Social Positions and Fairness Views on Inequality*

Kristoffer B. Hvidberg, Claus T. Kreiner, and Stefanie Stantcheva

December 2022

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 they actually are, whereas the opposite holds true 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 informing people about 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.

*Hvidberg: University of Copenhagen and CEBI (email: kristoffer.balle.hvidberg@econ.ku.dk). Kreiner: University of Copenhagen, CEBI, CESifo, and CEPR (email: ctk@econ.ku.dk). Stantcheva: Harvard University, CEPR, and NBER (e-mail: sstantcheva@fas.harvard.edu). We thank Leonardo D'Amico, Beatrice Ferrario, Martha Fiehn, Ida Maria Hartmann and Isabel Skak Olufsen for excellent research assistance. We are also grateful for comments by seminar participants in the Deaton workshop on Attitudes Towards Inequality and Redistribution, the Selten Lecture in Bonn, IFN in Stockholm, NHH in Bergen, LSE, Princeton, UCSD, UC Berkeley, UCLA, Uppsala, Zurich, and the NBER Public Economics Meetings. We thank three anonymous referees, the editor, Ingvild Almås, Asger Andersen, Richard Blundell, Alexander Cappelen, Dietmar Fehr, Ernst Fehr, Søren Leth-Petersen, Erzo Luttmer, Andreas Peichl, Ricardo Perez-Truglia, Chris Roth, Emmanuel Saez, Julien Senn, David Seim, Krishna Srinivasan, Bertil Tungodden, Andrea Weber, Roberto Weber, and Matthew Weinzierl for feedback and suggestions. The activities of CEBI are financed by the Danish National Research Foundation grant DNRF134. We are also grateful for financial support from the Candys Foundation. The use of the data for this project complies with Danish legislation (persondataforordningen, forordning 2016/679 om persondatabeskyttelse) and has been approved by the Danish Data Protection Agency (File No. 514-0018/2018-2000 at the University of Copenhagen). The project includes a randomized information treatment and was preregistered in the AER RCT Registry (AEARCTR-0003923).

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 perceptions? 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 about the inequalities that matter 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 be able to identify all people in that group and have information on 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 used. 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 birth 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 45 to 50 years old, which means they are well into their working lives but still far from retirement.

The link between survey and administrative data enables us to explore how well people know their positions and the relationship between social positions and fairness views.

[1] Alesina 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 (1995, 2001); Fehr and Schmidt (1999); Meltzer and Richard (1981)

Importantly, it also allows us to pinpoint where misperceptions come from because we can verify the accuracy of perceptions of the respondent's own income as well as of the income distributions and positions in each group by using their tax return and the tax returns of all people in the reference groups. The linked data 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 cohort. This may call for a combination of general redistribution through the tax system and 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 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 the incomes of others, i.e., the income distribution. These misperceptions may vary systematically or idiosyncratically by income. Even misperceptions that are idiosyncratic can create systematic misperceptions

of own position 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' incomes. 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 the 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 vicinity instead of people living in the same municipality. In fact, respondents are

[2]We use the term "center bias" as opposed to "middle-class bias" (Fehr et al., 2022) 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.

better at predicting where they rank relative to former schoolmates than relative to current co-workers.

We also highlight some of the characteristics that are correlated with the accuracy of people's perceptions of the income distributions and their own positions. 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 regarding income (e.g., being in a managerial position with more information about others' income, employed by a firm with high unionization rates, or in a public sector job). Other factors predict overoptimism about one's position. For instance, respondents with a high-income partner tend to overestimate their position by more. Visible signals of income also play a role: respondents whose houses or cars are more expensive relative to their neighbors' 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. We find 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 the inequalities and social positions that matter 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, 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 shared 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 very stable.

Related Literature. The main novelty of our paper is to provide systematic and comprehensive evidence across key *reference groups* of people. We elicit people's perceptions of inequality, their 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 salary differences affect satisfaction and effort focusing on a single employer or sector. For instance, Cullen and Perez-Truglia (2018, 2022) 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. (2022) 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 salaries below median for their pay unit and occupation in California. We complement these studies by using a representative sample of people, working across many different firms and sectors, to show that people care significantly more about income differences within co-workers than overall income differences, and that they strongly misperceive inequality and their own 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, education level, and in the same region. Luttmer (2005) finds that those who live in localities (Public Use Microdata Areas) 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 references 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, 2022; Cruces et al., 2013; Fehr et al., 2022; 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. 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. (2022) find that people in the bottom of the national income distribution overestimate their own position while people in the top underestimate it and that 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. Our sample is also an order of magnitude larger than existing studies, which further enables us to detect differences in the degree of misperceptions 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 that more educated respondents have more accurate perceptions. In addition, we use our granular administrative data to study the role of partner's income, family background, occupation, visible consumption, proximity of reference group individuals, and transparency of incomes on perceptions.

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, 2022). More related to our study of life events and historical changes in individual position, a 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, 2022; Cruces et al., 2013; Fehr et al., 2022; 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. Hoy and Mager (2021) on the other hand find that 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.

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 and 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 Danish public authorities and citizens. The invitations were sent out through the secure website Digital Post, which is used to receive and read electronic mail from public authorities. All citizens older than 15 are required to have such an electronic mailbox. The use of this official channel of communication, together with the University of Copenhagen's

stamp, likely increased the credibility of our survey and the information provided to respondents. To incentivize people to respond and provide accurate information, they were told that those who completed the survey would be enrolled in a lottery for 100 gift cards for 150 store chains in Denmark, each worth 1,000 DKK ($150). The average completion time of the survey was 31 minutes, and the median time was 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). 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 in the top 10% of the income distribution, making up almost 17% of our analysis sample. Note that in the invited sample, people in 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.[3] 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, the difference in age is significant, 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 reweight 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 reweighting 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.[4] After dropping respondents for whom

[3]Appendix 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.

[4]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. For comparison, a recent study in Denmark invited similar cohorts by ordinary mail and reports a response rate of 13% (Epper et al., 2020). Appendix Table A-2 highlights which characteristics predict the drop out rate and at

Table 1: Summary statistics

	Sample	Invited	P-value (%)
	(1)	(2)	(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.

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 end up with 9,415 respondents in total.

1.2 Survey Outline and response quality

The survey consists of five blocks of questions. Below we summarize these blocks; the entire questionnaire is shown 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).[5] 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 social assistance). We ask about these three income components, individually and display

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.

[5] 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 discreprencies 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. The appendix in Hvidberg et al. (2020) 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.

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.

the sum oof the components on the screen (see 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. Respondents are informed that it is important to report the income correctly and that they can see the amounts on their annual tax return. Our rationale for asking about income as it appears on the tax return 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 generally

low in Denmark and close to zero on third-party reported income components (Kleven et al., 2011).[6]

Perceptions. This block elicits people's perceptions about the median (hereafter, P50), the 95th percentile (hereafter, P95), and their own position in the income distribution of each of the five large reference groups. The block starts with a video that uses a ladder and 100 stick figures 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 the large reference groups (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 ask the respondent about the number of individuals in these reference groups (denoted by N) and then ask them to report their perceived income position on a horizontal slider going from 1 to N (see Appendix Figure A-4 for the co-worker question as an example). For these small reference groups, it does not make sense to ask about positions in the distribution such as P50 and P95 as we do for the large reference groups.

