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Subjective beliefs about the income distribution and preferences for redistribution

Lionel Page[1] · **Daniel G. Goldstein**[2]

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Abstract We investigate whether beliefs about the income distribution are associated with political positions for or against redistribution. Using a novel elicitation method, we assess individuals' beliefs about the shape of the income distribution in the United States. We find that respondents' beliefs approximate the actual distribution on average. However they tend to overestimate the median income and underestimate the level of inequality. Surprisingly we find that beliefs about overall inequality, measured in terms of income dispersion, play only a marginal role in political positions as well as prospects of future wealth. Political preferences, however, are predicted by first, beliefs about the level of income of the poorest members of society, and second, a belief in an open society with equal opportunities for all. Support for redistribution is lower for people who give higher estimates of the income level of the poorest members of society and for people who perceive that opportunities for upward mobility are available.

1 Introduction

Recent research spanning several countries has found that that citizens' perception of the national level of inequalities are systematically biased (Piketty 2003; Norton and Ariely 2011; Cruces et al. 2013). This finding has important implications for the understanding of political preferences. Political debates often take place along a left–right dimension along which the ideal level of redistribution of resources is one of

✉ Lionel Page
lionel.page@qut.edu.au

Daniel G. Goldstein
dgg@microsoft.com

[1] Queensland University of Technology, 2 George Street, Brisbane 4000, Australia

[2] Microsoft Research, 641 Avenue of the Americas, New York, NY 10011, USA

the main points of disagreement (Przeworski and Sprague 1986; Poole and Rosenthal 1991; Kitschelt 1994). Voting models in economics and political science most often assume that citizens' position in a known income distribution determine their political stances (Persson and Tabellini 2002).

In the present study we elicit beliefs about the perceived shape of the US income distribution from a large national sample of respondents and investigate how these beliefs relate to their political positions. To elicit subjective beliefs we use an interactive graphical tool, the Distribution Builder (Goldstein et al. 2008), with which participants can quickly and easily specify a 100 unit income distribution, providing more precise information about subjective income distributions than possible with previous methods. This method provides more precise information about subjective income distributions than previous techniques, allowing for the investigation of beliefs about the distribution's tail as well as its overall shape (e.g., skewness, degree of inequality). The average distribution elicited is close to the actual income distribution in the US. Participants also answered questions about a range of beliefs and values concerning inequalities (e.g. equality of opportunity, determinants of economic success, prospect of upward mobility) in order to distinguish between competing theories of how redistribution preferences are formed.

Overall, this paper contributes to three strands of literature. First, it contributes to the literature on the accuracy of people's beliefs about the *income* distribution. In accordance with previous studies, we find systematic biases in individual beliefs with an overestimation of average household incomes and an underestimation of the dispersion of household incomes in the USA. Recent studies have pointed out that people's beliefs about macroeconomic variables can be influenced by local variations in these variables (Li et al. 2011; Ansolabehere et al. 2014). In the specific case of the beliefs about the income distribution, Cruces et al. (2013) suggest that the local income distribution may influence households' beliefs about the national distribution. We specifically selected our sample of respondents to test this hypothesis. We only find limited evidence that the local average income and other local characteristics are correlated with beliefs about the income distribution.

Second, this study contributes to the empirical literature on the factors influencing voters' preferences for redistribution (Fong 2001; Alesina and Angeletos 2005; Alesina and Ferrara 2005; Fong et al. 2006; Alesina and Giuliano 2009; Isaksson and Lindskog 2009). First, the use of the Distribution Builder allows us to have a rich view of participants' beliefs and to investigate a wide range of possible links between beliefs and political positions. The main result of this analysis is that we do not find that beliefs about the centrality and variance of the income distribution predict political attitudes and preferences for redistribution. Instead, beliefs about the income level of the poorest members of society are the strongest predictors of redistribution preferences. Second, we designed a new survey including a wider range of questions than previous surveys used to address this question (e.g., the General Social Survey and World Value Survey). We are therefore able to test the correlations between a wide range of beliefs and political positions and to compare the ability of various economic theories to account for the observed data. We find that beliefs about the ease of social mobility and the fairness of society have a higher correlation with political positions than do beliefs about the distribution itself. These results do not seem to be driven primarily by

self-interest. That is, the link between beliefs about inequalities and redistribution preferences does not seem to be related to respondents' beliefs about their relative position in the income distribution or to their subjective prospects of upward mobility.

