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SOCIAL POSITIONS AND FAIRNESS VIEWS ON INEQUALITY

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ABSTRACT

We link survey data on Danish people's perceived income positions and fairness views on inequality within various reference groups to administrative records on their reference groups, income histories, and life events. People are, on average, well- informed about the income levels of their reference groups. Yet, lower-ranked respondents in all groups tend to overestimate their own position among others because they believe others' incomes are lower than is the case, while the opposite holds for higher-ranked respondents. Misperceptions of positions in reference groups relate to proximity to other individuals, transparency norms, and visible signals of income. People view inequalities within their co-workers and education groups as significantly more unfair than overall inequality, yet underestimate inequality the most exactly within these groups. Views on the fairness of inequalities are strongly correlated with an individual's current position, move with shocks like unemployment or promotions, and change when experimentally showing people their actual positions. However, the higher perceived unfairness of income differences within co-workers and education groups stays unchanged. The theoretical framework shows that this can have important implications for redistribution policy.

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People care about inequalities and their social position relative to others. This underlies fairness considerations and motives for redistribution in policy debates and in economic theory.¹ But how much do people know about income inequalities and their own position relative to others in various reference groups, such as their neighbors, their co-workers, their cohort, or people with the same level of education? What drives their misperceptions? How do they view fairness of income differences within these groups? Are their views fixed or do they move with changes in their perceptions and social positions? Are they better or worse informed where it matters the most to them?

Studying these questions is challenging because of the data requirements. To understand how accurately people rank themselves among others in a reference group – say, their neighbors – we need to know all people in that group and their income levels. If we find that people misperceive their position, we would need to know whether this is due to misperceptions of the income distribution among their neighbors, erroneous assessment of their own income, or misunderstanding of the income concept. Comparing people’s perceptions across key reference groups further necessitates homogeneous information on all people in all the groups. And studying how changes in social position affect people’s views requires knowledge about people’s income histories, including shocks that have shifted their position.

To overcome these challenges, we leverage a unique dataset that we constructed by linking responses from a custom survey of a large sample of people in Denmark to detailed administrative data on their full income histories, life events, and true positions in the income distributions of different reference groups. The reference groups vary by domain, size, and proximity to the respondent. They include large groups such as people from the same cohort and of the same gender, living in the same municipality, having the same education level, or working in the same sector, as well as smaller groups such as neighbors, co-workers at the same workplace, or former schoolmates.

In the survey, we ask people about their knowledge of the income distributions in these reference groups, how fair they think income inequalities within these groups are, and where they rank themselves within the various groups (i.e., their income or “social” position within each group). The respondents are sampled randomly among 45- to 50-year-old people, who are well into their working years, but still far from retirement.

The link between survey and administrative data enables us to explore how well people know their positions in various reference groups and the relationship between social positions and fairness views. It also allows us to pinpoint where misperceptions come from, because

¹Alesina and Angeletos (2005); Almås et al. (2010); Bénabou and Ok (2001); Blanchflower and Oswald (2004); Boskin and Sheshinski (1978); Clark and Oswald (1996); Duesenberry (1949); Easterlin (1974, 1995, 2001); Easterlin et al. (2010); Fehr and Schmidt (1999); Meltzer and Richard (1981)

we can verify the accuracy of perceptions of the respondent’s own income by using their tax return, as well as of the income distributions and positions in each group, which we can compute from the tax returns of all people in the reference groups. The link further enables us to study how respondents’ perceptions and fairness views relate to various characteristics and factors, including changes in their social positions due to unemployment, health shocks, and promotions.

Our results can be grouped into three main sets of findings related to fairness views on inequality (Section 2), perceptions about inequality and social positions (Section 3), and the relationship between perceptions, fairness views, and changes in social position (Section 4). Our analysis starts with a simple theoretical framework that illustrates the role of reference group comparisons and their relevance for redistribution policy. This theoretical part sets the stage for the empirical analyses. One theoretical result is that, if people care more about income differences within certain reference groups than about overall income inequality, they demand more redistribution within these groups than overall redistribution. For example, we find empirically that people in general care more about income differences within their education group than overall inequality within their age group. This may call for combining general redistribution through the tax system with education subsidies, thereby achieving more income redistribution within, rather than between education groups. We also find that people care more about income differences among co-workers, which may lead them to support actions for “the same wage for the same work.” On the other hand, people do not find income differences within their municipality any more or less unfair than overall income differences, which means that there may not be as much demand for delegating redistribution policy to local governments.

The second set of findings relates to people’s perceptions of inequality and their own position within reference groups. On average, people perceive the overall income level (the median, which we call P50) of their reference groups correctly and, therefore, are well aware of core income differences across different groups of people. At the same time, we observe systematic misperceptions that vary in magnitude across the reference groups.

A common misperception for all reference groups is that people think they are closer to the center of the income distribution of each group than is the case. Within all reference groups, people in the upper part of the distribution believe they are ranked lower than they really are, while people in the lower part of the distribution believe they are ranked higher. This may be due to misperceptions of own income or misperceptions of incomes of others (the income distribution). These misperceptions may vary systematically or idiosyncratically by income. Even misperceptions that are idiosyncratic by income can create systematic

misperceptions of own position in the distribution due to a mechanical “direction bias,” because people at the top of the distribution can only weakly underestimate their position, while people at the bottom can only weakly overestimate it. We show that the systematic misperceptions of social position are not due to either misperceptions of own income or to random misperceptions of others’ income. Rather, they are due to systematic misperceptions of the incomes of others: Those with higher incomes tend to overestimate others’ incomes and, therefore, underestimate their own income position, while those with lower incomes tend to underestimate others’ incomes and, thus, overestimate their own position. We call this “center bias.”²

An important baseline reference group is one’s cohort since it captures the overall income distribution in the country, while at the same time controlling for life-cycle effects. On average, people are quite accurate about both the P50 and the P95 (the 95th percentile) income levels of their cohort, and many respondents have relatively small misperceptions. For instance, 45% of the respondents perceive the median income level of their cohort correctly, with at most 10% error. For comparison, 70% report their own income correctly within a 10% error band. However, because of the center bias, people in the lower part of the distribution underestimate both the P50 and the P95, while people in the upper part of the distribution overestimate them. The further away respondents are from the center of their cohort’s income distribution, the larger their misperceptions. Most strikingly, people at the very top of the distribution (above P95) overestimate their cohort’s P95 by 50%.

The relatively small misperceptions within the cohort apply to some, but not all, of the other reference groups. In particular, respondents systematically underestimate the P95 income level among workers in their sector and among people with the same level of education. Furthermore, lower-ranked individuals overestimate their social position most within their sector of work and education group. For example, people at the 20th percentile among their co-workers think they are, on average, well above the 40th percentile, while people at the 20th percentile in their municipality believe they are around the 30th percentile. This pattern also holds if we zoom in on smaller reference groups, namely co-workers within a firm instead of within a sector, and if we look at neighbors in the respondent’s immediate

²We use the term “center bias” as opposed to “middle-class bias” (Fehr et al., 2021) or “median bias” (Hoy and Mager, 2021) used for related patterns. In our case, the patterns observed are not driven by people thinking they are all middle-class. Instead, the bias appears in all reference groups, some of which have low average incomes while others have high average incomes. The “center” positions in these groups are different and cannot all be considered middle-class. Furthermore, “center bias” better describes the patterns we observe in the data than “median bias” since people do not only misperceive the median. Our results suggest that *the entire perceived distribution* is shifted relative to the actual income distribution. The shift is such that people perceive the center of each distribution – but not necessarily every point of the distribution – to be closer to themselves than is the case.

vicinity instead of people living in the same municipality. In fact, respondents are better at predicting where they rank relative to former schoolmates than relative to current co-workers.

In summary, people are on average well-informed about income differences across their various reference groups, but they have the tendency to perceive themselves as closer to the center of each of their groups than is the case, and they especially misperceive the extent of inequalities between people in the same education group, sector, or firm.

We also highlight some of the individual characteristics and other factors that are correlated with people’s accuracy about income distributions and their own positions and with their likelihood of being overoptimistic about their position. We show that, conditional on actual position, more accurate perceptions are significantly correlated with the level of education, the length of time since starting a job or moving to a new neighborhood, physical proximity (e.g., living on a shorter road as compared to a longer road), and transparency norms around income (e.g., being in a managerial position with more information about others’ income, employed by a firm with high unionization rates, in an academic occupation, or in a public sector job). Other factors predict overoptimism about one’s position. Thus, respondents with a high-income partner and those with high-income parents tend to overestimate their position more. Visible signals of income also play a role: respondents whose houses or cars are more expensive relative to their neighbors with the same income tend to overestimate their income rank among neighbors.

The third set of findings relates to the relationship between perceptions, fairness views, and changes in social position. A corollary of the above findings is that people care most about income differences within their education and sector groups. Yet, it is precisely in these groups that respondents underestimate the degree of inequality the most and lower-income people strongly overestimate their own positions. In this sense, people are less informed about inequality and social positions where it matters the most to them.

To analyze whether there is a causal relationship between misperceptions and fairness views across reference groups, we carry out an information treatment that informs half of the respondents about their true social positions in *all* their reference groups before eliciting their fairness views. This information treatment systematically made people view inequality as more unfair across all reference groups. However, the differences in fairness views across the reference groups, notably the stronger unfairness views on income differences within education group and co-workers relative to overall income inequality, remained even after people were informed fully about their positions.

Our analysis of changes in social position over time, including those due to life events such as unemployment, health shocks, and promotions, indicates that people’s perceptions

of and fairness views on inequality move significantly when their social position changes. However, their fairness views move to the same extent across all reference groups, implying again that differences in fairness views are unchanged. Thus, a common conclusion from the information treatment and the study of life events is that fairness views tend to move with changes in circumstances of the individual, but that the differences in fairness views across the reference groups are quite stable.

Related Literature. The main novelty of our paper is to provide systematic and comprehensive evidence across key *reference groups* of people. We elicit their perceptions of inequality, own social positions, and fairness views for each of these groups. The existing literature described below studies perceptions of people related to the *national income distribution* or consider within-employer perceptions for specific firms or employers.

For our study of reference groups, it is crucial to link survey data on people’s perceptions to information from administrative records on their real-life outcomes. Recent research has started to combine subjective information from surveys with objective information from administrative records to answer different questions (Almås et al., 2017; Andersen and Leth-Petersen, 2020; Bastani and Waldenström, 2021; Epper et al., 2020; Jäger et al., 2021; Kreiner et al., 2019). Closest to our agenda of studying perceptions about income inequality and social positions, one previous study (Karadja et al., 2017) has merged survey data and administrative data in Sweden and used it to check the reported income of respondents against their actual income as we do, but without studying reference groups. We discuss the link to this study in more detail below.

Related to our first main finding on fairness views within different reference groups, recent papers have analyzed how wage differences affect satisfaction and effort focusing on a single employer or sector. For instance, Cullen and Perez-Truglia (2018, 2021) show that privacy norms keep employees from revealing their salaries and that there are large misperceptions about others’ salaries. Among university faculty, Baker et al. (2019) find that salary disclosure in Canada reduces the gender pay gap and Card et al. (2012) show that it reduces job satisfaction for employees with incomes below median for their pay unit and occupation in California. We complement these studies by showing for a representative sample of people, working across many different firms and sectors, that people care significantly more about income differences within co-workers compared to overall income differences, and that they strongly misperceive inequality and their own income position within this particular reference group.

Also related to our first finding, Ferrer-i-Carbonell (2005) show that people report being happier when their income is above the average income of people of a similar age, educa-

tion level, and in the same region. [Luttmer \(2005\)](#) finds that those who live in localities (Public Use Microdata Areas, “PUMAs”) with higher average earnings report lower levels of happiness. We contribute to this strand of literature by showing that relative position in reference groups is not only important for well-being but also for fairness views. Because we have data on all people in various reference groups and their incomes, we can also study people’s actual position in the groups and document their understanding of it.

Related to our second set of findings regarding people’s perceptions of inequality and their own social position, previous studies have analyzed people’s perceived ranking in the national income distribution with a few studies also looking at the position in the global income distribution ([Bublitz, 2020](#); [Cruces et al., 2013](#); [Fehr et al., 2021](#); [Feichtmayer and Gründler, 2021](#); [Hoy and Mager, 2021](#); [Karadja et al., 2017](#); [Nair, 2018](#)). For instance, [Karadja et al. \(2017\)](#) find that 86% of the Swedish respondents in their sample underestimate their position in the national income’ distribution. In line with our findings, they conclude that misreporting of own income is small compared to misreporting of relative income.³ In a survey of households in Buenos Aires, [Cruces et al. \(2013\)](#) find that 55% of respondents underestimate their position, 30% overestimate it, and only 15% placed themselves in the correct income decile. Using a representative sample of Germans, [Fehr et al. \(2021\)](#) find that people in the bottom of the national income distribution overestimate their own position while people in the top underestimate it and similar patterns arise for people’s perceived positions in the global income distribution.

It is well known that these general patterns of overestimations of positions among people in the bottom of the distribution and underestimations of people in the top can arise because of a mechanical “direction bias” without any systematic bias in the underlying perceptions of incomes ([Gignac and Zajenkowski, 2020](#); [Krueger and Mueller, 2002](#)). One of our contributions is to be able to link the systematic bias in perceived income positions to a systematic bias in perceptions about the incomes of others (the center bias result).

We also contribute by considering many key reference groups of people. Interestingly, people are on average well aware of the income differences across these reference groups. We show that there are systematic misperceptions of own position across all reference groups (resembling findings for the national distribution described above) but the degree of misperceptions is relatively small in some groups and larger in others. Our sample is an order of

³The misreporting of own income is even smaller in our case. For example, close to 40% deviate less than 2.5% in our case, which applies to less than 30% of the respondents in their study (Figure 1). They report that the mean discrepancy between perceived and actual position is 16 percentiles, while it is 6 percentiles in our case.

magnitude larger than existing studies, which enables us to detect such differences across reference groups.

Karadja et al. (2017) use the link to their administrative data to show that the accuracy of perceived position, conditional on actual position, correlates with educational attainment and cognitive ability test scores. This aligns well with our findings regarding the higher accuracy of more educated respondents. In addition, we use our granular administrative data to study the role of partner’s income, family background, occupation, strength of social interactions, visible consumption, proximity of reference group individuals, and transparency of incomes.

Our evidence of imperfect information in the labor market (in our case, within firm and sector) is in line with the findings in Jäger et al. (2021). That paper shows that workers’ are imperfectly informed about their outside options. The implications of this lack of information, which they discuss, can apply to our results too. Wages may be sticky and poorly informed employees may forego better opportunities or asking for wage increases.

Related to our third main finding on the link between perceptions about inequality, fairness views, and changes in social position, previous literature has studied how people’s views on inequality are affected by the environment in which they grew up (Roth and Wohlfart, 2018; Giuliano and Spilimbergo, 2014; Malmendier and Nagel, 2011) or their exposure to a more socioeconomically diverse group of individuals (Londoño-Vélez, 2021). More related to our study of life events and historical changes in individual position, a recent study by Andersen et al. (2020) shows that winning a housing lottery in Ethiopia did not change respondents’ views on inequality.

Similar to our information experiment on reference groups, earlier work provided respondents with information on the national income distribution (Bublitz, 2020; Cruces et al., 2013; Fehr et al., 2021; Hoy and Mager, 2021; Karadja et al., 2017; Kuziemko et al., 2015). In line with our results, Cruces et al. (2013) finds that those who are told they rank *lower* than they thought demand more redistribution, while Hoy and Mager (2021) find they demand less; Karadja et al. (2017) find that only those informed that they rank *higher* demand less redistribution. An important contribution of our analyses is to show that, although changes in social position and full information about individual social positions change people’s fairness views across all reference groups, the marked differences in fairness views across the groups remain unaffected.

Our paper is also broadly related to empirical work documenting that people care about relative income and that their social positions shape their well-being, as referenced in the introduction.⁴

Organization. Section 1 describes our survey, administrative data, and sample. Section 2 provides a conceptual framework to think about the role of reference groups and empirical evidence on fairness views. Section 3 analyzes respondents’ perceptions and misperceptions about the distributions of income and their own positions in various reference groups. Section 4 studies the relationship between perceptions, fairness views and changes in social position. Section 5 discusses the results and offers concluding remarks.

1 Data Collection

1.1 Survey Sample and Link to Administrative Data

Target Sample. Assisted by Statistics Denmark, we conducted a large-scale survey in February and March 2019. We sent out survey invitations to a representative sample of 50,100 respondents, born in Denmark in the years 1969-1973, randomly selected by Statistics Denmark. The respondents were aged 45-50 at the time of the survey and, hence, past formal education, well into their careers, but still quite far from retirement. We selected people born in Denmark because the analysis requires information about people’s income histories, schoolmates, and parental positions, which is only available for Danish-born respondents.

Survey Method. Our survey method leverages an official channel of communication between the Danish public authorities and citizens. The invitations were sent out through the secure website Digital Post, used to receive and read mail from public authorities. All citizens older than 15 have to have an electronic mailbox where they receive important information from public institutions such as the tax and health authorities and without receiving unwanted advertising from private firms. The use of this official channel of communication, together with the University of Copenhagen’s stamp, likely increased the credibility of our survey and of the information provided to respondents. To incentivize respondents further, they were told that those who completed the full survey would be enrolled in a lottery for

⁴In addition to these papers, Kuziemko et al. (2014) highlight the role of “last-place aversion,” a particular form of relative position concerns whereby individuals particularly fear being ranked last. Charité et al. (2015) point out the importance of reference points, while we highlight the need to consider specific reference groups. Fisman et al. (2021) show that people care about inequality in a nonlinear way relative to their own position, putting weight both on their nearest neighbors and on the top of the distribution. Using online surveys, Weinzierl (2014) demonstrates that people do not hold utilitarian preferences, but rather have other mixed fairness views.

100 gift cards with a value of 1,000 DKK (\$150) each to be used in more than 150 store chains in Denmark. The average time for completion of the survey was 31 minutes, with a median time of 25 minutes. Responses were linked by Statistics Denmark to the register data using the Social Security number assigned to all Danes at birth.

Role of Selection into the Survey and Attrition. Since we have register data information on all people invited to participate, we can analyze selection into the survey. Table 1 shows summary statistics for the sample of people who received an invitation and completed the survey (column 1), and compares it to the characteristics of the target population that was invited to participate in the survey (column 2), with the p-values for the null hypothesis that each characteristic is equally represented in these two groups shown in column (3). Compared to many other surveys, the top of the income distribution is well-represented with people from the top 10% of the income distribution, making up almost 17% of our analysis sample. A reason may be the contact through the official Digital Post channel and the easy “press-a-button” access to the survey. Note that in the invited sample, people from the top 10% of the distribution make up a little bit more than 10% because we sampled Danish-born individuals, who, on average, have higher incomes than non-Danish born in Denmark.⁵ Most differences between the samples of respondents and non-respondents are significant, but this is to some extent due to the large sample size. For instance, age is significantly different, but the difference amounts to approximately 3 weeks. The sample of respondents who completed the survey has in general slightly higher income and education levels than the full target population. To evaluate the potential importance of the imbalance in observables, we reweigh our sample using all the covariates in Table 1 to match the invited population and check that our key results are not affected by this reweighing in Appendix Figure A-5.

Out of the 50,100 people invited from the population, 13,686 clicked on the personal link in the invitation, and 10,089 completed the survey. The response rate of 20% ($=10,089/50,100$) is reasonably high when contacting a representative sample of new potential respondents who have never expressed a particular interest in taking surveys.⁶ After dropping respondents

⁵Appendix Table A-1 further shows characteristics for those who received an invitation to participate and started the survey, regardless of whether they completed it or not (column 2), the characteristics of the full Danish-born population in these cohorts, excluding non-Danish born people, from which the invitees were randomly sampled by Statistics Denmark (column 4), and the full population in these cohorts, including immigrants (column 5). By construction, the invitee group who received an invitation to participate is almost identical to the full Danish-born population excluding immigrants (column 3) in these cohorts, as should be the case given that they were randomly drawn from this group by Statistics Denmark.

⁶For comparison, a recent study in Denmark invited similar cohorts by ordinary mail and reports a response rate of 13% (Epper et al., 2020). The completion rate of 74% ($=10,089/13,686$) may seem low, but our invitees are not people who have signed up in advance to participate in survey panels, as is the case in other settings (where completion rates are of the same order of magnitude too). Instead, our potential

TABLE 1: SUMMARY STATISTICS

	Sample (1)	Invited (2)	P-value (%) (3)
Demographics			
Male (%)	51.4	50.8	16.6
Age	47.0	47.0	0.0
Married (%)	63.3	57.0	0.0
Descendant (%)	0.4	0.5	6.7
Income Position			
Income position	64.2	53.7	0.0
Bottom 50% (%)	28.8	45.5	0.0
Middle 40% (%)	54.3	43.7	0.0
Top 10% (%)	16.9	10.8	0.0
Education			
Primary education (%)	7.6	15.6	0.0
Upper secondary edu. (%)	5.8	5.2	0.4
Vocational education (%)	31.5	39.3	0.0
Short cycle higher edu. (%)	9.1	7.0	0.0
Bachelor's programs (%)	26.9	20.2	0.0
Master's programs (%)	19.2	12.6	0.0
Socioeconomic Status			
Self-employed (%)	3.7	6.0	0.0
Employee (%)	90.2	80.8	0.0
Unemployed (%)	1.3	1.9	0.0
Not in work force (%)	4.8	11.3	0.0
Private sector (%)	65.8	70.0	0.0
Regions			
Copenhagen (%)	31.0	29.2	0.0
Sealand (%)	16.2	16.1	62.7
Southern Denmark (%)	20.7	21.5	4.3
Middle Jutland (%)	23.1	23.4	43.8
North Jutland (%)	8.9	9.9	0.0
Parents' Income			
Mother's income position	53.1	50.6	0.0
Father's income position	53.3	50.7	0.0
Observations	9415	50100	

Notes: *Sample* are the respondents who completed the survey and are used in the analysis. *Invited* are the respondents who received an invitation to participate in the survey. *P-value (%)* are the P-values in percent from a test of whether the averages for invited people in the analysis sample and invited people not in the analysis sample are the same. All variables marked with (%) are indicators.

for whom the reported birth year or gender do not match the register data (19 respondents), who spent less than 10 minutes answering the survey (50), who did not report their income as instructed in the survey, for example by reporting monthly instead of annual income (343), had zero or negative income according to the register data or missing background register data (61), or who skipped one of our key questions (201), we have 9,415 respondents in total (column 1).

Appendix Table A-2 highlights which characteristics predict the drop out rate and at which point respondents drop out. Out of those who start the survey, 6% dropped out at the consent page or are screened out for the reasons listed above; 10% drop out when having to report their income. Only 1% drop out after the treatment. This means that attrition is not selectively driven by the treatment, as confirmed by the insignificant coefficient on treatment status. Men, non-married, higher-income, and more educated respondents are less likely to drop out.

1.2 Survey Outline and response quality

The survey consists of five blocks of questions and the entire questionnaire can be seen in Appendix A.1. In addition, a consent page informs respondents about the use of their responses in accordance with the General Data Protection Regulation of the European Union and a conclusion section asks respondents whether they thought that the survey was left- or right-wing biased. 81% think the survey is neutral, 14% that it is left-wing biased, and 5% that it is right-wing biased. Below we summarize the questions that we use in the paper.

Background. This block contains questions on birth year, gender, educational attainment, and sector of employment. These answers are later used to inform respondents about their positions relative to other people in the same large reference groups (see Table 2 for a definition of each reference group). We also asked about their attitudes on economic policy [Very left-wing; Left-wing; Moderate; Right-wing; Very right-wing].

Income. This block asks about the income of the respondent one year ago (earned in 2017) and includes wage income, self-employment income, and taxable income benefits and transfers (composed mainly of unemployment insurance benefits, disability benefits, and

respondents receive an invitation through the official Digital Post, which probably leads many to click on the survey link in order to learn more about this somewhat unusual for them invitation. Once people realize it is a research survey they are not obliged to answer and they have to report personal information, some of them drop out. In regular survey settings where respondents have signed up to receive survey links, those not interested do not even click on the link to start with, as there is no element of surprise for them. In our case this will appear as attrition, while in other settings, we will never get to see who did not click on the survey link to start with.

social assistance). We ask separately about these three income components, while their sum appears on the screen (see an image of the exact formulation in Appendix Figure A-1). The breakdown of total income into smaller parts is to help people report the correct income and highlight that self-employment income and taxable benefits are included in total income. We include taxable benefits and transfers to reflect the fact that they contribute to income and leaving them out may lead us to wrongly rank individuals, e.g., individuals receiving UI benefits are in general better off economically both in the short run and in the long run than individuals receiving social assistance. Respondents are informed that it is important to report the income correctly and that they can see the amounts on their annual tax statement (available online to them). Our rationale for asking about income as it appears on the tax statement is to be able to base the analysis on a well-defined income concept that is both clear to the respondent and for which we can verify the true value in the register data. With the exception of self-employment income, the income components are third-party reported to the tax agency and pre-populated on the tax return. Tax evasion is in general low in Denmark and close to zero on third-party reported income components (Kleven et al., 2011).⁷

Perceptions. This block elicits people’s perceptions about the median (hereafter, P50), the 95th percentile (hereafter, P95), and their own position in the distribution of each of the five large reference groups. The block starts with a video that uses a ladder and 100 stick people to explain the different positions in the income distribution. It states and illustrates, for instance, that P50 is the income level for which 50% have a lower income and 50% have a higher income. The full script for and link to the video are in Appendix A.2. After this video, we elicit respondents’ perception of the P50 and P95 income levels of all people in their cohort and of people in their cohort who belong to the same municipality, education group, gender group, or sector (see Appendix Figures A-2 and A-3). Respondents are subsequently prompted to place themselves in the distribution of each of the five large reference groups using a vertical slider next to a ladder, identical to the one used in the explanatory video (see Panel A of Figure 1).

For neighbors, co-workers, and former schoolmates, we first asked the respondent about the number of individuals in these reference groups (denoted by N) and then to report their

⁷To avoid making the survey too complicated and time-consuming, we exclude capital income, deductions, and tax payments. This is not an important issue for our analysis for two reasons. First, our narrower income definition makes up almost all of total income as calculated by Statistics Denmark for most respondents, which includes capital income. Thus, the average across individuals of our narrower income concept relative to average total income, according to Statistics Denmark, is 96.0%; the median income according to our definition represents 98.5% of the median total income, according to Statistics Denmark. Second, Appendix Figure A-6 shows that the income rank positions based on total income line up almost perfectly with the positions based on our income definition. This is also the case if we use Statistics Denmark’s measure of “disposable income” that includes the imputed value of housing, interest deductions, and tax payments.

TABLE 2: DEFINITION OF REFERENCE GROUPS

Reference group	Definition
Large reference groups	
Cohort	People born the same year.
Gender	People born the same year with the same gender.
Municipality	People born the same year currently living in the same municipality.
Educational level	People born the same year with the same level of education: basic school, upper secondary education, vocational education and training, short-cycle higher education, bachelor's degree, and master's or PhD. Uses the Danish DISCED education classification, which follows the international education classification ISCED.
Sector of work	People born the same year and working in the same sector: Construction, real estate, business services, finance and insurance, trade and transport, manufacturing, information and communication, culture, agriculture, public work. Uses the Danish Sector Codes DB07, which is a sub-classification of the NACE classifications of the EU.
Small reference groups	
Schoolmates	People born the same year who went to the same school the year they turned 15.
Co-workers	People working in the same workplace. Workplace is defined as a single address entity, e.g., for a firm with multiple locations, each location is a separate workplace.
Neighbors	For people living in an apartment, the neighbors are people from age 25 to 65 who live in the same stairwell. For people living in a house, the neighbors are people from age 25 to 65 who live on the same road.

perceived income position on a horizontal slider going from 1 to N (see e.g., Figure A-4 for the co-worker question). For these small reference groups, it does not make sense to ask about moments of the distribution such as P50 and P95 as we do for the large reference groups.

