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Financial Literacy and Retirement Planning: New Evidence from the Rand American Life Panel

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Financial Literacy and Retirement Planning:
New Evidence from the Rand American Life Panel

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Abstract:
The present paper introduces a new dataset, the Rand American Life Panel (ALP), which offers several appealing features for an analysis of financial literacy and retirement planning. It allows us to evaluate financial knowledge during workers' prime earning years when they are making key financial decisions, and it offers detailed financial literacy and retirement planning questions, permitting a finer assessment of respondents' financial literacy than heretofore feasible. We can also compare respondents' self-assessed financial knowledge levels with objective measures of financial literacy, and most valuably, we can investigate prior financial training which permits us to identify key causal links. By every measure, and in every sample we examine, financial literacy proves to be a key determinant of retirement planning. We also find that respondent literacy is higher when they were exposed to economics in school and to company-based financial education programs.

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Ordinary consumers must make extraordinarily complex financial decisions on a daily basis, yet recent research shows that they often make these decisions without what would seem to be essential financial knowledge. For instance, only half of older Americans could correctly answer two simple questions about compound interest and inflation; only one-third of this group of respondents answered those two questions correctly plus a third question about risk diversification (Lusardi and Mitchell, 2006). Financial illiteracy is particularly acute among older women, Blacks, Hispanics, and the least educated (Lusardi and Mitchell, 2006, 2007b). This is a matter of concern to those focused on retirement saving, inasmuch as data on older adults indicates that the financially illiterate appear to be unable to calculate how much they need to save for retirement, and they also have less wealth (Lusardi and Mitchell, 2006, 2007a).

Relatively little analysis of financial literacy has been conducted on younger persons and the work that has been done has only scratched the surface of this literacy/retirement planning problem. One factor holding back research has been difficulty obtaining data which merges information about peoples' financial literacy and saving behavior. Indeed, most analysis of such questions has focused on respondents to the Health and Retirement Study (HRS), who are over age 50. The present paper introduces a new dataset, the Rand American Life Panel (ALP), which is an internet survey for somewhat younger respondents. This dataset has several appealing features. First, it allows us to evaluate financial knowledge during workers' prime earning years when they are making key financial decisions such as buying a home or saving via company pensions. Second, the ALP financial literacy and retirement planning questions are quite detailed and extensive, permitting a finer assessment of respondents' financial literacy than heretofore feasible. Third, the online approach allows questions to be randomized, so that respondents can be asked a given question with different (inverted) wording; this permits us to

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assess how well respondents understand questions and how often they tend to guess the answers. Fourth, the ALP allows us to link respondents' self-assessed financial knowledge levels and the more objective measures of financial literacy. Finally, the ALP asks about financial training acquired before the respondents entered the labor market and before they started planning for retirement; this permits us to identify the causal links between financial literacy and retirement planning.

To preview findings, we show that the financial literacy index we create is a strong predictor of retirement planning, particularly after correcting for potential endogeneity bias. We also find that respondent literacy is higher when they were exposed to economics in school and to company-based financial education programs. Our analysis is informative for researchers and policymakers in several ways. The last decade has seen an explosion of commercial products and financial planning programs. In addition, several government agencies have begun to foster financial education, and many employers are offering retirement seminars to their employees. Thus far, the evidence on these programs' effectiveness has been mixed (Lusardi, 2004). Our paper documents wide gaps in economic knowledge even among individuals with a given level of income and education. This underscores the importance of acknowledging such differences when devising programs to foster retirement security. It also suggests how to improve the effectiveness of such financial education programs.

Background

Economists have been seeking to understand the links between financial literacy, retirement planning, and wealth for the last decade.[1] This research is beginning to attribute retirement shortfalls to the fact that many workers are poorly informed about basic economic and financial concepts, including the meaning of compound interest and risk diversification. Such financial illiteracy is widespread, as shown by the National Council on Economic Education (2005) which found poor knowledge of key economic concepts among both high school students and working-age adults. There is also frequently a mismatch between what people think they know and objectively measured financial knowledge (Agnew and Szykman, 2005). Strikingly, people tend to be remarkably uninformed about two key sources of retirement income, namely Social Security benefits and pensions, and they often fail to understand loans and mortgages (Gustman and Steinmeier, 2004; Moore, 2003). Similar financial illiteracy has been confirmed in other countries as well.[2]

To remedy these shortfalls, some employers and policymakers have begun to offer financial education and retirement planning seminars (Bernheim and Garrett, 2003; Lusardi, 2004). Unfortunately there is little evidence that such programs are effective, mainly because they have been cursory and tend not to be tailored to specific knowledge gaps (Lusardi, 2008). Most critically, analysts lack data on what economic and financial knowledge is most effective in enhancing retirement planning and saving decisions. In what follows, therefore, we draw on a new dataset designed to tease out this link.

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[1] See Ameriks et al. (2003), Bernheim (1995, 1998); Hurst (2006); Lusardi (1999, 2002, 2003, 2008), Lusardi and Beeler (2007); and Lusardi and Mitchell (2006, 2007a,b) among others.

