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THE IMPACTS OF A LARGE-SCALE FINANCIAL EDUCATION INTERVENTION ON RETIREMENT SAVING BEHAVIORS AND PORTFOLIO ALLOCATION: EVIDENCE FROM PENSION FUND DATA

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Abstract:

We analyze the causal impact of a large-scale financial education intervention on retirement saving behaviors and asset allocation decisions. The studied intervention is a nationwide retirement seminar program that is administered by a major Australian pension fund. Making use of the variation in the timing of seminar invitations, we find that seminar attendance has large positive effects on a range of desirable behaviors. Over a span of two years, the seminars generate excess voluntary contributions worth 6 per cent of the attending members' pension balances. Seminar attendees also become more likely to use sophisticated portfolio allocation strategies, lowering the risk of their asset holdings as they approach retirement. We show that the seminars are highly profitable for both the fund and its members, which highlights the unique potential for an active role of pension funds in the domain of financial education and retirement planning.

JEL Codes: D14, J26, J32

Key words: Retirement Savings, Pension, Superannuation, Financial Education

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1. INTRODUCTION

Financial knowledge is broadly considered to be one of the key determinants of retirement preparedness. Numerous studies link financial knowledge to positive retirement behaviors, such as retirement planning (e.g. Lusardi and Mitchell, 2011; Van Rooij, Lusardi and Alessie, 2012), voluntary pension contributions (Clark, d'Ambrosio, McDermed and Sawant, 2006), and the use of sophisticated savings strategies (Deuflhard, Georgarakos and Inderst, 2018). However, despite its clear benefits, many countries report strikingly low levels of financial education among their working-age populations.[2] This raises concerns regarding the sustainability of national retirement systems, particularly in the countries which are currently transitioning from state-based pensions to individual retirement saving schemes.

A variety of financial education interventions have been proposed to increase the rates of retirement preparedness, with a host of survey-based studies indicating that these interventions are likely to stimulate the desired behaviors (e.g., Bernheim and Garett 2003; Lusardi, 2004; Bayer, Bernheim and Scholz, 2009). Such claims have been assessed by a small, but influential body of experimental research (Duflo and Saez, 2003; Collins, 2013; Goda, Manchester and Sojourner, 2014), which yielded causal evidence in support of the positive effects of financial education interventions on positive retirement behaviors.[3]

[2] Almost half of the adult population in major advanced economies (Canada, France, Germany, Japan, the UK and the US) and almost three quarters in major emerging economies (Brazil, Russia, India, China and South Africa) are not financially literate (Klapper, Lusardi and Van Oudheusden, 2015). In a recent survey of Australian population, around a quarter of respondents were found to lack an understanding of basic financial concepts such as inflation and diversification (Productivity Commission, 2018). An earlier report showed the respondents to be even less financially literate with regard to old-age pensions and retirement planning (Productivity Commission, 2015).

[3] Duflo and Saez, (2003) and Goda, Manchester and Sojourner (2014) found modest increases of voluntary pension contributions following RCT interventions that involved university staff. Collins (2013) focused on a sample of disadvantaged families, finding significant effects on self-reported behaviors, but null effects on objective behaviors.

The experimental studies paint an encouraging picture for the active role of financial education interventions in the effort to improve peoples' retirement preparedness. But at the same time, it is important to acknowledge their limitations. First, the interventions were administered to small and highly selective samples of participants. This limits their external validity and leads to concerns that the positive intervention effects may be endemic to the experimental samples (Bellemare and Kröger, 2007). Second, the interventions were shown to affect only a small number of outcomes, including voluntary pension contributions and self-reported financial behaviors. It is yet to be ascertained whether they are also able to stimulate more sophisticated financial behaviors, including asset allocation, risk management, and further engagement with the topic of retirement. Third, the literature is largely underdeveloped in terms of the design and implementation of these interventions. We know very little about the relative effectiveness of different providers of financial education information, the costs of their services, and the resulting implications for the possible sources of financing for larger intervention programs.

In this paper, we aim to contribute to this literature by conducting a comprehensive analysis of a large-scale financial education program administered by one of Australia's largest pension funds. Our paper highlights the unique positioning of pension funds in the domain of financial education, pointing to the fact that, unlike other providers of financial education, the pension funds have vested interests in stimulating additional savings. This, together with their broad institutional knowledge and access to large pools of clients,[4] makes them particularly effective in terms of stimulating the desired retirement behaviors.

[4] Every employee in Australia is automatically a member of a pension fund.

Our empirical analyses support these claims. First, using a retirement module from the large, nationally representative Household, Income and Labour Dynamics in Australia (HILDA) survey, we show that pension funds represent one of the primary sources of financial education and retirement advice for pre-retiree Australians. We also show that the respondents who sought financial education from pension funds were more likely to engage in positive retirement behaviors (making voluntary contributions to their pension accounts) compared to those who consulted other sources of financial education. This suggests that the pension funds' financial education initiatives may have the desired effects on Australian pre-retirees.

To estimate these effects causally, we turn to the quasi-experimental analysis of the fund-administered retirement seminar program. We study the effects of attending one of more than 100 retirement seminars that took place across Australia in 2017 and 2018. The seminars covered financial literacy and institutional knowledge, and they were targeted at the pre-retiree members of the pension fund. Using a micro-level administrative dataset of fund members' monthly activities, we quantify the effects of seminar attendance on a range of retirement-related behaviors. The identification of our models is aided by variation in the timing of retirement seminars, allowing us to compare the behaviors of fund members who have already attended the seminar to the behaviors of fund members who are yet to attend. Our first finding is that attending a retirement seminar makes the fund members more likely to make voluntary pension contributions. Over the 20-month period of observation, seminar attendees raise their voluntary pension contributions by an average of A$15,259[5], which corresponds to 6% of their pre-seminar pension balances. The contributions induced by the seminars are concentrated in the month corresponding to the end of the financial year (June), and in the first three months following the

[5] All subsequent dollar figures are in Australian dollars.

seminar date. Second, we find that the seminar attendees also become more likely to engage in sophisticated savings strategies, lowering the risk of their asset holdings as they near the age of their retirement. This is an important behavioral change since most fund members hold (by default) high-risk portfolios with long investment time frames. Lowering the risks of pension asset holdings becomes crucial upon retirement, since it reduces the retirees' exposure to short-run fluctuations of the stock market and the economy. Third, we show that the seminar attendees also become more engaged with their pensions, increasing the number of users of the funds' online portal. Other modelling approaches, including difference-in-differences model and coarsened exact matching model yield comparable results.

Our study makes several important contributions to the retirement finance literature, and more broadly, to the literature on the effects of financial education on peoples' financial behaviors.[6] First, our study is the first to analyze the effects of a large-scale financial education intervention on positive retirement behaviors. The intervention is targeted at a representative sample of Australian pre-retirees, which allows us to confirm the existence of the positive intervention effects outside of selective experimental samples. In terms of voluntary pension contributions, our effects are larger than the causal effects found by the previous RCT studies (Duflo and Saez, 2003; Goda, Manchester and Sojourner, 2014). The larger magnitude of our effects reinforces the claim that the superannuation funds are likely to be effective in disseminating financial education and retirement advice. Our effects are smaller than the associations found by the previous survey-based studies (Lusardi, 2004; Bayer, Bernheim and Scholz, 2009), and they are also

[6] Apart from the aforementioned studies focusing on retirement behaviors, other studies have documented the effects of financial education on entrepreneurial outcomes (Karlan and Valdivia, 2011; Drexler, Fischer and Schoar, 2014), household savings (Carpena et al., 2019), demand for bank accounts (Cole, Sampson and Zia, 2011) and financial behaviors of teenagers and young adults (e.g., Lührmann, Serra-Garcia and Winter, 2015; Brown et al., 2016).

smaller than the associations we retrieved from the HILDA survey. This comparison echoes the concerns of Collins and O'Rourke (2010), who highlight the issues of selection bias and self-reported outcome measures in the survey-based studies of financial education.

Second, we show that the positive effects of financial education interventions are not restricted to the voluntary pension contributions. The seminar participants become more sophisticated in terms of asset allocation and risk management strategies, and also become more engaged with their superannuation accounts. Third, we conduct a cost-benefit analysis, showing that the retirement seminars are profitable for both the seminar participants and the seminar providers. For the superannuation fund, the costs are three-times lower than the revenues resulting from the induced savings through annual asset fees. Conveniently, this makes the issue of intervention financing largely irrelevant. As documented by our study, pension funds are incentivized to run the financial education seminars *pro bono*, and by doing so they are likely to improve both their revenues and the retirement preparedness of the populace.

The rest of the paper is organized as follows: Section 2 discusses the institutional background of the Australian pension system. Section 3 presents our analysis of the HILDA survey. Section 4 provides the background of the pension fund, their seminars and the administrative data used for our quasi-experimental analysis. The econometric model is presented in Section 5, and Section 6 discusses the results. Section 7 concludes with a discussion of the implications of our study.

2. Australian Pension System

All Australian employers are required to contribute a fixed proportion of employees' salaries (currently 9.5%) to defined-contribution retirement savings accounts managed by a

superannuation fund.[7] On top of the statutory employer contributions, employees can make additional voluntary contributions via concessional (before-tax) and non-concessional (after-tax) channels. Concessional contributions are taxed at 15%, which is a highly advantageous rate for salary packaging (marginal income tax rate for the majority of Australian workers is currently 32.5%). The maximum amount of concessional contributions is capped at $25,000 per financial year, which means that all excess contributions have to be non-concessional (after-tax). Non-concessional contributions do not offer immediate tax benefits, but they are still regarded as a very favorable investment option because earnings from superannuation investment returns are taxed at around 6.5% for most people (up to a maximum of 15%) instead of the marginal income tax rate. The superannuation balances can be withdrawn when an individual fully retires, although large shares of the balances can be accessed ahead of the full retirement as well.[8]

An asset-tested age pension system remains in place, with eligible age currently increasing from 65 to 67.[9] The average age of retirement in Australia is 62.9 for recent retirees and the average age at which Australians intend to retire is 65 (Australian Bureau of Statistics, 2017). Australians are generally expected to receive a stream of income from their superannuation savings, which is topped up by age pension.

