

Raising pension awareness through letters and social media: What works for whom? Evidence from a randomized and quasi-experiment¹

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Abstract

This paper analyzes the effectiveness of an informative letter versus a Facebook-ad and the effectiveness of positive and negative framing to raise pension awareness. Pension awareness is measured by 1) knowledge of the Dutch pension system, and 2) actions undertaken to gain information regarding the personal financial situation. To identify the causal effect of a letter, we rely on a randomized field experiment using a survey administered to a representative sample of about 4,000 individuals in the Netherlands. Randomization takes place in 1) receiving a letter with information regarding the pension system and detailed information on where to find information about the personal situation and 2) the framing (e.g. positive or negative wording) of the letter. To identify causal effects of a Facebook-ad with the same content, we use an Instrumental Variables approach using self-reported time spent on Facebook as an instrument. This quasi-experimental approach bypasses ethical issues with experiments on social media platforms. We find a strong effect to login of the Facebook-ad. An informative letter is less effective in stimulating logging in, but a negatively framed letter does raise the knowledge of the pension system.

JEL codes: C93, D14, D83, G40, I22

Keywords: Pension Literacy, Communication, Framing, Field experiment, Facebook

1 Introduction

The aging of the population has resulted in a wide range of pension reforms in order to sustain the public finances in many Western countries. Furthermore, occupational pension systems in many countries shift from defined benefit plans to defined contribution plans. Whereas traditional pension plans were a paternal employer responsibility, it has increasingly become an individual responsibility. This raises concerns how we can ensure that individuals understand their options and can be guided towards sensible and adequate retirement choices, alongside other lifetime savings choices.

A vast amount of recent literature has shown that most individuals are ill-informed and lack the basic knowledge⁵ to make well-informed financial decisions (Lusardi and Mitchell, 2014).⁶ This applies to a wide range of countries, and hence, pension systems.⁷ Financial illiteracy is overrepresented among women and among low-educated, low-income, non-working, and young individuals (Lusardi and Mitchell, 2014). Financially illiterate households are generally found to make worse financial decisions than their financially literate counterparts, which has consequences for the adequacy of income during retirement (Van Rooij et al. 2012).

Although agents may rationally choose to not invest in acquiring financial knowledge, it may be socially optimal to increase financial literacy. Especially as ill-informed individuals are less responsive to designed pension incentives because of misperceptions (Chan and Stevens, 2008; Van Rooij and Teppa, 2014). Also, for sound political decisions it may be important that voters understand the basic concepts of the pension system. Furthermore, understanding the basic concepts may increase the confidence of people in their own pension.⁸ Increasing financial knowledge can be costly to acquire (Delavande et al. 2008; Lusardi et al. 2017). A way of lowering the cost of acquiring financial knowledge is making it more readily available. This paper aims to

⁵ Next to objective knowledge, such as understanding percentages and compound interest, Hadar et al. (2013) found that subjective knowledge (e.g. learning from experiencing) is important in financial decision making.

⁶ This is confirmed by many studies from various disciplines (Lynch, 2011).

⁷ E.g. Agnew et al., 2013; Alessie et al. 2011; Almenberg and Säve-Södenberg, 2011; Van Rooij et al., 2011; Arrondel et al., 2013; Beckmann, 2013; Boisclair et al., 2015; Fornero and Monticone, 2011; Klapper and Panos, 2011; Crossan et al. 2011; Bücher-Koenen et al. 2011; Sekita, 2011; Brown and Graf 2013; Landerretche and Martinez, 2013; Lusardi and Mitchell, 2011.

⁸ For example, in The Netherlands a lot of young people worry that when they are old there is no pension anymore for them. If they would have a better understanding of the pension system, they would know that because of the low interest rate quiet a lot of pension wealth is reserved for young people.

increase our knowledge of how to make information available by investigating the effectiveness of framing and of two different communication channels on raising pension awareness. Financial literacy regarding pension awareness is particularly interesting because of the huge implications financial literacy can have on retirement savings (McKenzie and Liersch, 2011).

Several studies find that framing plays an important role in economic behavior. For example, Card and Ransom (2011) find that pension contributions are asymmetrical in the framing of employer and employee contributions. Framing also affects perceived risk and risk taking behavior (Steul, 2006, and Diacon and Hasseldine, 2007). Furthermore, Krijnen et al. (2016) find an adverse effect of the word “important” on the attention that people pay to pension communication. Eberhardt et al. (2017) build upon the *prospect theory* (Kahneman and Tversky, 1979) and find that an assurance frame (the loss alternative) can be twice as effective than an investment frame (the gain alternative) in engaging participants to click on a video link that explains pension scheme changes. Similarly, framing affects social security benefit claiming decisions (Brown et al., 2016). Although negative framing is generally more effective than positive framing in inducing pension saving (Block and Keller, 1995; Agnew et al., 2008; Montgomery et al., 2011; Bateman et al., 2015 and Bockweg et al. 2017), it may also scare off participants (Brüggen et al., 2017). This fits in the more general view of increasing use of non-pecuniary strategies to influence households’ behavior by policymakers (Ferraro and Price, 2013). In contrast, Bauer et al. (2017) find that people are more likely to inform themselves about their individual pension situation with a small financial incentive than with nudging.

With regard to communication channels, Johansen (2013) suggests that pension information should be spread wider. That is because households collect information through different channels and at least as much from their social environment as from experts. Hence, it may be less costly and more effective to increase financial awareness through unofficial communication channels such as through peers (Kast, et al., 2012). Social interactions are found to affect retirement decisions (Brown and Laschever, 2012; Rege et al., 2012), the enrollment in retirement plans (Duflo and Saez 2002, 2003), as well as households’ portfolio choice.⁹ Even more so, the choice for a pension fund depends stronger on the choice of peers than on observable performance measures (Mugerman

⁹ E.g. Gali, 1994; Hong et al., 2004; Brown et al., 2008; Georgarakos and Pasini, 2011; Kaustia and Knüpfer, 2012; Georgarakos et al., 2014.

et al., 2014). Nonetheless, such peer effects can also induce negative reactions to pension plan enrollment (Beshears et al., 2015).

The importance of peers is likely to have increased because of social media. Next to companies being able to directly communicate with their customers, social media enables consumer-to-consumer communication (Mangold and Faulds, 2009). This type of communication is found to affect purchasing decisions (Wang et al., 2012). Research also suggested that Facebook can be an effective instrument to find a job (Gee et al., 2017). Social media is not only reserved for commercial products, but nonprofit organizations are also increasingly involved in expanding awareness through social media (Waters et al., 2009). This increasingly takes the form of governments communicating with civilians on numerous different topics related to public safety (Kavanaugh et al., 2012). The strategy of governments informing civilians through social media is especially promising in promoting health (Househ et al., 2014). Also the more disadvantaged groups can be reached (Chou et al., 2009). Therefore, social media could provide an opportunity to increase pension awareness, even among more disadvantaged groups that are potentially hard to target. However, aforementioned studies are mainly exploratory, thereby postponing issues concerning causality of the findings.

This paper analyzes both the effectiveness of different pension communication channels and framing on raising pension awareness. Here, pension awareness is defined by two components, namely 1) pension literacy, and 2) logging in to a national website to gain information on one's pension entitlements (in the remainder of the paper we will call this the pension check). The first component measures people's general knowledge (with five basic questions about the pension system), while the second component measures the actions taken to get informed about one's personal pension. First, we analyze the effectiveness of sending an informative letter. The letter consists of information regarding the pension system as well as a link to the pension check (in Dutch: *mijnpensioenoverzicht.nl*). To identify the causal effect of the letter on pension awareness, avoiding problems related to correlational studies of financial literacy (as explained by Fernandes et al., 2014), we rely on a randomized field experiment using a survey administered to a representative sample of about 4,000 individuals in the Netherlands. Secondly, since randomization takes place in receiving a letter as well as the framing of the letter (positive or negative), we are able to analyze the effectiveness of positive versus negative wording on financial literacy and doing

the pension check. Thirdly, we analyze the extent to which Facebook is an effective communication channel to increase pension awareness. Therefore, we targeted individuals between the ages of 20 and 40 with a Facebook-ad. We focus on the effectiveness of using Facebook as a communication channel for important information. As no randomization takes place in observing the ad, we use an instrumental variable approach with self-reported time spent on Facebook as an instrument.

