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Supporting decision-making in retirement planning: Do diagrams on pension benefit statements help?

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Abstract: This paper investigates whether exposure to explanatory diagrams can affect a major financial decision. In a controlled experiment, participants were given pension benefit statements with or without one or two diagrams, before answering incentivised questions that measured recall, comprehension and choice of contribution rate. The diagrams had at best a marginal influence on recall or comprehension. Nevertheless, a diagram relating contributions to income projections prompted more participants to advocate higher contributions, while both diagrams influenced the rationale participants gave for decisions. The implication is that diagrams may alter pension planning decisions by reinforcing causal inferences, despite the absence of measurable improvements in understanding.

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1. Introduction

There is growing concern among economists and policymakers that many individuals have insufficient savings for retirement (Munnell et al., 2012; Crawford and O’Dea, 2012; Benartzi and Thaler, 2013). Two trends make this concern pressing. First, rapidly expanding life expectancies mean absolute levels of savings must be greater to sustain lifestyles in retirement. Second, the shift from defined benefit (DB) pensions to defined contribution (DC) pensions combined with widespread scaling back of state pension entitlements (OECD, 2015) transfers much responsibility for retirement planning from professionals and institutions to individuals (Baldwin, 2008; Poterba et al, 2007; Broadbent et al, 2006).

This transfer of responsibility is unproblematic if individuals have the wherewithal to make good retirement planning decisions, benefitting from available subsidies and investment returns in a manner that maintains income and smooths spending over the life span.

Unfortunately, evidence from behavioural economics questions whether individuals have such decision-making capacity. Despite the fact that it is a financial choice with potentially large consequences, the decision over whether and how much to save for retirement, and in what form, can be easily and substantially altered by how pension choices are presented (e.g., Madrian and Shea, 2001; Thaler and Benartzi, 2004; Iyengar and Kamenica, 2010). With respect to coverage, younger workers may not start a pension because of lack of knowledge or myopia (Foster, 2017). Statistics suggest the number of young workers with a pension is declining in many countries.¹ Several countries have followed the lead of New Zealand in implementing auto-enrolment, though its appropriateness as a policy instrument is debated, since default contribution rates may be insufficient (O’Dea, 2015). Those who do take out a

¹ In Ireland, the number of 25-34 year olds in employment with a pension fell from 49% in 2009 to 36% in 2015 (CSO, 2015). Similarly, in Britain the savings rate fell from 43% to 31% for those aged 20-40 between 2001 and 2011 (ONS, 2011).

pension may find it difficult to decide on an appropriate contribution rate (Banks and Oldfield, 2007). Pensions are complex products involving multiple subsidies, a trade-off between present and future income, and essential financial concepts such as interest compounding, inflation and diversification. Less than one-third of young American adults understand these concepts (Lusardi, Mitchell and Curto, 2010), while the least financially literate are also least likely to save for retirement (Lusardi and Mitchell, 2007). Complexity and comprehension may, therefore, turn out to be central issues in the retirement savings problem.

The present study focuses on one potential method by which pensions might be simplified and comprehension improved. Based on previous work in educational psychology, we set out to test the influence of explanatory diagrams. As described below, diagrams have been shown to promote learning in other domains where decision makers are faced with comparative complexity. In collaboration with Ireland's regulator, the *Pensions Authority*, we conducted an incentivised laboratory experiment in which we manipulated the presence or absence of two diagrams on a Pension Benefit Statement (PBS), comparing outcomes against conventional tables and text. The annual PBS summarises the current financial position of a member's account. Because it is the most regular and salient form of information disclosure that pension scheme members receive, its content and format have drawn the attention of policymakers. Recent EU legislation revised the guidelines for the PBS with the intention to "provide clear and adequate information to prospective members, members and beneficiaries to support their decision-making about their retirement" (Directive (EU) 2016/2341, recital 46). The experiment we describe tested how the format of the PBS influences recall, understanding and decisions about contributions. The work therefore represents an example of empirically informed regulation (Sunstein, 2011).

We designed and tested two diagrams. The first depicted the three components of the annual total contribution (employee contribution from take home pay, employer match, tax relief). The second showed how different contribution levels related to projected fund sizes and monthly pensions at retirement. The presence of these diagrams was randomly manipulated across PBS statements assigned to a representative sample of working-age individuals. We tested whether the explanatory diagrams improved scores on incentivised recall and comprehension questions, then whether they affected decisions about contribution levels and the rationales participants gave for their decisions.

The results indicated no clear and consistent influence on explicit recall or comprehension. Positive effects recorded for a subset of questions were marginal. Nevertheless, the explanatory diagrams did influence decision-making. Participants who saw the graphic depicting projected fund sizes were more inclined to propose raising the contribution level. Both diagrams influenced the reasons participants gave for their decision, increasing the likelihood that they cited the financial mechanism that each graphic depicted. The primary contribution of the paper, therefore, is to demonstrate that diagrams designed to explain how pensions work can support decision-making by facilitating relevant causal inferences.

The paper makes two further contributions. First, our results go beyond existing survey evidence in revealing not just limited comprehension of pensions, but continued problems in understanding among individuals who pay attention to and read documentation. In the experiment, a representative sample of adults was incentivised to read and absorb typical information available to scheme members, presented in the simplest and clearest form we could develop. Yet comprehension remained disconcertingly poor. In particular, we found

very limited understanding of tax relief and matching contributions, with implications for their effectiveness as incentives. Second, the empirical results are of potential use for the broader provision of information, both regarding pensions and other financial products. The kind of diagrams we designed and tested may be helpful in multiple types of advice, marketing material and disclosures.

