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Quantitative framing of pension income

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The Power of Percentage: Quantitative Framing of Pension Income

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Abstract

We investigate whether the quantitative frame used to communicate future pension income to plan members matters for perceived pension income adequacy. We allocate plan members randomly to one of four pension income framing conditions: annual pension income, monthly pension income, pension income as percentage of current income, pension income as decimal of current income. We find that expressing projected pension income as a percentage (decimal) of current income significantly increases (decreases) the probability that a plan member perceives the pension income as too low. This effect is robust to adding retirement savings attitude. In addition, we find significant and intuitive effects of household wealth, income, age and education on perceived pension income adequacy. We discuss our findings against the backdrop of previous studies on the effect of numeric frames on perceptions, provide suggestions for further research and draw conclusions for pension communication and survey design.

Key words: framing effects, pension income, perceived adequacy.

JEL Codes: C5; C9; D12; G11

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1. Introduction

Around the world pension reforms and a shift in pension risk towards employees have made plan members more responsible for saving and investing for retirement. Policymakers and the pension industry use pension communication to create pension awareness, hoping that this will lead to action in case saving is inadequate (e.g. European Commission, 2013). In the Netherlands, pension funds are mandated by law to provide plan members once a year with a projection of their pension income if they will continue working in the same job until retirement. They usually give this projection in terms of annual gross income in euros. However, they could also choose to provide a replacement rate (percentage or decimal) or to give a monthly rather than an annual pension income. In this paper, we investigate whether there is an effect of the quantitative frame used to inform plan members about their future pension income on the level of satisfaction of their projected future pension income.

A framing effect occurs if descriptions that are logically equivalent have different effects on perception, attitudes, preferences, judgment and/or decisions. We distinguish between four frames: annual income, monthly income, percentage of current income, decimal of current income. We allocate respondents randomly to one of these conditions and provide them with a projected pension equal to 50% of their current income. We then ask them whether they think this pension income will be sufficient.

A framing effect may occur through an influence on deliberative and/or affective processes (Loewenstein *et al*, 2001; Loewenstein *et al.*, 2015). Levin *et al* (1998) distinguish between three categories of framing: attribute framing, risky choice framing, goal framing. In all these three cases, the framing implies that there are two logically equivalent descriptions of which one is positive and the other is negative. For each, an example is illustrative.

Attribute framing implies that an aspect of an object is described with either a positive or negative frame, and a framing effect occurs if these logically

equivalent descriptions lead to different judgments of the object. For instance, a food item can be described as 75% lean (positive frame) or as 25% fat (negative frame) (Keren, 2007). A positive frame has been shown to result in a higher rating of a product by consumers (Levin and Gaeth, 1988).

Risky choice framing involves a description of a choice where the probability and size of outcomes are given. A wellknown example is the choice between two treatments of a disease that without treatment will kill 600 people. Two treatments are possible, and their effectiveness can be framed either in terms of deaths or in terms of lives saved (Tversky and Kahneman, 1981). If the risky choice is framed in terms of losses and their probabilities people tend to prefer risk, while if it is framed in terms of gains and their probabilities people tend to prefer certainty. The risky choice framing effect is explained by prospect theory and loss aversion. People evaluate outcomes in terms of changes with respect to a reference point, and losses are weighed more than twice as large as gains.

Goal framing implies that a choice is framed in terms of either the advantages of taking action, or the disadvantages of not taking action (Levin *et al,* 1998). A negative (disadvantage) frame leads to more action than an advantage frame.

The effect of frames on spending behavior takes place through *mental accounting* (Soman, 2004; Thaler, 1985, 1999). For instance, consumers (and investors) mentally allocate income sources and spending categories, and this may be influenced by frames (Keren, 2012)

The above framing effects occur through their influence on deliberation. People compare outcomes and anticipated the related emotions, and this deliberation is affected by the frame. These framing effects therefore fit in with a consequentialist model of behavior (Slovic *et al*, 2005; Loewenstein et al, 2015).

Framing effects may also occur through affective processes. A frame may induce affect, which in its turn influences risk perception and return expectations (McGregor *et al*, 2000; Besnier, 1990): this is known as the *affect heuristic* (Tversky and Kahneman, 1974; Andrade, 2005). Positive (negative) *affect*, besides decreasing (increasing) perceived risk, also leads to a higher (lower)

estimate of return (Alhakami and Slovic 1994; Slovic *et al.* 2005). [1]

Research on framing effects of the quantitative format finds that percentage formats, such as "x percent of patients experience side effects" increase comprehension (and decrease perceived risk) as compared to frequency formats, such as "y out of z patients experience side effects" (Sinayev *et al.*, 2015). Moreover, a low probability event is perceived as more likely if it is quantitatively presented as a ratio with large numbers, for instance 20/100, as compared to an equivalent ratio expressed with smaller numbers, like 2/10 (Kirkpatrick & Epstein, 1999). This so-called ratio bias also influences the judgment of the attractiveness of a gamble. Slovic *et al* (2007) ask people how much they would pay for two gambles: a chance of 29/36 to win $2 and of 7/36 to win $9. They also ask people would to rate the attractiveness of these gambles on a scale from 0-20. They find that while the mean price people are willing to pay for the first gamble is much less than for the second one (which makes sense given the expected pay off), the mean rating of the attractiveness of the first gamble is almost twice as high as that for the second one. This is due to the influence of the frame on the affective process: a nominator of 29 creates more positive affect than one of 7. The ratio bias also explains why a risk of people dying is perceived as higher if it is presented as 3650 deaths per year than as 100 deaths per day. In marketing, Del Vecchio *et al* (2007) find that the effect of a price discount on consumer expectations differs according to whether it is framed in cents or percent, but that this does not apply for a discount that is easy to compute, like 50%. This finding is relevant for the research presented in this paper, as we deliberately use a 50% replacement rate (see section 2 below). Cuite *et al.* (2008) test the effect of three different numerical formats (percentage, frequency, for instance 8 out of 12, and 1-in-n) and ask participants to answer questions about the magnitude of risks in hypothetical scenarios. Hence answering requires a mathematical operation from respondents and any framing effect occurs through an influence on the deliberative process. The results show that the numerical format significantly