The contribution of this paper to the literature threefold. Firstly, whereas others investigated the effect of framing on outcome measures such as risk perception, annuity choices, social security claiming, retirement saving intentions, or clicking on a video about pensions, this paper investigates the effect of framing on pension awareness. As far as we know, this is the first paper on pension communication that investigates whether people have a better knowledge of the pension system ten weeks after receiving information. Secondly, we are the first to investigate whether social media can play an effective role in increasing pension awareness. More particularly, we present a quasi-experimental approach to identify causal effects of interventions through social media. Earlier papers, like Kramer et al. 2014a, used experiments through Facebook which has led to discussions regarding the ethics of such experiments (Kramer et al., 2014b). We propose to use self-reported weekly time spend on social media as an instrumental variable. In this way we can effectively avoid ethical concerns and the results show that time spend on social media is a strong instrumental variable in a quasi-experimental IV-framework. Thirdly, our respondents represent a random draw from the population, instead of being specifically targeted (like the often used setting of company-specific employees or pension fund specific participants). In this way we follow the suggestions for future research of Lusardi and Mitchell (2014), who argue that more research is needed that uses carefully-designed experiments. With our data set we even have a sufficiently large number of observations to focus on large subgroups with respect to age, gender, and education level. Finally, the Netherlands is an interesting case as most of the retirement savings are mandatory (Knoef et al., 2016), which implies fewer incentives to invest in financial literacy (Jappelli and Padula, 2013). This means that the results can be considered as a lower bound for other countries. Our conclusions give new insight in target-specific communication strategies of public policy, pension funds, and insurance companies for important life-cycle decisions.

The results show that the Facebook-ad is very strong in activating respondents to login at the *mijnpensioenoverzicht.nl* website to see their personal financial situation. Sending an informative

letter to respondents is less effective in stimulating logging in, but does significantly increase pension literacy. However, this is only true for the negatively-framed letters. Positively-framed letters did not have a significant effect on raising pension awareness whatsoever. We do not find significant heterogeneous effects with regard to age, gender and education level. These results are robust to a variety of specifications.

The structure of the paper is as follows. Section 2 describes the randomized field experiment regarding the informative letters as well as the quasi-experiment using the Facebook-ad. Data and descriptive statistics are described in Section 3. Estimation results are presented in Section 4. Finally, we conclude in Section 5 and provide some additional discussion of the results in Section 6.

2 Method

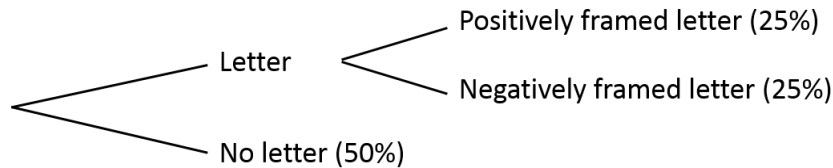
This section first describes the design of the field experiment that was executed to analyze the effect of framing and the effectiveness of an informative letter to increase pension awareness. Secondly, section 2.2 explains the quasi-experimental design used to investigate the effectiveness of a Facebook-ad to increase pension awareness.

2.1 Letter

To test whether an informative letter increases pension awareness we set up a field experiment. In this experiment we designed a letter consisting of three parts. The first part is the introduction which is framed either positively or negatively.¹⁰ The second part asks people to do the pension check (i.e. logging in at the personal pension registry to see their personal pension entitlements). The third part shows seven basic facts about the pension system.

We use a panel of representative individuals and randomly assign individuals to one of the following three groups:

¹⁰ The positively and negatively-framed letters can be found in Appendix A. The highlighted text in green (red) is the part of the letter that is positively (negatively) framed. The highlighted text in yellow presents the objective information about the Dutch pension system. The positively framed letter asks people whether they aren't curious about their pension. The negatively framed letter asks whether people know whether they have saved enough (given the gloomy media reports about pensions).



The letter was sent 17 March 2017. As from June 1st the panel received an online questionnaire which they could fill out until June 19th.¹¹ In order to measure pension literacy, we rely on the financial literacy literature and test the basic pension knowledge with five general questions which were based on the information presented in the letters (for details, see Section 3). Secondly, we asked people about the pension check. In order to ease the hassle involved with logging into the registry this information was sent at the time of the yearly tax filing, where the same password is necessary to file taxes.

In order to analyze the effects of a letter on pension awareness, we compare individuals who received a letter (treatment group) to individuals who did not receive a letter (control group). We thus estimate the intention to treat (instead of a lab experiment, where respondent are forced to read a letter). We estimate the following model

$$y_i = \alpha_1 + \beta_1 D_i + X_i \gamma_1 + \epsilon_i, \quad (1)$$

where y is one of the two outcome variables (pension literacy or doing the pension check), α is the constant, D is a dummy variable indicating whether an individual received a letter, and X is a vector of individual characteristics such as gender, education, household, age, and work situation.

To differentiate between positively- and negatively-framed letters, we estimate

$$y_i = \alpha_2 + \beta_2 D_i + \delta D_i^+ + X_i \gamma_2 + u_i, \quad (2)$$

where D^+ is a dummy variable which is equal to one for individuals who received a positively-framed letter and zero for all other individuals. β_2 measures the effect of a negatively-framed letter. The sum of β_2 and δ measures the effect of a positively-framed letter. When the dependent variable

¹¹ The letter was sent in the name of Pensioenlab. A Dutch organization that aims to increase pension awareness. Ten weeks later the questionnaire was sent in the name of Leiden University to an online panel that is answering questionnaires regularly with a wide variety of topics. Respondents receive a small remuneration of 0.10 euro's per question in a survey that they can use to sponsor a self-chosen charity. We asked a general question about the pension check and do not refer to Pensioenlab anywhere in the survey. Therefore we expect it to be unlikely that panel members knew that the letter and the questionnaire were related to each other.

is pension literacy we estimate a linear regression model with OLS. In case of analyzing the probability of doing the pension check, we estimate a probit model with Maximum Likelihood. Whether people did the pension check is a self-reported variable. Social desirability may lead to an overestimation of the number of people doing the pension check. However, we do not expect this to bias our results, because we do not expect the treatment to affect the self-report bias. That is because the letter was sent in the name of Pensioenlab (a Dutch organization that aims to increase pension awareness). Ten weeks later the questionnaire was sent in the name of Leiden University to an online panel that is answering questionnaires on a regular basis. We asked a general question about the pension check and did not refer to Pensioenlab anywhere in the survey. Therefore, the treated individuals did not know that the letter and the questionnaire were related to each other and that it was more desirable for them to answer that they did the pension check.

2.2 Facebook-ad

To test whether pension awareness increases by informing individuals by way of social media, we set out a Facebook-ad on 4 April that informs people about the pension system and asks them to do the pension check (see appendix B). The ad does not contain the first framing part of the letter (it was thus framed in a neutral way). The ad targeted people aged under 40s. This does not mean that the over 40s were unable to see the ad since members of their network may ‘like’ the ad, but the chances are small. In the online survey we ask whether respondents have noticed the Facebook ad.