There is currently around $2.7 trillion worth of assets managed by Australian superannuation funds (Association of Superannuation Funds of Australia, 2019). More than 200 superannuation funds are currently active in Australia, and they are split between for-profit funds and not-for-

[7] In Australia, all pension funds are referred to as superannuation funds. Throughout the rest of the paper, we use this term to refer to the Australian pension funds.
[8] Full access to retirement funds is conditional on reaching the preservation age, which is currently rising from 55 to 60 years. An individual aged 55-60 may also choose to enroll in Transition to Retirement program, which allows the individual to withdraw up to 10% of his/her superannuation balance each year until the age of 65.
[9] As of 2018, age pension provides up to $826.20 per fortnight for a single person and $1245.60 per fortnight for a couple.

profit funds.[10] Most people are defaulted into a superannuation fund based on their employers' superannuation fund of choice, and most people invest all their superannuation balances in a "Balanced" portfolio, which is the default investment option that involves higher expected short-term risks for higher expected long-term returns. The minimum investment time frame for this portfolio is 10 years, and the investment performance benchmark is typically 4% above CPI per annum. As fund members near the retirement age, it is advisable that they switch to portfolios with shorter minimum investment time frames, thereby reducing the short-term volatility of their superannuation balances.

Due to the favorable tax treatment and broad diversification of the superannuation portfolios, voluntary superannuation contributions are deemed to be the best-performing investment vehicle for a large majority of the Australian pre-retirees, outperforming both real estate and wealth funds in terms of the interest rates. In addition, reaching the preservation age gives the pre-retirees (at least partial) access to the superannuation balances, which means that making concessional superannuation contributions yields large tax benefits with little liquidity sacrificed for those near their preservation age.[11]

Finally, we note that these incentive structures are not unique to Australia. All OECD countries use fiscal incentives to stimulate positive retirement behaviors (OECD, 2018). In fact, in terms of the amount of tax savings, the majority of OECD countries outperform Australia (OECD, 2018). Accordingly, voluntary superannuation / pension contributions would be one of the most profitable investment vehicles for pre-retirees in most of the developed countries.

[10] Not-for-profit funds have the greatest number of members, highest amount of assets, and generally the highest investment returns after fees (Productivity Commission, 2018).
[11] Preservation age ranges from 55 to 60 years depending on year of birth.

3. Sources of Financial Education for Australian Pre-Retirees

As an initial step of our empirical analysis, we investigate which sources of financial education are typically consulted by Australian pre-retirees and assess whether the engagement with these sources is likely to foster positive retirement behaviors. To this end, we leverage the Household, Income and Labour Dynamics in Australia (HILDA) survey, which is a representative household panel that collects a wide range of information on its respondents, including their retirement planning strategies and financial literacy.

We focus on the sample of pre-retirees who were at least 50 years old at the time of answering the 2015 superannuation and retirement planning module (n=2,194). Summary statistics corresponding to this sample are presented in Table 1. First, we note that less than a half of the respondents are actively planning for their retirement. 51% of respondents stated that they gave little to no thought to how much money they need in retirement, which suggests that a large share of the Australian populace would benefit from information interventions aimed at improving financial education and retirement planning. On the other hand, 43% of respondents stated that they sought advice and information to help them in their planning, listing all the sources of information they consulted.

As shown in Figure 1, the information was solicited most commonly from financial advisors (30%), followed by superannuation funds (16%), and friends or family (7%). The listed sources of retirement advice are likely to differ in terms of the quality and relevance of the information provided. Some sources, such as friends and family, may provide suboptimal advice because of their own limited expertise. Other sources, such as financial advisors and banks, may do so because they face incentive structures that create conflicts of interest (Beyer, de Meza and

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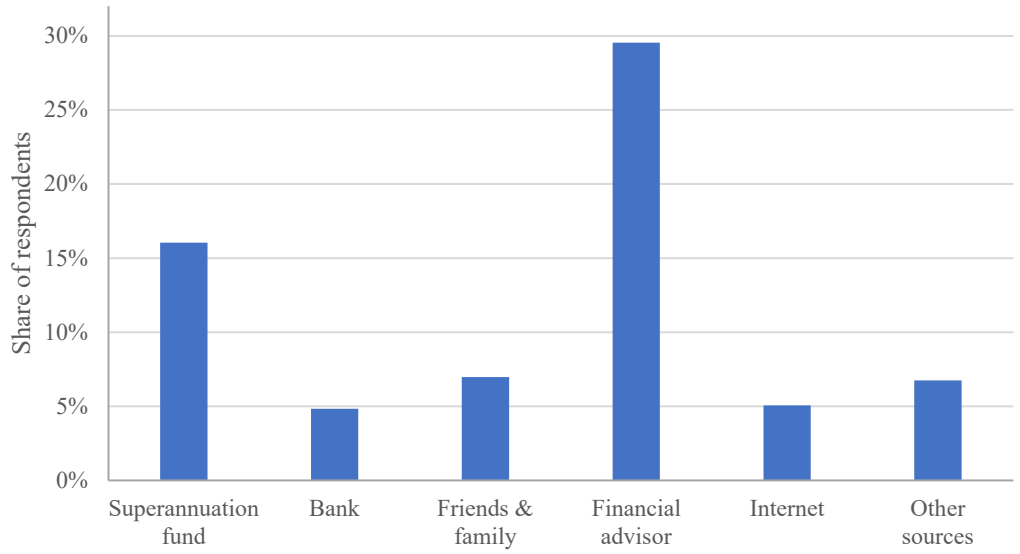
TABLE 1. SUMMARY STATISTICS OF PRE-RETIREE RESPONDENTS IN THE HILDA SURVEY

Variable	Mean	Standard deviation
Age	56.27	4.76
Female	0.50	
Actively planning for retirement	0.49	
Retirement advice sought	0.43	
Making voluntary superannuation contributions	0.36	
Financial literacy index	4.37	0.99
Education: High school or less	0.30	
Education: Vocational degree	0.39	
Education: Bachelor's degree	0.14	
Education: Master's degree	0.09	
Education: Postgraduate degree	0.08	
Gross annual income	$68,340	$55,998
Financial wealth	$282,313	$664,177
Number of respondents	2,194	

Notes: Authors' estimates of descriptive statistics corresponding to HILDA respondents who were at least 50 years old and neither fully nor partially retired in year 2015. The financial literacy index is a six-point scale (0-5) computed as a sum of correct answers to the questions listed in Appendix Table A1. The answers were coded as correct only if they were provided without the assistance of someone else.

FIGURE 1: SOURCES OF RETIREMENT PLANNING ADVICE AND INFORMATION LISTED BY THE HILDA RESPONDENTS



Notes: Authors' estimates of the take up of retirement planning advice from a set of mutually non-exclusive sources. HILDA data, respondents who were at least 50 years old and neither fully nor partially retired in year 2015.

Reyniers, 2013; Hauptman and Roper, 2017; Robinson, 2007). It can be therefore expected that the most relevant information is likely to come from sources that have strong institutional knowledge, and that also share common interests with the pre-retirees.

Superannuation funds appear to be enviably placed in both respects. Apart from their comprehensive institutional expertise, the incentives of the superannuation funds are broadly aligned with the incentives of pre-retirees. The funds seek to maximize members' voluntary contributions, thereby increasing the revenue and creating economies of scale. Pre-retirees seek to maximize their disposable wealth, and the voluntary superannuation contributions are considered to be the optimal investment vehicle in this regard. That is why we expect the superannuation funds to be particularly effective in translating their advice into positive retirement behaviors.[12]

To test this prediction, we turn again to our HILDA sample and investigate whether the respondents who consulted the listed information sources were engaging in positive retirement behaviors. We focus on the respondents' decision to make voluntary superannuation contributions, which is again motivated by the favorable properties of this type of investment. Within our sample of pre-retirees, 36% of respondents stated that they make voluntary contributions to their superannuation accounts.

We estimate a Linear Probability Model of the binary decision to make voluntary superannuation contributions, with the independent variables being the dummies for the respective sources of

[12] One potential concern in this regard is that superannuation funds may have incentives to exaggerate the recommended retirement savings targets and coerce their members into overinvesting. In our case, this concern is mitigated by the corporate structure of the fund we study. Similar to the major pension funds in other countries (*e.g.*, the Netherlands, Switzerland, or the United Kingdom), the studied fund is a not-for-profit organization which is owned by its members. As such, all profits are given back to the fund members in the form of lower fees, which limits the scope for agency problems and other conflicts of interest.

financial advice, a financial literacy index, and a set of socio-economic controls (gender, age, age squared, educational attainment, and natural logarithms of gross annual income, and gross financial wealth). The inclusion of a financial literacy index allows us to compare the relative importance of respondents' general financial literacy and the provision of targeted retirement planning advice for their retirement savings decisions.[13]

The results are listed in Table 2. Compared to the respondents who did not seek any retirement advice, the respondents who consulted superannuation funds and financial advisors are significantly more likely to make voluntary superannuation contributions. The contribution rate is 19.3 p.p. higher among those who consulted superannuation funds, and 11.5 p.p. higher among those who consulted financial advisors. The contribution rates of respondents who consulted other information sources are not significantly different from the rates of the reference group.

Financial literacy is also positively associated with voluntary superannuation contributions, although the magnitude of this association is relatively low: one standard deviation change of the financial literacy index is associated with 3.5 p.p. higher probability of making voluntary contributions. This result – albeit associational – suggests that financial literacy alone is unlikely to be the solution of the problems faced by the Australian pension system. Instead, targeted retirement planning advice provided by professionals is likely to yield comparatively better outcomes.

[13] While not explored by our model, we note that financial literacy has interesting interactions with the respondents' tendencies to follow financial advice. Stolper (2018) shows that individuals who are highly financially literate are less likely to follow financial advice, treating the advice as just one of the sources of information they consult for their financial decision-making.

TABLE 2: OLS COEFFICIENTS CORRESPONDING TO THE MODEL OF VOLUNTARY SUPERANNUATION CONTRIBUTIONS

Variables	Coeff.	Standard error
Source of advice and information (reference group: no advice sought)		
Superannuation fund	0.197***	0.029
Bank	0.025	0.047
Friends and family	0.048	0.042
Financial Advisor	0.119***	0.023
Internet	0.004	0.051
Other sources	0.027	0.045
Financial literacy index, normalized	0.035***	0.014
Control variables		
Female	0.025	0.021
Age	0.081**	0.041
Age squared	-0.001*	0.000
Vocational degree	-0.002	0.025
Bachelor's degree	-0.014	0.034
Master's degree	0.023	0.039
Postgraduate degree	0.072*	0.041
Log(income)	0.091***	0.015
Log(financial wealth)	0.006***	0.002
Constant	-3.316***	1.203
Observations	2,087	
R-squared	0.109	

Notes: Authors' estimates corresponding to the model of voluntary superannuation contribution behavior. HILDA data, respondents who were at least 50 years old and neither fully nor partially retired in year 2015. 107 respondents were excluded from the estimation sample because of missing information on their financial literacy. Standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

In line with our earlier discussion, the regression model highlights the advisory role of superannuation funds. A disadvantage of our regression model is that it does not yield causal estimates. The respondents who consulted a superannuation fund may have been more likely to make voluntary contributions due to their unobserved characteristics (see Calcagno and Monticone, 2015). To obtain causal estimates, we turn to the quasi-experimental analysis of retirement seminars on positive retirement behaviors.