Data and Methodology

To explore these questions in greater detail, we have developed a set of financial literacy and planning questions, in collaboration with Arthur van Soest, for the Rand American Life Panel (ALP). This is an Internet-based survey of respondents age 18+ recruited by the University of Michigan's Survey Research Center from former participants in the Survey of Consumer Attitudes (this forms the basis for Michigan's Index of Consumer Expectations).[3] The value of examining financial literacy for households in their prime earning years is that it permits the assessment of their information set when they make some of their most important financial decisions. Participants in the ALP use their own computers or a Web TV to log on to the Internet monthly where they are asked to complete an on-line survey lasting no more than half an hour at a time.[4]

Data collected for ALP respondents include the usual demographic and economic attributes one would anticipate (education, age, sex, income, wealth). The average age of the sample is almost 53, and most of the respondents are between the age of 40 and 60 (see Appendix Table 1). The sample is relatively highly educated (over half have college or more years of education) and it is also relatively high income: almost 30 percent of respondents earn an annual $100,000 or more. Given the composition of the sample, and the fact that weights are not available to convert the results into a more representative picture of the US population, our findings below will tend to overstate the level of financial literacy in the overall population.[5]

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[2] See Miles (2004) and Christelis et al. (2006).
[3] Prior to December 2006, respondents were required to be at least 40 or older at the time of the survey interview.
[4] For more information see www.rand.org/labor/roybalfd/american_life.html. .
[5] Because of the composition of the sample, the method of data collection (internet versus phone interviews), and the types of respondents (those using internet versus the general population), it would be inaccurate to compare these results with those from the older nationally representative HRS.

We explore respondents' financial literacy levels in two ways, first with questions on *basic financial literacy*, and second with a more extensive set of questions on what we term *sophisticated financial literacy*. The former area is assessed by questions similar to those developed for the Health and Retirement Study (HRS) about compound interest, inflation, and time discounting. The latter questions seek to measure more advanced financial knowledge and cover topics such as the difference between stocks and bonds, the function of the stock market, the working of risk diversification, and the relationship between bond prices and interest rates. These build on a module designed by van Rooij, Lusardi and Alessie piloted for the DNB Household survey, which is another internet survey collecting data for a panel of Dutch households.

The precise wording of the basic financial literacy questions is as follows:

Basic Financial Literacy Questions

1. Numeracy
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? (i) More than $102; (ii) Exactly $102; (iii) Less than $102; (iv) Do not know (DK); (v) Refuse.

2. Compound Interest
Suppose you had $100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total? (i) More than $200; (ii) Exactly $200; (iii) Less than $200; (iv) DK; (v) Refuse.

3. 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? (i) More than today; (ii) Exactly the same; (iii) Less than today; (iv) DK; (v) Refuse.

4. Time Value of Money
Assume a friend inherits $10,000 today and his sibling inherits $10,000 3 years from now. Who is richer because of the inheritance? (i) My friend; (ii) His sibling; (iii) They are equally rich; (iv) DK; (v) Refuse.

5. Money Illusion
Suppose that in the year 2010, your income has doubled and prices of all goods have doubled too. In 2010, how much will you be able to buy with your income? (i) More than today; (ii) The same; (iii) Less than today; (iv) DK; (v) Refuse.

Of course, to competently plan for retirement and invest retirement assets, consumers would need more knowledge of additional financial concepts, including the relationship between risk and return, risk diversification, and how stocks and bonds work. To quantify how sophisticated people are in this realm, we have created several additional questions along the lines of questions designed for the DNB Household Survey (van Rooij, Lusardi and Alessie 2007), and similar to a few US surveys.[6] The exact wording of this second set of questions is as follows:

Sophisticated Financial Literacy Questions

1. Function of Stock Market
Which of the following statements describes the main function of the stock market? (i) The stock market helps to predict stock earnings; (ii) The stock market results in an increase in the price of stocks; (iii) The stock market brings people who want to buy stocks together with those who want to sell stocks; (iv) None of the above; (v) DK; (vi) Refuse.

2. Knowledge of Mutual Funds
Which of the following statements is correct? (i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; (ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) DK; (vi) Refuse.

3. Relation between Interest Rates and Bond Prices
If the interest rate falls, what should happen to bond prices? (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) DK; (vi) Refuse.

4. Safer: Company Stock or Mutual Fund
True or false? Buying a company stock usually provides a safer return than a stock mutual fund. (i) True; (ii) False; (iii) DK; (iv) Refuse.

5. Riskier: Stocks or Bonds
True or false? Stocks are normally riskier than bonds. (i) True; (ii) False; (iii) KD; (iv) Refuse.

6. Long Period Returns
Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return? (i) Savings accounts; (ii) Bonds; or (iii) Stocks; (iv) DK; (vi) Refuse.

7. Highest Fluctuations
Normally, which asset displays the highest fluctuations over time? (i) Savings accounts, (ii) Bonds, (iii) Stocks; (iv) DK; (v) Refuse.

8. Risk Diversification
When an investor spreads his money among different assets, does the risk of losing money: (i) Increase, (ii) Decrease (iii) Stay the same; (iv) DK; (v) Refuse.

These more complex questions require knowledge of both financial concepts and financial instruments, such as stocks, bonds, and mutual funds. To assess whether respondents actually understand the questions, versus simply guessing, in some cases we have reversed the question wording and exposed two randomly chosen groups of respondents to a different wording to see whether the order appears to influence their answers. This process was implemented for three questions: Q5 about risk differences between bonds and stocks; Q4, which is the more difficult question about risk diversification; and Q3, the most difficult question about the link between bond prices and interest rates. Specifically the word reversals are as reported below:

Randomization of Word Order for Three Sophisticated Financial Literacy Questions
Q5. True or false?
 (a) *Stocks* are normally riskier than *bonds*.
(b) *Bonds* are normally riskier than *stocks*.
Q4. True or false?
 (a) Buying a *company stock* usually provides a safer return than a *stock mutual fund*.
(b) Buying a *stock mutual fund* usually provides a safer return than a *company stock*.
Q3. Rise/fall/stay the same/none of the above?
 (a) If the interest rate *falls*, what should happen to bond prices?
(b) If the interest rate *rises*, what should happen to bond prices?