Since it is not possible to randomize a Facebook ad,¹² regressing our outcome variables on whether the Facebook-ad was noticed by the respondent by OLS may be endogenous. For example, it could be that only those who are interested in pensions and are already relatively pension aware noticed the Facebook ad (only a selective sample noticed the ad). Or, that especially those who did see the Facebook ad *and* became more aware of their pension and the pension system remember that they have seen the ad (selective measurement error in the self-report of having seen the ad). This would lead OLS to overestimate the effect of the Facebook ad on pension awareness. On the other hand, it could be that especially the individuals who were relatively unaware of pensions remember the

¹² In 2014, Kramer et al. studied emotional contagion with a Facebook experiment in the US among 155.000 Facebook users. After the study was published ethical concerns were expressed by the media and PNAS published an “Editorial Expression of Concern” (Kramer et al., 2014b).

Facebook ad, while those who are already aware of pensions did not pay attention anymore and scrolled further without noticing the ad consciously. They may be confronted with the ad, but do not remember this anymore. In that case OLS underestimates the effect of the Facebook ad on pension awareness.

One could also think of third factors: maybe for some reason some people are relatively a lot of hours online. Then they may spend relatively a lot of time on Facebook and they may be more likely to have searched for pension information on the internet and checked their pension on the national website. On the other hand, there are 1001 things you can do and find on the internet, so why would heavy internet users more often choose to read pension information and do the pension check compared to less heavy internet users (unless they are hinted on this by Facebook).

To identify causal effects of the Facebook-ad on pension awareness we use an Instrumental Variables approach. We asked respondents about their average time spent on Facebook per week and use this information as an instrument. Time spent on Facebook is likely to predict whether an individual noticed the Facebook-ad (*relevant instrument*), but the time spent on Facebook is unlikely to be correlated with pension awareness other than through the Facebook-ad (*valid instrument*). Also, we find it unlikely that the time spent on Facebook is correlated with measurement error in the self-report of having seen the ad. Our approach taken has two main advantages: 1) we avoid ethical concerns regarding randomized experiments on Facebook (Kramer et al., 2014a; 2014b) and 2) we measure the true effect of complying with the treatment (that is seeing and remembering the Facebook ad) on pension awareness.¹³

We estimate:

$$y_i = \alpha_3 + \beta_3 FB_i + \delta_3 D_i + X_i \gamma_3 + v_i \quad (3)$$

$$FB_i = \alpha_4 + \beta_4 T_i + X_i \gamma_4 + \mu_i \quad (4)$$

Where, FB indicates whether a person noticed the Facebook-ad (one if the ad was noticed and zero otherwise), and T is the average time spent on Facebook per week. Equations (3) and (4) are

¹³ Other types of research investigate how Facebook ads should be designed, such that they are being remembered by people.

estimated simultaneously through Maximum Likelihood such that the error terms v and μ are allowed to be correlated.

As a robustness check we include information about the importance that individuals give to the topic of pensions and the self-reported ability to find pension information easily (both measured on a 5-point scale). This is important if those who spend a lot of time on Facebook also find pensions relatively important or are more able to find information about pensions.¹⁴ Despite the fact that these additional variable are highly significant, their inclusion does not change the results.

3 Data

Data are collected from an online panel of Panelwizard. The planned sample size after nonresponse was 4,000 individuals, of which 50% aged 20-40 and 50% aged 41-64. The panel consists of 4560 individuals aged 20-40 and 3387 individuals aged 41-64. These sizes are based upon expected non-response rates, which are higher for young than for old people. Within the two age groups we have a stratified sample that is representative to the Dutch population with regard to age, gender, household composition, labor market participation and education. Details on the actual survey sample can be found in Table 1. The most important things to note from the table is that the sample consists of 4,000+ respondents¹⁵ and response rates are fairly similar across type of letter received. Hence, there is sufficient variation in the data and non-response is not likely to be correlated with receiving a letter or not and the type of letter that was received.

[Insert Table 1. Sample here]

To see that certain characteristics are not over- or underrepresented in the different groups we present the mean values of characteristics in Table 2. None of the characteristics we observe seem to be over- or underrepresented in a way that renders our analysis invalid. The Facebook ad reached 770.134 persons in the Netherlands. 45 of the individuals in our sample remembered seeing the

¹⁴ This could bias our estimate upwards (as we measure pension importance and the ability to find pension information through our instrumental variable).

¹⁵ With 95% confidence this sample does not deviate more than 4.2% of the actual composition of the population, so we conclude that the sample is representative for the Dutch population.

Facebook ad. The percentage of respondents that noticed the Facebook-ad is quite similar among the groups that received different letters or no letters.

[Insert Table 2. Descriptives here]

Pension awareness is measured by combining two sets of information from the survey. First, we use the concept of *pension literacy* based on five questions regarding the current pension system. Details on these five questions are presented in Table A1 in the Appendix. This table shows that more than half of the respondents gave a wrong answer to four out of five questions. In general, we do observe that respondents with a correct answer were more confident in giving the correct answer (measured by a confidence scale 1-5). Second, we use the concept of the pension check based on whether the respondent logged in at mijnpensioenoverzicht.nl in order to see their personal financial situation.

To get a first impression of the effect of the positive and negative letter on pension awareness, we present the average number of correct answers to the pension literacy questions in Figure 1a. This figure shows that not more than two out of five questions are answered correctly, on average, in the three different groups that received a positive letter, a negative letter, or no letter. With an average of about 2.1 correct answers the group without a letter performs worst. The group with a positive letter performs slightly better with an average slightly above 2.1 correct answers. The group with a negative letter gives the most correct answers (about 2.2).

Similarly, Figure 1b shows the pension check by received letter. The group without a letter logged in less frequently than the groups that received a letter (about 30% of the respondents without a letter). About 32% of the group that received a positive letter logged in. This is less than the group with a negative letter whose respondents logged in in about 33% of the cases. The importance of logging in at mijnpensioenoverzicht.nl is shown in Table C1 in the Appendix. To persons who logged in, we asked the five questions shown in Table C1. Answers were given on a 5-point scale where 5 is 'totally applicable' and 1 is 'totally not applicable'. The results indicate that logging in has positive effects with respect to insight, confidence, interest, actions, and awareness. Logging in especially increases the insight in the personal pension situation. The tool of logging in can also

help in raising awareness of a potentially low pension income. All in all, results indicate that logging in can make people's expectations more in line with the actual situation.

Figure 1a. Pension literacy. Number of correct answers (0-5) to pension knowledge questions by type of letter.