Experimental treatment. The information treatment is shown to the treatment group at this point in the survey and at the very end of the survey for the control group (so that it does not affect their answers). The treatment informs respondents about their actual income positions in each of the five large reference groups, which we interactively calculate based on their answers to the questions in the background and income blocks. Due to Danish rules

of conduct, we cannot show respondents their true position in the small reference groups (co-workers, neighbors, former schoolmates).

For each of the five large reference groups, the treatment reminds people the position they had guessed earlier, shows them their actual position, and highlights the difference between the two. Panel B of Figure 1 shows a screenshot from one of the treatment screens for the cohort reference group for a fictitious respondent. In this example, the respondent had guessed that she was ranked at position 70; the treatment informs her that she is, in fact, ranked at position 57 and points out the misperception gap of 13 positions. Appendix Table A-3 shows that the treatment and control groups are balanced in terms of observable respondent characteristics.

Fairness views. This sequence asks two standard questions for each reference group: one about the fairness of inequality and one about the role of effort versus luck. We only asked two questions for each reference group to avoid increasing the length of the survey too much, and selected questions that could be applied with the same formulation across all reference groups. The questions are (translated into English):

“On a scale from 1 to 7 where 1 is “Completely fair”, 4 is “Neither fair nor unfair” and 7 is “Completely unfair”, indicate to what extent you think that it is fair or unfair that there are differences in income among people born the same year as you WITHIN the following groups that you are yourself a part of?”

[The screen then lists five reference groups, filling out their labels directly with the respondent’s information from the earlier block, as can be seen in Panel C of Figure 1.]

“Now, think about people born the same year as you WITHIN these groups (indicated below). On a scale from 1 to 7 where 1 is “Only luck”, 4 is “Equally important”, and 7 is “Only effort”, indicate to what extent you think that differences in income are caused by differences in people’s efforts over their lifetime or rather by luck? By luck, we mean conditions, which you have no control over. By effort, we mean conditions, which you can control.”

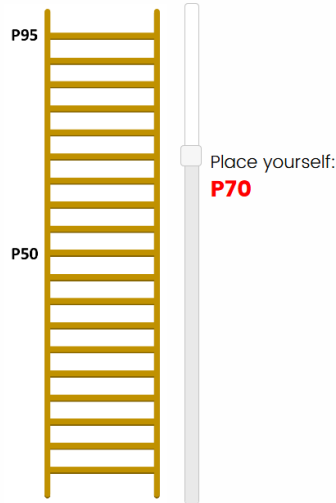
Response Quality. Reported incomes in the survey match the actual incomes on tax returns well. The average percentage difference between reported and actual income is less than 0.5%. More than 25% of the respondents report an income that is within 1% of their actual income and more than 70% of the respondents report an income that differs by at most 10%. Appendix Figure A-7 shows the full distribution of differences between reported and actual income.

FIGURE 1: EXAMPLE SURVEY PAGES

(A) ELICITING PERCEIVED POSITION

Rank among all people **born in 1970**

You previously reported that you had a yearly income in 2017 of 400000 DKK before tax. We will now ask you to report where you think this income placed you on the income ladder in 2017 for people who were born in 1970. Use the slider to select your position. Later, we will inform you about your true position.



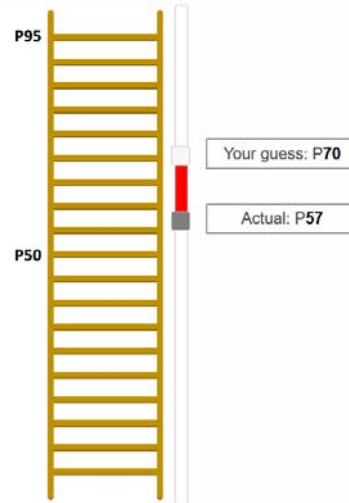
(B) INFORMATION TREATMENT

Rank among all people born in 1970

You GUESSED that you were on position **P70**.

Based on the income you reported, your TRUE position is **P57**.

You are actually 13 positions lower on the ladder than you thought.



(C) QUESTION ON UNFAIRNESS OF INEQUALITY

On a scale from 1 to 7 where 1 is "Completely fair", 4 is "Neither fair or unfair" and 7 is "Completely unfair", indicate to what extent you think that is fair or unfair that there are differences in income among people born the same year as you **WITHIN** the following groups that you are yourself a part of?

	Completely fair			Neither fair or unfair		Completely unfair	
	1	2	3	4	5	6	7
Differences in income among people born in 1970	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Differences in income among men born in 1970	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Differences in income among people, living in Københavns municipality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Differences in income among people with the educational level! Master or PhD program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Differences in income among people working in the sector Finance and insurance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Notes: Panel A shows the question eliciting the perceived position in the income distribution. In this example, a respondent, born in 1970 with an income of 400,000 DKK, perceives to be in position 70. The slider is initialized at P1. Panel B shows part of the information treatment this respondent receives, i.e., on the cohort reference group. The bottom panel shows a screenshot of the fairness of inequality question and illustrates how the reference groups are adapted (in bold) based on the respondent's earlier answers.

Appendix Table A-4 describes how well the reference groups reported by the respondents align with the official classifications in the administrative data. It shows that information on cohort, gender, and municipality are aligned. There are discrepancies with respect to educational level and sector of work, for example reflecting that people have difficulties in distinguishing, for instance, between *Real estate activities* and *Construction*. The benchmark results we present use the reference groups that respondents believe they belong to. Appendix D shows that the conclusions are unchanged if we instead use their actual reference groups or only include respondents who perceive their reference group correctly, reflecting that groups that are difficult for respondents to differentiate between are relatively similar to start with.

2 Fairness Views in Reference Groups

This section outlines a simple theoretical framework that illustrates the role of reference group comparisons and its relevance for redistribution policy and sets the stage for the empirical analyses. In line with the framework, this section provides the first empirical evidence on people’s fairness views of income differences within their reference groups.

2.1 Conceptual Framework

We consider a simple model of demand for redistribution, along the line of [Meltzer and Richard \(1981\)](#) and [Alesina and La Ferrara \(2005\)](#), which we extend to include fairness concerns. More precisely, people care about their position relative to others within various reference groups.

Setting. Consider n individuals, indexed by i , and let x_i denote the income of individual i . Redistribution policy takes the form of a proportional income tax τ , which finances a lump sum transfer b . Thus, $b = \frac{1}{n} \sum_{j=1}^n \tau x_j$. The consumption of an individual with income x_i is $c_i = (1 - \tau)x_i + b$. Individuals derive utility from consumption and care about their position relative to others. Furthermore, taxes are distortionary. A simple utility function that captures these concerns is:

$$u_i = \alpha c_i + \sum_{j=1}^n \beta_j (c_i - c_j) - \frac{\phi}{2} \frac{1}{n} \sum_{j=1}^n \tau^2 x_j. \quad (1)$$

The first term represents standard utility of consumption, with marginal utility of consumption α . The second term captures utility from relative ranking, where β_j is the ‘fairness

weight' that individual i puts on individual j in this comparison.⁸ The third term represents distortionary and administrative costs of taxation. The costs are quadratic, following earlier work, e.g. [Alesina and La Ferrara \(2005\)](#), and the marginal costs of taxation is given by ϕ .

Taking the derivative of their utility with respect to τ and using the expression for c_i and b , we obtain the demand for redistribution of individual i :

$$\tau = \frac{\alpha}{\phi} \frac{\bar{x} - x_i}{\bar{x}} + \sum_{j=1}^n \frac{\beta_j}{\phi} \frac{x_j - x_i}{\bar{x}}. \quad (2)$$

The first term is standard and shows the demand for redistribution driven by individual consumption. It depends on individual income x_i relative to the average in the population \bar{x} , reflecting the burden of taxation relative to the benefits from transfers. The second term is new and captures the importance of consumption or income relative to others. Note that if the individual cares equally about relative consumption across all other individuals, with a weight of $\beta_j = \gamma/n$, then the demand for redistribution simplifies to

$$\tau = \frac{\alpha + \gamma}{\phi} \frac{\bar{x} - x_i}{\bar{x}}, \quad (3)$$

which is similar to the standard formula with the exception that the constant $\alpha + \gamma$ now includes positional concerns (γ). Without loss of generality, we abstract from the direct utility of consumption (α) from now on, since it can be absorbed into the γ -parameter.

Reference groups. Consider now the case where individual i cares about her position in a number of reference groups R . Each reference group is indexed by r and contains n_r people. Individual i puts a fairness weight γ_r/n_r on each individual in reference group r . Therefore, the weight β_j placed by i on any other individual j is the aggregate of the fairness weights placed on each reference group that individual j has in common with individual i . For example, if individual j is in reference groups 1 and 2 of individual i then $\beta_j = \gamma_1/n_1 + \gamma_2/n_2$, while if individual j is only in reference group 1 then $\beta_j = \gamma_1/n_1$. As shown in [Appendix B.1](#), we can then rewrite eq. (2) as:

$$\tau = \sum_{r=1}^R \frac{\gamma_r}{\phi} \frac{\bar{x}_r - x_i}{\bar{x}}, \quad (4)$$

where \bar{x}_r is the average income of individuals in reference group r . The special case in eq. (3) arises when there is only one reference group ($R = 1$) comprising everybody else in society.

⁸For simplicity and without loss of generality, the summation includes $j = i$, i.e., self-comparison.

Consider now the case where, in addition to everybody else in society ($r = 1$), individual i cares about a second reference group ($r = 2$). This could, for instance, be other individuals with similar education levels. If individual i considers income differences of individuals within this reference group to be *more* unfair than overall income differences, then $\gamma_2 > 0$. We explore whether this is the case in our survey by comparing views on the fairness of overall income differences and income differences within reference groups (same education, sector of work, area of residence, and gender).

Relevance for redistribution policy. To see the relevance of reference groups for redistribution policy, consider a simple example with two education groups. High-educated individuals earn x_H and low-educated individuals earn $x_L < x_H$. If the low-educated apply the same fairness weight γ to all income differences, they will demand redistribution according to the standard formula $\tau = \frac{\gamma}{\phi} \frac{\bar{x} - x_L}{\bar{x}} > 0$. In the polar opposite case, in which they only care about income differences within their own education group, they will not demand any redistribution at all, $\tau = 0$, since everyone earns the same conditional on education. If there are income differences conditional on education, then those with income x_i below the group average \bar{x}_L will demand general redistribution according to $\tau = \frac{\gamma}{\phi} \frac{\bar{x}_L - x_i}{\bar{x}}$. This desired tax level is lower than in the standard model because people here compare themselves to the (low-educated) group average \bar{x}_L rather than to the higher population average $\bar{x} > \bar{x}_L$. More importantly, instead of the general redistribution policy (τ, b) , they would prefer to have a tax-benefit system that redistributes within their reference group, i.e., a tax-benefit system conditional on education level (τ_L, b_L) . Their preferred tax rate in this system would be $\tau_L = \frac{\gamma}{\phi} \frac{\bar{x}_L - x_i}{\bar{x}_L}$ (see Appendix B.2).

Thus, if reference groups matter to people, they would like redistribution *within* these groups beyond what is provided by the general redistribution scheme. For instance, if people find income differences within education groups more unfair than overall income differences then this may be an argument in favor of combining standard redistribution with education subsidies, thereby achieving more redistribution of income within education groups rather than between groups.⁹ If income differences within people's local area/municipality are important to them, then this may call for decentralizing redistribution policy to the local level. If income differences within co-workers in same sector or firm matter to people, there

⁹To see this, note that, as in [Stantcheva \(2018\)](#), the income tax partially captures the returns to more education. An education subsidy partially cancels out this effect of the income tax and thus, to some extent, reduces between-education group redistribution.

may be a wish for “same wage for the same work,” more unionization at the sector level, and wage transparency policies at the firm level.¹⁰

Perceptions. In the model, income differences overall and within reference groups are important to people. In reality, it is people’s perceptions, $E[\bar{x}_r - x_i]$, that enter the formula for their preferred level of redistribution. Systematic misperceptions can thus be important for policy views. For example, people in the bottom of the distribution will demand less redistribution if they underestimate inequality and overestimate their own position. Section 3 provides a thorough analysis of misperceptions including whether measures of misperception are due to misreporting of own income (x_i) or misperceptions of the incomes of others (\bar{x}_r). We also analyze whether people are better or worse informed about inequality and their own income position in reference groups that matter most to them in terms of their fairness views. Section 4 analyses the relationship between perceptions and fairness views, including whether misperceptions are the cause of differences in fairness views across reference groups, and whether perceptions and fairness views move with negative and positive shocks to people’s own position.

Fairness motive. In the model, individuals care about their own position relative to others, which we can call a “self-centered fairness” motive. In Appendix B.3, we provide an alternative model where individuals care about income differences per se, unrelated to their own position (“non self-centered fairness” motive), but may care more about differences within certain reference groups. The main conclusions about the relevance of reference groups and implications for public policy carry over to this setting. In practice, it is difficult to infer which motive is most relevant. However, if people’s views on fairness change when their social position changes or when they receive information about their own true social positions, it suggests that the self-centered motive is relevant at least to some extent.¹¹

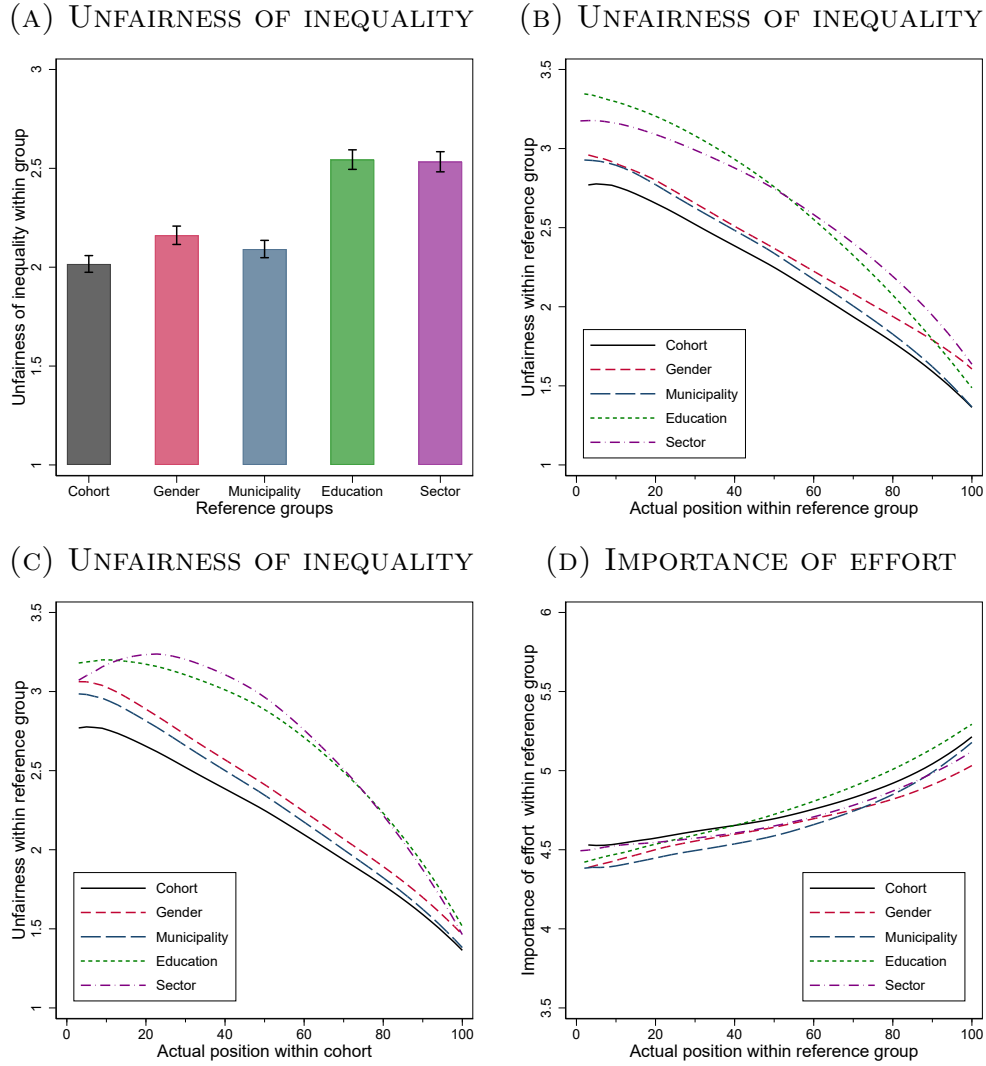
2.2 Evidence on Fairness Views Across Reference Groups

In the survey, we asked people aged between 45 and 50 about fairness of income variation and perceptions of income positions within their birth cohort. By focusing on within birth cohort variation, we neutralize life-cycle effects, which is both practically convenient and normatively important. Arguably, large income variations due to life-cycle effects are less

¹⁰Note that redistribution contingent on group is different from the traditional “tagging” idea in Akerlof (1978). Tagging is a way to reduce the efficiency loss from redistribution. In our case, fairness concerns motivate reference group dependence in redistribution schemes.

¹¹An alternative explanation could be that when people’s information about own position changes, they infer information about inequality overall, which could then change their fairness views due to a non self-centered motive.

FIGURE 2: UNFAIRNESS OF INEQUALITY AND IMPORTANCE OF EFFORT ACROSS LARGE REFERENCE GROUPS



Notes: The top left panel shows the average of the unfairness of inequality variable, which is on a scale of 1 (completely fair) to 7 (completely unfair) for each of the large reference groups. The top right panel plots the unfairness of inequality variable against actual position within the reference group (locally linear polynomials with bandwidth 20), while the bottom left panel plots it against actual position within the cohort. The bottom right panel plots the perceived importance of effort on a scale of 1 (only luck matters) to 7 (only effort matters) against actual position within the reference group. The sample is restricted to respondents in the control group only.

relevant from a normative perspective than large income differences across people of the same age, especially if we consider an age for which current incomes proxy relatively well for permanent incomes. We will refer to the within-cohort inequality as “overall inequality.”¹²

¹²Appendix Figure A-8 and Appendix Table A-5 highlight the pitfalls of asking about the full income distribution without specifying proper age limits. For example, the median income level of a cohort varies

Panel A of Figure 2 plots the respondents’ views on the unfairness of income inequality. The first bar shows views on unfairness within the birth cohort (“overall” inequality), and the subsequent bars zoom in on unfairness views within various reference groups *and* within the cohort. In general, people consider income differences within reference groups to be more unfair than overall inequality (within the cohort). Income differences within gender and local area (municipality) are considered similarly unfair as overall income differences. However, people think that income differences within their education group and within people working in the same sector are much more unfair than overall income differences. As seen in the graph, the unfairness score is approximately 0.5 higher for these two reference groups (and strongly significant) which corresponds to 25% of the unfairness score at the cohort level (and 34% of the standard deviation of the cohort unfairness score). In Appendix Figure A-9, we show that, across all education groups and sectors, people perceive income differences within education and sector groups to be more unfair. For example, both low-educated and high-educated respondents find income differences with their education group to be more unfair than overall income inequality.

Panel B plots respondents’ perceived unfairness of inequality for each reference group against their own position in that reference group. For all reference groups, those who are ranked higher believe that inequality within that group is less unfair. However, in line with Panel A, people at all income positions consistently think that income differences within their reference groups are more unfair than overall income differences in the cohort. Education group and sector of work stand out as the reference groups where income differences are perceived as most unfair.¹³ In this panel, the variation conditional on position is not within-individual, as one person may be ranked low in the cohort but ranked high in a reference group. In Panel C, we plot unfairness views for each reference group against the position in the cohort and find a very similar pattern.

We also asked respondents a standard question about their views on the role of effort versus luck for income differences. Panel D shows that, for all reference groups, people who are ranked higher in a reference group think that effort plays a larger role for income

drastically across different ages and an overall median income level depends a lot on inclusion or exclusion of young or old cohorts.

¹³We test this by stacking the observations such that we have 5 observations per respondent: one for actual position and unfairness view for each reference group. We then regress unfairness view on position and reference group indicators and an interaction of these (N=46576). We cluster the standard errors at the respondent level (9415 clusters) and find that the negative slopes are strongly significant. We center the position around P50, such that the constant is estimated at P50. The level difference between the cohort and education and sector is 0.47 and 0.45 with $p < 0.001$.

differences in the reference group.¹⁴ Unlike for fairness views, there are no major differences in views on the role of effort across reference groups.¹⁵

3 Perceptions of Social Positions

In this section, we describe people’s perceptions and misperceptions of their own position in their cohort and their large and small reference groups, as well as their perceptions of their own income and those of others. We also analyse which characteristics and factors are correlated with being more accurate and more optimistic about one’s own position.

3.1 Overall Position in Cohort

Perception of own position. Respondents who are ranked lower in their cohort tend to think they are ranked higher, while those that are ranked higher tend to think they are ranked lower. This can be seen in Figure 3, which shows the relation between respondents’ actual position in their cohort and their average or median perceived positions.¹⁶ The two curves both have a horizontal, inverted S-shape, whereby people below the median income level overestimate their position, while people above the median tend to underestimate it. This leads to the question: What is driving this systematic pattern in misperceptions of position?

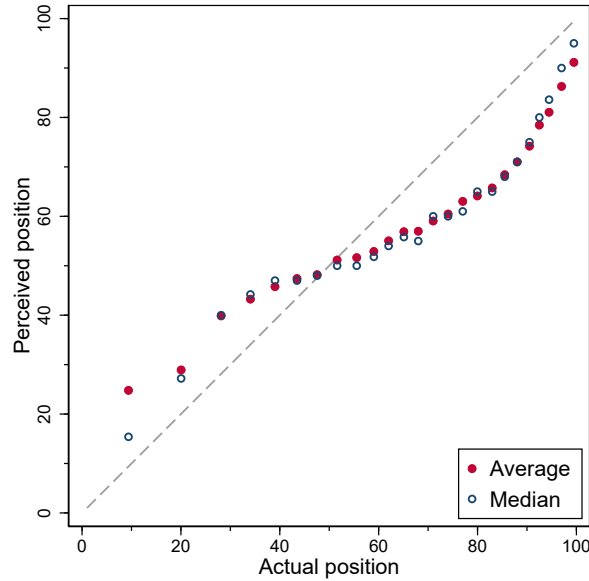
To address this question note first that people may misperceive their position in the income distribution because they misperceive their own income or the incomes of others. Second, the inverted S-shape can arise from misperceptions that either vary systematically across the income distribution or that are idiosyncratic. The latter case is possible because positions are bounded, so that people at the bottom of the distribution can only weakly overestimate their position, while people at the top can only weakly underestimate it. This

¹⁴If we regress importance of effort view in the cohort on actual position in the cohort, we get a slope of 0.008, i.e. going from position 1 to 100 is associated with an increase of 0.8 in the importance of effort ($p < 0.001$).

¹⁵From the clear differences in fairness views, one might have expected that luck was perceived as more important for income differences conditional on education and sector compared to unconditional income variation. A reason why we do not find this might be that we emphasized luck as factors outside individual control, which could include talent and returns to effort. We further discuss this in the last section.

¹⁶In Appendix Figure A-10, Panel A shows that the averages in the top and bottom of the distribution are significantly different from the 45-degree line. Panel B shows that if we compute the actual position in different ways using the average income on the tax return over the last three years (to reduce the role of potential noise and large fluctuations in actual position) or the reported income in the survey, the pattern is the same.

FIGURE 3: PERCEIVED VS. ACTUAL POSITION IN THE COHORT



Notes: The figure shows a bin scatter of the average and median perceived position by actual position in 25 equally sized bins. Actual position is based on the income from the tax return.

direction bias in income position can potentially give rise to the inverted S-shape even if the underlying misperceptions of incomes are idiosyncratic.

We start by ruling out that misperceptions of own income play a major role. Respondents do not perfectly know their income (see Appendix Figure A-7), and those who misperceive their income are more likely to make larger errors in estimating their position (see Panel A of Appendix Figure A-11). However, Panel A of Figure 4 reveals no systematic misperceptions of income as a function of actual income. Furthermore, idiosyncratic misperceptions of own income are also not main drivers of the misperception of positions, as can be seen in Panel B of Figure 4. The figure shows that the relationship between perceived and actual positions is similar for those who perceive their income accurately (i.e., are within a 5% error band of the income observed in the administrative data) and those who do not. The interquartile range represented by the intervals in the figure is only slightly larger for those with inaccurate income perceptions.¹⁷

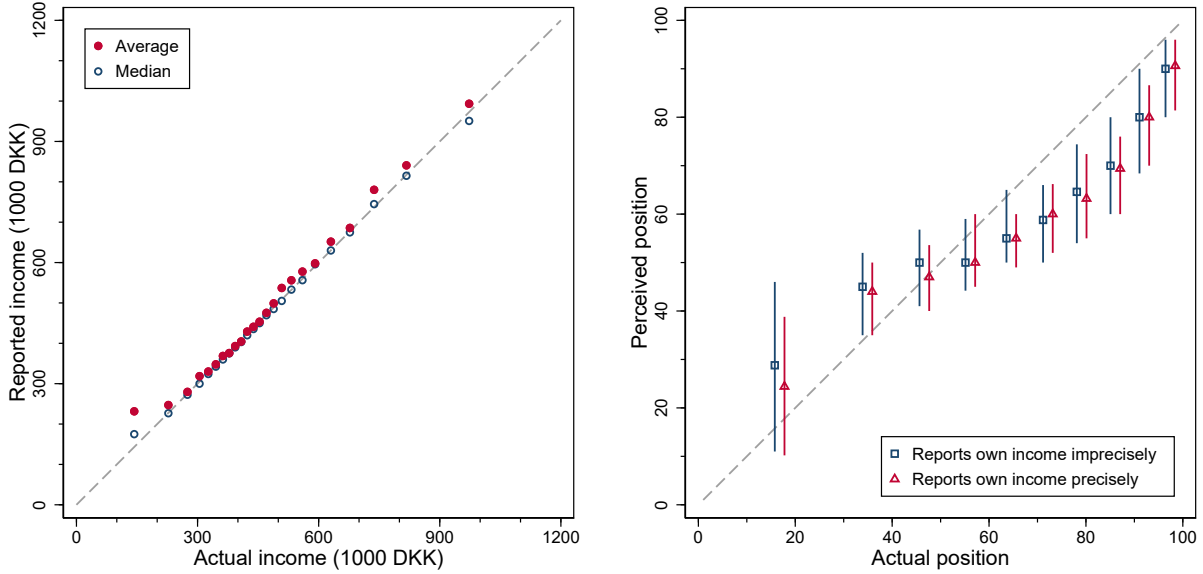
Perceptions of the income distribution. We next turn to the respondents' perceptions of the income distribution. Our first finding is that people estimate median incomes reasonably

¹⁷Panel B of Appendix Figure A-11 shows that respondents who report a 10,000 DKK higher income (than their actual income) on average report a 1000 DKK higher median income in the cohort. Panel C then shows that respondents who report an income that would imply they are 10 positions higher than their actual position overestimate their actual rank by 6 positions. Therefore, these misperceptions tend to cancel out.