[1] Boggio *et al* (2017) find that most metaphors in stock market language refer to war, battle, force and competitive play, and hypothesize that this may attract men and deter women when it comes to participating in the stock market. See also Sanders et al ().

influences the probability that respondents answer correctly, with the percentage frame and the frequency frame improving performance relative to the 1-in-n format. Peters *et al.* (2007) study the effect of numeracy on risk assessment, namely the risk that a hypothetical mental patient will commit an act of violence. The risk information is presented in a percentage and a frequency format. Higher numeracy turns out to be associated with less sensitivity to framing.

Keren (2012) provides an overview of framing effects in pension communication and finds effects of on, inter alia, plan members' risk perception, intention to save for retirement, trust in their pension fund. He finds that risk communication is more neutral when expressed by numerical rather than by verbal probabilities, the reason being that words tend to imply a judgment. We have not found any studies into the effect of a percentage versus a ratio frame in pension communication. The present paper adds to the research on the effects of numerical formats by asking people about the adequacy of a future pension income.

We find that presenting the pension projection as 50% of current gross income significantly increases the probability that respondents perceive the pension income as insufficient compared to presenting the projection as annual income, monthly income or decimal (0.5) of current income. This finding is robust to controlling for various background variables, including household wealth and savings attitudes. We also find that wealthier households are significantly less likely to perceive the projected pension as insufficient, which conforms our intuition, as wealthier households need less pension income to maintain their living standard. When controlling for household wealth, gross household income is also significant: respondents with higher incomes report less often that the projected pension income is too low. This makes sense too, as higher incomes need a lower replacement rate. The satisfaction probability also increases with age. That younger respondents perceive the projected pension income as less adequate makes sense because the projection is based on their current income while the young can be expected to earn more when getting older and making a career. Our regressions also show that respondents who

declare themselves to be the financially knowledgeable person in the household are less likely to report a dissatisfactory pension income. This is remarkable, as a replacement rate of 50% is generally considered to be too low, and hence judging this income as adequate would seem a "wrong" answer. However, it could be that self-assessed financial knowledge reflects confidence in one's abilities to earn an income even after retirement.

Our findings do not only have practical implications for communication policies. They are also relevant from the point of view of survey methodology. While attention has been paid to the effect of small changes in wording and changes response order on the answers people give in surveys, and also to the effect of framing on risk attitudes and estimates, to our knowledge no research has been published focusing on the implications for survey methodology of quantitative frames in which income streams are presented.

The paper is structured as follows. Section 2 describes our data and methodology. In section 3 our aggregate findings are presented, compared and interpreted. Section 4 presents the results of our regression analysis. In section 5 we discuss our findings and draw policy implications, and section 6 summarizes and concludes.

2. Data and methodology

Our data have been collected through a survey in June 2017 among participants of the CentERpanel run by CentERdata at Tilburg University. CentERdata is a survey research institute that is specialized in data collection and Internet surveys. The CentERpanel consists of about 2,000 households representative of the Dutch-speaking population in the Netherlands, where all household members participate. The questionnaires are answered at home using an Internet connection. Data collected with Internet surveys display higher validity and less social desirability response bias than those collected via

telephone interviewing (Chang and Krosnick, 2003).[2] The panel has been used in many studies of pension behaviour and attitude among Dutch employees (see for instance Van Rooij *et al*, 2007) and of financial literacy and retirement planning in the Netherlands (see Alessie *et al*, 2011). Panel members fill out short questionnaires via the Internet on a weekly basis. Annually, panel members provide information on individual income, household wealth, health, employment, pensions, savings attitudes, and savings behaviour for the DNB Household Survey (DHS), providing researchers with a rich set of background information on the respondents. The availability of a computer or Internet connection is not a prerequisite of the selection procedure, which is done by a combination of recruiting randomly selected households over the phone and by house visits. Participants did not receive a financial incentive to fill out the questionnaire. For a complete description of the CentERpanel and the DHS, see Teppa and Vis (2012).

Our main focus is to study whether the quantitative framing of the pension income projection matters for the employee's judgment of pension adequacy. We use four different quantitative frames and allocate respondents randomly to one of these framing conditions. The quantitative frame conditions are the following:

- gross annual pension income
- gross monthly pension income
- pension income as % of current income
- pension income as decimal of current income.

In all frames, the projected pension income amounts to 50 % of current income. We chose this percentage for three reasons. First, it is generally assumed to be too low to maintain the living standard at retirement. Second, in the

[2] CentERdata is located at Tilburg University. See also http://www.uvt.nl/centerdata/en. Households who do not have access to a pc are provided with a set-top-box for their television. In case of attrition of panel members, CentERdata selects new members to keep the panel representative for the Dutch population. High-income members are somewhat overrepresented. We have verified that this does not affect the descriptive statistics qualitatively. If the first questionnaire was not completed the first time, we offered the questionnaire for a second and if necessary a third time to the group of non-respondents to improve the response rate (actually the survey weekends fell within the summer vacation period).