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4. Analysis of Retirement Seminars – Background and Data

We analyze a series of retirement seminars provided by one of Australia's largest superannuation funds. The fund has over $100 billion in assets and over 1 million members. It is a not-for-profit superannuation fund, with most of its members defaulted into the fund by their employers. The pool of fund members is largely nationally representative, having broad member bases in all parts of the country and spanning many different industries.

4.1 Retirement Seminars

The retirement seminars are 90-minutes long sessions hosted in the members' local areas. They are run from February to early December each year in a wide range of locations across Australia.[14] Exact timing and location of seminars depend on external factors such as availability of venues. The seminars are free of charge and they are generally targeted at pre-retiree fund members aged either 53 and above or 58 and above (although some attendees are as young as 51). All such members living near a seminar location are invited to the seminar 4 weeks in advance, either by post or email. Each seminar can hold up to 80 attendees, although most seminars have around 50 participants. The seminar contents include general advice related to retirement as well as basic financial skills and knowledge. Among other topics, the attendees are informed about the retirement and preservation ages, how much money one needs for retirement, how to check if one is on track in terms of retirement savings, how age pension works, how to make additional superannuation contributions and the associated tax benefits of doing so, asset allocation and associated knowledge (e.g. sequencing risks, compound interests), retirement

[14] There are seminar locations in every state and territory of Australia. Around half of the seminars are located in suburbs of the three biggest Australian cities (Brisbane, Sydney and Melbourne), just over a quarter are in other major cities and other non-capital economic centers, the rest are in regional and rural areas.

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income streams, and how to seek financial advice and make an action plan to improve retirement preparedness (e.g. calculating income requirement, budgeting). The retirement seminars receive extremely positive feedback from attendees according to feedback forms completed at the end of the seminar. The average costs to the superannuation fund are $1,800 per seminar.

4.2 Data

As part of this research, we have obtained access to an administrative dataset containing individual characteristics and monthly activity records of all pre-retiree fund members who were invited to retirement seminars in years 2017 and 2018 (n=167,330). This dataset was accompanied by a dataset containing a random sample of pre-retiree fund members aged 51 and over who were not invited during those two years (n=87,000). The monthly activity records cover the period from January 2017 to August 2018 (20 months in total), which means that, for a subset of fund members who were invited to a seminar after August 2018 (n=47,235), we only observe their monthly activities prior to the seminar date.

Each person-month record contains a unique person identifier, current superannuation balance, employer contribution amount, voluntary contribution amount, amount invested in each of the investment options, riskiness of these investment options (in terms of the investment time frame), engagement with the funds' online portal, gross salary (imputed from employer contribution amounts), age, gender and postcode. Using the unique person identifiers, we merge the monthly activity records with the records of seminar invitation and attendance. These records contain the month of the invitation and (if applicable) the month of seminar attendance for all fund members invited to the seminars taking place in 2017 and 2018. Out of the total of 167,330 invitees, we observe that 2,227 members attended the seminar. This corresponds to a conversion

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rate of 1.3%, which is in line with other mailing campaigns (Tezinde et al., 2002; Kumar et al., 2014).

Summary statistics corresponding to the group of seminar invitees are presented in Column 1 of Table 3. To ensure that the statistics are not distorted by the effects of seminar attendance, the characteristics are measured in the month preceding the date of seminar to which the fund members were invited (or in August 2018 if the seminars took place after August 2018). The average seminar invitee is 62 years old, earns $66,655 per year, and has a superannuation balance of $111,803. 40.3% of seminar invitees are women. 5.7% of seminar invitees have been observed to make a voluntary contribution in the past 12 months, depositing on average $13,346 per contribution. Consistent with other funds, most invited members invest in the default investment option, which is a higher-risk portfolio with an investment time frame of 10 years and an average nominal return of over 9% per annum.[15] The average investment time frame is slightly lower (9.7 years), which is because the 15.9% of fund members who choose non-default investment options tend to favor less risky portfolios. A large share of seminar invitees is interacting with the pension fund, with 40.6% of members being active online users (that is, they have been observed to interact with the fund's online portal). Auxiliary analyses leveraging the random sample of non-invited pre-retiree members confirm that the group of seminar invitees is largely representative of the fund member base.[16]

[15] Each investment option is assigned a (minimum) suggested investment time frame. Investment options with longer time frames have higher expected risks in the short run and higher expected returns in the long run. Fund members may choose predefined portfolio mixes such as high growth (12 years) or conservative (5 years) options, but they can also choose to add more specific options to their holdings, such as cash (1 year). To approximate the portfolio risk for each member, we use a weighted average of investment time frames that correspond to the investment options in their holdings.

[16] Appendix Table A2 compares the average characteristics of seminar invitees to the average characteristics of non-invited fund members aged 51 and above. We find some significant differences between the two groups; however

TABLE 3: AVERAGE CHARACTERISTICS OF SEMINAR INVITEES AND DIFFERENCES BETWEEN THOSE WHO DID AND DID NOT ATTEND A SEMINAR

	(1) All invitees	(2) Attendees	(3) Invited non-attendees	(4) Difference (2) – (3)
Age	61.6	62.2	61.6	0.5***
Female	40.3%	38.2%	40.3%	-2.1%***
Annual salary (gross)	$66,655	$82,871	$66,504	16,366***
Superannuation balance	$111,803	$260,193	$110,211	149,982***
Made at least one voluntary contribution in the past 12 months[1]	5.7%	12.3%	5.6%	6.66%***
Voluntary contribution amount (per non-zero contribution)	$13,346	$18,732	$13,254	$5,478***
Default investment option	84.1%	68.4%	84.3%	-15.9%***
Investment time frame (years)	9.7	9.4	9.7	-0.3***
Online user	41.2%	69.8%	41.2%	28.9%***
Number of fund members	167,330	2,227	165,103	

Notes: [1] for seminar invitees and attendees, we only use the information of fund members who were observed for 12 months or more prior to being invited to the seminar. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

We note that the average superannuation balance is relatively low for the fund members' age and salary levels. According to the Association of Superannuation Funds of Australia (2019), the average balance for our sample of fund members should be approximately $225,000. This discrepancy is likely attributable to some fund members holding multiple accounts in different superannuation funds (which results from job changes and employers defaulting their employees to a single superannuation fund). This may also be one of the reasons why the share of fund members making voluntary contributions is considerably lower than the one reported by the HILDA respondents.[17]

these are attributable largely to age differences. Most seminars are targeted at fund members aged 53 and above, or 58 and above, which raises the average age among the group of seminar invitees. Once we condition on age, the differences in average superannuation balances and voluntary contribution amounts become statistically insignificant. A small statistically significant difference in average annual salaries remains even after conditioning on age. Details available upon request.

[17] Fund members can also choose to automatically sacrifice a fraction of their salaries to the superannuation balances. This option is exercised by 9% of members in our sample, which brings the total share of fund members supplementing their superannuation accounts to 13%.

Next, we compare the average characteristics of fund members who did attend the seminar (Column 2 in Table 1) to those who did not (Column 3). Column 4 lists the differences in average characteristics accompanied by the results of two-sided means comparison tests. Seminar attendees are different from the non-invitees in each of the listed characteristics, and some of these differences are substantial. In particular, seminar attendees earn more money than non-attendees, hold considerably higher superannuation balances, and they are more likely to make additional contribution even before attending the seminar. They also contribute larger amounts of money, and they are more likely to hold a non-default investment portfolio. This illustrates that the group of seminar attendees is highly selective in terms of their observable (and perhaps also unobservable) characteristics.[18] The inevitable consequence of this is that our models capture the average effects on the treated (ATT), rather than the unconditional average treatment effects (ATE). Importantly, the selection into attendance does not invalidate causality of the presented estimates, however it may mean that the effects observed among the group of seminar attendees may be different from the effects we would observe if the whole population of fund members was exposed to the same seminar information.

4.3 Dynamics of Voluntary Contributions

In terms of frequency of voluntary contributions, only a small fraction of fund members makes contributions every month. In fact, 56% of actively contributing members make only one contribution per year, and they generally do so at the end of the financial year (which in Australia falls on 30 June). The contributions spike at the end of the financial year because

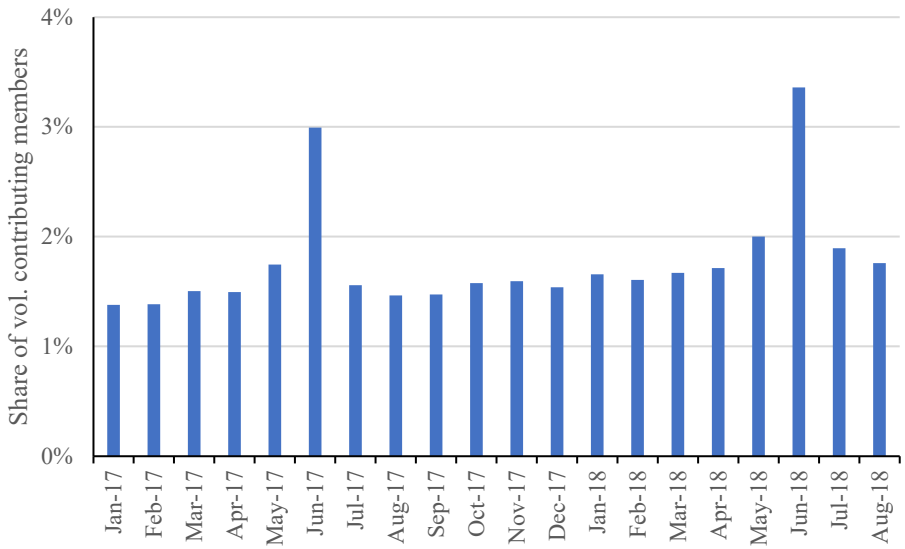
[18] This selectivity is reminiscent of findings presented in Bekaert et al. (2017), who show that individuals who seek online financial advice with regard to their 401(k) plans have higher-than-average salaries, and they are also more likely to hold well-diversified pension portfolios. However, the authors could not determine whether the differences in diversification were attributable to the selectivity or due to the advice itself.

employees can easily find out how much superannuation has been contributed by their employers in the given financial year and exactly how much more they could contribute before reaching the concessional cap.