FIGURE 4: ROLE OF MISPERCEPTIONS OF OWN INCOME

(A) ACTUAL VS. REPORTED INCOME

(B) PERCEIVED VS. ACTUAL POSITION



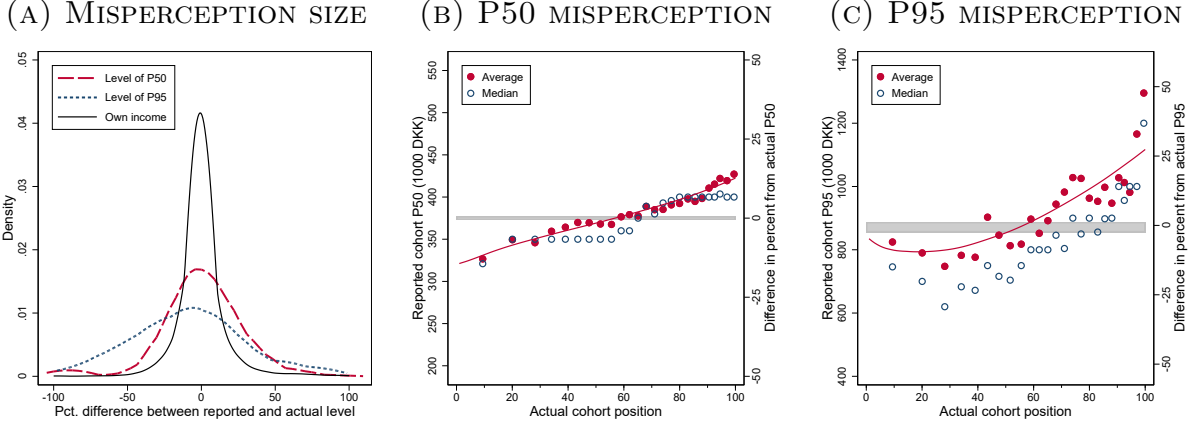
Notes: The left panel shows binned scatter plots of the average and median reported income against actual income (measured in 1000 DKK). The 25 bins have approximately the same number of respondents. The right panel replicates the plot in Figure 3 by showing the median perceived position by actual position, but splits the sample into people whose perceived income is within a 5% error band of their actual income, *Reports own income precisely*, and those whose perceived income is more than 5% above or below their actual income, *Reports on income imprecisely*. The intervals show the interquartile range.

well, but are less accurate in estimating top incomes. Panel A of Figure 5 plots respondents' misperceptions about the P50 income level (red long dash curve) and the P95 income level (blue short dash curve) relative to the actual levels. For the P50 income level, errors are symmetric around zero and bell-shaped. 45% of respondents estimate the median with at most a 10% error; 75% estimate it with at most a 25% error. For comparison, the errors when people report their own income (black solid curve) are such that 70% (respectively, 90%) percent report correctly within a 10% (respectively, 25%) error band.¹⁸ Against this benchmark, people seem reasonably well aware of the P50 income level in their cohort. As compared to the perceived P50, there is larger variance of the perceived P95 level and a small majority of people underestimate its level.

Our second finding is that people's own income systematically influences their views on the incomes of others. To see this, consider Panels B and C, which reveal an increasing relationship between the average perceived P50 and P95 income levels and the respondent's

¹⁸Regarding this comparison, note that the spike at exactly zero in Appendix Figure A-7 suggests that some of the respondents have checked their actual income on the tax return when answering the survey. It is not possible to similarly easily find information about the median of a cohort.

FIGURE 5: PERCEIVED P50 AND P95 OF THE COHORT



Notes: Panel A shows the distribution across respondents of the misperception in percent of the level of P50 and P95 (i.e., the percent difference between perceived and actual levels). For comparison, we plot the misperception of the respondent’s own income as reported in the survey and their actual income on the tax return. The distributions are smoothed using Epanechnikov kernels with a bandwidth of 5 for *Own income*, 10 for *Level of P50* and 15 for *Level of P95*. Panel B (respectively, Panel C) is a bin scatter with 25 bins of the average and median perceived P50 (respectively, P95) reported in DKK (left scale) and the corresponding misperception in percent (right scale) by actual position in the within-cohort income distribution. The perceived P50 and P95 are winsorized at the 5th and 95th percentiles within each bin (the median is unaffected by this). The local linear polynomials have a bandwidth of 20. A linear fit has a slope of 0.95 in Panel B and 4.06 in Panel C ($p < 0.001$ for both).

own position in the distribution. Higher-income respondents tend to overestimate both P50 and P95 and lower-income people underestimate them. Except for respondents in the very top and the very bottom of the distribution, the average prediction errors at each percentile are within 5% of the actual P50 value.¹⁹ The average perception error for the P95 is below 20% at all percentiles with the exception of people at the very top who starkly overestimate P95 by 50%. Note that people do not systematically think that others are closer to themselves than in reality since people placed between P50 and P95 in the cohort distribution tend to believe that P95 is further away from them than it actually is.

Misperceptions of own position due to “center bias.” Returning to the question of what causes the systematic misperceptions of own position in Figure 3, we find that the systematic errors in assessing others’ incomes play an important role: People who are in higher positions rank themselves lower relative to others not because they misperceive their own income, but because they tend to overestimate the incomes of others. Conversely, people who are lower ranked tend to place themselves at higher positions because they overestimate

¹⁹Equivalently, in terms of positions, an income level 5% below the actual median (DKK 350,000) corresponds to a percentile position of 44-45 within the cohorts and an income level 5% above (DKK 400,000) corresponds to a percentile position of 56-57.

the incomes of others.²⁰ We label this “center bias” because people’s perceived distribution of incomes is shifted relative to the actual distribution of incomes in a way that makes them think they are closer to the center than they actually are. This is conceptually different from “middle-class bias,” i.e., the idea that people tend to think they belong to the middle-class. As we will see below, center bias appears for all reference groups, and the middle positions in those groups correspond to very different income levels and are not all representative of a middle-class income.

One may ask whether it is the systematic component in misperceptions of the income distribution (center bias) that creates the inverted S-shape in Figure 3 or whether this could be due to a random noise component that creates direction bias. To address this question, consider that a respondent’s perceived incomes of others (say, the income at the median, P50) can be written as the true value plus a random idiosyncratic component. We can see conceptually and with the help of simulations in Appendix Figure A-12 that this type of process cannot explain the patterns observed.

First, direction bias carries implications for the skewness of perceptions at any given income level, which are not in line with the data. At a given position, the average respondent’s perception of their position is biased by the direction bias, but the perception of the median individual is unbiased. For instance, imagine people with true rank of 100. For those that would normally overestimate their rank (because they underestimate others’ incomes), the perceived position is truncated and equal to 100. For those who overestimate others’ income and underestimate their own position, the perceived position is below 100. Thus, the average person of true rank 100 will underestimate their position, but the median will perceive the rank to be 100. This is inconsistent with the inverted S-shape of the medians in Figure 3, which tracks the shape of the average perception, and is further documented with simulations in Appendix Figure A-12. On the other hand, the similar S-shape for the median and the average perceptions is consistent with a systematic relationship between own income and the income misperceptions of others income as observed in Figure 5, which we further document with simulation results in Appendix Figure A-13. For instance, we can also see that top earners are not simply “constrained” by the upper bound of positions, since they systematically overestimate how much people at the top earn (P95).

Second, direction bias implies that the distribution of perceptions will be more concentrated at the extremes, as shown in Panel A of Figure A-12, which does not align well with

²⁰Note that the large misperceptions of P95 in Panel C of Figure 5 by people in the top of the distribution is consistent with their quite accurate perceptions of own rank in Figure 3 because of the large distance between percentiles in the top of the distribution.

the observed distribution of perceptions. On the contrary, center bias generates exactly the distribution of perceptions observed (Panel A of Figure A-13).

3.2 Position in Large Reference Groups

Perceptions of the income distributions of large reference groups. On average, respondents estimate the median income level of their various reference groups – cohort, education, sector, municipality, gender – very well. They also assess the P95 of their cohort, gender, and municipality accurately, but significantly underestimate the P95 of their education group and their sector of work. Thus, respondents are not well aware of the extent of income differences among people with the same education and among those working in the same sector.

To see these results, consider Panel A of Figure 6, which plots the average perceived P50 for different reference groups of respondents in those groups against the actual P50. Each point represents either the overall cohort, a gender group, an education group, a sector, or a set of municipalities. For example, the two red plus signs show how men perceive the P50 of men and how women perceive the P50 of women. Municipalities, which are too numerous to be plotted individually, are grouped into ten bins defined by median municipality income. Most points are closely aligned with the 45-degree line, suggesting that individuals are well aware of the overall income levels of their reference groups. Misperceptions of the P50 are largest for the two sectors with the highest median income levels, *Finance and insurance* and *Information and communication*. In those sectors, respondents tend to underestimate the median income.²¹

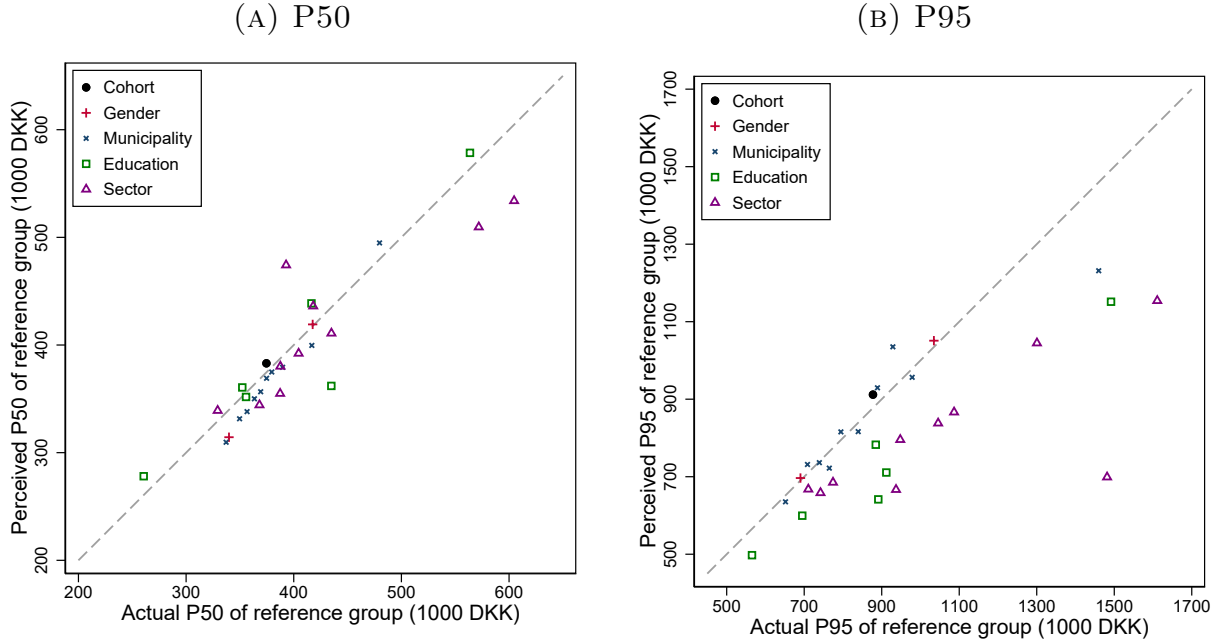
Panel B shows the perceived P95 levels for the different reference groups. The points representing the cohort, gender, and municipality groups are overall close to the 45-degree line. However, the green and purple points, representing individuals' sectors and education groups, are all below the 45-degree line.²² Thus, respondents systematically underestimate the degree of inequality within their education groups and within their sectors,²³ which is exactly the reference groups where respondents reported income inequality to be most unfair, as described in Section 2. Panels B and C of Appendix Figure A-14 show that these

²¹The *Information and communication* sector covers a wide range of industries, from computer programming to the publication of newspapers. It does not include advertising or marketing.

²²Panel A of Appendix Figure A-14 displays the 95% confidence intervals for the averages of these groups and show that they are all significantly below the 45-degree line.

²³The outlier in the lower-right corner is the *Agriculture, forestry and fishing* sector. This is a small sector in Denmark measured by the number of employed people in the sector with only 80 respondents in our sample. It is also a sector with large income inequality: the P50 income level is the lowest of the ten sectors, yet it has the second highest P95 income level.

FIGURE 6: PERCEIVED AND ACTUAL P50 AND P95 LEVELS OF LARGE GROUPS



Notes: For gender, we show one point for men and one for women. For municipality, we divide the respondents into 10 similar-sized groups based on the actual municipality P50 and P95 income and plot one point for each group. Each education level and sector are also represented by one point. The points show the means of the reported P50 or P95 by respondents in that group, winsorized at the 5th and 95th percentiles within the group.

patterns also hold if we use group medians instead of averages. The full distributions of P50 misperceptions can be seen in Panel D of Appendix Figure A-14. They are similar across reference groups and mirror the distribution of misperceptions of the cohort P50 from Figure 5.

How do people’s perceptions of their reference groups depend on their own income? The average perceptions just described obscure significant heterogeneity by income level. For each reference group, lower-income respondents have lower perceptions of the median and top-income level of the group, and higher-income respondents have higher perceptions.

To zoom in on these findings, Figure 7 shows the relationship between perceived P50 levels and own income in Panel A, and the relationship between perceived P95 levels and own income in Panel B. These graphs display the heterogeneity underlying the group averages of the different reference groups in Figure 6. To do this for each reference group, we need to aggregate the sub-groups within each reference groups, i.e., aggregate men and women into one “gender” group. We do this by demeaning the perceived P50 and P95 as well as own

income within each sub-group. We then plot the relationship between de-meaned perceptions and de-meaned income for each reference group using local linear polynomials. Panel A of Figure 7 shows an increasing relationship between perceived P50 in a group and the respondents' own incomes implying that respondents with income below (above) the average in a group perceive the P50 level of the group to be lower (higher) than the average perception. This relationship is strongest for the sector and education groups, which, together with the findings below, shows that the center bias is strongest in these groups compared with cohort, gender and municipality.²⁴ Panel B shows a similar increasing relationship between own income and the perceived P95 levels and, in this case, without major differences across the reference groups.

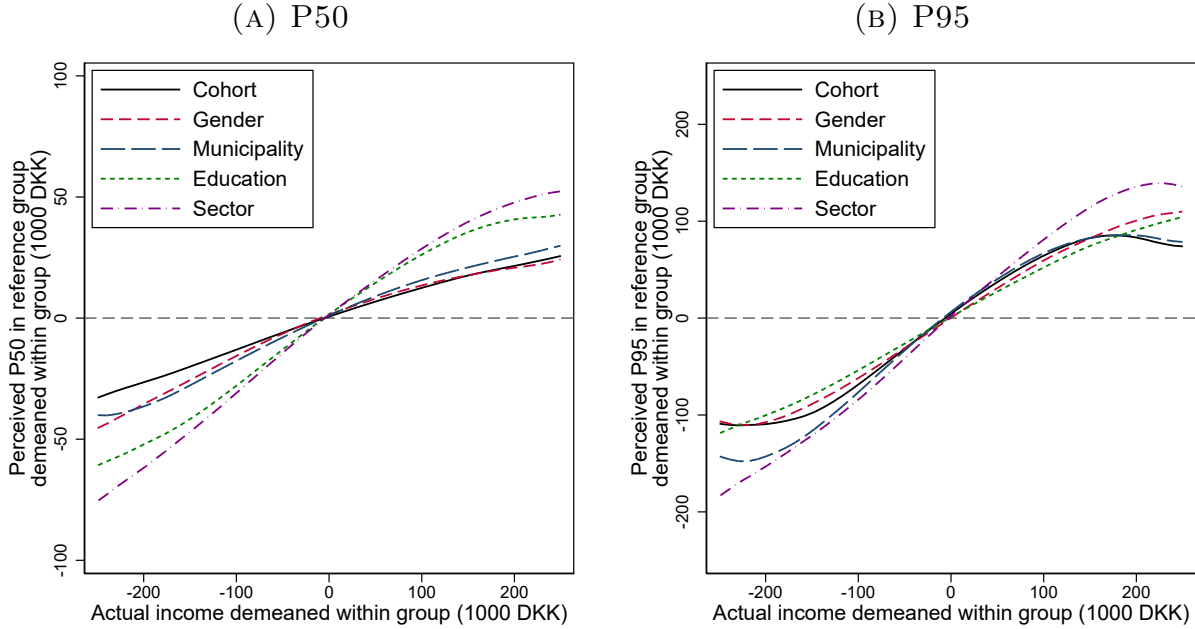
Perceptions of own position in different reference groups. In all reference groups, people's perceptions exhibit center bias. Respondents in the lower part of the income distribution tend to overestimate their positions, while people in the upper part tend to underestimate their positions. The misperceptions are largest for the sector and education groups, in which people ranked in the lower part starkly overestimate their positions.

Figure 8 illustrates these findings. Panel A plots respondents' perceptions of their own position within each reference group as a function of their actual position within that group. To better compare the different reference group positions, we show local linear polynomials for each group in the same plot. The familiar S-shaped curve is visible here too. Panel B recasts this information in a different way by plotting respondents' misperception of their reference group positions for given overall position *in the cohort*. At all income levels, people tend to be most overoptimistic about their position in their education group and their sector—the two dimensions where income inequality is considered most unfair. For example, people at the 20th percentile among their co-workers on average think they are well above the 40th percentile, while people at the 20th percentile in their municipality believe they are around the 30th percentile.²⁵

²⁴We test this by stacking the observations such that we have 5 observations per respondent: one for actual demeaned income and demeaned perceived P50 level for each reference group. We then regress perceived P50 on actual income and reference group indicators and an interaction of these (N=36916). We cluster the standard errors at the respondent level (8193 clusters) and find a slope of 0.124 for cohort ($p < 0.001$), i.e. a 500,000 increase in income is associated with an 62,000 increase in perceived P50. The slopes for education and sector are 0.129 and 0.161 steeper, both significantly so with $p < 0.001$.

²⁵We test this by stacking the observations such that we have 5 observations per respondent: one for actual and perceived position for each reference group. We then use respondents with actual position 20 to 40 (N=7139) and regress perceived position on dummies for which reference group the observation is related to and actual position fixed effects and cluster the standard errors at the respondent level (3181 clusters). We find no significant difference between perceived position within cohort and within gender or municipality at the 5%-level, with the point estimates 0.2 and 0.7. Perceived position is 5.9 and 8.0 positions higher for education and sector and the differences are both significant on the 0.1%-level.

FIGURE 7: PERCEIVED P50 AND P95 OF THE LARGE REFERENCE GROUPS BY INCOME



Notes: For each group, e.g., women within gender, we use respondents who have an income that is within 250,000 DKK of the mean income within the group. First, we winsorize perceived P50 and P95 at the 5th and 95th percentile within the respondents in the group. Second, we demean P50 in the left panel (P95 in the right panel) by subtracting the average perceived P50 (P95) among the respondents in the group from the respondent's perceived P50 (P95) level. Similarly, we demean the respondent's income by subtracting the average income among respondents in the group. Finally, we plot the demeaned P50 and P95 perceptions against demeaned income using local linear polynomials with a bandwidth of 100,000 DKK.

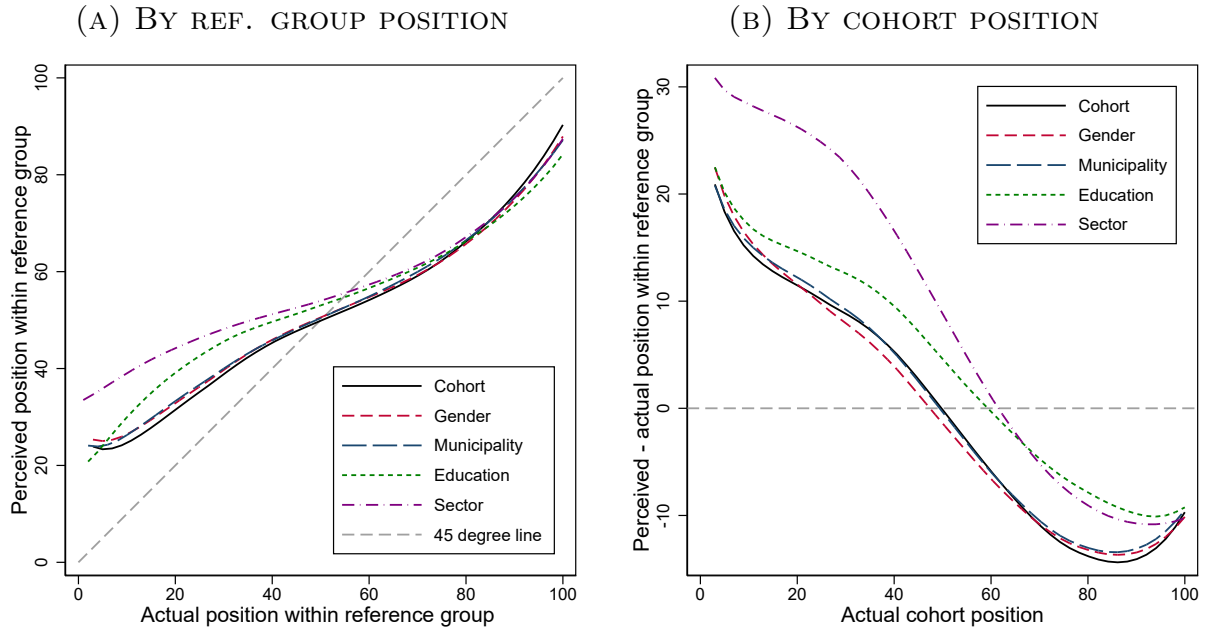
These patterns of misperceptions of own position are in line with our finding that people in general tend to underestimate the inequality in their sector (as reflected by their underestimation of the P95), and that people in the lower part of the distribution significantly understate the P50 income level of their sector.²⁶

3.3 Perceptions of Social Position in Small Groups

In this section, we study perceptions related to smaller reference groups that may be close to a respondent's daily life and potentially easy to relate to: co-workers at the same workplace, neighbors living on the same road (if living in a house) or stairwell (if living in an apartment),

²⁶We may wonder to what extent respondents report similar positions across different reference groups. They may do so out of carelessness, fatigue, or because they do not appreciate the distinctions between the groups. Appendix Figure A-15 shows that this is not the case. For each perceived position in the overall cohort distribution, we observe significant variation in perceived reference group positions. The bottom row also shows that for any given misperception of the cohort position, the misperceptions of positions in the other groups vary substantially.

FIGURE 8: PERCEIVED AND ACTUAL POSITION WITHIN LARGE REFERENCE GROUPS



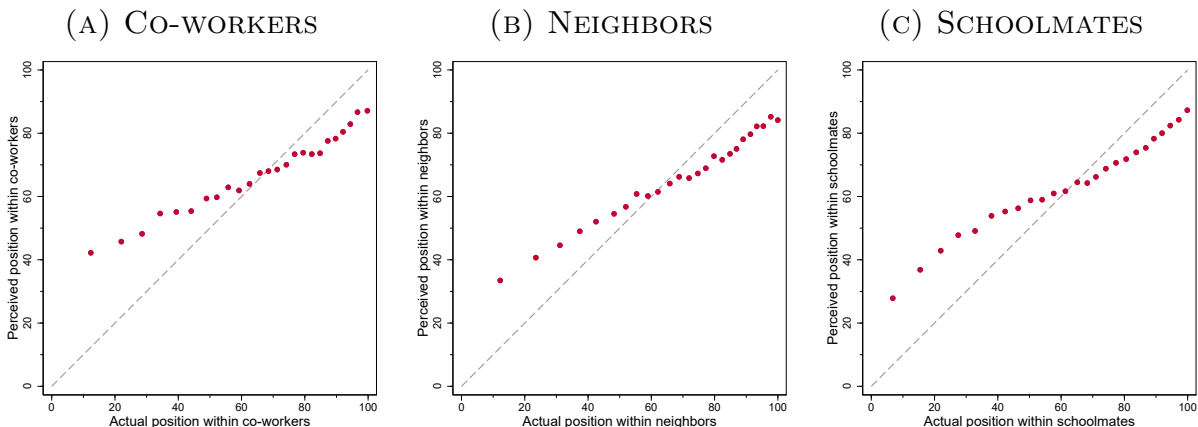
Notes: Panel A plots perceived position within each reference group as a function of actual position in that reference group. Panel B plots misperception of position in reference group by cohort position. The local linear polynomials have a bandwidth of 10. We use reported reference groups both for actual and perceived positions.

former schoolmates, and siblings. The pattern of perceived positions within these small groups resembles the findings for the large groups. Respondents misperceive their position among their current co-workers more strongly than among their neighbors, which is aligned with their misperceptions related to their sector of work being larger than that related to their municipality. They even tend to make smaller errors when ranking themselves among their former schoolmates during their teenage years than when ranking themselves among their current co-workers.

Figure 9 shows these results. Recall from Section 1 that for each group, we first asked the respondent about the perceived number of individuals in the group (N) and then asked them to report their perceived income position (X) on a horizontal slider going from 1 to N . We compute the perceived percentile rank as $\frac{X}{N} \cdot 100$ and the actual percentile rank using the true X and N from the register data. Panels A through C in Figure 9 show how people rank themselves among co-workers, neighbors, and former schoolmates.

The graph of the perceived position among co-workers at the same workplace in Panel A is very similar to the result for perceived position among co-workers in the same sector in Figure 8. In both cases, people who are in the bottom of the distribution believe that they are much

FIGURE 9: PERCEIVED POSITION WITHIN SMALL REFERENCE GROUPS



Notes: The panels depict the average perceived position of respondents among their co-workers in the same firm, their neighbors, and their former schoolmates, as a function of their actual position within these groups. There are 25 equally sized bins in each panel.

higher up than they truly are, e.g., respondents at the 20th percentile among co-workers in the same firm or sector on average believe that they are above the 40th percentile in those groups. In the upper part of the distribution, people underestimate their positions, but the misperceptions are smaller than in the bottom. The graph of the perceived position among neighbors in Panel B shows smaller misperceptions at the lower part of the distribution. The conclusions are thus consistent for large and small reference groups: misperceptions at the bottom are larger when people compare themselves to co-workers in either their sector or firm than when they compare themselves to people living in their area, either in their city or immediate vicinity.²⁷ The graph of the perceived position among schoolmates in Panel C also has the same shape and exhibits lower errors than the graph for co-workers.²⁸

²⁷We test this by stacking the observations such that we have 3 observations per respondent: one for actual and perceived position for each small reference group. We then use respondents with actual position 20 to 40 ($N=3797$) and regress perceived position on indicators for which reference group the observation is related to and actual position fixed effects and cluster the standard errors at the respondent level (2766 clusters). We find that perceived position within schoolmates is 2.4 positions lower than perceived position within co-workers ($p = 0.003$) while perceived position within neighbors is 6.1 positions lower ($p < 0.001$).

²⁸A deviation between perceived and actual rank could reflect that people misperceive the number of people belonging to their reference group rather than their own position within the group. In Appendix Figure A-16, we show that respondents are well aware of the size of their reference groups. The exception is a small share of respondents who have more than 100 neighbors and underestimate that number. Appendix Figure A-17 shows that we obtain similar results if we restrict the analysis to respondents whose reported number of people in the small reference group matches the number observed in the register data within a 10% error band or if we use bin medians instead of bin averages. In addition, Appendix Figure A-17 shows similar patterns for co-workers and for neighbors if we split the respondents into people working in small firms versus large firms and into those living in apartments versus houses.

3.4 Predictors of Misperceptions

In addition to actual position within a group, what are the characteristics and factors correlated with respondents' perceptions and misperceptions?

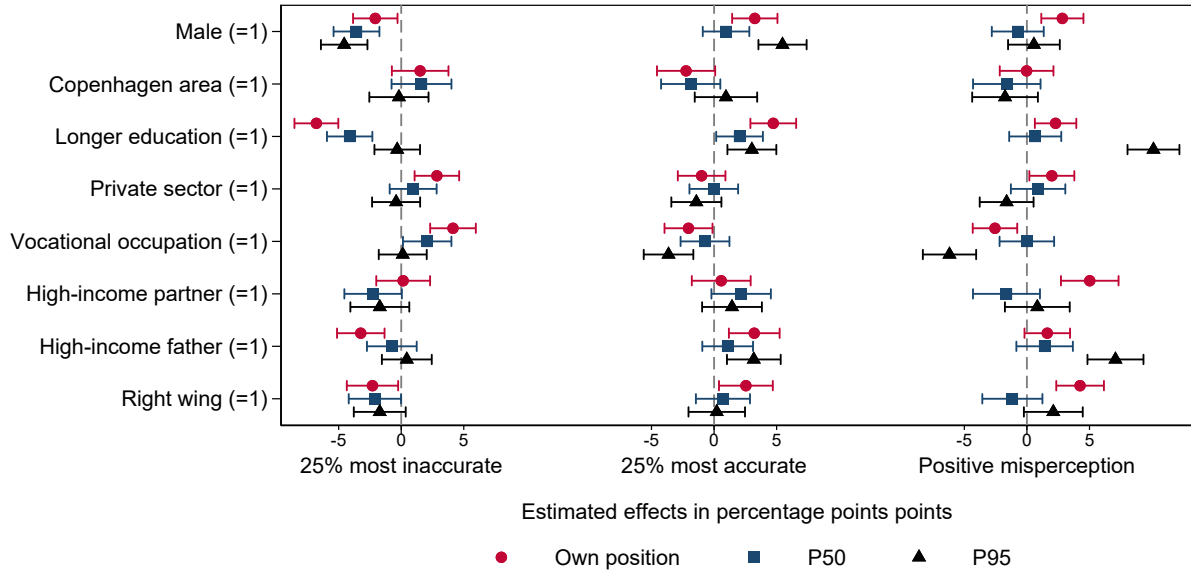
We start by studying overall misperceptions (at the cohort level). Figure 10 shows a coefficient plot of how individual characteristics correlate with measures of accuracy, inaccuracy, and direction of misperception of their perceived position (dot), P50 (square), and P95 (triangle) in the cohort. The coefficients come from separate regressions of the outcome variables on the horizontal axis on each of the variables on the vertical axis, conditional on fixed effects for position in the cohort. The outcome variables are indicators for being among the 25% most accurate of respondents, the 25% most inaccurate ones, and for having positive misperceptions. Appendix Table A-6 shows more detailed results from regressions when all variables are included simultaneously along with additional controls.