Experimental treatment. We show the information treatment to the treatment group after the perceptions block 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. Panel

[6]To 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," which includes the imputed value of housing, interest deductions, and tax payments.

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 they were ranked at position 70 and the treatment informs them that they are, 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 characteristics.

Fairness views. This block 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 (translated) questions are:
"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."

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

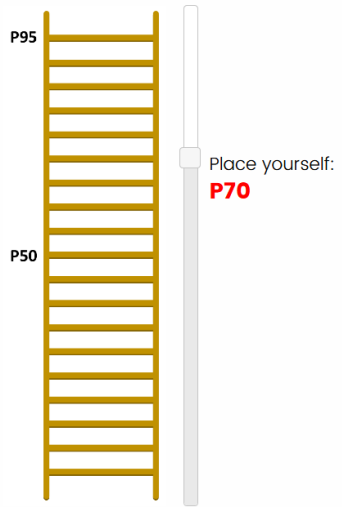
We consider a simple model of demand for redistribution, along the line of Meltzer and Richard (1981) and Alesina and La Ferrara (2005), which we extend to include fairness

Figure 1: Example Survey Pages

(a) Eliciting perceived position

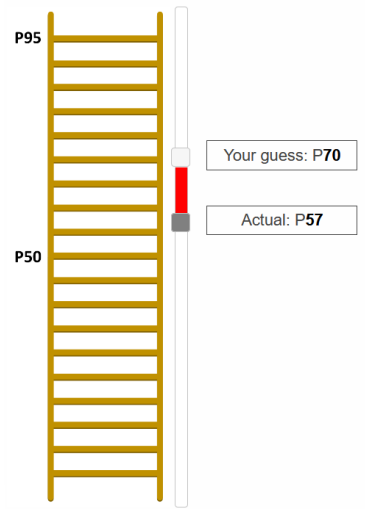
Rank among all people **born in 1970**

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 P**70**.
Based on the income you reported, your TRUE position is P**57**.
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**	○	○	○	○	○	○	○
Differences in income among **men** born in 1970	○	○	○	○	○	○	○
Differences in income among people, living in **Københavns municipality**	○	○	○	○	○	○	○
Differences in income among people with the educational level **Master or PhD program**	○	○	○	○	○	○	○
Differences in income among people working in the sector **Finance and insurance**	○	○	○	○	○	○	○

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 themself 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. Panel C 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.

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:

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

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. 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.[7]

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:

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

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

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

[7]Including the resource cost of taxation directly in the utility function is slightly more general than including it in the government budget constraint as Alesina and La Ferrara (2005) do. It allows for people caring about costs of taxation not only because it reduces their own consumption (through the lower lump sum transfer b) but also because it reduces aggregate consumption, i.e., consumption of others. In addition, the more general setting makes it possible to analyse the fairness motive in isolation by setting $\alpha = 0$. Our model collapses to the model of Alesina and La Ferrara (2005) when $\alpha = \phi = 1$ and $\beta = 0$. Finally, note that for simplicity and without loss of generality, the summation includes $j = i$, i.e., self-comparison.

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 $\gamma-$ parameter.

Reference groups. Consider now the case where individual i cares about their 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 equation (2) as:

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

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

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 given through 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.[8] 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, they may want "same wage for the same work," more unionization at the sector level, and wage transparency policies at the firm level.[9]

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 $(\bar{x}_r)$ while section 4 analyses the relationship between perceptions and fairness views.

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 so-

[8] To see this, note that, as in Stantcheva (2017), 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.

[9] Note 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.

cial position changes or when they receive information about their own true social positions, this suggests that the self-centered motive is relevant at least to some extent.[10]

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 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 relevant from a normative perspective than large income differences across people of the same age, especially since 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."[11]

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 (we refer to this as "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 Figure 2, 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-8, 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.

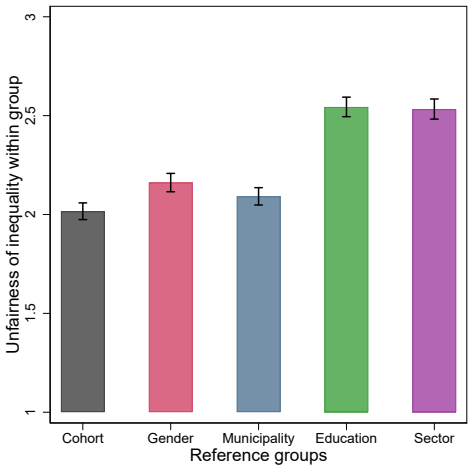
Panel B of Figure 2 plots respondents' perceived unfairness of inequality for each reference group against their own position in that reference group. For all reference groups, those who are ranked higher believe that inequality within that group is less unfair. However, in line with Panel A, people at all income positions consistently think that income differences

[10] An 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.

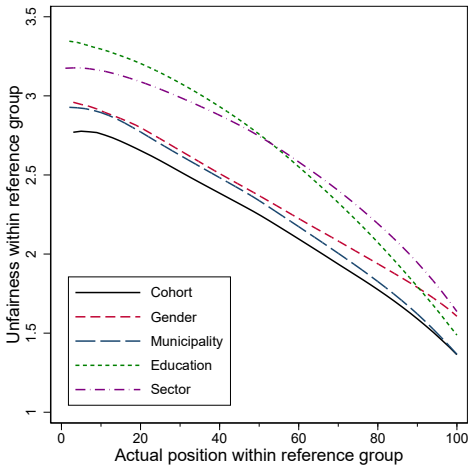
[11] Appendix Figure A-7 and Appendix Table A-5 highlight the pitfalls of asking about the full income distribution without specifying proper age limits. For example, the median income level of a cohort varies drastically across different ages and an overall median income level depends a lot on inclusion or exclusion of young or old cohorts.

Figure 2: Unfairness of inequality and importance of effort across large reference groups

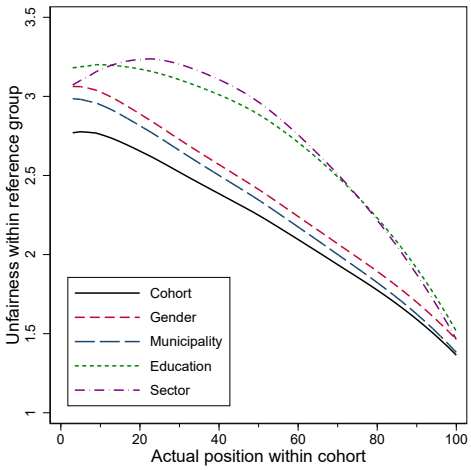
(a) Unfairness of inequality



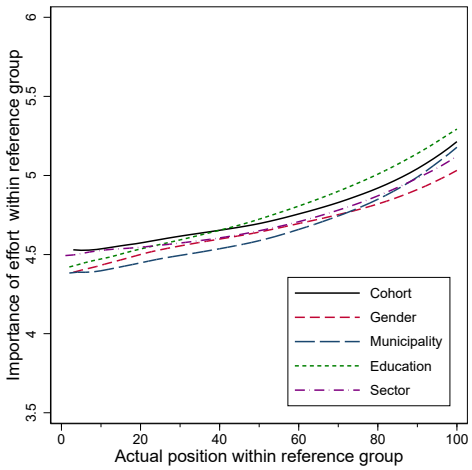
(b) Unfairness by reference group position



(c) Unfairness by cohort position



(d) Importance of effort



Notes: Panel A 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. Panel B plots the unfairness of inequality variable against actual position within the reference group (locally linear polynomials with bandwidth 20), while Panel C plots it against actual position within the cohort. Panel D 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.