The paper proceeds as follows: Section 2 reviews relevant literature and motivates our hypotheses. Section 3 describes the experiment and its results. Section 4 concludes and discusses implications.

2. Literature Review and Hypotheses

2.1 How Well Do People Understand Their Pensions?

Survey evidence suggests that members' understanding of pension products is limited, particularly in relation to contribution details and projected pension entitlements. In the U.S., workers are not well informed about details of their pension plan (Mitchell, 1988) or their expected pension benefits (Bernheim, 1988; Gustman and Steinmeier, 2005). This latter study reported that many workers in DC schemes did not realise their employer contributed to the pension, with just a small minority knowing that the employee's pay determined employer contributions. Dvorak and Hanley (2010) recorded a somewhat higher level of understanding of DC plans, though the authors note that survey selection bias and the sample pool (employees of a small liberal arts college) may have led them to overestimate understanding relative to the broader population. Using longitudinal data, Dushi and Honig (2015) reported better knowledge about inclusion in a DC scheme among the more recent

cohort. However, conditional on inclusion, members of this cohort displayed no better knowledge than previous cohorts about the size of contributions and were equally inclined to systematic overestimation.

Among a sample of older English people, Crawford and Tetlow (2012) found that over half those aged 50 to 64 who were not retired could not report the exact amount they expected to get at retirement. A majority had never thought about how many years of retirement they might need to finance. Similarly, Barrett et al. (2015) reported that two-thirds of pension scheme members aged 50 and over in Ireland did not know what their payment in retirement would be or the form it would take. Accuracy of beliefs about retirement benefits improves with age (Gustman and Steinmeier, 2005; Bottazzi et al, 2006; Guiso et al, 2013), suggesting that results for these older samples probably represent upper bounds of knowledge in the wider population.

2.2 *Improving Understanding and Decision-Making: Experimental Evidence*

While there is some existing experimental evidence, to the best of our knowledge the present study is the first on simplifying pension disclosures to combine an explicit measure of comprehension with a decision task. In other financial domains, studies of simplified disclosures have produced mixed results. Lacko and Pappalardo (2010) tested a simplified mortgage disclosure form and showed that it improved understanding of the costs and terms of loans. By contrast, Beshears et al. (2011) found that a simplified Summary Prospectus did not improve decision-making in relation to mutual funds, as measured by the extent to which incentivised participants avoided paying unnecessary fees.

There is some evidence that interventions designed to improve understanding can lead to higher participation in retirement savings plans. Duflo and Saez (2003) used relatively small incentives to encourage individuals to learn more about retirement savings vehicles and found that this intervention boosted participation. Bernheim and Garrett (2003) reported large impacts of the provision of financial education seminars in the workplace on individual savings behaviour. However, other studies report that positive knowledge effects of information campaigns about pensions can be quite short lived (Finseraas, Jakobsson and Svensson, 2017).

Several interventions have focused on one of two specific aspects of pension schemes: the composition of contributions and the dynamics of fund growth. Duflo et al. (2006) used a large randomized field study to compare the effect of the U.S. government's Saver's Credit tax relief to an economically equivalent subsidy in the form of a simple and transparent matching contribution. The results showed a large positive effect of the 'match' presentation format on take-up and contribution rates compared to the more complex tax relief condition, implying a link between simplicity and willingness to make contributions. The complexity of tax incentives may partly explain why studies find them to be ineffective in boosting retirement savings (Börsch-Supan, 2004; Ramnath, 2013; Pensions Policy Institute, 2013)

With respect to fund growth, previous studies have emphasised systematic underestimation of compound interest, part of the broader phenomenon of "exponential growth bias" (EGB) (Wagenaar and Sagaria, 1975). Controlling for background characteristics, households with greater EGB borrow more and save less (Stango and Zinman, 2009). Goda et al. (2014) used a large field experiment to test two treatments in mailed information brochures designed to combat EGB. A "balance" treatment contained a projection of how additional contributions

would translate into assets at retirement. An “income” treatment added a customized projection of the additional annual income generated by these assets. The latter intervention was effective in increasing contributions relative to a control group, though multiple candidate mechanisms may have driven the increase.

In summary, previous research suggests that learning about retirement savings and simplified, salient information disclosures may induce higher pension contributions. The mechanism involved is often assumed to be improved comprehension, though this is not generally tested by combining measures of comprehension with decision outcomes. In the present study, we explore this link via explicit measures of both understanding and decisions within the same context.

2.3 *Explanatory Diagrams*

We consulted educational psychology literature to see what tools, if any, improved comprehension of other complex topics. The use of explanatory diagrams often has a beneficial impact on learning compared to text based explanations (Mayer, 2002; Butcher, 2006; McCrudden, 2007), giving credence to the folk wisdom that “a picture is worth a thousand words”. More specifically, these studies report that explanatory blocks of text often fail to impart understanding of causal relationships, while simple diagrams can assist causal inference. Although the mechanism is not fully understood, diagrams appear to be efficient in either unlocking additional cognitive capacity or simply eliminating the superfluous. Ainsworth (2006) posits that different representations of information lead learners to use different cognitive strategies. In a verbal protocol analysis, Cromley et. al. (2010) showed that high-level cognitive activities, such as inferences, were used more often when

comprehending diagrams than when reading text, albeit with the caveat that students often skipped diagrams.

These findings on the effectiveness of diagrams in promoting causal inference suggest potential merit in exploring the use of diagrams for communicating information about pensions. Two specific inferences seem particularly relevant: (1) that an increase in the contribution from take-home pay leads to a (often substantially) larger increase in the overall contribution to the fund; (2) that an increase in contributions generates a proportionally greater increase in the projected pension fund.