Respondents are also asked a question about retirement planning that permits us to compare levels of financial knowledge across socioeconomic groups. The particular question used here is identical to that used in the 1992 and 2004 HRS; the precise wording of the question is: *How much have you thought about retirement? A lot, some, little, or hardly at all?* Answers to this question are a strong predictor of retirement wealth in the HRS, where Lusardi (2003) showed that those who had not thought at all about retirement had half the wealth of those who

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Financial Literacy in Washington State, and the 2001 Survey of Consumers.

had given retirement at least some thought.[7] Moreover, while in principle, wealth can affect planning, Lusardi and Mitchell (2007a) have shown that the direction of causality goes the other way – from retirement planning to wealth.

Finally, we will also relate our financial literacy measures identified above with a self-assessed measure of economic knowledge. The question is worded as follows: *On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your understanding of economics?* This question is of interest because economic behavior may be affected by *perceived* rather than *actual* knowledge, so it is important to have both types of information to determine which has a stronger effect on observed behavioral patterns. Also, financial knowledge extends well beyond the specific questions we have included on the workings of the stock market, compound interest, and risk diversification. For this reason this summary self-assessment could potentially encompass peoples' knowledge of concepts and financial instruments that we do not separately evaluate here (e.g. mortgages, credit cards, etc.).

In what follows, we first report tabular results on the basic and sophisticated financial literacy questions. Next we relate these to the self-assessment reports on economic literacy, and show how retirement planning is linked to a literacy index we have built using the responses to the various financial literacy questions we have posed. Subsequently we undertake a multivariate analysis of patterns of retirement planning as a function of respondent literacy. Using an instrumental variables approach, we show that controlling for respondents' background training in economics greatly enhances the strength of the literacy/planning nexus. Additional robustness checks underscore the power of our empirical findings.

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[7]This finding does not change much over time and it is robust to controls for many socioeconomic characteristics including education and income (Lusardi and Beeler, 2007)

Basic and Sophisticated Financial Literacy

Our goal with the basic financial literacy questions is to measure simple concepts that are the basis for everyday financial transactions and decision-making. Table 1 reports summary response patterns overall, and by respondent socioeconomic characteristics. Panel A shows that respondents can do simple calculations regarding interest rates and they also understand the effects of inflation. But almost a quarter of respondents could not give the right answer to the compound interest question and the query regarding the time value of money. Similarly, a sizable fraction of respondents suffer from money illusion. Moreover, even though respondents could respond to individual questions accurately, fewer than half (47%) of the respondents could answer all five questions correctly (Panel B). Thus knowledge of basic financial concepts is far from widespread even among these relatively high income/highly educated respondents.

Table 1 here

Panel C offers insight into which individuals are relatively more financially literate, displayed by age, educational attainment, and sex. Respondents age 50 and older are consistently better informed, although the age differences are often not statistically significant. Differences in financial literacy by education are more striking: those with less than college are much less accurate, and are more likely to respond they do not know (DK), especially to questions on compound interest and the time value of money. It is also clear that women exhibit lower levels of financial literacy than men, where sex differences are statistically significant for all but the money illusion question. These descriptive results are similar to those in the older sample of the HRS (Lusardi and Mitchell, 2006).

Responses to the more complex battery of sophisticated financial literacy questions are summarized in Table 2. Panel A shows that most respondents, over three-quarters, do get most of

the answers right, so they have some knowledge of how the stock market and how risk diversification work. They are also more likely to be knowledgeable about fluctuations in assets than they are about patterns of asset returns. But a very difficult question is the one linking bond prices and interest rates – only about a third of the sample gets this correct, indicating striking ignorance of how assets are priced. There is also a wide range of incorrect versus DK responses, with the DK's ranging from 5 to 22 percent. Also of interest is the fact documented in Panel B, which indicates that only one fifth of respondents could answer all of these sophisticated questions accurately. Accordingly, financial sophisticated literacy is also not particularly widespread. More detail on who could accurately answer which question is provided by socioeconomic group in Panel C. Here we see that, as with the basic literacy questions, younger respondents are less well informed than older respondents: for instance, only 68 percent of the younger people but 81 percent of the older ones could explain the main function of the stock market. The younger group is also 10 percentage points less likely to correctly judge one company's stock to be riskier than a stock mutual fund. Educated respondents are again more knowledgeable than their less educated counterparts, with those having at least some college having particularly more accurate views of what the stock market does and the long run return advantage of stocks. Turning to the differences between men and women, the largest percentage point gap favoring men emerges in Q6 regarding the long run advantage of stocks versus other assets.

Table 2 here

Next we investigate how robust the answers are to the way in which specific words are ordered in three key questions. Table 3 shows the results. It is interesting that responses to Q5, regarding the risk of bonds versus stocks, are unaffected by which asset is listed first in the

question. This is an important result that shows that respondents understand the meaning of these simple questions and are not likely to be guessing in their responses. This is less true for Q4, a more difficult query about company stock versus stock mutual funds. Now 83 percent of the respondents get the answer right if the answer is True, but only 77 percent gets it right when the answer is False. The more complex question about bond pricing (Q3) is also affected by the wording: 45 percent gets the answer wrong when the question asks what happens when interest rates fall, while 38 percent get it wrong when the interest rate is stipulated to rise. What this shows is that measuring financial knowledge may be affected by error, which is a consideration that empirical analysis of these patterns should take into account. Below we deal with this issue in more detail.