Netherlands people expect to receive around 70% of income, which is too optimistic as in reality the replacement rate will be closer to 50%. Moreover, by using a projection equivalent to 50% of current income we avoid potential confusion about what the information implies. If we had used 40%, people may for instance think that it is a fall in income of 40% rather than a fall of 60%. Finally, as mentioned in the previous section, Del Vecchio *et al* (2007) find that the effect of a price discount on consumer expectations differs according to whether it is framed in cents or percent, but that this does *not* apply for a discount that is easy to compute, like 50%.

We can provide respondents with an individual income projection in euros based on their income thanks to the fact that the DNB Household Survey collects this information annually. We vary the framing condition, allocating respondents randomly to one of the frames, except for respondents who did not provide information regarding their income level; they were allocated randomly to either the percentage or the decimal frame.

Our questionnaire was submitted to panel members who are employed in the age range of 16 and above. Retirees are excluded. The response rate of our survey was 66%, which is in line with other survey modules fielded in the CentERpanel. The resulting sample size consists of 935 respondents.

This is the information that was given to respondents (translated from Dutch):

Imagine you get the following information about your future pension: if you keep on working until retirement you can expect from your retirement date the following pension: respondents in condition 1: gross …euros per year[3] respondents in condition 2: gross… euros per month respondents in condition 3: 50% of your current gross income respondents in condition 4: 0.5 of current income

The information was followed by this question (translated from Dutch):

Please indicate to what degree you regard this pension income sufficient or insufficient to be able to make a living. Please do not take your partner's income into account. o More than sufficient o Sufficient o Insufficient o Very insufficient o Do not know

Note that in the Netherlands, the income tax rate for retirees is somewhat lower than that for those who have not yet reached retirement age. So receiving 50% of current gross income would amount to a higher net replacement rate than 50%. Moreover, There are discounts for retirees for public transport and

[3] Please note that the annual income was calculated as 12.95 monthly income because an annual income contains vacation money. Strictly speaking, panel members in this condition received therefore a higher pension projection than the other three categories, as the latter three were all based on monthly income. In the robustness checks section we exclude this treatment from the analysis to see whether our findings hold.

cultural events. Also, work related spending vanishes at retirement.[4] For these reasons, it is generally assumed that a replacement rate of 70% would enable retirees to maintain their pre-retirement living standard. Note that in all frames pension income is gross, hence in all frames the lower tax rate for retirees is relevant. Whether or not respondents are aware of the lower tax rate may influence perceived adequacy, but in the same way for all frames.

Table 1 shows the distribution of the respondents over the four framing conditions. The slightly higher percentage of respondents in the conditions "50% of your current income" and "0.5 times your current income" is due to the random allocation of the respondents who did not provide information about their income. Note that we implicitly assume that the sensitivity for framing effects, if any, does not vary with whether respondents have provided information about their income. We will go into this when discussing our findings.

Table 1. Distribution of respondents over framing conditions

Frame	Frequency	Percent	Cumulative
Annual income	223	23.85	23.85
Monthly income	222	23.74	47.59
Replacement rate as percent	237	25.35	72.94
Replacement rate as decimal	253	27.06	100
Total	935	100	

Source: constructed by the authors based on the CentER panel data

[4] Hurst (2008) finds that at retirement, the decline in spending for the average household is limited to food and work related expenses. As for food, he suggests that retirees do not consume less, but spend less both because of home production and increased time spent on shopping (less waste).

3. General findings

In this section we present our aggregate findings as well as the findings according to the framing condition.

First of all, it should be remarked that not a single respondent answered "Do not know" to the question. As to perceived pension adequacy, Table 2 shows that the majority of the full sample (683 respondents or 73%) regards the projected pension income as either insufficient or very insufficient. Around a quarter regards it as sufficient and a mere 2 percent is more than happy with the pension projection. This finding is in line with what we expected, given that a 50% replacement rate is generally regarded as too low to maintain one's living standard, and it should be kept in mind that in the Netherlands pension plan members traditionally expected to receive a gross pension of around 70% of final wage, which would be around 90% after taxes, as tax rates are lower for retirees (AFM, 2012). Moreover, the young expect to end their career with a higher income than their current one, hence for them a 50% replacement rate based on current income would imply an even lower expected final wage replacement rate.

Table 2. Perceived adequacy of projected pension income: full sample

Perceived adequacy of pension income	Frequency	Percent	Cumulative
Very insufficient	181	19.36	19.36
Insufficient	502	53.69	73.05
Sufficient	229	24.49	97.54
Very sufficient	23	2.46	100
Total	935	100	

Source: constructed by the authors based on the CentER panel data

Of course the most interesting question is whether the quantitative pension income frame matters for perceived pension adequacy. This turns out to be the case, in the sense that a percentage frame results in a significantly different perception than each of the other frames. The findings according to frame are given in Table 3.

Table 3. Perceived adequacy of projected pension income by frame

	Projected pension income				
Perceived adequacy of pension income	Annual income	Monthly income	RP percent	RP decimal	Total
Very insufficient	19.28	22.07	18.57	17.79	19.36
Insufficient	52.02	50.90	63.71	48.22	53.69
Sufficient	25.11	26.13	16.03	30.43	24.49
Very sufficient	3.59	0.90	1.69	3.56	2.46
Total	100	100	100	100	100
Pearson chi2(9)* = 23.54 Pr = 0.005					

Source: constructed by the authors based on the CentER panel data
*Pearson's chi-squared for the hypothesis that the rows and columns in a two-way table are independent