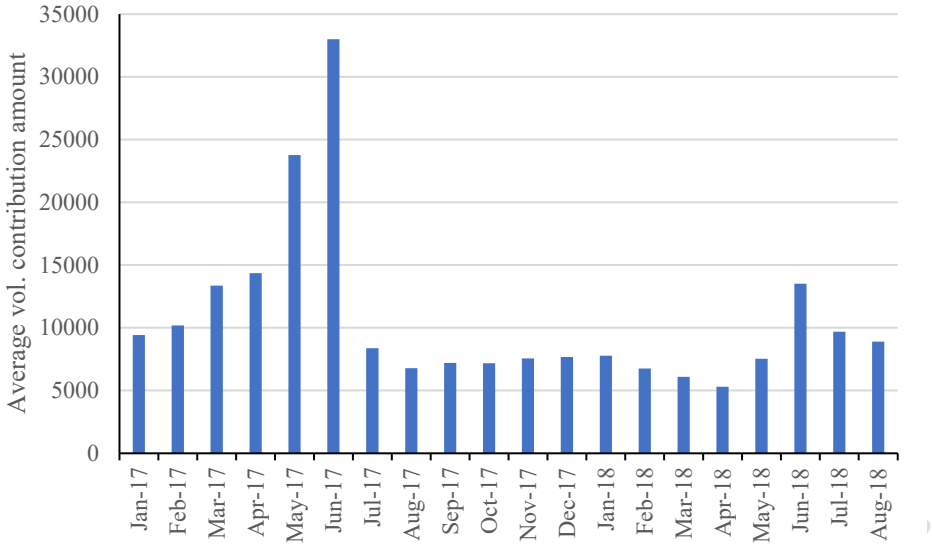
Figure 2 illustrates these dynamics, plotting the monthly shares of contributing members (panel a), and the average amounts of their voluntary contributions (panel b) over the period of observation. The monthly voluntary contribution rates presented in the first panel are relatively low, with approximately 1.5% of fund members making voluntary contributions during the months that precede the end of the financial year, and 3% of fund members making voluntary contributions at the end of the financial year.

FIGURE 2: DYNAMICS OF VOLUNTARY SUPERANNUATION CONTRIBUTIONS

(a) Share of members who made a voluntary contribution in a given month



(b) Average voluntary contribution amount (excluding zeros)



Notes: Authors' estimates of monthly contribution shares and average contribution amounts (including zeros) in the full dataset of fund members, irrespective of their invitation to the seminar.

In the second panel, we see that the first spike of voluntary contribution amounts is considerably larger than the second spike. This is likely due the stock market downturn which occurred in the first half of 2018. The largest component of the default superannuation investment portfolio is international shares, which may have discouraged some members from making larger contributions amidst the downturn.

The contribution spikes at the end of the two financial years also allow us to demonstrate the effects of retirement seminars on fund members' contribution behavior. In Figure 3, we plot the end-of-the-financial-year contribution rates of fund members who attended the seminar in the financial year 2017 and fund members who attended the seminar in the financial year 2018.

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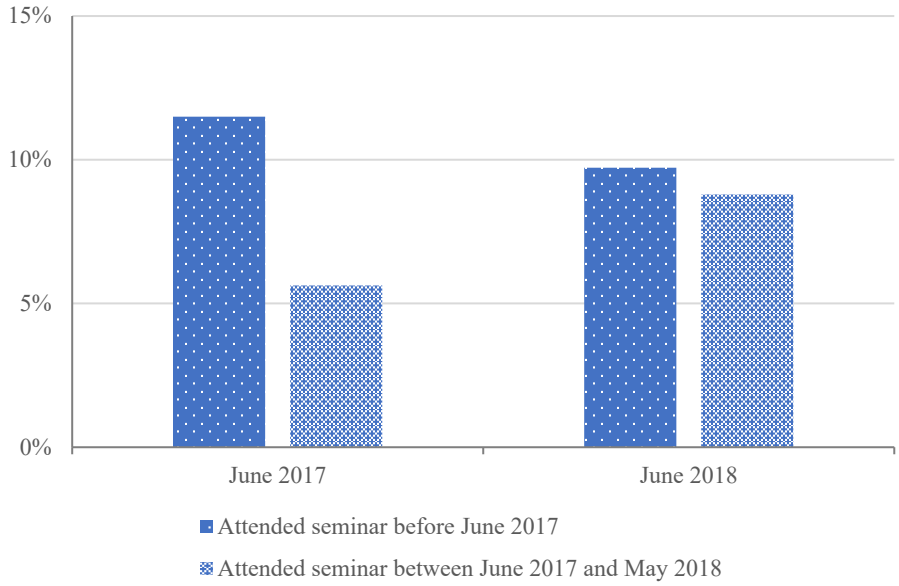
FIGURE 3: SHARES OF SEMINAR ATTENDEES WHO MADE A VOLUNTARY CONTRIBUTION AT THE END OF THE FINANCIAL YEAR



Notes: Authors' estimates of monthly voluntary contribution shares in the subsample of fund members who attended the seminar either between January 2017 and May 2017, or between June 2017 and May 2018.

In June 2017, only the first group has been exposed to the seminar information, which reflects in a large disparity between the two contribution rates: The members who had already attended the seminar are twice as likely to make a voluntary contribution as the members who had not. By June 2018, both groups have been exposed to the seminar information and we observe that the disparity between the two contribution rates disappears. These dynamics suggest that the retirement seminars have a sizable positive effect on the contribution behavior of seminar attendees.

5. ECONOMETRIC MODEL

To estimate the effects of attending a retirement seminar on positive retirement behaviors, we leverage the panel dimension of our data and estimate a series of fixed effects models. The specification of our models is as follows.

$$y_{it} = \alpha_i + \boldsymbol{x}_{it}^{'}\boldsymbol{\beta} + \varepsilon_{it}, i = 1, \ldots, N, t = 1, \ldots, T,$$

where y_{it} is the outcome of interest for individual i observed in month t. The term α_i denotes individual time-invariant characteristics, $\boldsymbol{x}_{it}^{'}\boldsymbol{\beta}$ corresponds to the product of (the vectors of) individual time-varying characteristics and the corresponding regression coefficients, and ε_{it} is an error term which is assumed to be i.i.d. Since we use a fixed-effects model specification, we do not have to impose any assumptions on the distribution of individual time-invariant characteristics and their correlation structure. This alleviates problems stemming from the fact that we do not observe many socio-economic characteristics that might be influencing positive retirement behaviors (such as educational attainment or family structure).

The outcome variables y_{it} include the decision to make a voluntary contribution (binary), the amount of voluntary contributions (in AUD, nominal), the choice of a non-default investment portfolio (binary), the weighted risk profile of the investment portfolio (in terms of investment time frame), and the active use of members' online account (binary).

Regression coefficients $\boldsymbol{\beta}$ are identified through within-person variation of covariates $\boldsymbol{x}_{it}$. These enter the model in the following form,

$$\begin{aligned}\boldsymbol{x}_{it}^{'}\boldsymbol{\beta} = \beta_0 + \beta_1 SQ1_{it} + \beta_2 SQ2_{it} + \beta_3 SQ3_{it} + \beta_4 SQ4_{it} + \beta_5 SQ5plus_{it} \\ + \beta_6 SEofy17_{it} + \beta_7 SEofy18_{it} \\ + \beta_5 age_{it} + \beta_6 age_{it}^2 + \beta_7 \log(earnings)_{it} + \lambda_t.\end{aligned}$$

We expect the effect of seminar attendance to be time-dependent, which is why we use several dummy variables to capture it. The first dummy variable ($SQ1$) captures the immediate effect of attending the seminar, being equal to one in the first three months following the date of attendance, and zero otherwise. We use a three-month measure, because it can take up to three

months for a voluntary contribution to be recorded in the system (if companies make contributions quarterly). The medium-run effects are captured by dummy variables $SQ2$, $SQ3$ and $SQ4$, which equal to one in the consecutive three-month segments of the first year following the seminar attendance, and zero otherwise. The dummy variable $SQ5plus$ approximates the effects during the second year following the seminar attendance, being equal to one if the fund member attended the seminar more than 12 months ago.[19]

As demonstrated in Section 4, voluntary contributions spike at the end of the financial year, and it can be expected that the seminar attendance may influence people's decisions in this focal month as well. To capture these effects, we use dummies $SEofy17$ and $SEofy18$ which correspond to the seminar effects at the end of the financial years 2017 and 2018.[20] The other covariates entering our models include quadratic age polynomial, logarithm of annual earnings, and monthly time dummies.

In terms of the sample selection, we estimate our baseline models using the sample of seminar attendees. The identification in our models comes from the fact that different attendees have been exposed to the seminar information at different times. This means that, at any given time, the fund members who are yet to attend their seminar act as a *de-facto* control group for the fund members who have already attended. The future seminar attendees constitute an ideal control group, because they are well matched with the past attendees on both their observed and unobserved characteristics, and they are largely unaware of the seminars' existence. This means that their behavior can be used as a valid counterfactual to the behavior of those who have been

[19] We have decided to approximate the effects during the second year by a single dummy because the number of seminar attendees whose post-seminar activities are tracked for more than 12 months is relatively low.
[20] The dummies equal to one if the fund member who is observed at the end of the respective financial years has already attended the retirement seminar, and zero otherwise.

already exposed to the seminar information.[21] To assess the robustness of our results, we also estimate a DiD model using the full sample of seminar invitees, and an FE model using an expanded sample that includes both seminar attendees and a sample of non-invitees who were matched with attendees on their observable characteristics.

Additional models are estimated to assess: the cumulative effects of seminar attendance on the voluntary contribution and portfolio allocation behaviors; long-run persistence of the voluntary contribution effects; sensitivity to the functional form assumptions; and the heterogeneity with respect to the contribution withdrawal behavior. These models will be discussed later in the text.

6. RESULTS

6.1. Baseline results

The coefficient estimates corresponding to our baseline models of positive retirement behaviors are presented in Table 4. Column 1 lists the estimates for the binary decision to make voluntary superannuation contributions. We see that attending the seminar has a significant immediate effect on voluntary contributions. Within the first three months following the seminar, the monthly voluntary contribution rate increases by 1.1 percentage points (p.p.) or 32% in relative terms (the pre-seminar rate of monthly voluntary contributions is 3.3%). Significant effects also appear 7-9 months after the seminar, and at the ends of the two financial years. The largest effect is recorded at the end of the financial year 2017, at which point the monthly contribution rate

[21] Here we should reiterate that the timing of individual seminars depended on external factors, which means that there may have been differences between the observed and unobserved characteristics of fund members attending the seminars at different points in time. Without controlling for individual fixed effects, these differences could confound our seminar effect estimates. To see whether this is the case, we estimated a series of OLS regression models which yielded seminar effects slightly larger than the ones corresponding to our favored FE specification, although the differences were not statistically significant. We decided to err on the side of caution and rely on the specification which is less vulnerable to confounding.

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increased by 2.7 p.p. (38% in relative terms).