2.4 *Hypotheses*

Given the findings reviewed above in relation to explanatory diagrams, we investigated whether diagrams might be exploited to help individuals to process information about pensions. The diagrams were designed specifically to assist in making the two inferences identified above. The following hypotheses were developed:

H1: Explanatory diagrams will lead to better recall of information contained in the PBS, relative to conditions with no diagram.

H2: Explanatory diagrams will improve comprehension of information contained in the PBS.

H3: Explanatory diagrams will increase willingness to increase contributions to the pension.

H4: Participants with better comprehension of the PBS contents will be more willing to increase contributions.

H5: Explanatory diagrams will improve the coherence of the stated rationale for decisions in relation to altering contribution levels.

In addition, we investigated whether recall, comprehension or decision-making were affected by presenting information about costs charged to pension members (e.g., annual management changes) in a narrative or in a tabular format (similar to a bank statement). This manipulation was motivated by the regulator's concerns that many individuals did not pay attention to or comprehend pension costs. As the literature does not address this issue, we had no prior hypothesis about the presence or direction of potential effects on recall, comprehension and decision-making.

3. Experiment

We designed and conducted a laboratory experiment in which participants read a single PBS form and answered questions about its contents, with key aspects of the PBS manipulated between subjects. The experiment centred on a hypothetical scenario. Participants were asked to consider a request from a friend to read a PBS statement and to provide advice. Although the scenario was hypothetical, participants were incentivised, given time to read the PBS carefully, and knew that it would form the basis of their subsequent responses. We judge it likely that knowing this led our participants to pay at least as much, if not more attention to the PBS than a person typically would when an annual PBS arrived through the post. Furthermore, while acknowledging that participants' responses might have been affected by the fact that the PBS information related to a third party, the comparison of responses between conditions is likely to be instructive as to how different formats of the PBS interact with cognitive mechanisms involved in judgement and decision-making. Where alternative PBS formats generate different patterns of responses, the implication is that formats engage cognitive mechanisms in systematic ways, with consequent relevance for real world contexts.

The experiment followed a 2 x 2 x 2, orthogonal, between-subjects design. The three manipulations were the presence of a diagram (versus a table) designed to illustrate contributions, the presence of a diagram (versus a table) designed to illustrate projected pension income, and the presence of a table (versus text) designed to inform about costs. The orthogonal design ensured that both sides of each manipulation were encountered by half the experimental sample and the eight possible combinations of the three manipulations were each encountered by one eighth of the sample.

3.1 Method

3.1.1 *Participants*

Participants were a representative sample of 176 Dublin-based consumers aged 22-60 (mean=37.5), balanced across gender (85 Male, 91 Female), educational attainment (104 with a primary degree)² and working status (144 working), recruited by a market research company. Each was paid a guaranteed €30 for participation in the present experiment and an unrelated study. Performance in the experiment was incentivised via a lottery in which participants could win a €50 shopping voucher. Additional lottery tickets were earned for correct responses (to each question with an objectively correct answer). One in ten participants stood to win a voucher and participants were aware of this chance of winning. The experiment conformed to institutional ethical procedures. The session lasted approximately one hour.

² The Dublin population has a high level of educational attainment by international standards, with the majority of working age people educated to degree level. Thirty-eight of the sample also had a postgraduate qualification and another 20 a diploma.

3.1.2. *PBS Forms*

The PBS forms were based on the existing templates provided by Ireland's pensions regulator. They were three pages long and comprised eight sections. The experimental manipulations centred on Sections 4, 5 and 7.

Section 1 gave eight pieces of information: name, age, marital status, pensionable salary, membership number, retirement age, retirement date, years to retirement. Membership number and retirement age (68) were held constant across all forms. The other information varied. Half the forms had female names, the other half male. On half the forms the pension member was married, on the other half single. The age of the pension member varied from 23-54. Salaries were selected pseudorandomly from a range beginning at €22,425 and increasing in increments of €25 up to the high-rate tax cut-off of €33,300, then in increments of €75 up to a maximum of €75,100. Thus, half the forms described members taxed at Ireland's standard 20% rate, the other 88 at the higher 40% marginal rate. A moderate correlation was imposed between age and salary. The 176 different salaries were assigned to equalise the mean salary across the eight PBS types.

Section 2 was titled 'How much have I built up so far?' and detailed the balance in the retirement savings account at the start and end of the year. The starting balance ranged from €10,590 to €110,590, with a moderate positive correlation between starting fund size and salary.

Section 3, 'How much might I get when I retire?', displayed two projections for fund size at retirement and the pension that fund size might buy, one based on an "expected" scenario and

the other on an “unfavourable” scenario. These projections used the assumptions laid out by the regulator in its online pension calculator.

Section 4 presented the breakdown of contributions. Half the participants saw the standard contributions table (Appendix A, Figure A1, top). Underneath was a brief explanation of how tax relief works. The other 88 participants saw our contributions diagram (Appendix A, Figure A1, bottom). Stacks of Euro coins represented each element, with arrows and symbols indicating relations between them. There was no text description of how tax relief works.

Section 5 was titled ‘Charges and Investment Return’. Half the participants received a tabular version (Appendix A, Figure A2, top), the other half a narrative version containing the same information in a short paragraph of text (Appendix A, Figure A2, bottom).

Section 6 detailed how the pension member’s details had changed since the previous year. On all forms the salary (and hence contribution) increased by 2.5%.

Section 7, ‘Income Now for Income Later’ (hereafter INFIL), described how savings at retirement could be increased by contributing more now. Half the participants received a tabular version (Appendix A, Figure A3, top), with different columns showing alternative monthly contributions from take home pay, projected fund sizes at retirement and the commensurate pension. The columns compared the current contribution with increases from take home pay of 50% and 100%. The INFIL diagram shown to the other 88 participants was based on the same figures, but the projections were placed inside cartoon pots of money of increasing size (Appendix A, Figure A3, bottom).

