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# *Beliefs about demographic change: How well are individuals informed?*

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JENA ECONOMICS RESEARCH PAPERS · # 2024 -003

Beliefs about demographic change:  
How well are individuals informed? \*

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**Abstract**

Demographic change is one of Germany's most pressing social and economic challenges. Using data from a representative telephone survey, we analyze how well informed respondents are about the magnitude of demographic change and what factors influence the accuracy of their beliefs. We find that respondents tend to overestimate the old-age dependency ratio when considering the current and long-term demographic situation separately. However, their beliefs regarding the change of the old-age dependency ratios over the considered period are not far from the projected change. A better understanding of the German statutory pension insurance plays an important role for more accurate beliefs.

*JEL classification:* H55, D83

*Keywords:* beliefs, belief updating, demographic change, old-age dependency ratio, information provision

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## 1 Introduction

As many developed countries face ageing populations, public debate has drawn more attention to the potential consequences of demographic change. These include increased pressure on health care systems (Caley and Sidhu 2011), adverse effects on the labour market due to skills shortages (Börsch-Supan 2003) and challenges for pension systems (OECD 2021). The latter is particularly relevant for countries that rely on a pay-as-you-go system, where contributions from today's working generation are used to finance the pensions of today's retirees. Given the direct and indirect impact that demographic change will have on key policy areas in the coming years and decades, it is important that the public has a good understanding of the underlying demographic dynamics. This will make it more likely that voters will recognize the need for reforms and give them democratic legitimacy at the ballot box. As the baby boomers begin to move out of the labour market and into retirement, this is an urgent issue.

This paper examines how informed people are about the extent of demographic change and identifies factors that contribute to more accurate estimates or beliefs.<sup>1</sup> It also examines whether providing respondents with information about demographic change helps them to update their beliefs so that they become more accurate.

Our analysis consists of three steps: First, we conduct a descriptive analysis to gain insight into the distribution of respondents' prior beliefs about the ageing of the German population, which we capture by the old-age dependency ratio.<sup>2</sup> Prior beliefs are elicited separately for the old-age dependency ratio in 2020 and 2050. In order to capture not only beliefs about the level of the ratios but also their change, we calculate the difference between the prior beliefs for 2020 and 2050. This difference reflects the demographic change that respondents expect to occur over time. Second, we use multinomial probit models to identify the factors that make respondents more likely to underestimate, correctly estimate or overestimate the ratios and their change. Finally, we analyse belief updating, that is whether and to what extent respondents change their beliefs about demographic change once we provide them with information about the old-age dependency ratios. To do this, we compare the average prior and posterior beliefs for both 2020 and 2050.

In the descriptive analysis, we find that respondents tend to overestimate the old-age dependency ratio for both 2020 and 2050. However, beliefs about the expected demographic change, that is the difference between the two ratios, are generally more accurate.

The results of our multinomial probit models suggest that a better understanding of the functioning of the German statutory pension insurance is related to more accurate beliefs about the old-age dependency ratios for 2020 and 2050 and demographic change, that is the difference between the two ratios. Furthermore, the findings point to heterogeneities related to the age of respondents who have informed themselves about their retirement needs. Older respondents who have informed

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<sup>1</sup>As common in the economics literature (see Haaland et al. 2023, and the literature cited there), we use the terms *belief* and *estimate* interchangeably throughout the paper. For the same reason, we use the terms *biased* and *unbiased* when referring to the accuracy of beliefs or estimates; when the direction of the bias matters, we also use *underestimated* and *overestimated*. Some of these terms are used differently in other disciplines.

<sup>2</sup>The old-age dependency ratio is defined here as the number of people of retirement age (i.e. over 65 years old) for every 100 people of working age (i.e. between 20 and 65 years old).

themselves about their needs are more likely to underestimate (and less likely to overestimate) the old-age dependency ratio for both 2020 and 2050 and the magnitude of demographic change. These effects are not observed for younger respondents who have informed themselves about their needs. We can only speculate about the reasons for this: Older respondents close to retirement may be less concerned about demographic change because they have already (at least partially) prepared for their old age. As a result, they may be more likely to underestimate the extent of projected population ageing. Alternatively, they may try to convince themselves of a more positive outlook, especially if they have not yet sufficiently prepared for their old age or would not have the opportunity to react to a more adverse demographic development. The exact mechanisms, however, require further research.

In the final step of our analysis, we examine belief updating, that is whether respondents who have received the information about the old-age dependency ratios are able to remember it. Our results show that respondents update their beliefs in a significant way, with posterior beliefs closely matching the projected old-age dependency ratios for both 2020 and 2050. This holds for the full sample as well as for subgroups based on age, gender, and the extent of understanding the German statutory pension insurance. Our analysis suggests that differences in the strength of belief updating are determined by the strength of biases in prior beliefs.

This paper is related to several strands of literature. The first strand is the economics literature on surveys and information provision experiments. In recent years, economists have increasingly used surveys to elicit beliefs about socio-economic statistics and to study policy preferences. Typical applications include beliefs about inequality and preferences for redistribution (Cruces et al. 2013; Kuziemko et al. 2015; Alesina et al. 2018; Hoy and Mager 2021; Casarico et al. 2023) and beliefs about immigration statistics and attitudes towards migration (Grigorieff et al. 2020; Haaland and Roth 2020; Dylong and Uebelmesser 2024; Alesina et al. 2023). All these studies have in common that they elicit respondents' beliefs and then provide one or several pieces of information to the treatment group(s) in order to study the effect of the treatment on the outcome of interest for the treated group compared to the control group. Some studies also examine whether respondents in the treatment group(s) were able to process and retain the information provided. Analysing belief updating behaviour helps to understand the underlying mechanisms of a potential treatment effect (Haaland et al. 2023).<sup>3</sup> To the best of our knowledge, however, there are no experimental studies in the economics literature that elicit beliefs about demographic change and examine belief updating in response to information provision.<sup>4</sup>

The second strand of literature is related to (lay)people's expectations about the economy. Laypeople's expectations are most commonly studied in the context of inflation (see, e.g., Armantier et al. 2016; D'Acunto et al. 2021; Coibion et al. 2023), but have also become the focus

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<sup>3</sup>To measure belief updating, some studies elicit posterior beliefs at the end of the initial survey and/or conduct follow-up surveys a few weeks after the initial survey (Kuziemko et al. 2015; Alesina et al. 2018; Grigorieff et al. 2020; Haaland and Roth 2020; Angelici et al. 2022; Alesina et al. 2023).

<sup>4</sup>An exception is Schuetz et al. (2023), which uses the same survey with the same information experiment as in this paper, but with a focus on the acceptance of pension reforms (see below at the end of the literature review). In Naumann (2017), Angelici et al. (2022), and Boeri et al. (2024), information about demographic dynamics is part of the treatment, but without eliciting prior or posterior beliefs about it.

in other economic applications. For example, Roth and Wohlfart (2020) study how people's expectations about economic growth influence what they think about their own financial situation as well as their behavioral reactions to changes in these expectations while Bjuggren and Elert (2019) investigate gender differences in expectations about economic development. We add to this literature with our study of beliefs about demographic change, which can be related to people's expected development of population ageing.

Finally, the third strand is the economics literature on pensions, which provides a possible application of the implications of (corrected) beliefs about demographic change on individuals' acceptance of reforms.<sup>5</sup> Overall, pension reforms face low acceptance and thus may come at a cost to politicians in terms of a reduced probability of re-election. However, higher levels of economic and financial literacy may reduce the electoral costs of pension reforms as shown by Fornero and Lo Prete (2019) for a sample of 21 advanced countries, including Germany and Italy. This finding is in line with Boeri and Tabellini (2012) who show for Italy that more informed individuals are more likely to accept pension reforms. However, Gouveia (2017) for Portugal and Kangas et al. (2022) for Finland find mixed results. More closely related to this paper, Schuetz et al. (2023) show that providing information about demographic change and, more broadly, increasing the salience of this issue, increases the awareness that pension reforms are necessary. Similarly, Naumann (2017) examines how information about demographic change and its consequences for the financing of the statutory pension insurance affects the perceived pressure for reforms. Our paper aims to study how well informed individuals are about demographic change, which factors determine the accuracy of their beliefs and whether beliefs are updated when information is provided.

This paper is structured as follows: The next section introduces the dataset and explains how we measure beliefs about demographic change. The first step of our analysis is presented in section 3, which contains a brief descriptive analysis of the distributions of beliefs. Section 4 explains our empirical strategy, and section 5 presents step two of our analysis, the multinomial probit models, and step three, the belief updating. Finally, section 6 concludes.

## **2 Data and Experimental Design**

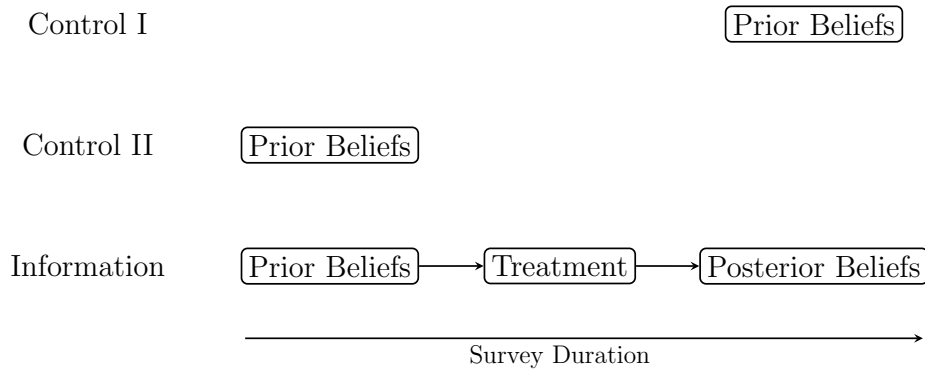
Our analysis is based on a unique dataset collected through computer-assisted telephone interviews (CATI) in late 2020 and early 2021. The interviews were conducted by a professional survey company, targeting both landline and mobile numbers. About 1000 respondents answered questions on socio-demographic characteristics, their understanding of the German statutory pension insurance, their attitudes towards pension issues, their view of pension reforms, their own pension saving behaviour, and their beliefs about demographic change.<sup>6</sup> Due to missing responses in some of those variables, our final sample size reduces to 882 observations. The questionnaire was distributed to individuals in Germany who were at least 18 years old, not employed as civil servants and not retired. Our sample is representative of East and West Germany in terms of

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<sup>5</sup>See also the survey by Haupt (2023) on pension communication and information and its effects on individuals' knowledge, attitudes and behaviour.