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.[12] In this Panel B, 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 differences in the reference group.[13] Unlike for fairness views, there are no major differences in views on the role of effort across reference groups.[14]

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 analyze which characteristics and factors are correlated with being more accurate and more optimistic about one's own position.

3.1 Overall Position in Cohort

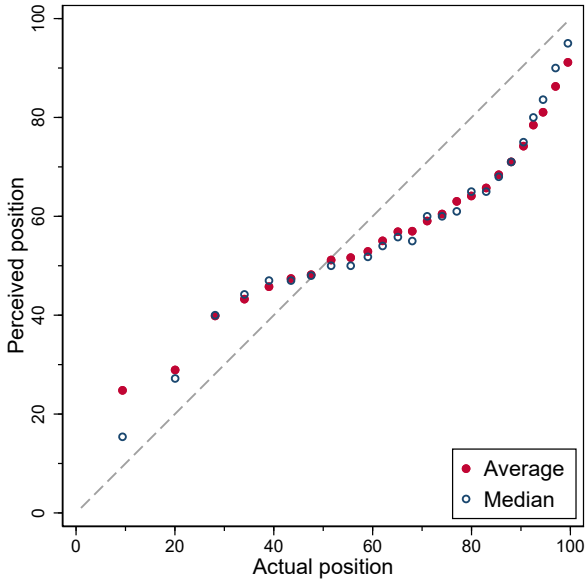
Perception of own position. Figure 3 shows the relation between respondents' actual position in their cohort and their average or median perceived positions. The two curves both have a horizontal, inverted S-shape, whereby people below the median income level

[12]We 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 $p < 0.001$.

[13]When we regress importance of effort view in the cohort on actual position in the cohort, we find that going from position 1 to 100 is associated with an increase of 0.8 in the importance of effort ($p < 0.001$).

[14]From 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.

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.

overestimate their position while people above the median tend to underestimate it.[15] This leads to the question: what is driving this systematic pattern in misperceptions of position?

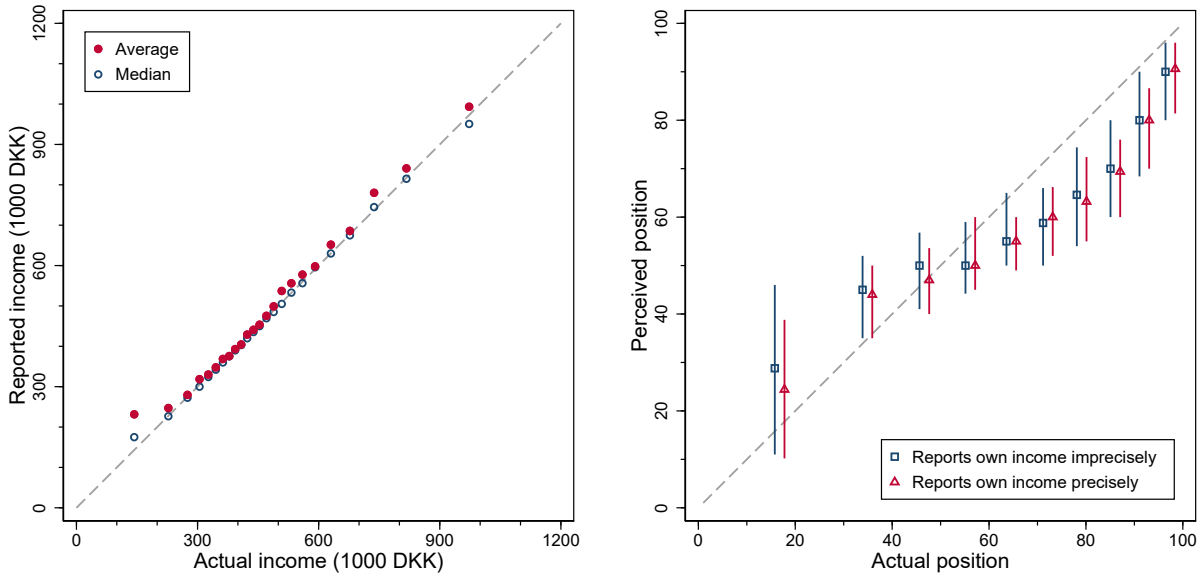
To address this question, note first that people may misperceive their position in the income distribution because they misperceive their own income or the incomes of others. Second, the inverted S-shape can arise from misperceptions that either vary systematically across the income distribution or idiosyncratically. The latter case is possible because positions are bounded, which means 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 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 (Appendix Figure A-10 shows the full distribution of differences between reported and actual income), 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

[15] In Appendix Figure A-9, 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 4: Role of misperceptions of own income

(a) Actual vs. reported income (b) Perceived vs. actual position



Notes: Panel A 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. Panel B 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.

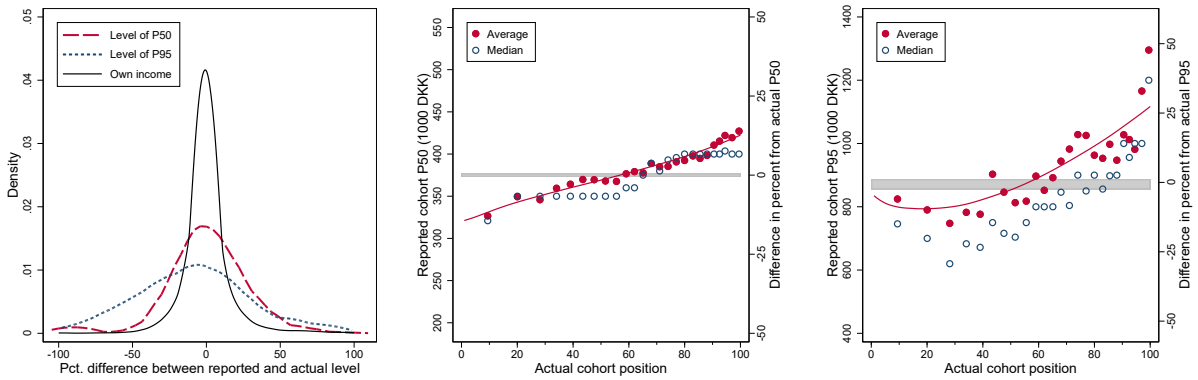
as a function of actual income. Furthermore, idiosyncratic misperceptions of own income are also not the main drivers of the misperception of positions, as can be seen in Panel B of Figure 4. The figure shows that the relationship between perceived and actual positions is similar for those who perceive 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.[16]

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 well, but are less accurate in estimating top incomes. Panel A of Figure 5 plots respondents' misperceptions of the P50 income level (long dashed red curve) and the P95 income level

[16]Panel 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 5: Perceived P50 and P95 of the cohort

(a) Misperception size (b) P50 misperception (c) P95 misperception



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. Actual income can be checked on the tax return whereas it is not possible to easily find information about the P50 and P95. 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 and C show a bin scatter with 25 bins of the average and median perceived P50 and P95, respectively, reported in DKK (left axis) and the corresponding misperception in percent (right axis) 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).

