



University of Pennsylvania
ScholarlyCommons

Wharton Pension Research Council Working
Papers

Wharton Pension Research Council

6-1-2016

Employee Financial Literacy and Retirement Plan Behavior: A Case Study

Robert Clark

North Carolina State University

Olivia S. Mitchell

The Wharton School, University of Pennsylvania

Annamaria Lusardi

The George Washington University School of Business

Follow this and additional works at: https://repository.upenn.edu/prc_papers

 Part of the [Behavioral Economics Commons](#)

Clark, Robert; Mitchell, Olivia S.; and Lusardi, Annamaria, "Employee Financial Literacy and Retirement Plan Behavior: A Case Study" (2016). *Wharton Pension Research Council Working Papers*. 44.

https://repository.upenn.edu/prc_papers/44

This paper is posted at ScholarlyCommons. https://repository.upenn.edu/prc_papers/44

For more information, please contact repository@pobox.upenn.edu.

Employee Financial Literacy and Retirement Plan Behavior: A Case Study

Abstract

This paper uses administrative data on all active employees of the Federal Reserve System to examine participation in and contributions to the Thrift Saving Plan, the System's defined contribution (DC) plan. We link to administrative records a unique employee survey of economic/demographic factors including a set of financial literacy questions. Not surprisingly, Federal Reserve employees are substantially more financially literate than the population at large. Most importantly, financially savvy employees are also most likely to participate in their DC plan. Sophisticated workers contribute three percentage points more of their earnings to the DC plan than do the less knowledgeable, and they hold more equity in their pension accounts. We examine changes in employee plan behavior one year after employees completed a Learning Module about retirement planning, and we compare it to baseline patterns. We find that those employees who completed the Learning Module were more likely to start contributing and less likely to have stopped contributing to the DC plan post-survey. In sum, employer-provided learning programs are shown to significantly impact employee retirement saving decisions and consistent with a lot of other research, higher levels of financial literacy is found to have a beneficial impact on retirement saving patterns.

Disciplines

Behavioral Economics

Employee Financial Literacy and Retirement Plan Behavior: A Case Study

Robert Clark, Annamaria Lusardi, and Olivia S. Mitchell

June 2016

PRC WP2016

Pension Research Council Working Paper

Pension Research Council

The Wharton School, University of Pennsylvania

3620 Locust Walk, 3000 SH-DH

Philadelphia, PA 19104-6302

Tel.: 215.898.7620 Fax: 215.573.3418

Email: prc@wharton.upenn.edu

<http://www.pensionresearchcouncil.org>

Research support for the work reported herein was provided by the Pension Research Council/Boettner Center at the Wharton School of the University of Pennsylvania as well as the Office of Employee Benefits at the Federal Reserve System that provided the data for the study. We are grateful for excellent programming assistance from Yong Yu, and for helpful suggestions and guidance from the staff of the Federal Reserve's Office of Employee Benefits and Ryan Peters. We are also grateful to the editor and two anonymous referees. Opinions and conclusions expressed herein are solely those of the authors and do not represent the opinions or policy of the funders or any other institutions with which the authors are affiliated. ©2016 Clark, Lusardi, and Mitchell. All rights reserved.

Employee Financial Literacy and Retirement Plan Behavior: A Case Study

Abstract

This paper uses administrative data on all active employees of the Federal Reserve System to examine participation in and contributions to the Thrift Saving Plan, the System's defined contribution (DC) plan. We link to administrative records a unique employee survey of economic/demographic factors including a set of financial literacy questions. Not surprisingly, Federal Reserve employees are substantially more financially literate than the population at large. Most importantly, financially savvy employees are also most likely to participate in their DC plan. Sophisticated workers contribute three percentage points more of their earnings to the DC plan than do the less knowledgeable, and they hold more equity in their pension accounts. We examine changes in employee plan behavior one year after employees completed a Learning Module about retirement planning, and we compare it to baseline patterns. We find that those employees who completed the Learning Module were more likely to start contributing and less likely to have stopped contributing to the DC plan post-survey. In sum, employer-provided learning programs are shown to significantly impact employee retirement saving decisions and consistent with a lot of other research, higher levels of financial literacy is found to have a beneficial impact on retirement saving patterns.

Robert Clark

Poole College of Management, Box 7229
NC State University
Raleigh, NC 27696
e-mail: robert_clark@ncsu.edu

Olivia S. Mitchell

Wharton School, University of Pennsylvania
3620 Locust Walk, 3000 SH-DH
Philadelphia, PA 19104
e-mail: mitchelo@wharton.upenn.edu

Annamaria Lusardi

The George Washington University School
of Business
2201 G Street, Suite 450E, Duquès Hall
Washington, DC 20052
e-mail: alusardi@gwu.edu

Employee Financial Literacy and Retirement Plan Behavior: A Case Study

Employers offer pension plans in the workplace to attract, retain, motivate, and ultimately retire their employees. Nevertheless, many workers are quite uninformed about financial matters, both in the United States and around the world (Lusardi and Mitchell, 2014). Unless employees understand their plans and the incentives imbedded in them, they are unlikely to value them, save, invest, and manage their retirement portfolios appropriately. For this reason, employers have an interest in providing financial education to help workers better understand and make better decisions about their retirement savings.

Previous evidence has shown that workplace-based financial education programs can be beneficial. For instance Allen et al. (2016) assessed employer-provided retirement seminars and showed that these seminars boosted financial literacy and influenced people's ability to plan for retirement.¹ In our previous research (Clark, Lusardi and Mitchell, 2016; Lusardi, Michaud and Mitchell, 2016 forthcoming), we examined whether financial literacy is linked to investment returns and we found that more financially literate employees are better investors. Moreover the higher returns earned by the more financially savvy are an important contributor to household wealth inequality.

Nevertheless, few studies to date have focused on how employer-provided learning modules can shape pension plan participation, contributions, and investment patterns. Below, we use a unique dataset on employees of the US Federal Reserve (FR) System provided by the

¹Other studies on workplace financial education programs include Bernheim and Garrett (2003); Bayer, Bernheim, and Sholz (2009); Clark, d'Ambrosio, McDermed, and Sawant (2006); and Clark, Morrill, and Allen (2012a, b; 2014). Clark and Lusardi (2012) examine the business case for such programs and present best practices used in employer-provided programs. For recent reviews, see Lusardi and Mitchell (2007, 2014, 2015).

