*Financial literacy and retirement preparation in the Netherlands**

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Abstract

We present new evidence on financial literacy and retirement preparation in the Netherlands based on two surveys conducted before and after the onset of the financial crisis. We document that while financial knowledge did not increase from 2005 to 2010, in 2010 significantly more individuals report having thought about their retirement. Using information on financial conditions and financial knowledge of relatives, we find a positive causal effect of financial literacy on retirement preparation. Employing the panel feature of our dataset, we show that the effect of financial knowledge on retirement planning is bound to be positive.

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1 Introduction

A typical Dutch employee is confident of receiving a generous pension benefit upon retirement, in sharp contrast with what pension funds can realistically promise to future retirees. In fact, there is a broad consensus that current pension arrangements

are not sustainable, and changes in the design and implementation of pension plans are being discussed. These changes will most likely result in lower replacement rates or increased dependency upon investment risk or both. In either case, there is an increasing need for employees to prepare for retirement and become informed about their pension plans.

Whether Dutch workers have the financial knowledge and skills to plan and save adequately for retirement is increasingly cause for concern. Based on a 2005 survey, more than a third of Dutch households report having thought 'little' or 'hardly at all' about their retirement, a measure that is shown to be correlated with saving behavior and wealth accumulation in both the Netherlands and other countries (Lusardi and Mitchell, 2007, 2011; Van Rooij *et al.*, 2011*b*). In this paper, we investigate whether levels of financial literacy and retirement preparedness changed in the 5 years between 2005 and 2010. During that period, public discussions of the low level of solvency of Dutch pension funds, restoring the sustainability of the Dutch pension system, and increasing the pension age may have encouraged retirement preparation in the Netherlands. Also during this time, the government and the financial sector developed several initiatives to increase financial awareness. Moreover, in this period, we witnessed the biggest financial crisis since the Great Depression.

We commissioned a new survey on financial literacy and retirement preparedness in summer 2010, as part of the Dutch Central Bank (DNB) Household Survey (DHS). Our main conclusions are as follows: there are vast differences in levels of financial knowledge among the Dutch population: women and those with low levels of education often display a lack of basic financial skills. Moreover, despite the financial crisis and several initiatives to enhance financial skills, the overall level of financial literacy did not improve between 2005 and 2010. Nevertheless, based on 2010 results, individuals seem to be doing more in preparation for retirement. This might be the result of the policy debate on the future of the Dutch pension system and the worsening solvency position of pension funds. When we use the financial situation of older siblings and parents as instruments for financial literacy, we find that financial literacy is an important determinant of retirement readiness. As the Dutch pension system prepares to transfer much more responsibility for financial security in retirement to employees, it is important to develop programs to increase financial literacy and pension knowledge and awareness, especially among the more vulnerable groups of the population. The richness of our dataset allows us to provide a number of novel contributions to this research field. First, by using information on literacy levels and financial situations of parents and siblings of respondents, we are able to go beyond highlighting associations and can make causal inferences about the effect of literacy on retirement planning. Second, by collecting the same type of information in 2010 as we did in 2005, we are able to exploit the panel component of our survey to circumvent the problem of unobserved individual heterogeneity to study the effect of financial literacy on retirement planning. Third, our dataset includes information on religion. This enables us to explore the correlation between financial literacy, retirement planning and religion, a relationship that no other scholars have yet explored.

The outline of the paper is as follows: In Section 2, we briefly explain and describe the Dutch pension system and the policy debate on pension arrangements. In Section 3, we provide information on our survey data. In Section 4, we introduce the questions used to measure financial literacy and present the distribution of financial knowledge across demographic variables. In Section 5, we discuss to what extent Dutch citizens plan for retirement and the relationship between financial literacy and planning. In Section 6, we use the panel component of our survey to account for unobserved individual heterogeneity when assessing the relationship between financial literacy and retirement planning. In Section 7, we discuss policy implications.

2 The Dutch pension system

Internationally, the Dutch pension system often stands as an example for other countries. There is a pay-as-you-go financed AOW (Algemene Ouderdomswet) pension, which is a flat, relatively generous benefit based on an individual's number of years of residence in the Netherlands between the ages of 15 and 65. Beyond that, more than nine out of ten employees are enrolled in compulsory company pension plans. On average, the company pension benefit and the AOW benefit are approximately equal. The combined average gross replacement rate provided by these pension systems has been above 80%, a level that makes the additional third pillar for household savings of minor importance.

Company retirement plans have historically provided little freedom of choice (Van Rooij *et al.*, 2007). Trade unions determine, together with employers, the level of pension contributions, and pension funds decide the investment policy. Until the start of the new century, the majority of retirees were entitled to a retirement benefit of 70% of their final salary after 35–40 years of work. As the number of retirees was low compared to the number of workers, pension funds were able to exploit intergenerational solidarity among their participants to protect the retirees from shocks to investment returns or longevity. While the ageing of the population led to a steady increase in the ratio of retirees to workers, a period of strong investment returns in the 1990s enabled pension funds to make payments without endangering solvency ratios. After the dot-com crash, these ratios decreased dramatically, and pension funds overwhelmingly exchanged career-final wage pension plans for career-average wage plans with conditional indexation for active participants and retirees. As these indexation decisions are dependent on solvency ratios, this policy change introduced an important element of Defined Contribution pension systems into the Dutch pension system.

