.

The amount of loans held by a commercial bank was included as a seemingly

competitive variable to the Y. Every dollar that is put towards loan repayments would be money

that is not going towards retirement savings. Additionally, with the continuously rising cost of

college, people within all age ranges have been forced to begin making decisions between

paying off student loans or saving for college versus building a nest egg. As there exists a

potential opportunity cost between this and the Y variable, the coefficient would be expected

as negative. After running the full model, this expectation was not observed, and so future

expectations for the age-group regression were modified to be positive.

An individual's risk aversion also has significance in how much one saves for retirement.

A large defining factor in investment choice is the investor's appetite for risk. It would be

expected that those who are more risk averse would choose a safer investment option such as

a savings account which is not included in the Y variable. Therefore, we would expect that this variable will have a negative relationship with totalsave.

As age is also evaluated in retirement research as an incredibly important factor, it is also included as an independent variable. Munnell (2013) suggests that the age of retirement and the age in which one starts saving are the two most significant factors which affect the amount of funds available for retirement. This is partially due to an increased time period allowing for greater compounding of assets, but also has a behavioral aspect that suggests better planning and/or financial constraint. In addition, as mentioned in Henager, different age groups make decisions using different forms of intelligence and reasoning with middle aged individuals making the "smartest" choices. As age is being categorized within this study, we would expect a natural accumulation of retirement savings as one got older meaning that agegroup1, as the only group younger than the comparison group of 35-44, would have a negative coefficient while agegroups 3, 4, 5, and 6, would all have positive coefficients.

The Model

The full data-set contained 31,240 observations. The age-group regressions, when dropping group1 and group6, account for 23,250 participants, or 74% of the full data. The variables chosen are a combination of continuous, indicator, and categorical. The continuous financial variables include the Y variable (totalsave), income, and LLOAN1.

The indicator variables are the five age groups, male, marital status, college, dcplancj and nofinrisk. These variables' responses are interpreted as either one or zero responses. The dummy variables coded responses are laid out in Table 1, with each variable being compared to

the negative version of the question (for example being male is coded as 1, and not male coded as 0) except for the age groups. These are coded as "1" for being in the age group and "0" for not being in the age group. The age group of 35-44 is not included as an indicator variable agegroup as it is left as the comparison group. This means that any coefficient of the age groups is interpreted as "individuals in agegroupX will have Y more/less savings on average than individuals between 35-44 years old". This age range was chosen as the best approximation of the peak earning, and therefore savings time.

Financial Literacy is the only categorical variable and is measured on a range from 0-3, 0 being no financial literacy questions answered correctly and 3 being all of the financial literacy questions were answered correctly.

3. Discussion and Results

Variable	Full Model	Age-group2	Age-group3	Age-group4	Age-group5
finlit	893,288.8***	97,557**	416,413***	442,643**	972,391*
	(155,634)	(49,639.14)	(95,972.59)	(191,359.6)	(605,243.5)
income	1.17***	1.20***	0.90***	1.52***	0.56***
	(0.26)	(.25)	(.16)	(.30)	(.21)
LLOAN1	2.97***	4.72***	2.02***	13.28***	1.12***
	(1)	(.76)	(.74)	(2.56)	(.15)
male	213,219.80	-54,074	1,339,959***	-2,736,274***	2,224,189*
	(277,742)	(68,201.34)	(395,107.5)	(621,892.2)	(1,377,258)

marital_status	567,658.7*	46,748	-1,205,339***	1,313,032**	258,096
	(341,640)	(134,160.6)	(441,473.8)	(559,556.9)	(1,720,346)
college	1,198,442***	116,975	664,045***	258,154	2,049,469***
	(149,325)	(94,239.82)	(126,014.8)	(387,177.5)	(742,387.6)
dcplancj	-1,259,842***	-800,517***	-1,379,153***	-1,045,467**	133,007
	(245,685)	(148,295.8)	(223,537.5)	(611,124.5)	(1,342,037)
nofinrisk	-1,024,610*	-86,250*	-519,546***	1,635,365***	-4,654,819***
	(400,22)	(51,935.4)	(113,661.9)	(636,197.9)	(638,221.4)
agegroup1	51,214.77				
	(102,456)				
agegroup3	-27,753.64				
	(183,014)				
agegroup4	1,205,589***				
	(289,083)				
agegroup5	2,370,709***				
	(490,794)				
agegroup6	4,543,950***				
	(590,989)				
Constant	-2,480,819***				
	(500,591.3)				

Table2: Regression Model. Robust Standard errors in parenthesis Significance: *** p<. 01 ** p<.05 *p<.1

Model	Full Model	Age-group2	Age-group3	Age-group4	Age-group5
Sample Size	31,240	5,135	6,170	7,230	4,715
Adjusted R^2	16.2%	33.8%	31.9%	55.6%	7.0%