Office of Employee Benefits of the Federal Reserve System (OEB). These data were collected in connection with an on-line employer-provided educational module (hereafter, the Learning Module), which included a survey inquiring about FR employees' financial literacy. The linked data allow us to study the saving and investment patterns of the more- versus less-financially literate segments of employees who were offered the opportunity to save in a defined contribution (DC) plan. Specifically, we combine administrative records with a survey evaluating workers' financial knowledge. With these data, we can examine whether financial literacy is associated with higher participation and contribution rates in the employer plan. We also evaluate, for those who participate in the program, whether financial literacy influences saving responses after exposure to a learning module.

As one might expect, we find that FR employees perform better on the financial literacy survey compared to average Americans, and they also save at substantially higher rates. As in other studies, marital status, salary, tenure, and financial literacy are all associated with greater plan participation, and DC contribution levels are influenced by workers' age, salary, and financial literacy. We also find that more financially knowledgeable employees are much more likely to participate in their retirement saving plan, contribute a higher percentage of their salaries, and hold more equity in their DC retirement accounts. While this correlation is not definitively causal, we present some results suggesting that the relationships are real and not merely associations.

An important contribution of this research is that we show that participation in the Learning Module had large and significant effects on the retirement saving decisions of FR employees. Of those not participating in the retirement savings plan at baseline, employees who took the Learning Module had a 4.6 probability of starting to contribute post-Module, or 40

percent higher than their counterparts. Of those who stopped participation, those who took the Module had a 3.8 percentage point change of stopping contributions, or half that of their counterparts. We also find that those who took the Module contributed 1.0 percent more of their salaries post-Module, for an improvement of 12 percent, and they boosted their equity share by 3.7 percentage points (compared to a baseline of 57.2 percent, or a 6.5 percent change). When we attenuate potential sample selection issues using inverse propensity weighting, the increases in contributions and equity shares are even larger. Those taking the Module contributed 11 percent of their salaries, more than doubling their pre-Module rates, and increased their equity share by 6.3 percentage points, for an 11 percent change. To summarize, the employer did have a positive impact on participation, contributions, and allocation to riskier assets as a result of implementing the Learning Module.

Data and Methods

For this case study of FR employees, we focus on three measures of pension plan behavior: participation in the DC plan, the percent of salary contributed by those making contributions, and portfolio allocations by plan participants. All FR employees are covered by a relatively generous defined benefit (DB) plan and Social Security. In addition, the FR System offers its employees the opportunity to participate in a DC plan. The investment menu includes stock and bond index funds, lifestyle funds (conservative, moderate, aggressive), international and emerging market funds, and a real estate fund. Approximately 84 percent of the employees studied contributed to the DC plan.²

Anonymized pension plan data were drawn from administrative records for over 21,000 FR employees across the U.S., as of September 2013. The items provided included each

² See also Clark, Lusardi and Mitchell (2014, 2016).

employee's contribution rates and investment allocations, as well as other items including sex, age, marital status, job tenure, salary, and DC plan balance. In October 2013, we also fielded an internet survey on financial knowledge, enabling us to link survey responses to the administrative data. Subsequently the employer released to its workforce a Learning Module on the DC plan benefit offerings.³ The goal for this Learning Module was to help workers assess their retirement spending needs; learn how Social Security and personal savings as well as the employer's retirement offerings interacted; and evaluate their DC plan savings. Below, we use the merged dataset to estimate empirical relationships between financial literacy, DC pension contributions, and investment allocations. We were granted access to similar administrative records in 2014, which allowed us to measure changes in retirement plan participation and contribution rates for those who participated in the Learning Module compared to those who did not. Thus, a distinguishing feature of this paper is our ability to use administrative records to track actual behavioral changes before and after participation in the Learning Module, conditioned on financial literacy levels for those taking the survey. We were not able to randomize who was exposed to the Learning Module, yet our empirical work seeks to address potential selection issues to the extent possible.

Measuring Financial Literacy

With our input, the OEB designed and fielded an online survey on employee financial knowledge levels as part of a Learning Module provided to all employees via the FR's internal email system. In this section, we discuss the questions we have used to measure financial literacy while in the following section, we describe the employer's educational module. Of

³ For additional detail on implementation see Clark, Lusardi, and Mitchell (2014).

approximately 21,000 active workers, 16 percent responded to the invitation to take the survey. This response rate is similar to those in other voluntary and non-incentivized internet surveys.⁴

To compare the respondent sample with non-respondents, we draw on information provided in the administrative data. The first column of Table 1 presents summary statistics from the administrative data for all employees. Over two-thirds of all employees contributed to the pretax plan alone, and eight percent participated only in the Roth (after tax) plan. Interestingly, about nine percent contributed to both types of plans.

[Table 1 here]

Columns 2 and 3 report means for individuals who did versus did not complete the Learning Module. Module respondents contributed 2 percentage points more of their salaries to the DC plan.⁵ They also had significantly larger plan balances, held 2.4 percentage points more equity, were about four years older, and had worked for the institution about three years longer than non-respondents. Accordingly, it appears that the employees who participated in the Learning Module were likely to be more financially sophisticated than those who did not, a point to which we return below.

Financial Literacy Questions. We measured respondent financial knowledge using questions that have been tested in many other surveys (correct answers are provided in bold):

- **Interest Rate:** Suppose you had \$100 in a savings account and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow? **More than \$110**, *Exactly \$110*, *Less than \$110*, *DK*, *RF*⁶

⁴ This response rate is in line with what is found in many other online, non-mandatory, and non-incentivized surveys (c.f., Clark, Maki, and Morrill (2014); Constant Contact <http://support2.constantcontact.com/articles/FAQ/2344>; Benchmark <http://www.benchmarkemail.com/help-FAQ/answer/what-is-a-typical-survey-response-rate>; Surveygizmo, <http://www.surveygizmo.com/survey-blog/survey-response-rates/>).