Section 8, 'How do I find out more?', provided additional information available from the pension provider. This standard section was identical on all forms and did not contain information relevant to the experiment.

3.1.3 Questionnaire

Responses were obtained via a computerised questionnaire programmed in Python using the PsychoPy package (Peirce, 2007; 2009) and presented on individual 14" laptops. The questionnaire consisted of four stages. The first was conducted after participants initially read the PBS and placed it back in its envelope. The PBS was taken back out again for the remaining sections (see Procedure).

Stage 1 involved eight multiple-choice questions (MCQs) that tested recall. Two questions were related to each of the three main manipulations, while the remaining two were control questions. The specific questions are provided in Appendix A (Table A1); Figure A4 shows a screenshot. The position of the correct answer was randomised. For numeric questions, incorrect answers were pseudo-randomised to be 10%, 15% and 25% larger or smaller than the correct answer, such that the correct response was equally likely to be the largest, second largest, second smallest or smallest answer. After completing the eight questions, participants judged confidence in their answers on a scale of 1-7.

Stage 2 comprised eight MCQs that probed comprehension. Again, two questions targeted each manipulation. The questions are provided in Appendix A (Table A2); Figure A5 shows a screenshot. Incorrect answers were pseudo-randomised as in Stage 1. For questions not based on specific figures in the participant's PBS (Q2.1, Q2.2 and Q2.8) some incorrect

answers were designed to be intuitively appealing as an answer. After completing the questions participants again rated their confidence.

Stage 3 asked for advice based on the PBS form. They were instructed: “In Stage 3 your friend is going to ask you for some advice. There are no right or wrong answers, but please try to give the advice you would genuinely give to a friend of yours”. They were then asked: “Your friend wants to know whether you think they should change their contribution. What do you think they should do?” The following responses were offered: “don’t change it”, “decrease it a little”, “increase it a little”, “decrease it a lot”, “increase it a lot”, “I wouldn’t feel comfortable giving a friend pension advice”. If the last option was selected, a screen appeared with the following text: “Your friend understands you don’t feel comfortable giving pension advice, but they are insisting you at least give them your best guess. What option would you go for?”. Participants could choose: “increase pension contribution”, “decrease pension contribution” and “don’t change pension contribution”. Participants were then asked: “What are your reasons for giving this advice?” and prompted to type an answer of up to 50 words. Lastly, they again rated confidence in their decisions.

Stage 4 collected information on the participant’s own pension situation and background. This included whether they had a private pension and, if so, whether it was a defined benefit or defined contribution pension. They rated their knowledge of their pension and whether they were intending to alter contributions. Participants also provided their gender, age and highest level of educational attainment. Questions are provided in Appendix A (Table A3).

3.1.4 Procedure

Participants arrived to the laboratory in groups of ten. PBS forms were randomly assigned and placed in an opaque envelope beside each laptop. Participants read and signed a consent form before attention was directed to the envelopes. The experimenter explained that participants were “to imagine you are at a friend’s house and your friend has received this envelope in the post, and they would like you to look at it for them”. They were told the contents would form the basis for the following stages of the experiment. Participants had been informed in the consent sheet that there were performance-based financial incentives. Participants were asked to read the PBS carefully for four minutes, after which they returned the form to the envelope.

The experimenter then explained that onscreen instructions would guide them through four stages, but stressed that the first two stages involved MCQs, some of which may be quite difficult. The lottery incentive structure was described: “Before we start I want to remind you that one-in-ten of our participants will win a €50 [brand name] voucher for taking part in today’s experiment. We are going to hold a raffle for these vouchers and everyone’s name will go in at least once. But for each MCQ question you get correct, your name will go into the raffle for a €50 voucher an extra time. So please try your best as it will increase your chances of winning a voucher.” This incentive structure meant that even participants who felt they were unlikely to fare well relative to others still improved their chances with every good answer.

Participants proceeded at their own pace. Before Stage 2 an onscreen instruction told them to remove the PBS from the envelope again and use it to answer the questions. On finishing Stage 4, the questionnaire ended and participants were thanked.

3.2 Results

3.2.1 Recall Questions

The number of correct responses in Stage 1 was approximately normally distributed across the 176 participants (mean = 4.43, sd = 1.57). Performance by question and format is shown in Table 1. Binomial tests of proportion were used to test whether diagrams improved recall. H1 is directional, so the appropriate test is one-tailed for comparisons between diagrams and tables. For the costs questions, tests were two-tailed. For Question 1.2, which asked participants to recall the total annual pension contribution, those who saw the contributions diagram were more likely to respond correctly ($p < 0.05$). All other differences were non-significant. Although participants were randomly assigned, logistic regressions were estimated to ensure the results were robust to controlling for background characteristics. Separate models were estimated for correct/incorrect responses to each question, with condition, gender, age, educational attainment and whether the participant had a pension specified as control variables. The pattern of statistical significance was as in Table 1. The total number of correct answers was almost identical between conditions with and without the relevant diagram.

Table 1: Number of Correct Responses by Question for Stage 1 Recall and Stage 2 Comprehension. Percentage Correct reported in Parentheses.