Table 3 here

Next we combine both the basic and sophisticated financial literacy questions into a financial literacy index, which we will use in additional analysis. To this end, we undertake factor analysis on the responses to the 13 questions available in the ALP survey (more detail is provided in Appendix Table 2). From this analysis, we extract one factor which is a composite of each respondent's financial knowledge, and we compare this to respondents' own self-assessed level of financial literacy. Table 4 summarizes results, where we see that there is a strong positive correlation between the index we have created for financial knowledge and self-assessments of financial knowledge. Most respondents who report they are not very economically informed are also classified according to our index as low-literacy respondents; the degree of overlap is 66 percent. Conversely, most who report being economic knowledgeable are also classified according to our index as being financially literate; 50 percent of those who self-rate themselves as financially savvy are also classified as such by our index. This shows that our

set of questions is able to capture economic knowledge and also that the index derived from the factor analysis contains important information about financial knowledge.

Table 4 here

Financial Literacy and Retirement Planning

Next we turn to the question of whether financial literacy matters for retirement planning. We address this point using the identical question as that asked in the HRS, namely: *How much have you thought about retirement? A lot, some, little, or hardly at all?* Our tabulations by socioeconomic characteristic appear in Table 5. One interesting point is that most of the respondents in the ALP sample have thought some or a lot about retirement. This is a higher rate than in the HRS, which is not surprising since Lusardi (2003) and Lusardi and Mitchell (2007a) show that higher income and educated persons, such as those in the ALP sample, are more likely to be planners. The table also confirms that older, better educated, and male respondents are more likely to be planners. As we have mentioned before, these are also the characteristics of people who have a high level of financial knowledge.

Table 5 here

Next we turn to a multivariate analysis of retirement planning, which follows Lusardi and Mitchell (2006) in relating planning to key socioeconomic variables including age, sex, and marital status to account for different preferences over the life-cycle. For instance, young respondents may not plan for retirement as they may feel they face too much uncertainty about their future. We also control on labor force status, education, and income, to account for differences in economic circumstances along with need for and ability to plan. Of most interest is

the Index we have created to see whether financial literacy has an effect on planning, above and beyond the effects of education, income, and other individual characteristics.

Two models appear in Table 6. The first is an ordinary linear regression (OLS) relationship (column 1) which demonstrates that financial knowledge is influential in retirement planning, even after controlling for a range of socioeconomic factors. In other words our index of financial literacy still has its own independent effect, although formal education and in particular, having an advanced degree, boosts the probability of retirement planning. This confirms findings for the HRS in models that use a similar planning measure but only the basic financial literacy questions (Lusardi and Mitchell 2006). It is also worth noting that, to the extent our literacy questions are influenced by noisy response patterns, the OLS estimates may suffer from attenuation bias and therefore underestimate the full effects of financial literacy.

Table 6 here

The second column in Table 6 refers to the issue of the possible endogeneity of financial literacy itself. That is, if those who attempt to plan for retirement become more financially knowledgeable in the process, then planning would be influencing financial literacy rather than the other way around. To evaluate this possibility, we have devised a question about respondents' youthful exposure to financial training that would have occurred well before they entered the job market and began planning for retirement. This question is as follows:

How much of your school's education (high school, college or higher degrees) was devoted to economics? A lot, some, little, or hardly at all?

This question is used as an instrumental variable for our literacy index (Table 6). Table 7 reports the first-stage estimates, and these indicate that our economics education instrument alone, and also interactions with sex and age, are good predictors of the financial literacy index.

Specifically, respondents exposed to economics while in school display a much higher level of financial knowledge and the effect is particularly strong for those younger than age 55. This may suggest that the knowledge acquired in school becomes obsolete over time, or that there is a strong cohort effect such that "modern" economic training is more valuable.[8]

Table 7 here

Having implemented the Instrumental Variables (IV) approach, we find that the impact of the financial literacy index in the planning equation is positive, statistically significant, and seven times larger than the OLS estimate. These results imply that it is critical to carefully disentangle the causal relationships of interest using arguably exogenous instruments.

Alternative Empirical Specifications and Robustness Checks

Next we summarize results from alternative specifications that help us assess the robustness of our results thus far. One consideration is that there may be some measurement error in the answers provided to the financial literacy questions. As noted earlier, responses to the questions where wording was randomized suggest some evidence of guessing, particularly for the most difficult sophisticated literacy question. Accordingly, Panel A of Table 8 excludes from the literacy index the three randomized questions, to help examine the sensitivity of our estimates to the type of questions included in the literacy index. In particular, these results exclude the most difficult question about bond pricing, which means that the new financial literacy index is restricted to simpler knowledge levels. It is interesting that this alternative index of financial literacy is again positive and statistically significant, but the magnitude of the IV coefficient are similar to that in Table 7, whereas the OLS coefficient is smaller.

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[8] Agarwal, Driscoll, Gabaix and Laibson (2007) find that financial mistakes are concentrated among the very young and the very old; the former tends to include respondents with low financial literacy levels, and the latter may have

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Table 8 here

Panel B of Table 8 replaces our somewhat complex financial literacy index with the respondents' own self-reported assessment of their economics knowledge. Earlier we showed that these two measures were positively correlated, but self-reported measures have the advantage of being simple to gather. Because current knowledge may be influenced by the extent of how much one has planned for retirement, we again instrument respondents' self-reported financial knowledge with past training in economics. Once again, financial literacy measured in this alternative way is again positive and statistically significant. Thus those who claim they are knowledgeable about economics are more likely to plan for retirement, suggesting that financial literacy truly does affect retirement planning and the relationship does not rely on a specific measure of literacy.