Column 2 lists the estimates for the monthly voluntary contribution amounts. We see that attending the seminar leads to a significant increase in voluntary contributions in the three months following the seminar. The outcomes are measured monthly, which means that the seminar stimulated \$2,522.4 (840.8 × 3) over the first three months following the seminar. The coefficients corresponding to the medium-run effect are not statistically significant, however we do see significant effects reappearing at the ends of the two financial years, with the 2017 effect amounting to \$7,888, and the 2018 effect amounting to \$1,663. The smaller magnitude of the latter effect could be attributed to various factors, including the weak stock market in 2018, lower level of disposable funds resulting from previous voluntary contributions, or decreasing salience of retirement information among fund members who attended the seminar in 2017.

Next, we turn to the asset allocation decisions. Columns 3 and 4 list the estimates for the choice of the non-default investment portfolio, and for the weighted risk profile of the chosen portfolio. Also, in this case, the seminars are shown to foster desired retirement behaviors. Unlike the effects on voluntary contribution decisions, the effects on portfolio allocation grow over time. This is to be expected, since the importance of risk management rises as fund members get closer to the age of retirement.[22] One year after the seminar, the share of seminar attendees opting for the non-default investment portfolio is raised by 4 p.p. (33% in relative terms). In line with this change, the risk profile of the maintained portfolios falls by 0.24.

[22] To provide further empirical evidence in support of this argument, we estimate an auxiliary specification of the model in which we interact the seminar effects with the ages of the attendees. We find that fund members below 60 years of age do not adjust their portfolio holdings in response to the seminar. The seminar effects are concentrated among members aged 60-65, falling somewhat in magnitude among members who are older than that.

TABLE 4: BASELINE REGRESSION RESULTS

Variable label	Variable name	(1) Made Vol. Contribution	(2) Vol. Contribution Amount	(3) Non-default Investment Option	(5) Investment Risk Profile	(5) Online User
1-3 months after seminar	*SQ*1	0.011***	840.8***	0.012***	-0.043***	0.020***
		(0.003)	(312.6)	(0.002)	(0.016)	(0.003)
4-6 months after seminar	*SQ*2	0.004	-15.5	0.024***	-0.119***	0.027***
		(0.003)	(341.0)	(0.002)	(0.017)	(0.003)
7-9 months after seminar	*SQ*3	0.008**	206.6	0.030***	-0.135***	0.025***
		(0.004)	(399.5)	(0.002)	(0.020)	(0.004)
10-12 months after seminar	*SQ*4	0.003	425.4	0.038***	-0.183***	0.030***
		(0.004)	(454.8)	(0.003)	(0.023)	(0.004)
More than 12 months after seminar	*SQ5plus*	0.001	221.1	0.040***	-0.242***	0.035***
		(0.005)	(539.9)	(0.003)	(0.027)	(0.005)
End of financial year 2017 after seminar	*SEofy*17	0.027***	7,888.2***	-0.005	0.008	-0.002
		(0.007)	(740.6)	(0.004)	(0.038)	(0.007)
End of financial year 2018 after seminar	*SEofy*18	0.013**	1,663.9**	0.003	0.027	0.004
		(0.007)	(667.0)	(0.004)	(0.034)	(0.006)
Log earnings	log(*earnings*)	0.005	559.6	0.007***	0.021	-0.009**
		(0.005)	(481.5)	(0.003)	(0.024)	(0.005)
Age	*age*	0.032*	666.9	0.019*	0.365***	-0.053***
		(0.018)	(1,795.6)	(0.010)	(0.091)	(0.017)
Age squared	age^2	-0.001*	-3.2	-0.001*	-0.003***	0.001***
		(0.000)	(14.5)	(0.000)	(0.001)	(0.000)
Constant	-	-1.068*	-34,542.7	-0.383	-1.775	2.282***
		(0.561)	(56,721.1)	(0.329)	(2.881)	(0.546)
Monthly Time Dummies		✓	✓	✓	✓	✓
Observations		38,739	38,739	38,739	38,739	38,739
R-squared		0.015	0.005	0.027	0.009	0.032
Number of members		2,215	2,215	2,215	2,215	2,215

Notes: Coefficients from fixed-effects models of monthly contribution behavior and other engagement with the pension account. Estimation sample consists of fund members who have attended a retirement seminar in years 2017 or 2018. Robust standard errors in parentheses.
Significance: *** p<0.01, ** p<0.05, * p<0.1

In column 5 of Table 4, we show that the seminar attendees become more likely to interact with the superannuation funds' online portal. Similar to the asset allocation outcomes, the engagement effect grows over time, with the share of online users increasing by 3.5 p.p. (5% in relative terms) over the period of observation.[23]

6.2. Overall effects of the seminar attendance

The results presented in Table 4 indicate that attending the retirement seminar induces the fund members to increase their monthly voluntary contributions. To quantify the total amount of contributions induced by the seminar, we estimate a model of cumulative voluntary contributions recorded within the span of our data. The set of covariates corresponding to this model excludes the $SEofy17$ and $SEofy18$ dummies, because we are primarily interested in the growth of the total contribution amount over the period of observation. The results corresponding to this model are presented in column 1 of Table 5. The cumulative seminar effects are shown to be increasing over time, reaching \$15,259 during the second year following the seminar attendance. This is a large effect, representing approximately 6% of the superannuation balances held by the attendees.

We also consider the cumulative effect of retirement seminars on portfolio risk. Table 4 shows that the attendees are likely to lower the riskiness of their portfolios in response to the seminar, which is at least partially attributable to the fund members abandoning the default investment option. However, members who already hold non-default portfolios may respond to the seminars

[23] We note that the goodness of fit of across our models is rather low. This is a consequence of the irregular nature of our outcomes of interest. To illustrate, relatively few fund members make regular monthly contributions to their superannuation accounts. The majority of contributing fund members make irregular contributions once or twice per year, which means that the monthly incidence of their contributions will be subject to variation that cannot be easily explained by the covariates. Similar reasoning applies to the other outcomes of interest.

as well, which is why we estimate an additional model of portfolio allocation which accounts for both types of responses. We use an outcome variable equal to one if the fund member made any change to their initial portfolio (as observed in January 2017), and zero otherwise.

TABLE 5: REGRESSION MODELS CORRESPONDING TO THE OTHER OUTCOMES OF INTEREST

Variable label	Variable name	(1) Voluntary contribution amount (cumulative)	(3) Changing the initial portfolio
1-3 months after seminar	*SQ*1	3,023.7***	0.017***
		(513.9)	(0.004)
4-6 months after seminar	*SQ*2	6,176.2***	0.038***
		(575.6)	(0.004)
7-9 months after seminar	*SQ*3	8,214.2***	0.058***
		(676.4)	(0.005)
10-12 months after seminar	*SQ*4	10,559.7***	0.073***
		(768.0)	(0.005)
More than 12 months after seminar	*SQ5plus*	15,258.9***	0.089***
		(899.4)	(0.006)
Log earnings (cumulative)	log(*earnings*)	6,566.2**	0.085***
		(3,045.0)	(0.021)
Age	*age*	-56.1**	-0.001***
		(24.5)	(0.000)
Age squared	age^2	2,890.8***	0.028***
		(729.0)	(0.005)
Constant	-	-21,884.1**	-2.689***
		(9,433.3)	(0.662)
Monthly Time Dummies		✓	✓
Observations		38,739	38,739
R-squared		0.001	0.097
Number of members		2,215	2,215

Notes: Coefficients from fixed-effects models of fund members' retirement behaviors. Estimation sample consists of fund members who have attended a retirement seminar in 2017 and 2018. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

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The results (presented in column 3 of Table 5) show that the share of fund members changing their initial portfolio in response to the seminar reaches 6.4 p.p. during the second year following the date of attendance. This means that the responses of fund members with non-default initial portfolios account for 38% (2.4 p.p.) of the overall portfolio allocation response. With this information, we can also compute the average risk reduction per portfolio change induced by the seminar, which equals to 3.7 years (40% of the average investment time frame).

6.3 Models using expanded samples of fund members

The estimation sample for our baseline models consists of seminar attendees only. This sample restriction limits the scope for confounding, however a potential issue with this approach is that the control group of future attendees thins out as we approach the end of our observation period. By then, most attendees have already participated in the seminar, which means that they entered the 'treatment group' of past attendees. This could pose a problem for consistent estimation of the time dummy coefficients corresponding to this period, and that could in turn distort our seminar effect estimates.

To see whether these concerns are justified, we leverage the rest of our data and estimate alternative models of positive retirement behaviors using expanded estimation samples. The first model uses a coarsened exact matching (CEM) procedure to expand our baseline estimation sample of attendees by a matched sample of non-invited fund members. The matching variables are age, salary and initial superannuation balance. For every seminar attendee, we randomly select two non-invitees with matching observable characteristics, yielding a sample of 6,461 fund

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members.[24] With this expanded sample, we re-estimate our baseline models of positive retirement behaviors. The matched sample of non-invitees becomes part of the 'control group', helping us to consistently estimate the regression coefficients corresponding to the time dummies and other control variables. The estimates of seminar effects corresponding to the model of voluntary contribution amounts are presented in the second column of Table 6. The first column lists the estimates corresponding to our baseline specification. We see that the estimates are largely unaffected by the sampling change. The seminar effect at the end of the financial year 2018 becomes slightly larger, however it is not significantly different from the baseline model estimates. The coefficient estimates for the other outcomes of interest are presented in Appendix Table A3a, and they are also similar to the baseline model estimates.[25]

The second model we consider is a DiD model which uses the full sample of seminar invitees. Unlike our baseline specification, the composition of the treatment group and the control group in the DiD model is fixed over time; the treatment group consists of fund members who did attend the seminar, and the control group consists of fund members who did not. The specification of the model is as follows,

$$y_{it} = \alpha_i + \boldsymbol{x}_{it}^{'}\boldsymbol{\beta} + \varepsilon_{it}, i = 1, \ldots, N, t = 1, \ldots, T,$$

$$\boldsymbol{x}_{it}^{'}\boldsymbol{\beta} = \beta_1 SQ1_{it} + \beta_2 SQ2_{it} + \beta_3 SQ3_{it} + \beta_4 SQ4_{it} + \beta_5 SQ5plus_{it} + \beta_6 SEofy17_{it} + \beta_7 SEofy18_{it} +$$
$$att_i * (\gamma_1 SQ1_{it} + \gamma_2 SQ2_{it} + \gamma_3 SQ3_{it} + \gamma_4 SQ4_{it} + \gamma_5 SQ5plus_{it} + \gamma_6 SEofy17_{it} + \gamma_7 SEofy18_{it}) +$$
$$+ \beta_5 age_{it} + \beta_6 age_{it}^2 + \beta_7 \log(earnings)_{it} + \lambda_t.$$

[24] We sample the non-invited fund members without replacement, meaning that the matched sample consists of unique fund members. For 92 seminar attendees we were able to retrieve only one matched non-invited fund member.