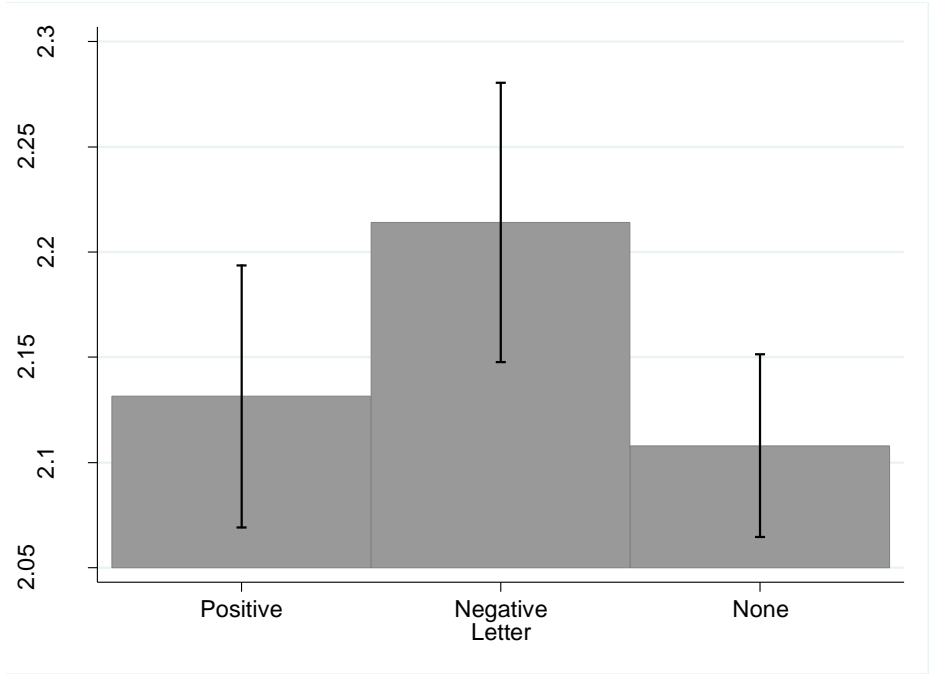
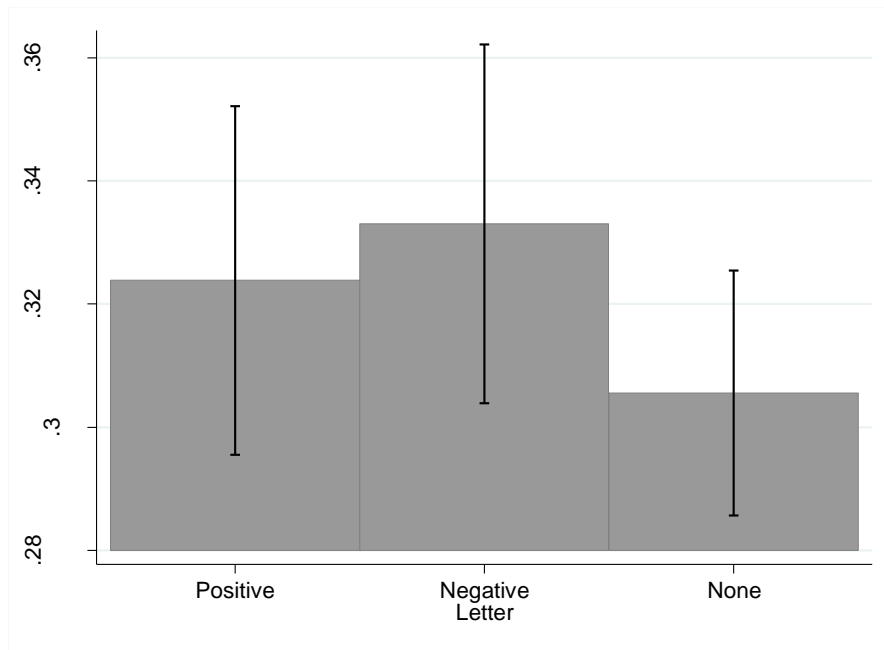


Figure 1b. Pension check. Percentage logged in by type of letter.



Next to the letters, we used the Facebook-ad to raise pension awareness. Since Facebook is not made for large messages, we reduced the amount of information as well as the number of pension literacy questions from five to three. In the Facebook-ad we only included information with regard to questions 1, 4, and 5. Hence, the pension literacy scale for the Facebook-ad runs from 0-3. Figure 2a shows that only 0.8 out of 3 questions were answered correctly among persons that did not see the ad. Persons who did see the ad answered 0.93 out of 3 questions correctly.

Figure 2b shows the percentage of respondents that logged in differentiated by noticing or not noticing the ad (notice that this does not represent a causal effect). In the group that did not notice the ad only about 15% of the people logged in. In the group that noticed the ad this percentage is much higher and about 54%.

Figure 2a. Pension literacy. Number of correct answers (0-3) to pension knowledge questions by Facebook-ad.

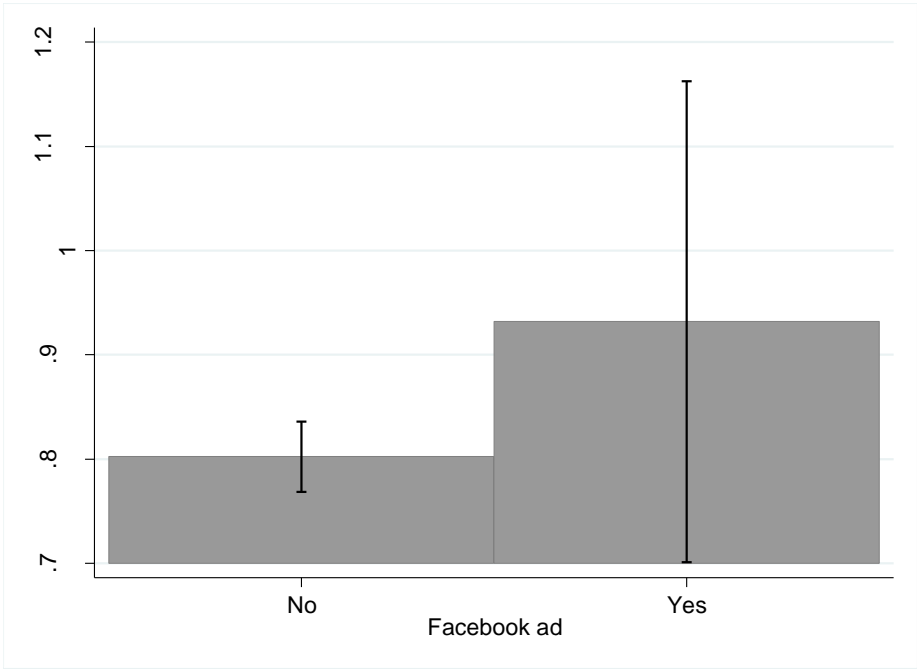
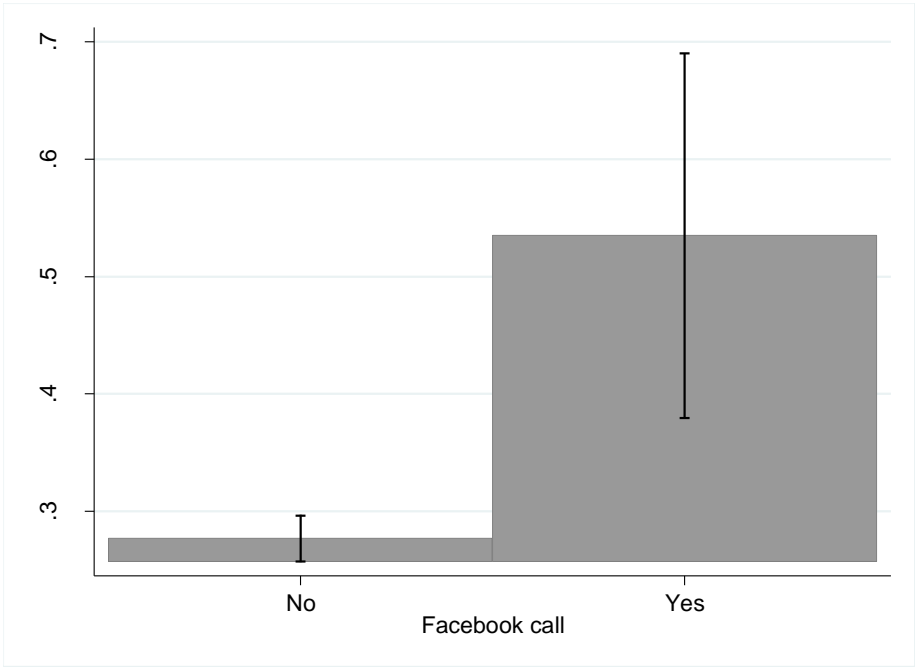


Figure 2b. Pension check. Percentage logged in by Facebook-ad.



Section 4 tests aforementioned relationships by way of regression analysis. In these analyses we estimate the effects of the letter and the ad conditional on observed characteristics of the respondent.

4 Results

4.1 Letters

Table 3 shows the estimation results for Equation 1-2 using the randomized field-experiment of letters. Models 1-4 estimate the effect of receiving a letter on pension literacy using OLS.¹⁶ Models 5-8 use the pension check as a dependent variable and use a Probit estimator. Models 2, 4, 6, and 8 differentiate between the effects of positively and negatively-framed letters.