⁵ Allen et al. (2016) also find that participation in retirement seminars significantly increased the financial literacy and knowledge of retirement plans of older workers and that this greater knowledge affected retirement planning.

⁶ DK refers to “Do not know” and RF to “refuse to answer.”

- **Inflation:** Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, how much would you be able to buy with the money in this account? *More than today, Exactly the same, Less than today, DK, RF*
- **Risk:** Is this statement True or False? Buying a single company's stock usually provides a safer return than a stock mutual fund. *True, False, DK, RF*
- **Tax Offset:** Assume you were in the 25-percent tax bracket (you pay \$0.25 in tax for each dollar earned) and you contributed \$100 pretax to an employer's 401(k) plan. Your take-home pay (what's in your paycheck after all taxes and other payments are taken out) will then: *Decline by \$100, Decline by \$75, Decline by \$50, Remain the same, DK, RF*
- **Match:** Assume that an employer matched employee contributions dollar for dollar. If the employee contributed \$100 to the 401(k) plan, his account balance in the plan including his contribution would: *Increase by \$50, Increase by \$100, Increase by \$200, Remain the same, DK, RF*

The first question measures people's ability to do a simple interest rate calculation; the second tests people's understanding of inflation; and the third is a joint test of knowledge about "stocks" and "stock mutual funds" as well as knowledge of risk diversification, since the correct response requires the respondent to know both what a stock is and that a mutual fund is comprised of many stocks. The first three questions were developed by Lusardi and Mitchell (2008; 2011a) and used in the Health and Retirement Study and many other US national surveys including the National Longitudinal Survey of Youth (Lusardi, Mitchell and Curto, 2010), the American Life Panel (Lusardi and Mitchell, 2009), and the US National Financial Capability Study (Lusardi, 2011; Lusardi and Mitchell, 2011b). They have also been fielded in fourteen other countries.⁷

Previous research has demonstrated that very few Americans can answer all of the first three questions correctly (with similar results in other countries). Not many more know the correct answers to two of the three questions (Lusardi and Mitchell, 2014). By contrast, the FR workforce is substantially more financially knowledgeable (as measured by the first three queries) than the general population, an unsurprising result given that the workforce consists of financial sector employees. Specifically, 75 percent of the respondents answered the Interest

⁷ For the list of countries, see <http://gflec.org/initiatives/flat-world/>. See also the discussion in Lusardi and Mitchell (2011c).

Rate question, 91 percent the Inflation question, and 85 percent the Risk question correctly. This can be compared to substantially lower correct response rates in other surveys. For example, Americans in the 2012 National Financial Capability Study (NFCS) averaged 75, 61, and 48 percent correct on the interest, inflation, and risk diversification questions.⁸

The last pair of financial knowledge questions, developed by Clark, Maki, and Morrill (2014), proved more difficult, even for this relatively-sophisticated employee group. These queries required respondents to understand how employer and employee contributions influence pension accumulations, taking into account the tax implications of worker pre-tax contributions. In the Tax Offset question, the employee needed to understand that the tax-deferred aspect of own contributions reduces the net cost of payments into the plan. Here, only 43 percent of respondents answered correctly. The Match question required the employee to know that a dollar-for-dollar match means that \$100 of own contributions would generate an equal employer contribution. This last question was easier to answer, and 76 percent of FR employees scored correctly.

As is conventional, we sum the correct answers to these questions to produce a *Financial Knowledge Index* for each employee respondent. This Index ranges from 0 to 5, with a mean of 3.7 and a standard deviation of 1.2.⁹ One-third of the FR respondents answered all five questions correctly, and just under two percent (46 respondents) cannot answer any question correctly. The proportion answering each question correctly is shown in Table 2 along with the average number of correct answers.

[Table 2 here]

⁸ The NFCS is also an online survey; see

http://www.usfinancialcapability.org/downloads/NFCS_2012_Report_Natl_Findings.pdf

⁹ Inasmuch as respondents to the Learning Module are more likely to be financially knowledgeable than non-respondents, it is safe to infer that the average level of financial literacy for the entire FR labor force is lower than the respondent average.

Financial Literacy Heterogeneity by Employee Characteristics. Prior research has shown that the level of financial literacy is associated with a higher probability of planning for retirement, participating in retirement saving plans, and contributing to these plans. Yet little attention has been devoted to how financial literacy varies by employee characteristics and how this variation might influence econometric results. Table 3 illustrates the distribution of financial literacy as measured by our literacy index across economic and demographic variables. Interestingly, we find little difference in financial literacy across age groups, as the mean of the literacy index is 3.8 for those younger than age 60, and it only rises to 3.9 for those age 60 and over. Similarly, measures of literacy differ only modestly by years of tenure. Factors associated with larger differences include sex, marital status, and annual salary. Three-quarters of the male FR employees correctly answered 4 or 5 of the literacy questions correctly, compared to only 56 percent of the females. Some 70 percent of married employees scored 4 or 5 correct answers, but only 60 percent of non-married individuals met this standard. By far, the largest differences are observed across levels of salary. Only a little over one-third of workers earning under \$50,000 per year scored 4 or 5 right answers, and the mean number of correct answers was 2.9 out of five. By comparison, 96 percent of those with incomes over \$250,000 correctly answered 4 or 5 questions with an average of 4.7 correct answers. This may be due to higher salary individuals being economists, but the findings related to sex, marital status, and income are overall similar to what is reported in many other papers (see Lusardi and Mitchell, 2014, for a review).

[Table 3 here]

The Learning Module

Our financial knowledge online survey was paired with a Learning Module developed by OEB entitled “Your Retirement Plan.” The Module was available as a video which was introduced by a high-ranking member of the Federal Reserve Bank who chaired the Committee on Employee Benefits. It was sent to all employees as a video file via the company intranet, so employees could view it at times convenient to them. Employees were told that the video “shouldn’t take more than 30 minutes to complete.”