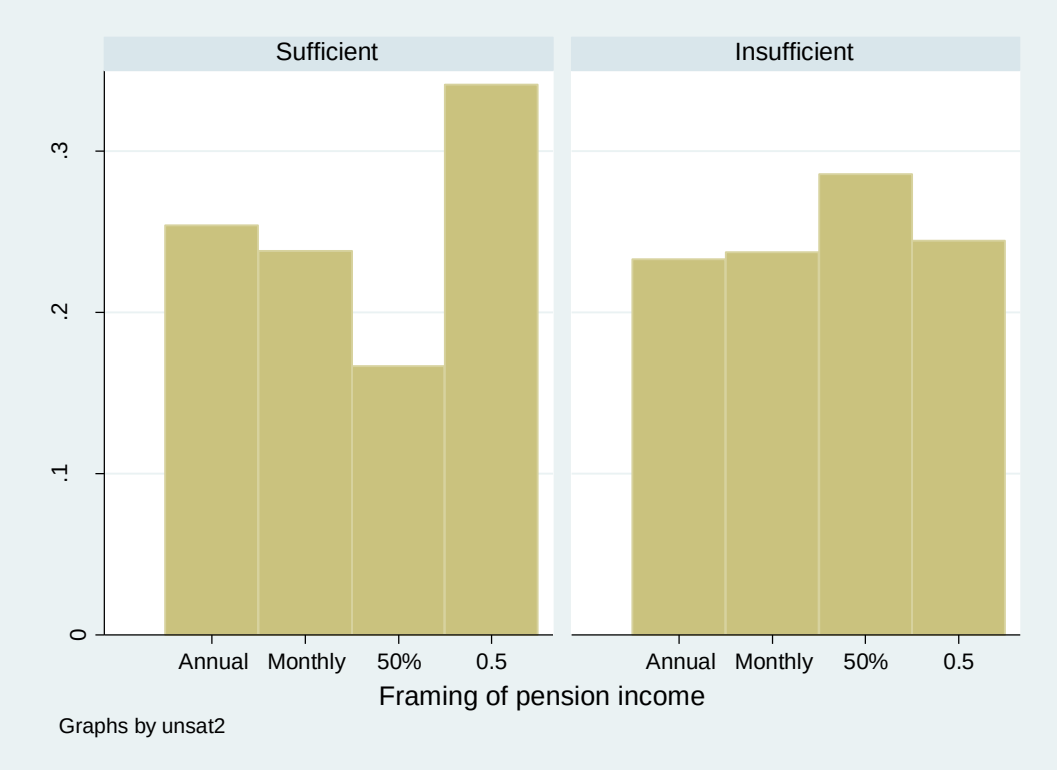
The purpose of communicating projected pension income is to enable plan members to take action if they consider their projected pension income as too low. From a policy-oriented perspective it is therefore useful to understand whether any systematic difference in perceptions arise from different ways of communication. . With this in mind, in the empirical analysis we bundle the categories sufficient and very sufficient, and the categories insufficient and very insufficient. Table 4 reiterates Table 3's content as we sum the first two cells for each framing condition separately.

Table 4. The dependent variable: Percentage regarding the pension income as (in)adequate, by frame

	Projected pension income			
Perceived (in)adequacy of pension income	Annual income	Monthly income	RP percent	RP decimal
Very insufficient/Insufficient	71.30	72.97	82.28	66.01
Sufficient/Very sufficient	28.70	27.03	17.72	33.99
Total	100	100	100	100

We then construct an indicator variable taking value 1 if pension income is reported to be very insufficient or insufficient, and value 0 otherwise. This indicator serves as dependent variable in the empirical analysis that follows. Figure 1 visualizes the tabulations.

Figure 1. Pension income (very) sufficient (left) and (very) insufficient (right)



Source: constructed by the authors based on the CentER panel data

Tables 3 and 4 and Figure 1 suggest a difference between the euro frames (annual and monthly) on the one hand and the replacement frames (percentage and decimal) on the other. Moreover, the first impression is that the replacement frames have an opposite effect on perceived adequacy: respondents in the percentage frame seem to be more likely to consider the projected pension income as insufficient, while those in the decimal frame judge the projected pension more often as sufficient. Further analysis reveals that these differences are indeed significant, as shown in Tables 5 and 6 which give details about the variables that we will focus on in the regression analysis of which the results will be presented in the next Section.

Table 5 "Focused" variables – used in the regressions of Section 5
Projected pension income framed as replacement rate in terms of percent of gross income vs any other frames
Perceived adequacy of pension income: (very) insufficient vs (very) sufficient

Perceived adequacy of pension income	Projected pension income		
	Replacement rate as percent	Any other frame	Total
(Very) Insufficient	28.55	71.45	100
(Very) Sufficient	16.67	83.33	100
Total	25.35	74.65	100
Pearson chi2(1) = 13.74 Pr = 0.000			

Source: constructed by the authors based on CentERpanel data

Table 6 "Focused" variables – used in the regressions of Section 5
Projected pension income framed as replacement rate in terms of fraction of gross income vs any other frames
Perceived adequacy of pension income: (very) insufficient vs (very) sufficient

Perceived adequacy of pension income	Projected pension income		
	Replacement rate as decimal	Any other frame	Total
(Very) Insufficient	24.45	75.55	100
(Very) Sufficient	34.13	65.87	100
Total	27.06	72.94	100
Pearson chi2(1) = 8.73 Pr = 0.003			

Source: constructed by the authors based on CentERpanel data

Hence the conclusion of this simple analysis is that if people are informed about their future pension, the quantitative frame matters: a % income replacement frame leads to a significantly higher percentage of respondents judging their future pension as being too low as compared to a euro income frame or a replacement ratio, while a decimal frame results in a higher probability of perceiving the projected pension income to be sufficient. This framing effect has important implications for survey design purposes. Presenting the same information in two slightly different formats proves to be non-neutral in terms of outcomes.