Third, this paper adds to the literature on social preferences and inequality aversion. Recent experimental evidence suggests that, unlike the first models about inequality aversion (Fehr and Schmidt 1999; Bolton and Ockenfels 2000), social preferences for redistribution are primarily driven by a concern for the poorest (Charness and Rabin 2002; Engelmann and Strobel 2004, 2007). Our elicitation tool allows us to disentangle these two different types of social preferences. Doing so, we find that participants who believe that the incomes of the poor are relatively lower tend to be more in favor of redistribution, in agreement with quasi-maximin and concave altruistic utility functions (Charness and Rabin 2002; Andreoni and Miller 2002; Cox and Sadiraj 2006). To our knowledge, this is the first time that citizens' political preferences for redistribution have been linked to their beliefs about the lower part of the income distribution, that is, concern for the poorest.

The remainder of the paper is organized as follows. Section 2 discusses the empirical evidence concerning subjective perceptions of income inequality, Sect. 3 presents a theoretical framework showing how different types of beliefs about inequalities can play a role in preferences for redistribution. Section 4 describes our elicitation method and the sample of respondents. Section 5 analyzes participants' beliefs about the income distribution and how they relate to their individual and local-area characteristics. Section 6 examines how beliefs relate to political positions. Section 7 discusses the results and concludes.

2 Beliefs about inequality and the income distribution

Prior empirical research suggests that people often misperceive the distribution of income or wealth in the country in which they live. Research by Piketty (2003) in France and by Norton and Ariely (2011) in the USA found that people make systematic mistakes when estimating levels of inequality. Piketty conducted a survey in 1998 on a representative sample of 2000 people in France, asking participants about their beliefs about the country's average income, the average income of two typical professions (cashier and middle management supervisor) and the percentage of people earning more than the equivalent of around $4000 and $10,000 per month. Respondents' answers were characterized by significant biases. First, they significantly underestimated the average income by around 30 %. In addition, they overestimated the percentage of people with high incomes, estimating that 27 % of households earned above $4000 per month and that 12 % earned above $10,000. (The correct answers are 20 and 2 %.) While these results suggest that respondents overestimated the level of inequality, beliefs about the income distribution did not seem to drive political positions concerning redistribution. In a more recent study, Norton and Ariely (2011) surveyed beliefs above the distribution of wealth (as opposed to income) in the USA. In 2005, they asked an online sample to indicate their beliefs about the share of national wealth held by each quintile of the wealth distribution. Respondents underestimated the level of inequality, estimating that 56 % of wealth was held by the richest quintile

while it is actually 84 %. In spite of this underestimation, respondents still supported a move towards greater wealth equality.

Two recent studies address how inequalities are perceived and the role of perceived inequalities in political positions. Cruces et al. (2013) studied the views of a representative sample of households from greater Buenos Aires. They asked respondents about the income decile they think they belong to on a national level. They found systematic biases including a tendency for respondents to place themselves in the middle of the income distribution. They also found that providing information to the respondent about their actual position in the distribution could influence their stated preferences for redistribution. Similarly, Kuziemko et al. (2015) tested whether giving information about inequalities and their evolution could change attitudes in favor of redistribution. In their study the information provided changed the stated perception of respondents about the importance of inequalities. However, it had only a limited impact on views regarding the reduction of poverty.

If citizens find it hard to form accurate beliefs about the income distribution, it is likely to be even harder for them to assess how difficult it is to move upward in this distribution. Several studies have shown environmental impacts in the formation of subjective beliefs about social mobility. People who grew up during recessions have been found to have a tendency to believe that success is more influenced by luck than effort and they also tend to support greater levels of redistribution (Giuliano and Spilimbergo 2009). In the same spirit, positive macro-economic shocks tend to be followed by a decrease in support for redistribution (Brunner et al. 2011). A natural experiment by Tella et al. (2007) also found that squatters who were randomly selected to benefit from housing policy tended to change their beliefs about the ability to succeed on ones own. Together, these studies suggest that individuals beliefs about the possibility of social mobility in society may be influenced by random events and not entirely accurate

3 Theoretical framework

In line with the Social Choice literature, we consider a decision maker having to chose between different income distributions. If the decision maker follows the standard von Neumann–Morgenstern axioms, she will behave, when choosing between two distributions, as if she was maximizing a social welfare function (Kolm 1969; Atkinson 1970):

$$W(X) = \int u(x) dF \tag{1}$$

where F represents the belief of the decision maker about the income distribution in the society. If the decision maker is perfectly informed (ie F is the true distribution), her choices are driven by the function u whose curvature reflects her preferences for redistribution. A limitation of this model is that it places the decision maker under the "veil of ignorance" (Harsanyi 1955; Rawls 1971). When making political decisions about the right level of redistribution, the decision maker typically knows her own income, x^s this may affect her choice. We can modify (1), calling F^o the distribution of others' income (x^o):

$$W(X) = \int u(x^s, x^o) dF^o. \tag{2}$$

Such models are typically considered in the literature on social preferences in game theory.[1] In such a situation, the decision maker's choice can be driven by beliefs about the income distribution in society F^o. If u is concave as usually assumed, a belief in a higher level of dispersion (ie inequality) of income in the society will be associated with a lower associated utility for the decision maker.