	Diagram		Table		Control
	Yes	No	Yes	No	
Recall					
Q1.1	29 (33%)	36 (41%)	-	-	-
Q1.2	64 (73%)**	54 (61%)	-	-	-
Q1.4	51 (58%)	54 (61%)	-	-	-
Q1.5	43 (49%)	46 (52%)	-	-	-
Q1.7	-	-	46 (52%)	50 (57%)	-
Q1.8	-	-	35 (40%)	45 (51%)	-
Q1.3	-	-	-	-	131 (74%)
Q1.6	-	-	-	-	98 (56%)
Total	187 (53%)	190 (54%)	81 (46%)	95 (54%)	229 (65%)
Comprehension					
Q2.1	12 (14%)	14 (16%)	-	-	-
Q2.2	19 (22%)	14 (16%)	-	-	-
Q2.4	48 (55%)	49 (56%)	-	-	-
Q2.5	44 (50%)*	35 (40%)	-	-	-
Q2.7	-	-	64 (73%)	65 (74%)	-
Q2.8	-	-	49 (56%)	52 (59%)	-
Q2.3	-	-	-	-	123 (70%)
Q2.6	-	-	-	-	128 (73%)
	123 (35%)	112 (32%)	115 (65%)	117 (66%)	251 (71%)

* p<0.1; ** p<0.05; *** p<0.01

3.2.2 Comprehension Questions

The number of correct responses in Stage 2 was approximately normally distributed (mean = 4.07, sd = 1.60). Table 1 (bottom) shows correct responses by question and format.

Participants shown the relevant diagram were marginally ($p < 0.1$) more likely to respond correctly to Question 2.5, which asked about the effect on the projected monthly pension of doubling contributions from take home pay. This pattern was again confirmed in logistic

regressions specified as described in subsection 3.2.1. The proportions of correct answers to the comprehension questions on contributions (Questions 2.1 and 2.2) were substantially lower than for the other questions. The total number of correct answers was closely similar by condition. Across all eight (recall and comprehension) relevant questions, performance was better without the diagram for five and better with the diagram for three.

3.2.3 *Advice by Format*

In Stage 3, the majority of participants (125) proposed that contributions should be increased, most (106) by “a little”. Table 2 reports odds ratios from a series of logistic regressions where the dependent variable is whether the participant proposed increased contributions. As previously, the diagrams are subject to one-tailed tests. Model (1) includes only the PBS formats as independent variables. Participants who saw the INFIL diagram were significantly more likely to recommend an increase. The estimated effect remains strong and is highly significant after control variables are added in Model (2), giving an odds ratio of 2.62. The contributions diagram and tabular costs had no significant effect. Model (3) introduces a variable for the number of correct answers to comprehension questions in Stage 2, which is positive and highly significant. The point estimate implies an odds ratio of 1.35 for each additional correct question. The introduction of this variable has no impact on the estimated odds ratio for the INFIL diagram. When control variables are added in Model (4) the comprehension variable becomes non-significant, while the INFIL diagram remains highly significant.

Table 2: Logistic regressions for whether participant advised an increase in contributions. Output is given as odds ratios.

	(1)	(2)	(3)	(4)
Contributions diagram	.945 (.319)	1.04 (.373)	.841 (.293)	.945 (.348)
INFIL diagram	1.86** (.635)	2.62*** (.986)	1.87** (.653)	2.54*** (.962)
Tabular costs	1.67 (.566)	1.39 (.508)	1.56 (.541)	1.39 (.515)
Male		1.20 (.433)		1.16 (.420)
Over 35		.671 (.254)		.771 (.304)
Degree		3.29*** (1.24)		3.10*** (1.18)
Pension holder		1.94* (.737)		1.61 (.651)
Comprehension score (Stage 2)			1.35*** (.149)	1.18 (.147)
Constant	1.48 (.477)	.578 (.293)	.578 (.293)	.578 (.293)
Obs.	176	176	176	176

* p<0.1; ** p<0.05; *** p<0.01

3.2.4 Rationale for Advice by Format

The reasons participants gave for their advice were coded independently by two researchers according to the protocol outlined in Appendix B. Both researchers were blind to the PBS formats of the participants. The intention of this coding was to act as a proxy variable for the making of the two key inferences that were highlighted in Section 2 and formed the basis for the diagrams. Two of the categories related to the composition of contributions: category (a), whether participants mentioned the employer matching contribution; and category (b),

whether they mentioned tax relief. Similarly, two of the categories related to projections of pension income: category (c), whether participants mentioned increasing returns from contributing to the pension; and category (d), whether they mentioned the current projected pension being insufficient for retirement. Table 3 presents logistic regression models where the dependent variable is whether a “contributions” (category a or b) or “projections” (category c or d) rationale was given. Models (1) and (2) confirm that those who saw the contributions diagram were significantly more likely to produce a rationale for their advice based on tax relief or the employer match. Models (3) and (4) confirm that those who saw the INFIL diagram were significantly more likely to produce a rationale for their advice based on projected pension income or increasing returns. The contributions diagram and the tabular costs also generated increases in the likelihood of providing a “projections” rationale, albeit that these estimated effects were smaller than the effect of the INFIL diagram.

3.2.5 Individual Differences

Across the various outcome variables of interest there were statistically significant effects of background characteristics. Most notably, those with a degree were substantially more likely to propose an increase in contributions (Table 2) and to give one of the two rationales related to the two inferences of interest (Table 3). Any effects associated with having a pension were positive but only marginally significant. An OLS regression of the total number of correct recall answers in Stage 1 on format and available background characteristics revealed no significant effects of background characteristics on recall except for marginally better performance among men ($\beta=.403$, $z=1.69$, $p<0.1$). A similar analysis of the number of correct comprehension answers in Stage 2 found that participants aged under 35 years produced

significantly more correct answers ($\beta=.777$, $z=3.41$, $p<0.01$), as did those with a degree ($\beta=.499$, $z=2.16$, $p<0.05$) and those who had a pension ($\beta=1.08$, $z=4.73$, $p<0.001$).