Two final robustness checks split the sample by age and retirement status, in order to focus attention on younger respondents who are likely to be most actively planning ahead for retirement. Accordingly, Panel C excludes those older than 62 and Panel D excludes respondents who report themselves as fully retired. Restricting the sample to the younger age group may permit the instruments to have stronger predictive power, since economic training acquired in high school may become obsolete over time. Nevertheless, we see that the importance of financial literacy remains strong even in these alternative specifications, and the estimated magnitudes of the IV estimates remain positive and statistically significant as before. Thus we conclude that younger and non-retired respondents who are more financially knowledgeable are also more likely to plan for retirement.

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financial knowledge that has become obsolete.

Another Path to Financial Knowledge

While schooling can and apparently does train many in financial decisionmaking facts and skills, employers have also started to offer retirement seminars and financial education programs in the workplace. This movement is attributable, in part, to the spread of defined contribution retirement plans, where plan sponsors have acknowledged the need to provide financial education. Indeed, many large companies offering DC pension currently offers some form of financial education to their employees (Berhneim and Garrett 2003). Such initiatives may represent an important source of information and a way to improve financial knowledge in the future, particularly for those not exposed to economics in school.

To glean some information about this path to financial literacy, we have also included in the ALP survey a question about employer-based financial education programs. The specific wording of the question is as follows: *Did any of the firms you worked for offer financial education programs, for example retirement seminars? i)Yes, ii) No, iii) Not applicable.* Note that we explicitly ask whether the employee's firm *offered* financial education programs rather than whether a respondent ever *attended* a workplace-based financial education program, because attending such a seminar could again be an endogenous behavior. The employer's decision to offer financial education programs might also be endogenous, but such programs tend to be remedial, offered when workers save too little rather than too much (Bernheim and Garrett 2001; Bayer, Bernheim, and Scholz 1996). In such a case workers are unlikely to be retirement planners, so using this variable would tend to understate the effect of financial literacy on planning. It is also worth noting that, even when respondents do not attend firm-provided retirement seminars, they could be influenced by peer group effects (Duflo and Saez 2004).

Table 9 summarizes results when we replace economic training in school with employees' potential exposure to company-based financial education programs as the instrument for financial literacy. Our estimates show that this new variable is, in fact, a strong predictor of financial knowledge; the first stage estimates in Column 1 show that those who work or worked at a firm providing financial education are more likely to display higher levels of financial literacy. The column labeled IV shows that the improvement in financial literacy offered by employers' financial education programs does lead workers to plan more for their retirement. Interestingly, the estimated coefficient is similar in magnitude to that we obtain from the model using high school economics exposure. In sum, we can be confident that the positive, large, and statistically significant impact of financial literacy on retirement planning holds across a wide variety of samples and identification strategies. This supports conclusions reached by Bernheim, Garrett and Maki (2001) who found that those who attended high schools which offered financial education programs were also more likely to save later in life. Moreover, Bernheim and Garrett (2003) show that those who were exposed to employer-provided financial education programs were more likely to save and contribute to pensions.

Table 9 here

Conclusion and Discussion

Determining how much to save for retirement is a complex undertaking, as it requires that the consumer gather, process, and project data on compound interest, risk diversification, and inflation, as well as a myriad of data on asset market performance. Despite the fundamental importance of finding out what consumers know and how this drives their retirement planning and saving patterns, surprisingly little research has asked how real-world households gather this

information and apply it to make retirement saving decisions. These topics are of paramount importance, especially at a time when households are increasingly responsible for saving and investing not only their personal financial wealth but also their pension wealth.

Our research using the new RAND ALP survey provides results consistent with prior analysis using the HRS by Lusardi and Mitchell (2006, 2007a). Nevertheless, the earlier work used much simpler financial literacy questions, whereas the present study adds several more sophisticated measures. Further, here we create a financial literacy index and correct for possible endogeneity using some heretofore unavailable instruments. By every measure, and in every sample we have examined, we conclude that financial literacy is a key determinant of retirement planning. We also find that respondent literacy is higher when they were exposed to economics in school and to company-based financial education programs.

This research should be of interest to researchers and policymakers, as well as employers interested in enhancing workers' efforts to plan and save for retirement. First, it is critical to ask specific questions about financial knowledge as outlined here, since education, income, and age are correlated with but do not adequately capture the full flavor of the financial literacy measures developed here. Second, the fact that we find more financially literate adults are more likely to plan for retirement complements other analysts who have sought to link financial sophistication and decisionmaking. For instance, research shows that financially unsophisticated households tend to avoid the stock market (van Rooij, Lusardi and Alessie 2007; Kimball and Shumway 2006; Christelis, Jappelli and Padula 2006; Hilgert and Hogarth 2003). The financially unsophisticated are also less likely to refinance their mortgage in a propitious environment (Campbell 2006), and they select less advantageous mortgages (Moore 2003). People who cannot correctly calculate interest rates given a stream of payments borrow more and accumulate

less wealth (Stango and Zinman 2007). And now our results show that the financially illiterate do not plan for retirement either.

Obviously promoting financial literacy is a difficult and likely costly task, and more research is required to determine when and how to most efficiently build financial literacy. Nevertheless, it is clear that it is necessary to enhance financial knowledge if consumers are to do a better job navigating the financial complexities of the modern world. Indeed individuals are confronted at a very early age with the opportunity to use credit cards, take out loans, and purchase assets ranging from mutual funds to stocks and tax-favored plans such as IRAs and 401(k)s. As a result, saving for retirement is becoming more and more challenging and more important objective requiring ever-greater levels of financial sophistication. Clearly it is urgent to target effective programs to those who can put this necessary financial knowledge to work.