We can use this framework to represent how social mobility can play a role in individual preferences for mobility.[2] Following Atkinson and Bourguignon (1982) and Gottschalk and Spolaore (2002), we can extend (1) to a two period model by writing the preference of a decision maker over distributions as:

$$W(X_1, X_2) = \int V(u_1(x_1) + u_2(x_2)) dF_{12} \tag{3}$$

where V is a concave transformation which creates the possibility for preferences over social mobility as such, and F_{12} is the joint income distribution over the two periods. Allowing for the decision maker to know her present income x_1^s and to form beliefs about the distribution F_2^s of her income in period 2, we can generalize (2) to:

$$W(X_1, X_2) = \int \int V(u_1(x_1^s, x_1^o) + u_2(x_2^s, x_2^o)) dF_{12}^o dF_2^s. \tag{4}$$

While the decision maker knows her income in period 1, she does not know it with certainty for period 2 and forms a belief about it. F_2^s represents the corresponding subjective distribution of probability over future incomes. Using (4), we can decompose the sources of differences in political positions for redistribution as: (1) differences in preferences for fairness per se (curvatures of u_1, u_2, V), (2) beliefs about present inequalities (marginal distribution of F_{12}^o in period 1), (3) differences in beliefs about social mobility in society (marginal distributions of F_{12}^o in period 2 conditional on the incomes in period 1), (4) and differences in beliefs about the decision maker's own prospects of mobility (distribution F_2^s).

In the present study, we elicit beliefs related to (2)–(4). In particular, we use a new elicitation tool to get a full elicitation of F_1^o. In this theoretical framework, individual differences preferences for or against redistribution can be driven by differences in beliefs and not just by differences in preferences as often assumed. By eliciting individual beliefs about income distribution and mobility jointly with individual preferences for redistribution, we aim to clarify how such beliefs relate to political positions. From this theoretical framework and the existing literature we make the following hypotheses:

[1] Several models in the literature are equivalent to specific cases of (2) where u is additively separable in own and others income (Fehr and Schmidt 1999; Andreoni and Miller 2002). Such a separability has been axiomatised in the two person case by Karni and Safra (2002).

[2] We do not make claims of exhaustivity here. Our framework is not the only way to represent preferences for redistribution. More general models of preferences over distribution already exist in the one period case (Weymark 1981).

Hypothesis 1 (*Subjective perception of inequality*)

(i) Individuals have biased perception of the income distribution F_1^o.
(ii) Individuals' misperception of the income distribution F_1^o is influenced by the characteristics of the local area where they live.

Hypothesis 1(i) follows naturally from the existing evidence (Piketty 2003; Norton and Ariely 2011; Cruces et al. 2013). The additional Hypothesis 1(ii) is motivated by the research on the influence of local variables on beliefs about macro level variables (Li et al. 2011; Cruces et al. 2013; Ansolabehere et al. 2014).

Hypothesis 2 (*Beliefs on inequality and preferences for redistribution*) Beliefs in the level of inequality characterising F_1^o will be positively correlated with positions in favor of redistribution.

It is usually assumed that voters exhibit a preference for fairness (or aversion to inequality). In the model (1) such an aversion to inequality is represented by a concave u function. A decision maker with such preferences will prefer lower levels of inequality in that whenever a distribution second-order stochastically dominates (SOSD) another one, it will be preferred (Chakravarty 2009). Pigou–Dalton transfers from rich households to poor households are a simple way to reach an SOSD distribution in a mean preserving way. One can therefore expect that beliefs in higher inequality will be associated with support for redistribution in order to reach greater income equality. Even if the decision maker takes her own income into account, the literature on social preferences suggests that she may be willing to reduce inequalities at a cost of a lower net income for herself (Fehr and Schmidt 1999; Bolton and Ockenfels 2000). Finally, even if the decision maker is purely self-centered, a more unequal distribution will typically be negatively skewed with the mean income in the distribution falling above the median. In that case, more voters are going to favor redistribution (Alesina and Rodrik 1994).