If pension adequacy is defined – as it usually is, as the extent to which retirement income allows individuals to replicate the standards of living they had while in working life, a 50% replacement rate of end wage can be deemed insufficient (Binswanger and Schunk, 2012; Redwood and others, 2013).[5] This applies even more to current income, especially for those who expect wage increases until their retirement date. In that sense, judging the projected pension income as (very) insufficient seems to be the closest to being a proper answer. Hence if information provision is meant a "wake up call" for plan

[5]An alternative definition of pension adequacy is that retirement income allows individuals to fulfil basic needs. However, such a definition is not in line with the assumption of a preference for consumption smoothing, let alone loss aversion.

members, our analysis suggests that providing an outlook in terms of a percentage replacement rate is the effective way to get the message thorough. The next section presents the results of regression analysis to investigate which background variables influence the pension (in)adequacy judgment, and to see whether the frame remains significant in a multivariate context.

3. **Regression analysis**

In this section we present the results of a regression analysis of the whole sample to see whether the framing effect is robust after adding potentially relevant background variables. Our dependent variable is the probability that a respondent judges the individual projected pension income as (very) dissatisfactory. Note that the purpose of the mandated pension projection in the Netherlands is to enable people to take action if they consider their projected pension income to be too low. Our framing condition enters as an explanatory in the regression, where this takes on value 1 for it the percentage frame, and value 0 for other.

First, we have run regressions adding to the focused variables the background characteristics that we had at our disposition on the basis of our own current questionnaire. In this case, the number of observations is 935 as we have the information available for all respondents. Next, we added variables from the DNB Household survey because we felt they had to be included to check for robustness to adding wealth. The DNB Household Survey includes information on total household wealth, household financial wealth, and net total household wealth (taking account of household debts). The merging of these two datasets results in a fall in the number of observations, from 935 to 715.

Table 7 gives summary statistics of the variables used in the regression analysis.

Table 7. Summary statistics of variables in regression equations

Variable	Mean	Std.Dev.	Min.	Max.	N.Obs.
Dissatisfaction	0.730	0. 444	0	1	935
Pension as % income	0.253	0.435	0	1	935
Pension as decimal income	0.270	0.444	0	1	935
Gross pers. Income	4,654	2,722	0	40,000	935
Total hh wealth	250,975	230,830	30	3,324,771	698
Financial hh wealth	40,378	123,295	0	2,874,771	698
Net fin. hh wealth	34,723	125,573	-227,775	2,874,771	698
Age 18-20 yrs	0.090	0.286	0	1	935
Age 30-39 yrs	0.261	0.439	0	1	935
Age 40-49 yrs	0.280	0.449	0	1	935
Age 50-59 yrs	0.244	0.430	0	1	935
Age 60+ yrs	0.125	0.331	0	1	935
Education:					
Primary	0.014	0.117	0	1	935
Prevocational	0.137	0.344	0	1	935
Selective secundary	0.083	0.277	0	1	935
Applied science 1	0.313	0.464	0	1	935
Applied science 2	0.292	0.455	0	1	935
University degree	0.160	0.367	0	1	935
Have a partner	0.738	0.440	0	1	935
FKP	0.713	0.452	0	1	935
Homeowner yes/no	0.785	0.411	0	1	935

Source: author's calculations based on CentERpanel data

The results of the regression analysis are given in Table 8. First of all, Table 8 shows that the framing effect is significant in the multivariate context in all specifications and at the 1% level. Column (1) gives the regression before merging our dataset with the DHS, hence it includes all 1034 observations but does not contain wealth variables. It shows that the framing condition remains significant in a multivariate context, with the percentage frame condition increasing the probability of finding the projected pension income significantly (at the 5% level) dissatisfactory. Column (1) also shows that the probability of finding the pension inadequate falls with age, which makes sense as the projection is based on current income, which normally increases with age because of career steps: keep in mind that the projected pension income is expressed in terms of current income. In column (1) there is also an effect of education: people with a university degree have a significantly lower probability

of judging the projected pension as inadequate. However, this could reflect an effect of wealth, which is not included in this column. This explanation is confirmed in the regressions that add various measures of wealth to the regression equation (columns 3-5). Once wealth is added, having a university degree becomes insignificant, suggesting that a degree was a proxy for wealth. Total household wealth (column 3), household financial wealth (column 4) and household total net wealth are significant, with each decreasing the probability that the projected pension income is deemed inadequate. This of course makes sense, as financial and other wealth provide households with additional consumption possibilities, both by generating an income stream and because wealth can be drawn down at retirement. Controlling for wealth moreover makes income become significant with the expected negative sign: higher income reduces the possibility that respondents judge the projected pension income as too low. This makes sense because higher incomes need a lower replacement rate, as the inflexible part of their consumption is a smaller fraction of income. We find a small effect of being the financially knowledgeable person (FKP) in the household. A possible interpretation is that the knowledgeable household member is more confident in being able to add to pension income after retirement; with men being (self assessed) more often the FKP, this could also reflect overconfidence. We did not find an effect of gender in any of the regressions and left this variable out. We also interacted the dummy variable for being the financially knowledgeable person with the level of wealth, but did not find any significant effect.

