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Misperceptions and mismeasurements: An analysis of subjective economic inequality*

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Abstract

This paper focuses on an important aspect of economic inequality – the question of how people perceive inequality and whether these perceptions deviate in any meaningful way from statistical measures of inequality. Using a novel approach I investigate whether individuals across different countries are able to correctly estimate the shape of income distribution of the country where they reside. I find that perceptions of inequality are frequently shaped by reference groups such as those formed according to educational attainment, age, and gender.

Keywords: Income inequality, perception, reference groups.

JEL Classification: D31, D83, D63, I30.

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1 Introduction

There are many reasons why we should care about people's perceptions of inequality. First, public support for redistribution has been linked to the way people think about inequality and interpret their relative positions in society. Engelhardt and Wagener (2014) use survey results and find that a subjective distribution of income based on their respondents' perceived location in the income distribution greatly explains the respondent's demand for redistribution. Niehues (2014) shows that while the Gini coefficient has no statistically significant effect on support for redistribution, perceived inequality is positively correlated and highly significant.

Perceptions of inequality are not only relevant in public finance models; they may also have psychological and behavioral implications. Traditionally, the link between inequality and happiness has been studied by looking at the link between average happiness and aggregated, statistical measures of inequality (Wilkinson and Pickett, 2010). However, more recent studies have shown that it is the perception of differences rather than objective differences in circumstances that have negative effects on happiness (Diener, Sandvik, Seidlitz, and Diener, 1993; Ferrer-i Carbonell, 2005; Clark et al., 2003).

Most studies that look at perceived inequality have found inconsistencies between perceived inequality and officially reported statistical measures of inequality. For instance, research by Norton and Ariely (2011) finds that in most surveys in the United States, respondents systematically *underestimate* the inequality of wealth. In contrast, Chambers, Swan, and Heesacker (2014) find that Americans tend to *overestimate* the gap between the top 20 percent and the bottom 20 percent of wealth earners in the United States. Gimpelson and Treisman (2015) find that people in most countries do only slightly better than chance at guessing the shape of the distribution of income in their country. In only 5 of the 40 countries where their survey was administered were a majority

of respondents able to *correctly* state the level of income inequality in their country. According to Gimpelson and Treisman, "[i]t requires a great leap of faith to suppose that ordinary people can guess the level of inequality more accurately than expert statisticians —with all the censuses, surveys, and sophisticated statistical techniques at their disposal."

The inconsistencies between perceived inequality and objective measures of inequality are thus typically attributed to errors on the part of everyday individuals. Ordinary individuals are said to be "wrong" about the level of inequality in their country, and their biases are frequently referred to as *misperceptions*. Yet, despite these characterizations, it seems reasonable to consider whether part of the observed discrepancy between perceptions and official inequality statistics can be attributable to errors and biases on the part of those who measure inequality rather than those who perceive it. Given some of the divergent results in the perceptions literature, given the many difficulties associated with capturing and interpreting subjective, and often tacit, pieces of information, and given the specific construction of our "objective" inequality measures, it is likely that the discrepancies between objective and subjective measures of inequality are not simply the result of *misperception*, but also the result of some *mismeasurement*.

Surveys that ask ordinary individuals about inequality are the fountainhead of many potential errors. Questions framed too broadly or too technically on a survey can easily be misinterpreted. For instance, if not specified, survey respondents may easily confuse wealth inequality with income inequality, household income with individual income, and before-tax income with after-tax income. More technical questions, on the other hand, many also lead to confusion. Many survey questions ask respondents to describe their perception of inequality in terms of probability distributions using quantiles, moments, or points of the distribution – all of which may be challenging concepts for anybody who is not accustomed to thinking about inequality in terms of probability and statistics.

This has been shown in the contrast between the work of Norton and Ariely (2011) and

Eriksson and Simpson (2012). In their study, Norton and Ariely (2011) ask respondents what percent of wealth is owned by each of the five quintiles in the United States. They find that Americans drastically underestimate the level of wealth inequality and conclude that individuals are unaware of the true gaps that exist. However, in a replication of this study conducted by Eriksson and Simpson (2012), respondents, rather than being asked about the relative wealth shares of each quintile, were asked to indicate the *average* wealth of individual households within a given quintile. This line of questioning resulted in dramatically higher answers than what Norton and Ariely found. When the question was asked about the percentage of wealth owned by each quintile the ratio of the wealth of the top to bottom quintile was perceived to be 1:21. However, when the question was asked about the average wealth of each quintile in the United States, respondents estimated the same ratio to be 1:1,500. Eriksson and Simpson's replication demonstrates that simply rephrasing survey questions can lead to dramatically different answers. Similarly, Amiel and Cowell (1999) find that respondents to their questionnaires, answered differently to verbal and numerical questions that were aimed at asking similar things.

These studies among many others demonstrate the wide range of choices researchers face when trying to extract information about perceptions. In another study, Chambers et al. (2014) use multiple choice questions and ask individuals to guess the cut-off points of income quintiles in the United States. Respondents were asked, for example, whether the cut-off point for the top 1% was at $380,354 (the actual value) or $681,649 (an extremely high value). In their survey, they found that most participants (76%) selected the wrong answer. Cruces, Perez-Truglia, and Tetaz (2013) who conduceted their study in Argentina find that providing supplementary information to respondents alters results. They show that if participants are asked to estimate the average income of different income groups without any further information, their answer would be different than the case in which they are given some basic information about, for instance, the average income of the

bottom 20% of the income distribution. Cruces et al. (2013) also attempted to eliminate the notion of percentage shares from some of their questions. For example, they ask their respondents the following question: "There are 10 million households in Argentina. How many have incomes lower than yours?" They use this question as a proxy for individuals' perception of their own position in the income ladder. Finally, a nationwide survey of 3,000 Canadians demonstrates contradictory results. When asked what the ideal distribution of wealth should be across each quintile of the population, individuals in the sample, on average, responded that while the wealthiest quintile should own 30.3% of the total wealth, the rest of the quintiles should own 20.4%, 23.7%, 14.1%, and 11.5%, respectively (Broadbent-Institute, 2014). The second quintile was given a lower share of wealth than the third quintile, demonstrating there was some confusion regarding the question.

Given these issues, I question some of the conclusions drawn from previous studies. Are respondents really misperceiving inequality or do our measures of subjective inequality depend just as much on how researchers frame questions and interpret survey results? Using the same survey data used by Gimpelson and Treisman (2015), but using a different interpretive approach, I am able to draw conclusions that are somewhat contrary to Gimpelson and Treisman's findings. One of the questions in the International Social Survey Programme (ISSP) asks individuals to guess the shape of the income distribution in their country. The advantage of this question over others is the relative simplicity and clarity of the question. Respondents are shown five diagrams depicting five different types of distributions and are asked which diagram "best describes" the county they live in. Using personal-level micro data from the Luxembourg Income Study (LIS), I find the shape of the income distribution for each country represented in the survey, and using the Bhattacharyya coefficient, I compare each respondent's answer to the distribution I derive for their country. In doing so, I am able to show that the perceptions of many of the respondents are well aligned with the actual distributions.