One of the strongest predictors of accuracy is education. More educated respondents are more likely to be accurate across all domains (own position, P50, and P95), although they are also more likely to have positive misperceptions. Similarly, male respondents are more likely to be accurate and to have positive misperceptions. Place of residence is not strongly associated with misperception. Respondents who work in the private sector or have a vocational occupation are less accurate than respondents who work in the public sector or have an academic occupation, which may reflect different levels of pay transparency. People working in the private sector tend to have a positive misperception of their own position, while people working in a vocational occupation have a negative misperception.

Respondents who have partners with a higher income than themselves are neither more nor less accurate than others, but are more likely to have a positive misperception of their position, suggesting that “family income” may influence their perception of their own ranking. Those with a high-income father tend to be somewhat more accurate about their own position, but are also more likely to have a positive misperception of the P95 level. Finally, right leaning respondents are more likely to be inaccurate with respect to their own position and to overestimate it. These results continue to hold when all explanatory variables are included simultaneously, except that the right-wing indicator becomes insignificant (see Appendix Table A-6).

The small reference groups allow us to explore other potential dimensions of what drives respondents' perceptions and misperceptions: income distributions, strength of interactions, visible signals, and pay transparency. Figure 11 shows a similar coefficient plot as Figure 10, focused on own position within the small reference groups (among schoolmates, neighbors, and co-workers). We control for position within the group and for gender, region of residence,

FIGURE 10: ACCURACY AND DIRECTION OF PERCEPTIONS OF OWN POSITION, P50, AND P95 IN THE COHORT



Notes: Coefficients from separate regressions of indicators for being among the 25% most inaccurate or accurate respondents and an indicator for having a positive misperceptions with respect to own position, P50 level and P95 level of the cohort on the explanatory variables indicated on the y-axis (one by one) with actual cohort position fixed effects. *Longer education* indicates Bachelor's or Master's degrees. The baseline (omitted) category for *Private sector* is public sector. Unemployed respondents are randomly assigned to one of the categories. The baseline for *Vocational occupation* is academic occupations according to the Danish ISCO codes. Unemployed people and managers are randomly assigned to one of the categories. *High-income partner* indicates that the partner's income is more than 25% above the respondent's income. *High-income father* indicates that the father was in the top 25% of the income distribution of fathers when the respondent was 15 years old. *Right wing* indicates that the respondent answered *Right wing* or *Very right wing* to the economic policy view question. We depict the 95% confidence intervals using robust standard errors.

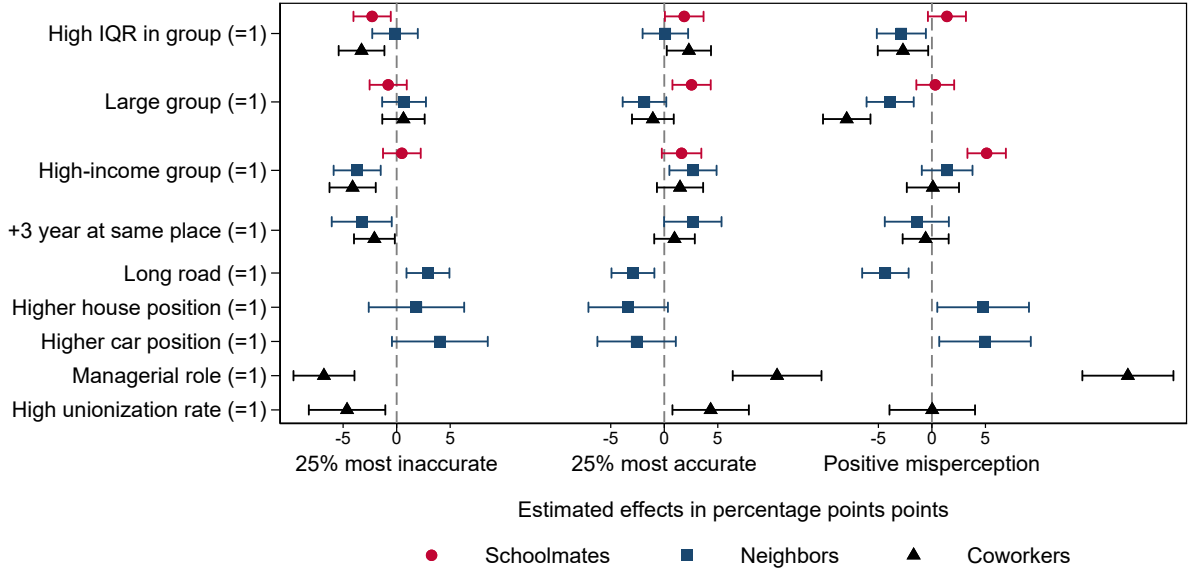
educational level, and sector of work with fixed effects. Appendix Table A-7 shows that the results still hold when the variables are included simultaneously and also shows the estimated effects of the additional controls.

The first three explanatory variables analyze the role of characteristics of the income distribution of the group. First, a respondent who is in a group with more income inequality (as captured by the inter-quartile range), tends to be somewhat more accurate, suggesting that a higher dispersion of incomes may make it easier for the respondents to assess their rank correctly. Second, the size of the group only matters marginally, especially after adding more controls (Appendix Table A-7). Third, respondents who live in a high-income neighborhood or work in a high-income firm are less likely to be inaccurate. Those who went to school with, on average, higher-income schoolmates are more likely to have a positive misperception of their own position.

The next two characteristics proxy for possible strength of interactions within the group using length of time in the group and proximity to others. Respondents who have worked at the same workplace or lived on the same road for a longer time are more likely to have accurate perceptions of their position in that group. Respondents who live on a longer road are less able to accurately assess their position among their neighbors.

Furthermore, we can also investigate how visible signals of own and other's income relate to perceptions. Respondents with houses and cars that are among the most expensive ones among their neighbors, conditional on their income positions are more likely to overestimate their income positions, suggesting that people do infer information from these visible markers. Furthermore, we can consider pay transparency and information on pay: Those who have a managerial position (and, therefore, presumably more information about their coworkers' incomes) have much more accurate perceptions even though they also are more likely to overestimate their position. We also explore how the workplace's unionization rates relate to misperceptions. If a large share of the workers in a workplace are subject to union agreements, this could increase the information about coworkers' incomes and make it easier for the respondents to position themselves accurately, which is exactly what we find.

FIGURE 11: ACCURACY AND DIRECTION OF PERCEPTIONS OF OWN POSITION IN THE SMALL REFERENCE GROUPS



Notes: Coefficients from separate regressions of indicators for being among the 25% most inaccurate or accurate respondents and an indicator for having a positive misperceptions with respect to own position within schoolmates, neighbors and coworkers on the explanatory variables indicated on the y-axis (one by one) with actual position in group fixed effects as well as cohort, gender, region of residence, educational level, and sector of work fixed effects. *High IQR in group*, *Large group*, and *High-income group* indicate whether a respondent is among the half of respondents with the highest values of the variables, i.e. have the largest income dispersion (inter-quartile range), the largest group size, and the highest income as measured by the median income of the group. *+3 year at same place* indicates that the respondent has lived on the same address or worked at the same workplace for at least 3 years. *Higher house position* and *Higher car position* indicate that a respondent has a higher position in the distributions of house and car values compared to the income position and is among the 25% with the largest differences. *Managerial role* indicates that a respondent has management occupation according to the Danish ISCO classification. *High unionization rate* indicates that a respondent's workplace has a unionization rate above 50%. We restrict to respondents who belong to groups with at least 10 people. For *Neighbors*, we exclude respondents who live in apartments. We depict the 95% confidence intervals using robust standard errors.

4 Relationship Between Fairness Views, Misperceptions and Positional Changes

This section studies the relationship between misperceptions of social positions and fairness views in the different reference groups. In particular, do the larger misperceptions of social position within certain reference groups (namely, education or sector groups) matter for differences in fairness views across reference groups as well? How are misperceptions and fairness views related to variations in social position over time? Do changes in people's social position systematically affect their fairness views across reference groups?

TABLE 3: UNFAIRNESS VIEW BY ACTUAL POSITION AND POSITION MISPERCEPTION

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A: No controls					
Level at P50	2.23*** (0.03)	2.36*** (0.03)	2.32*** (0.03)	2.72*** (0.03)	2.77*** (0.03)
Position in group	-1.74*** (0.10)	-1.83*** (0.12)	-1.96*** (0.11)	-2.36*** (0.12)	-2.47*** (0.12)
Misperception	-0.57*** (0.15)	-0.99*** (0.16)	-0.74*** (0.14)	-0.65*** (0.15)	-1.50*** (0.16)
Panel B: With controls					
Position in group	-1.61*** (0.13)	-1.64*** (0.14)	-1.68*** (0.13)	-1.79*** (0.14)	-2.06*** (0.14)
Misperception	-0.60*** (0.15)	-0.67*** (0.16)	-0.64*** (0.14)	-0.52*** (0.15)	-1.06*** (0.16)
<i>N</i>	4692	4692	4692	4692	4452

Notes: The sample is restricted to control group respondents. *Position in group* denotes the actual position within the reference group from percentile 1 to 100 divided by 100. A coefficient of 1 means that going from the bottom of the distribution to the top increases the outcome by one standard deviation. Similarly, *Misperception* is the difference between perceived and actual position within the reference group divided by 100. *Level at P50* is the constant term in the regression since *Position in group* has been centered at P50. *Controls* are cohort, municipality, education, gender, and sector fixed effects (including unemployed/not in workforce). Robust standard errors on the estimates are reported in the parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.1 Role of Misperceptions of Social Positions for Fairness Views

Correlations. Fairness views on inequality are strongly correlated with misperceptions of social position. This is seen in Table 3, which reports results from regressing unfairness of inequality within each reference group against actual position and misperception of position within the reference group without controls (Panel A) and with fixed effects for cohort, gender, municipality, educational level, sector of work, and employment status (Panel B).

The first row in Panel A reports the level of the dependent variable for the respondent situated at P50; the second row shows the correlation between actual position in the group and fairness views. These two rows confirm the graphical analysis in Figure 2: First, income differences within education group and co-workers in same cohort are considered considerably more unfair than overall income differences within the cohort. For instance, the unfairness view at the median position within education group is $(2.72-2.23)/2.23 = 22\%$ higher than the median in the cohort. Second, people with a higher social position in a given group think inequality within that group is less unfair. Thus, going from the lowest to the highest social

position within education group is associated with a drop of $2.36/2.72 = 87\%$ in perceived unfairness relative to its level at the median position.

The third row shows that those with a higher misperception of their position, conditional on their true position, perceive inequality as significantly more fair. The effects of moving up in misperceived position across the reference groups are smaller than the effects of moving up in actual position (the magnitudes of the coefficients in row 3 are around 30%-60% of those in row 2), but they are still significant and sizable. The same results appear when including controls in Panel B.

The next question is whether the association between perceptions and fairness views represents a causal relationship.

Information experiment. Thanks to our information experiment, we can show that if people were fully informed about their social positions, they would view income inequality within all reference groups as significantly more unfair. However, the *differences* in fairness views across reference groups, notably the higher perceived unfairness of within-education group and within-sector inequality relative to the other reference groups, would be unchanged.

As described in Section 1.2, we informed a random half of the sample (the treatment group) about their true social positions in the five large reference groups prior to asking about their views on fairness.²⁹

Table 4 shows how the respondents' views on the unfairness of income inequality across reference groups were affected by the information treatment. Across all reference groups, the fully informed individuals in the treatment group view inequality to be more unfair than individuals in the control group. The table shows that the treatment effects on fairness views are significant at a 5%-level across all reference groups (Panel A), and of relatively similar magnitudes. As a result, the treatment has small and insignificant effects on the differences in fairness views on inequality in the reference groups relative to fairness of inequality at the overall cohort level (Panel C).³⁰ Furthermore, the increase in perceived unfairness of inequality is driven by people who initially overestimate their own social position and are then informed that they are not as high up as they thought (second row of Panel B). Across all reference groups, these individuals become less tolerant of inequality. There are no significant changes in the fairness views of people who are informed that they are ranked higher than they thought, suggesting that “bad news” weigh more heavily than “good news.”

²⁹In our effort to treat all respondents fairly, the other half of the sample (the control group) was informed about their true positions only *after* these outcome questions, with no possibility to go back and change their answers. Hence, their answers to the outcome questions cannot be affected by this information.

³⁰Appendix Table A-8 shows that this is also the case if we restrict to respondents whose reported and observed income matches well.

TABLE 4: SURVEY INFORMATION EXPERIMENT AND UNFAIRNESS VIEWS

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A					
Treatment (=1)	0.091** (0.030)	0.067* (0.033)	0.080** (0.031)	0.089** (0.034)	0.078* (0.036)
Panel B					
Positive misperception	-0.116*** (0.035)	-0.132*** (0.033)	-0.118*** (0.033)	-0.110*** (0.031)	-0.254*** (0.033)
$T \times \text{Positive}$	0.137*** (0.039)	0.075* (0.036)	0.096** (0.037)	0.070* (0.031)	0.083** (0.031)
$T \times \text{Negative}$	0.026 (0.023)	0.024 (0.024)	0.026 (0.024)	0.035 (0.026)	0.007 (0.027)
Difference in unfairness relative to cohort					
		Gender	Municipality	Education	Sector
Panel C					
Treatment (=1)		-0.024 (0.015)	-0.014 (0.013)	-0.002 (0.026)	-0.012 (0.027)
N	9331	9331	9331	9331	8854
Group position FE	✓	✓	✓	✓	✓

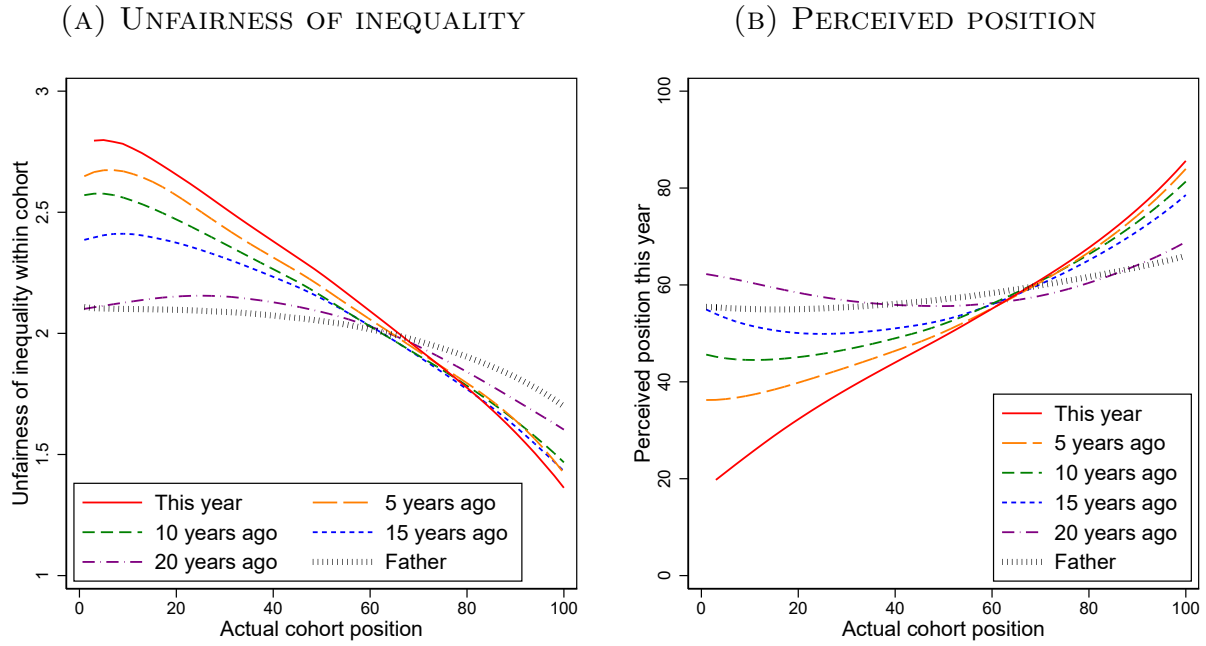
Notes: *Positive misperception* is an indicator that equals 1 if the perceived position is larger than the actual position within the reported reference group specified in each column. $T \times \text{Positive}$ is an interaction of the treatment indicator and the *Positive misperception* indicator. $T \times \text{Negative}$ is an interaction of the treatment indicator and an indicator for having a misperception < 0 . In the regressions, we also include a constant term. Robust standard errors on the estimates are reported in the parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.2 Role of Variation in Social Positions over Time for Perceptions and Fairness Views

Correlations. To what extent do the past social positions of the respondents matter for their current perceived position and fairness views? To address this question, we make use of the rich register data to reconstruct people’s economic histories for the last 20 years and correlate them with their perceptions and fairness views today. We first focus on people’s overall income path and variations in positions before considering the effects of changes in social position due to specific negative and positive events.

Panel A of Figure 12 plots respondents’ views against their position in their cohort, measured at different points in time in five-year intervals, as well as against their father’s position relative to other fathers in the cohort, measured when the individual was 15 years

FIGURE 12: HISTORY OF PAST SOCIAL POSITIONS AND UNFAIRNESS VIEWS AND PERCEIVED POSITION



Notes: Bandwidth for local linear polynomials is 20. For *Father*, the x-axis is the father's position among fathers when the respondent was 15 years old. In the left panel, the sample is restricted to the control group.

old. The association between current fairness views and social position becomes weaker when measuring social position at more distant points back in time.³¹

Panel B shows a similar relationship when we correlate perceived current position as a function of past positions: the correlation between current perceived and past actual position becomes weaker as we go back in time. These results need to be interpreted keeping the degree of income mobility over different time spans in mind. Appendix Figure A-18 shows that, naturally, the correlation between the current social position and past positions decreases as we move back in time. The evidence in Figure 12 is consistent with people's perceived position and fairness views on inequality changing when their actual social position changes. In this case, the lower correlations of current perceptions and fairness views with social position further back in time reflect the lower correlations between actual current and more distant past positions.

³¹We test this by stacking the observations such that we have 6 observation per respondent: one for each actual historic position curve in Panel A of Figure 12. We then regress cohort unfairness view on indicators for each curve, actual position, and an interaction of these ($N = 56,089$) and cluster the standard errors at the respondent level (9415 clusters). The slope for the *This year* curve is -0.016 ($p < 0.001$). The remaining slopes are significant less steep: the estimated slope is 0.002 higher for the *5 years ago* curve ($p < 0.001$) and 0.013 higher for the *Father* curve ($p < 0.001$).

Life events. To further analyse whether perceptions and fairness views move with social position, we consider four life events – negative and positive – that move people’s position: unemployment spells, disability, unexpected health conditions that require hospitalization, and promotions at work.

We focus on the last 10 years before the survey and split those years into a “pre-shock period” from 2008 to 2011 and a “shock period” from 2012 to 2017. For each of the four shocks, we perform the analysis on the subsample of individuals who did not experience this shock in the pre-shock period and define an indicator variable equal to 1 if an individual experienced the shock at some point during the shock period.³² We regress our outcome variables on each shock indicator (one at a time) and include detailed individual level controls including fixed effects for cohort, gender, municipality, education, sector, and percentile cohort position prior to the shock. Thus, the question we ask is: conditional on starting at the same position 10 years ago, and conditional on an array of personal characteristics, do respondents who experienced one of these four shocks, which shift their social position, hold different views today from those who did not?

Table 5 shows the results. Each row represents a separate regression, one for each of the four shocks. Column 1 and 2 present the effect of the shock on current social position and perceived position; columns 3-7 show the effect on fairness views across reference groups; column 8 reports the size of the sample in each regression; and column 9 indicates the share of respondents affected by the shock during the shock period.

The shocks differ in their frequency and impact. Unemployment and promotions affect 5-7% of the sample and are related to relatively large changes in social position (in opposite directions). Disability shocks are rare but entail very large drops of around 18 percentiles in social position. By contrast, around half of the sample went to the hospital during the shock period, and this is associated with a small 2-percentile drop in social position. The change in perceived position in column 2 mirrors to a large extent the change in actual position, although perceptions move less than actual positions.

Respondents who have experienced any of the negative shocks (unemployment, disability, and hospitalization) are significantly more likely to consider inequality within various

³²The unemployment shock is defined as three or more months of unemployment in at least one year in the shock period. To study its effect, we focus on respondents who were in the workforce for the entire ten-year period. A disability shock is defined as a respondent starting to receive disability insurance benefits (without having received it before) in one of the years in the shock period (according to the official Integrated Database for Labour Market Research, IDA, from Statistics Denmark). Hospitalization refers to at least one emergency room visit or hospital visit by referral from a general practitioner, excluding visits due to congenital diseases, pregnancy, or routine checks, which do not reflect unexpected health shocks. Finally, a promotion is defined as a respondent switching from a job as a regular employee in the pre-shock period to a management position in the following period.

reference groups unfair. Conversely, those who have been promoted are less likely to consider inequality unfair, especially within sector, which is the domain most closely related to work promotions. The shocks that move social positions the most (i.e., disability and unemployment) have the largest effects on fairness views. Fairness views move symmetrically across the reference groups implying that the differences in fairness views across reference groups are unchanged, as documented in Appendix Table A-9. The only exception is that the promotion shock tends to make people even more accepting of inequality within co-workers and people with similar education relative to overall inequality within the cohort.

The identified effects are not necessarily causal, since these life events may be correlated with other unobservable characteristics of the respondents that also affect their views. Nevertheless, the detailed controls and fixed effects (including for the starting position ten years ago) likely absorb a substantial share of heterogeneity. In fact, we obtain similar effects if we omit individual level controls except for starting position (see Appendix Table A-10), suggesting that there is no systematic correlation between these individual characteristics and life events. It is also informative that we are able to study four different types of shocks, with some that could be perceived as more exogenous to individual choice, conditional on a detailed set of controls (e.g., hospitalization or disability).³³

5 Discussion of Results and Concluding Remarks

Standard theories of policy preferences and optimal policy design often assume that the extent of inequality is common knowledge and abstract from inequalities in different reference groups. How much do people know about these inequalities and how fair do they perceive them to be?

People consider inequalities conditional on the same level of education or sector of work as most unfair, which has potential implications for design of redistribution policy, as shown in Section 2. The evidence is consistent with people seeing differences in education and type of work as more fair determinants of income differences than other types of variation. More research is needed to disentangle the underlying reasons for the differences in fairness views

³³We can also do an IV-type analysis, in which we instrument for current position using the occurrences of these shocks. The exclusion restriction needed for this strategy to correctly identify the effect of social position on fairness views is that the life events only affect fairness views through social position, which is a strong assumption. Appendix Table A-11 shows that the pooled IV results that use all four shocks at once are close in magnitude to the baseline OLS estimates from Table 3. Using the individual shocks as instruments one by one yields broadly consistent effects as well. The exception is the hospitalization shock, which is at the same time very common and shifts income position only by a little (the “first stage” is weak).

TABLE 5: CORRELATION OF LIFE EVENTS WITH UNFAIRNESS OF INEQUALITY

	Cohort position		Unfairness of inequality					N	Affected
	Actual (1)	Perceived (2)	Cohort (3)	Gender (4)	Mun. (5)	Edu. (6)	Sector (7)	(8)	% (9)
Unemployment	-9.47*** (1.29)	-4.18** (1.33)	0.31** (0.12)	0.36** (0.13)	0.31** (0.12)	0.25* (0.12)	0.28* (0.13)	3758	5.27
Disability	-17.69*** (2.54)	-18.00*** (3.17)	0.67* (0.31)	0.82* (0.34)	0.94** (0.34)	0.43 (0.30)		4649	0.67
Hospitalization	-1.84** (0.69)	-1.10 (0.68)	0.19** (0.06)	0.21** (0.07)	0.18** (0.06)	0.14* (0.07)	0.10 (0.07)	2234	55.64
Promotion	8.51*** (0.85)	6.90*** (1.01)	-0.19* (0.08)	-0.20* (0.09)	-0.21* (0.09)	-0.34*** (0.10)	-0.42*** (0.10)	3889	6.74
Pre-shock position FE	✓	✓	✓	✓	✓	✓	✓		
Controls	✓	✓	✓	✓	✓	✓	✓		

Notes: Each cell in the table is a separate regression of the column outcome on the row regressor and the controls indicated in the bottom part of the table. The explaining variables are all indicators that equal 1 if the respondent experienced the shock between 2012 and 2017. In each row, we exclude respondents who already experienced this type of shock in the pre-period (2008-2011) or did not answer all unfairness questions. For *Unemployment*, we only use respondents who were in the workforce in the entire period. For *Disability*, we do not estimate the effect on fairness within sector, because very few disabled people work. *Controls* included in all regressions are a treatment indicator, cohort, gender, municipality, education, and sector fixed effects (incl. unemployed/not in workforce), all measured in 2008. Robust standard errors on the estimates are reported in the parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

across reference groups, for example, along the lines of the experiments in Cappelen et al. (2010), Cappelen et al. (2013), and Almås et al. (2017).

Because these reference groups are key to understanding fairness views, our paper systematically studies perceived inequality and social positions across people’s different reference groups. A key finding is that people are, on average, well-informed about the overall income levels of their different reference groups. However, we also detect important misperceptions. Across all reference groups, we observe center bias, whereby lower-ranked people tend to position themselves higher than they truly are because they underestimate others’ incomes. The reverse is true for higher-ranked people. The fact that people in the lower part of the income distribution systematically overestimate their position could perhaps be one of the explanations for the puzzling finding that people sometimes support policies that are seemingly against their economic self-interest Bartels (2016).

The result that people find income differences within education and sector groups to be most unfair is even more interesting in light of their misperceptions: Exactly in these dimensions—where it matters most to them—people are least informed about inequality and lower-income people strongly overestimate their positions. One reason could be that people have different aspirations across reference groups, and admitting that they have a low position within education group or sector could lead to more resentment. The particularly stark lack of information within firms and sectors could have important implications for wage setting and career dynamics.

It is important to understand whether the strong negative correlation between people’s social positions and their fairness views on inequality is due to fixed personal characteristics or whether instead fairness views move together with changes in their income and social positions. In the latter case, policies that change social positions can also change fairness views, which can lead to multiple equilibria as in Alesina and Angeletos (2005). We provide a number of results suggesting that people’s fairness views are strongly related to their social position and change when their positions change. In particular, fairness views correlate more strongly with current social positions than with past positions, and movements up or down in social positions caused by real-life events are also related to changes in people’s fairness views.

As in other studies involving surveys, selection into participation may create biases. As described earlier, we do not find evidence that such biases affect our results when we reweigh our sample to match the characteristics of the population along a broad range of dimensions in the registrar data. This does not exclude selection bias due to unobservable factors. However, most of our results are based on within-individual and across-reference groups

comparisons (fairness views and perceptions of own position, P50, and P95). Arguably, this should be less sensitive to participation or selection bias, as it is essentially controlling for individual fixed effects and, hence, individual-specific factors that shape their fairness views and perceptions in the same way across reference groups. The fact that we focus on differences in views and perceptions across reference groups and within individuals is also helpful to assuage concerns about experimenter demand effects in the information experiment (Haaland et al., 2021), as such a confounding effect would probably apply to all reference groups we provide information about.