Table 8: Projected pension (very) insufficient – the role of replacement rate framed as % of current income

	(1)	(2)	(3)	(4)	(5)
Controls	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)	Marg.Eff (Std.Err.
Pension as % inc.	0.118***	0.155***	0.160***	0.152***	0.152**
	(0.030)	(0.034)	(0.034)	(0.035)	(0.035)
Gross hh income	-0.043**	-0.049*	-0.041	-0.045*	-0.046*
	(0.020)	(0.026)	(0.025)	(0.025)	(0.025)
Total hh wealth			-0.024***		
			(0.009)		
Fin. hh wealth				-0.073**	
				(0.030)	
Net tot. hh wealth					-0.064**
					(0.021)
Age 30-39 yrs	0.028	0.066	0.093	0.074	0.071
	(0.060)	(0.073)	(0.071)	(0.073)	(0.073)
Age 40-49 yrs	-0.111*	-0.085	-0.052	-0.074	-0.073
	(0.065)	(0.081)	(0.081)	(0.081)	(0.081)
Age 50-59 yrs	-0.171**	-0.167*	-0.124	-0.138	-0.139
	(0.069)	(0.085)	(0.085)	(0.085)	(0.085)
Age 60+ yrs	-0.218***	-0.178*	-0.118	-0.131	-0.134
	(0.080)	(0.096)	(0.096)	(0.096)	(0.096)
Prevoc education	-0.312	-0.262	-0.313	-0.308	-0.303
	(0.218)	(0.243)	(0.242)	(0.244)	(0.243)
Selective secondary	-0.202	-0.221	-0.270	-0.260	-0.258
education	(0.225)	(0.250)	(0.251)	(0.253)	(0.252)
Vocational education	-0.255	-0.220	-0.270	-0.269	-0.265
	(0.199)	(0.227)	(0.228)	(0.231)	(0.230)
Applied sciences	-0.313	-0.263	-0.299	-0.297	-0.294
	(0.201)	(0.220)	(0.219)	(0.221)	(0.221)
University degree	-0.395*	-0.305	-0.323	-0.333	-0.336
	(0.210)	(0.237)	(0.235)	(0.237)	(0.236)
Have a partner	-0.009	-0.014	-0.003	-0.011	-0.013
	(0.038)	(0.047)	(0.048)	(0.047)	(0.047)
FKP	-0.043	-0.071*	-0.062	-0.066*	-0.068*
	(0.033)	(0.038)	(0.038)	(0.038)	(0.038)
Be homeowner	-0.032	-0.037	0.022	-0.028	-0.028
	(0.037)	(0.047)	(0.056)	(0.048)	(0.048)
Observations	935	698	698	698	698
Pseudo R-squared	0.061	0.067	0.077	0.079	0.078
Joint sign. age (p)	0.000	0.000	0.001	0.001	0.001
Joint sign. edu (p)	0.050	0.618	0.727	0.681	0.654

The table reports marginal effects and standard errors in parentheses of probit regressions.
*** p<0.01, ** p<0.05, * p<0.1 The dependent variable is an indicator of whether the respondent is (very) dissatisfied with his/her projected pension income (value 1) or (very) satisfied (value 0). Gross hh income is household gross income per month in logs. Wealth variables are expressed in 100,000 euros. Age, education levels, have a partner, FKP, be homeowner are indicator variables each. FKP denotes financially knowledgeable person in the household. Age 18-29 yrs. serves as reference category for age; basic education serves as reference category for education levels. Regression (1) excludes household wealth and it is estimated on the full sample (1,034 obs.). Regressions (3)-(5) includes alternative measures of household wealth and are estimated on the restricted subsample of respondents merged with the DHS 2016 wave (713 obs.). Regression (2) has the same specification as Regression (1), without household wealth, but it is estimated on the restricted sample.

Table 9. Projected pension (very) insufficient– the role of replacement rate framed as decimal of current income

	(1)	(2)	(3)	(4)	(5)
Controls	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)	Marg.Eff (Std.Err.
Pension as decimal	-0.097***	-0.122***	-0.120***	-0.117***	-0.116**
of income	(0.035)	(0.042)	(0.042)	(0.043)	(0.042)
Gross hh income	-0.045**	-0.050**	-0.043*	-0.046*	-0.047*
	(0.020)	(0.025)	(0.025)	(0.025)	(0.025)
Total hh wealth			-0.022**		
			(0.009)		
Fin. hh wealth				-0.078**	
				(0.030)	
Net tot. hh wealth					-0.066**
					(0.028)
Age 30-39 yrs	0.027	0.043	0.069	0.052	0.050
	(0.060)	(0.075)	(0.073)	(0.074)	(0.074)
Age 40-49 yrs	-0.111*	-0.104	-0.073	-0.091	-0.090
	(0.065)	(0.082)	(0.081)	(0.082)	(0.082)
Age 50-59 yrs	-0.171**	-0.187**	-0.147*	-0.156*	-0.157*
	(0.069)	(0.085)	(0.085)	(0.086)	(0.086)
Age 60+ yrs	-0.227***	-0.209**	-0.155	-0.159*	-0.164*
	(0.080)	(0.096)	(0.097)	(0.097)	(0.097)
Prevoc education	-0.296	-0.235	-0.283	-0.279	-0.273
	(0.212)	(0.234)	(0.235)	(0.236)	(0.236)
Selective secondary	-0.181	-0.186	-0.231	-0.223	-0.220
education	(0.217)	(0.240)	(0.243)	(0.243)	(0.243)
Vocational education	-0.241	-0.196	-0.242	-0.244	-0.238
	(0.193)	(0.219)	(0.221)	(0.222)	(0.222)
Applied sciences	-0.301	-0.241	-0.276	-0.273	-0.270
	(0.195)	(0.213)	(0.213)	(0.214)	(0.214)
University degree	-0.384*	-0.285	-0.305	-0.311	-0.314
	(0.204)	(0.229)	(0.228)	(0.229)	(0.229)
Have a partner	-0.003	0.002	0.012	0.003	0.002
	(0.038)	(0.048)	(0.049)	(0.049)	(0.048)
FKP	-0.039	-0.064*	-0.056	-0.060	-0.062
	(0.034)	(0.038)	(0.038)	(0.038)	(0.038)
Be homeowner	-0.033	-0.040	0.012	-0.031	-0.032
	(0.037)	(0.047)	(0.055)	(0.048)	(0.048)
Observations	935	698	698	698	698
Pseudo R-squared	0.056	0.056	0.065	0.069	0.068
Joint sign. age (p)	0.000	0.000	0.001	0.001	0.001
Joint sign. edu (p)	0.037	0.575	0.687	0.656	0.618