Table 3: Logistic regressions for whether participant’s rationale for advice was based on the composition of contributions (Models 1 and 2) or whether the rationale was based on projections of pension income (Models 3 and 4). Output is given as odds ratios.

	Contributions rationale		Projections rationale	
	(1)	(2)	(3)	(4)
Contributions diagram	2.94* (1.87)	3.71** (2.45)	2.99* (1.76)	3.06* (1.83)
INFIL diagram	1.28 (.91)	1.71 (1.25)	3.35** (1.96)	3.80** (2.27)
Contributions and INFIL diagrams	1.89 (1.26)	2.88 (2.03)	2.65 (1.57)	3.01 (1.84)
Tabular costs	1.00 (.43)	.83 (.385)	2.08** (.78)	1.90* (.74)
Male		1.04 (.469)		1.32 (.497)
Over 35		1.03 (.494)		.76 (.299)
Degree		3.28** (1.79)		2.03* (.83)
Pension holder		2.47* (1.22)		.892 (.349)
Constant	.1*** (.057)	.021*** (.019)	.084*** (.045)	.056*** (.039)
Obs.	176	176	176	176

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

3.3. Discussion

The results provide insufficient evidence to support H1 and H2: the two diagrams did not improve recall or comprehension in a systematic way. Participants who saw the contributions

diagram were significantly more likely to recall the total contributions from a single reading of the PBS. Participants who saw the INFIL diagram were more likely to correctly determine the impact on projected income of doubling contributions, although this effect was only marginally statistically significant. Overall, however, there was not a consistent, clear advantage associated with the diagrams, with no overall effect on the total of correct answers.

Regarding comprehension of contributions (questions Q2.1 and Q2.2), the low level of correct responses means that it is possible that the comparison between conditions was subject to a floor effect. Participants found these questions harder than anticipated based on piloting; perhaps too hard for variation between the diagram and non-diagram conditions to emerge. However, the two questions used round numbers designed to minimise arithmetic difficulty and centred on the relationships that matter for understanding incentives to contribute. Arguably, therefore, employing easier questions might not have generated any meaningful result even if variation between conditions had been observed. The more pressing concern is that even when the description was made as simple and clear as the experimenters could manage these two substantial subsidies from the employer and the government were beyond the grasp of a sample more than half of which possessed a primary degree.

H3 was partially supported. Participants who saw the INFIL diagram were more likely to propose an increase in contributions, but there was no equivalent effect for the contributions diagram. H4 was supported. The higher the comprehension score in Stage 2, the more likely participants were to propose an increase in contributions. However, this effect became non-significant and approximately halved in magnitude once educational attainment was controlled for (Table 2, Model 4). Thus, it is not clear whether the impact of better comprehension on advice was driven by the better comprehension itself, or whether

education to degree level both improves comprehension and increases the propensity to increase contributions via some other mechanism.

H5 was also strongly supported by the present results. Participants who saw diagrams were more likely to employ arguments associated with those diagrams to explain their decision-making. This effect was largely specific to the diagram concerned: participants who saw the contributions diagram were more likely to cite tax relief or matching contributions as a reason for their advice, while those who saw the INFIL diagram were more likely to cite reasons associated with projected income or investment returns. The suggestion is that the diagrams promoted the causal connections that they were designed to highlight, perhaps resulting in participants viewing the connection as more important, even though they did not improve answers to explicit comprehension questions.

The contributions diagram and tabular costs manipulation both contributed to the likelihood that participants gave a rationale for their advice based on projected income or returns. While we cannot be sure of the reason for this, one possibility is that both manipulations reduced the amount of text on the PBS form and, in this sense, amounted to simplifications of the form as a whole. This may have increased the probability that participants located, paid attention to, or otherwise placed greater weight on the currently projected pension income, which appeared in two places on the form. With the exception of this (in any case marginal) effect, the comparison between the text and tabular provision of information about costs and fees was not significant. Responses to the relevant comprehension questions indicate that a substantial minority of participants were unable to understand how the balance between costs and returns on the investment determined growth in the overall fund.

The findings that participants displayed better comprehension of the key relationships if they were younger, more educated or already had a pension, are broadly in line with previous work (Lusardi, 2008). Having a degree also increased the likelihood of advising an increase in contributions. Naturally it is difficult to infer the direction of the various potential causal relationships, but they do confirm substantial and important individual differences.

4. General Discussion

The results of the present study suggest that there may be benefits to the use of explanatory diagrams in a Pension Benefit Statement (PBS) and other communications materials directed at pension scheme members and potential members. The ‘Income Now for Income Later’ (INFIL) diagram increased the likelihood of proposing an increase in contributions. The effect size was quite substantial, generating odds ratios of 1.9-2.6. Both diagrams supported decision-making in that they contributed to the reasons participants gave for contribution decisions. The implication is that the diagrams led participants to pay more attention or otherwise increase the weight given to tax relief and matching contributions, as well as to projected income, such that they were more likely to make inferences on the basis of these factors.

Had these findings been accompanied by a clear and consistent improvement in recall and comprehension, the case that these inferences were good inferences, and hence that the diagrams tested improved decision-making, would be strong. That they did not invites further consideration. As outlined in the Section 2.3, diagrams can reinforce perceptions of causal relationships (Butcher, 2006), the idea that one thing leads to another, without necessarily improving understanding of exactly how such causal relationships operate. Thus, the present

results suggest that the introduction of such diagrams on the annual PBS may influence decision-making by leading decision-makers to make inferences about factors that they do not necessarily fully comprehend. From one perspective this might be considered problematic. On the other hand, the evidence supplied here shows that the direction of this influence leads decision-makers, on average, to support increased contributions to retirement saving, moving them into closer alignment with those decisions-makers who have higher educational attainment and score more highly on objective tests of comprehension.