Are our results generalizable to other countries? Denmark is one of the most equal countries in the world (Atkinson and SØgaard, 2016; Boserup et al., 2016; Jakobsen et al., 2020) and attitudes vary across countries (Alesina et al., 2001, 2018; Almås et al., 2020). Yet, because we analyze rank positions, relative inequality perceptions (e.g., differences between perceived and actual P95 levels compared to corresponding P50 levels), and relative fairness views across reference groups (rather than levels), it is not *a priori* clear that our results are biased in a systematic direction. One hypothesis is that it is more difficult to place yourself in a more compressed distribution, where income differences between percentiles are relatively small. Our analysis in Section 3.4 reveals a weak positive correlation between the dispersion of incomes in a reference group and the accuracy of respondents' perceived position, suggesting that, if anything, accuracy may be even better in countries with more inequality. On the other hand, the Danish income differences may align more with visible social stratification or be more transparent than in other countries, which would make ranking oneself and others easier. However, in Denmark, income differences are not as directly visible as in Norway, where tax records have been easily accessible online since 2001 (Bø et al., 2015; Perez-Truglia, 2020). The significant effects from our information treatment, as well as the correlations between misperceptions and measures of transparency, social interactions, visible consumption, and other factors in Section 3.4, also suggest that Danes are not fully informed about the incomes of others.

Key to our analyses and findings is the linking of large-scale survey data on perceived social positions and fairness across many reference groups to administrative records on actual social positions across time, life events, and reference groups. We see this combination of subjective and objective information as a promising avenue to learn more about the determinants of perceptions and attitudes.

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APPENDIX

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A Survey

A.1 Survey link and questions in English

Link: https://cebi.eu.qualtrics.com/jfe/form/SV_6PcXP1t0Mw89iqp

Background and Political views

1. What is your birth year?

Dropdown menu with years. Only 1969-1973 accepted.

2. What is your gender?

Male; Female

3. How many siblings do you have with the same biological mother and father as you?

0; 1; 2 or more

4. Which municipality did you live in at the beginning of 2017? Note that in the following options, some of the municipalities are grouped together.

Dropdown menu with Danish municipalities

5. Which of the following categories best describes your highest educational level?

Primary education; Upper secondary education; Vocational education and training; Short cycle higher education; Bachelor program or vocational bachelor education; Master program or PhD program

6. What was your employment status at the beginning of 2017?

Full-time employment; Part-time employment; Self-employed; Unemployed; Not in the workforce

7. Which sector did you work in at the beginning of 2017? Note that we mean the sector which your workplace belongs to. For example, if you work with PR in a bank you should choose the sector “Finance and insurance” and not the sector “Information and communication”.

Construction; Real estate activities; Business services; Finance and insurance; Trade and transport; Manufacturing, raw material extraction and utilities; Information and communication; Culture, leisure and other services; Agriculture, forestry and fishing; Public administration, education, health and social work activities

8. Which party did you vote for in the last general election (in 2015)?
Socialdemokratiet; Venstre, Danmarks Liberale Parti; Radikale Venstre; Enhedslisten - De Rød-Grønne; Det Konservative Folkeparti; Alternativet; SF - Socialistisk Folkeparti; Liberal Alliance; Kristendemokraterne; Dansk Folkeparti; Other; Did not vote; Do not wish to answer
9. How would you describe your attitude on economic policy?
Very left-wing; Left-wing; Moderate; Right-wing; Very right-wing

Income

1. We will now ask you about your total income BEFORE tax in 2017. You should NOT include contributions to employer-managed pension schemes or mandatory pension contributions. When we later will inform you about your own position, it is important that you state your total income as precisely as possible. If you are in doubt about the amounts, you can view them on your annual statement for 2017 from SKAT under *Opgørelse af indkomst* below *Før AM-bidrag*. You can also see a description of the different categories below. Note: In the scheme below we ask you to please state the yearly amounts in entire thousand DKK. If you enter 1 this corresponds to 1,000 DKK. *Salary and fees; Net profit from self-employment; Unemployment benefits, social assistance, study grants and pension payments*

Perceptions

1. Instruction video
2. We will now ask you a question to see if you have understood the video's explanation of the ladder's different positions. Think about a person with an income where 73 out of 100 people have an income that is the same as or lower than this person's income. 27 out of 100 people have an income which is higher than this person's income. Select this person's position on the income ladder using the slider below.
3. What do you think the income for P50 was in 2017 for individuals born in [PIPED BIRTH YEAR]? Remember that P50 is the income, where half have an income that is the same as or lower than this income, and half have an income that is higher than this income. Remember also that income is before tax for the whole of 2017 and consists of salary, net profit from self-employment, other business income, unemployment benefits,

transfers and payments from private and public pensions. Note: Please state your answer in entire thousand DKK. If you enter 1 it corresponds to 1,000 DKK

4. We will now ask you what you think the before tax income for P50 was in 2017 for the groups below which you are a part of. The first slider shows your answer from the previous question. You can use the other sliders to select what you think the income was for P50 for the different groups of people who were born the same year as you.
One horizontal slider for each reference group. The slider for cohort is locked at the amount entered in the previous question.
5. What do you think the income for P95 was in 2017 for individuals born in [PIPED BIRTH YEAR]? Remember that P95 is the income where 95 out of 100 have an income that is the same as or lower than this income, and 5 out of 100 have an income that is higher than this income. Please state your answer in entire thousand DKK. If you enter 1 it corresponds to 1,000 DKK
6. We will now ask you what you think the before tax income for P95 was in 2017 for the groups below which you are a part of. The first slider shows your answer from the previous question. You can use the other sliders to select what you think the income was for P95 for the different groups of people who were born the same year as you.
One horizontal slider for each reference group. The slider for cohort is locked at the amount entered in the previous question.
7. Rank among all people born in [PIPED BIRTH YEAR]. You previously reported that you had a yearly income in 2017 of [PIPED INCOME] DKK before tax. We will now ask you to report where you think this income placed you on the income ladder in 2017 for people who were born in [PIPED BIRTH YEAR]. Use the slider to select your position. Later, we will inform you about your true position.
8. Rank among [PIPED GENDER]. Now, think about all [PIPED GENDER] born in [PIPED BIRTH YEAR]. Use the slider to select where you think you were placed on the income ladder in 2017 for this group of people. Later, we will inform you about your true position.
9. Rank within [PIPED MUNICIPALITY] municipality. Now, think about people who also lived in [PIPED MUNICIPALITY] municipality at the beginning of 2017 and were born in [PIPED BIRTH YEAR]. Use the slider to select where you think you were placed on the income ladder in 2017 for this group of people. Later, we will inform you about your true position.

10. Rank within the educational level [PIPED EDUCATION]. Now, think about people whose educational level also was [PIPED EDUCATION] at the beginning of 2017 and were born in [PIPED BIRTH YEAR]. Use the slider to select where you think you were placed on the income ladder in 2017 for this group of people. Later, we will inform you about your true position.
11. Rank within the sector [PIPED SECTOR]. Now, think about people who also worked in the sector [PIPED SECTOR] at the beginning of 2017 and were born in [PIPED BIRTH YEAR]. Use the slider to select where you think you were placed on the income ladder in 2017 for this group of people. Later, we will inform you about your true position.
12. Think about your [FOR WOMEN: mother's. FOR MEN: father's] total income in the year where you turned 15. Compared to [FOR WOMEN: mothers. FOR MEN: fathers] of children, who were also born in [PIPED BIRTH YEAR], where do you think your [FOR WOMEN: mother. FOR MEN: father] was placed on the income ladder in the year where you turned 15?
13. Is your income higher or lower than [FOR RESPONDENTS WITH ONE SIBLING: your brother's/sister's income? FOR RESPONDENTS WITH 2 OR MORE SIBLINGS: the average income of your siblings?]
Higher; The same; Lower
14. Think about your co-workers at the beginning of 2017. By co-workers, we mean the people who had the same workplace as you at the beginning of 2017. A workplace usually has the same address so if you for instance worked in a chain store then your co-workers are those who worked in the same store as you and not all the people, who were employed in the same firm. How many people worked at your workplace at the beginning of 2017 incl. you? If you do not remember the exact number then report your best guess.
15. Imagine that we rank you and your colleagues by your income in 2017 such that the person with the lowest income is number 1 and the person with the highest income is number [PIPED # COWORKERS]. What do you think your position was in this rank in 2017?
16. Think about your neighbors at the beginning of 2017. By neighbors, we mean the people who lived on the same road as you, if you lived in a house, or the people living

on the same stairwell as you, if you lived in an apartment. Think only about the people, who were between 25 and 65 years old. How many people lived on the same road or on the same stairwell as you, including your own household, at the beginning of 2017? If you do not remember the exact number then report your best guess.

17. Imagine that we rank you and your neighbors by your income in 2017 such that the person with the lowest income is number 1 and the person with the highest income is number [PIPED # NEIGHBORS]. What do you think your position was in this rank in 2017?
18. Think about your schoolmates when you were 15 years old. By schoolmates, we mean everybody at your school who was born in [PIPED BIRTH YEAR], and not just the people in your class. How many schoolmates were you including yourself? If you do not remember the exact number then report your best guess.
19. Imagine that we rank you and your schoolmates by your income in 2017, such that the person with the lowest income is number 1 and the person with the highest income is number [PIPED # SCHOOLMATES]. What do you think your position was in this rank in 2017?

Treatment

For the treatment group this block appears here. For the control group it appears after the block "Outcomes".

For each reference group, cohort/gender/municipality/educational level/sector, we provide the following information on separate pages along with a visualization of the difference:

You GUESSED that you were on position PXX.

Based on the income you reported, your TRUE position is PXX.

You are actually X positions higher/lower on the ladder than you thought.

Outcomes

1. On a scale from 1 to 7 where 1 is "Completely fair", 4 is "Neither fair nor unfair" and 7 is "Completely unfair", indicate to what extent you think that it is fair or unfair that there are differences in income among people born the same year as you WITHIN the following groups that you are yourself a part of?
 - (a) Differences in income among people born in [PIPED BIRTH YEAR]

- (b) Differences in income among [PIPED GENDER] born in [PIPED BIRTH YEAR]
 - (c) Differences in income among people living in [PIPED MUNICIPALITY] municipality
 - (d) Differences in income among people with the educational level [PIPED EDUCATION]
 - (e) Differences in income among people working in the sector [PIPED SECTOR]
2. Now, think about people born the same year as you WITHIN these groups (indicated below). On a scale from 1 to 7 where 1 is “Only luck”, 4 is “Equally important”, and 7 is “Only effort”, indicate to what extent you think that differences in income are caused by differences in peoples’ efforts over their lifetime or rather by luck? By luck, we mean conditions, which you have no control over. By effort, we mean conditions, which you can control.
- (a) Reason for different incomes among people born in [PIPED BIRTH YEAR]?
 - (b) Reason for different incomes among [PIPED GENDER] born in [PIPED BIRTH YEAR]?
 - (c) Reason for different incomes among people living in [PIPED MUNICIPALITY] municipality?
 - (d) Reason for different incomes among people with the educational level [PIPED EDUCATION]?
 - (e) Reason for different incomes among people working in the sector [PIPED SECTOR]?
3. Which party would you vote for if there was a general election today?
Socialdemokratiet; Venstre, Danmarks Liberale Parti; Radikale Venstre; Enhedslisten - De Rød-Grønne; Det Konservative Folkeparti; Alternativet; SF - Socialistisk Folkeparti; Liberal Alliance; Kristendemokraterne; Dansk Folkeparti; Nye Borgerlige; Other; Do not wish to answer
4. Below, you see six statements which you can agree or disagree with. On a scale from 1 to 7 where 1 is ”Completely agree”, 4 is ”Neither agree nor disagree”, and 7 is ”Completely disagree”, indicate to what extent you agree or disagree with each statement.
- (a) Income inequality is a problem in Denmark

- (b) The government should increase redistribution of income by increasing taxes and transfers to reduce inequality
- (c) I am generally satisfied with my life
- (d) My work has generally paid off
- (e) People with high incomes have worked hard for their income and deserve it
- (f) If a person is poor this is mainly due to lack of effort from his or her side

Outro

1. It is important for our study that we only use responses from people, who have given the survey their full attention. You will automatically participate in the lottery no matter what you answer, but we would like to know how much attention you have given the survey.
1 I barely gave the survey any attention; ... ; 7 I gave the survey my full attention
2. Do you think that the survey was biased?
Yes, it was right-winged; Yes, it was left-winged; No, it was neutral
3. If you have any comments about the survey, then you are welcome to write them here:

A.2 Instruction video link and script

Link: <https://www.dropbox.com/s/ya1z0nlmii5tkpo/Instruktionsvideo.m4v?dl=0>

We will now ask you some questions regarding the distribution of income between Danes born the same year as you.

It may be difficult to answer, but we ask you to try your best.

There are differences between peoples' incomes. Some people have a high income, others have a low income.

The ladder to the left illustrates **how the incomes are distributed between Danes** born the same year as you.

This is also called the income distribution.

Think of 100 people born the same year as you.

They are ranked according to their income such that the person with the lowest income is at the bottom of the ladder and the person with the highest income is at the top of the ladder.

Look at the person next to the first rung of the ladder.

5 out of 100 people (i.e. 5 %) have an income which is the same as or **lower** than the income of this person.

We call this P5, because the person has position 5 on the income ladder.

The person on the middle rung has position 50.

Exactly half of all people (i.e. 50 %) born the same year as you have an income which is the same as or **lower** than the income of this person and **exactly half** have an income which is **higher** than the income of this person.

We call the position in the middle for P50.

Remember that P50 is the position in the middle since we will use this several times in the following questions.

The person next to the top rung has position 95.

95 out of 100 (i.e. 95 %) have an income which is the same as or **lower** than the income of this person and only 5 out of 100 people born the same year as you (i.e. 5 %) have an income which is higher than the income of this person.

Remember what P95 indicates since we are going to use this several times.

Shortly, we will now ask you what you think the income is for P50 and P95, respectively, for Danes born the same year as you

Next, we will ask you what you think **your position** is on the ladder.

You are welcome to watch the video again if you are not sure of the meaning of the different positions.

A.3 Survey screenshots

FIGURE A-1: INCOME QUESTION

We will now ask you about your **total income BEFORE tax in 2017**. You should **NOT** include contributions to employer-managed pension schemes or mandatory pension contributions. When we later will inform you about your own position, it is important that you state your total income as precisely as possible. If you are in doubt about the amounts, you can view them on your annual statement for 2017 from SKAT under *Opgørelse af indkomst* below **Før AM-bidrag**. You can also see a description of the different categories below.

Note: In the scheme below we ask you to please state the **yearly** amounts in **entire thousand DKK**. If you enter 1 this corresponds to 1,000 DKK.

Salary and fees	<input type="text"/>	thousand DKK
Net profit from self-employment	<input type="text"/>	thousand DKK
Unemployment benefits, social assistance, study grants and pension payments	<input type="text"/>	thousand DKK
Total	<input type="text" value="0"/>	thousand DKK

Examples

Salary and fees: Taxable wage income before tax and before labor market contribution and fees. You should include:

- Value of fringe benefits
- Taxable foreign wage
- Wage during sickness and maternity/paternity leave
- Fees from board duties, consultancy work, talks etc.
- Value of stock options, severance pay and anniversary bonus

On your tax statement this corresponds to box 11 + 12 + 14.

Net profit from self-employment: Net profit from self-employment after capital income and expenses. On your tax statement this corresponds to box 111 minus box 112.

Unemployment benefits, social assistance, study grants and pension payments: Unemployment benefits, cash benefits, sickness benefits, maternity/paternity benefits, study grants, payments from private pensions, public pensions and disability pensions. On your tax statement this corresponds to box 16.

FIGURE A-2: ELICITATION OF COHORT P50 PERCEPTION

What do you think the income for **P50** was in 2017 for individuals born in 1970?

Remember that P50 is the income, where half have an income that is the same as or lower than this income, and half have an income that is higher than this income.

Remember also that income is before tax for the whole of 2017 and consists of salary, net profit from self-employment, other business income, unemployment benefits, transfers and payments from private and public pensions.

Note: Please state your answer in **entire thousand DKKs**. If you enter 1 it corresponds to 1,000 DKK.



Notes: The figure shows a screenshot from the survey for a person who reported being born in 1971.

FIGURE A-3: ELICITATION OF LARGE REFERENCE GROUP P50 PERCEPTIONS

We will now ask you what you think the before tax income for **P50** was in 2017 for the groups below, which you are a part of. The first slider shows your answer from the previous question. You can use the other sliders to select, what you think the income was for P50 for the different groups of **people who were born the same year as you.**

P50 for people **born in 1970**

400.000

P50 for **men** born in 1970

20.000

P50 for people who also lived in **Københavns municipality**

20.000

P50 for people who also had the educational level **Master or PhD program**

20.000

P50 for people who also worked in the sector **Finance and insurance**

20.000

Notes: The top slider shows the piped answer to the question in figure A-2 and cannot be moved. The sliders go from 20,000 to 8,069,000 in 200 steps according to $Y = 20000 * EXP(0.03 * Step)$. In the middle position the slider has the value 402,000.

FIGURE A-4: ELICITATION OF NUMBER OF CO-WORKERS AND POSITION AMONG CO-WORKERS

(A) NUMBER

Think about your co-workers in the beginning of 2017. By co-workers we mean the people who had the same workplace as you in the beginning of 2017. A workplace usually has the same address so if you for instance worked in a chain store then your co-workers are those who worked in the same store as you and **not** all the people who were employed in the same firm.

How many people worked in your workplace at the beginning of 2017 incl. you? If you do not remember the exact number then report your best guess.

50

(B) POSITION

Imagine that we rank you and your co-workers by your incomes in 2017 such that the person with the lowest income is number 1 and the person with the highest income is number 50. What do you think your position was in this rank in 2017?

50

1

Place yourself:
Number 1 out of 50 in my workplace.

Notes: The panels show screenshots from two pages in the survey. On the first page in this example, the respondent reports having 50 co-workers (the box is empty as default). On the second page, this number is piped as the max of the slider, and when the respondent moves the slider with the cursor the red position number changes accordingly.

B Conceptual Framework: Derivations

B.1 Reference groups

Let J_r denote the set of individuals j in reference group r of individual i . As explained in the main text, the weight γ_r denotes the reference group specific contribution to the fairness weight β_j if individual j belongs to the reference group of individual i . We can then rewrite eq. (2) as

$$\begin{aligned}\tau &= \frac{\gamma_1/n_1}{\phi} \sum_{j \in J_1} \frac{x_j - x_i}{\bar{x}} + \frac{\gamma_2/n_2}{\phi} \sum_{j \in J_2} \frac{x_j - x_i}{\bar{x}} + \dots \\ &= \frac{\gamma_1}{\phi} \frac{\bar{x}_1 - x_i}{\bar{x}} + \frac{\gamma_2}{\phi} \frac{\bar{x}_2 - x_i}{\bar{x}} + \dots \\ &= \sum_{r=1}^R \frac{\gamma_r}{\phi} \frac{\bar{x}_r - x_i}{\bar{x}}.\end{aligned}$$

QED.

B.2 Relevance for redistribution policy

We consider the demand for general redistribution (b, τ) and for redistribution within low-educated individuals (b_L, τ_L) of a person i who only cares about income differences within the low-educated. Consumption of individual i equals

$$c_i = (1 - \tau - \tau_L) x_i + b + b_L,$$

where

$$b = \frac{1}{n} \sum_{j=1}^n \tau x_j, \quad b_L = \frac{1}{n_L} \sum_{j=1}^{n_L} \tau_L x_j.$$

Utility now equals

$$u_i = \frac{1}{n_L} \sum_{j=1}^{n_L} \gamma (c_i - c_j) - \frac{\phi}{2} \frac{1}{n} \sum_{j=1}^n \tau^2 x_j - \frac{\phi}{2} \frac{1}{n_L} \sum_{j=1}^{n_L} [(\tau + \tau_L)^2 x_j - \tau^2 x_j],$$

where the second term is the average tax cost from the general tax while the third term is the additional tax cost on low-educated from their redistributive tax.

After inserting the above equations this becomes

$$u_i = (1 - \tau - \tau_L) \gamma (x_i - \bar{x}_L) - \frac{\phi}{2} \frac{1}{n} \sum_{j=1}^n \tau^2 x_j - \frac{\phi}{2} \frac{1}{n_L} \sum_{j=1}^{n_L} [(\tau + \tau_L)^2 x_j - \tau^2 x_j]$$

Differentiation wrt. τ and τ_L gives the first order conditions:

$$\begin{aligned} -\gamma (x_i - \bar{x}_L) - \phi \tau \bar{x} - \phi \tau_L \bar{x}_L &= 0, \\ -\gamma (x_i - \bar{x}_L) - \phi \tau \bar{x}_L - \phi \tau_L \bar{x}_L &= 0. \end{aligned}$$

By comparing these two equations, it follows that $\tau = 0$ (no demand for general redistribution). Solving for τ_L then gives

$$\tau_L = \frac{\gamma}{\phi} \frac{\bar{x}_L - x_i}{\bar{x}_L},$$

which reveals a demand for redistribution within the reference group. QED.

B.3 Fairness motive

The main result is derived for the case where individuals care about their own position relative to others (selfish fairness motive). Here, we consider an alternative setting with individuals care about income differences per se, unrelated to own position (altruistic fairness motive), but may care more about differences within certain reference groups.

The utility function of the individual equals

$$u = - \sum_{i=1}^n \sum_{j=1}^n \beta_{ij} |c_i - c_j| - \frac{\phi}{2} \frac{1}{n} \sum_{j=1}^n \tau^2 x_j$$

where $|c_i - c_j|$ denotes the numerical value of the income difference between a pair of individuals. The demand for redistribution is found by taking the derivative with respect to τ and using the expression for c_i and b , which gives

$$\tau = \sum_{i=1}^n \sum_{j=1}^n \frac{\beta_{ij}}{\phi} \left| \frac{x_i - x_j}{\bar{x}} \right|.$$

Consider now the case where the individual cares about income differences within a number of reference groups R , indexed by r . Group r contains n_r people. Individual i places a fairness weight γ_r/n_r^2 on income differences between any pair of individuals in reference groups r . Two individuals can belong to different reference groups. Therefore, the weight β_j placed on

a pair of individuals is the aggregate of the fairness weights placed on each reference group they belong to. For example, if a pair is in reference group 1 and 2 then $\beta_{ji} = \gamma_1/n_1^2 + \gamma_2/n_2^2$, while if they are only in reference group 1 then $\beta_j = \gamma_1/n_1^2$. We can then rewrite the above formula as

$$\tau = \sum_{r=1}^R \frac{\gamma_r}{\phi} \sigma_r, \quad \sigma_r \equiv \frac{1}{n_r^2} \sum_{i \in J_r} \sum_{j \in J_r} \left| \frac{x_i - x_j}{\bar{x}} \right|,$$

where J_r denotes the set of individuals in reference group r . Note that this formula is the same as (4) with the exception that the relevant income inequality measure within reference groups is now σ_r . This implies that the main results that follow from (4) also go through with the altruistic fairness motive.

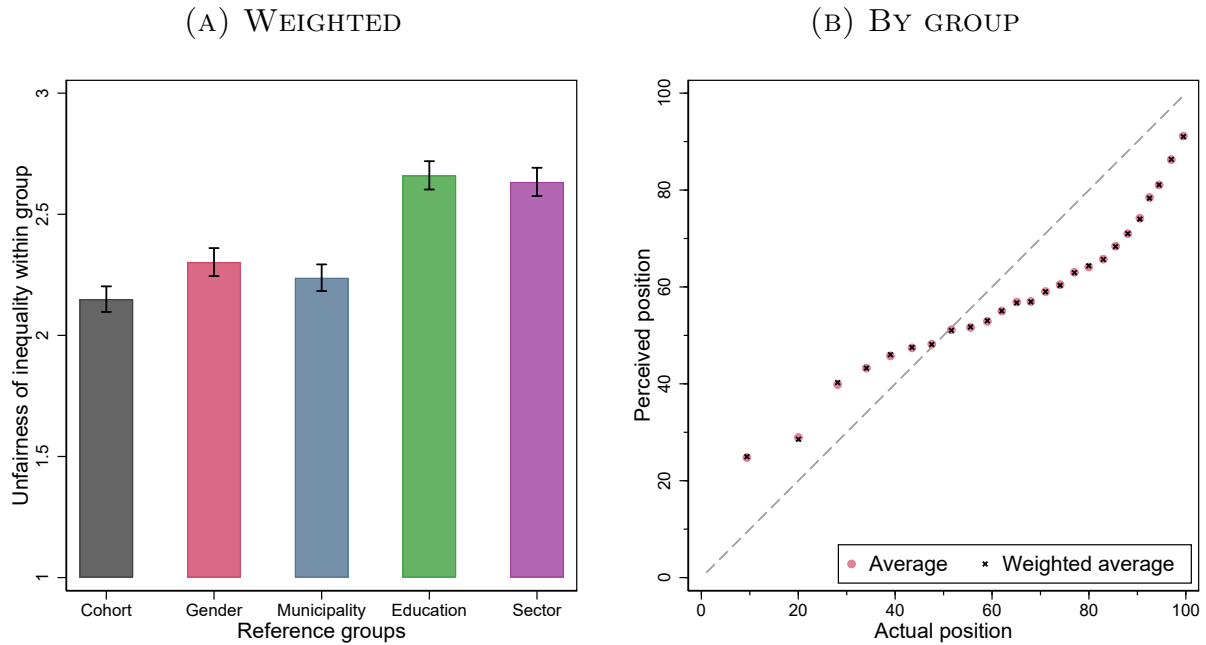
C Figures and tables referenced in the main text

TABLE A-1: SUMMARY STATISTICS: SAMPLE COMPARED TO POPULATION

	Sample (1)	Started (2)	Invited (3)	Population (4)	Incl. immigrants (5)
Demographics					
Male (%)	51.4	47.2	50.8	50.5	50.3
Age	47.0	47.0	47.0	47.0	47.0
Married (%)	63.3	61.3	57.0	56.5	57.8
Immigrant (%)	0.0	0.0	0.0	0.0	13.0
Descendant (%)	0.4	0.4	0.5	0.5	0.4
Income Position					
Income position	64.2	59.6	53.7	53.3	50.5
Bottom 50% (%)	28.8	36.1	45.5	46.1	50.0
Middle 40% (%)	54.3	50.1	43.7	43.2	40.0
Top 10% (%)	16.9	13.8	10.8	10.7	10.0
Education					
Primary education (%)	7.6	9.6	15.6	15.8	17.2
Upper secondary edu. (%)	5.8	5.6	5.2	5.3	5.8
Vocational education (%)	31.5	34.1	39.3	38.8	37.6
Short cycle higher edu. (%)	9.1	8.2	7.0	7.0	7.0
Bachelor's programs (%)	26.9	25.9	20.2	20.2	19.6
Master's programs (%)	19.2	16.5	12.6	12.7	12.8
Socioeconomic Status					
Self-employed (%)	3.7	4.1	6.0	5.9	6.0
Employee (%)	90.2	87.3	80.8	80.3	77.2
Unemployed (%)	1.3	1.6	1.9	2.1	2.5
Not in work force (%)	4.8	7.0	11.3	11.7	14.3
Private sector (%)	65.8	64.6	70.0	69.3	69.7
Regions					
Copenhagen (%)	31.0	30.3	29.2	29.5	31.7
Sealand (%)	16.2	16.5	16.1	15.9	15.3
Southern Denmark (%)	20.7	21.4	21.5	21.5	21.0
Middle Jutland (%)	23.1	22.7	23.4	23.0	22.4
North Jutland (%)	8.9	9.2	9.9	10.0	9.5
Parents' Income					
Mother's income position	53.1	52.1	50.6	50.5	50.2
Father's income position	53.3	52.4	50.7	50.8	50.5
Observations	9415	13686	50100	339231	389863

Notes: *Sample* are the respondents who completed the survey and are used in the analysis. *Started* are the respondents who began the survey. *Invited* are the respondents who received an invitation to participate in the survey. *Population* is the population our contact sample was drawn from. This sample was provided by Statistics Denmark and is the full population excluding immigrants. *Incl. immigrants* is the full Danish population born in 1969-1973. All variables marked with (%) are indicators.