Respondents of the survey are shown to do a better job at guessing the income distribution when their answers are compared to the actual distribution rather than compared to synthetic measures of inequality like the Gini coefficient such as they are in Gimpelson and Treisman (2015) and Niehues (2014). Given these exceptions, I investigate some factors that could explain variations in perceived inequality across countries, and find that income and education are important factors that can explain differences in how accurately individuals perceive inequality across countries.

Moreover, I investigate the role of "reference groups" in shaping perceptions of inequality. I look at whether subjective and objective inequality levels will be closer if one readjusts the income distribution based on more refined reference groups. This is based on the hypothesis that people's perception of inequality and where they stand in the income distribution is to a large extent based on their reference groups, which can be formed on the basis of educational and demographic factors.

Unfortunately, economists who study inequality tend to ignore reference groups, often pointing to the arbitrariness of defining reference groups and arguing *de gustibus non est disputandum*. However, in this project, taking advantage of the richness of the LIS dataset, I attempt to calculate the distribution of income within a variety of reference groups and see whether respondent's perceptions of inequality are closer to any of these distributions than they are to the overall distribution of income in their country. I define reference groups based on education, age, and gender. The importance of each of these reference groups varies from country to country.

While the inconsistencies between subjective and objective levels of inequality are important, it is imperative that researchers do not entirely write these inconsistencies off as misperceptions. It is important to fully recognize that despite being armed with "censuses, surveys, and sophisticated statistical techniques," researchers can still be prone to misinterpretation, mismeasurement, and biases of their own. Thus, any consideration of misperceived inequality needs to be considered with scrutiny for how the perceptions were observed. This paper sheds more light on perceptions of

income inequality especially through the lens of reference groups.

The structure of the paper is as follows. Section 2 summarizes the data sources used in this study. In Section 3, I introduce my methodology and show the results of comparing objective inequality measures and perceived inequality. In Section 4, I consider the role of reference groups in shaping perceptions of inequality. Sections 5 and 6 discuss the limitations of my analysis and conclude the paper.

2 Data

There is only a limited number of cross-national surveys on perception of inequality. While most of these surveys include questions about individuals' relative position in the income scale (information that is then used in order to find the perceived income distribution), only a few of them ask respondents what they think is the existing level of inequality in their country, and only one, the International Social Survey Programme (ISSP), asks individuals to guess the shape of inequality in their country.

ISSP is a collaboration of international organizations and universities surveying individuals from more than 50 countries covering topics for social science research. The data set contains information on around 1000 individuals from each participating country resulting in a large overall sample. The themes of the survey change from year to year, but in 2009, the survey focused on the topic of social inequality and included questions ranging from attitudes toward inequality, discrimination, corruption, and merit; perceptions of inequality; sources of inequality; and government policies to reduce inequality. The survey also includes demographic, educational, occupational, social, and cultural variables corresponding to each participant.

Question 14 on the ISSP survey, which is the main question I consider, asks respondents to

guess the shape of distribution in their country, but does not make any reference to wealth or income. The exact prompt of the question is shown in Figure 1. As a result the same criticism about such confusion applies to this data set as well. However, as Gimpelson and Treisman (2015) suggest, since the previous question on the survey (Question 13) asks directly about "pay" and "earnings," it is safe to assume most respondents interpreted the question as referring to income and not wealth.[1]

While I use the ISSP data to get insights into perception of inequality across countries, I use Luxembourg Income Study (LIS) micro data in order to construct objective distributions of income for each country included in the ISSP survey. The LIS Database is one of the largest available income databases of microdata collected from multiple countries over a period of decades. These data are harmonized for cross-country comparisons, and the data set contains income (among many other variables) at both the individual and household level. Since one of the problems with cross-country comparisons is the heterogeneity in standards of data collection and constituting variables, the LIS data is advantageous since it minimizes these discrepancies and harmonizes the surveys. In this study, I will choose individuals, rather than households, as the consumption unit due to the fact that I rely on individual characteristics such as age and occupation that are impossible to define for a households.[2]

I use individual characteristics such as age, education, and occupation to define types or reference groups. I then find the objective income distribution within each of those groups. For instance, I find the income distribution of highly-educated individuals or those of age 20-29. Calculating the objective income distributions based on types allows me to have a better understanding of how individuals perceive income inequality and how they make inferences about the overall income distribution.

[1]Question 13 asks "Is your pay just? We are not asking about how much you would like to earn - but what you feel is just given your skills and effort. If you are not working now, please tell about your last job."

[2]Other researchers have, nonetheless, used the age of the head of the household, which seems irrelevant.

Lastly, since the ISSP survey was done in 2009, there are limits to the number of countries that show up in both LIS data and the survey in or around 2009.[3] The number of countries that appear in both data sets is 21 countries.

3 Perception of Inequality Across Countries

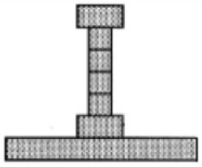
The main question from the survey I use in this study is a question about the shape of the income distribution. In the question, shown in Figure 1, individuals are asked to choose one of five distributional shapes (each accompanied by a brief explanation), which best represents their country. The five diagrams range from a more unequal society to more equal one. The diagram labeled "Type A," for instance, represents a society with a large percentage of people at the bottom of the distribution, a small middle class, and a relatively large group at the very top end of the distribution. The figure labeled, Type D represents a large middle class with a small and equal share of the population at the top and bottom end of the distribution.

Responses to the question show that there are large variations in the responses within each country.[4] For instance, in countries such as Austria, the United States, Great Britain, the Philippines, Slovenia, and Germany answers are divided among distributions A to D. In the United States, while a majority of respondents chose distribution B (38.9%), the rest of the population was divided between distributions A, C, and D (17.1%, 15.0%, and 26.0%, respectively). Across countries, too, answers are surprisingly at odds with each other. While in countries such as Croatia, Lithuania, Russia, Ukraine, South Africa, and Argentina a majority of individuals chose distribution A, most Scandinavians chose distribution D. In most western European countries, the United States, and China, distribution B was the most popular choice. Austria was the only country where the majority

[3]For some countries, I use LIS data for 2010 instead of 2009 because data was not available for them in 2009.

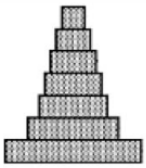
[4]The summary of responses in each country is not provided here but is accessible on the ISSP website: https://dbk.gesis.org/dbksearch/sdesc2.asp?no=5400

Q14. These five diagrams show different types of society. Please read the descriptions and look at the diagrams and decide which you think best describes <country> ..



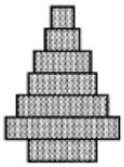
Type A

A small elite at the top, very few people in the middle and the great mass of people at the bottom.



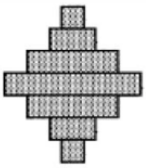
Type B

A society like a pyramid with a small elite at the top, more people in the middle, and most at the bottom.



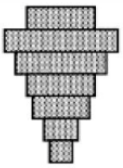
Type C

A pyramid except that just a few people are at the bottom.



Type D

A society with most people in the middle.



Type E

Many people near the top, and only a few near the bottom.

Figure 1: Characterization of the type of society in the ISSP survey, *Source: International Social Survey Programme, 2009 Social Inequality IV*

of individuals chose distribution C, and in New Zealand, the majority of answers were split between B and D.