During the financial crisis, pension funds incurred huge investment losses, especially in 2008. Low interest rates plus upward revisions in longevity expectations increased pension costs to unprecedented levels. The government appointed a committee of pension experts that concluded that the current system is not sustainable and that pension ambitions need to be lowered in terms of either the level of benefits or the degree of certainty of receiving this benefit. Either way, it became obvious that it was increasingly important for households to prepare for retirement and to maintain or acquire the necessary financial skills to do so.

3 Data

To study the relationship between financial knowledge and retirement preparation following the financial crisis and the emergence of solvency problems for Dutch pension funds, we fielded a new survey among participants of the CentERpanel between June 25 and July 6, 2010. This panel is run by CentERdata at Tilburg University and contains approximately 2,000 households whose members fill out short questionnaires via the Internet on a weekly basis. Annually, panel members provide information on income, wealth, health, employment, pensions, attitudes toward saving and saving behavior for the DHS, providing researchers with a rich set of background information on the respondents. Households are recruited based on careful selection procedures to assure the representativeness of the Dutch population. The availability of a computer or Internet connection is not a prerequisite of the selection procedure. If necessary, either a computer with Internet access or alternative equipment such as a set-top box for communication through the television is provided to respondents. Participants do not receive financial incentives to fill out the survey.

To investigate the extent of financial literacy and retirement planning, we have selected members of the CentERpanel aged 25 years and older, including both the household head and partner, if present. A total of 1,665 respondents have completed the questionnaire, a response rate of 65.4%. The average age of respondents is 55 years, 53.0% are male, and 4.8% did not attain a school diploma after primary education, while 12.7% attained a university degree. As high-income respondents are somewhat overrepresented, we use weights to present statistics representative of the Dutch population. Since we fielded a similar survey using the CentERpanel 5 years earlier, we are able to compare the financial knowledge of and degree of retirement planning among respondents well before and since the onset of the financial crisis.

4 Empirical evidence

4.1 How much do individuals know?

We measure financial literacy by using the three questions that were first proposed by Lusardi and Mitchell (2011) and added to the 2004 U.S. Health and Retirement Study. The first two questions are rather basic and measure respondents' ability to perform simple calculations and understand the effect of inflation. To be able to classify respondents according to different levels of financial sophistication, a third and more complicated question was added to the module. This question measures understanding of risk diversification. The precise wording of the questions is as follows:

1. *Understanding of Interest Rate* (*Numeracy*). Suppose you had €100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? (i) More than €102; (ii) Exactly €102; (iii) Less than €102; (iv) Do not know; (v) Refusal.
2. *Understanding of Inflation*. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? (i) More than today; (ii) Exactly the same; (iii) Less than today; (iv) Do not know; (v) Refusal.

3. *Understanding of Risk Diversification*. Do you think that the following statement is true or false? Buying a company stock usually provides a safer return than a stock mutual fund. (i) True; (ii) False; (iii) Do not know; (iv) Refusal.

Van Rooij *et al.* (2011*a*) designed a financial literacy module for the DHS in 2005, which contained the three questions presented above, in addition to other questions. To assess the relevance of the wording of the questions, a randomly chosen group was exposed to the risk diversification question with inverted wording. The pattern of responses changed dramatically when the order of the wording was inverted. The number of correct answers was very low when respondents were asked whether 'buying a stock mutual fund usually provides a safer return than a company stock' but doubled when respondents were asked whether 'buying a company stock usually provides a safer return than a stock mutual fund'. For the current study, in order to keep the data for the Netherlands as comparable as possible with the data collected by the other countries participating in the international comparison, we did not do any randomization. However, the results of Van Rooij *et al.* (2011*a*) show that there are considerable measurement (classification) errors in our financial literacy variables. We will address the problem of measurement error when we assess the effect of financial literacy on retirement planning.

Responses to the three financial literacy questions asked of participants in the 2010 survey are reported in Tables 1a–c. Most respondents (84.8%) have at least some idea about interest rate calculations, with the percentage of incorrect answers at only 5.2% (Table 1a). About 10% of individuals refuse or do not know how to respond to this question. About 77% of respondents answered the inflation question correctly and about 11% responded incorrectly (Table 1b). To answer the second question correctly, individuals need to have some basic understanding of the concept of inflation and its impact on purchasing power. Note that well before the start of the Economic and Monetary Union (EMU) in 1999, the Dutch Central Bank closely followed the strict monetary policy of the German Bundesbank. As a result, inflation has been quite low since the mid-1980s and the Dutch population has not experienced periods of high inflation.

The proportion of correct answers decreases considerably, to a little more than 50%, when we consider the more complex question on risk diversification (Table 1c). A sizable fraction (35%) of respondents either refuses to or is not able to answer the risk diversification question. In order to interpret the low percentage of correct answers, one should realize that the questionnaire is representative of the Dutch population aged 25 years and older on an individual level, not on the household level. The sample contains respondents who are the primary household financial decision makers and respondents whose partner is in charge of the household finances. Moreover, about three-quarter of Dutch households neither holds company stocks nor stock mutual funds. Furthermore, concepts like 'stock mutual funds' are typically not covered in (lower secondary) high schools.