Table 1. Descriptive Results for Basic Financial Literacy Questions (% of respondents)

A. Percent Correct by Basic Literacy Question

	Numeracy	*Compound Interest*	*Inflation*	*Time value of money*	*Money illusion*
	92.9	75.7	91.4	77.2	80.2
Correct	5.0	19.5	4.0	15.5	18.3
Incorrect	2.0	3.0	2.5	7.1	1.4
DK	2.0	3.0	2.5	7.1	1.4

B. Percent Correct: Summary of Responses to All Basic Literacy Questions (5 questions total)

	Number of Correct, Incorrect and DK answers						
	None	One	Two	Three	Four	All Five	Mean
Correct	.6	1.5	5.2	12.7	32.8	47.3	4.2
Incorrect	55.5	31.7	8.7	3.3	.7	0	.62
DK	87.4	10.1	1.6	.9	0	0	.16

C. Percent Correct by Basic Literacy Question and Socioeconomic Characteristic

	Numeracy	*Compound Interest*	*Inflation*	*Time value of money*	*Money illusion*
Age<=50 (N=350)					
Correct	90.1	70.0	88.0	75.1	80.9
Incorrect	6.3	23.7	6.0	17.1	17.7
DK	2.6	4.0	4.0	7.7	1.4
Age > 50 (N=462)					
Correct	94.4	80.1	93.9	78.8	79.7
Incorrect	4.1	16.2	1.9	14.3	18.8
DK	1.5	2.2	1.5	6.7	1.3
Education LT college (N=389)					
Correct	89.7	67.4	88.4	71.7	76.9
Incorrect	6.7	24.4	4.9	21.1	22.1
DK	3.3	5.1	4.4	7.2	1.0
Education College+ (N=423)					
Correct	95.7	83.5	94.1	82.3	83.2
Incorrect	3.5	14.9	2.6	10.4	14.9
DK	.7	.9	.7	7.1	1.7
Male (N=363)					
Correct	95.0	84.3	93.9	82.9	78.2
Incorrect	3.3	11.3	2.8	11.3	20.1
DK	1.4	2.2	1.7	5.8	1.7
Female (N=449)					
Correct	91.1	68.8	89.3	72.6	81.7
Incorrect	6.5	26.1	4.5	18.9	16.9
DK	2.4	3.6	3.1	8.2	1.1

Note: Total number of observations: 812. Correct, Incorrect, and Do Not know (DK) may not sum to 100% due to rounding or refusals. See text for details on question wording.
Source: Authors' derivation from the RAND American Life Panel (ALP).

Table 2. Descriptive Results for Sophisticated Financial Literacy Questions[a] (% of respondents)

A. Percent Correct by Basic Literacy Question

	Correct	Incorrect	DK
Q1. Main function of the stock market	75.5	17.7	6.8
Q2. Knowledge of mutual fund.	72.4	11.3	16.3
Q3. Relation between interest rate and bond prices[b]	36.7	41.1	22.2
Q4. What is safer: company stock vs stock mutual fund[b]	80.2	3.3	16.5
Q5. Which is riskier: stocks vs bonds[b]	81.7	4.6	13.8
Q6. Highest return over long period: savings accounts, bonds or stocks	70.1	20.6	9.4
Q7. Highest fluctuations: savings accounts, bonds, stocks	88.8	3.7	7.5
Q8. Risk diversification	81.2	12.9	5.9

B. Percent Correct: Summary of Responses to Sophisticated Literacy Questions (11 questions total)

| | *Number of Correct, Incorrect and DK answers* | | | | | | | | | |
	None	One	Two	Three	Four	Five	Six	Seven	All 11	Mean
Correct	.7	2.7	3.6	6.2	8.9	13.3	17.7	25.6	21.4	5.9
Incorrect	35.6	33.0	18.4	8.1	3.5	1.5	0	0	0	1.2
DK	56.5	18.7	11.0	6.3	3.3	1.9	.6	1.2	.5	1.0

C. Percent Correct by Sophisticated Literacy Question and Socioeconomic Characteristic

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Age ≤ 50 (N=350)								
Correct	68.0	69.1	32.6	74.9	82.3	67.7	88.6	76.3
Incorrect	23.4	11.7	42.3	4.0	4.3	22.9	3.4	17.7
DK	8.6	19.1	25.1	21.1	13.4	9.4	8.0	6.0
Age > 50 (N=462)								
Correct	81.2	74.9	39.8	84.2	81.2	71.9	89.0	84.8
Incorrect	13.4	11.0	40.3	2.8	4.8	18.8	3.9	9.3
DK	5.4	14.1	19.9	13.0	14.1	9.3	7.1	5.8
Education LT college (N=389)								
Correct	65.0	62.7	25.2	71.2	75.3	58.9	84.1	73.0
Incorrect	23.4	13.6	48.6	3.6	4.1	29.3	4.4	18.3
DK	11.6	23.7	25.2	25.2	20.6	11.8	11.6	8.7
Education College + (N=423)								
Correct	85.1	81.3	46.3	88.4	87.5	80.4	93.1	88.7
Incorrect	12.5	9.2	34.3	3.1	5.0	12.5	3.1	8.0
DK	2.4	9.5	19.4	8.5	7.6	7.1	3.8	3.3
Male (N=363)								
Correct	84.3	81.3	47.1	86.2	84.8	83.2	90.4	88.7
Incorrect	12.4	9.6	39.9	3.6	5.2	11.8	4.4	7.4
DK	3.3	9.1	12.9	10.2	9.9	5.0	5.2	3.9
Female (N=414)								
Correct	68.4	65.3	28.3	75.3	79.1	59.5	87.5	75.1
Incorrect	22.0	12.7	42.1	3.1	4.0	27.6	3.1	17.4
DK	9.6	22.0	29.6	21.6	16.9	12.9	9.4	7.6

Notes: a) For exact wording of questions, see text. Correct, Incorrect and Do not know (DK) responses may not sum to 100% because of refusals. Percentages of total number of respondents provided (N=812) b) This question was phrased two different ways; see text.