Table3: Sample Size and Adjusted R-squared

Table 3 outlines the relationship of the independent variables on total save in both the full and age-group models. This study was accomplished by first running a complete model which included all participants of the 2016 survey. After running the original regression, 6 separate regressions were run to determine the specific effects of financial literacy in each age range. This has been seen in previous literature such as Henager et. al (2016) and also allows for the analysis of other independent variables. After running these regressions, agegroup1 andagegroup6 were dropped as they represented the extremes of the sample. Agegroups 2,3,4, and 5 were kept. Comparisons were made between these age groups to analyze changes in explanatory power, sign coefficient, and magnitude of the independent variables.

When looking at the age-group regressions, finlit had a positive coefficient across them all, in line with the original model. This supports the hypothesis that those who are more financially literate save more for retirement. There are a number of reasons for this, namely that understanding the strengths and weaknesses of different assets allows them to situate themselves in the best strategic position for retirement. Essentially, those who are more financially literate have a better understanding of the ideas discussed in the review of literature

The mean for the set of 3 financial literacy questions for participants in the agegroups were 2.19 for group2, 2.32 for group3, 2.43, and 2.44 for group4, indicating an average of 2 out of the three questions were answered correctly. Although there are not enough observations to

make a conclusive observation, there does seem to be signs of "diminishing returns" between

financial literacy and agegroup.

In agegroup2, 44.5%, or a little under half of the participants, answered all three of the

financial literacy questions correctly, a unexpectedly large percentage. This is compared with

only 4.5% answering none correctly and the remaining 51% answering either one or two

correctly. Although these results are higher than expected, Agegroup1 still has the highest

percentage of individuals answering all three wrong and the lowest percentage of individuals

answering all three right. The natural progression of percent of population getting all three

questions rights suggests that part of financial literacy is a natural development with age, but

also pinpoints younger agegroups as the periods in which benefit the from financial courses

would be greatest. Another observations is that, although financial literacy does increase

through age, the coefficients increase of the variable increase at much faster rates over the

same agegroups. This suggests the marginal value of financial literacy is also increasing as one

ages.

In the full model, Income and LLOAN1, the two continuous variables, both showed

multiplying effects to totalsave in that a one-dollar increase in either led to a $1.17 and $2.97

dollar increase in the Y variable. This means that each additional dollar earned, leads to more

than one additional dollar saved. While this was expected for the income variable, it was not for

the LLOAN1 variable. The explanation behind this positive and high (in comparison to the

income variable) magnitude of coefficient can be attributed to two different factors: firstly, as

this variable is a measure of all loans held by commercial banks specifically, it is mainly loans

taken out for homes or college, both of which indicate a high income and some existing level of

financial stability. Secondly, given the assumption that many of these loans are for homes, the

time of the survey (2016) would suggest a stringency from commercial banks on who they

would lend money to. After the financial crisis of 2008 that was largely caused by a faulty

mortgage epidemic, commercial banks increased the credit standards for those looking to take

out mortgages. This means that individuals who are accepted to take out loans would be those

who have shown financial responsibility in the past.

Breaking the sample down further into age-group regressions shows some interesting

results for both the income and LLOAN1 variable. For income, Agegroup 4 (55-64) has the

largest magnitude of coefficient at 1.52 with agegroup2 (35-44) having the second largest at

1.20. This suggests that, while income is a large influence on retirement savings across ages, it is

especially important when you start out. In addition, those who have more income during their

later working years, also have more accumulated savings than those who have less. This

relationship between retirement savings and income is weaker during agegroup5 likely because

there exists many more opportunity costs to retirement savings than in youth or older years. It

is the weakest in agegroup5, at which point individuals are pulling funds out of retirement

savings to act as income, and therefore there is not a 1 to 1 replacement rate.

In regards to LLOAN1, it remains positive across all four age groups, reaching its highest

magnitude in agegroup4 at 13.28. This indicates that for every dollar in commercial bank loans,

the individual has $13.28 in retirement savings, a full $10.32 above the original regression.

Given that the coefficient of this variable is a ratio of sorts, the large difference can be

explained by external life events not being accounted for in this model. Namely, the age range

of 55-64 not only represents the range just on the brink of retirement and therefore at the apex

in amount of savings, but also a range in which loans are beginning to taper off. At this time,

many individuals have choose to either downsize or are at the end of paying off a mortgage

which decreases the loans held with commercial banks. This naturally means that with a drop

off in amount of loans but the same amount of previous savings as well as final additions to the

pool, the ratio between the two would increase dramatically.