The table reports marginal effects and standard errors in parentheses of probit regressions.
*** p<0.01, ** p<0.05, * p<0.1 The dependent variable is an indicator of whether the respondent is (very) dissatisfied with his/her projected pension income (value 1) or (very) satisfied (value 0). Gross hh income is household gross income per month in logs. Wealth variables are expressed in 100,000 euros. Age, education levels, have a partner, FKP, be homeowner are indicator variables each. FKP denotes financially knowledgeable person in the household. Age 18-29 yrs. Serves as reference category for age; basic education serves as reference category for education levels. Regression (1) excludes household wealth and it is estimated on the full sample (1,034 obs.). Regressions (3)-(5) includes alternative measures of household wealth and are estimated on the restricted subsample of respondents merged with the DHS 2016 wave (713 obs.). Regression (2) has the same specification as Regression (1), without household wealth, but it is estimated on the restricted sample.

4. Robustness checks

In this section we present some robustness checks of our results. First, we exclude the annual income treatment condition. We do so because the annual income includes vacation allowance, hence it communicates a higher effective monthly income than the monthly income treatment. Table 10 presents the results for the percentage frame (column 1) and for the fraction frame (column 2) relative to the regression (1) in Table 8 and Table 9. Our finding that a percentage frame increases, and the decimal frame decreases, the probability that respondents perceive the projected pension as insufficient, is robust for excluding the annual income condition. Table 10 also shows that age and education remain significant. We repeated the exercise for any other regression presented in Table 8 and Table 9, and found that all previous findings are robust as well. The results are not shown in the paper, but they are available upon request.

Table 10. Projected pension (very) insufficient – excluding treatment 1 (13th month)

	(1)	(2)
Controls	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)
Pension as % inc.	0.119***	
	(0.031)	
Pension as decimal		-0.114***
of income		(0.035)
Gross hh income	0.041	0.037
	(0.065)	(0.065)
Age 30-39 yrs	-0.137*	-0.140*
	(0.074)	(0.074)
Age 40-49 yrs	-0.206***	-0.208***
	(0.079)	(0.079)
Age 50-59 yrs	-0.216**	-0.230**
	(0.093)	(0.093)
Age 60+ yrs	-0.032	-0.033*
	(0.020)	(0.020)
Prevoc education	0.000	0.007
	(0.042)	(0.042)
Selective secondary	-0.933***	-0.931***
education	(0.012)	(0.012)
Vocational education	-0.885***	-0.882***
	(0.014)	(0.014)
Applied sciences	-0.993***	-0.992***
	(0.005)	(0.005)
University degree	-0.991***	-0.990***
	(0.005)	(0.005)
Have a partner	-0.954***	-0.952***
	(0.010)	(0.011)
FKP	-0.030	-0.025
	(0.037)	(0.038)
Be homeowner	-0.028	-0.027
	(0.040)	(0.040)
Observations	712	712
Pseudo R-squared	0.076	0.074
Joint sign. age (p)	0.000	0.000
Joint sign. edu (p)	0.127	0.108

The table reports marginal effects and standard errors in parentheses of probit regressions.
*** p<0.01, ** p<0.05, * p<0.1 The dependent variable is an indicator of whether the respondent is (very) dissatisfied with his/her projected pension income (value 1) or (very) satisfied (value 0). Gross hh income is household gross income per month in logs. Wealth variables are expressed in 100,000 euros. Age, education levels, have a partner, FKP, be homeowner are indicator variables each. FKP denotes financially knowledgeable person in the household. Age 18-29 yrs. Serves as reference category for age; basic education serves as reference category for education levels.

Our next robustness check involves savings attitude. The hypothesis we want to test here is that the opposite framing effect on perceived pension income is robust to controlling for savings behavior. In fact, different perceptions of future pension income may reflect genuinely different savings for old-age attitudes. The DHS collects a number of motives for saving. For each of them, the respondents are asked to express how important each motive is for them. On a 1 to 7 scale, 1 means "very unimportant" and 7 means "very important". We selected the statement related to have some money saved "to supplement your general old-age pension" and controlled for it. Table 11 shows the results corresponding to regression (1) in Table 8 and in Table 9. The effect of frame remains robust, significant and with the opposite sign: as previously documented, the percentage frame increases the probability that projected income is insufficient, while the decimal frame reduces it. However, saving to supplement old-age pension is equally important in the two framing conditions. The estimated marginal effect not only is precisely the same in magnitude (0.030), but also displays the same positive sign. This implies that the two subgroups of respondents are observationally similar in terms of importance of saving for old-age provision, despite the fact that they are significantly different (opposite) in reporting their perceptions of the projected pension. We performed the exercise for all regressions in Table 8 and in Table 9, but not reported the outcome in the paper for space reason. The results are available upon request.

Table 11. Projected pension (very) insufficient – adding importance of saving for old-age provision.