There are large variations in answers across individuals and countries if we group individuals based on their education, income, or their political affinity. Taking advantage of this large data set of nearly 55,000 individuals across the world, how can we compare the perception of inequality in each country to their corresponding objective measures? As I mentioned before, one approach used by researchers[5] has been to compare the respondents answers to a single metric such as the Gini coefficient. For instance, Gimpelson and Treisman (2015) use the corrected Gini calculation method offered by Van Ourti and Clarke (2011) to calculate a Gini coefficient for each of the five diagrams represented in the question. They assume that each of the seven bars constituting one diagram represents a distinct income class. One issue with this method is that the conversion of each diagram into a single number, i.e. the Gini coefficient, expunges some of the fundamental differences of the diagrams. For instance, while diagrams D and E represent fundamentally different societies,

[5]See Niehues (2014) and Gimpelson and Treisman (2015).

the Gini coefficients calculated in Gimpleson and Treisman are almost the same (0.20 versus 0.21 respectively). A similar approach is used in Niehues (2014). Furthermore, the method used in the paper is only suitable only when the group sizes belonging to each bin are equal. Lastly, there is a problem of arbitrary choice of average income within each group. Gimpelson and Treisman (2015) assumed that the income gaps between each two consecutive bars were the same and that the scaled average income in the bottom bar is 1 and in the top bar is 7. This is a strong assumption and an alternative assumption will give different Gini coefficients for the distributional shapes. The combination of these problems will make it hard to rely on the comparisons of subjective and objective inequality measures as suggested in these papers.

To overcome such shortcomings, I use a method of closeness of distributions in order to compare subjective and objective income distributions without the need for calculating an index such as the Gini coefficient. I find the shape of the income distribution in each country using LIS data. To have an income distribution comparable to the diagrams in the ISSP survey, I divide the income distribution into 7 equal-width bins and calculate the share of population in each category.[6] Since extremely high and low income will result in very few people in the very bottom and very top bins, I need to "trim" the distribution by "winsorizing" the top 5% of the income distribution, an exercise that is common in calculations of inequality.[7] Figure 2 shows the objective income distributions in all the 21 countries. As is apparent, there is large variations in the shape of income distributions among the sample of countries depicted in the figure.

[6]Niehues (2014) takes a different albeit arbitrary approach in grouping the income distribution into bins. She chooses bin 1 to include everyone whose income is below 60% of the median income in the country (to represent a measure of poor household), bin 3 to be between 80% to 110% of the median income, bin 4 to include those with income between 110% to 150% of the median income (therefore, bin 3 and bin 4 together constitute the middle class), and bin 7 to include those with income higher than 250% of the median income representing the very rich. Since the share of each country's population who fall into each group highly depends on the choice of the numbers in grouping, this could be a bigger problem as those definitions such as the poor, the middle class, the rich, etc. ranges significantly across countries. For instance, while in most Western European countries poverty is a relative concept and is linked to the median income, in the United States and a majority of the rest of the world the definition is absolute.

[7]For more on winsorizing see Daniels (2008); White (2015).

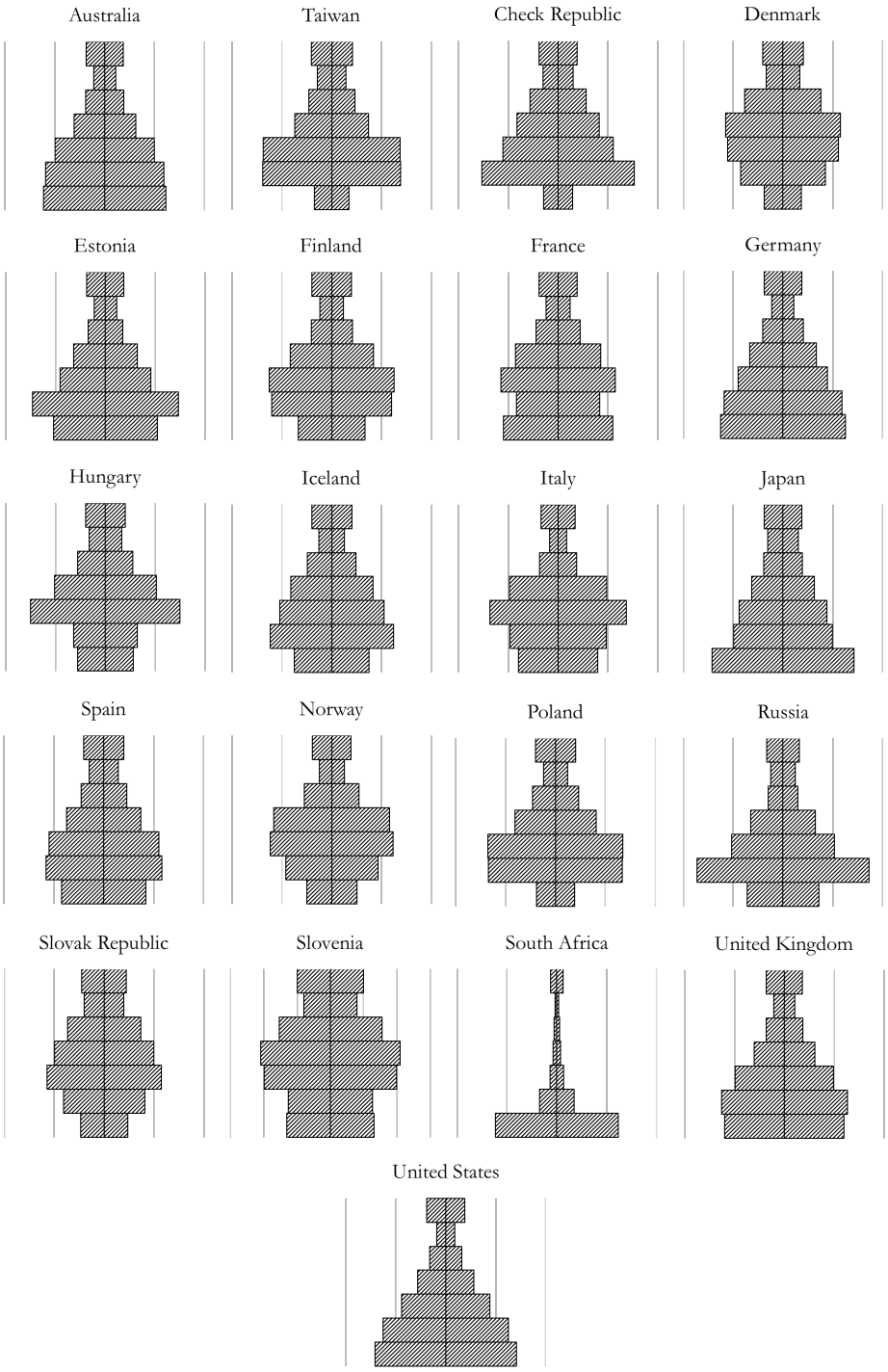


Figure 2: Income distribution in the countries in the sample, *Source: LIS Data, 2008–2010*

In what follows, I use the Bhattacharyya Coefficient (BC) in order to compare the shape of the income distribution in each country to the shape of distributions presented to respondents in the ISSP survey. Using the coefficient, I can find a *closeness* index between perceived and actual distributions.

3.1 Bhattacharyya coefficient

For each diagram, I measure the size of each bin as a share of the addition of all the bins in each diagram.[8] For instance, the relative size of the first bin in diagram A of the questionnaire relative to the overall size of all the bins is 49.07.