The video began with a discussion of income needs in retirement and noted that many analysts suggest that retirees should save enough to replace about 80 percent of their final earnings. The first section of the Learning Module discussed the importance of preparing for retirement and the likely differences in consumption needs before and after retirement. The video then went on to discuss the key components of retirement income including Social Security, the FR DB plan, the FR thrift saving plan, and personal savings. Next the video described the DB pension plan, including how retirement benefits were calculated as a function of salary and service, along with providing information on how the DB plan protected retirees from inflation, investment, and longevity risk. Slightly different presentations were provided to employees closer to retirement versus those with a longer planning horizon. The video also discussed how to think about whether the employee needed to undertake additional retirement savings. Finally, it described distribution options and how these could be used to enhance retirement income streams.¹⁰ Overall, the OEB’s goal in delivering the Learning Module was to boost employee awareness of the need for retirement savings, so as to help its workforce build better retirement incomes.

¹⁰ As with all videos and webinars, one cannot be certain whether the individual watch some or all of the program or whether all individuals completing the financial literacy quiz also viewed the entire Module.

Baseline Analysis

To explore how financial literacy is linked to DC plan outcomes, we first use multivariate analysis to examine plan contributions, percentage of salary saved in the DC plan, and equity allocation – all behaviors measured prior to the Learning Module. The next section examines changes post-intervention.

Table 4 reports the results of three regression models where the dependent variable is equal to one if the employee contributed to the DC contribution plan (0 otherwise) in April 2013, prior to the Module. The first two columns report results using all current employees, whereas the third column uses only those individuals who completed the Learning Module. These regressions allow us to explore the determinants of participation and contribution to the DC plan, taking many factors simultaneously into account.

[Table 4 here]

Results in Column 1 show that 84 percent of the FR employees contributed to their plan, with some differences by worker characteristics: men were 2.0 percentage points less likely to contribute to a plan compared to women, and each year of job tenure decreased the probability of contributing to a plan by 0.8 percentage points. Consistent with our prior research, we also find that those with higher earnings and married individuals were more likely to participate in the DC plan (Clark, Maki and Morrill, 2014).¹¹ Column 2 presents estimated coefficients from a model which adds an indicator variable taking the value of one for employees who participated in the subsequent Learning Module (0 otherwise). Inclusion of this variable in the model has no significant impact on the other estimated coefficients, but it does show that participants in the Module were 6.3 percentage points more likely to contribute to the DC plan. Evidently those

¹¹ The dataset does not include measures of employees' defined benefit (DB) pension wealth, but since the DB benefit formula depends on salary and years of service, our analysis controls on employee age, salary, and tenure, to proxy for DB pension wealth.

who elected to take the survey and participate in the educational module differed from their counterparts.

Column 3 reports results when we narrow the sample to only those employees who completed the Learning Module. In addition to the variables included in Column 1, two variables reflecting respondents' financial literacy levels are now included. One is an indicator for high financial knowledge (i.e., anyone who got 4-5 questions correct) versus medium (2-3 questions correct) versus the reference category (0-1 question correct). Our estimates indicate that the more financially knowledgeable employees were much more likely to contribute to the DC plan, and the estimated coefficients are strongly positive and statistically significant. The magnitudes imply that a worker scoring 4-5 correct answers was 13.4 percentage points more likely to be contributing, while someone scoring 2-3 answers correct had a 6.8 percentage point higher probability of contributing, compared to the least financially-savvy employee who had at most one correct answer.¹² We are aware these estimates do not necessarily establish a causal link between financial literacy and contributions to a retirement plan. For example, unobservable factors such as patience could be driving this finding. Nevertheless, our other work has explored the casual links between financial literacy and retirement planning, and we showed that OLS estimates (such as those reported here) tend to underestimate the true effect of financial literacy on retirement planning (Lusardi and Mitchell, 2014). Moreover, in the next section we provide some robustness analysis on this point.

¹² Simon, Warner, and Pleeter (2015) extend the analysis of the choice of retirement plan distributions by incorporating cognition, financial literacy, and personal discount rates in those decisions. They conclude their analysis by stating that "More work is needed to examine the link between cognition, financial literacy, and investment choices. Hopefully, too, subsequent surveys will contain questions to elicit information about financial literacy." Our survey of FR employees provides new evidence on financial literacy and how it influences retirement saving decisions.

Next, we examine plan contribution rates expressed as a percentage of employees' salary. Across all plan participants, the contribution rate as a percent of salary averaged 8.7 percent (see Table 5). Columns 1 and 2 again focus on all employees, while Column 3 limits the sample to survey participants only. The first two columns indicate that each additional 10 years of age was associated with 1.2 percentage points more pay being contributed to the DC plan. The more highly-paid also contributed a larger share of their pay, and this effect was statistically significant. Including a control for who took the Learning Module in Column 2 indicates those who answered the survey contributed around one percentage point more of their pay, for an improvement of 12 percent compared to their non-respondent counterparts (other coefficients are unaffected by including this additional variable). Finally, in the subsample of survey respondents, we see that being more financially literate is associated with higher contribution rates: that is, people who correctly answered 4-5 of the financial questions contributed 2.6 percentage points more of their pay, and those who answered 2-3 questions correctly contributed 1.4 percentage points more, compared to employees with 0-1 correct answers.

[Table 5 here]

It is also of interest to evaluate whether financially knowledgeable DC plan participants invested differently from their counterparts. To examine how employees invest in addition to whether they contribute and how much, we have classified each fund in the DC plan menu according to its equity share, after which we compute each person's stock exposure as a function of his allocation to each of the various funds. Table 6 shows, for the full sample, that men held more of their retirement savings in equities, and an additional \$10,000 in annual earnings increased the equity share by 1.4 percentage points. Not surprisingly, older workers favored less risky portfolios: an additional 10 years of age was associated with 5.7 percentage points less in

risky investments. Learning Module respondents held 3.7 percentage points more of their assets in equities, and given the mean baseline of 57.2 percent, this is a 6.5 percent higher equity share. In the final column of Table 6, we report estimates for the subset of respondents to the Learning Module. Coefficient estimates here are very similar to those for the full sample. Additionally, we learn that an employee measured to be highly financially knowledgeable had 14.6 percentage points more of his retirement assets in equities compared to the least savvy.¹³ Even those with intermediate knowledge held more in stocks than those who were less financially knowledgeable.