Without controlling for observed characteristics (Model 1) we find that receiving a letter increases the number of correct answers significantly by 0.06. Model 2 suggests that this effect is primarily due to receiving a negative letter. Receiving a negative letter significantly increases the number of correct answers by 0.11. This means that when we ask the five pension literacy questions and we send people a negative letter, on average 1 out of 10 persons provide an additional correct answer (compared to no letter). This is an increase of 5.2% in the number of correct answers.¹⁷ A positive letter does not significantly increase pension literacy.¹⁸ After conditioning on the observed characteristics gender, education, household, work, and age (Model 3-4) the treatment effects remain almost the same (as expected because of the random assignment).¹⁹

¹⁶ In the baseline regression, we model pension literacy by assuming that the number of correct answers (0-5) is a linear continuous dependent variable. However, this neglects the fact that the indicator is a limited dependent variable. Therefore, we check the robustness of our conclusions to using an ordered logit estimator. The conclusions do not change.

¹⁷ In Table D3 in the Appendix we do the same analysis for the five pension literacy questions separately. The results show that the increase in pension literacy because of the negatively framed letter is primarily because of better scores on question 1 and 4 (for details, see Table D1 in the Appendix). This demonstrates that the increase in pension literacy is due to better scores on both relatively simple and more advanced questions about the Dutch pension system.

¹⁸ Testing $H_0: \beta_2 + \delta_2 = 0$ in Model 4 gives a p-value of 0.55.

¹⁹ We evaluated the questions and answers with pension experts from Netspar. Some mentioned that the correct answer of the question “What is roughly the percentage of earnings that is on average used to pay pension contributions (by all parties)” depends on the interpretation of the question. People pay a premium of about 20% of their pensionable salary, which is only part of their full salary because of a state pension offset. The experts mention that this could result in 10, 15 and 20% being correct answers. Despite the fact that 20% is mentioned in the letters and Facebook-ad, we

Estimation results for the pension check show a weakly significant effect of a letter after conditioning on observed characteristics. The coefficients reported in Models 5-8 are average marginal effects. We find that receiving a letter increases the probability of doing the pension check by 3%-points. The effect of a positively framed letter is not significantly different from zero.²⁰

[Insert Table 3. Effects of randomized letters on pension awareness here]

Heterogeneous effects of the letters are analyzed in Table 4. We differentiate effects of the letters between age categories (Model 1 and 4), gender (Model 2 and 5), and educational level (Model 3 and 6). The effect of the letter on pension literacy is not significantly different for people in the age group 20-40 and the age group 41-64 (Model 1). This also applies to the effect of the letter on the pension check (Model 4). Model 2 and 5 show that the effect of the letter on pension literacy and the pension check is not significantly different for males and females and Model 3 and 6 show that there are also no significant differences between low and high educated individuals. Finally, we find that for highly educated individuals the total effect of a letter on pension literacy is significantly positive (0.15). Also the effect of a letter on the pension check is positive for highly educated individuals, but only weakly significant (Model 6, a p-value of 0.06).

[Insert Table 4. Heterogeneous effects of randomized letters here]

4.2 Facebook-ad

Table 5 shows the estimations results for Equations 3-4 using the quasi-experiment of the Facebook ad. Note that the pension literacy indicator runs from 0-3 here because of the information provided in the Facebook-ad (for details see Section 3).²¹ The effect of the Facebook-ad on the pension check is analyzed in Model 4-6. Given the fact that the Facebook-ad was targeted at people aged under 40s, we restrict the sample to persons aged 20-40.

did robustness checks of the estimation results when marking 10 and/or 15% also as correct. Conclusions are highly robust.

²⁰ Testing $H_0: \beta_2 + \delta_2 = 0$ in Model 8 gives a p-value of 0.18.

²¹ Table D2 in the Appendix uses the same set of questions for the analysis of the letters. Conclusions are highly comparable using 3 and 5 pension literacy questions.

A simple OLS estimate conditional on observed characteristics (Model 1) shows no significant effect of the Facebook-ad on pension literacy. However, the estimated coefficients might be biased due to non-randomness in the probability of seeing the Facebook-ad. Therefore, Model 2 shows estimates from an IV regression using the total time spent on Facebook per week as an instrumental variable. The F-statistic of the excluded instrument shows that this instrument is highly relevant in explaining the visibility of the Facebook-ad (its value is greater than 10). Correcting for potential endogeneity increases the coefficient of the Facebook ad.²² This suggests that those who noticed the Facebook ad are those with unobserved characteristics that are related to a relatively low pension literacy. The standard error increases and although the size of the coefficient is substantial, the coefficient is not significant. This may have to do with the small number of respondents who noticed the Facebook ad. Conditioning on the importance that people attach to pensions and the ability to search for pension information does not influence the conclusions. (Notice that the Facebook ad itself may also had an effect on the importance that people attach to pensions and the ability to search for pension information. Then this coefficient is an underestimate of the true effect.)

From the probit (Model 4) we conclude that noticing the Facebook-ad increases the probability of logging in by about 23%-points. Using an IV-probit to correct for a possible endogeneity bias between seeing the Facebook-ad and logging in we find an effect of 93%-points (Model 5).²³ This effect is slightly smaller, 87%-points, when conditioning on self-reported importance and ability to search (Model 6).

[Insert Table 5. Effects of a Facebook ad on pension awareness]

Reconciling our empirical evidence we find that the Facebook-ad is very strong in activating respondents to do their pension check. The coefficient for pension literacy is also substantial, but not significant. Sending an informative letter to respondents is less effective in stimulating to do the pension check, but is significantly effective in raising pension literacy. However, this is only

²² Adding an interaction effect between the letter and having seen the Facebook-ad shows a coefficient that is not significant and does not change the main conclusions (not reported here).

²³ Adding an interaction effect between the letter and having seen the Facebook-ad shows a coefficient that is negative and significant (at the 1%-level). If a person received a letter and was aware of the Facebook-ad, there is a 94,1% probability of logging in.

true if the informative letter is negatively-framed. Positively-framed letters did not have an effect on pension awareness.

4.3 Cost-effectiveness

This section provides a back-of-the-envelope calculation of the cost-effectiveness of a negative letter and the Facebook ad, which are analyzed in this paper.

Our results suggest that the negatively-framed letter has a significant effect on pension awareness. 1,051 persons received the negatively-framed letter (see Table 1). To reach these persons 504.48 euros were spent. The negatively-framed increased the number of correctly answered questions by 0.10 (on a scale of 0-5). In total, 105 additional questions are answered correctly because of the letter ($0.10 \times 1,051$). So, 4.80 euros ($504.48/105$) were spent for each additional correct answer.

We do not find a significant effect of the letter on the probability to log in, however, the point estimate is 0.03. Per person 48 cents were spent to send a letter, so that means that according to the point estimate 16 euros were spent for each additional person that logged in.

The Facebook ad was targeted at individuals between 20 and 40 years. In the Netherlands we have 4,206,639 individuals between 20-40 year. 87% of the respondents between 20-40 report a positive number of hours spent on Facebook per week. We therefore expect about 3,678,633 individuals in the Netherlands between 20-40 to use Facebook actively ($0.87 \times 4,206,639$). Facebook statistics indicate that we reached 770,134 individuals aged 20-40. This means that we reached 21% of the active Facebook users ($770,134/3,678,633$). Our sample contains 1,902 active Facebook users. So, when we assume a reach of 21%, about 398 individuals in our sample were reached (21% of 1,902). 11% ($45/398$) of them complied with the treatment (they saw and remembered the ad). For them, we find a 90%-points higher probability of logging in and answering 0.40 additional questions correctly (on a scale of 0-3). In total this means about 40 (0.9×45) additional persons logging in and 18 (0.40×45) additional correct answers.

1,939.76 euros were spent on the Facebook ad to reach the Dutch active Facebook users between the ages of 20 and 40. Proportionally on our sample, 1 euro was spent ($1,939.76 \times (1,902/3,678,633)$). This means that for each additional correct answer 5.6 cents were spent ($1/18$), and for each additional person logging 2.5 cents were spent ($1/40$).