Given the low percentage of correct answers to the risk diversification question, it is not surprising that only 45% of respondents answered all questions correctly (Table 1d). A considerable fraction of respondents (73%), however, provided the

Table 1a. *Interest question* (*weighted percentages*)

	Whole sample	Age 25–65
More than 102 euro	84.83	85.54
Exactly 102 euro	3.44	3.01
Less than 102 euro	1.74	2.11
Do not know	8.90	8.26
Refuse to answer	1.08	1.08
Number of observations	1,665	1,324

Table 1b. *Inflation question* (*weighted percentages*)

	Whole sample	Age 25–65
More	2.74	3.09
Exactly the same	5.65	5.77
Less	76.86	75.90
Do not know	13.54	14.01
Refuse to answer	1.20	1.24
Number of observations	1,665	1,324

Table 1c. *Risk question* (*weighted percentages*)

	Whole sample	Age 25–65
Correct 'false'	51.91	53.29
Incorrect 'true'	13.32	11.98
Do not know	33.20	32.86
Refuse to answer	1.57	1.87
Number of observations	1,665	1,324

Table 1d. *Answers across questions* (*weighted percentages*)

	Whole sample	Age 25–65
Interest and Inflation correct	73.36	73.11
All correct	44.83	46.18
No correct	10.46	10.45
At least 1 'Do not know'	37.60	37.25
All 'Do not know'	8.07	8.24
Number of observations	1,665	1,324

correct answer to both the interest rate and the inflation questions, and we thus find a strong positive association between the ability of respondents to correctly answer the first and second basic literacy questions.

Table 2. *Distribution of financial literacy across demographics* (*weighted percentages*)

	Interest question		Inflation question		Risk question		Overall	
	Correct	DK	Correct	DK	Correct	DK	3 correct	⩾1 DK
Age								
35 and younger	84.67	8.89	76.17	16.70	52.51	32.29	45.97	34.32
36–50	85.13	10.68	74.24	17.32	52.71	35.89	45.83	38.34
51–65	86.57	8.22	77.48	12.04	54.43	35.16	46.70	38.07
Older than 65	82.10	12.44	80.60	12.79	46.56	34.92	39.57	38.94
Gender								
Male	86.63	9.31	81.91	11.06	62.03	27.50	55.06	29.04
Female	83.10	10.63	71.99	18.30	42.14	41.79	34.96	45.85
Education								
Primary	70.24	18.29	65.62	19.49	41.68	48.53	28.01	54.36
Lower secondary	79.81	15.18	66.00	20.73	45.76	40.89	35.10	44.88
Middle secondary	85.30	8.90	75.28	16.55	47.43	34.87	41.66	38.07
Upper secondary	91.48	4.95	88.00	7.54	59.42	25.86	54.40	26.56
Higher vocational	89.45	6.78	85.80	9.52	59.70	29.68	55.38	30.81
University	95.66	2.63	94.79	4.81	72.40	23.19	69.76	24.11
Self-employed, non-employed, workers and retired								
Self-employed	86.54	8.99	78.30	13.13	55.34	33.28	50.15	34.39
Non-employed	87.84	6.66	84.39	13.54	65.53	23.99	57.96	28.14
Workers	78.94	12.49	68.05	21.63	40.90	43.43	28.30	50.14
Retired	85.86	10.81	80.31	11.89	50.82	32.58	44.97	35.24

4.2 Who knows the least?

Financial literacy varies widely across demographic variables such as age, gender, education and socioeconomic status (Table 2). Interestingly, the 65 plus cohort – who experienced the period of high inflation in the Netherlands during the 1970s – scores somewhat better on the inflation question than younger respondents, while the reverse is true for the other two questions and the overall score. Overall, however, differences across age are not statistically significant. These results differ from those found in a number of other studies, which find a hump-shaped age profile for financial literacy.

In line with the results of other studies, we find large gender differences in financial literacy in the Netherlands: women display much lower knowledge than men, and differences are statistically significant. Notice, however, that women do not give many more incorrect answers than men. Instead they state 'do not know' much more often. As expected, financial literacy increases strongly and significantly with the level of education. About a third of respondents with primary or lower secondary education answered all literacy questions correctly. Around half of those individuals answered at least one of the three literacy questions with 'do not know' or 'refuse to answer'. Conversely, the majority (70%) of respondents with a university degree gave correct answers to all three literacy questions.

Financial literacy is significantly correlated with socioeconomic status. Self-employed respondents not only have higher literacy scores overall but also provide a correct answer to each literacy question more often than those who are employed, retired or unemployed (other than retirees). This is important, since the self-employed in the Netherlands are in charge of their own retirement savings, while employees typically participate in their employer's mandatory pension plan. Employees seem more financially literate than retirees (including those who have retired early), who, in turn, score much better than do unemployed respondents. The latter group includes those who are unemployed but looking for a job, those who are not able to work and receive a disability benefit, and housewives and househusbands.

4.3 *Financial literacy and religious affiliation*

Renneboog and Spaenjers (2011) have used the DHS panel to investigate the differences in economic attitudes and financial decisions between religious and non-religious Dutch households. They find the Netherlands to be an important case study for examining the effect of religion on individual financial decision-making for two reasons. First, there is a considerable variety in religious beliefs in the Netherlands: Catholicism, different types of Protestantism, and several other beliefs (e.g., Islam). Nevertheless, Christian religions dominate. An essential difference between Catholics and Protestants is that 'the former rely on salvation by works with enforcement by the Church and the latter on salvation from divine grace with enforcement from social interaction' (Arruñada, 2010). Second, the distinction between religious and non-religious individuals is probably easier to make in the Netherlands than in other countries. Generally, those who claim affiliation with a specific religious denomination also practice their religion, which is not the case in all countries.