Table 3. Percent Correct for Specific Sophisticated Literacy Questions: Impact of Reverse Wording

Q5	Correct	Incorrect	DK
Stocks are normally riskier than *bonds*. True or false? (N=403)	82.1	6.5	11.4
Bonds are normally riskier than *stocks*. True or false? (N=409)	81.2	2.7	16.1
Pearson chi2(2) =9.61 (p =0.008)			
Q4			
Buying a *company stock* usually provides a safer return than a *stock mutual fund*. True or false? (N=409)	77.0	5.6	17.4
Buying a *stock mutual fund* usually provides a safer return than a *company stock*. True or false? (N=403)	83.4	1.0	15.6
Pearson chi2(2) = 14.48 (p = 0.001)			
Q3			
If the interest rate *falls*, what should happen to bond prices: rise/fall/stay the same/none of the above? (N=404)	34.9	44.6	20.5
If the interest rate *rises*, what should happen to bond prices: rise/fall/stay the same/none of the above? (N=408)	38.5	37.7	23.8
Pearson chi2(2) = 3.95 (p =0.14)			

Note: See Tables 1 and 2.

Table 4. Financial Literacy Index Compared to Self-assessed Financial Literacy
(row percentages shown)

	Literacy Index Quartiles (%)				
Self-assessed literacy	*1 (Low)*	*2*	*3*	*4 (Top)*	*N*
1 (very low)	66.7	16.7	8.3	8.3	12
2	47.5	32.5	10.0	10.0	40
3	33.3	31.1	21.1	14.4	90
4	34.4	29.3	18.1	18.1	215
5	16.4	25.3	23.1	35.2	281
6	13.1	16.1	27.7	43.1	137
7 (very high)	16.7	16.7	16.7	50.0	36

Note: See Tables 1 and 2.

Table 5. Patterns of Retirement Planning By Socioeconomic Characteristics (%)

		Age		Education		Sex	
	Full sample	*≤50*	*>50*	*LT college*	*≥College*	*Male*	*Female*
How much have you thought about retirement?							
A lot	37.8	25.7	47.0	36.5	39.0	39.4	36.5
Some	44.7	49.1	41.3	39.3	49.6	46.3	43.4
A little	12.6	19.1	7.6	17.5	8.0	10.5	14.3
Hardly at all	4.8	6.0	3.9	6.4	3.3	3.8	5.6

Note: See Tables 1 and 2.

Table 6. Multivariate Analysis of Retirement Planning

	OLS	IV
Literacy index	0.117	0.915
	[0.035]***	[0.329]***
Age	0.014	-0.001
	[0.003]***	[0.007]
Male	-0.027	-0.351
	[0.056]	[0.152]**
Married	0.036	0.044
	[0.065]	[0.088]
Working	-0.195	-0.27
	[0.063]***	[0.084]***
Some college	0.166	-0.108
	[0.103]	[0.194]
Associate degree	0.299	-0.228
	[0.114]***	[0.270]
College degree	0.153	-0.486
	[0.102]	[0.307]
Masters degree	0.222	-0.429
	[0.111]**	[0.318]
Doctorate degree	0.246	-0.354
	[0.130]*	[0.327]
Income $50,000-74,999	0.251	0.028
	[0.077]***	[0.138]
Income $75,000-99,999	0.295	0.045
	[0.086]***	[0.156]
Income $100,000-149,999	0.342	-0.026
	[0.085]***	[0.194]
Income ≥$150,000	0.322	-0.23
	[0.110]***	[0.263]
Constant	2.186	3.804
	[0.188]***	[0.698]***
Number of Observations	811	811
R-squared	0.16	
Hansen J test p-value		0.394
F-statistic first stage regression		3.600
p-value F-statistics		0.000
p-value exogeneity test		0.004

Notes: This table reports OLS and IV estimates of the effect of literacy on the probability of having done at least some retirement planning. The vector of instrumental variables includes indicators for having had economics education, age*economics education, and male*economics education. Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. A control for missing income is also included.

Table 7. First stage regressions

A lot of econ education	0.767
	[0.189]***
Some econ education	0.094
	[0.126]
Little econ education	0.014
	[0.125]
A lot of econ education * age $\geq$55	-0.33
	[0.139]**
Some econ education * age $\geq$55	0.02
	[0.127]
Little econ education * age $\geq$55	0.079
	[0.118]
A lot of econ education * male	-0.247
	[0.226]
Some econ education * male	0.1
	[0.188]
Little econ education * male	0.216
	[0.183]
Age	0.017
	[0.004]***
Male	0.258
	[0.155]*
Married	-0.019
	[0.074]
Working	0.09
	[0.070]
Some college	0.326
	[0.121]***
Associate degree	0.658
	[0.133]***
College degree	0.776
	[0.115]***
Masters degree	0.792
	[0.124]***
Doctorate degree	0.722
	[0.149]***
Income $50,000- 74,999	0.281
	[0.090]***
Income $75,000-99,999	0.336
	[0.107]***
Income $100,000-149,999	0.457
	[0.106]***
Income $\geq$$150,000	0.683
	[0.102]***
Constant	-2.02
	[0.250]***
Observations	811
R-squared	0.3
F-statistic instruments	3.6
p-value instruments	0.00

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1 A control for missing income is also included.