I now use BC to compare the amount of overlap between the subjective distribution S and the objective distribution O as follows

$$BC(S, O) = \sum_{i=1}^{7} \sqrt{S_i O_i}$$

where S_i is the size of the i-th bin of distribution S, and O_i is the size of the i-th bin of distribution O (Bhattachayya, 1943). BC is equal to 0 if there is no overlap at all due to the multiplication by zero in every partition and equal to 100 if there is perfect correspondence between S and O. BC is widely used in research of feature extraction and selection, image processing, and other statistical purposes. After this calculations, I normalize he BC scores such that the highest score is set to 100 and the lowest is set to 0. Table 1 presents this normalized BC measure for the closeness of the different distributional diagrams in the ISSP survey to the objective income distribution in each country.

It is worth mentioning that there are other methods that are used in calculating the closeness of two distributions such as the chi-square measure and the Kullback–Leibler divergence measure. However, BC has the advantage of avoiding singularities when empty bins are compared. When

[8] Simply by using a ruler.

Table 1: Normalized Bhattacharyya coefficient for the closeness of objective distributions in each country to different distributional diagrams from ISSP

	Diagram A	Diagram B	Diagram C	Diagram D	Diagram E
Australia	56.64	100	95.8	30.33	0
Taiwan	0	72.93	100	74.39	45.93
Czech Rep	0	72.1	100	79.35	52.44
Denmark	0	71.9	96.11	100	69.64
Estonia	46.63	97.72	100	31.38	0
Finland	0	80.56	100	56.38	12.28
France	33.37	100	99.31	48.05	0
Germany	57.86	100	94.52	30.83	0
Hungary	0	79.42	100	96.22	57.26
Iceland	0	82.93	100	48.8	5.33
Italy	3.67	85.63	100	60.55	0
Japan	65.85	100	87.19	22.52	0
Norway	0	77.62	100	91.24	47.85
Poland	0	73.75	100	74.75	41.23
Russia	16.48	84.88	100	35.94	0
Slovak Rep	0	76.6	100	97.31	70.45
Slovenia	0	82.56	100	99.33	69.85
S. Africa	100	81.81	56	3.59	0
Spain	6.23	87.31	100	40.14	0
UK	56.05	100	97.02	30.75	0
US	72.26	100	90.75	25.15	0

empty bins are compared the denominator of the chi-square measure will be zero; in contrast, BC is insensitive to zero denominators. It is important to note that all these measures are ordinally equivalent. Since the relative closeness of distributions and not the absolute values are the main subject of this study I find that both chi-square and BC measures give the same rank ordering for the closeness of distributions, i.e., for instance, if the chi-square measure finds the diagram C to be the closest (among other diagrams) to the actual income distribution in the U.S., BC, too, will rank diagram C as the closest to the actual income distribution.

3.2 Are perceptions different?

Based on Table 1, distributions B and C are the closest to the objective distribution in most countries with the exception of Denmark (where the closest distribution is D) and South Africa (where the closest distribution is A). While South Africa is the only country where the distribution of income is closest to diagram A, there is virtually no country where the income distribution mimics diagram E. To answer the question of whether perceptions are different from measured inequality we can simply look at what percentage of respondents have chosen each of the distributions in the questionnaire. For instance, 58.7% of Danish, 53.6% of French, 35.4% of Germans, 38.5% of Japanese, 50.8% of South Africans, 41.9% of the British, and 38.9% of Americans, which constituted the majority in their countries, chose the closest distribution to the actual income distribution in their country. However, for countries such as Hungary, Poland, and Slovak Republic, 56.6%, 37.1%, and 43.6% of respondents, respectively, (again majorities in their countries) chose the least similar shape to the shape of income distribution in their countries. Only 6% of Hungarians selected the correct shape.

Since the BC measure gives us a non-binary closeness index, I can calculate an aggregate closeness index for each country by multiplying the share who selected each diagram by the normalized BC measure for each diagram. Figure 3 shows the score for the countries in our sample. The average closeness across all countries is 66.7%, a number smaller than the closeness score in the United States and the United Kingdom. The aggregate closeness seems to be highest two Scandinavian countries, Denmark and Norway, and lowest among Eastern European countries.

In what follows I try to answer whether BC is different across individuals with different characteristics. In the first exercise, I divide individuals into three educational groups: low education, medium education, and high education.[9] As shown in Figure 4, and not very surprisingly,

[9]Low education are those with no formal education, with lowest formal qualification, or above lowest qualification. Medium education are those with higher secondary completed or those above higher secondary level. High education

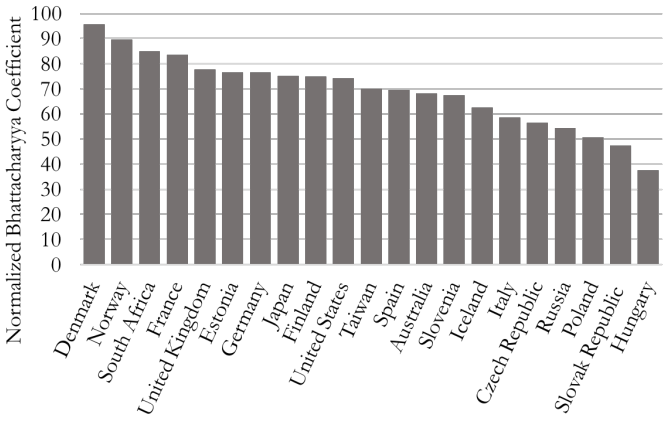


Figure 3: Aggregate closeness of subjective and objective distributions across countries

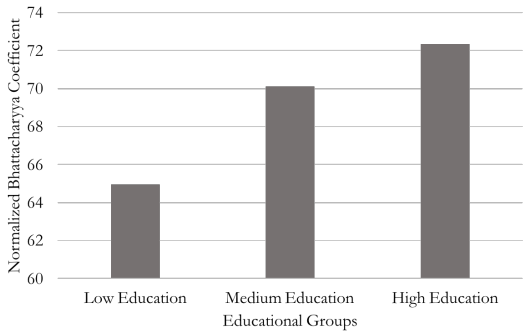


Figure 4: Bhattacharyya coefficient for different educational groups aggregated over all countries

respondents with higher education are better at guessing the correct income distribution. The gap in terms of BC between a highly educated person and someone with low levels of education is, on average, 14.5 points. After testing age as another explanatory factor, I find practically no difference in terms of normalized BC across different age groups.

In order to study other factors that can help explain the variations in answers across all countries, I employ regression analysis with country fixed effects. I first use normalized BC as the dependent variables as shown in the first two columns of Table 2. On the right hand side of the regression, I use factors such as gender, self-identified income decile, education, and age as well as

are those with university degree completed or with graduate studies.

country fixed effects. This is shown in model (1). I find that those with high levels of education and at the top declies of the income distribution are the most likely to correctly guess the shape of the income distribution in their country. In model (2) I add factors such as political affinity, occupational groups, and whether the person lives in urban area as explanatory variables.[10] My intuition is that individual's political affinity may affect their perception of the income distribution. Additionally, their perception of inequality is likely affected by people around them, so it seems important to study factors such as occupational group or geography.[11] I find that those on the left are slightly better than those in the center or right in guessing the shape of the income distribution. I do not find any significant differences across the occupational spectrum, except for those in professional occupations. Moreover, location does not seem to be an important variable.