Renneboog and Spaenjers (2011) find that religious households (those practicing a religion) consider themselves more trusting, have a stronger bequest motive and – most important for our work – a longer planning horizon. (Given this last finding, one would expect religious individuals to put more emphasis on retirement planning than those who are not religious. We will return to this issue in Section 5 of the paper.) Furthermore, they find that Catholics invest less in the stock market. At the same time, in line with the differences between the two Christian religions, Protestants seem to have a weaker internal locus of control than Catholics (i.e., they feel less able to influence the course of their life), but a higher awareness of individual financial responsibility. Given this last result, one may expect differences in the level of financial literacy across religious groups. As our survey contains information on religion, we are able to explore this relationship. While our religion variable measures affiliation and does not necessarily capture upbringing and/or active practice, we feel we can assume that claiming of affiliation indicates a likelihood of religious practice. In our empirical work, we make a distinction between no religion (including humanists), Catholic, Protestant (including Evangelicals) and 'other' religions. The last category consists of Muslims and other smaller religious groups. Table 3a shows that individuals with religion designated 'other' display the least financial literacy. However, we do not find that Protestants are more financially literate than Catholics or

Table 3a. *Distribution of financial literacy across religion* (*weighted percentages*)

	Interest question		Inflation question		Risk question		Overall	
	Correct	DK	Correct	DK	Correct	DK	3 correct	⩾1 DK
No religion	86.03	9.47	78.92	13.34	53.57	34.42	46.97	36.35
Roman Catholic	84.79	9.84	74.32	16.58	54.20	32.29	44.82	36.26
Protestant	83.48	9.59	78.94	10.64	50.50	31.73	43.82	35.84
Other religion	81.74	14.58	69.18	26.94	37.08	54.92	35.15	54.92

non-religious individuals. Individuals of 'other' religion report that they do not know the answer to the financial literacy questions more often than other groups.

5 Thinking about retirement

5.1 Descriptive evidence

Our main interest is explaining why some households prepare for retirement more effectively than others. To that end, we included the following question in our 2010 survey: *How much have you thought about retirement: A lot, some, little, or hardly at all?* This question was also included in the 2005 DHS questionnaire on financial literacy. As we stated in the introduction, the recent financial crisis has shown that the Dutch pension system is vulnerable to financial-market shocks. As a result, Dutch policy-makers have proposed additional pension reforms, such as an increase in the statutory retirement age. A key element of the proposed reforms is more individual choice concerning the timing of retirement. Furthermore, the market risk of pension investments will be deferred away from employers, meaning individuals will face more uncertainty with their second pillar pension. In this respect, one would expect that in the years since the 2005 survey, individuals would have taken more responsibility in preparing for retirement.

Table 3b indeed suggests that in 2010 respondents think significantly more about their retirement than they did in 2005 (see the results of the χ^2-tests). Note that there are some differences in the composition of the 2005 and 2010 samples. In 2005, the financial literacy questionnaire was only filled out by the household member in charge of household finances, whereas in 2010 we selected all household members aged 25 and older, including both the household head and partner, if present. In order to have comparable results, we consider in Table 3b the same group of individuals in 2005 and 2010, i.e., individuals aged 25 or over in charge of household finances.

While the observed increase in retirement preparation is a comforting result, it should be made clear that about a third of respondents acknowledged having thought 'a little' (28.1% in 2005; 21.9% in 2010) or 'hardly at all' (7% in 2005 and 2010) about retirement. Only a small group of respondents (12.9% in 2005; 17.1% in 2010) have thought 'a lot' about retirement. The majority (about 50%) took an intermediate position and reported having thought 'some' about retirement. If we

Table 3b. *Retirement planning across years (weighted percentages)*

Thought about retirement	Whole sample			Non-retired, age 65 and younger		
	2005	2010	Total	2005	2010	Total
A lot	12.9	17.1	14.7	9.7	13.2	11.2
Some	51.1	52.4	51.6	51.6	53.1	52.3
Little	28.1	21.9	25.4	28.7	24.7	27.0
Hardly at all	7.2	7.0	7.1	9.0	6.7	8.0
Do not know/Refusal	0.8	1.7	1.1	1.0	2.2	1.5
Number of observations	1,498	1,138	2,636	1,028	769	1,797
χ^2-statistic (*P*-value)	15.73 (0.0034)			9.77 (0.0444)		

Note: Respondents are in charge of household finances and at least 25 years old.

consider the subsample of non-retirees – the group of individuals who should be preparing for retirement – compared with the whole sample, we find that relatively more respondents in this subgroup have thought 'hardly at all' or 'little' about retirement.

Overall, most respondents seem to prepare only to a limited extent for retirement. Moreover, one may debate whether respondents who reported thinking 'a lot' or 'some' about retirement are actually thinking about the sufficiency of retirement savings rather than of ways to enjoy life after retirement. Psychological research, however, has shown that having a concrete picture in mind induces action and has a positive effect on the likelihood of taking concrete steps (McCrea *et al.*, 2008). Indeed, the Dutch data show that respondents who think more about retirement not only find it more important to save but also manage to save more (Van Rooij *et al.*, 2011*b*). Lusardi and Mitchell (2007) report evidence from the US showing households who think a little, somewhat or a lot about retirement accumulate substantially more wealth than those who do not think about retirement at all. For the median household, older planners (51–56 years old) hold twice as much wealth as non-planners.