[Table 6 here]

This analysis of plan contributions and holdings provides key insights about the heterogeneity of employee behavior, which we summarize as follows. First, a relatively large share of FR employees participated in the DC plan, and those who did contributed an average of almost 9 percent of their pay. Married employees were more likely to participate and older employees were more likely to contribute, while men participated and contributed less than women. Overall, this employee group held about 57 percent of its retirement assets in equities, with older workers holding slightly less, and men, married, and particularly the higher-paid workers taking riskier positions.

Second, employees who responded to the Learning Module were 6 percentage points more likely than non-respondents to participate in the plan. Also they contributed 1.0 percentage point more of their pay and held somewhat more equity (4 percentage points). The fact that the Learning Module respondents differed somewhat from the non-respondent workers suggests

¹³ A more detailed analysis of how financial literacy influences the investment behavior and portfolio allocation of FR employees is available in Clark, Lusardi, and Mitchell (2016). This analysis shows that individuals with higher levels for financial literacy tend to have less idiosyncratic risk and earn higher expected risk-adjusted returns.

some degree of self-selection, about which we say more below. And finally, people scoring high on the financial knowledge survey were even more likely to participate in the plan, contribute even more of their salaries, and hold even more equity in their retirement accounts.

Behavioral Changes Post Learning Module

Several recent studies have examined how financial literacy influences retirement savings, and our results from the FR case study are consistent. Nevertheless, we can also move beyond simply correlating how financial literacy is associated with plan behaviors by estimating the impact of the Learning Module on retirement plan behavior. Specifically, we evaluate whether there were significant *changes* in retirement saving patterns after the module was fielded, by drawing on additional administrative data on participation, contributions, and investment allocations gathered one year after the initial information examined above.

Our pre/post sample includes 20,867 individuals for whom we have retirement saving data for the pre-survey wave in 2013 as well as six months after the completion of the Learning Module in 2014. To determine the impact of participating in the Module, we examine factors associated with the probability that a participant contributed to the DC plan at baseline and then stopped contributing one year later. Results appear in Table 7, where the first column in each case shows results controlling only on the Learning Module dummy, and the second includes other controls.

Prior to the fielding of the Module, 17,538 FR employees contributed to the DC plan while 3,329 did not (in 2013). A year later, 7.1 percent of plan participants stopped contributing and 11.6 started contributing. Taking the Learning Module deterred plan dropouts, with a 3.7 percentage point reduced plan dropout rate (Column 1) compared to those who did not take the

Module. In Column 2, we see that the learning Module dummy is not altered when we control for other socio-demographics. Married employees and the more highly-paid were less likely, while those with more tenure and older were more likely to stop contributing. In sum, taking the Module likely encouraged employees to remain in the plan.

Table 7 here]

Columns 3 and 4 of Table 7 examine whether employees who were not contributing to the DC plan in 2013 began contributing one year later. Of the employees who were not contributing to the DC plan in 2013, 11.6 percent were contributing a year later, and interestingly, people who completed the Learning Module were 2.9 percentage points more likely to initiate DC contributions, relative to those who did not, in Column 3. The effect in Column 4 is larger, with a 4.6 percentage point rise in contributors. By this measure, the Module had a significant positive effect on employee retirement savings, as almost 40 percent more of Module participants began contributing to a retirement saving plan. We also find that older employees not enrolled in 2013 were less likely to start contributing, as were workers with more years of service. By contrast, more highly-paid employees were more likely to have enrolled a year later.

In summary, employees who completed the Learning Module were more likely to start contributing and less likely to have stopped contributing to the DC plan, compared to their non-respondents. This suggests that participating in the program had a positive effect on DC plan behavior. Thus, from the standpoint of the employer, we have learned that providing employees with access to financial education can alter their retirement saving behavior.¹⁴

¹⁴Appendix Table C shows results testing for differences in characteristics of plan participants who took the Learning Module versus those who did not, adopting the weighting based on each respondent's Inverse Propensity Weighting (IPW) score from Appendix Table B. Overall, several factors become insignificant including tenure, male, and the probability of being in a pretax account only. Still significant

Robustness Checks

As noted above, we were unable to randomize treatments across different subsets of the employee population, and we have shown that employees who elected to take the Learning Module differed in observable ways from those who did not. In an effort to investigate whether our results are sensitive to sample selection, we have undertaken two additional tests. One technique uses a Heckman 2-step model to first estimate the probability that employees took the Learning Module, followed by a second stage model indicating the estimated effects of financial knowledge on changes in contributions and changes in equity allocation pre/post the Module. Controlling on this selection correction confirms that the most financially knowledgeable (with an index score of 4-5) boosted their contribution amounts and equity allocations substantially, and the effects are statistically significant (see Appendix A for detail). In particular, and after correcting for selection, those scoring highest on the knowledge index boosted their contributions by 2.5 percent (or 25% above the baseline), and increased their equity percentage by 14.6 percentage points (or 25% above the baseline). Evidently the employer's intervention was quite influential for those who took advantage of the Learning Module.¹⁵

A second way to model sample selection uses a propensity matching model with inverse probability weights, a tactic more robust to misspecification bias (Todd 2014). Yet matching models also maintain that there is no systematic unobserved difference between those who were “treated” – i.e., took the Learning Module – and their counterparts.¹⁶ This is not directly testable with our data, but when we use this framework to estimate the impact of the Learning Module on

but quantitatively smaller are the effects of contribution rates, total balance, age, and salary. Correcting for the sample selection in this way raises the estimated effect on the equity share.

¹⁵ We acknowledge that this test for sample selection approach relies on functional form for identification.

¹⁶ See Cattaneo (2010) and Austin (2011).

changes in contribution and equity allocations, the estimated Average Treatment Effect (ATE) of the Module proves to be strongly positive and significant for both changes in contributions and equity share (see Appendix Table B). Specifically, those taking the Module contributed 11 percentage points more (compared to a baseline of 9 percentage points), and held 6 percentage points more equity (compared to a baseline of 57 percent), after doing the Module. In other words, even after controlling for sample selection, we find a strong positive association between taking the Module and boosting contributions and equity allocations. Accordingly, the employer's effort to boost awareness of the FR retirement plan appears to have worked in the anticipated direction.