Regression (3) uses a binary variable for whether the person guessed the correct distributional diagram in their country. Therefore, in the United States, it is equal to 1 for a person who chose distribution B and 0 for everyone else. The coefficients on education categories are the opposite of the ones in Regressions (1) and (2). This may be due to the heterogeneity in choosing diagrams other than the one that is the closest to the shape of the income distribution in a country. The dependent variable in Regression (3) does not distinguish between getting a *wrong* answer and a *very wrong* answer. The results in this column are similar to the binary approach used in Gimpelson and Treisman (2015). Note that Regressions (1) and (2) fit the data better compared to Regression (3).

In all three regressions, I control for country fixed effects.

One possible reason for why characteristics such as income and education are important determinants of correctness in choosing the shape of income distribution is the notion of reference groups. The socio-economic or demographic group an individual belongs to may indeed shape

[10]The indication of whether the individual is politically on the left, center, or right is done by surveyors based on individuals' party memberships.

[11]Unfortunately, I do not have more specific geodata beyond a dummy variable indicating whether the person lives in rural or urban areas.

Table 2: Regeression of BC and a binary score for closeness of objective and subjective distributions on individuals' characteristics

	(1) BC	(2) BC	(3) Binary Score
Female	0.0978	−0.2346	−0.0078
Education			
Medium	1.9497***	1.4237**	−0.0127
High	3.2849***	1.9975**	−0.0399***
Income Decile			
2nd	8.0994***	9.9872***	0.0535*
3rd	6.4969***	6.3877***	−0.0180
4th	9.4803***	8.4556***	−0.0032
5th	12.9066***	11.6019***	0.0189
6th	11.5352***	10.3949***	0.0046
7th	12.3421***	11.5086***	0.0027
8th	12.4439***	12.2454***	0.0005
9th	7.8354***	6.1418**	−0.0369
10th	9.0288**	5.1720	−0.0517
Age			
30- to 39-year olds	0.5682	1.7409*	0.0051
40- to 49-year olds	−0.6013	−0.0352	−0.0138
50- to 59-year olds	−1.4763*	−0.6259	−0.0071
60- to 69-year olds	0.2543	1.3519	0.0068
Political Affinity			
Left		1.8662**	0.0097
Right		−1.2064*	−0.0086
Occupation Groups			
Professionals		3.2088***	0.0266*
Technicians		1.9448*	0.0219
Clerical Support		1.5669	0.0169
Service & Sales		0.5961	0.0117
Ag., Forestry & Fishery		−0.3895	−0.0214
Crafts & Related Trades		−0.4209	−0.0233
Operators & Assemblers		1.0590	−0.0007
Elementary Occupations		1.2494	−0.0154
Armed Forces		−2.1983	0.0773
Lives in Urban Areas		−0.6428	−0.0053
Constant	52.7009***	52.5935***	0.2862***
Observations	19840	13964	14680
Adjusted R^2	0.175	0.146	0.117

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each regression model contains country fixed effects. Reference groups are male, those with low levels of education, age group 20- to 29-year olds, those at the center of the political spectrum, those in managerial jobs, and those living in rural areas. BC is normalized. The binary score is a score that is 1 if the individual guessed the closest diagram to the income distribution in her country and 0 if she selected any other diagram.

their perception of inequality. In the next section, I explore the role of reference groups by defining reference groups based on education, age, and gender.

4 Comparative Reference Groups and Perceptions of Inequality

Individuals' perception of inequality are significantly correlated with their relative position within their reference groups. The term "reference group" is defined as the group of individuals to which one compares oneself to for the purpose of self-appraisal. Roper (1940) was probably the first to introduce the idea of reference group. He argued that two people of equal income living in different areas may have different relative statuses depending on the incomes of their associates. He attempted to classify respondents by economic status. Hyman (1942) was first to delve into the empirics of reference groups in his seminal work, *The Psychology of Status*.

The concept of reference groups is crucial for studies of inequality. Milanovic (2007) notes that"there is no point in studying inequality between two groups that do not interact or that ignore each other's existence." Sen (2000) also argues that the focus of inequality studies is "on the utilities of the individuals only in that group [the reference group], without any direct note being taken of the utilities of others not in the group." Cruces et al. (2013) point out that the perceptions of where individuals stand in the distribution of income are significantly correlated with their relative position within their reference groups. Surveys that ask whose income the respondents are most likely to compare their own income with suggest that colleagues, friends, and family members are the most important reference groups. Reference groups are usually defined on the basis of geographical, education, and demographic groups or even friends and family. An individual's reference group could also be one's own status in the future.

So what is the role of reference groups in perceptions of inequality? According to Kahneman

[11]See for instance Clark and Senik (2010).

and Tversky (1972), subjective assessments are statistical inference problems in the presence of limited information. In other words, individuals observe the income of others in their reference group, which is a sub-sample of the overall population, and then infer the income distribution in the overall population. Cruces et al. (2013) claim that agents will still be able to arrive at consistent estimates of the entire distribution "by factoring in the selection process of the non-representative sample of incomes that they observe." Based on their model, an agent i can infer information about the distribution of income in the society, $f(.)$, or some statistic of the distribution such as the mean, median, or agent's own ranking, using information about observed incomes. An individual with income x_i estimates the distribution of income in his or her reference group through the following identity

$$f(x_i|i \in S_j) = \frac{Pr(i \in S_j|x_i)f(x_i)}{P_{S_j}}$$

where $Pr(i \in S_j|x_i)$ is the probability that individual i belongs to the reference group S_j, given that his or her income is x_i; $f(x_i)$ is the income distribution for the entire population; and P_{S_j} represents the population share of group S_j, which may also be written as $Pr(i \in S_j)$. Based on the Bayes' rule, individuals' inference of the income distribution is then

$$f(x_i) = f(x_i|i \in S_j)\frac{P_{S_j}}{Pr(i \in S_j|x_i)}$$

In other words, the inference about the income distribution of the population requires knowledge about the relative size of the reference group, knowledge about the selection process leading to the formation of the reference group, and the ability to make probability judgments. Imperfection in any of this information will result in biased perceptions about how income is distributed among the general population. An implication of this discussion is that individuals perceive inequality in the overall population by virtue of observing inequality in their reference group.

What determines who individuals compare themselves to? D'Ambrosio and Clark (2015) argue that one of the most important drawbacks in the literature on well-being and inequality is that the reference groups are usually defined on the basis of conjecture and that there have not been thorough studies attempting to identify what the most likely reference group is. Other than a few experiments, we can only rely on surveys to understand what reference groups individuals are more likely to compare themselves to. In most studies, reference group definitions are imposed by the researcher (Clark and Senik, 2010). Senik (2009), Knight, Lina, and Gunatilaka (2009), and Clark and Senik (2010) use surveys in which people are explicitly asked about their reference groups. People in the same locality, colleagues, former schoolmates, and family members constitute most respondents' reference groups.

In this paper, I take an analytic approach to studying reference groups. Having defined a way of finding the degree of similarity between perceived distributions and the objective distribution in each country, I can replicate the analysis by finding an objective distribution for specific reference group. For instance, I can divide the population into three education groups and look at how similar a respondent's answer is to the distribution of income within her education-based reference group. I do this analysis using three different types of reference groups: education, age, and gender. A better approach would be to find reference groups based on interactions of the three types mentioned above. However, due to the small sample size in each group, the statistical power of the results will be severely diminished.