FIGURE A-5: UNFAIRNESS VIEWS AND PERCEPTIONS OF OWN POSITION WHEN RE-WEIGHTING



Notes:

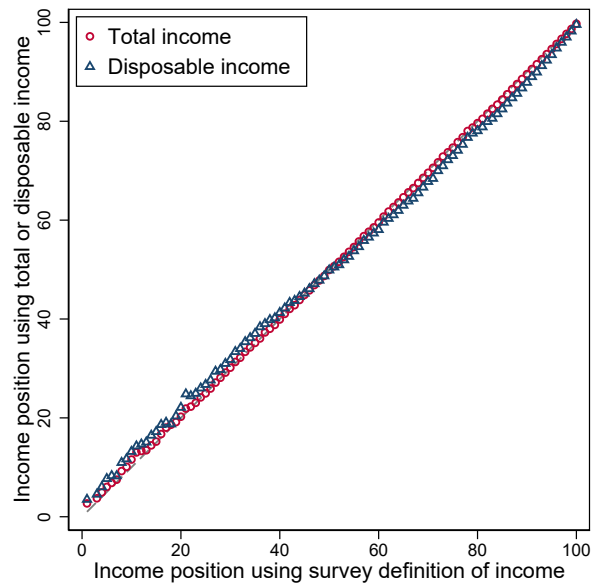
This figure is constructed by reweighting the analysis sample to match the representative sample of people invited and then redo the key results on fairness in Figure 2, panel A and the key result on perception about own position in Figure 3. The probability weights are based on the inverse of the predicted probability that an invitee completed the survey. The prediction uses income position, cohort, gender, region of residence and sector of work (incl. a category for unemployed/not in the work force) fixed effects. The graphs are very similar to the original graphs in Figure 2, panel A and Figure 3.

TABLE A-2: ATTRITION ANALYSIS

	Not in sample	
Panel A		
Treatment	0.011	(0.008)
Male	-0.083***	(0.008)
Age	0.001	(0.003)
Married	-0.021**	(0.008)
Ref.: Middle 40%		
Bottom 50 %	0.149***	(0.009)
Top 10 %	-0.060***	(0.012)
Ref.: Master's programs		
Primary education	0.157***	(0.017)
Upper secondary edu.	0.017	(0.019)
Vocational education	0.086***	(0.012)
Short-cycle higher edu.	0.014	(0.017)
Bachelor's programs	0.026*	(0.012)
Ref.: Northern Jutland		
Copenhagen	0.016	(0.015)
Sealand	-0.000	(0.016)
Southern Denmark	0.007	(0.015)
Middle Jutland	-0.014	(0.015)
Observations	13667	
Panel B		
		Share
Not in the final sample		0.312
Drop out at consent question		0.010
Drop out at income question		0.102
Drop out before treatment		0.242
Drop out after treatment		0.012
Screened out		0.049

Notes: Respondents who dropped out before the treatment, were not assigned to either the treatment or control group. We randomly assign these individuals to one of the groups. The number of observations in the regression in Panel A is 19 less than total number of people who started the survey. This is because we miss educational information for these individuals. The sum of *Drop out before treatment*, *Drop out after treatment* and *Screened out* is 30.3%. The last 0.9% are people who are assigned to the control but do not complete the survey. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

FIGURE A-6: COMPARISON OF POSITION USING DIFFERENT INCOME DEFINITIONS



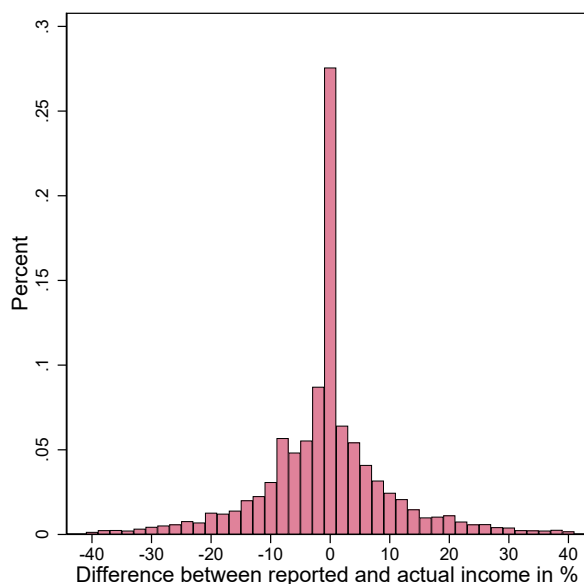
Notes: The figure uses all individuals born from 1969 to 1973 observed in the income register data. $N=389,759$. For each percentile position in the income distribution based on the survey definition of income, we plot the average percentile position in the income distribution based on either total income or disposable income of the individuals at that position. We use total income and disposable income as defined by Statistics Denmark.

TABLE A-3: TREATMENT BALANCING

	Control	Treatment	Difference	
Actual cohort position	64.003	64.370	-0.367	(0.513)
Treatment information	-5.812	-6.048	0.237	(0.335)
Cohort misperception	-5.767	-6.064	0.297	(0.353)
Left-wing	0.219	0.222	-0.003	(0.009)
Right-wing	0.236	0.241	-0.004	(0.009)
Male	0.511	0.518	-0.007	(0.010)
Age	47.058	46.998	0.060*	(0.029)
Primary education	0.077	0.075	0.001	(0.005)
Upper secondary education	0.061	0.054	0.007	(0.005)
Vocational education	0.317	0.312	0.005	(0.010)
Short-cycle higher education	0.090	0.091	-0.001	(0.006)
Bachelor's programs	0.264	0.274	-0.010	(0.009)
Master's programs	0.190	0.193	-0.003	(0.008)
Self-employed	0.037	0.037	0.000	(0.004)
Employee	0.901	0.903	-0.002	(0.006)
Unemployed	0.013	0.013	-0.000	(0.002)
Private sector	0.660	0.657	0.003	(0.010)
Not in work force	0.049	0.047	0.002	(0.004)
Copenhagen	0.087	0.086	0.001	(0.006)
Sealand	0.237	0.229	0.008	(0.009)
Southern Denmark	0.199	0.215	-0.016	(0.008)
Middle Jutland	0.312	0.308	0.004	(0.010)
Northern Jutland	0.164	0.161	0.003	(0.008)
<i>N</i>			9415	

Notes: Column 1 and 2 show the group means of the variables. Column 3 shows the difference. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

FIGURE A-7: RELATIVE DIFFERENCE BETWEEN REPORTED AND ACTUAL INCOME

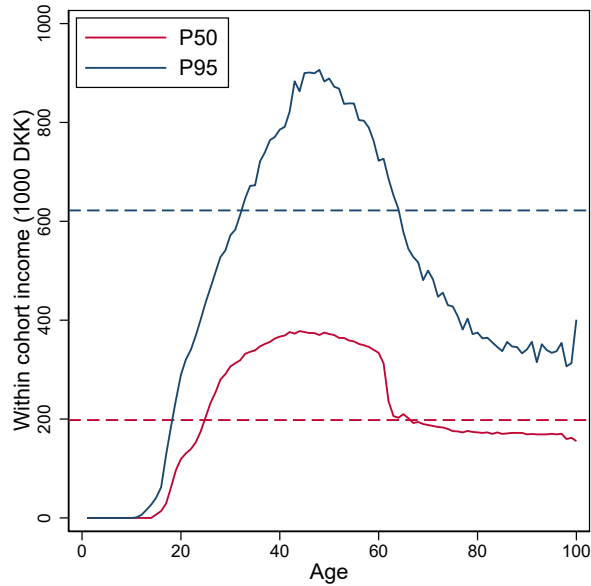


Notes: The panel shows a histogram of the relative difference between reported and actual income in %. The bin width is 2 and the plot is truncated at ± 41 . We see a small spike at a reported income 8-9% below actual income. Respondents are asked to report their income including labor-market contribution, which is 8% of income before taxes; a few respondents seem to report their income excluding these contributions. The spike at zero suggests that some of the respondents have checked their actual income on the tax return when answering the survey.

TABLE A-4: MATCH BETWEEN SURVEY RESPONSE AND REGISTER DATA

	N	Share
Correct cohort	9,415	1.00
Correct gender	9,415	1.00
Correct municipality	9,239	0.98
Correct level of education	6,958	0.74
Correct sector	6,768	0.72
All correct	4,952	0.53

FIGURE A-8: WITHIN COHORT P50 AND P95 BY AGE



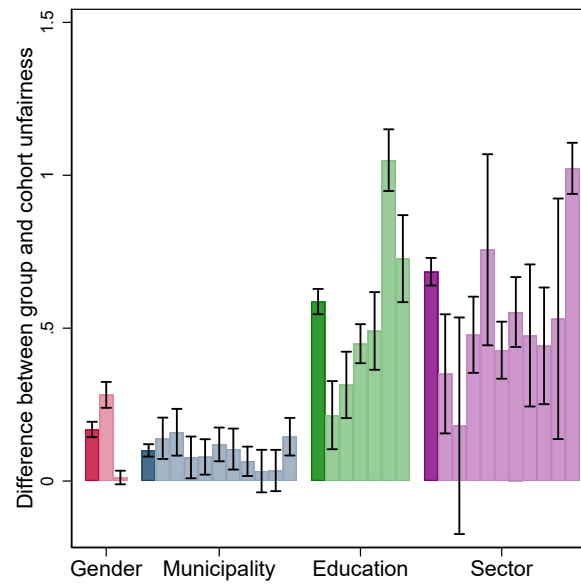
Notes: This figure shows the within cohort P50 and P95 income based on a 10% sample of the full population in Denmark. We use the same income definition as in the survey which excludes early retirement benefits, since the cohorts surveyed are not yet eligible for this benefit. The age cut-off for early retirement benefits is 60 and therefore we see a sharp drop at this age. We include pension payments, since we cannot disentangle old-age pension and disability pension.

TABLE A-5: MOMENTS IN THE FULL INCOME DISTRIBUTION

	Income distribution percentiles				
	P5	P25	P50	P75	P95
Full population	0	57	198	358	622
Adult population	36	158	261	394	670
Working age population	39	217	333	447	751
45- to 50-year-olds	112	262	373	502	896

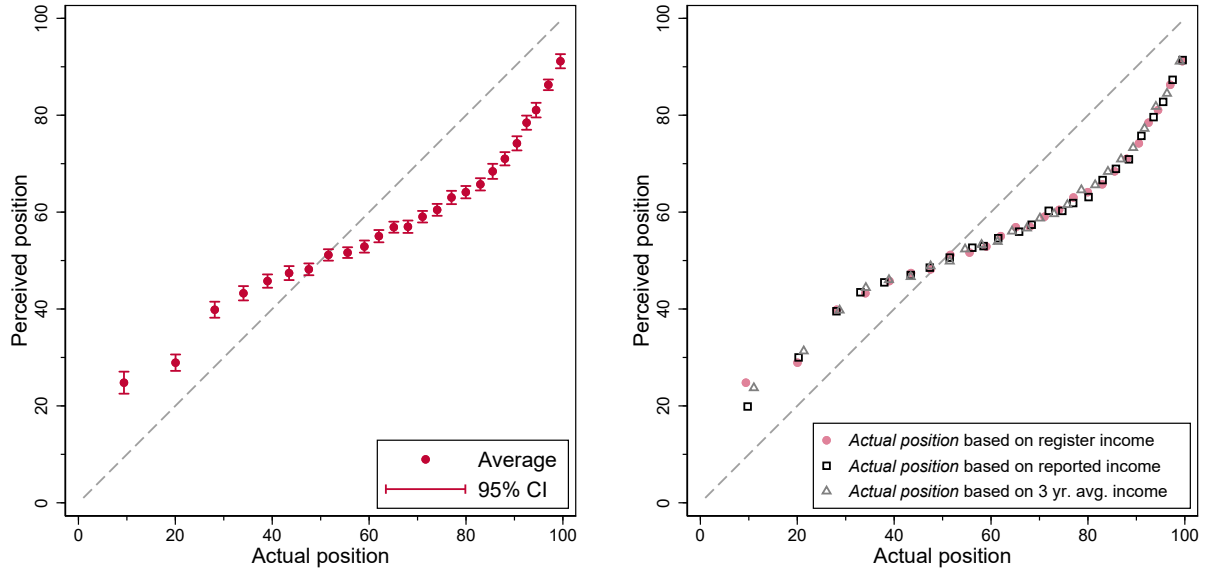
Notes: This table shows different moments of the income distribution in 1,000 DKK based of different definitions of the population. The moments are based on a 10% sample of the full population in Denmark in 2017. *Adult population* are individuals from age 18 and up. *Working age population* are from age 25 to 65.

FIGURE A-9: DIFFERENCES IN VIEWS ON UNFAIRNESS OF INEQUALITY BETWEEN LARGE REFERENCE GROUPS AND COHORT



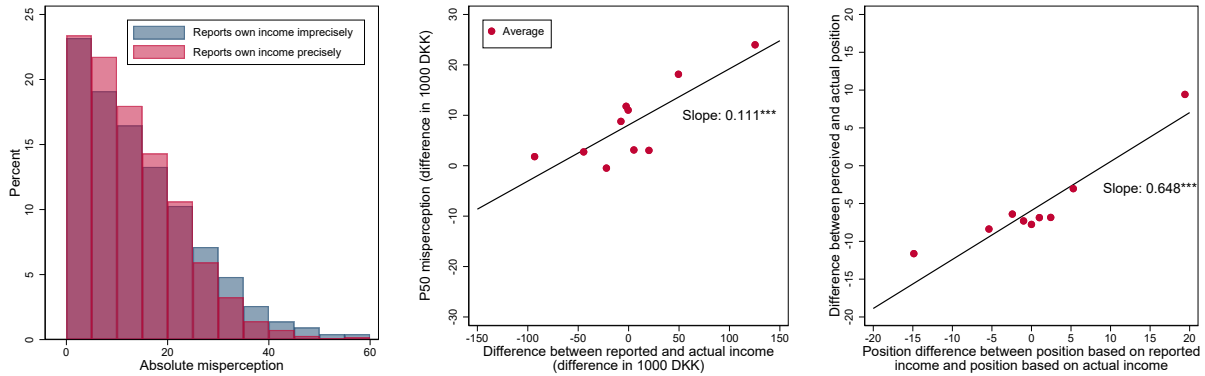
Notes: The figure uses only responses from the control group. The panel shows the unfairness views for the large reference groups (darker color) as well as the specific reference groups, i.e. men and women for *Gender* (lighter color), relative to cohort unfairness views. For municipality we do not show the difference for each municipality, but group the municipalities into 10 groups based on the P50 income level in the municipality. We control for actual income position linearly (normalized such that P50 is the constant in the regression).

FIGURE A-10: PERCEIVED POSITION WITHIN COHORT
(A) WITH CONFIDENCE BANDS (B) ACTUAL INCOME MEASURES



Notes: The left panel is a bin scatter of the average perceived position by actual position (in 25 equal-sized bins) with 95% confidence bands using robust standard errors. In the right panel, actual position is either based on the actual income observed on the tax return, the income reported in the survey, or a three-year average of actual income.

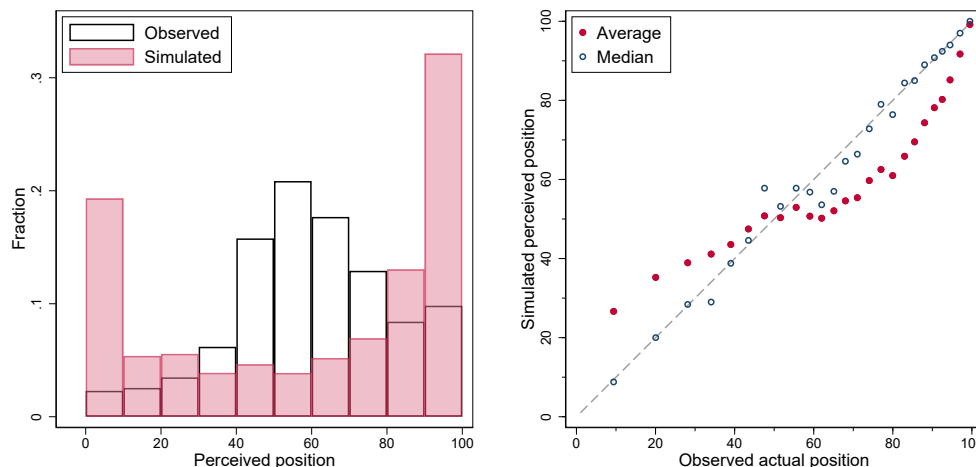
FIGURE A-11: MISPERCEPTION OF OWN INCOME AND OWN POSITION
(A) DISTRIBUTION (B) P50 MISPERCEPTION (C) OWN POSITION



Notes: Panel A shows the distribution of absolute misperceptions. We split the sample into people whose perceived income is within a 5% error band of the actual income, *Reports own income precisely*, and those whose perceived income is more than 5% above or below the actual income, *Reports own income imprecisely*. Panel B shows a binned scatter of the average misperception in P50 by difference between reported and actual income. The line illustrates the predicted relationship from an OLS regression. Panel C shows a binned scatter of the average misperception of cohort position by the difference between actual position based on reported income and actual position based on actual income. The line illustrates the predicted relationship from an OLS regression.

FIGURE A-12: SIMULATION: LINK BETWEEN MISPERCEPTIONS OF THE INCOME DISTRIBUTION AND MISPERCEPTION OF OWN INCOME POSITION

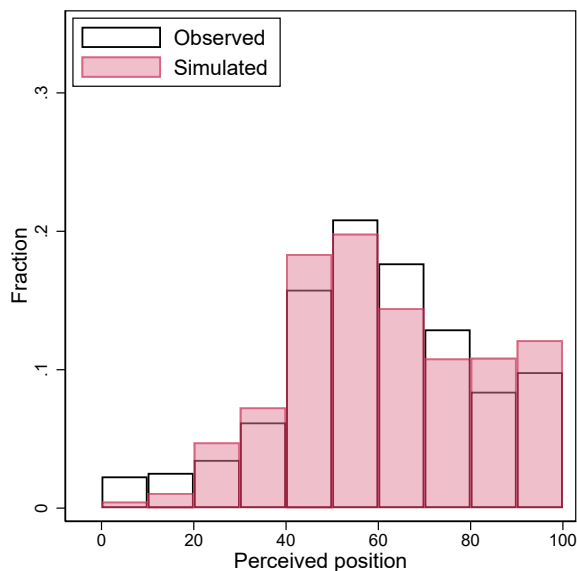
(A) DISTRIBUTION OF ACTUAL AND (B) RELATION TO ACTUAL POSITION
SIMULATED PERCEPTIONS



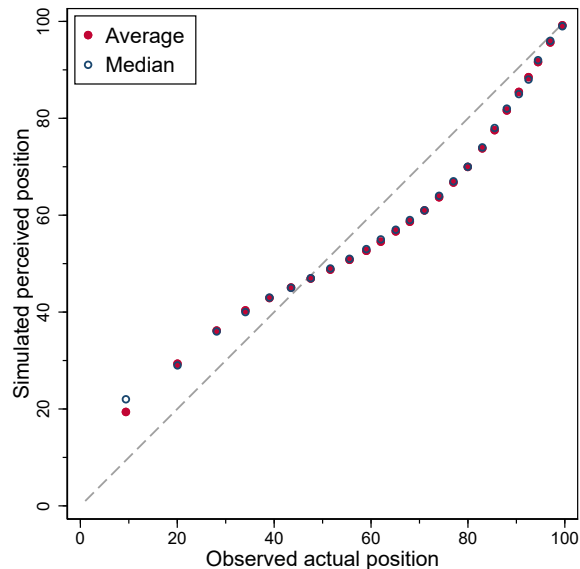
Notes: This figure illustrates that idiosyncratic misperceptions of the income distribution cannot explain the inverted S-shape of perceived own income positions in Figure 3. For each individual, we draw μ from a normal distribution with the same standard deviation as $\hat{\mu}$ obtained from the estimation underlying Appendix Figure A-13. We generate the respondents' (simulated) perceived positions by assuming they know their own income perfectly and add μ to the actual percentile limits in the cohort income distribution and use these “noisy” distributions to place the respondents in the distribution. The left panel shows the distribution of perceived positions among the respondents (*Actual*) and the distribution of perceived positions based on the simulated perceptions (*Simulated*). The two distributions are not aligned. The right panel shows bin scatters of the average and median perceived position by actual position in 25 equally sized bins as in Figure 3. *Actual position* is based on the income from the tax return and *Perceived position* is based on the simulation. While the simulated average perceptions exhibit an inverted S-shape, the medians lie closely to the 45⁰-line, in contrast to the inverted S-shape of the medians in Figure 3.

FIGURE A-13: SIMULATION: LINK BETWEEN MISPERCEPTIONS OF THE INCOME DISTRIBUTION AND MISPERCEPTION OF OWN INCOME POSITION

(A) DISTRIBUTION OF ACTUAL AND SIMULATED PERCEPTIONS



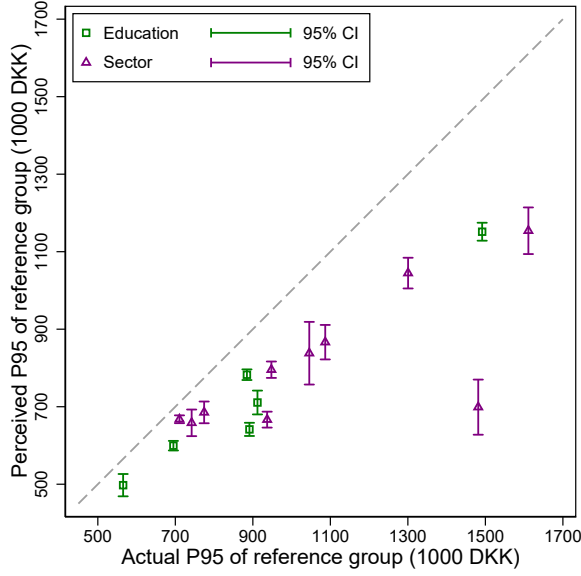
(B) RELATION TO ACTUAL POSITION



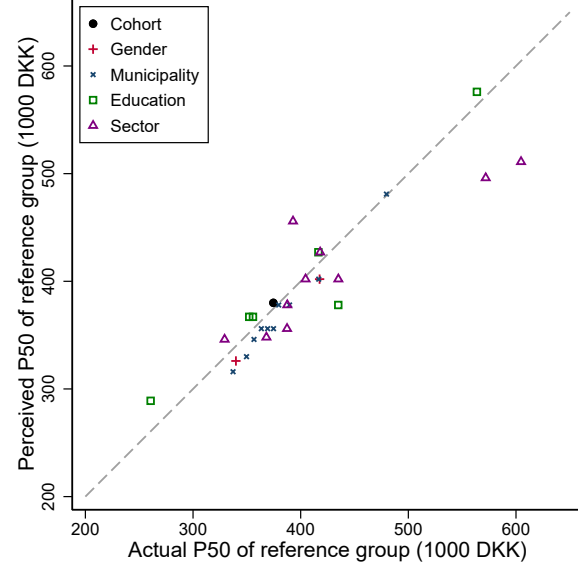
Notes: This figure illustrates how systematic misperceptions of the income distribution (P50 and P95) lead to misperceptions of own income position. To generate the simulated perceived position, we first generate a noise term from the actual data, $\varepsilon = 0.5\text{Misperception}_{P50} + 0.5\text{Misperception}_{P95}$, where $\text{Misperception}_{P50}$ and $\text{Misperception}_{P95}$ are the misperceptions of P50 and P95 in the cohort in DKK (both winzorized at the 5th and 95th percentile within actual position percentile). We then estimate the systematic part of the noise by predicting $\hat{\varepsilon}_i$ from the following OLS regression: $\varepsilon_i = \beta_0 + \beta_1 \text{Actual position}_i + \mu$. Finally, we generate the respondents' (simulated) perceived positions by assuming they know their incomes perfectly and add $\hat{\varepsilon}_i$ to the actual percentile limits in the cohort income distribution and use this “noisy” distribution to place the respondents in the distribution. The left panel shows the distribution of perceived positions among the respondents (*Actual*) and the distribution of perceived positions based on the simulated perceptions (*Simulated*). They align reasonably well. The right panel shows a bin scatter of the average and median perceived position by actual position in 25 equally sized bins as in Figure 3. *Actual position* is based on the income from the tax return and *Perceived position* is based on the simulation. The simulated median and average perceptions by actual position both exhibit an inverted S-shape like in Figure 3.