Discussion and Implications

Our analysis of FR employee behavior is only a case study of a single employer, yet several observations can be made. First, despite the fact that this workforce is covered by both a DB plan and Social Security, a remarkably high proportion of employees participates in and contributes to the DC retirement plan. Second, the surveyed employees' level of financial literacy is quite high compared to the general population. Third, we confirm, as in other studies, that marital status, salary, tenure, and financial literacy are all predictors of participation and contribution levels to DC plans. Fourth, the most financially knowledgeable employees are more likely to participate in their pension plan, contribute a higher percent of their pay, and hold more equity in their retirement accounts. In general, higher levels of financial literacy do appear to be associated with greater retirement readiness.

We also examine the effects of a Learning Module offered to the employees. When we compare behavioral changes among employees who took the Learning Module versus their

counterparts who did not, we show that a significantly higher proportion of non-contributors who completed the Module subsequently enrolled in the retirement saving plan, compared to those who did not. Very few of those who viewed the Module stopped contributing to their DC plan, compared to those who did not view the Module. Moreover, the most financially knowledgeable were significantly more likely to boost contributions and equity allocation after having taken the employer's Learning Module. In other words, employer-provided information about the need to save for retirement increased workers' willingness to participate in and contribute to the DC vehicle. Accordingly, employers seeking reasons to develop such educational programs can be more confident that these programs will boost employee awareness and enhance retirement readiness.

References

- Allen, Steven, Robert Clark, Jen Maki, and Melinda Morrill. 2016. Golden Years or Financial Fears: How Plans Change After Retirement Seminars. *Journal of Retirement* 3(3): 96-115.
- Austin, Peter C. 2011. An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. *Multivariate Behavioral Research* 46: 399–424.
- Bayer, Patrick, Douglas Bernheim, and John Karl Scholz. 2009. The Effects of Financial Education in the Workplace: Evidence from a Survey of Employers. *Economic Inquiry* 47(4): 605-624.
- Bernheim, Douglas, and Daniel Garrett. 2003. The Effects of Financial Education in the Workplace: Evidence from a Survey of Households. *Journal of Public Economics* 87: 1487–1519.
- Cattaneo, Matias D. 2010. Efficient Semiparametric Estimation of Multi-Valued Treatment Effects Under Ignorability. *Journal of Econometrics* 155: 138–154.
- Clark, Robert, Madeleine d’Ambrosio, Ann McDermed, and Kshama Sawant. 2006. Retirement Plans and Saving Decisions: The Role of Information and Education. *Journal of Pension Economics and Finance* 5(1): 45-67.
- Clark, Robert and Annamaria Lusardi. 2012. How Employers Can Help New Hires Save for Retirement: Best Practices that Build Long-Term Financial Security. FINRA Investor Education Foundation.
<http://www.finrafoundation.org/web/groups/foundation/@foundation/documents/foundation/p188046.pdf>
- Clark, Robert, Annamaria Lusardi, and Olivia Mitchell. 2014. Financial Literacy and Retirement Plan Saving and Investment among Federal Reserve System Employees. Final Report of the OEB, Federal Reserve Bank. November.
- Clark, Robert, Annamaria Lusardi, and Olivia Mitchell. 2016. Financial Knowledge and 401(k) Investment Performance. *Journal of Pension Economics and Finance* Forthcoming. DOI: <http://dx.doi.org/10.1017/S1474747215000384>
- Clark, Robert, Jennifer A. Maki, and Melinda Sandler Morrill. 2014. Can Simple Informational Nudges Increase Employee Participation in a 401(k) Plan? *Southern Economics Journal* 80(3): 677-701.

- Clark, Robert, Melinda Morrill, and Steven Allen. 2012a. Effectiveness of Employer-Provided Financial Information: Hiring to Retiring. *American Economic Review* 102(3): 314-18.
- Clark, Robert, Melinda Morrill, and Steven Allen. 2012b. The Role of Financial Literacy in Determining Retirement Plans. *Economic Inquiry* 50(4): 851-866.
- Consumer Financial Protection Bureau. 2014. Financial Wellness at Work: A Review of Promising Practices and Policies. August.
http://files.consumerfinance.gov/f/201408_cfpb_report_financial-wellness-at-work.pdf
- Lusardi, Annamaria. 2011. Americans' Financial Capability. NBER Working Paper 17103.
- Lusardi, Annamaria, Pierre-Carl Michaud, and Olivia S. Mitchell, 2016. Optimal Financial Knowledge and Wealth Inequality. *Journal of Political Economy*. Forthcoming.
- Lusardi, Annamaria and Olivia S. Mitchell. 2007. Financial Literacy and Retirement Preparedness. Evidence and Implications for Financial Education. *Business Economics*, January: 35-44.
- Lusardi, Annamaria and Olivia S. Mitchell. 2008. Planning and Financial Literacy: How Do Women Fare? *American Economic Review* 98(2): 413-417.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2009. How Ordinary Consumers Make Complex Economic Decisions: Financial Literacy and Retirement Readiness. NBER Working Paper 15350.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2011a. Financial Literacy and Planning: Implications for Retirement Wellbeing. In *Financial Literacy: Implications for Retirement Security and the Financial Marketplace*. Eds. O. S. Mitchell and A. Lusardi. Oxford, Oxford University Press: 17-39.
- Lusardi, Annamaria and Olivia S. Mitchell. 2011b. Financial Literacy and Retirement Planning in the United States. *Journal of Pension Economics and Finance* 10(4): 509-525.
- Lusardi, Annamaria and Olivia S. Mitchell. 2011c. Financial Literacy around the World: An Overview. *Journal of Pension Economics and Finance* 10(4): 497-508.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2014. The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature* 52(1): 5-44.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2015. Financial Literacy and Economic Outcomes. Evidence and Policy Implications. *Journal of Retirement* Summer: 107-114.

- Lusardi, Annamaria, Olivia S. Mitchell, and Vilsa Curto. 2010. Financial Literacy among the Young. *Journal of Consumer Affairs* 44(2): 358-380.
- Simon, Curtis John Warner, and Saul Pleeter. 2015. Discounting, Cognition, and Financial Awareness: New Evidence from a Change in the Military Retirement System, *Economic Inquiry* 53(1): 318-334.
- Todd, Petra E. 2014. *Advanced Microeconomic Techniques and Applications*. Unpublished manuscript, University of Pennsylvania.