It is also important to note that reference groups are likely to be endogenous and to depend on respondent's age, gender, education level, marital status, labor market status, etc. (Clark and Senik, 2010). Even the concept of reference group for an individual is dynamic: our reference group might change as we age, earn a higher income, migrate, get married, etc. Hyman (1942) suggests that reference groups "are chosen by virtue of similarity to the subject, proximity to him in life

situation, or as the result of subjective facts which facilitate such comparisons" and uses the term "affinity" for such similarities. Note that reference groups can also be chosen by virtue of "contrast" as opposed to affinity.[12] Falk and Knell (2004) suggest that the disparity in reference groups across the population reflects diverse coping strategies such as self enhancement and self improvement.

4.1 Education-Related Reference Groups

In both LIS and ISSP data I categorize education into three groups: low, medium, and high education.[13] I first find the income distribution within each education group for each country. Studies have shown that inequality varies across different demographic and socio-economic groups. Education is not an exception and the distribution of income is different depending on the education group, at least in most countries.

I then find the Bhattacharyya coefficient that measures the distance between respondent's chosen diagram and the income distribution in their education group. The first question is whether education is a relevant reference point. The second question is who is more likely to compare themselves to their education-related group. To answer these questions, I first compare the overall BC and the education BC. The cross-country variations in the difference between education-related BC and overall BC is shown in Figure 5. Note that the larger the number, the more important education is as a reference group. Not surprisingly, there are variations both at the individual and country levels. In Iceland and Finland, respondents' answers tend to be better aligned with the distribution of their education reference than they are with the overall distribution. For South Africa and France, answers are closer to the overall income distribution. One way to interpret these results

[12]It might be that individuals in the contrast group are so different from the person himself that they stand out as a comparison group.

[13]The group denoted as low education included individuals with less than secondary education completed (never attended, no completed education or education completed at the ISCED levels 0, 1 or 2). The group denoted as medium education includes those with secondary education completed (completed ISCED levels 3 or 4). Finally the group with high education consists of those with tertiary education completed (completed ISCED levels 5 or 6).

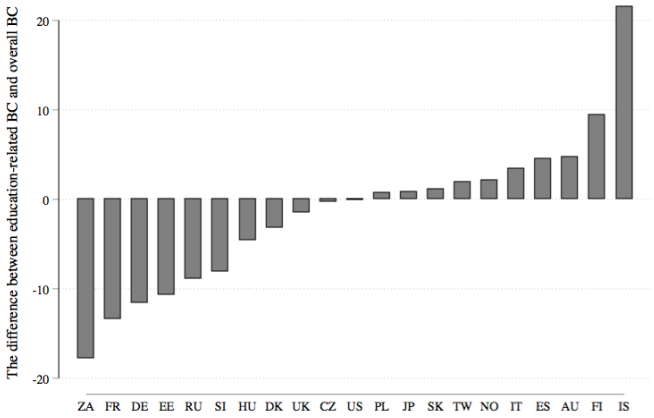


Figure 5: Cross-country differences between education-related BC and overall BC

is to assume that in countries with a higher BC for education-related reference groups such as Iceland and Finland, education-related reference groups are more important. It is interesting that in the United States and the United Kingdom, respondents' perceptions are equally similar to both education-related and overall distributions.

One might argue that in countries with more access to higher education individuals may compare their income only to those in their education group. One explanation is that in countries with higher (more equal) access to education individuals may feel more responsible for their education (lack of education) and, therefore, are more likely to compare themselves to others in their education-related reference group as opposed to the whole population. To test this hypothesis, I compute the correlation between access rate of higher education[14] and the difference between education-related BC and overall BC. The correlation equals 0.39 and is statistically significantly positive at 0.10 significance level ($z = 1.64$). Figure 6 show a scatter plot representing this correlation.

Let us now investigate the differences among individuals, i.e., who is more likely to guess the

[14]Data on access rate by country come from the *Education Indicators in Focus* report by OECD. February 2012. http://www.oecd.org/education/skills-beyond-school/49729932.pdf

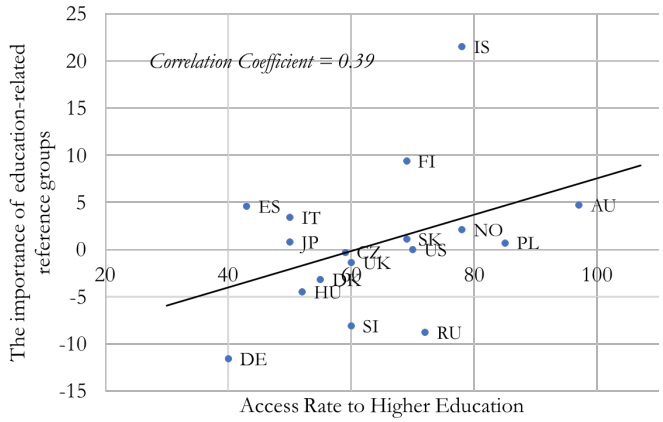


Figure 6: The relationship between the importance of education-related reference groups and access to higher education. Note: access rate data is only available for 17 countries.

distribution of income in their education-related reference group. I argue that those who are more likely to compare themselves to others in their education group are also likely to think that everyone has equal access to education and if there is any gap in education it is just. In the ISSP questionnaire, there are three statements related to this in which the respondent is asked to indicate to what extent he/she agrees or disagrees with the following statements: (i) [your country] only students from the best secondary schools have a good chance to obtain a university education, (ii) in [your country] only the rich can afford the costs of attending university, (iii) in [your country] people have the same chances to enter university, regardless of their gender, ethnicity, or social background. For the first and second statements, across roughly 20,000 respondents in 21 countries, those who agree or strongly agree that there is no equal access to post-secondary education in their country are more likely to accurately perceive the overall income distribution and those who disagree or strongly disagree are more likely to have their perception based on their education group. This is evident in the third statement as well, where the same question is framed positively rather than negatively. The results are shown in Table 3.

The findings in Table 3 are tied to an equality of opportunity approach to inequality. If

Table 3: The difference between education-related BC and overall BC versus beliefs about educational opportunities

	Strongly Agree or Agree	Neither Agree nor Disagree	Strongly Disagree or Disagree	p-value
In [your country] only students from the best secondary schools have a good chance to obtain a university education	-7.1	-3.5	-0.5	0.000
In [your country] only the rich can afford the costs of attending university	-7.2	-3.1	0.2	0.000
In [your country] people have the same chances to enter university, regardless of their gender, ethnicity or social background	-1.9	-3.6	-4.9	0.000

individuals are likely to think of differences in access to education as just and mainly due to effort, then they are less likely to compare themselves to groups with higher levels of education. In countries where individuals feel there is equality of opportunity, there may be more feeling of responsibility for lack of education. In this regard, education may only be individuals' *normative* reference group[15] and not their *comparative* reference group.

Given the regression results shown earlier in Table 2, it may be expected that political affinity is correlated with the likelihood that a respondent identifies more with the overall distribution than the education-related distribution. Indeed, I find that, as shown in Figure 7, across the political spectrum, perception of those on the left are more likely to be based on the overall distribution than on the education-related distribution. The difference between the left and the right is 8.2 points on the normalized BC scale.