<sup>6</sup>An overview of all variables included in our analysis can be found in Appendix B.

Figure 1: Survey Groups



*Notes:* This figure shows when in the survey our different groups responded to the questions about their prior beliefs and, where applicable, their posterior beliefs.

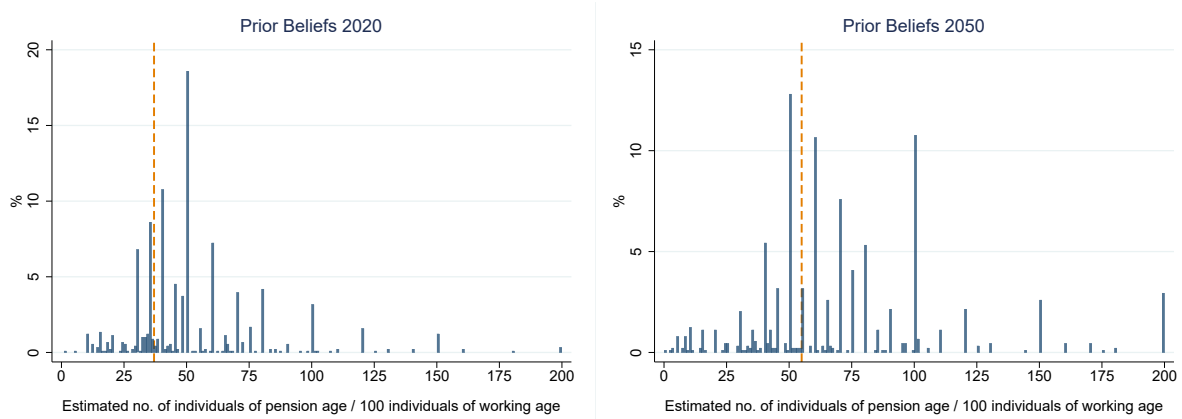
age, gender, and state of residence according to the German Microcensus. In terms of education, our sample is more educated than the average population; in addition, the share of West German respondents with a migrant background is lower in our sample than in the population in West Germany.

We elicit beliefs about demographic change by asking survey respondents about their estimates of the ratios of old-age to working-age people for the years 2020 and 2050. We introduce the topic by telling respondents that old-age provision in Germany is based on the idea that the working generation finances the pensions of the retired generation. We also stress that this is why it is important to look at the ratio of people of retirement age (65 years and above) to people of working age (between 20 and 64 years of age). As respondents may find it difficult to estimate the old-age dependency ratio, we provide them with an anchor by telling them that in 1990 there were 24 people of retirement age for every 100 people of working age. We then ask them for their estimates of the number of people of retirement age per 100 people of working age in 2020 and 2050, respectively.<sup>7</sup>

Respondents are randomly assigned to one of three groups: two control groups and the information group. Figure 1 visualises the order of the questions for the different groups. All three groups are asked about their prior beliefs. The two control groups differ in the point in the survey at which we elicit prior beliefs. One group is asked about their prior beliefs near the end of the survey, the other at an early stage. The information group is also asked about their estimates at this early point. This group is then provided with information on the old-age dependency ratios. We elicit posterior beliefs for this group towards the end of the survey. An analysis of the effect of the information treatment on pension reform preferences can be found in Schuetz et al. (2023). Complementary to that, we provide a detailed analysis of prior beliefs, their determinants, and belief updating in this paper.

<sup>7</sup>The exact wording of the introduction to the topic as well as the questions used to elicit prior beliefs can be found in Appendix A.

Figure 2: Distributions of Prior Beliefs



Notes: The figures show the distribution of prior beliefs of the old-age dependency ratios for 2020 and 2050, respectively. To deal with extreme outliers, we winsorize the prior beliefs to 200 for both years.

### 3 Descriptives of Prior Beliefs

In each step of our analysis, we evaluate the prior beliefs for the years 2020 and 2050 individually and examine the change in the prior beliefs between 2020 and 2050 by subtracting the prior belief for 2020 from the prior belief for 2050 (see equation 1). This difference gives us an indication of respondents' estimate of demographic change.

$$diff_i = prior50_i - prior20_i \quad (1)$$

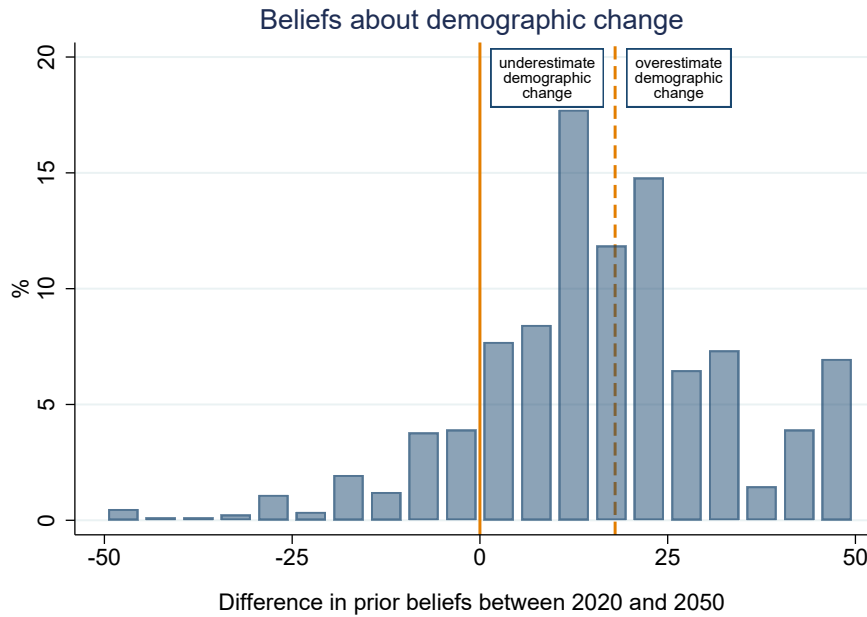
The first step is a descriptive analysis of the prior beliefs for 2020 and 2050 and the difference between the two as described in equation 1, to analyse the distribution of the beliefs. To deal with extreme outliers, we winsorize the prior beliefs to 200 for both years. This affects in total 58 observations.

Figure 2 illustrates the distribution of prior beliefs for 2020 and 2050, respectively. The orange dashed line represents the projected value of 37 for 2020 and the projected value of 55 for 2050. The projections come from the Federal Statistical Office (Destatis 2017) and assume an almost constant birth rate, a moderately increasing life expectancy, and take into account the increase in migration due to the 2015 refugee crisis. The distribution of beliefs for 2020 is relatively concentrated between 30 and 60. In contrast, the distribution for 2050 is much more spread out, suggesting that respondents are less certain about their estimates for this later year. A plausible explanation for this difference in dispersion is that respondents rely on the anchor value for their beliefs about the old-age dependency ratio in 2020. However, as the anchor only provides information on the old-age dependency ratio in 1990, respondents may find it more difficult to predict the development up to 2050.

Figure 3 shows the estimated magnitude of demographic change,  $diff_i$ , between 2020 and 2050 (see equation 1). The projected increase in the number of people of retirement age per 100 people of working age between 2020 and 2050 is 18 ( $= 55 - 37$ ). A negative value for  $diff_i$  indicates that



Figure 3: Distribution of Beliefs about Demographic Change



*Notes:* The figure shows the distribution of the estimated difference in the old-age dependency ratio between 2020 and 2050. We only show observations where the estimated change is greater than -50 and less than 50. However, only 64 observations fall outside the range shown.

a respondent expects demographic change to become less severe over time, that is that there will be fewer people of retirement age per 100 people of working age in 2050 than in 2020. Any value of  $diff_i$  above 0 and below 18 indicates that a respondent expects demographic change to become more severe, but underestimates its magnitude. Similarly, respondents with  $diff_i > 18$  expect demographic change to become more severe, but overestimate its magnitude. Importantly, if respondents overestimate both ratios, they may still have an accurate belief about the magnitude of demographic change, which is exactly what we are able to capture with equation 1. In essence, the bias can cancel out if it is of similar magnitude and same direction for both ratios.

About 14% of respondents have biased beliefs about the *direction* of demographic change. For reasons mentioned above, we can only work with a projection of the old-age dependency ratios in 2020 and 2050. Although the realised ratios may differ from the projected values, it is almost certain that the old-age dependency ratio in Germany will be higher in 2050 than in 2020.<sup>8</sup> Of those who correctly estimated the direction, most had biased beliefs about the *magnitude*: 54% underestimated demographic change, while 45% overestimated it and only 1% of respondents had correct estimates. In Figure 3, the two groups of underestimators and overestimators are separated by the dotted line. Later on in the analysis, we will allow for some tolerance in defining the correct estimate of demographic change.

<sup>8</sup>We exclude these respondents from the analysis of the difference in prior beliefs (see section 5.3) since we are interested there in the factors that drive the estimates of the *magnitude* (not the *direction*) of demographic change. However, these respondents are part of the analysis of the determinants of the beliefs of both ratios taken separately (see sections 5.1 and 5.2).

Overall, the majority of respondents overestimate the old-age dependency ratios for 2020 and 2050. Looking at the estimated magnitude of demographic change, that is the difference between the two estimated ratios, a more balanced picture emerges. There is a small percentage of respondents who do not expect any further ageing, while the rest is relatively evenly divided between those who underestimate and those who overestimate the extent of ageing. In the following analysis, we specifically distinguish between the prior beliefs of the ratios considered separately and the difference. This gives us a detailed insight into who has accurate beliefs about the (projected) ratios and who has biased beliefs but still seems to have a good understanding of the projected demographic change.

#### 4 Empirical Strategy

As presented in the previous section, our first step consists of a descriptive analysis of individual prior beliefs for 2020 and 2050 and the difference between the two. In the second step, we use an exploratory approach to identify factors that contribute to more accurate estimates of the old-age dependency ratios and the magnitude of demographic change.