Table 3c summarizes changes in financial literacy levels in the Netherlands between 2005 and 2010. As mentioned in Section 4, we randomized the risk diversification question in 2005 so that half of the sample answered the same question but with an inverted order. Hence, for an appropriate comparison, we restrict the 2005 sample to respondents who got exactly the same question on risk diversification as the members of the 2010 sample. Table 3c shows that the 2010 respondents had somewhat more trouble answering the interest rate and risk diversification questions correctly than did the 2005 respondents. This is a worrisome result as, given the events in the years 2005–2010 and the changes at the policy level, individuals should be taking on more responsibility for retirement preparation.[1]

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[1] Interestingly, the number of incorrect answers is not so much higher in 2010, rather the number of do not know answers has increased. This suggests that there might be less guessing and overconfidence than was present in 2005.

Table 3c. *Financial literacy across years* (*weighted percentages*)

Year	Number of observations	Interest question		Inflation question		Risk question		Overall	
		Correct	DK	Correct	DK	Correct	DK	3 correct	≥1 DK
2005	755	0.91	0.04	0.82	0.08	0.63	0.24	0.56	0.27
2010	1,138	0.86	0.09	0.81	0.12	0.56	0.33	0.50	0.35
Total	1,893	0.88	0.07	0.81	0.11	0.59	0.30	0.52	0.32
χ^2-statistic (*P*-value)		14.00 (0.0029)		4.49 (0.2127)		11.99 (0.0024)			

Note: Respondents are in charge of household finances and at least 25 years old. The 2005 sample is restricted to respondents who got the same risk question as 2010 sample.

Table 4. *Financial literacy by retirement planning* (*weighted percentages*)

	Planners	Non-planners
Interest question		
Correct	90.61	77.14
Do not know	4.24	17.32
Inflation question		
Correct	81.00	67.32
Do not know	9.06	25.48
Risk question		
Correct	62.15	39.05
Do not know	25.74	48.93
Overall		
Interest and inflation correct	77.85	64.86
All correct	52.96	34.88
At least 1 DK	28.67	51.00

Exploring the correlation between financial literacy and thinking about retirement, we find that respondents who reported thinking 'a lot' or 'some' about retirement have, on average, a similar level of financial literacy.[2] Moreover, these respondents are more financially literate than individuals who reported thinking 'little' or 'hardly at all' about retirement. Based on this evidence, in our multivariate analysis, we construct a dummy variable for retirement planning that takes on the value 1 if the respondent reported thinking 'a lot' or 'some' about retirement and 0 otherwise. Table 4 reports the relationship between this dummy variable and financial literacy, showing a strong positive correlation between financial literacy and thinking about retirement.

[2] Results are available from the authors upon request.

Table 5. *Multivariate analysis of retirement planning (1,166 observations)*

	1 OLS	2 GMM	3 OLS	4 GMM	5 OLS
All three correct	0.126*** (0.0308)	0.595*** (0.173)			
Number correct			0.101*** (0.0175)	0.175*** (0.0448)	
Interest question correct					0.173*** (0.0532)
Inflation question correct					−0.00621 (0.0460)
Diversification question correct					0.142*** (0.0310)
Age	0.0210 (0.0159)	0.0147 (0.0178)	0.0219 (0.0156)	0.0217 (0.0155)	0.0208 (0.0156)
Age squared	−0.000166 (0.000168)	−0.000107 (0.000188)	−0.000178 (0.000165)	−0.000180 (0.000164)	−0.000165 (0.000165)
Female	−0.0276 (0.0280)	0.0573 (0.0447)	−0.0235 (0.0275)	−0.000530 (0.0300)	−0.0215 (0.0277)
Education dummies (base: primary education)					
Lower secondary	0.104 (0.0791)	0.0562 (0.0862)	0.0982 (0.0766)	0.0887 (0.0759)	0.0986 (0.0760)
Middle secondary	0.0900 (0.0823)	0.00511 (0.0941)	0.0721 (0.0800)	0.0452 (0.0813)	0.0824 (0.0795)
Upper secondary	0.0745 (0.0881)	−0.0593 (0.108)	0.0466 (0.0856)	0.00244 (0.0889)	0.0582 (0.0856)
Higher vocational	0.159* (0.0812)	0.0390 (0.0976)	0.141* (0.0789)	0.105 (0.0802)	0.151* (0.0783)
University	0.125 (0.0869)	−0.0420 (0.112)	0.101 (0.0845)	0.0584 (0.0876)	0.111 (0.0842)
Quartile dummies monthly net household income (base: lowest quartile)					
Second income quartile	0.0217 (0.0542)	0.0202 (0.0576)	0.00883 (0.0530)	0.00445 (0.0529)	0.0168 (0.0529)
Third income quartile	0.0214 (0.0573)	−0.0570 (0.0700)	5.78e-05 (0.0565)	−0.0254 (0.0598)	0.0107 (0.0562)
Highest income quartile	0.111* (0.0610)	0.0326 (0.0733)	0.0929 (0.0595)	0.0683 (0.0620)	0.101* (0.0591)
Income not known	−0.0181 (0.146)	−0.0636 (0.114)	0.00937 (0.130)	0.0215 (0.112)	−0.00736 (0.132)
Home-owner	0.0789** (0.0397)	0.0219 (0.0495)	0.0786** (0.0391)	0.0696* (0.0400)	0.0719* (0.0392)
Marital status (base: single)					
Married, no children	0.0122 (0.0470)	0.0707 (0.0552)	0.00473 (0.0460)	0.0115 (0.0457)	0.00328 (0.0461)
Married, children	−0.0812 (0.0721)	0.00528 (0.0814)	−0.0813 (0.0707)	−0.0593 (0.0703)	−0.0919 (0.0708)
Single parent, other	−0.0866 (0.0847)	−0.0265 (0.0929)	−0.0729 (0.0825)	−0.0436 (0.0821)	−0.0822 (0.0819)
Number of children	−0.00161 (0.0279)	−0.00740 (0.0293)	−0.000379 (0.0275)	−0.00270 (0.0272)	0.00330 (0.0276)