Table 1. Comparison of Observables for Learning Module Respondents and Non-respondents

Variable	Total	Nonrespondents	Respondents	Diff. (Nonpart.- Part.)	T-test for significance
% Participants in Pretax Only	66.86	66.39	69.41	-3.02	***
% Participants in Roth Only	8.13	7.97	9.00	-1.03	*
% Participants in Both	8.96	8.53	11.20	-2.67	***
% Salary Contribution	7.32	7.00	9.02	-2.02	***
Total balance (\$100k), Pretax Only	1.51	1.37	2.26	-0.89	***
% Balance in equity, Pretax Only	52.54	52.16	54.56	-2.40	***
% Contribution in equity	57.19	56.89	58.66	-1.77	**
Age	44.34	43.67	47.90	-4.22	***
Male	0.57	0.57	0.57	0.00	
Married	0.62	0.60	0.69	-0.08	***
Salary (\$10k)	9.82	9.68	10.55	-0.87	***
Tenure (years)	12.26	11.78	14.83	-3.05	***
N	21,192	17,835	3,357		

Note: *** Significant at the 0.01 level; ** Significant at the 0.05 level; * Significant at the 0.10 level.

This table summarizes key variables for all 2013 Federal Reserve System 401(k) plan participants who responded to the financial knowledge questions in the Learning Module as well as for those who did not. All data are taken from the institution's administrative records and refer to active employees (i.e., not retired, vested terminated, or deceased).

Table 2. Results of Financial Literacy Assessment

	% correct	S.D
Financial Literacy Questions:		
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? More than \$110, Exactly \$110, Less than \$110, DK, RF	0.75	0.44
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? More than today, Exactly the same, Less than today, DK, RF	0.91	0.29
True or False? Buying a single company's stock usually provides a safer return than a stock mutual fund. True, False, DK, RF	0.85	0.35
Assume you were in the 25% tax bracket (you pay \$0.25 in tax for each dollar earned) and you contributed \$100 pretax to an employer's 401(k) plan. Your take-home pay (what's in your paycheck after all taxes and other payments are taken out) will then: Decline by \$100, Decline by \$75, Decline by \$50, Remain the same, DK, RF	0.43	0.50
Assume that an employer matched employee contributions dollar for dollar. If the employee contributed \$100 to the 401(k) plan, his account balance in the plan including his contribution would: Increase by \$50, Increase by \$100, Increase by \$200, Remain the same, DK, RF	0.76	0.43
Financial Knowledge Index Score (number of questions answered correctly)	3.71	1.23
Note: DK refers to "do not know" and RF to "refuse to answer."		

Table 3. Heterogeneity in Financial Literacy Scores

Variable	% Survey Respondents by Financial Knowledge Index (row percentages reported)			Financial Literacy Index		
	<i>0-1</i>	<i>2-3</i>	<i>4-5</i>	<i>Mean</i>	<i>Std.Dev.</i>	<i>N</i>
Age						
<30	4.5	28.1	67.3	3.8	1.1	199
30-39	5.0	27.2	67.8	3.8	1.2	519
40-49	5.4	27.7	66.9	3.8	1.2	795
50-59	4.6	30.4	65.0	3.8	1.2	1,115
>=60	2.9	27.9	69.2	3.9	1.1	380
Sex						
Men	2.9	22.5	74.7	4.0	1.1	1,741
Women	7.1	37.2	55.7	3.5	1.2	1,267
Marital Status						
Married	4.0	26.5	69.5	3.9	1.1	2,079
Non-married	6.1	33.5	60.4	3.6	1.2	929
Tenure						
<10 years	4.8	27.7	67.5	3.8	1.2	1,348
10 to 14 years	3.1	28.0	68.9	3.9	1.1	354
15 to 19 years	5.3	31.3	63.4	3.7	1.2	374
>=20 years	4.7	29.3	66.0	3.8	1.2	932
Salary						
<\$50,000	15.6	48.3	36.1	2.9	1.3	263
\$50,000 to \$99,999	6.2	36.7	57.2	3.5	1.2	1,235
\$100,000 to \$149,999	1.7	21.0	77.4	4.1	1.0	1,007
\$150,000 to \$199,999	1.7	15.4	82.8	4.2	1.0	344
\$200,000 to \$249,999	0.0	14.7	85.3	4.3	0.8	109
>\$250,000	0.0	4.0	96.0	4.7	0.6	50

Table 4. Determinants of Pension Participation: All Employees, April 2013

Probit models, marginal effects reported.

	Full sample	Full sample	Surveyed in 2013
Age	0.0004 (0.0003)	0.0002 (0.0003)	0.0004 (0.0006)
Male	-0.0199 *** (0.0047)	-0.0191 *** (0.0047)	-0.0044 (0.0093)
Married	0.0094 * (0.0051)	0.0090 * (0.0051)	0.0037 (0.0101)
Salary (\$10k)	0.0183 *** (0.0007)	0.0177 *** (0.0007)	0.0078 *** (0.0015)
Tenure	-0.0080 *** (0.0003)	-0.0080 *** (0.0003)	-0.0045 *** (0.0005)
Learning Module		0.0627 *** (0.0054)	
Med. Fin. Knowl. Index (2-3)			0.0675 *** (0.0122)
High Fin. Knowl. Index (4-5)			0.1343 *** (0.0225)
N	21,192	21,192	3,357
R-square	0.142	0.147	0.133
Mean of dep var	0.840	0.840	0.896
St.dev of dep var	0.367	0.367	0.305

Note: * p<0.10, ** p<0.05, *** p<0.01

Table 5. Determinants of Employee Contributions in 2013 (as a % of salary)
OLS models.