Our primary estimation strategy is based on multinomial probit models. We categorize respondents into underestimators, correct estimators and overestimators based on their beliefs. We then use the belief categories as outcome variables. Our outcome categories are not ordered in a linear sense; we could also describe them as “bad”, “good”, and “another type of bad”, respectively. Accordingly, the parallel trends assumption of ordered probit models is violated. For this reason, we use multinomial probit models instead of ordered probit models. Running a Brant test on our data confirms this and indicates that a multinomial probit model is the better choice for our (non-linearly) ordered outcomes. This model allows us to estimate the potential impact of our explanatory variables on the probability of a respondent being an underestimator, a correct estimator, or an overestimator, based on the following equation:

$$\begin{aligned} P(\text{belief category} | \mathbf{X}_i, \text{under}_i, \mathbf{inform}_i, \text{prior}_i) = \\ = \beta_0 + \beta_1 \mathbf{X}_i + \beta_2 \text{under}_i + \beta_3 \mathbf{inform}_i + \beta_4 \text{prior}_i + \varepsilon_i \end{aligned} \quad (2)$$

where *belief category* is our outcome and can be categorised as “underestimator”, “correct estimator” and “overestimator” for each individual prior belief and the difference between them. The intervals we use to classify the respondents are as follows: For 2020, where the correct value is 37, a prior belief below 33 is considered an underestimate, a prior belief between 33 and 41 is considered a correct estimate and a prior belief above 41 is considered an overestimate. This range is determined on the basis of the information provision experiment, where respondents received feedback that their estimate was correct if it fell within the interval between 33 and 41. The intervals for underestimators and overestimators are chosen in relation to this interval.<sup>9</sup> For 2050, where the correct value is 55, the thresholds are below 51, between 51 and 59, and above 59 following a similar reasoning as for the 2020-ratio.

The vector of control variables,  $\mathbf{X}_i$ , includes socio-demographic variables such as age, gender,

<sup>9</sup>In order to prevent very large overestimations from influencing the results, prior beliefs are winsorized to 200. Beyond this value, beliefs are likely to be affected by inattentive or random responses.

education, living in East/West Germany, having a migration background, being employed, and being married, as explained in Appendix B. We include these variables because demographic change affects individuals from different generations and with different individual economic and social situations in different ways. This may, in turn, affect beliefs about the old-age dependency ratios and the extent of demographic change.

The variable,  $under_i$ , measures respondents' understanding of the statutory pension insurance based on 11 single-choice questions.<sup>10</sup> We calculate the total number of correct answers per respondent to construct our understanding index. By including both educational attainment and the understanding variable, despite the expected correlation between the two, we can accurately assess the role of knowledge acquired outside formal education. We expect that a better understanding of the statutory pension insurance makes the issue of demographic change more salient, which has a positive effect on the ability to correctly estimate the old-age dependency ratios and the magnitude of demographic change that cannot be explained by education.

The vector **inform<sub>i</sub>** captures the extent to which respondents have informed themselves about the income they will *need* in retirement, an interaction of the same variable with an indicator for being 60 or older, and a binary variable for whether respondents have informed themselves about the income they will *receive* in retirement. It seems reasonable that those respondents who are better informed will have more accurate beliefs about demographic change than those who are not. We also hypothesize that the effect of being informed varies by age.

Finally, the variable  $prior_i$  stands for the respective other prior belief. When explaining the beliefs about the prior belief of 2020, we control for the prior belief of 2050 to account for any other unobserved characteristics that systematically affect beliefs about the old-age dependency ratios. Conversely, we control for the prior belief of 2020 when the prior belief of 2050 is our outcome. In the model, which deals with the difference of prior beliefs, we control for the prior belief of 2020 because our descriptive analysis suggested that respondents were able to make a more informed choice of this prior belief compared to the prior belief of 2050. Due to potential endogeneity issues, we only include the respective other prior belief as a robustness check.  $\varepsilon_i$  is the error term.

In the third step, we analyse belief updating, that is whether the information treatment led respondents to update their beliefs about the old-age dependency ratios. We compare the prior beliefs for 2020 and 2050 with the posterior beliefs for 2020 and 2050, respectively. Again, we consider subgroups of underestimators, correct estimators, and overestimators based on the respondents' prior beliefs. We also differentiate by gender, age, and understanding of the German statutory pension insurance. Using t-tests we can determine whether respondents' prior and posterior beliefs are significantly different from the true (projected) values.

Descriptive statistics for all (control) variables are presented in Table 1 separately for underestimators, correct estimators, and overestimators for the ratio of 2020 (see Tables A.2 and A.3 in

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<sup>10</sup>In the survey, we ask respondents 14 questions related to their understanding of the statutory pension insurance. Based on psychometric analyses according to classical test theory and item response theory, we exclude three questions from the original index (see Baginski et al. 2023).

|                      | Underestimate 2020 |      | Correct 2020 |      | Overestimate 2020 |       |
|----------------------|--------------------|------|--------------|------|-------------------|-------|
|                      | Mean               | Sd   | Mean         | Sd   | Mean              | Sd    |
| Ratio 2020           | 23.85***           | 7.76 | 37.34        | 2.59 | 66.08***          | 26.28 |
| Age group            | 3.28               | 1.23 | 3.28         | 1.19 | 3.09*             | 1.31  |
| No income            | 0.20               | 0.40 | 0.14         | 0.34 | 0.17              | 0.38  |
| Income low (R)       | 0.10               | 0.30 | 0.07         | 0.25 | 0.11*             | 0.31  |
| Income medium-low    | 0.16               | 0.37 | 0.15         | 0.36 | 0.17              | 0.37  |
| Income medium-high   | 0.15               | 0.36 | 0.16         | 0.37 | 0.20              | 0.40  |
| Income high          | 0.39*              | 0.49 | 0.48         | 0.50 | 0.36***           | 0.48  |
| Female               | 0.55***            | 0.50 | 0.40         | 0.49 | 0.54***           | 0.50  |
| Employed             | 0.85*              | 0.36 | 0.86         | 0.35 | 0.84              | 0.37  |
| Migration background | 0.15               | 0.36 | 0.09         | 0.29 | 0.13              | 0.33  |
| Married              | 0.54               | 0.50 | 0.58         | 0.50 | 0.50*             | 0.50  |
| East                 | 0.42               | 0.49 | 0.41         | 0.49 | 0.41              | 0.49  |
| Inheritance          | 0.11               | 0.32 | 0.15         | 0.36 | 0.15              | 0.36  |
| Educ: 9th grade (R)  | 0.13               | 0.34 | 0.13         | 0.33 | 0.12              | 0.33  |
| Educ: 10th grade     | 0.32               | 0.47 | 0.31         | 0.47 | 0.35              | 0.48  |
| Educ: 12th grade     | 0.27*              | 0.44 | 0.19         | 0.03 | 0.22              | 0.02  |
| University degree    | 0.29               | 0.45 | 0.37         | 0.48 | 0.33              | 0.47  |
| Understanding index  | 7.05***            | 2.23 | 8.05         | 2.15 | 7.46***           | 2.16  |
| Pension need         | 4.52               | 2.01 | 4.85         | 1.92 | 4.67              | 1.88  |
| Pension need * 60+   | 1.02               | 2.37 | 0.83         | 2.10 | 0.87              | 2.14  |
| Pension receive      | 0.79               | 0.41 | 0.83         | 0.38 | 0.74**            | 0.44  |
| N                    | 142                |      | 213          |      | 527               |       |

*Notes:* This table presents descriptive statistics of our explanatory variables separately for underestimators, correct estimators, and overestimators of the old-age dependency ratio in 2020. For the income and education variables, (R) indicates the reference group in our regressions.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  indicate significant differences between the respective mean and the mean of the same variable for correct estimators.

Table 1: Summary Statistics by Prior Beliefs 2020

the Appendix for the same statistics for the ratio of 2050 and the difference between the ratios). A description of all variables can be found in Appendix B.

Our analysis focuses on the role of gender, the understanding of the German statutory pension insurance, which we capture through our understanding index, and whether respondents have informed themselves about their own retirement needs and expected retirement income. We expect that there may be differences between men and women in their beliefs about demographic change due to persistent inequalities in (unpaid) work. Those who are mainly responsible for raising the next generation may have different beliefs about demographic change and be exposed to different sources of information than their partners who are in (full-time) paid employment. We include our understanding index in the analysis as there may be a positive correlation between understanding the statutory pension insurance and understanding demographic change. Finally, we focus on whether respondents have informed themselves about their retirement needs and the income they will receive. With these variables, we hope to capture differences in how informed and possibly concerned respondents are about their individual pension situation, which again may be related to respondents' beliefs about demographic change.

As can be seen in Table 1, both the share of females and the average understanding index are

significantly different for underestimators and overestimators of the 2020 ratio compared to the correct estimators of this ratio. We also find a significant difference between overestimators and correct estimators when considering those who have informed themselves about the pension they will receive. These observations provide evidence that these variables are indeed relevant to our analysis of explaining prior beliefs. In Tables A.2 and A.3 we do not observe any systematic differences in the means for our variables of interest. However, as this is just a comparison of means, we expect the regression analysis to shed more light on possible correlations.

## **5 Beliefs of Demographic Change**

### **5.1 Prior Beliefs 2020**

The marginal effects of our multinomial probit regression analysis for the prior beliefs of 2020 are shown in Table 2. The table is divided into three panels corresponding to underestimators, correct estimators, and overestimators. The range of prior beliefs for each category is given in square brackets in the table.

In Table 2, we observe that being female is associated with a significantly lower probability of correctly estimating the ratio for 2020 and a marginally significantly higher probability of overestimating it. Specifically, in the first four columns, being female is associated with a decrease in the probability of correctly estimating the ratio for 2020 by 7.5% to 10.1% and an increase in the probability of overestimating the ratio by 6.3% to 7.1%. In column (5) we add the prior belief for 2050 as a robustness check. The prior beliefs for 2020 and 2050 are highly correlated so that it is not surprising that adding the prior belief for 2050 has a significant impact on all marginal effects in the model. We argue that adding the prior belief for 2050 allows us to capture unobservable characteristics that affect both prior beliefs. In this case, being female loses its significance in the robustness check.