(short dashed blue 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 (solid black curve) are such that 70% (respectively, 90%) percent report correctly within a 10% (respectively, 25%) error band. 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 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.[17] 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 because people who are between P50 and P95 within 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 underestimate the incomes of others.[18] We call 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 really is center bias that creates the inverted S-shape in Figure 3 or whether this could be created by "direction bias" due to a random noise component. To address this question, consider that a respondent's perception of others' incomes, e.g., P50, can be written as the true value plus a random idiosyncratic component. We can see conceptually and with the help of simulations that this type of process cannot explain the patterns observed. First, direction bias implies that the distribution of perceptions will be more concentrated at the extremes, as shown in Panel A of Appendix Figure A-12, which does not align well with the observed distribution of perceptions. On the contrary, center bias generates exactly the distribution of perceptions we observe (Panel A of Appendix Figure A-13).

Second, direction bias carries implications for the skewness of perceptions at any given income level, which is 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 *median* respondent's

[17] Equivalently, 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.

[18] Note that the large misperceptions of P95 in Panel C of Figure 5 by people at 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 at the top of the distribution.

perception is unbiased. For instance, imagine people who are truly at position 100. For those who underestimate others' incomes, the perceived position is truncated and equal to 100. For those who overestimate others' incomes, the perceived position is below 100. Thus, the average person at position 100 will underestimate their position, but the median person 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 perceptions of others' incomes as observed in Figure 5, which we further document with simulation results in Appendix 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 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.

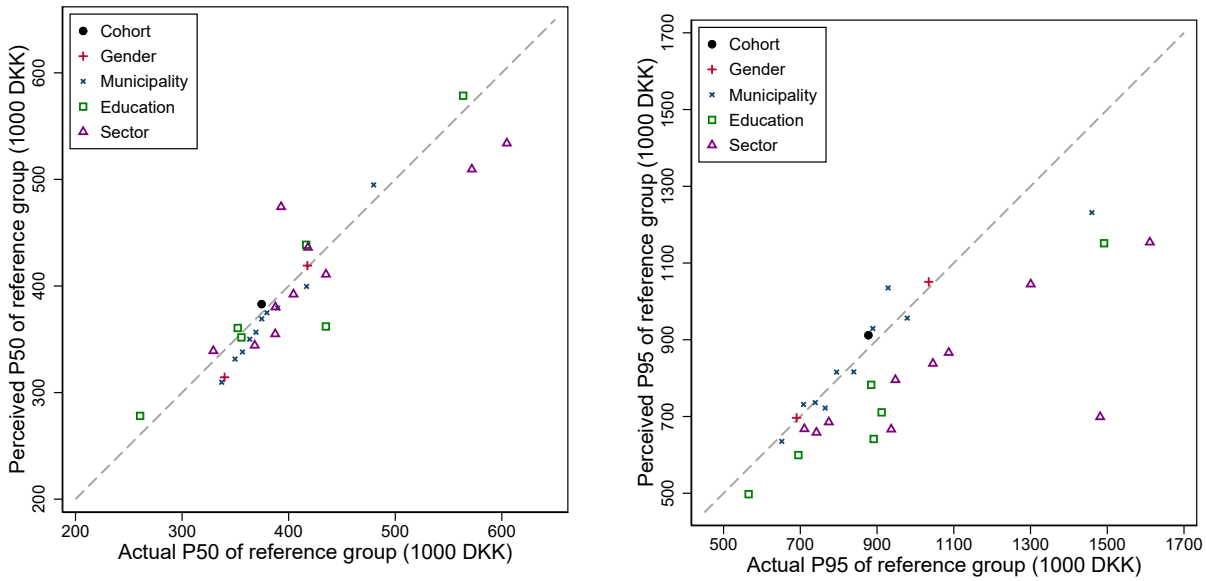
To see these results, consider Panel A of Figure 6, which plots the average perceived P50 for different reference groups of respondents in those groups against the actual P50. Each point represents either the overall cohort, a gender group, an education group, a sector, or a set of municipalities. For 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.[19]

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

[19]The *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.

Figure 6: Perceived and actual P50 and P95 levels of large groups

(a) P50 (b) P95



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.

groups, are all below the 45-degree line.[20] Thus, respondents systematically underestimate the degree of inequality within their education groups and within their sectors, which are 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 similar patterns 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.

Do people's perceptions of their reference groups depend on their income? The average perceptions just described obscure significant heterogeneity by income level. For each reference group, lower-income respondents have lower perceptions of the P50 and P95 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,

[20]Panel 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. The outlier in the lower-right corner in Panel B of Figure 6 is the *Agriculture, forestry and fishing* sector. This is a small sector measured by employment in which only 80 respondents work 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.

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 and plot the relationship for each reference group. 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.[21] 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.

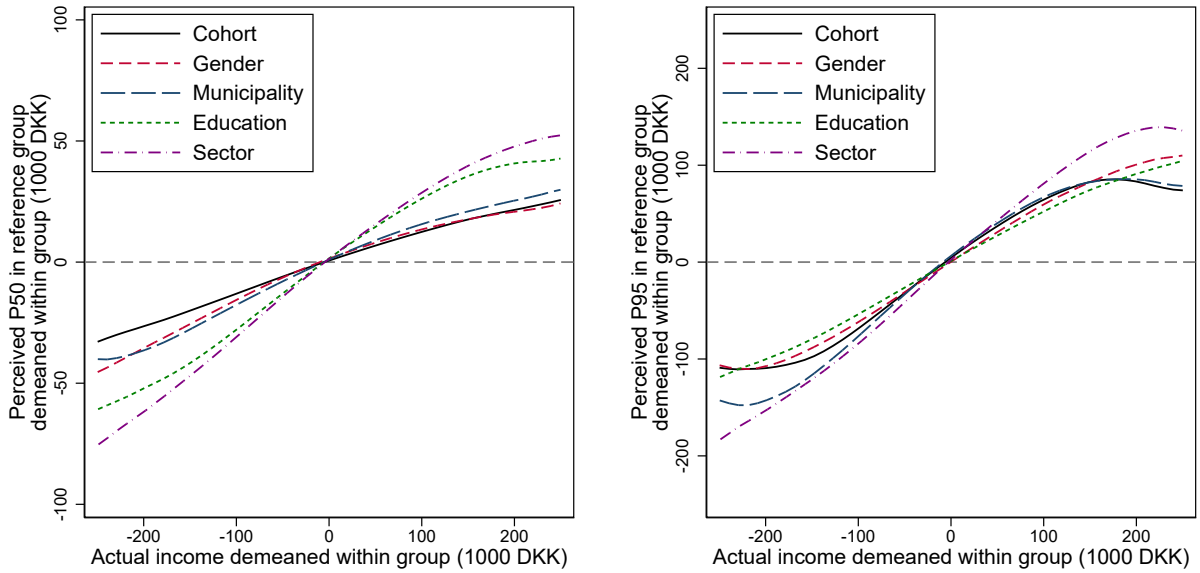
Perceptions of own position in different reference groups. Across all reference groups, people's perceptions exhibit center bias. Respondents in the lower part of the income distribution tend to overestimate their positions, while people in the upper part tend to underestimate their positions. The misperceptions 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.[22] 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

[21] We test this by stacking the observations such that we have 5 observations per respondent, one 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 estimate a slope of 0.124 for cohort ($p < 0.001$). The slopes for education and sector are 0.129 and 0.161 steeper as a result, both significantly so with $p < 0.001$.