[25] We note that the CEM techniques can also prove very useful for analyses of financial education which lack (quasi) experimental variation in the studied policy. In Appendix Section A1 we trim our data to simulate this type of empirical design, and we show that the CEM techniques can be successfully deployed to counter the omitted variable bias stemming from positive selection into seminar attendance.

TABLE 6: RESULTS CORRESPONDING TO ALTERNATIVE MODELLING SPECIFICATIONS

Variables	Voluntary contribution amount		
	(1) Baseline specification	(2) CEM specification	(3) DiD specification
1-3 months after seminar	840.8***	842.4***	693.7*
	(312.6)	(234.9)	(369.9)
4-6 months after seminar	-15.5	13.8	-273.1
	(341.0)	(242.4)	(284.9)
7-9 months after seminar	206.6	183.8	-152.6
	(399.5)	(275.6)	(289.9)
10-12 months after seminar	425.4	447.7	151.8
	(454.8)	(305.3)	(405.0)
More than 12 months after seminar	221.1	304.3	-51.6
	(539.9)	(348.8)	(440.5)
End of financial year 2017 after seminar	7,888.2***	7,791.2***	7,778.1***
	(740.6)	(541.2)	(2,463.7)
End of financial year 2018 after seminar	1,663.9**	2,072.9***	2,379.4***
	(667.0)	(401.5)	(692.8)
Monthly time dummies	✓	✓	✓
Age and income controls	✓	✓	✓
Observations	38,739	2,799,531	2,799,531
R-squared	0.005	0.006	0.006
Number of members	2,215	167,330	167,330

Notes: Coefficients from fixed-effects models of voluntary contribution amounts. Estimation sample for the baseline specification consists of fund members who attended a retirement seminar in 2017 or 2018. Estimation sample for the CEM specification expands the baseline sample by a matched sample of fund members who were not invited to the seminar over the period of observation. Estimation sample for the DiD specification consists of fund members who were invited to retirement seminar in 2017 or 2018. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

The DiD model includes the original set of dummies capturing the seminar effects at different points in time, as well as the same set of dummies interacted with the dummy att_i (equal to one if the fund member attended the seminar, and zero otherwise). This means that the original set of coefficients β_1- β_7 captures the 'placebo seminar effects' on invitees who did not attend the seminar, and the set of coefficients γ_1- γ_7 captures the seminar effects on attendees. Similar to our baseline specification, we also control for age, log(earnings), monthly time dummies, and individual fixed effects.

We note that the DiD model is subject to one limitation. That is, the control group of non-attendees may be also exposed to the seminar information through information spillovers and invitation effects. The former channel denotes the situation in which seminar attendees share information with their non-attendee friends or spouses, and the latter channel denotes the situation in which the invitation itself nudges some non-attendees into searching for relevant information. Accordingly, we might expect positive seminar effects even among the control group. The seminar effects (γ_1- γ_7) corresponding to the DiD model of voluntary contribution amounts are presented in Column 3 of Table 6. Also, in this case, we see that the results are largely comparable to the baseline specification. The only marginal difference is that the DiD model predicts slightly weaker effects during the first three months following the seminar, and slightly stronger effects at the end of the financial year 2018. Neither of these is, however, significantly different from the baseline model estimates. Appendix Table A3b lists the full sets of results for each of the DiD models. We see some evidence of placebo seminar effects on non-attendees, but these are an order of magnitude lower than the seminar effects on attendees.

6.4 Sensitivity Analyses

The CEM and DiD results bolster our conviction that the regression coefficients presented throughout this paper capture the causal estimates of seminar effects on the positive retirement behaviors of attending fund members. In this subsection, we subject our models to additional sensitivity checks to explore the robustness of our results.

First, we estimate a model of voluntary contribution amounts that uses log contribution amounts instead of nominal contribution amounts (Column 1 of Appendix Table A4). The resulting seminar effects are qualitatively similar to the baseline estimates. Second, we evaluate the

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persistence of the seminar effects on voluntary contribution amounts, using a model which splits the $SEofy18$ dummy into two dummies, one for members who attended the seminar within the given financial year (2018), and one for those who attended the seminar in the previous financial year (2017). Coefficient estimates presented in Column 2 of Appendix Table A4 indicate that the members who attended the seminar more than a year ago increase their contributions just as much as the members who attended the seminar within the given financial year. These results suggest that the seminar effects are persistent, which means that the cumulative contribution effects are likely to grow beyond our period of observation. Furthermore, they suggest that the smaller magnitude of the $SEofy18$ effect is likely to be a consequence of the weak stock market, rather than the lower levels of fund members' disposable funds or information salience. Columns 3 and 4 of Appendix Table A3 show the estimates of the contribution behavior for a sample which excludes members who have taken out any amount of superannuation during the period of observation. Our results remain largely the same, suggesting that the additional savings made after attending the seminar are likely to increase fund members' superannuation balances at retirement.

Next, we re-estimate our baseline models with alternative sample selection criteria. We estimate the baseline models using a sample that excludes attendees whose seminars took place outside of the observation period (after August 2018). The coefficient estimates presented in Appendix Table A5 are comparable to our baseline model estimates. We also estimate the baseline models using a restricted sample that excludes attendees who have been registered as active online users prior to attending the seminar. The coefficient estimates presented in Appendix Table A6 show that positive seminar effects manifest even among those fund members who were not actively engaging with the fund prior to the seminar. The effects on the contribution behavior are less

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pronounced than the baseline estimates, the effects on the investment decisions are comparable to the baseline estimates, and the effect on the decision to become active online user are more pronounced than the baseline estimates.

7. Discussion

The landscape of retirement is changing. Many countries are currently transitioning from state-based pension systems to individual retirement saving schemes, and this transition poses new challenges for savers and policy makers alike. Individualized accounts grant savers more flexibility, allowing them to pursue tailored retirement saving strategies that account for the savers' personal goals, risk attitudes, and other circumstances. However, this flexibility comes with a cost. Choosing among the available strategies requires high levels of financial sophistication, and savers who lack financial literacy and institutional knowledge may find themselves using severely suboptimal strategies. Reflecting these challenges, one of the imperative goals of national retirement policies should be to provide savers with a comprehensive financial education.

In this paper, we have evaluated whether pension funds are able to play an active role in this regard. First, we have established that the pension funds are uniquely placed among the common providers of financial education and retirement advice. This is because they have strong institutional knowledge, access to large pools of clients, and they have vested interests in stimulating retirement savings. This unique positioning was confirmed by our analysis of the HILDA survey, in which we have shown that Australian pre-retirees often seek retirement advice from the superannuation (*i.e.,* pension) funds, and we have established that the receipt of this information is associated with positive retirement behaviors (making voluntary pension

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contributions). These results, albeit associational, were suggestive of the positive effects of fund-administered financial education on retirement behaviors.

To obtain causal estimates of these effects, we turned to a quasi-experimental analysis of the large-scale retirement seminar program administered by one of Australia's biggest superannuation funds. Using an administrative dataset of the fund members' monthly activities, we have shown that the seminar attendance promotes a range of positive retirement behaviors, including voluntary pension contributions, portfolio risk management, and active engagement with the pension fund.

Over the 20-month window of observation, the retirement seminars induce additional pension contributions of $15,259 per seminar attendee, which equals to 6% of their pre-seminar superannuation balances. If the seminar effects prove to be persistent (as suggested by our sensitivity analyses), this figure will grow further. But even without accounting for the possible persistence, the additional savings are meaningful due to the accrued interest and tax benefits. To illustrate, a 62-year-old seminar attendee would see the savings induced by the seminar increase to $22,713 by the time they retire.[26] The attendee will also gain additional tax savings of $3,142 if the contributions were made before tax. The total amount of induced retirement savings among the studied group of seminar attendees is $50.6 million, with an expected surplus in wealth of up to $23.6 million for the attendees. The superannuation fund is also a net benefactor of the

[26] We assume that the member earns average salary for their age and retires upon reaching the retirement age (67). The calculation uses the long-term average investment returns of the default investment option (9.4% as of 30 June 2020). In addition, we assume current administration fees, investment fees, taxes and insurance fees.

program: The seminars cost approximately $36 per attendee, which can be compared to a yearly additional revenue of $101 per attendee from the asset fees.[27]

Apart from contributing more to their superannuation accounts, the seminar attendees also become more likely to use sophisticated asset allocation strategies, lowering the risk of their portfolio holdings as they near the point of their retirement. More than six percent of attendees are prompted to change their investment portfolios already within the 20-month span of our data, substantially reducing the overall risk of their superannuation assets. The seminar attendees also become more likely to become active users of the funds' online portal, which allows them to track their superannuation holdings and get further financial education and advice.

Our results are broadly consistent with the literature, although it should be noted that differences in institutional features, sample composition, and modelling assumptions inevitably complicate such comparisons. Using firm-level variation in the provision of retirement seminars, Bayer, Bernheim and Scholz, (2009) show that American workers whose employers often organize retirement seminars make retirement contributions that are nearly 20% larger than the contributions of workers who do not have such opportunities. This can be interpreted as an intention-to-treat (ITT) estimate since the data did not indicate whether the employees actually participated in these seminars. Our findings point towards a smaller increase: over the period of observation, the seminars administered by the superannuation fund induced $15,259 in voluntary contributions per seminar attendee, which translates to $203 per seminar invitee. To compute the ITT effect, we divide the contribution effect per invitee by the average contribution amount over the same period ($3,794). Using this back-of-the-envelope calculation, we conclude that the fund

[27] The asset fees correspond to 0.66% of induced contributions. Other associated fees and economies of scale are likely to make the return-to-investment ratio even higher

members who had the opportunity to participate in the retirement seminar (invitees) raised their contributions by 5% compared to those who did not have such opportunity (non-invitees). The smaller ITT effect compared to Bayer, Bernheim and Scholz (2009) may be attributed to the fact that the seminars administered by the superannuation fund were probably less attended (since they were not held at the workplace). Alternatively, Gale, Harris and Levine (2012) point to the potential upward biases of seminar effects in the studies exploiting non-experimental firm-level variation, arguing that the higher-contributing workers may sort themselves into firms which provide retirement seminars and other non-pecuniary benefits for their employees.

The RCT study of Goda, Manchester and Sojourner (2014) shows that providing university employees with retirement information leaflets yielded an $83 increase of their contributions. Duflo and Saez (2003) show that incentivizing employees to attend a benefit-information fair increased retirement plan participation by 1.25 percentage points. Our treatment effects are larger, both in terms of the contribution amounts and contribution rates. This may be related to the fact that specialized retirement seminars provide attendees with more detailed and actionable information compared to the benefit fairs and leaflet campaigns.

Lusardi (2004) shows that the financial net worth of senior survey respondents who have attended a financial education seminar is 18% higher than the financial net worth of senior respondents who have not done so. Our models show that the seminar attendance raises the pre-seminar superannuation balances of seminar attendees by 6%. This cumulative effect is likely to grow in the following years, although it remains to be seen whether it can raise the balances to the extent reported by Lusardi (2004).