[15]A normative reference group according to Kelley (1952) is a reference group that an individual does not necessarily use for the purpose of self-appraisal but rather a group that the individual aspires to be a member of. An individual is not necessarily a member of her normative reference group.

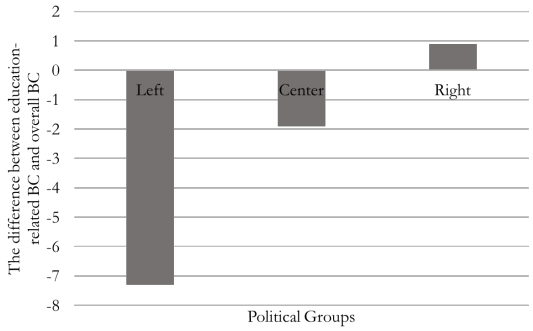


Figure 7: The importance of education-related reference groups across the political spectrum. The p-value for the F-test is 0.

4.2 Age-Related Reference Groups

Rawls's theory of original position behind the veil of ignorance (Rawls, 1971) can be useful in characterizing just and unjust inequalities. The advantage of the veil of ignorance is to force us to think about the problem of social justice through an impartial lens, minimizing our reliance on subjective morals and instead rely solely on rational self-interest. From the Rawlsian perspective, income inequality due to differences in experience, typically measured in terms of age, can be justified since individuals typically expect to receive higher incomes as they age.[16] This is contrary to inequalities due to gender and race, characteristics that are not subject to change during a person's lifetime. Stigler (1960) states that "if the men in an occupation were of identical ability and worked equal periods and with equal intensity, the present value of their lifetime earnings would be equal (chance factors aside), but their earnings in any one year. . . would display substantial dispersion."

There have been few attempts to find the impact of age distribution on inequality (Paglin, 1977; Osberg, 2003; Hadavand, 2017). All these studies show that objective measures of inequality such as the Gini coefficient or the Theil index would be smaller if we disregard income differences due to age. Individuals' perception of inequality can also be influenced by their age and the

[16]However, inequality due to differences in age would be unwanted or unjust in highly immobile societies.

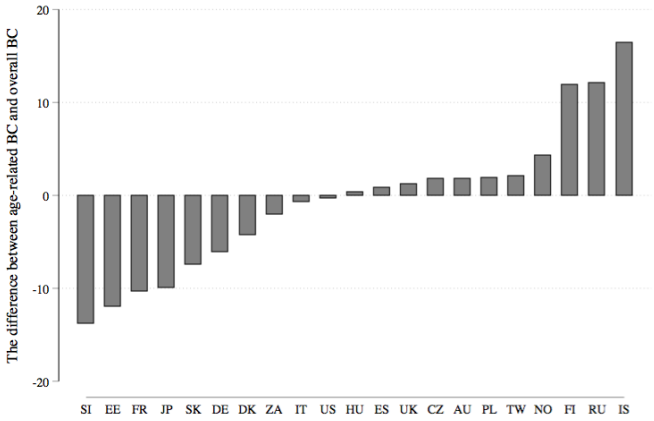


Figure 8: Cross-country differences between age-related BC and overall BC

distribution of income within their age cohorts.[17] One could argue, therefore, that since younger individuals typically expect to receive higher wages as they age, their reference group may be limited to individuals in their own age cohort.

To study whether age-related reference groups are important in an individual's perception, I examine the distribution of income in the individual's age cohort using LIS data and compare it to their choice of distribution in the ISSP data. I define age cohorts as individuals in 10-year intervals. Inequality within age cohorts varies based on the age of the cohort across most countries. Similar to education-related reference groups, it is interesting examine at where age-related reference groups are important. Figure 8 shows that this measure varies across countries from its lowest value in Slovenia (-13.8) to its highest value in Iceland (16.4).

In his infamous book, *The Study of Man*, Linton (1936) suggests that societies with a high rate of social mobility (in his terminology high rate of change) exhibit little difference between individuals' objective and subjective standing. If societies function smoothly and younger individuals may well expect to earn higher incomes as they age, one would expect age-related reference groups

[17]The definition of age cohort varies from study to study. While some consider individuals of the same exact age as a cohorts, others consider 2-, 5-, or 10-year intervals as a cohort.

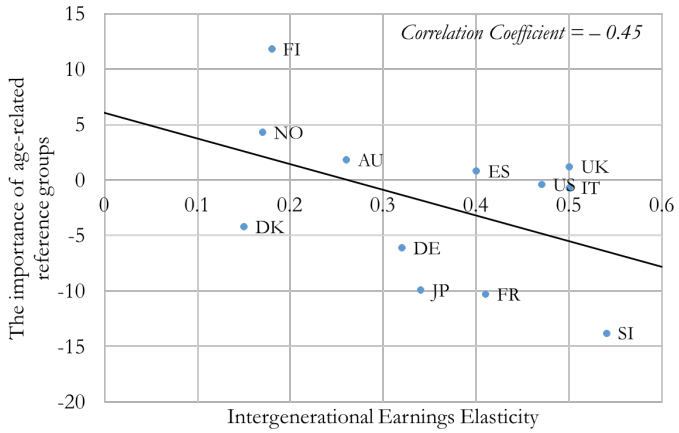


Figure 9: The relationship between the importance of age-related reference groups and mobility

to have an important impact on shaping individuals' perception. I examine this by finding the relationship between the importance of age-related reference groups and economic mobility. The mobility data come from Corak (2016) who calculates the "intergenerational earnings elasticity," which is the association between the percentage difference in earnings in a child's generation and the percentage difference in their parent's generation. A more mobile society has a lower earnings elasticity. Figure 9 shows the association between the importance of age-related reference groups and mobility across a sample of countries (where mobility data was available). The correlation coefficient is equal to -0.45, and is statistically significantly negative at 0.10 significance level ($z = 1.59$). The interpretation for the negative correlation is that where mobility is higher individuals' perception of inequality is less likely to be shaped by the inequality in the overall population.

Furthermore, Konrath, O'Brien, and Hsing (2011) find that younger cohorts are more likely to think that they are above the average. This can be attributed to the fact that younger people may compare themselves to narrower age groups. As individuals get older, their reference group expands. For an individual from the age cohort of 40- to 49-year olds, the reference groups may include the individual's age group and those below. I find evidence of this claim in my data. After calculating

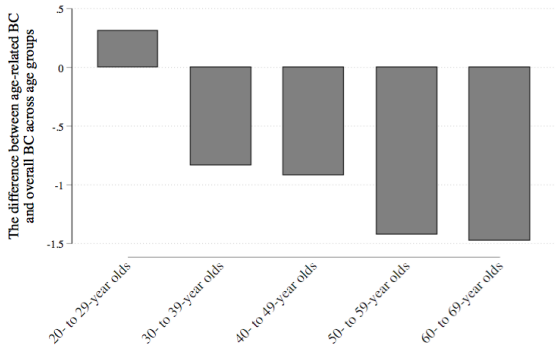


Figure 10: The importance of age-related reference groups across age groups

the age-related BC, I find that the degree to which age-related reference groups are important is stronger for younger individuals across all countries. This is shown in Figure 10. As individuals get older, the likelihood of referencing the overall distribution increases.