[22] We 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 7: Perceived P50 and P95 of the large reference groups by income

(a) P50 (b) P95



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 Panel A (P95 in Panel B) 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.

percentile, while people at the 20th percentile in their municipality believe they are around the 30th percentile.[23]

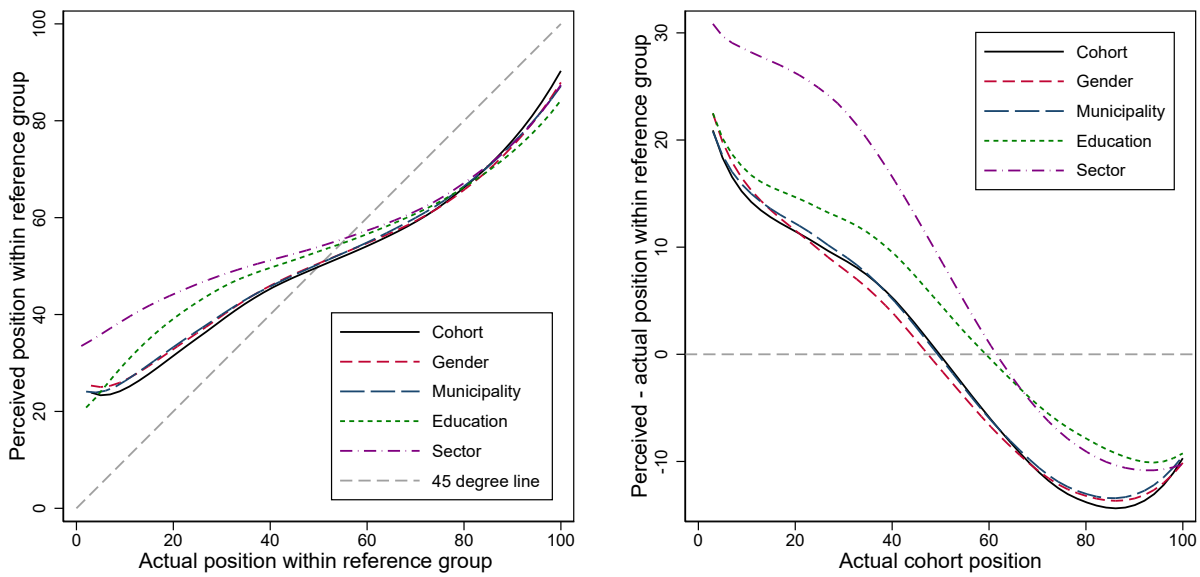
3.3 Perceptions of Social Position in Small Groups

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

[23]We test this by stacking the observations such that we have 5 observations per respondent, one 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 with $p < 0.001$).

Figure 8: Perceived and actual position within large reference groups

(a) By ref. group position (b) By cohort position



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.

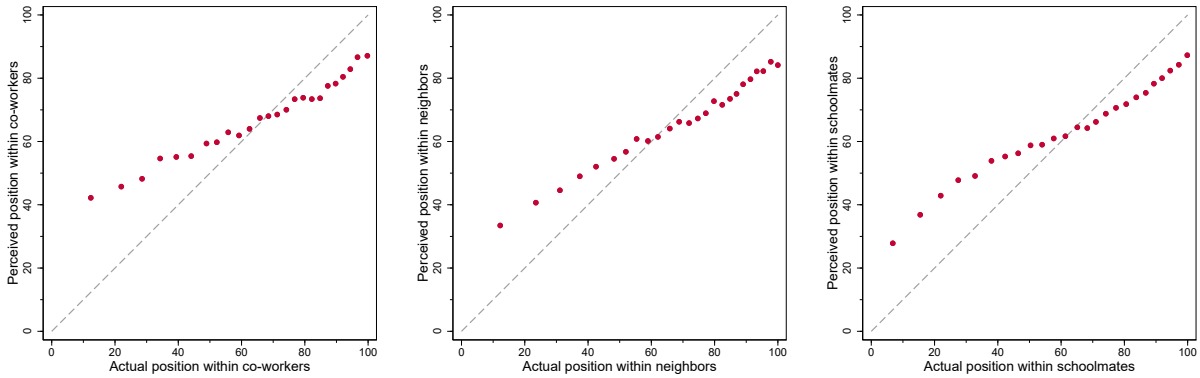
apartment), and former schoolmates. The pattern of perceived positions within these small groups resembles the findings for the large groups.

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 higher up than they truly are, for instance, 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

Figure 9: Perceived position within small reference groups

(a) Co-workers (b) Neighbors (c) Schoolmates



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.

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 workplace than when they compare themselves to people living in their area, either in their municipality or immediate vicinity.[24] 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.[25]

3.4 Predictors of Misperceptions

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

[24]We test this by stacking the observations such that we have 3 observations per respondent, one 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 ($p < 0.001$).

[25]A 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.

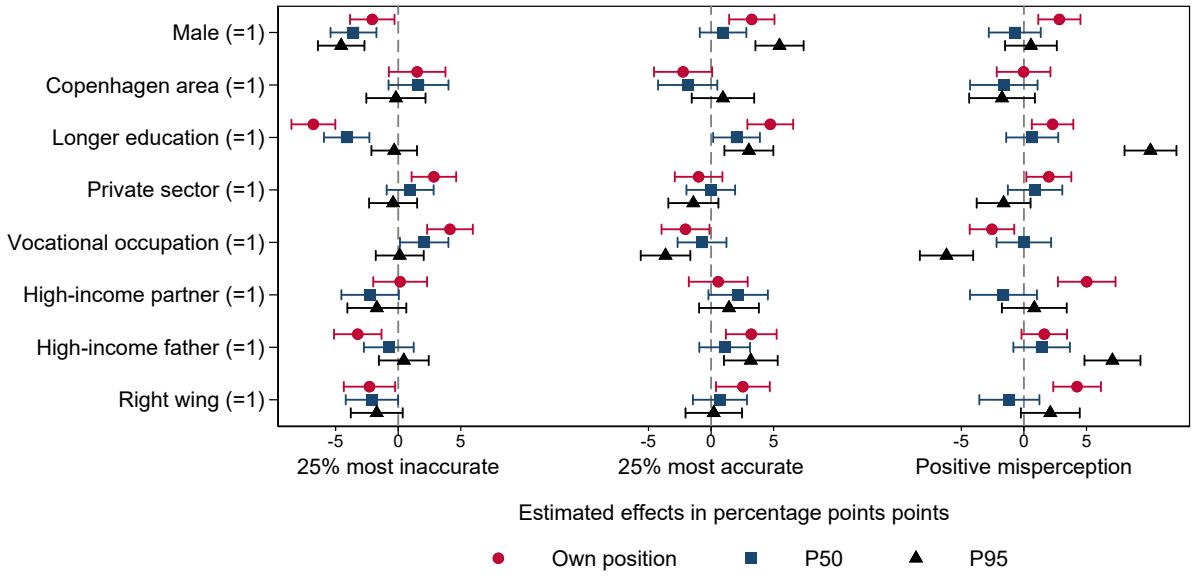
We start by studying overall misperceptions at the cohort level. Figure 10 shows a coefficient plot of how individual characteristics correlate with measures of accuracy, inaccuracy, and direction of misperception of their perceived position (dot), P50 (square), and P95 (triangle). The coefficients come 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, 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 they do 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 accurate with respect to their own position but also 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 coefficient plot 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, 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.