Table 5. (*cont.*)

	1 OLS	2 GMM	3 OLS	4 GMM	5 OLS
Socioeconomic status (base: employee)					
Self-employed	0.0252	0.00374	0.0171	0.00413	0.0201
	(0.0511)	(0.0598)	(0.0514)	(0.0527)	(0.0518)
Non-employed	−0.0501	−0.0341	−0.0560	−0.0556	−0.0592
	(0.0377)	(0.0421)	(0.0373)	(0.0374)	(0.0369)
Religion (base: no religion)					
Roman Catholic	0.0781**	0.0776**	0.0787**	0.0833**	0.0764**
	(0.0342)	(0.0371)	(0.0338)	(0.0335)	(0.0337)
Protestant	0.0179	0.0139	0.0190	0.0218	0.0171
	(0.0396)	(0.0426)	(0.0389)	(0.0385)	(0.0391)
Other religion	−0.0332	−0.0234	−0.0257	−0.0179	−0.0216
	(0.0597)	(0.0667)	(0.0608)	(0.0620)	(0.0602)
Constant	−0.211	−0.194	−0.356	−0.483	−0.345
	(0.374)	(0.413)	(0.368)	(0.370)	(0.369)
P-value age, age squared	0.00216	0.0314	0.00331	0.00685	0.00252
P-value education	0.280	0.328	0.269	0.258	0.255
P-value income	0.117	0.233	0.131	0.169	0.108
P-value marital status	0.504	0.503	0.581	0.735	0.493
P-value socioeconomic status	0.328	0.710	0.279	0.316	0.129
P-value religion	0.0860	0.153	0.0892	0.0698	0.231
F-statistic first stage regression		9.608		19.37	
P-value exogeneity test		0.00760		0.0817	
P-value Hansen OIR test		0.170		0.198	

Note: Standard errors reported in parentheses are clustered at the household level; ***$P<0.01$, **$P<0.05$, *$P<0.1$.

5.2 *Multivariate analysis of retirement preparation*

In this section, we perform a multivariate analysis of the relationship between retirement planning and financial literacy. We use several measures for financial literacy: (1) a dummy variable that equals one if a respondent correctly answered all three financial literacy questions and (2) a variable counting the number of correct answers to these three questions. To compare results with other countries, we also use three dummies for answering each financial literacy question correctly. We include dummy variables that control for age, education, gender, marital status, net monthly household income quartiles, home ownership and religion to take into account individual heterogeneity that might affect the relationship between retirement planning and financial literacy.

In Table 5, we first report the results of a simple Ordinary Least Squares (OLS) regression of retirement planning on socioeconomic controls and financial literacy.

In this analysis, we consider only the 2010 sample. Moreover, we select all respondents who are 65 or younger and not yet retired. The OLS estimates in Table 5 show that there is a strong positive relationship between retirement planning and financial literacy. The size of the estimated coefficient for the number of correct answers (0.101, see column 3) suggests that one extra correct answer is associated with an increased probability (by 10 percentage points) of having thought (some or a lot) about retirement. Answering all three questions correctly raises the probability of planning by 13 percentage points, and the last column of Table 5 (column 5) indicates that it is the understanding of interest rate and risk diversification that matters most for retirement planning. The OLS results also indicate that respondents do not tend to think much about retirement when they are young and retirement is a distant concept. After controlling for financial literacy, there is no role for education in explaining retirement planning once we control for other individual characteristics. While in the raw data, men think more often about retirement than women, the effect of gender disappears in the multivariate setting. Interestingly, Catholics think more about retirement than respondents of other religious affiliations (or no affiliation). This finding is consistent with the results of Renneboog and Spaenjers (2011) who find that, compared with respondents with 'other' religions or without religion, Catholics have a longer planning horizon.