For the understanding index, we find a significantly positive correlation with correctly estimating the ratio for 2020, which is robust across all specifications in terms of sign, magnitude, and significance. A one-unit increase in the index, that is one additional question answered correctly, is associated with a 2.8% to 2.9% increase in the probability of a correct estimate. Since this effect persists in the robustness check, we identify the understanding variable as a robust key factor in explaining prior beliefs for 2020. Respondents with a good understanding of the statutory pension insurance are likely to be able to process information about demographic change more efficiently and estimate the old-age dependency ratio more accurately, especially given the anchor value provided for 1990. Further evidence can be found in the panels for under- and overestimators. Understanding the statutory pension insurance is negatively related to both underestimating and overestimating the ratio for 2020. However, these effects are somewhat less robust.

|   | (1)                 | (2)                 | (3)                 | (4)                 | (5)                 |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|
|   | Ratio 2020          | Ratio 2020          | Ratio 2020          | Ratio 2020          | Ratio 2020          |
| Underestimators: Prior 2020 $\in [1,32]$  |                     |                     |                     |                     |                     |
| Age 60+                                   | -0.015<br>(0.06)    | 0.007<br>(0.06)     | 0.010<br>(0.06)     | -0.199***<br>(0.06) | -0.020<br>(0.02)    |
| Female                                    | 0.029<br>(0.03)     | 0.025<br>(0.03)     | 0.013<br>(0.03)     | 0.011<br>(0.03)     | 0.007<br>(0.01)     |
| Understanding                             |                     |                     | -0.019***<br>(0.01) | -0.017**<br>(0.01)  | -0.003<br>(0.00)    |
| Pension Need                              |                     |                     |                     | -0.020**<br>(0.01)  | -0.004<br>(0.00)    |
| Pension Need * 60+                        |                     |                     |                     | 0.089***<br>(0.03)  | 0.025**<br>(0.01)   |
| Pension Receive                           |                     |                     |                     | 0.020<br>(0.04)     | 0.014<br>(0.01)     |
| Prior 2050                                |                     |                     |                     |                     | -0.003***<br>(0.00) |
| Correct: Prior 2020 $\in [33,41]$         |                     |                     |                     |                     |                     |
| Age 60+                                   | 0.077<br>(0.06)     | 0.072<br>(0.06)     | 0.068<br>(0.06)     | 0.092<br>(0.14)     | 0.042<br>(0.13)     |
| Female                                    | -0.101***<br>(0.03) | -0.096***<br>(0.03) | -0.076**<br>(0.03)  | -0.075**<br>(0.03)  | -0.055<br>(0.03)    |
| Understanding                             |                     |                     | 0.029***<br>(0.01)  | 0.028***<br>(0.01)  | 0.029***<br>(0.01)  |
| Pension Need                              |                     |                     |                     | 0.003<br>(0.01)     | -0.007<br>(0.01)    |
| Pension Need * 60+                        |                     |                     |                     | -0.027<br>(0.03)    | 0.001<br>(0.03)     |
| Pension Receive                           |                     |                     |                     | 0.058<br>(0.04)     | 0.104**<br>(0.05)   |
| Prior 2050                                |                     |                     |                     |                     | -0.009***<br>(0.00) |
| Overestimators: Prior 2020 $\in [42,200]$ |                     |                     |                     |                     |                     |
| Age 60+                                   | -0.062<br>(0.07)    | -0.079<br>(0.07)    | -0.078<br>(0.07)    | 0.107<br>(0.15)     | -0.023<br>(0.13)    |
| Female                                    | 0.071*<br>(0.04)    | 0.071*<br>(0.04)    | 0.063*<br>(0.04)    | 0.064*<br>(0.04)    | 0.048<br>(0.04)     |
| Understanding                             |                     |                     | -0.011<br>(0.01)    | -0.010<br>(0.01)    | -0.026***<br>(0.01) |
| Pension Need                              |                     |                     |                     | 0.017<br>(0.01)     | 0.011<br>(0.01)     |
| Pension Need * 60+                        |                     |                     |                     | -0.062**<br>(0.03)  | -0.026<br>(0.03)    |
| Pension Receive                           |                     |                     |                     | -0.078<br>(0.05)    | -0.118**<br>(0.05)  |
| Prior 2050                                |                     |                     |                     |                     | 0.012***<br>(0.00)  |
| Controls                                  | Yes                 | Yes                 | Yes                 | Yes                 | Yes                 |
| Education                                 | No                  | Yes                 | Yes                 | Yes                 | Yes                 |
| N   | 882                 | 882                 | 882                 | 882                 | 882                 |

*Notes:* This table presents the marginal effects at means from our multinomial probit estimation. The outcome variable is the prior belief for 2020 winsorized to 200. Control variables include age, income, employment status, migration background, being married, living in East Germany, having inherited/expecting to inherit  $\geq 100,000\text{€}$ . Education captures various degrees. Detailed variable descriptions can be found in Appendix B. We employ weights to account for oversampling of respondents in East Germany. Robust standard errors in parentheses; \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2: Prior Beliefs 2020

In addition, we find that having informed oneself about one's own retirement needs (*Pension Need*)<sup>11</sup> is correlated differently with estimates of the 2020-ratio for younger and older respondents. For those who are at least 60 years old, it is associated with a decrease in the likelihood of overestimating the ratio for 2020 and an increase in the likelihood of underestimating it, compared to younger respondents who have informed themselves about their retirement needs (as shown by the interaction terms). Having done some research on retirement needs is thus associated with an increase in the probability of underestimating for older respondents. We can only speculate about the reasons. It is possible that older respondents who are aware of their future financial situation in retirement are those who have already actively taken measures to ensure a sufficient income. As a result, they may be less concerned and less informed about demographic change. Alternatively, they may try to convince themselves of a more positive outlook, especially if they have not yet sufficiently prepared for their old age or would not have the opportunity to react to a more adverse demographic development. For younger respondents, the future retirement income is much more uncertain so even those who have informed themselves about their retirement needs still need to keep up to date with information about the magnitude of demographic change. This seems to make it less likely for them to underestimate the ratio for 2020. The exact mechanisms, however, require further research.<sup>12</sup>

Given that different generations are affected by demographic change to very different degrees, it seems plausible that beliefs about demographic change may vary systematically across generations. For this reason, we also conduct our analysis of prior beliefs separately for the “young” (< 50 years old) and “old” ( $\geq$  50 years old) subsamples.<sup>13</sup> Table 3 shows the results of the subsample analysis for prior beliefs of 2020.<sup>14</sup>

We find that young women (relative to young men) are significantly more likely to underestimate the ratio for 2020, while older women (relative to older men) are significantly more likely to overestimate it. These results may indicate that the positive but smaller and less significant effect of being female that we found for the full sample (see Table 2, panel of overestimators) may be driven by the group of older respondents. A similar effect may be at play with respect to the understanding index. The index is not significant in the subsample of the young, but only in the subsample of the old, with the same sign as in the full sample. Understanding the statutory pension insurance thus seems to be unrelated to knowledge of the old-age dependency ratio for younger respondents, while it is positively related to correctly estimating the ratio for older respondents, and negatively related to both underestimating and overestimating the ratio.

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<sup>11</sup>The variable that captures whether respondents have informed themselves about their retirement needs is measured on a 7-point Likert scale ranging from “I have not informed myself at all” to “I have informed myself comprehensively”.

<sup>12</sup>One should note that for the age variable, we do not find any significant correlation for any regression with the exception of column (4) in the underestimator specification. Older individuals who have not (yet) informed themselves are less likely to underestimate the ratio for 2020.

<sup>13</sup>Because of the very low number of correct estimates for the old-age dependency ratio in 2050, we were only able to estimate the subsamples for the ratio in 2020 and the difference between the two ratios (see Section 5.3).

<sup>14</sup>As we now analyse age as a dimension of heterogeneity, we had to change our regression model slightly. We removed the interaction term “Pension Need \* 60+” and adjusted the age variable to be appropriate for each subgroup.

|   | Young               |                     | Old                |                     |
|---|---------------------|---------------------|--------------------|---------------------|
|   | (1)                 | (2)                 | (3)                | (4)                 |
|   | Ratio 2020          | Ratio 2020          | Ratio 2020         | Ratio 2020          |
| Underestimators: Prior 2020 $\in [1,32]$  |                     |                     |                    |                     |
| Female                                    | 0.081**<br>(0.04)   | 0.003<br>(0.01)     | -0.035<br>(0.04)   | 0.019<br>(0.02)     |
| Understanding                             | -0.014<br>(0.01)    | -0.002<br>(0.00)    | -0.018**<br>(0.01) | -0.006<br>(0.00)    |
| Pension Need                              | -0.037***<br>(0.01) | -0.004<br>(0.00)    | 0.029**<br>(0.01)  | 0.015**<br>(0.01)   |
| Pension Receive                           | -0.010<br>(0.04)    | 0.005<br>(0.01)     | 0.098<br>(0.07)    | 0.040<br>(0.03)     |
| Prior 2050                                |                     | -0.001<br>(0.00)    |                    | -0.005***<br>(0.00) |
| Correct: Prior 2020 $\in [33,41]$         |                     |                     |                    |                     |
| Female                                    | -0.058<br>(0.05)    | -0.052<br>(0.04)    | -0.114**<br>(0.05) | -0.085*<br>(0.05)   |
| Understanding                             | 0.014<br>(0.01)     | 0.006<br>(0.01)     | 0.041***<br>(0.01) | 0.048***<br>(0.01)  |
| Pension Need                              | 0.004<br>(0.01)     | -0.019<br>(0.01)    | -0.008<br>(0.01)   | -0.002<br>(0.01)    |
| Pension Receive                           | 0.110**<br>(0.05)   | 0.144**<br>(0.06)   | -0.026<br>(0.07)   | 0.007<br>(0.08)     |
| Prior 2050                                |                     | -0.011***<br>(0.00) |                    | -0.007***<br>(0.00) |
| Overestimators: Prior 2020 $\in [42,200]$ |                     |                     |                    |                     |
| Female                                    | -0.023<br>(0.05)    | 0.049<br>(0.05)     | 0.149***<br>(0.06) | 0.066<br>(0.06)     |
| Understanding                             | 0.001<br>(0.01)     | -0.004<br>(0.01)    | -0.023*<br>(0.01)  | -0.042***<br>(0.01) |
| Pension Need                              | 0.033**<br>(0.01)   | 0.023*<br>(0.01)    | -0.020<br>(0.02)   | -0.012<br>(0.02)    |
| Pension Receive                           | -0.100*<br>(0.06)   | -0.149**<br>(0.06)  | -0.072<br>(0.09)   | -0.047<br>(0.08)    |
| Prior 2050                                |                     | 0.012***<br>(0.00)  |                    | 0.012***<br>(0.00)  |
| Controls                                  | Yes                 | Yes                 | Yes                | Yes                 |
| N   | 468                 | 468                 | 414                | 414                 |

*Notes:* This table presents the marginal effects at means from our multinomial probit estimation. The outcome variable is the prior belief for 2020 winsorized to 200. The first two columns show results for participants under 50 years old and the last two columns show results for participants 50 years or older. For information on control variables see Table 2; \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 3: Prior Beliefs 2020 (By Age)

The subsample analysis confirms one of our previous findings: Older respondents who have informed themselves about their pension needs are more likely to underestimate the ratio in 2020, compared to their counterparts who are uninformed. In addition, we now observe that young respondents who have informed themselves about their pension needs are less likely to underestimate the ratio and more likely to overestimate it, compared to their uninformed peers. This is a new insight and may suggest that young respondents who have informed themselves



about their pension needs are overwhelmed with information leading to an overestimation of the severity of demographic change. Given that this younger generation has permanent access to information and will be the most affected by demographic change, it is possible that individuals who inform themselves about their pension needs may receive an overload of anxiety-driven information regarding demographic change, resulting in more pessimistic views when compared to those who remain uninformed. There is a vast amount of literature across disciplines suggesting that decision-making performance decreases once the information load becomes too large (Roetzel 2018). However, additional research is necessary to validate the mechanism underlying our findings.