FIGURE A-14: DISTRIBUTION OF P50 MISPERCEPTIONS AND MEDIAN PERCEIVED P50 AND P95 INCOMES FOR LARGE REFERENCE GROUPS

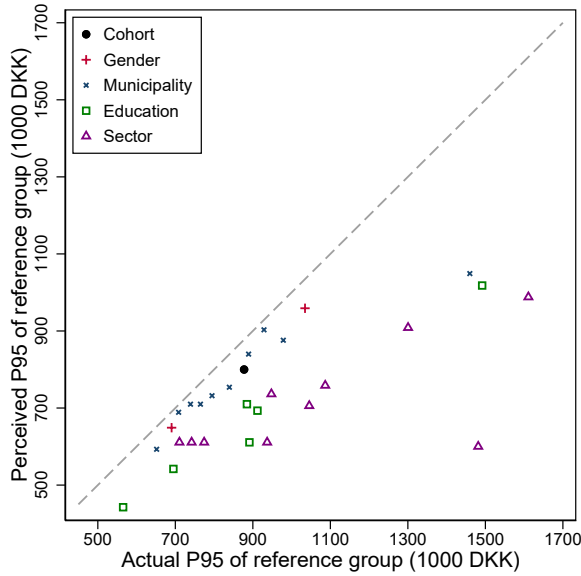
(A) P95 WITH CONFIDENCE BANDS



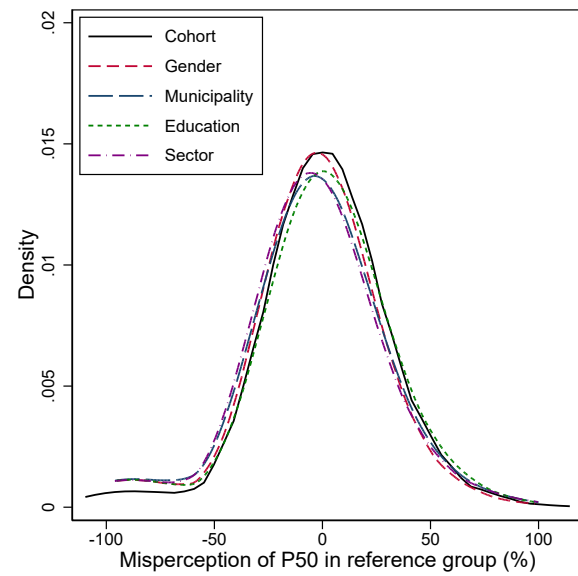
(B) P50 WITH MEDIAN



(C) P95 WITH MEDIAN

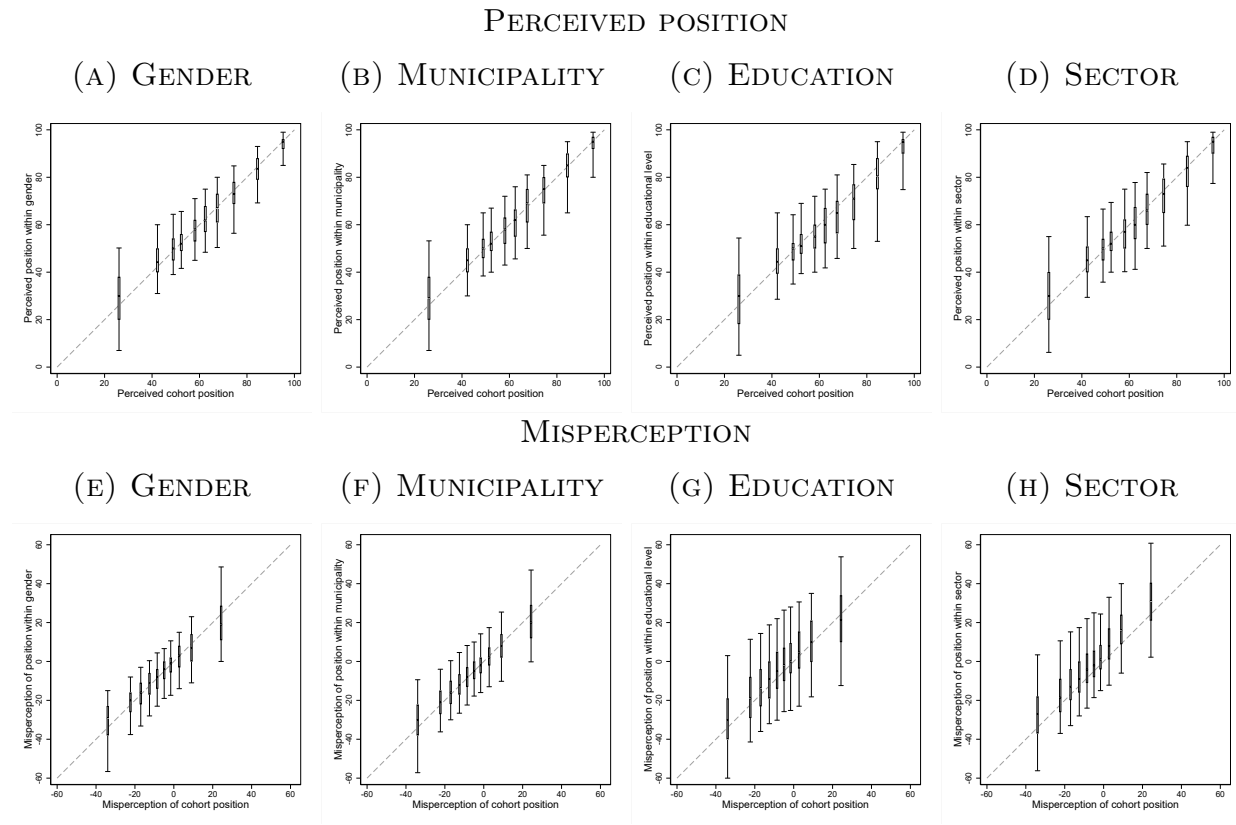


(D) DISTRIBUTION



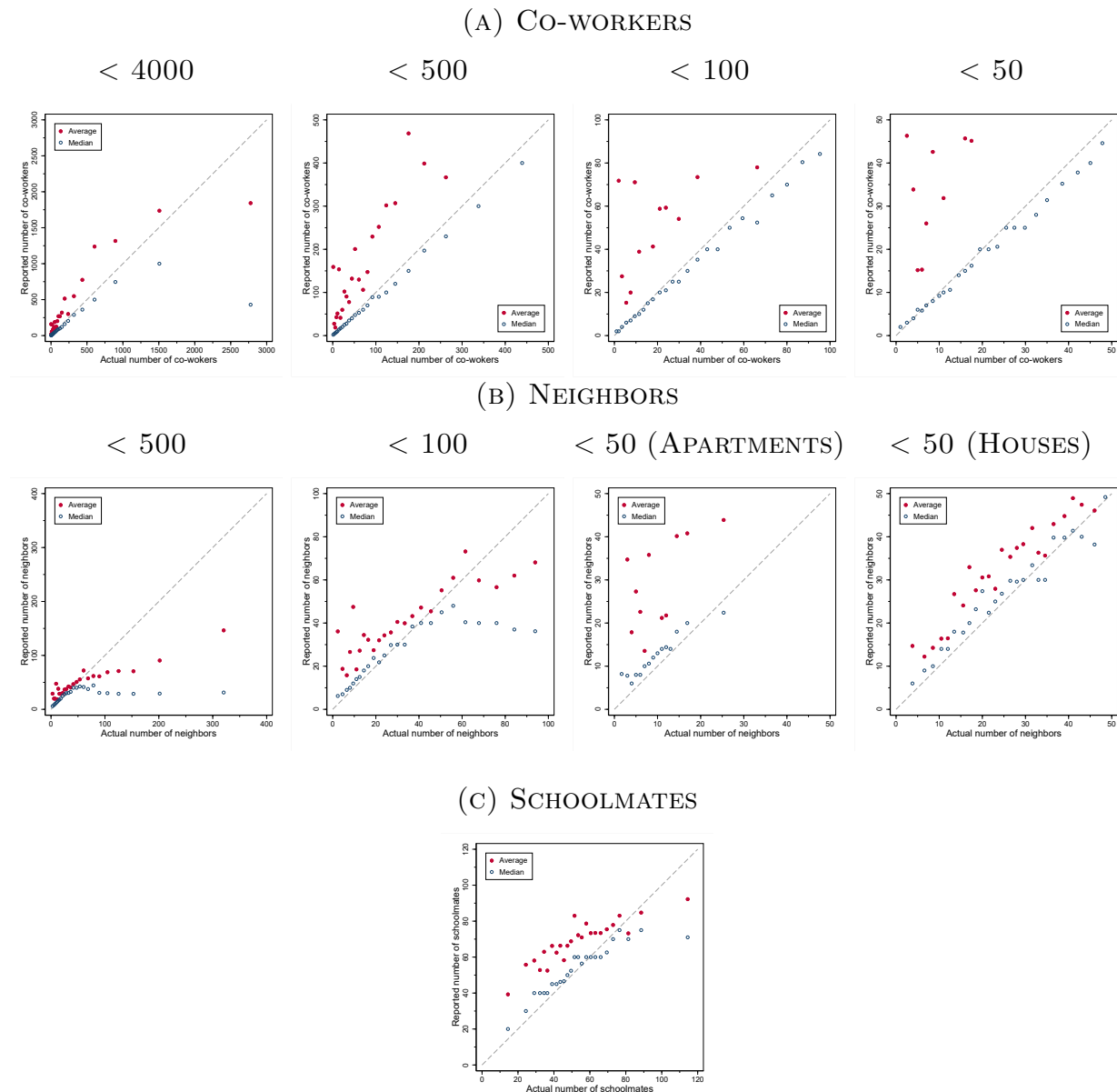
Notes: The top left panel shows the averages for the education and sector groups is in Figure 6 and includes the 95% confidence bands based on the robust standard errors. In the top right and bottom left panels, we show bin medians instead of bin means using the same sample as in Figure 6. For gender, we show one scatter for men and one for women. For municipality we divide the respondents into 10 similar-sized groups based on the actual municipality P50 and P95 income and plot one scatter for each group. For education and sector we show one scatter for each educational level or sector. In the bottom right panel, we show the distributions of P50 misperceptions in the large reference groups. The distributions are smoothed using Epanechnikov kernels with a bandwidth of 15.

FIGURE A-15: VARIATION IN PERCEIVED POSITION AND MISPERCEPTION ACROSS LARGE REFERENCE GROUPS



Notes: This figure shows 5th, 25th, 50th, 75th and 95th percentile of reported position within the large reference group by bins of perceived cohort position in the top row, and misperception of own position within the large reference group by bins of misperception of cohort position in the bottom row.

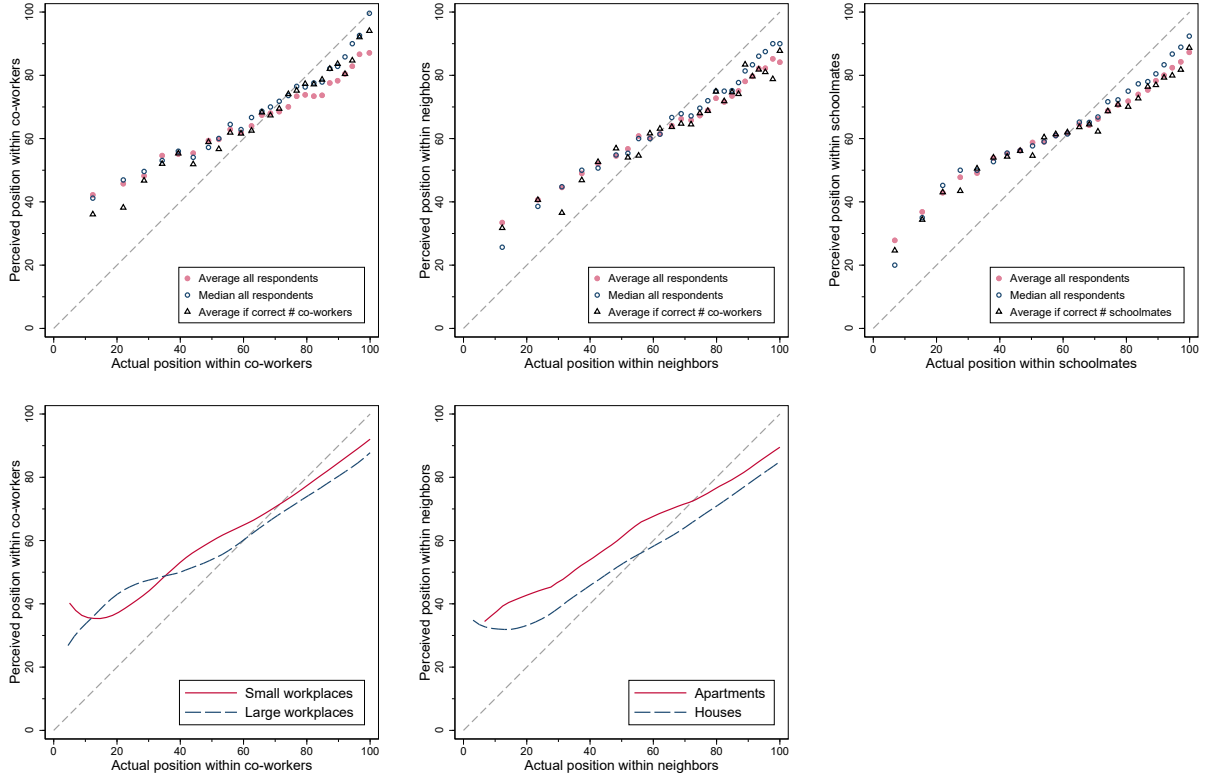
FIGURE A-16: ACTUAL AND REPORTED NUMBER OF PEOPLE IN SMALL REFERENCE GROUPS



Notes: The figures show bin scatters of the reported number of co-workers by the actual number of co-workers. In each panel, the sample is restricted to observations where the *Actual number of co-workers* is below a certain threshold. All observations are used to calculate the bin averages but the panels only show the averages if they are smaller than the threshold. There are 25 bins in each panel (15 in the third panel in B) and there are the same number of observations behind each bin. The bin averages are only plotted if they are lower than the maximum actual number. For *Schoolmates*, the figure is based on respondents enrolled in Basic School at age 15. The figure excludes observations from one very large school.

FIGURE A-17: PERCEIVED POSITION IN SMALL REFERENCE GROUPS

CO-WORKERS NEIGHBORS SCHOOLMATES



Notes: There are 25 bins in each panel. They are of equal size, except the top bin for co-workers and neighbors in the top panels, which have more observations. The top panels show similar patterns as in figure 9, using medians instead of averages or restricting the sample to respondents who report a number of people in the small reference group that matches the number observed in the register data $\pm 10\%$. In the bottom panels, the local linear polynomials have a bandwidth of 10 and are based on the respondents who report the correct number of people in the reference group $\pm 10\%$. Small workplaces have 10 to 100 employees. Large workplaces have more than 100 employees.

TABLE A-6: PERCEPTIONS REGRESSED ON INDIVIDUAL CHARACTERISTICS

	A. Top 25% most inaccurate			B. Top 25% most accurate			C. Positive misperception		
	Position	P50	P95	Position	P50	P95	Position	P50	P95
Male	-4.4*** (1.0)	-5.9*** (1.0)	-5.9*** (1.1)	5.1*** (1.0)	2.3* (1.1)	8.1*** (1.1)	4.1*** (0.9)	-0.5 (1.2)	3.6** (1.2)
Children	-1.2 (1.0)	0.9 (1.1)	-1.0 (1.1)	2.1* (1.0)	-0.6 (1.1)	0.8 (1.1)	0.8 (1.0)	0.4 (1.2)	1.2 (1.2)
Partner	-2.0 (1.2)	0.1 (1.2)	1.0 (1.2)	-0.1 (1.2)	0.1 (1.2)	1.0 (1.2)	0.5 (1.1)	-0.3 (1.4)	0.1 (1.3)
High-income partner	1.4 (1.2)	-3.3* (1.3)	-3.3* (1.3)	0.7 (1.3)	2.6 (1.4)	2.3 (1.4)	5.1*** (1.3)	-2.3 (1.5)	-0.4 (1.5)
Ref. Father mid 50%									
Bottom 25%	-0.9 (1.1)	-1.0 (1.1)	0.2 (1.2)	1.3 (1.1)	-1.1 (1.2)	0.7 (1.2)	-0.1 (1.1)	-0.6 (1.3)	0.8 (1.3)
Top 25%	-2.1* (1.0)	-0.4 (1.1)	0.6 (1.1)	2.4* (1.1)	0.5 (1.1)	2.6* (1.2)	0.7 (1.0)	0.7 (1.2)	5.1*** (1.2)
Ref. Moderate									
Left wing	-1.8 (1.1)	0.2 (1.1)	2.5* (1.2)	1.6 (1.1)	1.1 (1.2)	2.6* (1.2)	-1.6 (1.1)	-1.5 (1.3)	4.3*** (1.3)
Right wing	-2.9** (1.1)	-1.6 (1.1)	-0.3 (1.1)	2.9* (1.1)	1.0 (1.2)	-0.1 (1.2)	3.3** (1.0)	-1.8 (1.3)	3.1* (1.3)
Ref. Nothern Jutland									
Middle Jutland	-1.3 (1.7)	3.1 (1.7)	2.8 (1.7)	0.7 (1.8)	1.4 (1.8)	0.3 (1.8)	-3.5* (1.6)	2.7 (2.0)	3.8* (1.9)
Southern Denmark	-2.0 (1.7)	2.9 (1.7)	2.8 (1.8)	0.7 (1.8)	0.0 (1.8)	-1.4 (1.8)	-1.7 (1.7)	0.2 (2.0)	2.4 (2.0)
Sealand	-0.7 (1.6)	4.6** (1.7)	2.6 (1.7)	1.3 (1.7)	-0.3 (1.7)	0.3 (1.8)	-2.1 (1.6)	4.8* (2.0)	5.2** (1.9)
Copenhagen Area	-0.9 (1.8)	4.1* (1.8)	2.0 (1.8)	-0.4 (1.9)	-1.3 (1.9)	1.1 (1.9)	-1.8 (1.7)	0.8 (2.1)	3.4 (2.0)
Ref. Basic edu.									
Vocational education	-8.8*** (2.5)	-4.6 (2.6)	-3.1 (2.6)	1.6 (2.4)	-1.5 (2.4)	5.7* (2.6)	-2.3 (2.4)	12.6*** (2.8)	15.9*** (2.8)
Upper secondary edu.	-5.5** (1.8)	-4.7* (1.9)	-1.6 (1.9)	3.0 (1.8)	2.0 (1.8)	1.6 (1.8)	-0.7 (1.8)	7.1*** (2.0)	6.8*** (1.9)
Short-cycle higher edu.	-6.5** (2.3)	-8.9*** (2.3)	-5.2* (2.2)	2.6 (2.2)	1.4 (2.3)	7.5** (2.3)	-0.6 (2.1)	9.3*** (2.6)	8.5*** (2.4)
Bachelor's programs	-8.8*** (2.0)	-7.7*** (2.1)	-4.1* (2.1)	5.1** (2.0)	1.5 (2.0)	5.8** (2.0)	1.2 (2.0)	9.3*** (2.3)	15.1*** (2.2)
Master's programs and PhD	-17.2*** (2.2)	-13.2*** (2.2)	-3.3 (2.2)	11.7*** (2.2)	4.9* (2.2)	6.1** (2.2)	5.4** (2.1)	6.3* (2.5)	20.5*** (2.4)

Continues on next page.

TABLE A-6 CONTINUED

	A. Top 25% most inaccurate			B. Top 25% most accurate			C. Positive misperception		
	Position	P50	P95	Position	P50	P95	Position	P50	P95
Ref. Unemployed									
Construction	2.3 (3.2)	-0.7 (3.3)	-2.7 (3.3)	0.1 (3.3)	-4.8 (3.3)	-3.6 (3.3)	6.7* (3.2)	6.2 (3.7)	1.7 (3.6)
Real estate activities	5.4 (4.7)	-1.9 (4.5)	-5.2 (4.6)	-1.2 (4.8)	-6.1 (4.6)	-1.3 (4.7)	11.1* (4.6)	-6.0 (5.2)	-3.5 (5.2)
Business service	4.6 (2.7)	2.0 (2.7)	-1.1 (2.7)	-2.8 (2.7)	-2.5 (2.7)	-0.4 (2.7)	4.4 (2.6)	7.3* (3.0)	1.3 (2.9)
Finance and insurance	-1.4 (3.2)	0.9 (3.3)	-5.1 (3.2)	3.2 (3.3)	-6.1 (3.3)	4.0 (3.4)	7.1* (3.1)	5.8 (3.7)	3.7 (3.6)
Trade and transport	4.4 (2.6)	2.4 (2.6)	-1.1 (2.7)	-2.1 (2.6)	-3.8 (2.6)	-2.4 (2.6)	7.4** (2.5)	3.7 (2.8)	-2.8 (2.8)
Manufacturing	3.7 (2.7)	1.9 (2.7)	-0.5 (2.7)	-1.6 (2.7)	-4.6 (2.7)	-2.1 (2.7)	6.0* (2.6)	7.3* (2.9)	0.6 (2.9)
Information and comm.	-2.1 (3.0)	-1.5 (3.1)	-4.2 (3.1)	0.7 (3.1)	-3.9 (3.1)	-1.4 (3.2)	9.3** (2.9)	2.4 (3.4)	0.2 (3.4)
Culture and leisure	-0.3 (3.2)	-2.8 (3.3)	-4.0 (3.3)	6.4 (3.3)	0.6 (3.3)	0.3 (3.3)	7.5* (3.1)	1.1 (3.7)	-4.2 (3.6)
Agriculture	7.6 (5.6)	-11.2* (4.7)	-7.6 (4.9)	-5.7 (5.2)	3.7 (5.5)	1.4 (5.4)	9.0 (4.7)	6.0 (6.0)	7.2 (5.9)
Public adm., edu. & health	1.5 (2.6)	-3.1 (2.6)	-2.6 (2.6)	-1.0 (2.6)	0.4 (2.5)	-0.5 (2.5)	5.0* (2.6)	5.5 (2.8)	-0.9 (2.8)
Ref. Academic occupation									
Vocational occupation	1.4 (1.1)	0.5 (1.1)	-0.2 (1.1)	-0.5 (1.1)	0.0 (1.1)	-2.5* (1.1)	-2.9** (1.0)	0.6 (1.2)	-2.2 (1.2)
Ref. Public sector									
Private sector	-0.3 (1.4)	-2.8 (1.4)	-0.2 (1.5)	0.3 (1.5)	3.3* (1.5)	-0.3 (1.5)	1.7 (1.4)	1.7 (1.7)	2.0 (1.6)
N	9415	9415	9415	9415	9415	9415	9415	9415	9415
R^2	0.093	0.035	0.029	0.088	0.023	0.058	0.300	0.070	0.111
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Actual position FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: In Panel A (respectively, Panel B), the outcomes are indicator variables equal to 1 if the respondent is among the 25% of respondents with the largest (respectively, smallest) misperceptions for each variable. In Panel C, the outcome is an indicator for having positive misperceptions (> 0). All explanatory variables are indicators. See Figure 10 for details. The *Actual position FE* is fixed effects for all 100 positions in the cohort income distribution. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-7: PERCEPTIONS REGRESSED ON INDIVIDUAL CHARACTERISTICS

	A. Top 25% most inaccurate			B. Top 25% most accurate			C. Positive misperception		
	School	Road	Work	School	Road	Work	School	Road	Work
High IQR	-2.6** (0.9)	0.8 (1.1)	-2.6* (1.1)	1.6 (1.0)	-0.6 (1.1)	2.6* (1.1)	0.1 (0.9)	-3.2** (1.2)	-2.9* (1.3)
Large group	-0.8 (0.9)	-0.7 (1.1)	1.7 (1.0)	2.4** (0.9)	-0.7 (1.1)	-2.0* (1.0)	-0.1 (0.9)	-2.8* (1.2)	-7.8*** (1.2)
High-income group	1.1 (0.9)	-3.2** (1.2)	-2.5* (1.2)	1.0 (1.0)	2.0 (1.2)	0.6 (1.2)	5.1*** (1.0)	1.8 (1.3)	0.1 (1.3)
+3 years same place		-3.4* (1.5)	-2.1* (1.0)		2.7 (1.4)	1.1 (1.0)		-0.5 (1.6)	0.1 (1.1)
Long road		2.9* (1.1)			-2.4* (1.1)			-2.8* (1.2)	
Higher house position		1.7 (2.3)			-3.2 (1.9)			3.7 (2.2)	
Higher car position		4.4 (2.3)			-2.6 (1.9)			5.3* (2.2)	
Managerial role			-6.7*** (1.5)			10.2*** (2.1)			18.4*** (2.2)
High unionization rate			-4.8** (1.9)			4.8** (1.8)			1.6 (2.1)
Male	-0.4 (1.0)	-0.1 (1.2)	0.8 (1.1)	0.9 (1.0)	2.2 (1.2)	-0.3 (1.1)	5.6*** (1.0)	5.1*** (1.3)	6.8*** (1.3)
Children	0.6 (1.1)	1.3 (1.3)	0.8 (1.1)	-0.3 (1.0)	-0.9 (1.3)	-0.3 (1.1)	0.2 (1.1)	0.5 (1.4)	2.8* (1.3)
Partner	0.2 (1.2)	-1.3 (1.5)	0.4 (1.3)	2.9* (1.2)	1.9 (1.5)	0.7 (1.3)	-0.9 (1.2)	-6.3*** (1.7)	2.0 (1.5)
High-income partner	0.6 (1.3)	-0.4 (1.5)	2.0 (1.5)	-1.0 (1.3)	-1.1 (1.4)	-1.8 (1.4)	4.8*** (1.3)	0.5 (1.6)	-0.3 (1.6)
Ref. Father mid 50% Bottom 25%	-1.0 (1.1)	1.5 (1.3)	-0.3 (1.3)	-0.1 (1.2)	-0.3 (1.3)	0.1 (1.2)	0.2 (1.1)	-1.6 (1.4)	0.1 (1.4)
Top 25%	-0.4 (1.1)	0.7 (1.2)	-1.7 (1.1)	-0.4 (1.1)	0.0 (1.2)	-1.3 (1.2)	-0.8 (1.1)	-1.0 (1.3)	2.4 (1.3)
Ref. Moderate Left wing	-0.6 (1.1)	-0.8 (1.4)	0.5 (1.3)	0.7 (1.2)	0.4 (1.3)	-1.4 (1.2)	0.4 (1.2)	0.3 (1.5)	-2.4 (1.4)
Right wing	-0.7 (1.1)	-4.0*** (1.2)	-1.4 (1.2)	3.6** (1.2)	2.8* (1.3)	1.7 (1.2)	4.4*** (1.1)	3.9** (1.4)	2.0 (1.4)
Ref. Nothern Jutland Middle Jutland	-2.1 (1.7)	-0.1 (1.9)	-0.5 (1.9)	0.4 (1.7)	4.0* (1.8)	0.0 (1.9)	-1.8 (1.7)	-2.6 (2.0)	-1.0 (2.1)
Southern Denmark	-1.6 (1.8)	-1.1 (1.9)	-1.8 (2.0)	0.5 (1.8)	2.7 (1.9)	2.3 (1.9)	-2.4 (1.7)	-1.3 (2.1)	1.1 (2.1)
Sealand	-0.5 (1.7)	1.4 (2.0)	-2.0 (1.9)	0.7 (1.7)	1.9 (1.9)	4.0* (1.9)	-0.3 (1.7)	-2.5 (2.2)	-1.2 (2.1)
Copenhagen Area	-1.4 (1.9)	-0.1 (2.0)	-0.5 (2.1)	-0.5 (1.8)	3.5 (2.0)	0.6 (2.0)	-1.5 (1.8)	-0.1 (2.2)	0.7 (2.2)

Continues on next page.

TABLE A-7 CONTINUED

	A. Top 25% most inaccurate			B. Top 25% most accurate			C. Positive misperception		
	School	Road	Work	School	Road	Work	School	Road	Work
Ref. Basic edu.									
Vocational education	-3.6 (2.7)	-8.2** (3.1)	-7.5* (3.1)	1.2 (2.5)	1.7 (3.0)	7.3** (2.7)	2.8 (2.6)	1.5 (3.2)	3.0 (3.3)
Upper secondary edu.	-0.7 (2.0)	-2.7 (2.3)	-5.7* (2.4)	1.2 (1.7)	-1.7 (2.1)	4.7* (1.8)	2.9 (1.8)	1.1 (2.3)	0.9 (2.3)
Short-cycle higher edu.	-0.4 (2.4)	-5.1 (2.7)	-5.9* (2.8)	-1.1 (2.2)	1.2 (2.6)	5.0* (2.3)	4.2 (2.2)	2.2 (2.8)	2.6 (2.8)
Bachelor's programs	-2.7 (2.2)	-4.7 (2.5)	-7.2** (2.6)	3.0 (2.0)	-1.2 (2.3)	4.9* (2.1)	9.5*** (2.0)	6.0* (2.5)	7.5** (2.6)
Master's programs and PhD	-6.1** (2.3)	-9.8*** (2.6)	-10.7*** (2.7)	8.6*** (2.2)	3.3 (2.5)	9.1*** (2.3)	19.9*** (2.2)	13.0*** (2.7)	11.1*** (2.8)
Ref. Construction									
Real estate activities	2.8 (4.7)	5.2 (5.6)	11.6 (6.2)	-0.2 (4.5)	0.4 (5.5)	0.4 (5.5)	-0.2 (4.4)	2.0 (5.6)	0.7 (6.4)
Business service	1.6 (2.8)	3.2 (3.1)	-0.6 (3.2)	-2.0 (2.7)	-6.4* (3.1)	1.5 (2.9)	0.5 (2.7)	-1.9 (3.3)	-5.3 (3.3)
Finance and insurance	-1.7 (3.1)	-5.1 (3.3)	-4.5 (3.5)	0.1 (3.3)	4.0 (3.9)	3.3 (3.4)	2.3 (3.3)	3.6 (4.0)	-2.0 (3.8)
Trade and transport	1.3 (2.7)	2.1 (2.9)	-1.6 (3.0)	-1.0 (2.5)	-3.1 (2.9)	1.2 (2.7)	-0.3 (2.5)	0.9 (3.1)	0.0 (3.1)
Manufacturing	1.2 (2.7)	-0.5 (2.9)	-1.5 (3.0)	-0.2 (2.6)	-3.1 (3.0)	3.5 (2.7)	-1.7 (2.6)	-0.9 (3.1)	-2.2 (3.1)
Information and comm.	-1.6 (3.0)	2.1 (3.4)	-3.0 (3.4)	2.7 (3.2)	-0.0 (3.7)	5.2 (3.4)	3.6 (3.1)	1.4 (3.8)	1.0 (3.7)
Culture and leisure	2.9 (3.4)	-2.1 (3.9)	-0.7 (3.8)	0.7 (3.4)	-1.2 (4.0)	-2.6 (3.7)	1.4 (3.4)	-0.5 (4.2)	1.1 (4.3)
Agriculture	-2.6 (5.6)	7.3 (7.0)	-3.6 (7.4)	-7.7 (4.8)	-9.6 (5.4)	11.7 (8.2)	5.6 (5.3)	2.9 (6.6)	7.2 (9.7)
Public adm., edu. & health	3.1 (2.9)	3.9 (3.2)	2.2 (3.3)	-0.7 (2.7)	-2.2 (3.2)	-0.8 (3.0)	-3.5 (2.8)	-2.6 (3.4)	-3.5 (3.4)
Unemployed	-10.2** (3.4)	-1.8 (3.9)		3.7 (3.1)	-1.9 (3.6)		-11.3*** (3.2)	-8.9* (4.1)	
Ref. Academic occupation									
Vocational occupation	-0.1 (1.1)	1.4 (1.2)	3.1* (1.2)	0.5 (1.1)	-1.0 (1.2)	0.7 (1.2)	-0.7 (1.1)	-0.3 (1.3)	-2.7 (1.4)
Ref. Public sector									
Private sector	2.4 (1.5)	2.6 (1.8)	1.2 (1.8)	-0.5 (1.5)	1.0 (1.6)	-3.6* (1.7)	2.3 (1.5)	3.8* (1.8)	-1.7 (2.0)
N	9070	7203	7546	9070	7203	7546	9070	7203	7546
R^2	0.102	0.057	0.123	0.049	0.051	0.122	0.312	0.167	0.171
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Actual position FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

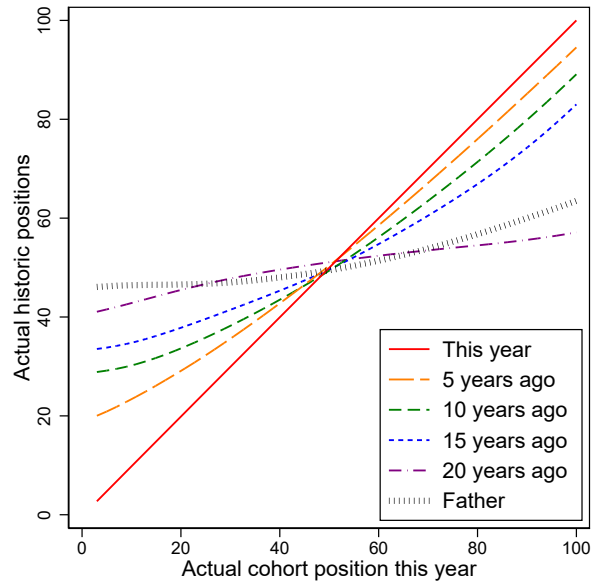
Notes: In Panel A (respectively, Panel B), the outcomes are indicator variables equal to 1 if the respondent is among the 25% of respondents with the largest (respectively, smallest) misperceptions of own position within each group. In Panel C, the outcome is an indicator for having positive misperceptions (> 0). All explanatory variables are indicators. See Figure 10 and 11 for details. The *Actual position FE* is fixed effects for all 100 positions in the income distribution of the group. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-8: SURVEY INFORMATION EXPERIMENT AND UNFAIRNESS VIEWS USING RESPONDENT WHOSE REPORTED INCOME MATCHES OBSERVED INCOME

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A					
Treatment (=1)	0.082* (0.034)	0.063 (0.038)	0.073* (0.036)	0.039 (0.041)	0.049 (0.042)
Panel B					
Positive misperception	-0.051 (0.042)	-0.114** (0.039)	-0.116** (0.040)	-0.082* (0.038)	-0.197*** (0.040)
T × Positive	0.117* (0.048)	0.118** (0.045)	0.105* (0.045)	0.043 (0.038)	0.065 (0.039)
T × Negative	0.031 (0.026)	0.004 (0.027)	0.020 (0.026)	0.006 (0.030)	-0.003 (0.031)
Difference in unfairness relative to cohort					
		Gender	Municipality	Education	Sector
Panel C					
Treatment (=1)		-0.016 (0.018)	-0.005 (0.014)	-0.026 (0.031)	-0.019 (0.032)
N	6660	6537	6539	6272	5873
Group position FE	✓	✓	✓	✓	✓

Notes: As Table 4 but we only use respondents whose reported income generate treatment information that is at most five positions from the information they would have received if the reported and actual income exactly matched. Robust standard errors on the estimates are reported in the parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

FIGURE A-18: CORRELATION OF CURRENT AND HISTORIC INCOME POSITIONS



Notes: Bandwidth for local linear polynomials is 20. For *Father*, the y-axis is the father's position among fathers when the respondent was 15 years old.