Based on these simple estimates, we cannot yet interpret the relationship between financial literacy and planning as causal. The literacy variable might itself be endogenous (by planning more for retirement, one becomes more literate) or could proxy for unobservable variables (e.g., ability). On the basis of these arguments, one might state that the estimated literacy coefficient is biased upward. On the other hand, Van Rooij et al. (2011a) show that financial literacy is rather difficult to measure. It is likely that there are considerable measurement (classification) errors in our discrete financial literacy variables, which might lead to a downward (attenuation) bias in the estimated financial literacy coefficient.[3] In either case, we cannot simply rely on the OLS estimates reported in Table 5 to assess the effect of literacy on retirement planning. To remedy this problem, we have collected additional information that can serve as instruments for advanced financial literacy. We asked respondents about the financial experiences of their siblings and parents.[4] Specifically, we collected information on whether the financial situation of the oldest sibling is 'better', 'the same', or 'worse' than the financial situation of the respondent. The experience of siblings is not under the control of the respondent, but respondents can learn from those around them and increase their own financial literacy. One may argue that the experience of siblings can proxy for a common set of preferences or for a family fixed effect. While plausible in theory, the first stage regressions indicate that when siblings are in worse financial condition than the respondents, respondents are more likely to

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[3] Because our financial literacy variables are discrete, measurement error is non-classical. Therefore, we cannot exclude the possibility that a classification error in financial literacy leads to an upward bias in the financial literacy coefficient rather than a downward bias. However, Aigner (1973) has shown that a classification error in a *binary* regressor (e.g., the dummy variable indicating that the respondent correctly answered all three literacy questions) leads to attenuation bias in the estimated coefficient of that variable.

[4] Van Rooij et al. (2011a) also use these instruments.

have higher financial literacy.[5] In addition to the financial situation of siblings, we also consider parents' understanding of financial matters as perceived by the respondent.

The estimates in the second stage, reported in columns 2 and 4 of Table 5, show that the relationship between literacy and retirement planning remains positive and statistically significant in the Generalized Method of Moments (GMM) regression. The results of the exogeneity test indicate that the OLS estimates differ significantly from the GMM estimates and that therefore the OLS estimates are inconsistent. Moreover, the Hansen's *J* test does not indicate rejection of the over-identifying restrictions. Overall, our GMM estimates show that financial literacy is an important determinant of retirement planning: Those who have low financial knowledge are less likely to plan for retirement.

6 Financial literacy and retirement planning: panel estimation results

We next exploit the longitudinal nature of our dataset. By merging the 2005 and 2010 surveys, we can control for an individual fixed effect and thereby address the problem of omitted variables (such as ability) that could bias our estimates.[6] Before estimating such models, we checked whether or not respondent attrition from the survey is random. Such a check is important because the attrition rate over the 5-year period is rather high (about 50% in the DHS panel). We split the 2005 sample into two parts: (1) the 'stayers', i.e., individuals who are in the data in both 2005 and 2010 and (2) the 'movers', i.e., individuals who took part in the survey in 2005 but not in 2010. The attrition is random if, on average, there are no significant differences in retirement planning between the two subgroups. The result of a χ^2-test indicates that we cannot reject the null hypothesis that the attrition is random ($\chi^2(1) = 0.513$). Given this result, we can estimate a fixed-effects model with some confidence. In the fixed-effects models, we control for a large number of background characteristics, as we did in the cross-sectional models. Moreover, we include a time dummy and a binary variable, taking into account that in 2005 the risk-diversification question was randomized.

Table 6 shows the results of the fixed-effects regressions for our two main measures of financial literacy. If we take the number of correct answers as the relevant measure of financial literacy, we find that the 'within estimate' of the financial literacy coefficient is positive and statistically significant. In other words, even after controlling for background characteristics and for correlated unobserved heterogeneity, we find that financial literacy has a significant positive effect on retirement planning. One should, however, be aware that the fixed-effect estimate is possibly still upward biased due to reverse causality. On the other hand, the downward bias caused by the problem of measurement error is normally exacerbated in a fixed-effect regression.[7] The (large)

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[5] For brevity, the first stage results are not reported here but are available in the working paper version of this article (Alessie *et al.*, 2011). These results also continue to confirm the relationship between financial literacy and demographic characteristics such as education and gender, reported in Table 2.

[6] In the fixed-effects regressions we consider only respondents who are in charge of household finances as this selection criterion was used in the 2005 survey.

[7] Freeman (1983) has shown that the problem of classification errors in a binary regressor (such as our dummy variable 'all answers correct') is exacerbated in a fixed-effect regression if $T = 2$.

Table 6. *Retirement planning and financial literacy: fixed-effects and dynamic regressions*

	Fixed-effects regressions		Dynamic regressions	
All three correct	0.0133			
	(0.0424)			
All three correct in 2005			0.0700	
			(0.0447)	
Number correct		0.0573**		
		(0.0278)		
Number correct in 2005				0.0609**
				(0.0283)
Time dummy	0.221*	0.216*		
(equals 1 in 2010)	(0.124)	(0.123)		
Dummy for alternative	0.0630	0.0472		
risk question in 2005	(0.0529)	(0.0514)		
Age			0.0703***	0.0700***
			(0.0265)	(0.0266)
Age squared	−0.000410	−0.000402	−0.000676**	−0.000675**
	(0.000276)	(0.000274)	(0.000277)	(0.000278)
Female			0.0625	0.0588
			(0.0449)	(0.0439)
Education dummies (base: primary education)				
Lower secondary	−0.0924	−0.0744	0.0332	0.0334
	(0.124)	(0.128)	(0.107)	(0.106)
Middle secondary	0.0430	0.0405	0.0694	0.0629
	(0.133)	(0.136)	(0.108)	(0.106)
Upper secondary	0.292	0.304	0.0435	0.0250
	(0.220)	(0.222)	(0.113)	(0.112)
Higher vocational	0.190*	0.219*	0.0678	0.0565
	(0.111)	(0.117)	(0.106)	(0.104)
University	0.553**	0.553**	0.0493	0.0343
	(0.257)	(0.257)	(0.114)	(0.112)
Quartile dummies monthly net household income (base: lowest quartile)				
Second income quartile	0.0744	0.0539	0.0339	0.0337
	(0.0785)	(0.0773)	(0.0729)	(0.0724)
Third income quartile	−0.0422	−0.0633	0.140*	0.128
	(0.104)	(0.103)	(0.0778)	(0.0779)
Highest income quartile	0.118	0.0857	0.202**	0.196**
	(0.137)	(0.137)	(0.0865)	(0.0861)
Marital status (base: single)				
Married, no children	0.0744	0.0539	0.0339	0.0337
	(0.0785)	(0.0773)	(0.0729)	(0.0724)
Married, children	−0.0422	−0.0633	0.140*	0.128
	(0.104)	(0.103)	(0.0778)	(0.0779)
Single parent, other	0.118	0.0857	0.202**	0.196**
	(0.137)	(0.137)	(0.0865)	(0.0861)
Number of children	−0.0979*	−0.0971*	0.0645	0.0672*
	(0.0579)	(0.0579)	(0.0398)	(0.0390)