## **5.2 Prior Beliefs 2050**

The descriptive analysis has already shown that there is a larger dispersion of prior beliefs about the old-age dependency ratio for 2050 (see Figure 2). Therefore, we expect that there is more randomness in these beliefs and that our regression model will not be able to explain them as well as the ones for 2020.

Table 4 is again divided into 3 panels corresponding to underestimators, correct estimators and overestimators. The range of prior beliefs for each category is, as before, given in square brackets.<sup>15</sup> As for the 2020 ratio, we find that a better understanding of the statutory pension insurance is associated with a higher probability to correctly estimate the 2050 ratio, although with an effect size which is less economically relevant than before. We provide thus further evidence for the proposed link between understanding the German statutory pension insurance and being able to correctly estimate dynamics of demographic change. To be sure, we do not provide evidence of a causal relationship between the two variables. Nevertheless, it seems plausible that those who have a better understanding of the statutory pension insurance also find it easier to assess the dynamics of demographic change (and vice versa). In addition, respondents who are well-informed about both the statutory pension insurance and demographic change may simply be more inclined to research complex social and economic issues. By controlling for education, we ensure that the marginal effects of understanding the statutory pension insurance do not simply capture the educational background of the respondents.

Furthermore, the marginal effect of the prior beliefs for 2020 is slightly negative and significant at the 1% level for correct estimators. Thus, a higher prior belief for 2020 is associated with a lower probability of correctly estimating the ratio for 2050. This observation is in line with the marginal effects of the prior belief for 2020 in the panels of underestimators and overestimators. A higher prior belief for 2020 is associated with a significantly lower probability of underestimating the ratio for 2020 and a significantly higher probability of (also) overestimating the ratio for 2050.

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<sup>15</sup>Note that only about 4.5% of respondents estimate the ratio for 2050 to be in the correct range of 51 to 59, compared to 24% who correctly estimate the ratio for 2020 in the corresponding range of 33 to 41. The results for the correct category of the prior belief for 2050 should therefore be interpreted with some caution.

|   | (1)               | (2)               | (3)               | (4)                | (5)                 |
|---|-------------------|-------------------|-------------------|--------------------|---------------------|
|   | Ratio 2050        | Ratio 2050        | Ratio 2050        | Ratio 2050         | Ratio 2050          |
| Underestimators: Prior 2050 $\in [1,50]$  |                   |                   |                   |                    |                     |
| Age 60+                                   | -0.003<br>(0.07)  | 0.002<br>(0.07)   | 0.002<br>(0.07)   | -0.234**<br>(0.11) | -0.235**<br>(0.11)  |
| Female                                    | -0.071*<br>(0.04) | -0.065*<br>(0.04) | -0.065*<br>(0.04) | -0.066*<br>(0.04)  | -0.033<br>(0.04)    |
| Understanding                             |                   |                   | -0.001<br>(0.01)  | -0.001<br>(0.01)   | -0.007<br>(0.01)    |
| Pension Need                              |                   |                   |                   | -0.003<br>(0.01)   | 0.000<br>(0.01)     |
| Pension Need * 60+                        |                   |                   |                   | 0.054*<br>(0.03)   | 0.047<br>(0.03)     |
| Pension Receive                           |                   |                   |                   | -0.005<br>(0.05)   | -0.013<br>(0.05)    |
| Prior 2020                                |                   |                   |                   |                    | -0.013***<br>(0.00) |
| Correct: Prior 2050 $\in [51,59]$         |                   |                   |                   |                    |                     |
| Age 60+                                   | -0.056*<br>(0.03) | -0.045<br>(0.03)  | -0.045<br>(0.03)  | -0.085**<br>(0.04) | -0.096**<br>(0.05)  |
| Female                                    | -0.016<br>(0.01)  | -0.014<br>(0.01)  | -0.011<br>(0.01)  | -0.010<br>(0.01)   | -0.009<br>(0.01)    |
| Understanding                             |                   |                   | 0.004*<br>(0.00)  | 0.004*<br>(0.00)   | 0.004*<br>(0.00)    |
| Pension Need                              |                   |                   |                   | -0.000<br>(0.00)   | 0.000<br>(0.00)     |
| Pension Need * 60+                        |                   |                   |                   | 0.014<br>(0.01)    | 0.013<br>(0.01)     |
| Pension Receive                           |                   |                   |                   | -0.003<br>(0.01)   | -0.004<br>(0.01)    |
| Prior 2020                                |                   |                   |                   |                    | -0.001***<br>(0.00) |
| Overestimators: Prior 2050 $\in [60,200]$ |                   |                   |                   |                    |                     |
| Age 60+                                   | 0.059<br>(0.07)   | 0.043<br>(0.08)   | 0.043<br>(0.08)   | 0.319***<br>(0.11) | 0.331***<br>(0.11)  |
| Female                                    | 0.086**<br>(0.04) | 0.079**<br>(0.04) | 0.076**<br>(0.04) | 0.076**<br>(0.04)  | 0.042<br>(0.04)     |
| Understanding                             |                   |                   | -0.003<br>(0.01)  | -0.004<br>(0.01)   | 0.003<br>(0.01)     |
| Pension Need                              |                   |                   |                   | 0.003<br>(0.01)    | -0.001<br>(0.01)    |
| Pension Need * 60+                        |                   |                   |                   | -0.068**<br>(0.03) | -0.060*<br>(0.03)   |
| Pension Receive                           |                   |                   |                   | 0.008<br>(0.05)    | 0.017<br>(0.05)     |
| Prior 2020                                |                   |                   |                   |                    | 0.014***<br>(0.00)  |
| Controls                                  | Yes               | Yes               | Yes               | Yes                | Yes                 |
| Education                                 | No                | Yes               | Yes               | Yes                | Yes                 |
| N   | 882               | 882               | 882               | 882                | 882                 |

*Notes:* This table presents the marginal effects at means from our multinomial probit estimation. The outcome variable is the prior belief for 2050, winsorized at 200. For information on control variables see Table 2; \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 4: Prior Beliefs 2050

We also find that being female is associated with a significantly lower (higher) probability of underestimating (overestimating) by 6.5% to 8.6%. Again, being female does not remain significant in the robustness check. Regarding the retirement needs we find similar effects as for the prior beliefs for 2020: Having collected some information on one's own retirement needs is associated with a higher probability of underestimating the ratio for 2050 for respondents aged 60 or older, although this effect loses its significance once the prior belief for 2020 is controlled for. Similarly, having collected information on one's own retirement needs is associated with a lower probability of overestimating the ratio for 2050 for older respondents. This effect appears to be somewhat more robust and is only reduced in significance by our robustness check. The above explanation still seems plausible: the older generation, which has actively gathered information about its retirement needs, is less concerned about and, in general, less affected by demographic change due to its older age, and is, therefore, more likely to underestimate the old-age dependency ratio.

### **5.3 Difference Between Prior Beliefs 2020 and 2050**

The explanation of individual prior beliefs already provides some interesting insights. We now apply the same methodology of a multinomial probit model to the difference in prior beliefs, which reflects the changes in the old-age dependency ratio that respondents expect to occur over time. To do this, we exclude those respondents who expect the old-age dependency ratio to fall over time, that is those with a negative value for  $diff_i$  (see equation 1). This leaves us with a sample of 765 respondents, relatively evenly spread across the three groups. About 34% of respondents underestimate the difference, 36% overestimate it and 30% correctly estimate it, based on the ranges given in square brackets in Table 5.

As before, we find that having a better understanding of the German statutory pension insurance is positively related to the probability of correctly estimating the magnitude of demographic change, although the marginal effect is not significant in this model.

Again, we observe different age effects for those who have informed themselves about their retirement needs. For respondents aged 60 and over, there is a significant decrease in the probability of correctly estimating the difference between the ratios. Conversely, they are significantly more likely to underestimate the difference. The effects are quite large. A one unit increase in having informed oneself about the retirements needs is associated with a 6.4% lower probability of correctly estimating the difference between the ratios and a 9.3% higher probability of underestimating the difference. Both effects remain robust in terms of size and significance when controlling for prior beliefs for 2020.<sup>16</sup> This reinforces the evidence we have found above, to varying degrees.