Figure 10: Accuracy and direction of perceptions of own position, P50, and P95 in the cohort

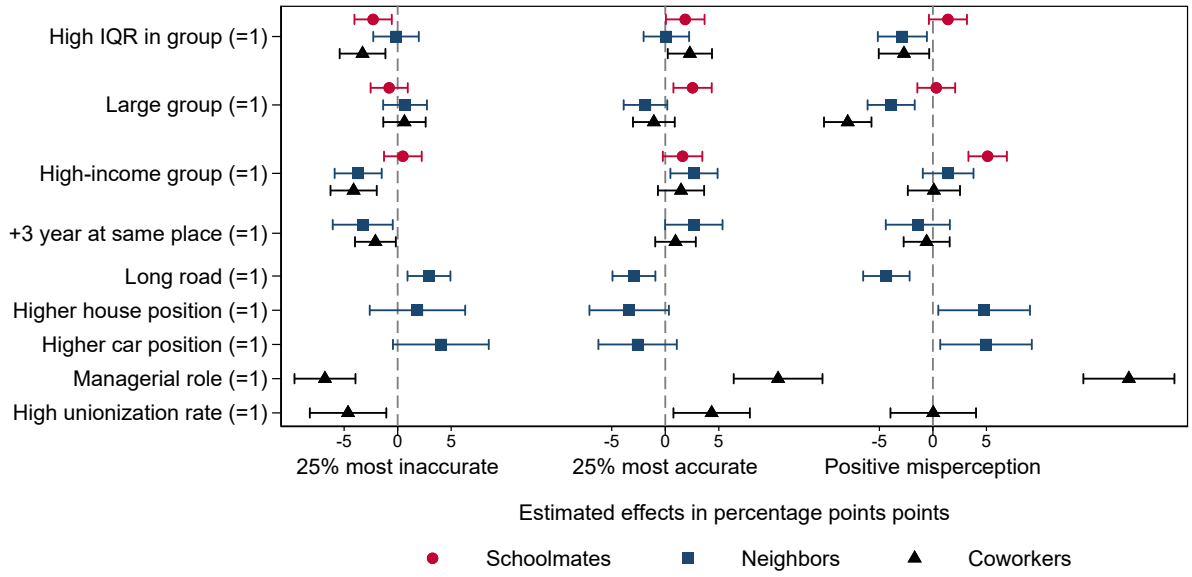


Notes: Coefficients from separate regressions of indicators for being among the 25% most inaccurate or accurate respondents and an indicator for having a positive misperceptions with respect to own position, P50 level and P95 level of the cohort on the explanatory variables indicated on the y-axis (considered separately) 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.

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 position 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 whose former schoolmates have, on average, higher-income 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

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 (considered separately) 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 at 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.

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.

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 matter for differences in fairness views across reference groups? 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?

4.1 Role of Misperceptions of Social Positions for Fairness Views

Correlations. Fairness views on inequality are strongly correlated with misperceptions of social position. We see this in Table 3, which reports results from regressing unfairness of inequality within each reference group on 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 and the second row shows the correlation between actual position in the group and fairness views. The two rows confirm the graphical analysis in Figure 2: First, income differences within education group and co-workers in same sector 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

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***	2.36***	2.32***	2.72***	2.77***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Position in group	-1.74***	-1.83***	-1.96***	-2.36***	-2.47***
	(0.10)	(0.12)	(0.11)	(0.12)	(0.12)
Misperception	-0.57***	-0.99***	-0.74***	-0.65***	-1.50***
	(0.15)	(0.16)	(0.14)	(0.15)	(0.16)
Panel B: With controls					
Position in group	-1.61***	-1.64***	-1.68***	-1.79***	-2.06***
	(0.13)	(0.14)	(0.13)	(0.14)	(0.14)
Misperception	-0.60***	-0.67***	-0.64***	-0.52***	-1.06***
	(0.15)	(0.16)	(0.14)	(0.15)	(0.16)
N	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. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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.

Information experiment. Does the association between perceptions and fairness views in Table 3 represent a causal relationship? We explore this using an information experiment and show that when people are fully informed about their social positions, they 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, are unchanged.

As described in Section 1.2, we randomly informed 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.[26] 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 the 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).[27] Furthermore, people who initially overestimate their own social position and are then informed that they are ranked lower than they thought drive the increase in perceived unfairness of inequality (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."

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 old. The association between current fairness views and social position becomes weaker when measuring social position at more distant points back in time.[28]

[26] In our effort to treat all respondents fairly, the other half of the sample (the control group) was informed about their true positions *after* answering 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.

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

[28] We 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

Table 4: Survey information experiment and unfairness views

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

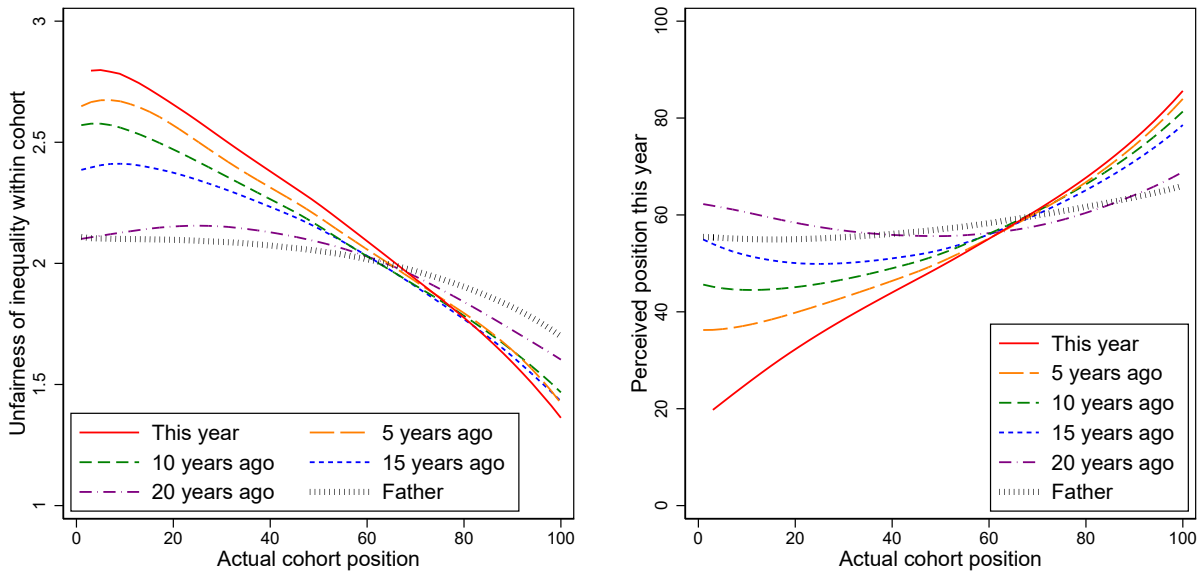
Notes: *Positive misperception* is an indicator that equals 1 if the perceived position is larger than the actual position within the reported reference group specified in each column. $T \times$ *Positive* is an interaction of the treatment indicator and the *Positive misperception* indicator. $T \times$ *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. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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.

the respondent level (9415 clusters). The slope for the *This year* curve is -0.016 ($p < 0.001$). The remaining slopes are significantly 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 ($p < 0.001$).