In the full model, Marital Status and nofinrisk showed significance at the 90th percentile

with marital status having an expected positive and moderately heavy coefficient. Nofinrisk

within this model put upward pressure on the totalsave variable contrary to expectations. A

reason behind this could be the omission of traditional savings, money market, and certificate

of deposit accounts, all of which offer a safer and less risky options than the ones presented in

this model.

Another factor to consider is the interpretation of financial literacy by individuals. As

there was no set definition provided, people may be judging their risk levels at different

baselines. Due to heterogeneity in individual risk assessments, interpreting coefficients

associated with self-reported risk measures should done with skepticism.

In the age regressions, marital status's statistical significance oscillates between age

groups and concludes that, in this study, marriage is not a signifier for whether one will save

more or less for retirement in the youngest or oldest analyzed agegroups. In agegroup 3 and 4,

it has high significance with downward pressure on totalsave in group3 and upward pressure in

4. In regards to nofinrisk, the full model's negative coefficient holds true for all age-groups

except for age-group 4. Here, it is not only positive, but with a large magnitude. From a financial

advisors standpoint, this makes sense because as you approach retirement age, your balanced

portfolio should become less risky due to the shortened time-frame.

The only variables which do not hold statistical significance within the full model are the

male, agegroup1, and agegroup3 indicator variables. The male variable, does gain significance

in agegroups 3,4, and 5. It is highly statistically significant in these age group regressions, but

the coefficient switches from positive in agegroup3, to negative in agegroups 4 and back to

positive in 5. This variation in coefficient explains the insignificance of the variable in the

original model and it can be inferred that the statistical insignificance of regression agegroup1,

is also due to a large volatility in totalsave within male identifying survey participants.

Regarding the Defined Contribution indicator variable, it carries a negative coefficient in

both the full and three out of four age-group models, contrary to expectations. The defined

contribution indicator variable remains negative in all age groups it holds significance, contrary

to both original and revised expectations. After running the original model, this coefficient was

assumed to be from lack of availability of DC plans in older age-groups, and the negative would

become positive in younger age-groups. After breaking the sample down, this was not proven

true.

This suggests that having a retirement savings plan does not necessarily dictate better

savings habit, either due to lack of information on how to invest or lack of discretionary funds

to contribute. It should be noted that, although it remains negative, the magnitude is much less

in the youngest agegroup, suggesting credibility to the idea that it is the recentness of usage in

these plans that contributes to the negative sign. The indicator variable for willingness to taking

financial risk remains negative in all but agegroup4. Here, it is not only positive, but with a large

magnitude. From a financial advisors standpoint, this makes sense because as you approach retirement age, your balanced portfolio should become less risky due to the shortened time-frame.

In the full model, the age group variables 4, 5, and 6 all had coefficients in the expected direction and were with chronologically increasing magnitudes. This is supported through the individual age-group model's summary statistics as well.

4. Conclusion and Policy Recommendations

The model supports previous literature that an increase in financial literacy will increase the amount of retirement savings, therefore supporting the hypothesis. This study used a statistically significant multiple linear regression model using robust standard errors to obtain unbiased coefficients given the likelihood of heteroskedasticity. A VIF test was used to test for multicollinearity which was non-existent. Results from this test can be found in the Appendix.

This study lays the groundwork for further research. Specifically, utilizing a dependent variable which specifically represents retirement savings in a defined contribution plan would allow more accuracy in the coefficients of the independent variables. As the model stands, it is possibly picking up savings for things such as mortgages or college savings. Interactions between financial literacy and education, financial literacy and risk, as well as racial demographics would assist in controlling the model further. In addition, dummy variables regarding which financial literacy questions were answered correctly to identify if knowledge regarding a certain type of economics or finance has a greater effect on retirement savings, however this information was not available within the scope of this research.

Another factor that should be taken into account is student loans. While some were incorporated within the loans from commercial bank variable, it would be beneficial to have a variable specifically showing how many student loans an individual has. This would be a more accurate representation as it would include loans from the government and the educational institutions, which are often given more heavily to low income students. This would be especially useful in a time series or panel model which could then view how and if increases in student loans affect the amount of retirement savings.

This study ultimately observes that, while financial literacy is a factor of higher amounts of retirement savings across all age groups, it is with the stipulation that the individual has the means to save in the first place. Given this, it would be assumed that, therefore, financial literacy should be aimed at those in higher income brackets. However, the data also suggests that, between age groups, there exists diminishing returns to the affect financial literacy has on individuals, i.e., the younger financial literacy is introduced, the more marginal benefit.

Ultimately, using conclusions between this and other research, it would be recommended that governments support financial literacy programs specifically within public education programs as this is their domain of influence. Furthermore, it would be suggested that these courses focus on modules regarding financial concepts which educate on how money can compound or depreciate in value, as well as the avenues one can pursue to open retirement savings accounts. These courses are recommended to students in high school where the imminence of workforce participation is more relevant.