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<sup>16</sup>One should also note that for the age variable, we find a significant correlation, but only in columns (4) and (5) in the underestimator specification. Older individuals who have not (yet) informed themselves are less likely to underestimate the difference.

|  | (1)              | (2)              | (3)              | (4)                | (5)                 |
|--|------------------|------------------|------------------|--------------------|---------------------|
|  | Difference       | Difference       | Difference       | Difference         | Difference          |
| Underestimators: Difference $\in [0, 12]$  |                  |                  |                  |                    |                     |
| Age 60+                                    | 0.087<br>(0.07)  | 0.085<br>(0.07)  | 0.086<br>(0.07)  | -0.239**<br>(0.09) | -0.278***<br>(0.10) |
| Female                                     | -0.020<br>(0.04) | -0.014<br>(0.04) | -0.018<br>(0.04) | -0.014<br>(0.04)   | -0.001<br>(0.04)    |
| Understanding                              |                  |                  | -0.006<br>(0.01) | -0.004<br>(0.01)   | -0.003<br>(0.01)    |
| Pension Need                               |                  |                  |                  | 0.010<br>(0.01)    | 0.010<br>(0.01)     |
| Pension Need * 60+                         |                  |                  |                  | 0.092**<br>(0.04)  | 0.093**<br>(0.04)   |
| Pension Receive                            |                  |                  |                  | -0.087<br>(0.05)   | -0.092*<br>(0.05)   |
| Prior 2020                                 |                  |                  |                  |                    | -0.004***<br>(0.00) |
| Correct: Difference $\in [13, 23]$         |                  |                  |                  |                    |                     |
| Age 60+                                    | -0.002<br>(0.07) | -0.020<br>(0.08) | -0.024<br>(0.08) | 0.283<br>(0.18)    | 0.241<br>(0.19)     |
| Female                                     | -0.033<br>(0.04) | -0.032<br>(0.04) | -0.022<br>(0.04) | -0.027<br>(0.04)   | -0.020<br>(0.04)    |
| Understanding                              |                  |                  | 0.015<br>(0.01)  | 0.014<br>(0.01)    | 0.015<br>(0.01)     |
| Pension Need                               |                  |                  |                  | -0.015<br>(0.01)   | -0.016<br>(0.01)    |
| Pension Need * 60+                         |                  |                  |                  | -0.064**<br>(0.03) | -0.064**<br>(0.03)  |
| Pension Receive                            |                  |                  |                  | 0.059<br>(0.05)    | 0.061<br>(0.05)     |
| Prior 2020                                 |                  |                  |                  |                    | -0.003***<br>(0.00) |
| Overestimators: Difference $\in [24, 150]$ |                  |                  |                  |                    |                     |
| Age 60+                                    | -0.085<br>(0.08) | -0.065<br>(0.08) | -0.062<br>(0.08) | -0.044<br>(0.19)   | 0.037<br>(0.19)     |
| Female                                     | 0.053<br>(0.04)  | 0.046<br>(0.04)  | 0.040<br>(0.04)  | 0.041<br>(0.04)    | 0.021<br>(0.04)     |
| Understanding                              |                  |                  | -0.009<br>(0.01) | -0.011<br>(0.01)   | -0.011<br>(0.01)    |
| Pension Need                               |                  |                  |                  | 0.005<br>(0.01)    | 0.006<br>(0.01)     |
| Pension Need * 60+                         |                  |                  |                  | -0.029<br>(0.03)   | -0.028<br>(0.03)    |
| Pension Receive                            |                  |                  |                  | 0.028<br>(0.05)    | 0.031<br>(0.05)     |
| Prior 2020                                 |                  |                  |                  |                    | 0.007***<br>(0.00)  |
| Controls                                   | Yes              | Yes              | Yes              | Yes                | Yes                 |
| Education                                  | No               | Yes              | Yes              | Yes                | Yes                 |
| N  | 765              | 765              | 765              | 765                | 765                 |

*Notes:* This table presents the marginal effects at means from our probit estimation. The outcome variable is the difference between the old-age dependency ratios, where respondents with a negative estimate for the difference have been excluded. For information on control variables see Table 2; \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 5: Difference Between Prior Beliefs

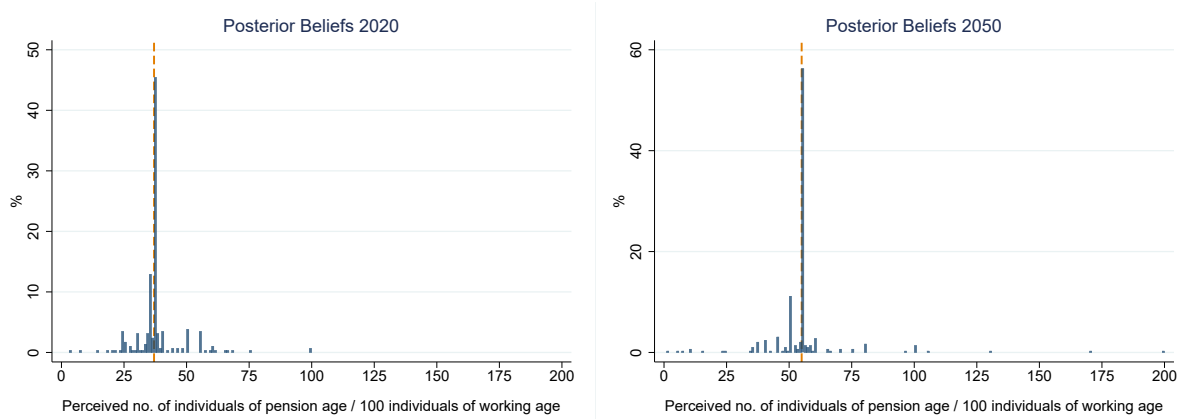
|   | Young             |                   | Old               |                   |
|---|-------------------|-------------------|-------------------|-------------------|
|   | (1)<br>Difference | (2)<br>Difference | (3)<br>Difference | (4)<br>Difference |
| Underestimators: Difference $\in [0,12]$  |                   |                   |                   |                   |
| Female                                    | 0.100*            | 0.106*            | -0.150**          | -0.142**          |
|   | (0.05)            | (0.06)            | (0.06)            | (0.06)            |
| Understanding                             | 0.004             | 0.003             | -0.012            | -0.012            |
|   | (0.01)            | (0.01)            | (0.01)            | (0.01)            |
| Pension Need                              | 0.012             | 0.016             | 0.026             | 0.025             |
|   | (0.02)            | (0.02)            | (0.02)            | (0.02)            |
| Pension Receive                           | -0.084            | -0.121*           | -0.109            | -0.095            |
|   | (0.07)            | (0.07)            | (0.09)            | (0.09)            |
| Prior 2020                                |                   | -0.006***         |                   | -0.002            |
|   |                   | (0.00)            |                   | (0.00)            |
| Correct: Difference $\in [13,23]$         |                   |                   |                   |                   |
| Female                                    | -0.080            | -0.071            | 0.034             | 0.035             |
|   | (0.05)            | (0.05)            | (0.06)            | (0.06)            |
| Understanding                             | 0.004             | 0.003             | 0.026*            | 0.026*            |
|   | (0.01)            | (0.01)            | (0.01)            | (0.01)            |
| Pension Need                              | -0.019            | -0.018            | -0.025            | -0.028            |
|   | (0.01)            | (0.01)            | (0.02)            | (0.02)            |
| Pension Receive                           | 0.082             | 0.078             | 0.087             | 0.098             |
|   | (0.06)            | (0.06)            | (0.09)            | (0.09)            |
| Prior 2020                                |                   | -0.003***         |                   | -0.002            |
|   |                   | (0.00)            |                   | (0.00)            |
| Overestimators: Difference $\in [24,150]$ |                   |                   |                   |                   |
| Female                                    | -0.020            | -0.035            | 0.116*            | 0.107*            |
|   | (0.06)            | (0.06)            | (0.06)            | (0.06)            |
| Understanding                             | -0.008            | -0.005            | -0.014            | -0.014            |
|   | (0.01)            | (0.02)            | (0.01)            | (0.01)            |
| Pension Need                              | 0.007             | 0.002             | -0.000            | 0.003             |
|   | (0.02)            | (0.02)            | (0.02)            | (0.02)            |
| Pension Receive                           | 0.003             | 0.043             | 0.021             | -0.003            |
|   | (0.07)            | (0.07)            | (0.09)            | (0.09)            |
| Prior 2020                                |                   | 0.009***          |                   | 0.005***          |
|   |                   | (0.00)            |                   | (0.00)            |
| Controls                                  | Yes               | Yes               | Yes               | Yes               |
| N   | 409               | 409               | 356               | 356               |

*Notes:* This table presents the marginal effects at means from our multinomial probit estimation. The outcome variable is the difference between the old-age dependency ratios, where respondents with a negative estimate for the difference have been excluded. The first two columns show results for participants under 50 years old and the last two columns show results for participants 50 years or older. For information on control variables see Table 2; \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 6: Difference Between Prior Beliefs (By Age)

Motivated by these heterogeneities with respect to age, we run subsample regressions, again separating “young” ( $< 50$  years old) and “old” ( $\geq 50$  years old) respondents. The results are shown in Table 6. We observe that young women are significantly more likely than young men to underestimate the difference between ratios, that is the magnitude of demographic change. We also find that older women are significantly less likely to underestimate the difference than

Figure 4: Distributions of Posterior Beliefs



*Notes:* The figures show the distribution of posterior beliefs of the old-age dependency ratios for 2020 and 2050, respectively, for the treatment group. To deal with one extreme outlier, we winsorize the posterior beliefs to 200 for both years.

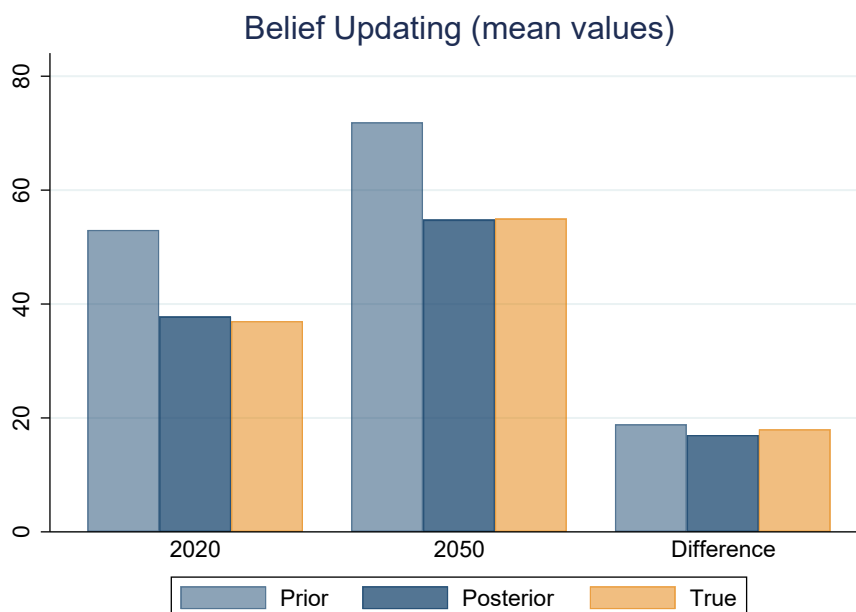
older men and more likely to overestimate it. The marginal effects of young and older women are about the same magnitude and appear to cancel each other out in the full sample, where we observe no significant marginal effect of the female variable. Again, we find some evidence that understanding is not related to correctly estimating the difference for young respondents, while there appears to be a positive relationship for older respondents – although at a lower significance than in the models for the 2020 ratio.