Figure 12: History of past social positions and unfairness views and perceived position

(a) Unfairness of inequality (b) 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 Panel A, the sample is restricted to the control group.

Life events. To further analyze 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 a given shock in the pre-shock period and define an indicator variable equal to 1 if an individual experienced this shock at some point during the shock period.[29] We regress our outcome variables on each shock indicator (individually) and include detailed individual level controls including fixed effects for cohort, gender, municipality, education, sector, and

[29]The 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.

percentile cohort position prior to the shock. 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 finally 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 are significantly more likely to consider inequality within the 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, which implies 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), which suggests that there is no systematic correlation between these individual characteristics and life events.[30]

[30] We 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

Table 5: Correlation of life events with unfairness of inequality

	Cohort position		Unfairness of inequality					N	Affected
	Actual	Perceived	Cohort	Gender	Mun.	Edu.	Sector		%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unemployment	-9.47***	-4.18**	0.31**	0.36**	0.31**	0.25*	0.28*	3758	5.27
	(1.29)	(1.33)	(0.12)	(0.13)	(0.12)	(0.12)	(0.13)		
Disability	-17.69***	-18.00***	0.67*	0.82*	0.94**	0.43		4649	0.67
	(2.54)	(3.17)	(0.31)	(0.34)	(0.34)	(0.30)			
Hospitalization	-1.84**	-1.10	0.19**	0.21**	0.18**	0.14*	0.10	2234	55.64
	(0.69)	(0.68)	(0.06)	(0.07)	(0.06)	(0.07)	(0.07)		
Promotion	8.51***	6.90***	-0.19*	-0.20*	-0.21*	-0.34***	-0.42***	3889	6.74
	(0.85)	(1.01)	(0.08)	(0.09)	(0.09)	(0.10)	(0.10)		
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 explanatory variables are all indicators that equal 1 if the respondent experienced a given 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 the 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. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

5 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. We analyze how much people know about these inequalities and how fair they perceive them to be.

People consider inequalities conditional on the same level of education or sector of work as most unfair, which may carry important implications for the design of redistribution policy, as shown in Section 2. More research is needed to disentangle the underlying reasons for the differences in fairness views 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).

When it comes to people's perceptions, a key finding is that people are, on average, well-informed about the overall income levels of their different reference groups. However, we also observe center bias in all reference groups, whereby higher-ranked people tend to position themselves lower than they truly are because they overestimate others' incomes. The reverse is true for lower-ranked people, which could 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.

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 fairness views move together with changes in their income and social postions. 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.

As in other studies involving surveys, selection into participation may create biases. We do not find evidence that such biases affect our results when we reweight our sample

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).

to match the characteristics of the population. This does not rule out 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, these results should be less sensitive to participation or selection bias: within-individual comparisons essentially control for individual fixed effects and, hence, individual-specific factors that shape 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., 2022), because such a confounding effect would probably apply to all reference groups we provide information about.

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 on inequalities vary across countries (Alesina et al., 2001, 2018; Almås et al., 2020). However, because we analyze rank positions and relative fairness views across reference groups, 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.

Data availability statement
The data for this project are confidential. Individual-level data is subject to the European Union's General Data Protection Regulation (GDPR). The data are physically stored on computers at Statistics Denmark and may not be transferred to computers outside this secure environment. Access is provided remotely through the internet. The data combines administrative records and survey data. The survey data cannot be made publicly available because there exists a link between the survey and administrative data at Statistics Denmark. The project was approved by the Danish Data Protection Agency and the University of Copenhagen (File No. 514-0018/2018-2000 at the University of Copenhagen) and was also approved by Statistics Denmark. Data and programs are stored in a separate directory at Statistics Denmark with project number 707208. All empirical analyses were carried out with the software Stata/MP 16.1 using the secure internet interface of Statistics Denmark. Researchers interested in obtaining access to the data at Statistics Denmark are required to submit a written application to gain approval from Statistics Denmark. Applications can be submitted by researchers who are affiliated with Danish institutions accepted by Statistics Denmark, or by researchers outside of Denmark who collaborate with researchers affiliated with these institutions. We will assist in any way we can with this procedure. For more information see https://www.dst.dk/en/TilSalg/Forskningsservice. Programs and all data used in the paper are stored on servers at The Division of Research Services – Statistics Denmark in the following folder: "I:\Workdata\707208\REPLICATION_FILES". The replication code for the figures and tables in the main text and detailed explanations of the construction of the analysis data sets are publicly available at the following DOI: https://doi.org/10.5281/zenodo.7430075.

References

Akerlof, G. A. (1978). The Economics of "Tagging" as Applied to the Optimal Income Tax, Welfare Programs, and Manpower Planning. *The American Economic Review 68*(1), 8–19.

Alesina, A. and G.-M. Angeletos (2005). Fairness and Redistribution. *American Economic Review 95*(4), 960–980.

Alesina, A., E. Glaeser, and B. Sacerdote (2001). Why Doesn't the United States Have a European-Style Welfare State? *Brookings Papers on Economic Activity 2001*(2), 187–277.

Alesina, A. and E. La Ferrara (2005). Preferences for redistribution in the land of opportunities. *Journal of Public Economics 89*(5-6), 897–931.

Alesina, A., S. Stantcheva, and E. Teso (2018). Intergenerational Mobility and Preferences for Redistribution. *American Economic Review 108*(2), 521–54.

Almås, I., A. W. Cappelen, K. G. Salvanes, E. Ø. Sørensen, and B. Tungodden (2017). Fairness and family background. *Politics, Philosophy & Economics 16*(2), 117–131.

Almås, I., A. W. Cappelen, E. Ø. Sørensen, and B. Tungodden (2010). Fairness and the Development of Inequality Acceptance. *Science 328*(5982), 1176–1178.

Almås, I., A. W. Cappelen, and B. Tungodden (2020). Cutthroat Capitalism versus Cuddly Socialism: Are Americans More Meritocratic and Efficiency-Seeking than Scandinavians? *Journal of Political Economy 128*(5), 1753–1788.

Andersen, A. G., S. Franklin, T. Getahun, A. Kotsadam, V. Somville, and E. Villanger (2020). Does Wealth Reduce Support for Redistribution? Evidence from an Ethiopian Housing Lottery. Discussion Paper SAM 18/2020.

Andersen, H. Y. and S. Leth-Petersen (2020). Housing Wealth or Collateral: How Home Value Shocks Drive Home Equity Extraction and Spending. *Journal of the European Economic Association 19*(1), 403–440.

Atkinson, A. B. and J. E. Søgaard (2016). The Long-Run History of Income Inequality in Denmark. *The Scandinavian Journal of Economics 118*(2), 264–291.

Baker, M., Y. Halberstam, K. Kroft, A. Mas, and D. Messacar (2022). Pay Transparency and the Gender Gap. *American Economic Journal: Applied Economics (Forthcoming).*

Bartels, L. M. (2016). *Unequal Democracy: The Political Economy of the New Gilded Age.* Princeton University Press.

Bastani, S. and D. Waldenström (2021). Perceptions of Inherited Wealth and the Support for Inheritance Taxation. *Economica 88*(350), 532–569.

Bénabou, R. and E. A. Ok (2001). Social Mobility and the Demand for Redistribution: The Poum Hypothesis. *The Quarterly Journal of Economics 116*(2), 447–487.

Blanchflower, D. G. and A. J. Oswald (2004). Well-being Over Time in Britain and the USA. *Journal of Public Economics 88*(7-8), 1359–1386.