The results of the present study raise concerns about the operation of tax relief and matching contributions as incentives for increasing people's willingness to contribute to their pension. A representative sample of participants, who were incentivised to respond accurately and most of whom had degrees, produced responses to multiple-choice questions about how these incentives work that were essentially no better than chance. This was despite the fact that the questions used simple round numbers and the participants had either a printed explanation or a diagram before them that was designed to assist. Moreover, the higher rate of successful responses to other questions, especially the control questions, indicates that participants were trying hard to answer correctly. It is difficult to avoid the conclusion that the composition of pension contributions is too complex for the general population to understand. It is possible that this lack of understanding partly explains why participants who saw the contributions diagram were more likely to cite tax relief or matching contributions as a rationale for their proposed contribution level, yet did not respond to these incentives by advising an increase. Thus, the present study might be considered supporting evidence for efforts to simplify incentives designed to encourage saving for retirement (Ranmath, 2013; Duflo et al, 2006).

As with all laboratory experiments, some caution is required in generalising and interpreting the results. Firstly, the present study may have underestimated the effect of providing diagrams, because the experimental design excluded the possibility that seeing that the document contained helpful diagrams might have led more people to pay attention to it in the first place. Participants had volunteered for the study and were incentivised to spend four minutes scrutinising the document, regardless of which version they received, and this is what experimenters observed during the sessions. Secondly, as explained in Section 3, the decisions made during the study were hypothetical. The majority of the experimental sample advised an increase in contributions, including those who did not themselves have a pension, echoing a possible disjunction between attitudes and behaviour, or perhaps intention and action. Yet these responses of our participants match survey evidence, which records that most people believe that they should increase their savings for retirement (Farkas and Johnson, 1997; Bernheim et al, 1995). It is also important to bear in mind that the primary findings consist of variation in responses across conditions, not absolute willingness or ability to act.

The present study focuses on the understanding and decision-making only of individuals and at no stage considers the potential response of providers to the voluntary or mandatory introduction of explanatory diagrams into PBSs. Mandating the presentation of diagrams would impose a regulatory burden that would have to be considered against any estimate of the benefits they might bring. These benefits might be increased, however, if the specific diagrams developed for the present experiment were to be improved upon through experience and testing, perhaps undertaken by pension providers.

The relevance of the present findings arguably extends beyond contribution decisions made by those already in a pension. Diagrams may improve communications targeted at the primary decision of whether or not to take out a pension. More broadly, diagrams might be beneficial for communications that try to demystify other financial products and in a range of policy areas where information disclosure is used as a regulatory tool to support individual decision-making. Overall, although the diagrams we tested did not deliver a step-jump in understanding of pensions, the evidence supplied here suggests that there they may generate some benefits for decision-makers. The study also provides further evidence that people's ability to comprehend pensions, as they are currently designed and described, requires attention from both economic researchers and policymakers.

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Appendix A

Figure A1: Contributions Table (top) and Diagram (bottom)

The table below shows the contributions to your retirement savings during 2016

You paid	Your employer paid	You transferred in	Total paid in	<i>Estimated net cost to you after tax relief*</i>
€2,454	€2,454	€0	€4,908	€1,472

*How does tax relief work? For every €3 from take-home pay you contribute, the government match it with €2 in the form of tax relief. Then your employer will double your contribution.

These are the total contributions made to your retirement savings for 2016.

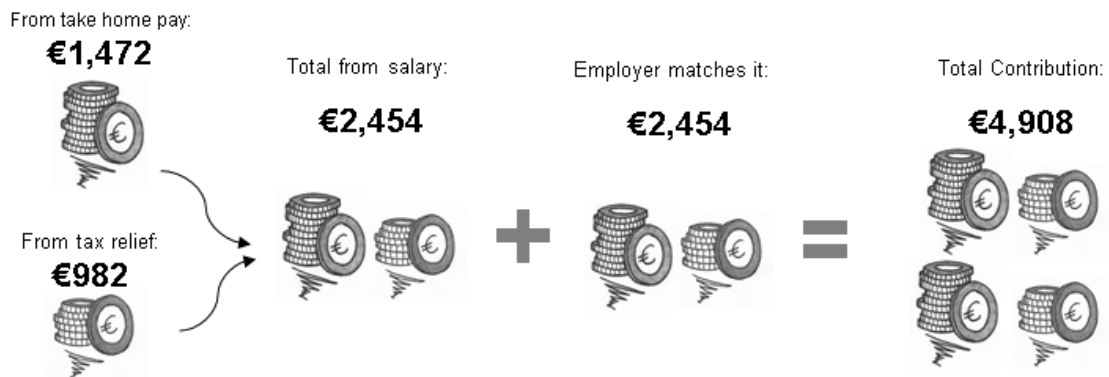



Figure A2: Costs Table (top) and Narrative (bottom)

 This table shows how the value of your retirement savings changed during 2016.

Value of your retirement savings at 31/12/2015		€35,590
Add: Total Contributions	€2,752	
Return on Investment	€1,414	€39,755
Less: Administration costs	€25	
Pensions Authority fees	€8	
Investment management fee (1% of value of your retirement savings)	€396	
Other costs	€0	- €429
Value of your retirement savings at 31/12/2016		€39,326

These charges were deducted from your retirement savings over the last year: €25 for administration costs, €8 for Pensions Authority fees, and €396 (1% of the value of your retirement savings) for managing your investments. These charges totalled €429 over the 12 months up to 31/12/2016.

The return on your investment over the last year, before the above costs was €1,414.