#### 5.4 Belief Updating

In the previous section, we analysed which variables influence the formation of prior beliefs. We now focus on belief updating, that is whether and to what extent respondents update their beliefs about the old-age dependency ratios after receiving information about the true (projected) values of these ratios. Respondents answered questions on pension policy preferences and socio-demographic characteristics between the information treatment and the elicitation of posterior beliefs so that we can analyse whether they were able to retain the information from the treatment throughout the survey. Since only respondents in the treatment group, that is those who received the information about the two old-age dependency ratios, were asked about their posterior beliefs, our number of observations is reduced to about one-third.

Figure 4 shows the distribution of posterior beliefs for the old-age dependency ratio in 2020 and 2050. As in Figure 2, the orange dashed line indicates the correct (projected) values. We find that the vast majority of participants were able to retain the information from the treatment throughout the survey. Only a small percentage of respondents reported posterior beliefs that were not (close to) the true (projected) values. Figure 5 then compares the means of the prior and posterior beliefs for 2020, 2050, and the difference between the two. It also includes the true (projected) values for references. We can see that, as indicated above, respondents on average overestimate the prior beliefs for both 2020 and 2050. Since the degree of overestimation is similar for both ratios, the average prior difference is close to the true (projected) value. As

Figure 5: Belief Updating



*Notes:* This figure presents the means for the prior and posterior beliefs as well as the true (projected) values for the old-age dependency ratios in 2020, 2050 and the difference between the two. Since only the treatment group was asked about posterior beliefs, all of these means are based on the treatment group only.

already suggested in Figure 4, the average posterior beliefs are very close to the true (projected) values for both ratios and the difference.

To identify patterns in belief updating, we consider descriptive statistics and test for statistically significant differences based on prior beliefs (Tables 7 and 8) as well as based on gender, age, and understanding of the statutory pension insurance (Tables 9).

Tables 7 and 8 provide more detailed statistics when respondents are differentiated by their prior beliefs. It can be seen that while the prior beliefs of the underestimators and overestimators differ significantly and substantially from the true (projected) ratios of 37 and 55 for 2020 and 2050, respectively, the posterior beliefs for both ratios are much closer to the true ratios. For example, the group of overestimators in 2020 reduced their estimated ratio by an average of 27 units for 2020 and 34 units for 2050.<sup>17</sup> But for those who overestimated the 2020 ratio and those who underestimated the 2050 ratio, the posterior beliefs are still significantly different from the true (projected) values.

Table 9 provides a similar overview of prior and posterior beliefs and updating, but now considers subgroups based on some of our main explanatory variables, namely gender (male/female), age ( $< 50/\geq 50$ ) and the understanding of the statutory pension insurance ( $< \text{median}/\geq \text{median}$ ). Panel A shows the average prior and posterior beliefs and the difference between the two for 2020,

<sup>17</sup>That is, they reduced their estimates of the number of people of retirement age per 100 people of working age by 27 and 34 people of retirement age for 2020 and 2050, respectively.

|                                     | Underestimate Prior 2020 |       | Correct Prior 2020 |      | Overestimate Prior 2020 |       |
|-------------------------------------|--------------------------|-------|--------------------|------|-------------------------|-------|
|                                     | Mean                     | Sd    | Mean               | Sd   | Mean                    | Sd    |
| Prior 2020                          | 24.05***                 | 8.18  | 37.30              | 2.61 | 66.71***                | 27.87 |
| Posterior 2020                      | 35.54                    | 12.35 | 36.15              | 4.94 | 39.97**                 | 16.25 |
| Difference prior and posterior 2020 | 11.49                    | 13.49 | -1.15              | 5.07 | -26.74                  | 31.91 |
| N                                   | 41                       |       | 74                 |      | 172                     |       |

*Notes:* This table presents descriptive statistics of posterior beliefs for 2020 separately by underestimators, correct estimators and overestimators of the old-age dependency ratio in 2020.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  indicate significant differences between the mean of the respective prior or posterior and 37, which is the true old-age dependency ratio in 2020.

Table 7: Summary Statistics for Prior and Posterior Beliefs 2020

|                                     | Underestimate Prior 2050 |       | Correct Prior 2050 |       | Overestimate Prior 2050 |       |
|-------------------------------------|--------------------------|-------|--------------------|-------|-------------------------|-------|
|                                     | Mean                     | Sd    | Mean               | Sd    | Mean                    | Sd    |
| Prior 2050                          | 39.15***                 | 12.79 | 54.60              | 1.96  | 92.21***                | 36.25 |
| Posterior 2050                      | 51.07***                 | 11.26 | 51.93              | 13.01 | 58.00*                  | 21.94 |
| Difference prior and posterior 2050 | 11.92                    | 13.72 | -2.67              | 14.00 | -34.21                  | 37.54 |
| N                                   | 99                       |       | 15                 |       | 173                     |       |

*Notes:* This table presents descriptive statistics of posterior beliefs for 2050 separately by underestimators, correct estimators and overestimators of the old-age dependency ratio in 2050.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  indicate significant differences between the mean of the respective prior or posterior and 55, which is the projected old-age dependency ratio in 2050.

Table 8: Summary Statistics for Prior and Posterior Beliefs 2050

while Panel B shows the same statistics for 2050. We test for significant differences between each subgroup's mean and the respective true (projected) value, as indicated by the stars. While the prior beliefs of all subgroups were significantly different from the true (projected) values, we find no significant difference for the posterior beliefs. This suggests full updating.

Despite (mostly) significant differences between subgroups in prior beliefs,<sup>18</sup> all groups – on average – updated their beliefs very close to the true (projected) ratios of 37 for 2020 and 55 for 2050. These results suggest that respondents in all subgroups were able to retain the information from the treatment. In addition, since all subgroups fully updated, our results indicate that the absolute magnitude of belief updating is determined by the magnitude of bias in prior beliefs. Those who held more biased prior beliefs (i.e. women, younger respondents, and those with below-median understanding), showed stronger belief updating.

## 6 Conclusion

We employ a three-step procedure to analyse beliefs about demographic change and identify factors that can explain the distribution of beliefs and belief updating. Our descriptive analysis shows that respondents tend to overestimate the old-age dependency ratios for both 2020 and

<sup>18</sup>We tested for significant differences in means between subgroups. The difference in prior beliefs between men and women and between older and younger respondents is significant at the 5%-level for both 2020 and 2050. For understanding, the difference between  $< \text{median}$  and  $\geq \text{median}$  is significant at the 10%-level only for 2020.



|                                | Gender   |          | Age      |          | Understanding |          |
|--------------------------------|----------|----------|----------|----------|---------------|----------|
|                                | Female   | Male     | < 50     | ≥ 50     | < Median      | ≥ Median |
| Panel A: 2020                  |          |          |          |          |               |          |
| Prior                          | 57.20*** | 48.89*** | 56.37*** | 49.11*** | 56.19***      | 50.41*** |
| Posterior                      | 38.99    | 37.71    | 38.35    | 39.35    | 37.87         | 38.75    |
| Difference prior and posterior | -18.21   | -11.18   | -18.03   | -10.76   | -18.32        | -11.67   |
| Panel B: 2050                  |          |          |          |          |               |          |
| Prior                          | 77.09*** | 66.83*** | 77.25*** | 65.71*** | 74.76***      | 69.61*** |
| Posterior                      | 55.48    | 55.10    | 55.92    | 54.56    | 55.2          | 55.37    |
| Difference prior and posterior | -21.61   | -11.72   | -21.33   | -11.15   | -19.56        | -14.24   |
| N                              | 143      | 144      | 155      | 132      | 130           | 157      |

*Notes:* This table shows the means of prior beliefs, posterior beliefs, and belief updating by gender, age, and understanding of the pension system. For understanding, the sample was split based on the median of the understanding index (=8). \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  indicate significant differences between the respective mean and 37 for Panel A and 55 for Panel B, which are the true (projected) old-age dependency ratios.

Not shown in the table: Prior beliefs between men and women and between older and younger respondents differ significantly at the 5%-level for both 2020 and 2050. For understanding, the difference between < median and ≥ median is significant at the 10%-level only for 2020.

Table 9: Belief Updating

2050. However, when these ratios are combined to capture the magnitude of demographic change, beliefs are closer to the true (projected) value. This means that respondents tend to overestimate the number of people of retirement age per 100 people of working age for both 2020 and 2050, but have a more accurate idea of the magnitude of the projected change between 2020 and 2050.

Using multinomial probit models we analyse the prior beliefs for 2020 and 2050 individually as well as the difference between them, to capture the beliefs about demographic change. We find that understanding the German statutory pension insurance is a key factor in explaining the beliefs. A better understanding is associated with a significantly higher probability of correctly estimating the ratio for 2020 and 2050. Respondents who understand the statutory pension insurance may also find it easier to assess demographic change, and vice versa. In addition, we control for education to ensure that the effect of understanding the statutory pension insurance is not just due to the respondents' educational background.

In addition, we find different age effects for respondents who have informed themselves about their retirement needs. Respondents aged 60 and above who have done some research on their retirement needs have a significantly higher probability of underestimating the ratio for 2020 as well as the difference between the ratios. In addition, this group is less likely to overestimate the ratio for 2050. None of these effects are observed for younger respondents. We suggest as a possible explanation that older respondents are less concerned about demographic changes if they have already (at least partially) prepared for their old age. Alternatively, they try to ignore a more adverse demographic development if they have not yet sufficiently prepared for their old age. The exact mechanisms, however, require further research.

Motivated by these heterogeneities with respect to age, we re-run our analysis for subsamples of younger and older respondents. This analysis reveals that for young respondents, understanding the statutory pension insurance is not significantly related to beliefs about demographic change. However, for older respondents, a better understanding is associated with more correct beliefs about demographic change. Reflecting back on our full sample analysis, the subsample results suggest that the effect of the understanding index is driven by older respondents.

In the final step of our analysis, we examine how individuals update their beliefs in response to receiving information. Specifically, we provided one-third of the respondents with information about the true (projected) old-age dependency ratios for 2020 and 2050. Our results suggest that participants were able to make use of the information, as their posterior beliefs about the old-age dependency ratios are much closer to the true values than their initial prior beliefs. Those with more biased prior beliefs (i.e. women, younger respondents, and those with below-median understanding) showed particularly strong belief updating.