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Finally, Clark et al. (2010) show that 37% of seminar attendees indicate they would increase contributions to the plan after attending the seminar. Our findings suggest that this claim is, at least in the Australian context, somewhat optimistic. The baseline voluntary contribution rate in the sample of attendees is approximately 12%. The seminars were shown to induce retirement contribution from another 9% of attendees. This means that the rate of intended contributions reported by Clark et al. (2010) would not be attained even if all contributing attendees were to increase their contributions amounts.

In summary, the magnitudes of the voluntary contribution effects presented in our paper are smaller than the associations found by survey-based studies, but larger than the causal effects found by smaller and non-representative experimental studies. The former comparison echoes the omitted variable concerns raised by Collins and O'Rourke, (2010), whereas the latter bolsters the claim that pension funds are likely to be particularly effective providers of financial education and retirement advice. Another mechanism which may contribute to the larger causal effects is that the superannuation fund offered their retirement seminars to large and representative samples of clients. People in representative samples may benefit from financial education more than the university staff (studied by Duflo and Saez, 2003; and Goda, Manchester and Sojourner, 2014), and they are likely to have more disposable income than disadvantaged families (studied by Collins, 2013). The representativeness of the studied sample is also likely to prove useful for future comparisons of other large-scale financial education interventions.

Several limitations need to be acknowledged. First, one of our key contributions is to evaluate the impact of a large-scale retirement education program that was offered to a nationally representative sample of pre-retirees in Australia. However, an inevitable consequence of this is

that the seminar effects presented in this paper are attributable to the subset of pre-retirees who decided to attend the seminars. The advantage of this empirical design is that it is shared with most studies of financial education, which facilitates the comparison of our findings to the findings of earlier studies. The disadvantage is that we cannot easily extrapolate the effects of seminar attendance to the broader population of Australian pre-retirees. We have shown that the group of seminar attendees is highly selective in terms of their observable characteristics, and this selectivity is likely influencing the magnitude of the seminar effects. One possible consequence of this selectivity is that the financial education is not provided to the fund members who need it the most, implying that we would observe larger treatment effects if we exposed all pre-retirees to the same seminar information. However, the opposite might be the case as well. The seminar attendees might be more responsive to the seminar information because they are less likely to qualify for partial or full state-based pension (due to their higher wealth), and so their voluntary pension behaviors have greater influence on their ability to maintain their living standards in retirement. Other empirical designs are needed to uncover the unconditional effects of financial education. Second, it should be noted that that not everyone should be expected to change their behavior after seminar attendance. Some fund members may be already contributing enough to their retirement accounts, and other fund members may be better off repaying their high-interest consumer debts before they start thinking about voluntary pension contributions.

Finally, we note that the retirement seminar program may be adjusted to yield even larger effects on positive retirement behaviors. The retirement seminars provided by the pension fund are typically targeted at fund members who are on the verge of retirement. It may be useful to target such education also at younger audiences. While younger audiences may have even less interest

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in the topic of retirement, small actions taken early can result in big changes of their final retirement balances. For instance, if an average 40-year-old Australian were to save just $10 a week towards their superannuation, the total balance at the retirement age of 67 would be $48,000 higher (after taxes and fees, adjusting for inflation). As such, it is important for policy makers and pension funds to increase the engagement and interests in the topic of retirement among younger working-age population. A key challenge in this regard is to change the common thinking that the retirement planning is a problem only for old people. As evidenced by this paper, comprehensive retirement education programs administered by professionals who share common goals with the savers are likely to be extremely useful in this regard.

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APPENDIX

APPENDIX SECTION A1. EXAMPLE OF CEM TECHNIQUES IN CROSS-SECTIONAL EMPIRICAL DESIGNS.

In what follows we show that the CEM techniques can be effectively deployed in conventional cross-sectional studies of financial education to counter the omitted variable bias stemming from positive selection of people who seek financial education (Collins and O'Rourke, 2010). Indeed, summary statistics presented in Table 3 show that people who seek financial education (in our case seminar attendees) tend to earn more and save more even in the absence of financial education. This poses a clear identification problem for standard cross-sectional models, because the higher baseline saving rates of people who seek financial education will be falsely attributed to the fact that they sought financial education.

To illustrate this problem, we estimate a simplified OLS model of voluntary contributions using a trimmed version of our dataset of seminar invitees. In this artificial dataset, we ignore the panel dimension of the contribution records, assuming that the dataset is a repeated cross-section with different fund members observed at different times. The only indicator of seminar attendance in this dataset is a dummy $attended$, which equals to one if the fund member has attended the seminar prior to the point of observation, and zero otherwise.

The simplified OLS model has the following functional form,

$$VolCont_{it} = \beta_1\, attended_{it} + \beta_5 age_{it} + \beta_6 age_{it}^2 + \beta_7 \log(earnings)_{it} + \varepsilon_{it}.$$

The results corresponding to this model are listed in Column 1 of Appendix Table A7. The OLS model predicts that the seminar attendance increases voluntary contributions by $1230.2, which is an effect that is $235.5 higher than the causal effect predicted by the model presented in Column 2, which restricts the sample to seminar attendees and leverages the panel dimension

and variation in the timing of seminars to aid identification. This confirms that the cross-sectional OLS estimate is upward-biased due to the positive selection into seminar attendance. In order to reduce this bias, we can use matching. Matching techniques (such as the CEM) allow us to make the group of people who did not attend the seminar more comparable to the people who did. Similar to the CEM exercise discussed in the main text, the cross-section of seminar attendees is matched with the random sample of fund members who have not been invited to the seminar. The matching variables are age, salary, and initial superannuation balance. Using this matched sample, we re-estimate the OLS model, and we present the results in Column 3 of Appendix Table A7. The seminar effect corresponding to the matched model is $1004.9, nearly identical to the causal estimate. It is also statistically different from the biased OLS estimate.

We should note that the strengths of matching techniques depend on many factors, including the sample size, size of the matched group relative to the matching pool, number of matching variables, and also their precision. Our specific application benefited from a large sample of non-invitees which enabled us to match the small group of attendees on several variables with relatively narrow matching bins. Further, the administrative nature of the data ensured that our variables were measured with high degree of precision. Regardless, the results of this exercise suggest that the matching techniques can be an effective tool for countering selection bias, although its effectiveness is likely to depend on the underlying characteristics of the data.

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APPENDIX TABLE A1: FINANCIAL LITERACY QUESTIONS, HILDA SURVEY

1. If the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, would you be able to buy more/the same/less than today?
2. Do you agree with the following statement: Buying shares in a single company usually provides a safer return than buying shares in a number of different companies?
3. Suppose you put $100 into a no-fee savings account with a guaranteed interest rate of 2% per year. How much would be in the account at the end of the first year?
4. If by the year 2020 your income has doubled, but the prices of all of purchases have also doubled, will you be able to buy more/the same/less than today?
5. Do you agree with the following statement: An investment with a high return is likely to be high risk?

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TABLE A2: AVERAGE CHARACTERISTICS OF SEMINAR INVITEES AND NON-INVITEES AND DIFFERENCES BETWEEN THOSE TWO GROUPS

	(2) Invited	(3) Not invited	Difference (1) – (2)
Age	61.6	57.3	4.3***
Female	40.3%	40.9%	-0.7%***
Annual salary (gross)	$66,655	$64,283	2,371***
Superannuation balance	$111,803	$103,230	8,573***
Made at least one voluntary contribution in the past 12 months[1]	5.7%	5.5%	0.2%
Voluntary contribution amount (per non-zero contribution)	$13,346	$9,136	$4,210***
Default investment option	84.1%	84.1%	-0.0%
Investment time frame (years)	9.7	9.8	-0.1***
Online user	41.2%	39.4%	1.8%***
Number of fund members	167,330	87,000	

Notes: [1] for seminar invitees and attendees, we only use the information of fund members who were observed for 12 months or more prior to being invited to the seminar. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

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APPENDIX TABLE A3A: REGRESSION MODELS WITH AN EXPANDED MATCHED SAMPLE

Variables	(1) Made Contribution	(2) Contribution Amount	(3) Non-default Investment Option	(5) Investment Risk Profile	(5) Online User
1-3 months after seminar	0.012***	842.4***	0.012***	-0.032**	0.015***
	(0.002)	(234.9)	(0.001)	(0.014)	(0.003)
4-6 months after seminar	0.005*	13.8	0.022***	-0.100***	0.020***
	(0.003)	(242.4)	(0.001)	(0.014)	(0.003)
7-9 months after seminar	0.011***	183.8	0.028***	-0.108***	0.016***
	(0.003)	(275.6)	(0.002)	(0.016)	(0.003)
10-12 months after seminar	0.006*	447.7	0.036***	-0.151***	0.020***
	(0.003)	(305.3)	(0.002)	(0.018)	(0.004)
More than 12 months after seminar	0.005	304.3	0.037***	-0.204***	0.024***
	(0.004)	(348.8)	(0.002)	(0.020)	(0.004)
End of financial year 2017 after seminar	0.037***	7,791.2***	-0.004	0.001	-0.000
	(0.006)	(541.2)	(0.003)	(0.032)	(0.006)
End of financial year 2018 after seminar	0.026***	2,072.9***	0.002	0.004	0.004
	(0.004)	(401.5)	(0.002)	(0.023)	(0.005)
Log Income	0.018**	743.4	0.011**	0.129**	-0.001
	(0.009)	(861.1)	(0.005)	(0.050)	(0.010)
Age	-0.000**	-5.8	-0.000**	-0.001***	0.000
	(0.000)	(6.9)	(0.000)	(0.000)	(0.000)
Age Squared	-0.002	492.8**	0.003**	0.014	0.006**
	(0.002)	(236.9)	(0.001)	(0.014)	(0.003)
Constant	-0.496*	-28,601.4	-0.091	5.724***	0.513
	(0.286)	(27,251.3)	(0.154)	(1.589)	(0.319)
Monthly Time Dummies	✓	✓	✓	✓	✓
Observations	114,410	114,410	114,410	111,870	114,410
R-squared	0.010	0.005	0.018	0.005	0.028
Number of members	6,461	6,461	6,461	6,375	6,461

Notes: Models were estimated using the baseline sample of fund members who have attended a seminar in years 2017 and 2018, and a matched sample of fund members who were not invited to the seminar. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