TABLE A-9: CORRELATION OF LIFE EVENTS WITH DIFFERENCES IN UN-FAIRNESS VIEWS

	Difference in unfairness relative to cohort				N
	Gender	Municipality	Education	Sector	
Unemployment	0.05 (0.06)	0.00 (0.05)	-0.06 (0.09)	-0.03 (0.09)	3758
Disability	0.15 (0.23)	0.27 (0.18)	-0.24 (0.28)		4649
Hospitalization	0.02 (0.03)	-0.01 (0.02)	-0.05 (0.05)	-0.09 (0.05)	2234
Promotion	-0.02 (0.04)	-0.02 (0.03)	-0.15* (0.07)	-0.23*** (0.07)	3889
Pre-shock position FE	✓	✓	✓	✓	
Controls	✓	✓	✓	✓	

Notes: Each cell in the table is a separate regression of the column outcome on the row regressor and the controls indicated in the bottom part of the table. The explaining variables are all indicators that equal 1 if the respondent experienced the shock between 2012 and 2017. In each row, we exclude respondents who already experienced this type of shock in the pre-period (2008-2011). For *Unemployment*, we only use respondents who were in the workforce in the entire period. For *Disability*, we do not estimate the effect on fairness within sector, because very few disabled people work. *Controls* included in all regressions are a treatment indicator, cohort, gender, municipality, education, and sector fixed effects (incl. unemployed/not in workforce), all measured in 2008. Robust standard errors on the estimates are reported in the parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-10: CORRELATION OF LIFE EVENTS WITH UNFAIRNESS VIEWS OF INEQUALITY WITHOUT CONTROLS

	Cohort position		Unfairness of inequality					N	Affected
	Actual (1)	Perceived (2)	Cohort (3)	Gender (4)	Mun. (5)	Edu. (6)	Sector (7)	(8)	% (9)
Unemployment	-9.41*** (1.37)	-4.24** (1.35)	0.27* (0.12)	0.31* (0.13)	0.28* (0.12)	0.13 (0.13)	0.16 (0.13)	3758	5.27
Disability	-20.75*** (2.47)	-20.43*** (3.25)	0.72* (0.31)	0.89** (0.34)	0.98** (0.33)	0.42 (0.29)		4649	0.67
Hospitalization	-2.57*** (0.70)	-1.76* (0.68)	0.22*** (0.06)	0.26*** (0.07)	0.21*** (0.06)	0.19** (0.07)	0.15* (0.07)	2234	55.64
Promotion	9.05*** (0.87)	7.53*** (1.08)	-0.21* (0.08)	-0.22* (0.09)	-0.23** (0.09)	-0.34*** (0.10)	-0.42*** (0.09)	3889	6.74
Pre-shock position FE	✓	✓	✓	✓	✓	✓	✓		
Controls									

Notes: Each cell in the table is a separate regression of the column outcome on the row regressor and the controls indicated in the bottom part of the table. The explaining variables are all indicators that equal 1 if the respondent experienced the shock between 2012 and 2017. In each row, we exclude respondents who experienced the shock between 2008 and 2011. For *Unemployment*, we only use respondents who were in the workforce in the entire period. For *Disability*, we do not estimate the effect on fairness within sector, because very few disabled people work. Robust standard errors on the estimates are reported in the parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-11: CORRELATION OF LIFE EVENTS WITH UNFAIRNESS VIEWS OF INEQUALITY USING 2SLS

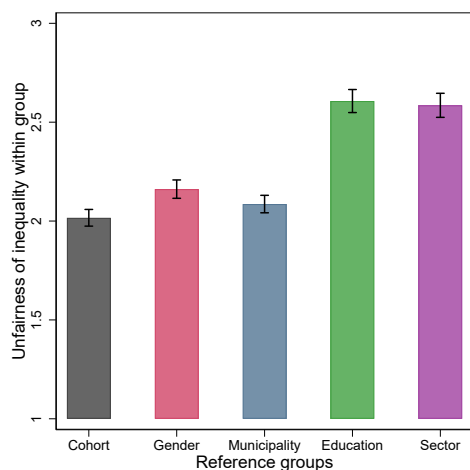
	Unfairness of inequality					N	Affected
	Cohort	Gender	Mun.	Edu.	Sector		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Unemployment	-3.25** (1.23)	-3.52** (1.25)	-3.30** (1.26)	-2.34* (1.15)	-4.41* (2.10)	3758	5.27
Disability	-3.77* (1.81)	-4.52* (1.78)	-5.05** (1.89)	-2.60 (1.90)		4649	0.67
Hospitalization	-10.5* (4.65)	-9.64* (3.96)	-8.56* (3.79)	-8.96 (5.72)	-5.98 (5.61)	2234	55.6
Promotion	-2.18* (0.95)	-2.30* (1.00)	-2.40* (0.99)	-3.36*** (0.93)	-3.56*** (0.83)	3889	6.74
Pooled	-3.05*** (0.76)	-3.45*** (0.79)	-3.50*** (0.81)	-2.82*** (0.74)	-3.59*** (0.80)	14530	11.9
Pre-shock position FE	✓	✓	✓	✓	✓		
Controls	✓	✓	✓	✓	✓		

Notes: Each cell in the table is a separate 2SLS regression of the column outcome on current position instrumented using the row regressor and the controls indicated in the bottom part of the table. The instruments are all indicators that equal 1 if the respondent experienced the shock between 2012 and 2017. In each row, we exclude respondents who experienced the shock between 2008 and 2011. For *Unemployment*, we only use respondents who were in the workforce in the entire period. For *Disability*, we do not estimate the effect on fairness within sector, because very few disabled people work. *Controls* includes cohort fixed effects, an indicator for men, municipality fixed effects, educational level fixed effects, and sector (incl. unemployed/not in workforce) fixed effects, all measured in 2008, and a treatment indicator. Robust standard errors on the estimates are reported in the parentheses. In the pooled regression we cluster the standard errors at the individual level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

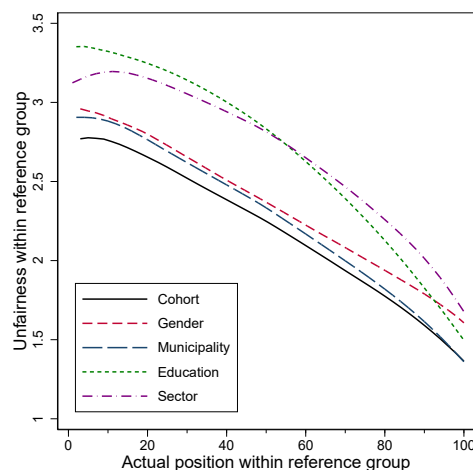
D Large Reference Groups: Using Actual Groups and Restricted Sample

FIGURE A-19: UNFAIRNESS OF INEQUALITY AND IMPORTANCE OF EFFORT ACROSS LARGE REFERENCE GROUPS USING RESTRICTED SAMPLE

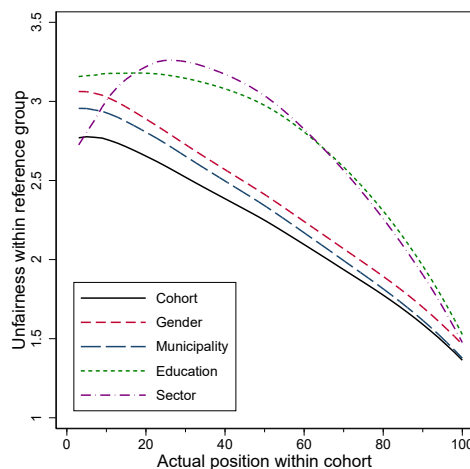
(A) UNFAIRNESS OF INEQUALITY



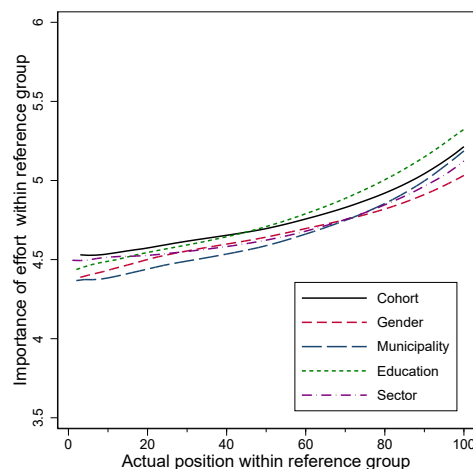
(B) UNFAIRNESS OF INEQUALITY



(C) UNFAIRNESS OF INEQUALITY



(D) IMPORTANCE OF EFFORT

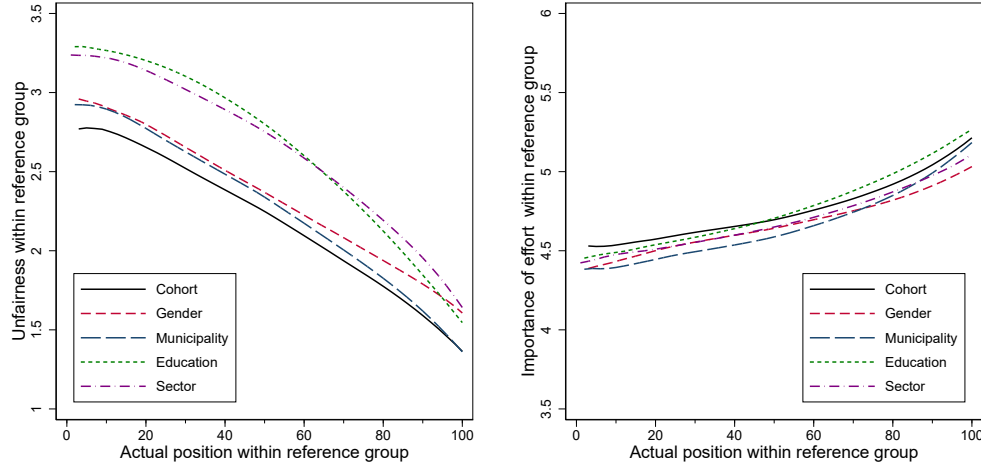


Notes: As Figure 2 but we restrict the sample and only include respondents in each reference group if the reported group matches the group observed in the register data.

FIGURE A-20: UNFAIRNESS OF INEQUALITY AND IMPORTANCE OF EFFORT ACROSS LARGE REFERENCE GROUPS USING RESTRICTED SAMPLE

(A) UNFAIRNESS OF INEQUALITY

(B) IMPORTANCE OF EFFORT

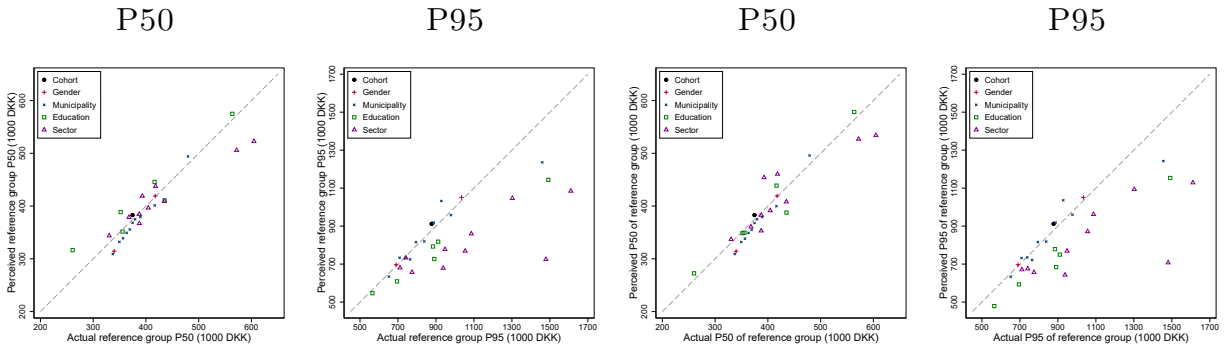


Notes: As Panel B and D of Figure 2 but we use actual reference group instead of reported reference group.

FIGURE A-21: PERCEIVED P50 AND P95 INCOMES FOR LARGE REFERENCE GROUPS USING ACTUAL GROUPS AND RESTRICTED SAMPLE

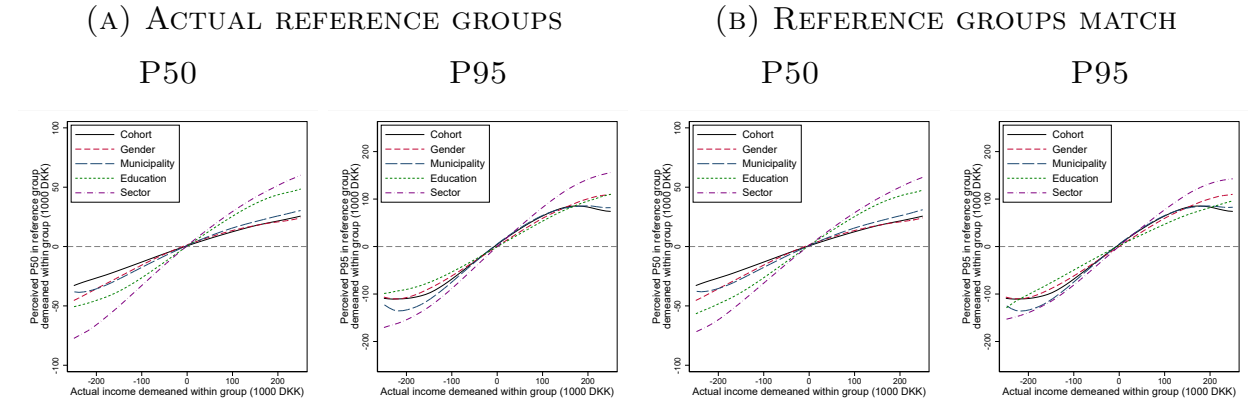
(A) ACTUAL REFERENCE GROUPS

(B) REFERENCE GROUPS MATCH



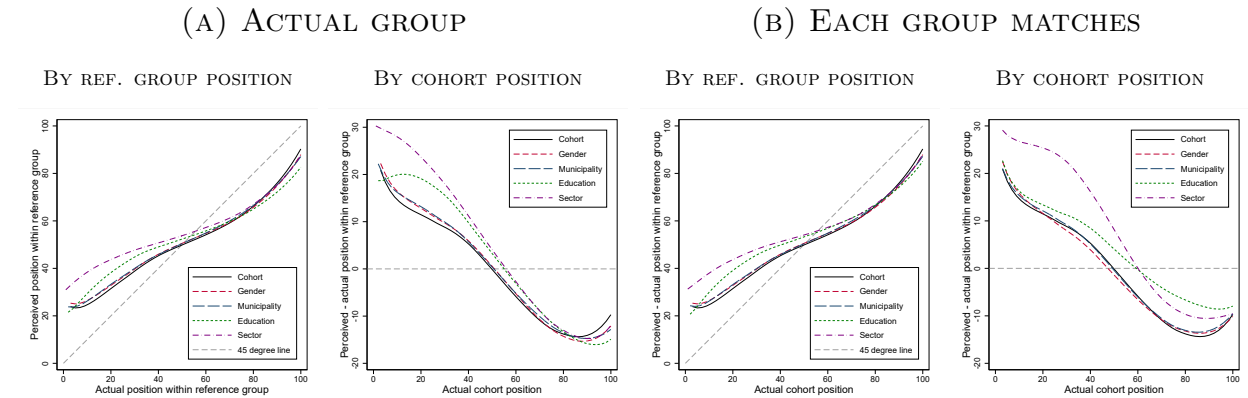
Notes: As Figure 6 but we use actual reference groups in Panel A instead of reported reference group, and in Panel B, we restrict the sample and only include respondents in each reference group if the reported group matches the group observed in the register data.

FIGURE A-22: PERCEIVED P50 AND P95 BY INCOME USING ACTUAL GROUPS AND RESTRICTED SAMPLE



Notes: As Figure 7 but we use actual reference groups in Panel A instead of reported reference group, and in Panel B, we restrict the sample and only include respondents in each reference group if the reported group matches the group observed in the register data.

FIGURE A-23: PERCEIVED AND ACTUAL POSITION FOR LARGE REFERENCE GROUPS USING ACTUAL GROUPS AND RESTRICTED SAMPLE

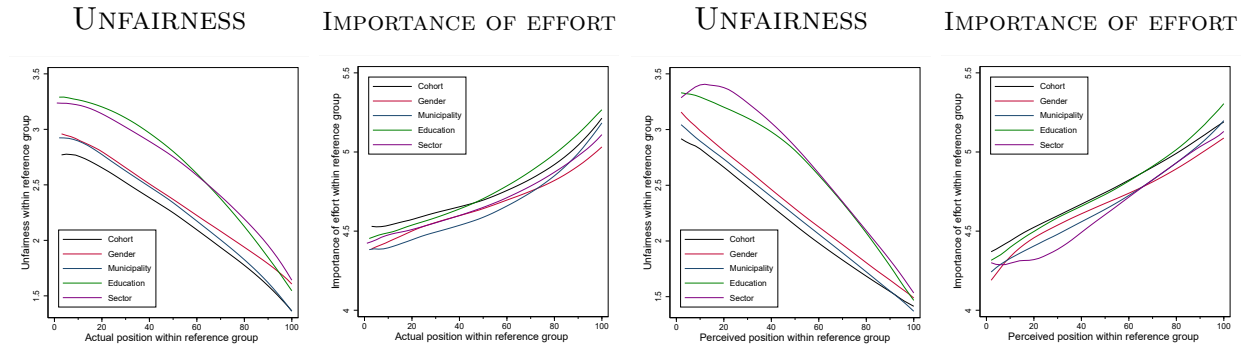


Notes: As Figure 8 but in Panel A, we use actual reference groups instead of reported reference groups. In Panel B, we only use respondents in each reference group if the reported group matches the group observed in the register data.

FIGURE A-24: VIEW ON FAIRNESS AND EFFORT VS. LUCK WITHIN LARGE REFERENCE GROUPS USING ACTUAL GROUPS AND RESTRICTED SAMPLE

(A) ACTUAL GROUPS

(B) REFERENCE GROUPS MATCH



Notes: As Figure 2 but in Panel A, we use actual reference groups instead of reported reference groups. In Panel B, we only use respondents in each reference group if the reported group matches the group observed in the register data.

TABLE A-12: UNFAIRNESS VIEW BY ACTUAL POSITION AND POSITION MISPERCEPTION USING ACTUAL REFERENCE GROUPS

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A: No controls					
Level at P50	2.23*** (0.03)	2.36*** (0.03)	2.32*** (0.03)	2.75*** (0.03)	2.78*** (0.03)
Position in group	-1.74*** (0.10)	-1.83*** (0.12)	-1.96*** (0.11)	-2.39*** (0.12)	-2.51*** (0.13)
Misperception	-0.57*** (0.15)	-0.99*** (0.16)	-0.73*** (0.14)	-0.74*** (0.15)	-1.44*** (0.16)
Panel B: With controls					
Position in group	-1.61*** (0.13)	-1.64*** (0.14)	-1.69*** (0.13)	-1.81*** (0.14)	-2.13*** (0.15)
Misperception	-0.60*** (0.15)	-0.67*** (0.16)	-0.63*** (0.14)	-0.49** (0.16)	-0.94*** (0.17)
<i>N</i>	4692	4692	4692	4692	4332

Notes: As Table 3 but we use actual reference groups instead of reported reference groups. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-13: UNFAIRNESSVIEW BY ACTUAL POSITION AND POSITION MIS-
PERCEPTION USING RESTRICTED SAMPLE

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A: No controls					
Level at P50	2.23*** (0.03)	2.36*** (0.03)	2.32*** (0.03)	2.80*** (0.03)	2.84*** (0.04)
Position in group	-1.74*** (0.10)	-1.83*** (0.12)	-1.96*** (0.11)	-2.51*** (0.14)	-2.54*** (0.15)
Misperception	-0.57*** (0.15)	-0.99*** (0.16)	-0.74*** (0.14)	-0.91*** (0.17)	-1.62*** (0.19)
Panel B: With controls					
Position in group	-1.61*** (0.13)	-1.64*** (0.14)	-1.69*** (0.13)	-1.94*** (0.16)	-2.06*** (0.17)
Misperception	-0.60*** (0.15)	-0.67*** (0.16)	-0.64*** (0.15)	-0.68*** (0.19)	-1.02*** (0.20)
<i>N</i>	4692	4692	4600	3453	3218

Notes: As Table 3 but we only use respondents in each reference group if the reported group matches the group observed in the register data. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-14: SURVEY INFORMATION EXPERIMENT AND UNFAIRNESS VIEW USING ACTUAL REFERENCE GROUPS

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A					
Treatment (=1)	0.091** (0.030)	0.067* (0.033)	0.081** (0.031)	0.091** (0.034)	0.081* (0.036)
Panel B					
Positive misperception	-0.116*** (0.035)	-0.132*** (0.033)	-0.116*** (0.033)	-0.076* (0.030)	-0.186*** (0.032)
T × Positive	0.137*** (0.039)	0.075* (0.036)	0.093* (0.037)	0.071* (0.032)	0.075* (0.031)
T × Negative	0.026 (0.023)	0.024 (0.024)	0.028 (0.024)	0.036 (0.025)	0.013 (0.027)
Difference in unfairness relative to cohort					
		Gender	Municipality	Education	Sector
Panel C					
Treatment (=1)		-0.024 (0.015)	-0.014 (0.013)	0.002 (0.026)	-0.017 (0.027)
N	9331	9331	9331	9331	8854
Group position FE	✓	✓	✓	✓	✓

Notes: As Table 4 but we use actual reference groups instead of reported reference groups. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-15: SURVEY INFORMATION EXPERIMENT AND UNFAIRNESS VIEW USING RESTRICTED SAMPLE

	Unfairness of inequality				
	Cohort	Gender	Municipality	Education	Sector
Panel A					
Treatment (=1)	0.091** (0.030)	0.067* (0.033)	0.086** (0.031)	0.065 (0.040)	0.078 (0.043)
Panel B					
Positive misperception	-0.116*** (0.035)	-0.132*** (0.033)	-0.116*** (0.033)	-0.166*** (0.036)	-0.264*** (0.039)
T × Positive	0.137*** (0.039)	0.075* (0.036)	0.097** (0.037)	0.062 (0.035)	0.095* (0.038)
T × Negative	0.026 (0.023)	0.024 (0.024)	0.033 (0.024)	0.014 (0.031)	-0.001 (0.032)
Difference in unfairness relative to cohort					
		Gender	Municipality	Education	Sector
Panel C					
Treatment (=1)		-0.024 (0.015)	-0.012 (0.013)	0.003 (0.030)	-0.029 (0.033)
N	9331	9331	9156	6901	6356
Group position FE	✓	✓	✓	✓	✓

Notes: As Table 4 but we only use respondents in each reference group if the reported group matches the group observed in the register data. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE A-16: CORRELATION OF LIFE EVENTS WITH UNFAIRNESS OF INEQUALITY USING RESTRICTED SAMPLE

	Unfairness of inequality					(6)	(7)
	Cohort	Gender	Mun.	Edu.	Sector		
	(1)	(2)	(3)	(4)	(5)		
Unemployment	0.31** (0.12)	0.36** (0.13)	0.27* (0.12)	0.27 (0.16)	0.46** (0.18)		
Observations	3758	3758	3683	2772	2790		
Affected %	5.27	5.27	5.21	5.16	4.23		
Disability	0.67* (0.31)	0.82* (0.34)	1.00** (0.35)	0.66 (0.35)			
Observations	4649	4649	4557	3420			
Affected %	0.67	0.67	0.64	0.61			
Hospitalization	0.19** (0.06)	0.21** (0.07)	0.18** (0.06)	0.15 (0.09)	0.07 (0.09)		
Observations	2234	2234	2186	1650	1598		
Affected %	55.64	55.64	55.4	55.58	54.19		
Promotion	-0.19* (0.08)	-0.20* (0.09)	-0.21* (0.09)	-0.34** (0.12)	-0.43*** (0.12)		
Observations	3889	3889	3820	2896	2847		
Affected %	6.74	6.74	6.81	6.73	6.53		
Pre-shock position FE	✓	✓	✓	✓	✓		
Controls	✓	✓	✓	✓	✓		

Notes: As Table 5 but we only use respondents in each reference group if the reported group matches the group observed in the register data. Since the number of observations and share of respondents affected by the shock varies between reference groups, we show these for each column-by-row regression instead of for each row as in Table 5. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.