Bø, E. E., J. Slemrod, and T. O. Thoresen (2015). Taxes on the Internet: Deterrence Effects of Public Disclosure. *American Economic Journal: Economic Policy 7*(1), 36–62.

Boserup, S. H., W. Kopczuk, and C. T. Kreiner (2016). The Role of Bequests in Shaping Wealth Inequality: Evidence from Danish Wealth Records. *American Economic Review 106*(5), 656–61.

Boskin, M. J. and E. Sheshinski (1978). Optimal Redistributive Taxation When Individual Welfare Depends Upon Relative Income. *The Quarterly Journal of Economics 92*(4), 589–601.

Bublitz, E. (2022). Misperceptions of income distributions: Cross-country evidence from a randomized survey experiment. *Socio-Economic Review 20*(2), 435–462.

Cappelen, A. W., J. Konow, E. Ø. Sørensen, and B. Tungodden (2013). Just luck: An experimental study of risk-taking and fairness. *American Economic Review 103*(4), 1398–1413.

Cappelen, A. W., E. Ø. Sørensen, and B. Tungodden (2010). Responsibility for what? Fairness and individual responsibility. *European Economic Review 54*(3), 429–441.

Card, D., A. Mas, E. Moretti, and E. Saez (2012). Inequality at Work: The Effect of Peer Salaries on Job Satisfaction. *American Economic Review 102*(6), 2981–3003.

Clark, A. E. and A. J. Oswald (1996). Satisfaction and comparison income. *Journal of Public Economics 61*(3), 359–381.

Cruces, G., R. Perez-Truglia, and M. Tetaz (2013). Biased perceptions of income distribution and preferences for redistribution: Evidence from a survey experiment. *Journal of Public Economics 98*, 100–112.

Cullen, Z. and R. Perez-Truglia (2022). How Much Does Your Boss Make? The Effects of Salary Comparisons. *Journal of Political Economy 130*(3), 766–822.

Cullen, Z. B. and R. Perez-Truglia (2018). The Salary Taboo: Privacy Norms and the Diffusion of Information. NBER Working Paper 25145. *National Bureau of Economic Research*.

Duesenberry, J. (1949). *Income, Saving, and the Theory of Consumer Behavior*. Economic Studies : No. 87. Harvard University Press.

Easterlin, R. A. (1995). Will raising the incomes of all increase the happiness of all? *Journal of Economic Behavior & Organization 27*(1), 35–47.

Easterlin, R. A. (2001). Income and Happiness: Towards a Unified Theory. *The Economic Journal 111*(473), 465–484.

Epper, T., E. Fehr, H. Fehr-Duda, C. T. Kreiner, D. D. Lassen, S. Leth-Petersen, and G. N. Rasmussen (2020). Time Discounting and Wealth Inequality. *American Economic Review 110*(4), 1177–1205.

Fehr, D., J. Mollerstrom, and R. Perez-Truglia (2022). Your Place in the World: Relative Income and Global Inequality. *American Economic Journal: Economic Policy 14*(4), 232–68.

Fehr, E. and K. M. Schmidt (1999). A Theory of Fairness, Competition, and Cooperation. *The Quarterly Journal of Economics 114*(3), 817–868.

Feichtmayer, J. E. and K. Gründler (2021). Global Evidence on Misperceptions and Preferences for Redistribution. CESifo Working Paper No. 9381. *CESifo*.

Ferrer-i-Carbonell, A. (2005). Income and well-being: An empirical analysis of the comparison income effect. *Journal of Public Economics 89*(5-6), 997–1019.

Gignac, G. E. and M. Zajenkowski (2020). The Dunning-Kruger effect is (mostly) a statistical artefact: Valid approaches to testing the hypothesis with individual differences data. *Intelligence 80*, 101449.

Giuliano, P. and A. Spilimbergo (2014). Growing up in a Recession. *Review of Economic Studies 81*(2), 787–817.

Haaland, I., C. Roth, and J. Wohlfart (2022). Designing Information Provision Experiments. *Journal of Economic Literature (Forthcoming)*.

Hoy, C. and F. Mager (2021). Why Are Relatively Poor People Not More Supportive of Redistribution? Evidence from a Randomized Survey Experiment across 10 Countries. *American Economic Journal: Economic Policy 13*(4), 299–328.

Hvidberg, K. B., C. T. Kreiner, and S. Stantcheva (2020). Social Positions and Fairness Views on Inequality. NBER Working Paper 28099. Updated July 2022. *National Bureau of Economic Research*.

Jäger, S., C. Roth, N. Roussille, and B. Schoefer (2021). Worker Beliefs About Outside Options. NBER Working Paper 29623. *National Bureau of Economic Research*.

Jakobsen, K., K. Jakobsen, H. Kleven, and G. Zucman (2020). Wealth Taxation and Wealth Accumulation: Theory and Evidence from Denmark. *The Quarterly Journal of Economics 135*(1), 329–388.

Karadja, M., J. Mollerstrom, and D. Seim (2017). Richer (and Holier) Than Thou? The Effect of Relative Income Improvements on Demand for Redistribution. *Review of Economics and Statistics 99*(2), 201–212.

Kleven, H. J., M. B. Knudsen, C. T. Kreiner, S. Pedersen, and E. Saez (2011). Unwilling or Unable to Cheat? Evidence From a Tax Audit Experiment in Denmark. *Econometrica 79*(3), 651–692.

Kreiner, C. T., D. D. Lassen, and S. Leth-Petersen (2019). Liquidity Constraint Tightness and Consumer Responses to Fiscal Stimulus Policy. *American Economic Journal: Economic Policy 11*(1), 351–379.

Krueger, J. and R. A. Mueller (2002). Unskilled, unaware, or both? The better-than-average heuristic and statistical regression predict errors in estimates of own performance. *Journal of Personality and Social Psychology 82*(2), 180–188.

Kuziemko, I., M. I. Norton, E. Saez, and S. Stantcheva (2015). How Elastic Are Preferences for Redistribution? Evidence from Randomized Survey Experiments. *American Economic Review 105*(4), 1478–1508.

Londoño-Vélez, J. (2022). The impact of diversity on perceptions of income distribution and preferences for redistribution. *Journal of Public Economics 214*, 104732.

Luttmer, E. F. P. (2005). Neighbors as Negatives: Relative Earnings and Well-Being. *The Quarterly Journal of Economics 120*(3), 963–1002.

Malmendier, U. and S. Nagel (2011). Depression Babies: Do Macroeconomic Experiences Affect Risk Taking? *The Quarterly Journal of Economics 126*(1), 373–416.

Meltzer, A. H. and S. F. Richard (1981). A Rational Theory of the Size of Government. *Journal of Political Economy 89*(5), 914–927.

Nair, G. (2018). Misperceptions of Relative Affluence and Support for International Redistribution. *The Journal of Politics 80*(3), 815–830.

Perez-Truglia, R. (2020). The effects of income transparency on well-being: Evidence from a natural experiment. *American Economic Review 110*, 1019–1054.

Roth, C. and J. Wohlfart (2018). Experienced inequality and preferences for redistribution. *Journal of Public Economics 167*, 251–262.

Stantcheva, S. (2017). Optimal Taxation and Human Capital Policies over the Life Cycle. *Journal of Political Economy 125*(6), 1931–1990.