To do: calculate the standard errors.

5 Conclusion

This paper analyzes the effectiveness of different communication channels and framing on raising pension awareness. More specifically, we analyze the effectiveness of an informative letter versus a Facebook ad and the effectiveness of positive and negative framing to raise pension awareness. Pension awareness is measured by 1) knowledge of the Dutch pension system, and 2) actions undertaken to gain information regarding the personal financial situation.

To identify the causal effect of a letter, we rely on a randomized field experiment using a survey administered to a representative sample of about 4,000 individuals in the Netherlands. Randomization takes place in 1) receiving a letter with information regarding the pension system as well as detailed information on where to find information about the personal situation and 2) the framing (e.g. positive or negative wording) of the letter. To identify causal effects of a Facebook ad with the same content, we use an Instrumental Variables approach using self-reported time spent on Facebook as an instrument. This approach bypasses ethical issues concerned with experiments on social media platforms.

Compared to prior literature we make three contributions. Firstly, whereas others investigated the effect of framing on risk perception, annuity choices, social security claiming, retirement saving intentions, or clicking on a video about pensions, this paper investigates the effect of framing on pension awareness (ten weeks after the information is presented). Secondly, we are the first to investigate whether social media can play a role in increasing pension awareness. Thirdly, the paper follows the suggestions for future research of Lusardi and Mitchell (2014) who argue that more research is needed that uses carefully-designed experiments to evaluate effective ways to increase knowledge of personal finances.

The results show that pension literacy is low. The Facebook ad is very strong in activating respondents to login at the webpage of *mijnpensioenoverzicht.nl* to see their personal financial situation. Sending an informative letter to respondents is less effective in stimulating active logging in to see the personal financial situation, but is significantly raising pension literacy. However, this

only holds when the informative letter is negatively-framed. Positively-framed letters did not raise pension awareness significantly. We do not find significantly heterogeneous effects with regard to age, gender and education level.

6 Discussion

Although estimation results are highly robust to different specifications and estimators we should remain aware of possible drawbacks of our approach taken in the paper that are important to take into account when interpreting the results. Pension awareness consists of two elements in the paper. The first being objectively measured by several questions regarding the pension system. The second, however, is not whether people have taken action to login but whether they say that they have taken the action. There might be a difference between what people do and what people say they do. The paper assumes that there is no difference, or at least that the differences are random across the control and treatment groups, but future research might focus on revealed instead of stated actions taken by merging administrative data about logins.

A second point of discussion is the small percentage of respondents that mentioned to be aware of the Facebook ad. Since only 45 out of the 2,166 targeted respondents remember seeing the Facebook ad, identification of the effect of the Facebook ad relies on a small sample of respondents. Future research should address this difficulty of social media and representative survey data more prominently. Also because internet use and survey data have additional difficulties regarding the representativeness of the panel. Although PanelWizard stratifies the sample of survey respondents in such a way that the panel is representative for the Dutch population it should be kept in mind that the panel only consists of internet users. This may lead to overestimation of the effect of the Facebook ad. However, in the group aged 20-40, for whom we test the Facebook-ad, internet coverage is very high in the Netherlands (12-24: 98.7% / 25-44: 98.2%)²⁴ and should, therefore, not be a serious problem for the inference of conclusions from our estimation results.

Finally, as stressed in the introduction, pension literacy may play a role in the confidence that people have in pensions. (Think for example about young people that worry that when they are old

²⁴ <https://www.cbs.nl/nl-nl/nieuws/2016/22/acht-procent-van-de-nederlanders-nooit-op-internet>

there is no pension anymore for them). Our experiment has generated exogenous variation in pension literacy and in a follow-up paper we will try to exploit this exogenous variation to investigate the causal effect of pension literacy on the confidence of people in their pension.

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Appendix A Positive and negative letter

Wat kun je doen?

Stel je voor: Na jaren werken is het zover, je mag met pensioen. Er is ineens tijd voor die wereldreis, die leuke hobby waar je nooit tijd voor had, of toch de geraniums verplanten? Hoe je het ook wendt of keert, dit kost allemaal geld. Misschien wel meer geld dan de uitkering die je krijgt vanuit de AOW en je aanvullende pensioen.

Ben jij benieuwd hoeveel je nu al gespaard hebt? En wat voor leuke dingen je daar later mee kan doen? Kijk dan op www.mijnpensioenoverzicht.nl nadat je de belastingaangifte hebt gedaan dit jaar, want dan heb je jouw DigiD toch al bij de hand! Zo doe je dat:

- 1) *Je doet je belastingaangifte*
- 2) *Dan klik je door naar www.mijnpensioenoverzicht.nl*
- 3) *Log in met je DigiD (die je toch al bij de hand hebt voor de belastingaangifte)*
- 4) *Geef jezelf inzicht in je inkomen voor later*

Waarom zou ik dit doen?

Pensioen heeft niet alleen te maken met “later”, maar ook met nu. Pensioenpremies betalen, een huis kopen, trouwen, scheiden, kinderen krijgen, een jaar er tussenuit of eerder stoppen met werken. Dit heeft allemaal te maken met je financiële planning en je pensioen.

Wist je dat:

- + 20% van je loon naar je pensioen gaat? Dat is gelijk aan 1 dag werken per week.
- ✗ De AOW premie die je nu betaalt volledig gebruikt wordt om de AOW uitkeringen van de huidige ouderen te betalen?
- ✗ De meeste werknemers bouwen verplicht een werknemerspensioen op, bovenop de AOW.
- ✗ Werknemers en werkgevers meestal allebei premies betalen voor het werknemerspensioen? Deze premies worden belegd en daar wordt later de pensioenuitkering van betaald.
- + Als een pensioenfonds er slecht voor staat moeten pensioenen verlaagd worden. Dit raakt niet alleen gepensioneerden, maar ook de pensioenopbouw van werknemers.
- + Een pensioenfonds uitkeringen alleen aanpast aan stijgende prijzen wanneer de financiële positie van het fonds goed genoeg is? Dit wordt *indexatie* genoemd.
- + Iemand die 20 uur per week werkt de helft minder werknemerspensioen opbouwt dan zijn/haar collega die 40 uur per week werkt?

Maak jij je zorgen?

In de media lezen we sombere berichten over het pensioenstelsel. "De AOW wordt onbetaalbaar", "Pensioenfondsen bereiden deelnemers voor op verlaging pensioen" en "Kabinet waarschuwt voor lager pensioen". Het is geen wonder dat 8 op de 10 Nederlanders onzeker is over hun inkomen voor later of denken dat ze te weinig pensioen opbouwen.

Heb jij je pensioen eigenlijk wel goed geregeld? Wil je zeker weten dat je genoeg inkomen hebt als je later met pensioen gaat? Kijk dan op www.mijnpensioenoverzicht.nl nadat je de belastingaangifte hebt gedaan dit jaar, want dan heb je jouw DigiD toch al bij de hand! Zo doe je dat:

- 1) *Je doet je belastingaangifte*
- 2) *Dan klik je door naar www.mijnpensioenoverzicht.nl*
- 3) *Log in met je DigiD (die je toch al bij de hand hebt voor de belastingaangifte)*
- 4) *Geef jezelf inzicht in je inkomen voor later*

Waarom zou ik dit doen?

Pensioen heeft niet alleen te maken met "later", maar ook met nu. Pensioenpremies betalen, een huis kopen, trouwen, scheiden, kinderen krijgen, een jaar er tussenuit of eerder stoppen met werken. Dit heeft allemaal te maken met je financiële planning en je pensioen.