APPENDIX TABLE A3B: REGRESSION MODELS USING A DID SPECIFICATION

Variables	(1) Made Contribution	(2) Contribution Amount	(3) Non-default Investment Option	(5) Investment Risk Profile	(5) Online User
1-3 months after seminar	-0.001**	-48.5***	0.000**	-0.005**	0.004***
	(0.000)	(18.2)	(0.000)	(0.002)	(0.000)
4-6 months after seminar	0.000	30.2	0.001***	-0.009***	0.005***
	(0.000)	(19.7)	(0.000)	(0.003)	(0.001)
7-9 months after seminar	0.000	33.8	0.002***	-0.016***	0.006***
	(0.000)	(22.0)	(0.000)	(0.004)	(0.001)
10-12 months after seminar	-0.001**	-19.3	0.003***	-0.017***	0.004***
	(0.000)	(24.4)	(0.000)	(0.005)	(0.001)
More than 12 months after seminar	-0.001	39.9	0.004***	-0.025***	0.004***
	(0.001)	(31.2)	(0.001)	(0.006)	(0.001)
End of financial year 2017 after seminar	0.005***	480.1***	-0.000	0.009***	-0.003***
	(0.001)	(119.7)	(0.000)	(0.003)	(0.001)
End of financial year 2018 after seminar	0.001	65.2**	-0.000	0.000	-0.001
	(0.001)	(33.3)	(0.000)	(0.002)	(0.001)
1-3 months after seminar * attended	0.011***	693.7*	0.013***	-0.034	0.014***
	(0.004)	(369.9)	(0.004)	(0.028)	(0.005)
4-6 months after seminar * attended	0.002	-273.1	0.024***	-0.097***	0.019***
	(0.004)	(284.9)	(0.005)	(0.036)	(0.006)
7-9 months after seminar * attended	0.008*	-152.6	0.030***	-0.103**	0.015**
	(0.005)	(289.9)	(0.006)	(0.041)	(0.007)
10-12 months after seminar * attended	0.004	151.8	0.038***	-0.142***	0.023***
	(0.005)	(405.0)	(0.007)	(0.049)	(0.008)
More than 12 months after seminar * attended	0.003	-51.6	0.039***	-0.187***	0.030***
	(0.006)	(440.5)	(0.008)	(0.061)	(0.010)
End of financial year 2017 after seminar * attended	0.045***	7,778.1***	-0.004	0.005	0.001
	(0.012)	(2,463.7)	(0.004)	(0.032)	(0.005)
End of financial year 2018 after seminar * attended	0.040***	2,379.4***	0.002	-0.004	0.006
	(0.008)	(692.8)	(0.002)	(0.021)	(0.004)

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Log Income	0.006***	52.4**	0.003***	0.011*	0.011***
	(0.002)	(23.8)	(0.001)	(0.007)	(0.004)
Age	-0.000***	-0.4**	-0.000***	-0.000*	-0.000**
	(0.000)	(0.2)	(0.000)	(0.000)	(0.000)
Age Squared	-0.001**	74.9	0.003***	0.002	0.009***
	(0.001)	(46.4)	(0.001)	(0.008)	(0.002)
Monthly Time Dummies	✓	✓	✓	✓	✓
Observations	2,799,531	2,799,531	2,799,531	2,708,856	2,799,531
R-squared	0.005	0.006	0.006	0.002	0.022
Number of members	167,330	167,330	167,330	163,543	167,330

Notes: Models were estimated using the sample of fund members who were invited to a seminar in years 2017 and 2018. Robust standard errors in parentheses.
Significance: *** p<0.01, ** p<0.05, * p<0.1

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APPENDIX TABLE A4: ROBUSTNESS CHECKS

Variables	(1) Log Contribution Amount	(2) Contribution Amount Persistence	(3) No withdrawal Made Contribution:	(4) No withdrawal Contribution Amount:
1-3 months after seminar	0.102***	838.5***	0.010***	630.9**
	(0.028)	(313.6)	(0.003)	(309.9)
4-6 months after seminar	0.034	-16.9	0.003	-15.6
	(0.031)	(341.4)	(0.004)	(337.3)
7-9 months after seminar	0.080**	204.2	0.009**	205.8
	(0.036)	(400.3)	(0.004)	(395.5)
10-12 months after seminar	0.046	421.5	0.003	327.7
	(0.041)	(456.8)	(0.005)	(450.2)
More than 12 months after seminar	0.020	229.5	0.003	2.5
	(0.049)	(547.4)	(0.006)	(535.2)
End of financial year 2017 after seminar	0.365***	7,888.4***	0.039***	9,079.3***
	(0.067)	(740.7)	(0.008)	(738.4)
End of financial year 2018 after seminar	0.131**		0.015**	2,080.1***
	(0.060)		(0.007)	(651.2)
End of financial year 2018 after seminar held in fin.year 2018		1,692.3**		
		(733.1)		
End of financial year 2018 after seminar held in fin.year 2017		1,605.7*		
		(913.5)		
Log Income	0.029	559.6	0.004	391.1
	(0.044)	(481.5)	(0.005)	(468.5)
Age	0.218	666.2	0.037*	1,035.1
	(0.163)	(1,795.6)	(0.019)	(1,812.5)
Age Squared	-0.002	-3.2	-0.000*	-6.0
	(0.001)	(14.5)	(0.000)	(14.7)
Constant	-7.445	-34,517.6	-1.194**	-44,295.7
	(5.135)	(56,722.5)	(0.596)	(56,839.7)
Monthly Time Dummies	✓		✓	✓
Observations	38,739	38,739	36,108	36,108
R-squared	0.016	0.005	0.016	0.011
Number of members	2,215	2,215	2,078	2,078

Notes: Models were estimated using the baseline sample of seminar attendees. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.

APPENDIX TABLE A5: REGRESSION MODELS EXCLUDING MEMBERS WHO DID NOT ATTEND SEMINAR IN THE OBSERVATION PERIOD

Variables	(1) Made Contribution	(2) Contribution Amount	(3) Non-default Investment Option	(5) Investment Risk Profile	(5) Online User
1-3 months after seminar	0.010***	802.9**	0.011***	-0.041**	0.017***
	(0.003)	(372.0)	(0.002)	(0.018)	(0.003)
4-6 months after seminar	0.003	-84.0	0.022***	-0.117***	0.023***
	(0.004)	(421.1)	(0.002)	(0.020)	(0.004)
7-9 months after seminar	0.008*	145.3	0.028***	-0.132***	0.019***
	(0.004)	(504.7)	(0.003)	(0.024)	(0.005)
10-12 months after seminar	0.001	312.9	0.035***	-0.180***	0.021***
	(0.005)	(588.3)	(0.003)	(0.028)	(0.005)
More than 12 months after seminar	-0.002	20.3	0.036***	-0.240***	0.022***
	(0.006)	(715.4)	(0.004)	(0.034)	(0.007)
End of financial year 2017 after seminar	0.033***	8,385.7***	-0.005	-0.002	-0.003
	(0.008)	(889.3)	(0.005)	(0.043)	(0.008)
End of financial year 2018 after seminar	0.021**	2,163.7**	0.002	0.013	-0.002
	(0.009)	(1,063.3)	(0.006)	(0.051)	(0.010)
Log Income	0.037*	1,598.6	0.034**	0.470***	-0.058***
	(0.021)	(2,400.0)	(0.014)	(0.115)	(0.022)
Age	-0.000	-9.4	-0.000**	-0.004***	0.000***
	(0.000)	(19.0)	(0.000)	(0.001)	(0.000)
Age Squared	-0.000	530.4	0.007**	0.051*	-0.016***
	(0.006)	(643.6)	(0.004)	(0.031)	(0.006)
Monthly Time Dummies	✓	✓	✓	✓	✓
Observations	28,924	28,924	28,924	28,924	28,924
R-squared	0.015	0.001	0.029	0.010	0.036
Number of members	1,590	1,590	1,590	1,590	1,590

Notes: Models were estimated using the sample of fund members who have attended the seminar in year 2017 and in the first eight months of year 2018. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

APPENDIX TABLE A6: REGRESSION MODELS FOR ATTENDEES WHO WERE NOT ACTIVE ONLINE USERS

Variables	(1) Made Contribution	(2) Contribution Amount	(3) Non-default Investment Option	(5) Investment Risk Profile	(5) Online User
1-3 months after seminar	0.003	626.2	0.002	-0.032	0.048***
	(0.004)	(428.3)	(0.003)	(0.021)	(0.006)
4-6 months after seminar	0.008*	398.2	0.014***	-0.126***	0.082***
	(0.004)	(473.1)	(0.003)	(0.023)	(0.006)
7-9 months after seminar	0.009*	690.6	0.019***	-0.135***	0.107***
	(0.005)	(563.8)	(0.004)	(0.028)	(0.008)
10-12 months after seminar	0.010*	1,290.8**	0.040***	-0.222***	0.142***
	(0.006)	(653.7)	(0.005)	(0.032)	(0.009)
More than 12 months after seminar	0.009	870.5	0.050***	-0.247***	0.200***
	(0.007)	(799.3)	(0.006)	(0.039)	(0.011)
End of financial year 2017 after seminar	0.009	4,018.0***	0.005	-0.083	-0.010
	(0.009)	(1,055.1)	(0.007)	(0.052)	(0.014)
End of financial year 2018 after seminar	-0.001	749.3	-0.001	0.007	0.016
	(0.009)	(1,068.0)	(0.007)	(0.052)	(0.015)
Log Income	0.020	1,870.7	0.067***	0.004	0.018
	(0.020)	(2,295.1)	(0.016)	(0.115)	(0.031)
Age	-0.000	-13.4	-0.001***	-0.000	-0.000
	(0.000)	(18.5)	(0.000)	(0.001)	(0.000)
Age Squared	-0.009	-472.7	0.005	-0.044	0.023**
	(0.007)	(756.2)	(0.005)	(0.038)	(0.010)
Monthly Time Dummies	✓	✓	✓	✓	✓
Observations	11,972	11,972	11,972	11,972	11,972
R-squared	0.006	0.001	0.030	0.023	0.109
Number of members	654	654	654	654	654

Notes: Models were estimated using the sample of fund members who have attended a seminar in years 2017 and 2018, but who were not active online users ahead of the seminar. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

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APPENDIX TABLE A7: RESULTS CORRESPONDING TO THE AUXILIARY MATCHING EXERCISE

Variables	(1) OLS model, pooled cross-section	(2) FE model, causal estimates	(3) Matched OLS model, pooled cross-section
Attended the seminar	1,230.3***	994.8***	1,004.9***
	(55.2)	(266.8)	(109.1)
Log Income	153.9***	1,362.6	760.6***
	(10.9)	(1,782.1)	(155.1)
Age	-1.2***	-8.9	-6.0***
	(0.1)	(14.4)	(1.2)
Age Squared	96.1***	563.0	-81.7
	(8.8)	(482.3)	(76.0)
Monthly Time Dummies	✓	✓	✓
Observations	2,799,531	38,739	88,051
R-squared	0.016	0.005	0.005
Number of members	167,330	2,215	6,461

Notes: Models were estimated using the baseline sample of seminar attendees. Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.