4.3 Gender-Related Reference Groups

Income comparisons are said to be to those whose income generating attributes are similar (van de Stadt, van de Geer, and Kapteyn, 1985). If this is the case, in addition to education and age, we should look at gender groups. Although it is merely an assumption that women (men) compare themselves to other women (men), in some developing countries and in countries where gender disparities are more pronounced, it might indeed be the case that gender is a defining factor in shaping perceptions. There is, however, no hard evidence that this is indeed the case. Ferrer-i Carbonell (2005) find that, in the case of Germany, gender is not an important reference group.

I first find the distributional diagrams for each gender group across all countries using LIS data, and similar to before, I calculate the degree of similarity between the subjective and objective distributional diagrams. In Iceland and South Africa[18], there is not much difference between the

[18]The country abbreviation for South Africa is ZA.

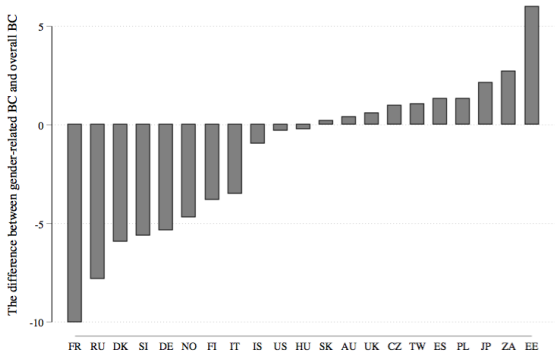


Figure 11: Cross-country differences between gender-related BC and overall BC

distribution of wages of men and women. In the United States and France, however, the two distributions are quite different. After finding the BC measures between distributions, I calculate the difference between gender-related BC and overall BC that reflects the importance of gender-related reference groups. Figure 11 shows this difference measure for each country.

If the difference between gender-related BC and overall BC shows the importance of gender reference groups, then why is it that it varies notably from country to country? One conjecture is that in countries where gender disparities are more accepted, gender reference groups become a significant predictor of perceived inequality. I use the Gender Inequality Index (GII) by the United Nations Development Programme (UNDP) in order to find whether such disparities are correlated with the importance of gender-related reference groups.[19] Using GII, I indeed find a positive correlation between the two measures, however, the correlation is not significantly positive ($z = 1.18$). The scatter plot for a sample of countries (for which data exist) is shown in Figure 12.

[19]GII measures gender inequalities in three different dimensions: reproductive health, empowerment, and economic status. More information about the index can be found here `http://hdr.undp.org/en/content/gender-inequality-index-gii`

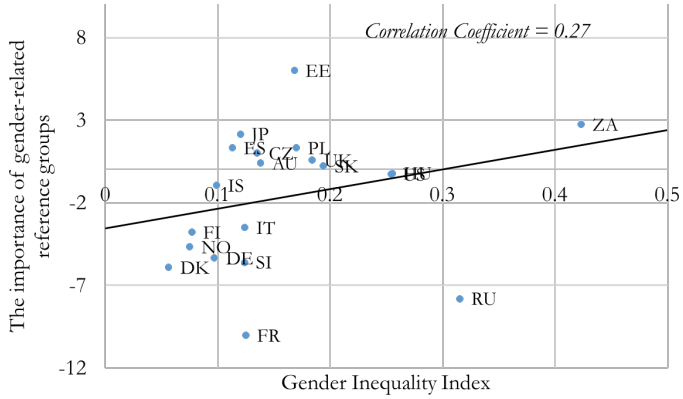


Figure 12: The relationship between the importance of gender-related reference groups and gender disparity index

5 Limitations of the Analysis

First and foremost, similar to most inequality studies that rely on surveys, my analysis suffers from underrepresentation of the top incomes. This is a problem with both data sets that are used in this paper. Chambers et al. (2014) find that most of the distortion in guessing the income distribution comes from the large overestimation of the top 1%. Therefore, one could argue that part of the mismatch between perceptions and objective measures is due to the fact that ISSP respondents' perception may in fact be shaped by the existence of the 1% or the media attention given to them.

Second, an independent definition of reference groups based on education, age, and gender may not be accurate. One can argue that an individual's reference groups may be a combination of the factors mentioned above. For instance, it is more accurate to define comparative reference groups as people in one's education, age, and gender groups. I have ignored such definitions to avoid small sample sizes in each group.

A third, and yet important, caveat is the fact that in ISSP, like most other surveys of subjective inequality, there is no specifying whether the question refers to wealth, before-tax income, or

after-tax income. As I discussed in Section 1, this can plague the results of any study on the subject. Related to this is the fact that I use personal-level data for reasons mentioned in Section 2. It is worth mentioning that a household approach to welfare analysis is preferable to an approach based on personal income since individuals' perception of inequality and where they stand in the income distribution is likely to be affected by overall family income and transfers (including both monetary and in-kind transfers) minus taxes.

Lastly, there are other types of reference groups to explore that are not considered in this study. One of these is reference groups based on location. Although common sense suggests that reference groups based on individuals' locations are important, the idea has been picked up by only a few researchers. Luttmer (2005) uses reference groups based on geography to show that, after controlling for own's income, average income of the local area is negatively correlated with respondents' life satisfaction. A limitation of the data I use is the absence of any geodata to calculate income inequality within specific locations.

6 Concluding Remarks

In some ways, perceptions of inequality are just as as important as the official statistical measures we use such as the Gini coefficient and income shares. Perceptions are shown to impact happiness, job satisfaction, and support for redistribution. If perceived inequality is important, the next question is whether there are any discrepancies between perceived inequality and objective inequality measures. Numerous studies have argued that the inconsistencies between perceived inequality, usually measured through surveys, and statistical measures of inequality are the result of individuals' misperception of inequality.

I introduce a new method of deducing individuals' perception of inequality from survey

results from the International Social Survey Programme (ISSP) in which individuals across more than 40 countries are asked about their perception of the shape of income distribution in their society. I introduce a measure of closeness between the distributions and find that although there are inconsistencies between objective and subjective inequalities, in most countries a majority of respondents choose the closest distribution to the income distribution in their society. For instance, 58.7% of Danish, 53.6% of French, 35.4% of Germans, 38.5% of Japanese, 50.8% of South Africans, 41.9% of the British, and 38.9% of Americans, which constituted the majority in their countries, chose the closest distribution to the actual income distribution in their country. However, the difference between subjective and objective measures varies across countries. For instance, only 6% of Hungarians selected the correct shape. I also find that characteristics such as income level and education can be important factors explaining variations in correctness across individuals.

In this essay, I address whether perceptions of inequality are shaped by observing the overall population or only specific subgroups known as reference groups. Reference groups and an individual's perception of inequality are intrinsically related. However, the definition of reference groups in the literature has been mostly arbitrary. One can define factors such as age, gender, education, geography, friends, etc. as factors defining reference groups. In this paper, I take a more analytical approach to reference groups. I test whether answers to a question on the ISSP are closer to overall distributions or distributions based on education, age, and gender. I find that perceptions are indeed affected by reference groups. Across countries, I find that education is a more important reference group where access to education (more specifically to higher education) is better. In addition, I find that age-related reference group are more important in societies with higher intergenerational mobility. Lastly, there is some tentative evidence that gender reference groups are more pronounced in countries where gender disparities are more dire and maybe more accepted.

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