Wist je dat:

- + 20% van je loon naar je pensioen gaat? Dat is gelijk aan 1 dag werken per week.
- ✗ De AOW premie die je nu betaalt volledig gebruikt wordt om de AOW uitkeringen van de huidige ouderen te betalen?
- ✗ De meeste werknemers bouwen verplicht een werknemerspensioen op, bovenop de AOW.
- ✗ Werknemers en werkgevers meestal allebei premies betalen voor het werknemerspensioen? Deze premies worden belegd en daar wordt later de pensioenuitkering van betaald.
- + Als een pensioenfonds er slecht voor staat moeten pensioenen verlaagd worden. Dit raakt niet alleen gepensioneerden, maar ook de pensioenopbouw van werknemers.
- ✗ Een pensioenfonds uitkeringen alleen aanpast aan stijgende prijzen wanneer de financiële positie van het fonds goed genoeg is? Dit wordt *indexatie* genoemd.
- + Iemand die 20 uur per week werkt de helft minder werknemerspensioen opbouwt dan zijn/haar collega die 40 uur per week werkt?

Appendix B Facebook-ad

PENSIOEN LAB

PensioenLab
@PensioenLab

Startpagina
Info
Foto's
Vind-ik-leuks
Video's
Evenementen
Berichten
Een pagina maken

Vind ik leuk · Delen · Bewerkingen voorstellen · ...

PENSIOEN LAB PensioenLab
4 april om 2:26 · €

Als jij je belastingaangifte dit jaar doet, kijk dan ook meteen hoeveel je al gespaard hebt voor je pensioen door met je DigiD in te loggen op www.mijnpensioenoverzicht.nl

Want wist je dat...

- * 20% van je loon nu al naar je pensioen gaat?
- * De AOW premie die je nu betaalt volledig gebruikt wordt om de AOW uitkeringen van de huidige ouderen te betalen?
- * Iemand die 20 uur per week werkt de heft minder werknemerspensioen opbouw dan zijn/haar collega die 40 uur per week werkt?

Appendix C Effects of logging in at mijnpensioenoverzicht.nl

[Table C1 here]

Appendix D Pension literacy questions

[Table D1 here]

[Table D2 here]

Tables

Table 1. Sample

	Positive	Letter Negative	None
<i>Sample aged 20-40</i>			
Gross sample	1,145	1,124	2,291
Letter sent back	23	21	n/a
Bouncers	46	45	92
Deleted after check	17	33	64
Chipped surveys	14	8	35
No cooperation	504	481	1,073
Complete surveys	542	536	1,027
Response-rate	52%	53%	51%
<i>Sample aged 41-64</i>			
Gross sample	883	727	1,777
Letter sent back	6	8	n/a
Bouncers	35	29	71
Deleted after check	26	6	36
Chipped surveys	8	14	37
No cooperation	279	177	595
Complete surveys	528	493	1,038
Response-rate	66%	74%	65%

Table 2. Descriptive statistics

	Letter						Facebook ad				Facebook user				Total	
	Positive		Negative		None		No		Yes		No		Yes		Mean	S.D.
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.		
Female	0.47	0.50	0.45	0.50	0.44	0.50	0.49	0.50	0.42	0.50	0.32	0.47	0.51	0.50	0.45	0.50
Low edu. level	0.18	0.38	0.17	0.37	0.17	0.38	0.13	0.33	0.11	0.32	0.11	0.31	0.13	0.34	0.17	0.38
Median edu. level	0.47	0.50	0.46	0.50	0.49	0.50	0.48	0.50	0.56	0.50	0.50	0.50	0.48	0.50	0.48	0.50
High edu. level	0.35	0.48	0.37	0.48	0.34	0.47	0.39	0.49	0.33	0.48	0.39	0.49	0.39	0.49	0.35	0.48
Single household	0.28	0.45	0.23	0.42	0.18	0.38	0.22	0.41	0.16	0.37	0.18	0.39	0.22	0.42	0.22	0.41
Children	0.20	0.40	0.34	0.48	0.32	0.47	0.30	0.46	0.33	0.48	0.36	0.48	0.29	0.46	0.29	0.46
Full-time work	0.40	0.49	0.38	0.49	0.41	0.49	0.40	0.49	0.51	0.51	0.30	0.46	0.41	0.49	0.40	0.49
Age 20-24	0.07	0.26	0.07	0.26	0.08	0.27	0.15	0.36	0.24	0.43	0.08	0.27	0.16	0.37	0.08	0.27
Age 25-29	0.12	0.33	0.12	0.32	0.12	0.33	0.24	0.42	0.40	0.50	0.21	0.40	0.24	0.43	0.12	0.33
Age 30-34	0.14	0.35	0.14	0.35	0.13	0.31	0.28	0.45	0.09	0.29	0.34	0.47	0.26	0.44	0.14	0.35
Age 35-40	0.17	0.38	0.18	0.39	0.16	0.37	0.34	0.47	0.27	0.45	0.38	0.49	0.33	0.47	0.17	0.38
Age 41-49	0.21	0.41	0.20	0.40	0.22	0.41	-	-	-	-	-	-	-	-	0.21	0.41
Age 50-59	0.22	0.42	0.23	0.42	0.11	0.41	-	-	-	-	-	-	-	-	0.22	0.42
Age 60-64	0.06	0.23	0.06	0.23	0.06	0.24	-	-	-	-	-	-	-	-	0.06	0.24
Facebook ad	0.01	0.12	0.02	0.13	0.01	0.11	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.15	0.01	0.12
Observations	1,092		1,051		2,154		2,121		45		273		1,902		4,297	

Table 3. Effects of randomized letters on pension awareness

	Dependent variable: Pension literacy (0-5)											
	Model 1		Model 2				Model 3		Model 4			
	OLS		OLS		OLS		OLS		OLS		OLS	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Letter	0.06	**	0.03	0.11	***	0.04	0.06	*	0.03	0.10	**	0.04
Positive letter				-0.08	*	0.05				-0.08	*	0.05
<i>Control variables</i>												
Female							-0.04		0.04	-0.04		0.04
Low edu. level							-0.12	***	0.04	-0.12	***	0.04
High edu. level							0.19	***	0.04	0.19	***	0.04
Single household							0.02		0.04	0.02		0.04
Children							0.01		0.04	0.00		0.04
Full-time work							-0.03		0.04	-0.03		0.04
Age 25-29							0.09		0.07	0.09		0.07
Age 30-34							0.17	**	0.07	0.17	**	0.07
Age 35-40							0.30	***	0.07	0.30	***	0.07
Age 41-49							0.34	***	0.07	0.35	***	0.07
Age 50-59							0.47	***	0.07	0.48	***	0.07
Age 60-64							0.53	***	0.08	0.53	***	0.08
Constant	2.11	***	0.02	2.11	***	0.02	1.79	***	0.06	1.79	***	0.06
Observations	4,212		4,212				4,212		4,212			

Robust standard errors are presented, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Probit coefficients represent Average Marginal Effects.

(Continued)

Dependent variable: Pension check (0,1)									
Model 5		Model 6		Model 7		Model 8			
Probit		Probit		Probit		Probit			
Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.		
0.02	0.01	0.03	0.02	0.03 *	0.01	0.03 *	0.02		
		-0.01	0.02			-0.01	0.02		
				-0.09 ***	0.02	-0.09 ***	0.02		
				-0.01	0.02	-0.01	0.02		
				0.04 **	0.02	0.04 **	0.02		
				-0.04 **	0.02	-0.04 **	0.02		
				-0.02	0.02	-0.02	0.02		
				-0.04 **	0.02	-0.04 **	0.02		
				0.12 ***	0.04	0.12 ***	0.04		
				0.13 ***	0.03	0.13 ***	0.03		
				0.11 ***	0.03	0.11 ***	0.03		
				0.12 ***	0.03	0.12 ***	0.03		
				0.18 ***	0.03	0.18 ***	0.03		
				0.29 ***	0.04	0.29 ***	0.04		
0.32 ***	0.01	0.32 ***	0.01	0.32 ***	0.01	0.32 ***	0.01		
4,124		4,124		4,124		4,124			