Table 8. Robustness Checks: Alternative Models and Samples

A. Excluding Randomized Questions

	OLS	IV
Literacy index without randomized questions	0.076	0.829
	[0.034]**	[0.322]**
Observations	811	811
R-squared	.15	
Hansen J test p-value		0.250
F-statistic first stage regression		3.560
p-value exogeneity test		0.010

B. Using Self-reported Financial Literacy

	OLS	IV
Self-reported economics understanding	0.096	0.164
	[0.027]***	[0.058]***
Observations	811	811
R-squared	0.17	
Hansen J test p-value		0.009
F-statistic first stage regression		20.18
p-value exogeneity test		0.308

C. Restricting the Sample to < Age 62

	OLS	IV
Literacy index	0.119	0.735
	[0.038]***	[0.320]**
Observations	633	633
R-squared	0.15	
Hansen J test p-value		0.717
F-statistic first stage regression		3.300
p-value exogeneity test		0.022

D. Sample Excluding the Completely Retired

	OLS	IV 1
Literacy index (sample restricted to exclude the completely retired	0.110	0.761
	[0.037]***	[0.310]**
Observations	658	658
R-squared	0.13	
Hansen J test p-value		0.285
F-statistic first stage regression		3.410
p-value exogeneity test		0.016

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The vector of instrumental variables includes indicators for having had economics education, age*economics education, and male*economics education All equations include the vector of socioeconomic variables listed in Table 7.

Table 9. Multivariate Analysis of Retirement Planning: Including Firm-Provided Financial Education

	First stage	IV
Firm offers financial education	0.227	
	[0.061]***	
Literacy index		0.799
		[0.305]***
Age	0.014	0.001
	[0.003]***	[0.007]
Male	-0.027	-0.304
	[0.056]	[0.143]**
Married	0.036	0.043
	[0.065]	[0.082]
Working	-0.195	-0.259
	[0.063]***	[0.080]***
Some college	0.166	-0.068
	[0.103]	[0.171]
Associate degree	0.299	-0.152
	[0.114]***	[0.252]
College degree	0.153	-0.394
	[0.102]	[0.279]
Masters degree	0.222	-0.335
	[0.111]**	[0.289]
Doctorate degree	0.246	-0.267
	[0.130]*	[0.290]
Income $50,000-74,999	0.251	0.061
	[0.077]***	[0.134]
Income $75,000-99,999	0.295	0.081
	[0.086]***	[0.150]
Income $100,000-149,999	0.342	0.028
	[0.085]***	[0.190]
Income ≥$150,000	0.322	-0.15
	[0.110]***	[0.249]
Constant	2.186	3.569
	[0.188]***	[0.663]***
Observations	811	811
R-squared	0.16	
F-statistic first stage regression		13.70
p-value exogeneity test		0.004

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; This table reports OLS estimates of the effect of firm-based financial education on financial literacy, and a second-stage IV estimate of the effect of financial literacy on retirement planning. A control for missing income is also included.

Appendix Table 1. Socioeconomic Characteristics of the American Life Panel: Descriptive Statistics

Variable	Mean	St. Dev.
Age	52.6	12.3
Male	.447	.497
Marital status		
Married	.644	.479
Separated	.016	.126
Divorced	.147	.354
Widowed	.058	.234
Single	.135	.342
Highest Education Completed		
1-12th grade no diploma (coded as 11 years)	.022	.147
High school graduate (12)	.124	.330
Some college but no degree (14)	.236	.425
Assoc/Occ/Voc (15)	.096	.295
Bachelors degree (16)	.276	.447
Masters degree (17)	.177	.382
Doctorate degree (20)	.068	.251
Total combined income		
< $25,000	.123	.329
$25,000-50,000	.230	.421
$50,000-75,000	.220	.415
$75,000-100,000	.129	.336
$100,000-150,000	.181	.385
> $150,000	.101	.301
Refused	.015	.121
Labor Force Status		
Working	.635	.482
Unemployed	.026	.159
Temporarily laid off, on leave	.007	.086
Disabled	.046	.209
Retired	.211	.408
Homemaker	.044	.206
Other	.031	.173
Retirement Status		
Completely retired	.190	.392
Partly retired	.100	.300
Not retired	.661	.474
Not applicable (homemaker, stop working < age 50 etc)	.049	.217

Note: Number of observations: 812.

Source: Authors' derivation from the RAND American Life Panel (ALP); see text.

Appendix Table 2: Constructing the Financial Literacy Index: Factor Loadings

The index for literacy is based on the 13 financial literacy questions discussed in the text. For each question we construct a dummy variable indicating which respondents answered the question correctly. We then perform factor analysis on those binary variables using the principal component factor method; factor loadings are presented below. We retain one factor which summarizes respondent financial literacy using factor scores derived with the Bartlett (1937) method.

Factor loadings corresponding to the five basic literacy questions

Financial Literacy Questions	Factor loadings
Numeracy	.3935
Compound Interest	.4899
Inflation	.4591
Time value of money	.4894
Money illusion	.2087
Main function of stock market	.5266
Function of mutual fund	.6581
Relation between Interest rate/bond prices	.4432
Which safer: Company stock vs stock mutual fund	.6049
Riskier: Stocks vs bonds	.3891
Higher return Long Run: Stocks or bonds	.5723
Highest fluctuations over time	.6391
Risk diversification	.4944

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