	Plan contribution rate		
	Plan participants	Plan participants	Surveyed & in plan in 2013
Age	0.0012 *** (0.0001)	0.0012 *** (0.0001)	0.0012 *** (0.0001)
Male	-0.0020 ** (0.0009)	-0.0021 ** (0.0009)	-0.0033 (0.0024)
Married	0.0000 (0.0009)	0.0000 (0.0009)	0.0022 (0.0026)
Salary (\$10k)	0.0004 *** (0.0001)	0.0004 *** (0.0001)	-0.0008 *** (0.0002)
Tenure	0.0001 (0.0001)	0.0000 (0.0001)	0.0002 * (0.0001)
Learning Module		0.0104 *** (0.0012)	
Med Fin. Knowl. Index (2-3)			0.0143 ** (0.0057)
High Fin. Knowl. index (4-5)			0.0255 *** (0.0055)
N	17,791	17,791	3,008
R-square	0.073	0.078	0.064
Mean of dep var	0.087	0.087	0.101
St.dev of dep var	0.057	0.057	0.062

Note: * p<0.10, ** p<0.05, *** p<0.01

Table 6. Determinants of Portfolio Share in Equities: Employees in 2013
OLS models.

	Plan participants	Plan participants	Surveyed & in plan in 2013
Age	-0.0057 *** (0.0002)	-0.0058 *** (0.0002)	-0.0065 *** (0.0006)
Male	0.0498 *** (0.0043)	0.0497 *** (0.0043)	0.0393 *** (0.0108)
Married	0.0160 *** (0.0047)	0.0159 *** (0.0047)	0.0230 ** (0.0117)
Salary (\$10k)	0.0139 *** (0.0005)	0.0137 *** (0.0005)	0.0070 *** (0.0014)
Tenure	-0.0035 *** (0.0003)	-0.0035 *** (0.0003)	-0.0033 *** (0.0006)
Learning Module		0.0369 *** (0.0059)	
Med Fin. Knowl. Index (2-3)			0.0559 ** (0.0264)
High Fin. Knowl. index (4-5)			0.1463 *** (0.0260)
N	17,791	17,791	3,008
R-square	0.107	0.109	0.146
Mean of dep var	0.572	0.572	0.587
St.dev of dep var	0.298	0.298	0.302

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7. Probability of Stopping or Starting Contributions in 2014, Relative to 2013, as a Function of Taking the Learning Module and Other Variables

	Stop participating		Start participating	
	Plan participants in 2013		Non- participants in 2013	
Learning Module	-0.0370 *** (0.0042)	-0.0377 *** (0.0041)	0.0289 * (0.0175)	0.0463 *** (0.0177)
Age		0.0005 ** (0.0002)		-0.0021 *** (0.0005)
Male		0.0129 *** (0.0038)		-0.0167 * (0.0085)
Married		-0.0189 *** (0.0042)		-0.0002 (0.0087)
Salary (\$10k)		-0.0021 *** (0.0005)		0.0061 *** (0.0010)
Tenure		0.0008 *** (0.0002)		-0.0050 *** (0.0005)
N	17,538	17,538	3,329	3,329
R-square	0.009	0.018	0.040	0.168
Mean of dep var	0.071	0.071	0.116	0.116
St.dev of dep var	0.257	0.257	0.320	0.320

Note: * p<0.10, ** p<0.05, *** p<0.01

Probit models, marginal effects reported.

Appendix Table A. Two-Stage Heckit Models Correcting for Sample Selection With Respect to Taking the Learning Module

	Took Learning Module	% Salary contribution	% Equity allocation
	<i>Probit</i>	1	2
Age	0.017 *** (0.001)	-0.001 (0.002)	-0.035 *** (0.009)
Male	0.010 (0.024)	-0.005 * (0.003)	0.024 * (0.012)
Married	0.032 (0.026)	-0.002 (0.004)	-0.033 (0.021)
Salary (\$10k)	0.017 *** (0.003)	-0.003 ** (0.002)	-0.020 ** (0.009)
Tenure	0.004 *** (0.001)	0.000 (0.000)	-0.009 *** (0.002)
Med Fin. Knowl. Index (2-3)		0.014 ** (0.006)	0.054 ** (0.026)
High Fin. Knowl. index (4-5)		0.025 *** (0.005)	0.146 *** (0.026)
Lambda		-0.172 (0.120)	-2.132 *** (0.661)
N	17,791	3,008	3,008
R-square	0.070	0.065	0.149
Mean of dep var	0.169	0.101	0.587
St.dev of dep var	0.375	0.062	0.302

Note: * Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.

Probit model in Column 1, OLS in columns 2 and 3.

Appendix Table B. Inverse Propensity Weighting Models: ATE refers to Average Treatment Effect in the Population. (Treatment is Took Learning Module, ATE reported)

	% Salary contribution	% Equity allocation
	<i>1</i>	<i>2</i>
ATE	0.009 *** (0.001)	0.036 *** (0.006)
P0mean Learning Module (0)	0.085 *** (0.000)	0.566 *** (0.002)
ATE*	0.106 *** (0.015)	0.063 *** (0.010)
	17,791	17,791

*ATE reported as a percentage

Appendix Table C. Weighted Comparisons Using Inverse Propensity Scores

Variable	Diff.		Diff.		Notes
	(Nonpart - Part)	Signif.	(Nonpart -Part)	Signif.	
% Participants in Pretax Only	-3.02	***	1.56		
% Participants in Roth Only	-1.03	*	-3.01	***	
% Participants in Both	-2.67	***	-5.64	***	
% Salary Contribution	-2.02	***	-1.43	***	
Total balance (\$100k), Pretax Only	-0.89	***	-0.26	***	
% Balance in equity, Pretax Only	-2.40	***	-4.41	***	
% Contribution in equity	-1.77	**	-3.59	***	
Age	-4.22	***	-2.90	***	
Male	0.00		0.02		Male excluded from IPW model
Married	-0.08	***	-0.02		Married excluded from IPW model
Salary (\$10k)	-0.87	***	-0.79	***	Salary excluded from IPW model
Tenure (years)	-3.05	***	0.07		Tenure excluded from IPW model

Note: * p<0.10, ** p<0.05, *** p<0.01

The first column restates results from Table 1, testing for differences in characteristics of plan participants who took the Learning Module versus those who did not. The second column repeats the exercise but now weighting observations based on each respondent's Inverse Propensity Weighting (IPW) score.