Table 4. Heterogeneous effects of randomized letters

	Dependent variable: Pension literacy (0-5)						
	Model 1		Model 2			Model 3	
	OLS		OLS			OLS	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	
Letter	0.13 **	0.06	0.13 **	0.05	0.07	0.05	
Letter · Age 20-40 ^a	0.06	0.08					
Letter · Female ^c			-0.08	0.08			
Letter · High educated ^e					0.08	0.08	
Positive letter	-0.12 *	0.06	-0.14 **	0.06	-0.06	0.06	
Positive letter · Age 20-40 ^b	0.07	0.09					
Positive letter · Female ^d			0.13	0.09			
Positive letter · High educated ^f					-0.04	0.10	
Control variables included	Yes		Yes			Yes	
Observations	4,212		4,124			4,212	

Robust standard errors are presented, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Probit coefficients represent Average Marginal Effects.

a Linear combination gives a p-value=0.21 (Model 1) and p-value=0.12 (Model 4) respectively.

b Linear combination gives a p-value=0.52 (Model 1) and p-value=0.88 (Model 4) respectively.

c Linear combination gives a p-value=0.35 (Model 2) and p-value=0.38 (Model 5) respectively.

d Linear combination gives a p-value=0.94 (Model 2) and p-value=0.80 (Model 5) respectively.

e Linear combination gives a p-value=0.03 (Model 3) and p-value=0.06 (Model 6) respectively.

f Linear combination gives a p-value=0.20 (Model 3) and p-value=0.70 (Model 6) respectively.

(Continued)

Dependent variable: Pension check (0,1)					
Model 4		Model 5		Model 6	
Probit		Probit		Probit	
Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
0.02	0.02	0.03	0.02	0.01	0.02
0.02	0.03				
		-0.01	0.04		
				0.04	0.04
-0.02	0.02	0.00	0.03	0.00	0.03
0.02	0.04				
		0.00	0.04		
				-0.01	0.04

Yes		Yes		Yes	
4,124		4,124		4,124	

Table 5. Effects of a Facebook ad on pension awareness

Dependent variable: Pension literacy (0-3)						
	Model 1		Model 2		Model 3	
	OLS		IV		IV	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Letter	0.03	0.05	0.02	0.04	0.03	0.04
Facebook ad	0.13	0.12	0.52	1.07	0.36	1.05
<i>Control variables</i>						
Female	-0.02	0.04	-0.01	0.04	0.00	0.04
Low edu. level	0.00	0.05	0.00	0.05	0.01	0.06
High edu. level	0.07 *	0.04	0.07 *	0.04	0.07 *	0.04
Single household	0.03	0.05	0.03	0.05	0.03	0.05
Children	0.05	0.01	0.05	0.04	0.07	0.05
Full-time work	0.01	0.04	0.01	0.04	0.02	0.04
Age 25-29	0.00	0.06	0.00	0.06	-0.04	0.06
Age 30-34	0.00	0.06	0.01	0.06	-0.04	0.07
Age 35-40	0.05	0.06	0.06	0.06	0.00	0.07
Important (1-5)					0.05 **	0.02
Search (1-5)					0.02	0.02
Constant	0.73 ***	0.05	0.72 ***	0.06	0.50 ***	0.09
Observations	2,128		2,128		2,007	
F-stat. first stage			25.10		26.42	

Robust standard errors are presented, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Probit coefficients represent Average Marginal Effects.

(Continued)

Dependent variable: Pension check (0,1)								
Model 4			Model 5			Model 6		
Probit			IV-Probit			IV-Probit		
Coeff.		S.E.	Coeff.		S.E.	Coeff.		S.E.
0.04	**	0.02	0.03		0.02	0.03	*	0.02
0.23	***	0.06	0.93	***	0.03	0.87	***	0.05
-0.09	***	0.02	-0.08	***	0.02	-0.06	***	0.02
0.04		0.03	0.04		0.03	0.05	*	0.03
0.07	***	0.02	0.06	***	0.02	0.04	**	0.02
-0.06	**	0.03	-0.06	**	0.02	-0.04	*	0.02
-0.01		0.02	-0.01		0.02	0.01		0.02
-0.04	**	0.02	-0.04	**	0.02	-0.04	*	0.02
0.11	***	0.03	0.10	***	0.03	0.04		0.03
0.13	***	0.03	0.13	***	0.03	0.05		0.03
0.10	***	0.03	0.10	***	0.03	0.01		0.04
						0.07	***	0.01
						0.09	***	0.01
0.28	***	0.01	0.29	***	0.01	0.30	***	0.01
2,067			2,067			1,922		

Table C1. The effects of logging in at mijnpensioenoverzicht.nl

Did logging in increase... (1-5)	1 (not at all)	2	3	4	5 (fully agree)
<i>Insight</i> in personal pension situation?	5.22%	7.98%	29.33%	37.15%	20.32%
<i>Confidence</i> in personal pension situation?	8.73%	21.46%	35.79%	23.70%	10.33%
<i>Interest</i> in personal pension situation?	5.97%	14.85%	35.74%	29.38%	14.06%
<i>Actions</i> that can be taken with the information?	5.20%	12.99%	34.34%	35.35%	15.12%
<i>Awareness</i> of having a too low pension?	24.49%	22.04%	23.46%	17.85%	12.16%

Table D1. Pension literacy questions and answers

		%	Confidence (1-5)
Q1	<i>"What happens with public pension contributions?"</i>		
a)	Invested for my pension benefits after retirement	12.18	2.77
b)	Used to pay pensions for current retirees	37.94	3.39
c)	Partly invested and partly used to pay pensions for current retirees	49.88	3.10
Q2	<i>"Who pays contributions to employer-related pensions?"</i>		
a)	Usually employees only	9.72	2.70
b)	Usually employers only	8.56	2.86
c)	Usually both employees and employers	81.73	3.63
Q3	<i>"When the financial condition of a pension fund is poor, the pension fund needs to cut pensions. Which pension fund participants are hit by a pension cut?"</i>		
a)	Retirees	32.87	3.32
b)	Active employees	20.42	2.86
c)	All (ex-)employees and retirees	46.70	3.34
Q4	<i>"What is roughly the percentage of earnings that is on average used to pay pension contributions (by all parties)?"</i>		
a)	10%	34.03	2.43
b)	15%	39.23	2.36
c)	20%	20.00	2.57
d)	30%	6.74	2.67
Q5	<i>"Lisa and Femke are colleagues with the same hourly wage and pension plan. Lisa works 20 h/w and Femke 40 h/w. How high is Lisa's employer-related pension?"</i>		
a)	Half of Femke's pension.	27.66	2.81
b)	Less than half of Femke's pension.	13.84	2.83
c)	Depends on the pension plan.	58.50	2.87

Table D2. Pension literacy with the Facebook information only.

	Dependent variable: Pension literacy (0-3)									
	Model 1		Model 2		Model 3		Model 4			
	OLS		OLS		OLS		OLS			
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.		
Letter	0.05 *	0.02	0.07 **	0.03	0.05 *	0.02	0.07 **	0.03		
Positive letter			-0.05	0.04			-0.05	0.04		
Control variables included	No		No		Yes		Yes			
Observations	4,212		4,212		4,212		4,212			

Robust standard errors are presented, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Probit coefficients represent Average Marginal Effects.

Table D3. Pension literacy questions separately as dependent variables.

	Dependent variable: Pension literacy questions 1 to 5									
	Q1		Q2		Q3		Q4		Q5	
	OLS		OLS		OLS		OLS		OLS	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Letter	0.03 *	0.02	0.02	0.01	0.01	0.02	0.04 **	0.02	0.00	0.02
Positive letter	-0.01	0.02	-0.02	0.02	-0.01	0.02	-0.02	0.02	-0.02	0.02
Control variables included	Yes		Yes		Yes		Yes		Yes	
Observations	4,220		4,219		4,216		4,214		4,212	

Robust standard errors are presented, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Probit coefficients represent Average Marginal Effects.