Figure A3: INFIL Table (top) and Diagram (bottom)

	If You Pay:	If You Pay:	You Now Pay:
Monthly Contribution	€246	€184	€123
Your savings at retirement	€386,027	€318,787	€251,546
Monthly pension	€1,239	€1,023	€807



Table A1: MCQs in Stage 1

No.	Manipulation	Question
Q1.1	Contributions	Who contributes most to the pension contribution?
Q1.2	Contributions	What is the total annual pension contribution?
Q1.3	Control	What is your friend's pensionable salary?
Q1.4	INFIL	What is your friend's current monthly contribution from take home pay?
Q1.5	INFIL	If your friend's pension contribution were to increase to [middle column amount] per month, what would their projected monthly pension be?
Q1.6	Control	What is your friend's current projected monthly pension in the 'best guess' scenario?
Q1.7	Costs	What are the total costs charged on your friend's retirement savings?
Q1.8	Costs	What is the return on investment on your friend's retirement savings?

Figure A4: Example screenshot of Stage 1 Question



Table A2: MCQs in Stage 2

No.	Manipulation	Question
Q2.1	Contributions	By how much would the total annual pension contribution increase if your friend were to contribute an extra €120 from their take home pay annually?
Q2.2	Contributions	If the annual contribution from gross salary were to decrease by €200, how much would the total annual pension contribution decrease by?
Q2.3	Control	By how much did your friend's salary change since their last statement?
Q2.4	INFIL	If you had to guess, approximately how large do you think your friend's monthly pension would be if they contributed €12 per month from take home pay?
Q2.5	INFIL	If monthly contributions from take home pay doubled, what would the projected monthly pension be?
Q2.6	Control	By how much did your friend's total annual contribution change since their last statement?
Q2.7	Costs	If the retirement fund grows at the same rate next year as this year, how will the charge in Euros for managing investments change?
Q2.8	Costs	The return on investment shows the fund grew by approximately what percentage between the start and end of the year?

Figure A5: Example screenshot of Stage 2 question

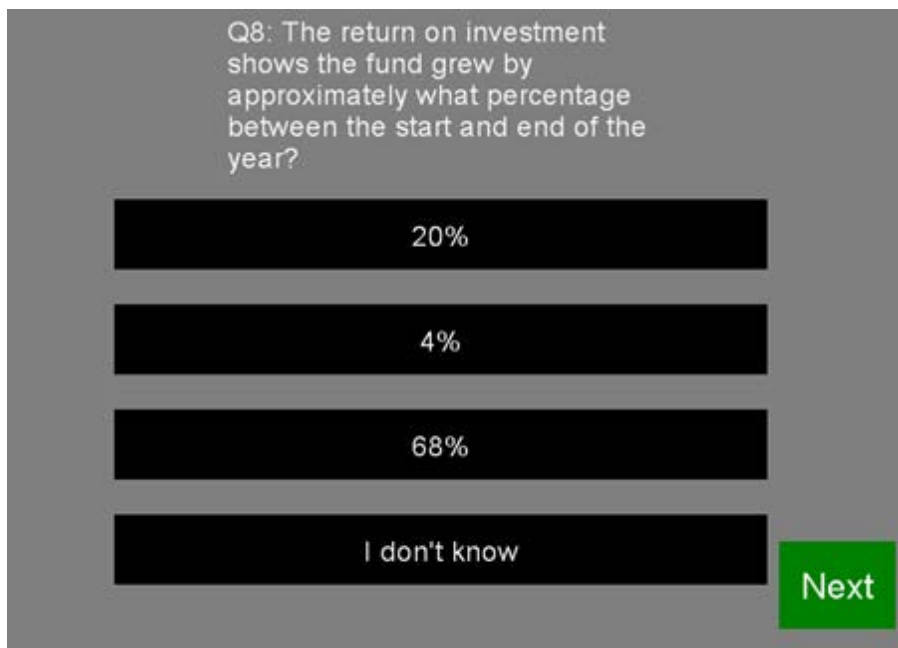


Table A3: Questions in Stage 4

No.	Question
Q4.1	Do you have a private pension or one provided through your employer:
Q4.2	Is it defined benefits or defined contributions?
Q4.3	On a scale of 1-7, how well do you know the specifics of your pension situation: 1 = not at all, 4 = some idea, 7 = extremely well
Q4.4a	(Asked if Q4.1 = YES) On a scale of 1-7, how likely are you to change your own pension contribution in the next 12 months?
Q4.4b	(Asked if Q4.1 = NO) On a scale of 1-7, how likely are you to look into starting a pension in the next 12 months?
Q4.5	(Asked if Q4.1 = YES & Q4.4a \geq 4) Are you thinking of increasing or decreasing your contribution level?

Appendix B

Table B1: Categories for Coding Reasons given in Stage 3 (Advice)

Category	Inclusion Criteria
(a) Match	Phrase mentioned employer matching contribution or similar wording with same meaning
(b) Tax	Phrase mentioning tax, tax relief or tax credits
(c) Increasing Returns	Phrase indicating that a small increase today in contributions leads to a larger proportional increase in the pension.
(d) Insufficient	Phrase mentioning that current projected pension would not be sufficient to live on, or similar phrasing to this effect.
(e) Salary Increase	If they mention salary increase from last year
(f) Affordability	Phrase indicating that they believe the friend can afford the proposed contribution change
(g) Age	If they mention friend's age or how many years till retirement
(h) Return On Investment	If they mention phrase 'return to investment' This overlaps somewhat with Increasing Returns but it is more focused on annual return than relationship between contribution level and final pension size.
(i) Saving is Good	Generic phrase about benefits of saving without giving a precise reason of why it's a good idea

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