In addition, similar modules could be introduced in workplaces, ideally with an incentive for participating. This kind of system exists in some large companies for things such as health

education which shows precedence for its introduction. Additionally, one thing noted in previous literature was how economic environments such as post Great-Depression (Lewis 2009) affected the proliferation of personal finance courses in high school. The rise of the current wave of financial literacy research was sparked by The Great Recession. Therefore, it is important to note that one concern surrounding financial literacy is the consistency of it's importance in society.

Ultimately, in America, a retirement crisis is a crisis for the government who is partially responsible for providing support to older Americans through social security and Medicaid. Individuals who have less savings are more likely to request these services which could lead to increased strain on the government. Therefore, being more financially literate would lead to a more individually sufficient population during retirement years.

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Appendix

Stata Output: Full Model

```
Linear regression                                   Number of obs    =     31,240
                                                    F(13, 31226)     =      53.92
                                                    Prob > F         =     0.0000
                                                    R-squared        =     0.1619
                                                    Root MSE         =    2.1e+07
```

totalsave	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
agegroup1	51214.77	102456.2	0.50	0.617	-149603.4	252033
agegroup3	-27753.64	183013.5	-0.15	0.879	-386467.5	330960.2
agegroup4	1205589	289083.2	4.17	0.000	638974.6	1772204
agegroup5	2370709	490794.2	4.83	0.000	1408733	3332686
agegroup6	4543950	590988.7	7.69	0.000	3385588	5702311
male	213219.8	277742	0.77	0.443	-331165.7	757605.2
marital_status	567658.7	341639.7	1.66	0.097	-101968.7	1237286
finlit	893288.8	155633.7	5.74	0.000	588240.7	1198337
income	1.169592	.260002	4.50	0.000	.6599774	1.679206
college	1198442	149325.1	8.03	0.000	905759.2	1491126
dcplancj	-1259842	245686	-5.13	0.000	-1741396	-778287.7
LLOAN1	2.969795	.9950357	2.98	0.003	1.019485	4.920105
nofinrisk	-1024610	400227.8	-2.56	0.010	-1809072	-240147.1
_cons	-2480819	500591.3	-4.96	0.000	-3461998	-1499640

Stata Output: VIF

```
. vif
```

Variable	VIF	1/VIF
marital_st~s	1.91	0.523915
male	1.88	0.532417
agegroup4	1.87	0.533450
agegroup3	1.77	0.564087
agegroup5	1.69	0.590349
agegroup1	1.68	0.593818
agegroup6	1.50	0.668891
nofinrisk	1.25	0.797251
finlit	1.22	0.817024
college	1.20	0.831512
dcplancj	1.19	0.842575
income	1.03	0.973435
LLOAN1	1.01	0.988225
Mean VIF	1.48	

Stata Output: Statistical Summary

```
    Variable |        Obs        Mean    Std. Dev.        Min         Max

   totalsave |     31,240     2556541     2.34e+07          0    1.00e+09
      income |     31,240    799817.4      5461926          0    3.06e+08
      LLOAN1 |     31,240    153495.7      1958625          0    1.49e+08
    agegroup1 |     31,240    .1605314      .367104          0           1
    agegroup3 |     31,240    .1975032     .3981215          0           1

    agegroup4 |     31,240    .2314341     .4217559          0           1
    agegroup5 |     31,240    .1509283     .3579847          0           1
    agegroup6 |     31,240    .0952305     .2935377          0           1
         male |     31,240    .7668054     .4228719          0           1
 marital_st~s |     31,240    .6248399      .484172          0           1

      college |     31,240    .6774648      .467454          0           1
      dcplancj |     31,240    .3628361     .4808258          0           1
     nofinrisk |     31,240    .3386684     .4732645          0           1
        finlit |     31,240    2.292414     .8381223          0           3
```

Table 4: Full Model: Descriptive Statistics of Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
totalsave	31,240	2,556,541.00	23,400,000.00	0	1,000,000,000
income	31,240	799,817.40	5,461,926	0	306,000,000
LLOAN1	31,240	153,495.70	1,958,625	0	149,000,000
agegroup1	31,240	0.16	0.37	0	1
agegroup3	31,240	0.20	0.40	0	1
agegroup4	31,240	0.23	0.42	0	1
agegroup5	31,240	0.15	0.36	0	1
agegroup6	31,240	0.10	0.29	0	1
male	31,240	0.77	0.42	0	1
marital_status	31,240	0.62	0.48	0	1
college	31,240	0.67	0.47	0	1

dcplancj	31,240	0.36	0.48	0	1
nofinrisk	31,240	0.34	0.47	0	1
finlit	31,240	2.29	0.84	0	3