Given that demographic change affects many policy areas including the labour market and social security systems, more broadly, the need for reforms increases, and with it the need for citizens to accept these reforms. Being better informed about demographic change is a prerequisite for understanding the sometimes complex mechanisms that lead, for example, to labour shortages in certain sectors or calls for more subsidies for public health insurance – not to mention the increasingly widespread discussions about how to address the problems of the pension system. Since better informed citizens can be expected to vote more in favour of policies that improve sustainability (see, for example, Naumann 2017; Schuetz et al. 2023), a better understanding of how well citizens are informed about demographic change and how they can benefit from the provision of additional information is of high policy relevance. This paper aims to take a first step in this direction as a basis for further research.

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## Appendix A: Information Provision Experiment

### Wording of belief elicitation questions

Old-age provision in Germany is based on the idea that the working generation finances the pensions of people in retirement. Therefore it is important to look at the ratio of people of retirement age starting from 65 years of age to people of working age between 20 and 64 years of age. In the year 1990, there were 24 people of retirement age for every 100 people of working age.

What do you estimate: in 2020, how many people of retirement age are there for every 100 people of working age?

And what do you estimate: in 2050, how many people of retirement age will be there for every 100 people of working age?

### Feedback + Information (Treatment group)

You have estimated  $xyz$  for 2020 and  $abc$  for 2050 [insert estimates here], the correct answers are 37 for the year 2020 and 55 for the year 2050. There are thus currently about three people of working age for every person of retirement age, and there will be more and more people of retirement age and fewer and fewer people of working age.

Estimation  $xyz$  (2020):

- Correct (33 – 41): So your estimate of  $xyz$  for the year 2020 was quite accurate.
- Overestimated (41 <): So your estimate of  $xyz$  for the year 2020 was too high.
- Underestimated (< 33): So your estimate of  $xyz$  for the year 2020 was too low.

Estimation  $abc$  (2050):

- Correct (51 – 59): So your estimate of  $abc$  for the year 2050 was quite accurate.
- Overestimated (59 <): So your estimate of  $abc$  for the year 2050 was too high.
- Underestimated (< 51): So your estimate of  $abc$  for the year 2050 was too low.

## Appendix B: Variable Overview

| Variable name        | Type              | Description  |
|----------------------|-------------------|--|
| Age                  | Categorical (1-5) | = 1, if age between 18 and 29, = 2, if age between 30 and 39, = 3, if age between 40 and 49, = 4, if age between 50 and 59, = 5, if age between 60 and 68  |
| Age old (60+)        | Dummy             | = 1, if age is 60 or above   |
| Female               | Dummy             | = 1, if gender is female   |
| Income               | Categorical (1-4) | Household net income according to the ranges: low (=1, below 1500 Euro), medium-low (=2, between 1500 Euro and below 2500 Euro), medium-high (=3, between 2500 and below 3500 Euro) and high (=4, 3500 Euro and higher). We also consider those who did not specify their net household income. In the regressions, we employ dummies for the different categories with the “low” category as the reference. |
| Employed             | Dummy             | = 1, if employed   |
| Migration background | Dummy             | = 1, if respondent has migration background  |
| Married              | Dummy             | = 1, if respondent is married or in a registered same-sex partnership  |
| East                 | Dummy             | = 1, if respondent lives in East Germany   |
| Inheritance          | Dummy             | = 1, if respondents has inherited more than 100,000€ or expects to inherit more than 100,000€  |
| Education            | Categorical (1-4) | Highest educational attainment according to the categories: 9th/10th grade (=1, lower secondary diploma/no diploma), 10th grade (=2, secondary school diploma), 12th grade (=3, higher education entrance qualification), university degree (=4). In the regressions, we employ dummies for the different categories with 9th/10th grade as the reference.   |
| Understanding index  | Numerical (0–11)  | Number of correct answers to 11 questions about the German statutory pension insurance   |
| Pension need         | Numerical (1-7)   | <i>“How extensive have you informed yourself about the pension income you will need?”</i> Answer options range from 1 “Not at all” to 7 “Very extensively”   |
| Pension receive      | Dummy             | = 1, if the respondent answers yes to the question <i>“Have you already gathered information about how much income you will receive in retirement?”</i>  |

A.1: Descriptive overview of variables.

## Appendix C: Descriptive Statistics

|                      | Underestimate 2050 |       | Correct 2050 |      | Overestimate 2050 |       |
|----------------------|--------------------|-------|--------------|------|-------------------|-------|
|                      | Mean               | Sd    | Mean         | Sd   | Mean              | Sd    |
| Ratio 2050           | 37.72***           | 14.04 | 54.72        | 1.49 | 92.30***          | 35.51 |
| Age                  | 3.26               | 1.21  | 3.00         | 1.19 | 3.12              | 1.31  |
| No income            | 0.15               | 0.35  | 0.21         | 0.41 | 0.18              | 0.38  |
| Income low (R)       | 0.09               | 0.29  | 0.05         | 0.22 | 0.10              | 0.30  |
| Income medium-low    | 0.16               | 0.37  | 0.13         | 0.34 | 0.17              | 0.37  |
| Income medium-high   | 0.14               | 0.35  | 0.10         | 0.31 | 0.22*             | 0.41  |
| Income high          | 0.47               | 0.50  | 0.51         | 0.51 | 0.34**            | 0.47  |
| Female               | 0.46               | 0.50  | 0.51         | 0.51 | 0.54              | 0.50  |
| Employed             | 0.88               | 0.33  | 0.85         | 0.37 | 0.82              | 0.38  |
| Migration background | 0.10               | 0.30  | 0.08         | 0.27 | 0.13              | 0.34  |
| Married              | 0.56               | 0.50  | 0.69         | 0.47 | 0.49**            | 0.50  |
| East                 | 0.40*              | 0.49  | 0.54         | 0.51 | 0.41              | 0.49  |
| Inheritance          | 0.18               | 0.38  | 0.13         | 0.34 | 0.13              | 0.33  |
| Educ: 9th grade (R)  | 0.12               | 0.33  | 0.13         | 0.34 | 0.13              | 0.33  |
| Educ: 10th grade     | 0.32               | 0.47  | 0.26         | 0.44 | 0.35              | 0.48  |
| Educ: 12th grade     | 0.21**             | 0.41  | 0.38         | 0.49 | 0.21**            | 0.41  |
| University degree    | 0.34               | 0.48  | 0.26         | 0.44 | 0.34              | 0.47  |
| Understanding index  | 7.57               | 2.29  | 8.08         | 2.51 | 7.47*             | 2.11  |
| Penion need          | 4.78               | 1.92  | 4.67         | 2.09 | 4.63              | 1.90  |
| Pension need * 60+   | 0.86               | 2.17  | 0.49         | 1.71 | 0.93              | 2.20  |
| Pension receive      | 0.79               | 0.41  | 0.74         | 0.44 | 0.76              | 0.43  |
| N                    | 323                |       | 39           |      | 520               |       |

*Notes:* This table presents descriptive statistics of our explanatory variables separately for underestimators, correct estimators, and overestimators of the old-age dependency ratio in 2050. For the income and education variables, (R) indicates the reference group in our regressions.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  indicate significant differences between the respective mean and the mean of the same variable for correct estimators.

## A.2: Summary Statistics by Prior Beliefs 2050



|                      | Underestimate difference |      | Correct difference |      | Overestimate difference |       |
|----------------------|--------------------------|------|--------------------|------|-------------------------|-------|
|                      | Mean                     | Sd   | Mean               | Sd   | Mean                    | Sd    |
| Difference           | 6.85***                  | 3.98 | 17.77              | 2.58 | 45.67***                | 24.95 |
| Age group            | 3.22                     | 1.19 | 3.27               | 1.27 | 3.01**                  | 1.34  |
| No income            | 0.16                     | 0.36 | 0.19               | 0.40 | 0.16                    | 0.36  |
| Income low (R)       | 0.08                     | 0.27 | 0.11               | 0.31 | 0.09                    | 0.29  |
| Income medium-low    | 0.16                     | 0.36 | 0.15               | 0.36 | 0.17                    | 0.38  |
| Income medium-high   | 0.21**                   | 0.41 | 0.14               | 0.34 | 0.23***                 | 0.42  |
| Income high          | 0.40                     | 0.49 | 0.40               | 0.49 | 0.35                    | 0.48  |
| Female               | 0.47                     | 0.50 | 0.47               | 0.50 | 0.53                    | 0.50  |
| Employed             | 0.85                     | 0.36 | 0.84               | 0.37 | 0.81                    | 0.39  |
| Migration background | 0.10                     | 0.30 | 0.13               | 0.34 | 0.13                    | 0.34  |
| Married              | 0.51                     | 0.50 | 0.57               | 0.50 | 0.49                    | 0.50  |
| East                 | 0.41                     | 0.49 | 0.41               | 0.49 | 0.40                    | 0.49  |
| Inheritance          | 0.12                     | 0.32 | 0.12               | 0.33 | 0.19*                   | 0.39  |
| Educ: 9th grade (R)  | 0.16                     | 0.37 | 0.13               | 0.34 | 0.09                    | 0.29  |
| Educ: 10th grade     | 0.29                     | 0.46 | 0.35               | 0.48 | 0.35                    | 0.48  |
| Educ: 12th grade     | 0.23                     | 0.42 | 0.19               | 0.40 | 0.24                    | 0.43  |
| University degree    | 0.33                     | 0.47 | 0.34               | 0.47 | 0.34                    | 0.48  |
| Understanding index  | 7.59                     | 2.17 | 7.73               | 2.17 | 7.54                    | 2.18  |
| Pension need         | 4.77                     | 1.86 | 4.52               | 1.99 | 4.67                    | 1.92  |
| Pension need * 60+   | 0.85                     | 2.18 | 0.90               | 2.14 | 0.93                    | 2.20  |
| Pension receive      | 0.74                     | 0.44 | 0.79               | 0.41 | 0.75                    | 0.43  |
| N                    | 264                      |      | 226                |      | 275                     |       |

*Notes:* This table presents descriptive statistics of our explanatory variables separately for underestimators, correct estimators, and overestimators of the difference in old-age dependency ratios. For the income and education variables, (R) indicates the reference group in our regressions.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  indicate significant differences between the respective mean and the mean of the same variable for correct estimators.

### A.3: Summary Statistics by Difference between Priors

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