Table 6. (*cont.*)

	Fixed-effects regressions		Dynamic regressions	
Socioeconomic status (base: employee)				
Self-employed	−0.0501	−0.0735	0.0938	0.0928
	(0.134)	(0.131)	(0.0628)	(0.0632)
Non-employed	−0.114	−0.126	−0.0364	−0.0375
	(0.0790)	(0.0798)	(0.0595)	(0.0593)
Constant	1.366**	1.243**	−1.312**	−1.391**
	(0.567)	(0.562)	(0.618)	(0.618)
Number of observations	1,784	1,784	472	472
R^2	0.080	0.088	0.115	0.119
P-value age, age squared	0.137	0.142	0.00347	0.00444
P-value education	0.248	0.205	0.980	0.986
P-value income	0.0265	0.0404	0.0491	0.0675
P-value marital status	0.105	0.107	0.00407	0.00375
P-value socioeconomic status	0.350	0.288	0.228	0.236
Number of unique respondents	1,338	1,338	472	472

Note: Standard errors reported in parentheses are clustered at the household level; ***P < 0.01, **P < 0.05, *P < 0.1.

difference between our GMM and fixed-effects estimates can, in our view, be attributed to the problem of measurement error. For this reason, we interpret our GMM estimates as causal effects.

The problem of reverse causality can potentially be addressed also by relating retirement planning in 2010 with financial literacy in 2005, since time spent thinking about retirement in 2010 should not affect the level of financial knowledge 5 years earlier. In columns 3 and 4 of Table 6, we show the results of an OLS regression that reports the relationship between thinking about retirement in 2010 and financial literacy level in 2005 (and other explanatory variables measuring personal characteristics and the socioeconomic situation in 2010). Again we find that financial literacy affects retirement planning. The coefficient of the number of correct answers to the three financial literacy questions is significant and is comparable to the coefficient in the fixed-effect regressions. It suggests that one additional correct answer on the three financial literacy questions increases the probability of planning for retirement by 6 percentage points.

7 Discussion and implications for policy

In 2006, the Dutch Treasury department created *CentiQ*, in which over 30 partner organizations within the financial sector, the government, consumer organizations and the academic community work together to increase the financial awareness and skills of Dutch consumers. Despite a large number of initiatives – often focused on

specific groups – our 2010 survey indicates that the financial knowledge of the population at large has not improved much compared to 2005 results. On the other hand, the increasing number of 'do not know' responses suggests that respondents have become better aware of the limitations of their financial knowledge.

At the same time, individuals' propensity to plan for retirement has increased. This change may not come as a surprise once we realize that worsening pension fund solvency is not only heavily debated in the Netherlands but also directly affects employees and retirees. For a few years now, accumulated pension rights and benefits have often not been indexed to price and wage developments, reducing their value in real terms. Sometimes even nominal pension benefits have been cut. There is broad consensus that current pension arrangements are not sustainable. The intense debate on the design and implementation of new pension contracts makes clear that the Dutch pension system is about to change from offering retirement plans with little freedom of choice and high levels of benefit certainty to pension arrangements with vastly different but as yet uncertain characteristics. Consequently, the need for individuals to inform themselves and prepare for retirement is likely to grow substantially.

This is especially important as Dutch workers hold overly optimistic replacement rate expectations and are quite confident of obtaining these high replacement rates (Alessie *et al.*, 2011). It is evident that pension fund companies have, so far, not been successful in effectively communicating what workers can expect from their retirement plans. This will make the transition to new pension contracts entailing reduced replacement rates or reduced levels of certainty even more difficult. The good news is that, with a more detailed exploration of individual financial literacy levels and their relation to expected replacement rates, we are able to show that financially knowledgeable employees are more likely to hold correct pension expectations (for details see Alessie *et al.*, 2011). Employees with higher financial literacy expect significantly lower replacement rates and recognize that these expectations entail a significant amount of uncertainty. This finding corroborates the main empirical results documented in this paper: using innovative instrumental variables and exploiting the panel component of our survey, we have shown that financial knowledge effectively boosts planning for retirement. Changes in retirement plans should therefore go hand in hand with programs to increase financial literacy and pension knowledge among the Dutch population.

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