	(1)	(2)
Controls	Marg.Eff. (Std.Err.)	Marg.Eff. (Std.Err.)
Saving for old age	0.030***	0.030***
	(0.011)	(0.011)
Pension as % inc.	0.136***	
	(0.036)	
Pension as decimal		-0.105**
of income		(0.042)
Gross hh income	-0.048*	-0.050**
	(0.025)	(0.024)
Age 30-39 yrs	0.014	-0.002
	(0.087)	(0.088)
Age 40-49 yrs	-0.122	-0.133
	(0.094)	(0.093)
Age 50-59 yrs	-0.202**	-0.211**
	(0.096)	(0.095)
Age 60+ yrs	-0.247**	-0.269**
	(0.108)	(0.107)
Prevoc education	-0.292	-0.275
	(0.242)	(0.234)
Selective secondary	-0.175	-0.149
education	(0.249)	(0.238)
Vocational education	-0.224	-0.212
	(0.229)	(0.221)
Applied sciences	-0.271	-0.257
	(0.221)	(0.213)
University degree	-0.328	-0.312
	(0.236)	(0.228)
Have a partner	-0.026	-0.014
	(0.047)	(0.047)
FKP	-0.055	-0.053
	(0.039)	(0.040)
Be homeowner	-0.046	-0.053
	(0.046)	(0.046)
Observations	709	709
Pseudo R-squared	0.069	0.062
Joint sign. age (p)	0.000	0.000
Joint sign. edu (p)	0.301	0.288

The table reports marginal effects and standard errors in parentheses of probit regressions.
*** p<0.01, ** p<0.05, * p<0.1 The dependent variable is an indicator of whether the respondent is (very) dissatisfied with his/her projected pension income (value 1) or (very) satisfied (value 0). Gross hh income is household gross income per month in logs. Wealth variables are expressed in 100,000 euros. Age, education levels, have a partner, FKP, be homeowner are indicator variables each. FKP denotes financially knowledgeable person in the household. Age 18-29 yrs. Serves as reference category for age; basic education serves as reference category for education levels.

5. Discussion

Our findings indicate that the quantitative frame – also called the numerical format - matters when informing plan members about their future pension. Logically equivalent frames used to inform people about their future pension have a different impact on perceived pension adequacy. We find that framing the pension as a replacement rate – in percentage or decimal of current income - has a significantly different impact than a euro frame (annual or monthly euros. No less remarkable is our finding that the replacement frames have opposite effects on perceived pension adequacy. While a percentage frame increases the probability that a respondent judges the projected income as insufficient, a decimal frame reduces it. These findings hold in a multivariate context and are robust for removing the annual income frame and for adding savings attitude. The latter turns out be significant. Note that our analysis is restricted to a situation in which people are informed about a pension which will be halve of their current income. This was a deliberate choice, as this enables us to rule out that people are confused about whether to interpret the quantitative information as a reduction with respect to current income, or as a replacement rate. As we pointed out in section 2, Del Vecchio *et al* (2007) find that the effect of a price discount on consumer expectations differs according to whether it is framed in cents or percent, but that this does not apply for a discount that is easy to compute, like 50%. Further research is needed to see whether our finding also holds for a replacement rate other than 50%.

Our finding is in line with the literature that shows that logically equivalent frames may matter for preferences, judgment and decision making. Moreover, evidence abounds that many people fail to solve the simple ratio and decimal problems that are often used in for instance risk communication. However, in a number of respects our analysis differs from previous studies. We do not

present a risky choice, and neither do we use a positive or a negative frame. Moreover, we do not ask people to choose between alternatives. In medical decision making research there is some evidence that percentage formats increase comprehension (and decrease perceived risk) as compared to frequency formats (Sinayev *et al.*, 2015). As far as we know, no previous studies have been published that measure the effect of a quantitative (pension) income frame on perceived pension income adequacy.

We can only speculate as to why the quantitative frame matters in pension projection. The fact that a replacement rate – be it in percentage or as a decimal – could be more effective as a "wake up call" for pension saving adequacy can be explained by assuming that people find it easy to imagine what it would mean, in terms of consumption, to be left with halve of their current income.. Also, people may not know exactly their current income, which would make a euro amount less salient in terms of what it means for consumption. What is striking is that the percentage frame and the decimal frame have opposite effects on perceived pension adequacy. Further research is needed to assess the effect of frames in pension income projections that are not equivalent to halve of current income, and on income projections other than pensions.

Whatever the explanation for our findings, they suggest that in communication about pensions attention should be paid to the quantitative framing of projected pension income.

Another important dimension of our findings has to do with survey design. If respondent fail to recognize the perfect equivalence between a percentage and a fraction, survey designers should be very careful about the wording used to elicit attitudes and personal information.

6. Summary and conclusions

We find that the quantitative frame in which future pension is presented matters for perceived pension income adequacy. If expressed as a replacement rate (either as percentage or decimal), the effect is significantly different from a pension income projection in euros. If framed as percentage of current income, the probability that respondents regard the pension income as too low is higher, while the opposite holds for a decimal frame. This finding is robust for adding other explanatory variables. The other determinants of perceived pension adequacy are in line with intuition: perceived adequacy falls with wealth and income, rises with age and depends on saving attitude. To our knowledge, this is the first study into framing effects in information about the future pension income. This finding is not only of academic importance. Policy makers, financial supervisors and the pension industry aim at communicating with plan participants in order to make them aware of their future pension and its adequacy, hoping this will help plan members to take action of needed. They put a lot of energy in finding out how to reach plan members by making information understandable and made to measure. Paying attention to subtle framing effects and using them effectively could provide useful. In addition, our findings are relevant also from a methodological point of view and for survey design purposes.

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