Hypothesis 3 (*Beliefs about prospects of upward mobility and preferences for redistribution*) Belief in ones' personal prospect for upward mobility reflected in F_2^s is negatively correlated with positions in favor of redistribution.

Voters who believe that their income is going to increase significantly in the near future may find rational to oppose greater taxation now for higher income. This is the Prospect Of Upward Mobility (POUM) hypothesis formalised by Bénabou and Ok (2001).[3]

Hypothesis 4 (*Beliefs in an open society and preferences for redistribution*) Beliefs in social mobility and opportunity stemming from F_{12}^o will be negatively correlated with positions in favor of redistribution.

Several recent papers have proposed models in which a belief in social mobility determines political positions: the more voters believe that social mobility is possible, the

[3] This idea got a lot visibility during the 2008 US presidential campaign when a member of the public, afterward nick named "Joe the plumber", criticized Obama for his proposed taxes which would hit Joe in the future as he was expecting to see his business grow.

less they tend to support redistribution (Piketty 1995; Alesina and Angeletos 2005; Alesina and Ferrara 2005; Bénabou and Tirole 2006). Outside of standard economic mechanisms, it has also been suggested that a belief in *equality of opportunity* may decrease preferences for redistribution. In this view, voters who believe in equality of opportunity may view the dire conditions of the poor as a result of their choices, in particular a lack of effort (Fong 2001; Fong et al. 2006).

4 Method and sample

4.1 Method

An innovation of this study is the use of an interactive computer application to elicit respondents' beliefs about the income distribution. This elicitation was conducted using the Distribution Builder (DB) methodology of Goldstein et al. (2008). The use of this application allows researchers to obtain richer data on participants' beliefs about the income distribution than was possible in previous survey studies. With the DB, a participant can quickly construct a 100 unit probability distribution over levels of household income through several movements of the mouse. Figure 1 shows the graphical interface of the application. At the start of the experiment, participants viewed a training video covering the use of the DB and the concepts of 50th and 95th percentiles of a distribution. They were next given a practice task with the DB before being instructed to create an income distribution with the following instruction: "Imagine that the 100 green markers represent 100 randomly-selected households in the US. If you had such a sample, how many households might fall into each category of annual income? Place the 100 markers on various columns to show us what you think this random sample might look like". To prevent anchoring effects, the 100 markers begin off to the left or right of the chart, determined randomly for each participant. One of the advantages of the DB is its ability to retrieve beliefs about the tails of the income distribution which may well play a specific role in preference for redistribution.

The DB is designed to be easy to understand and is based on numerous psychological studies showing that people better understand questions about probabilities when they are framed in terms of natural frequencies (Gigerenzer 1991; Goldstein et al. 2008; Goldstein and Rothschild 2014). That said, the task of specifying an entire distribution may be demanding in terms of knowledge and abstraction. As a robustness and comprehension check, participants were also asked to indicate their beliefs about the income distribution through direct fill-in-the-blank questions. First, participants gave point estimates of what they believed to be the 50th and 95th percentiles of household income in the US. Second, participants gave estimates of the average yearly income of four typical professions: unskilled workers, skilled workers, medical doctors, and CEOs of large national corporations.[4] Drawing on multiple and repeated measurements for each participant should provide the most detailed picture to date of

[4] These questions about the average income of typical professions are taken from the International Social Survey Program and allow for the elicitation of beliefs with simple benchmarks (e.g., "What do you think is the average income in the USA of a chairman of a large national corporation?" and "What do you think is the average income in the USA of an unskilled worker in a factory?").

what laypeople believe about the income distribution. In addition, the use of a variety of measurement tools helps to circumvent the limitations that each technique may present individually.

To test economic theories that link perceptions of income inequality to political leanings, we included questions to assess beliefs about several aspects of income inequality. From the General Social Survey (2010), we employed the following items: "America has an open society. What one achieves in life no longer depends on one's family background, but on the abilities one has and the education one acquires" and "Some people say that people get ahead by their own hard work; others say that lucky breaks or help from other people are more important. Which do you think is most important?". To measure participants' social mobility up to the present day, we asked the question: "Would you say that your current position and prospects in life are better than those of your parents at that age?". To measure beliefs about their future prospects, participants were asked: "What is your best guess of what your household income will be 5 years from today?". A 5 years horizon is chosen because participants are likely to be able to assess their prospects accurately within a relatively short time horizon and because Bénabou and Ok (2001) suggest that prospects of upward mobility can already have a substantial effect over such a short time horizon.

We measured political positions with questions about participants' political leaning on a left–right axis: "How would you describe yourself on the political spectrum, where left is liberal and right is conservative?". We also asked which candidate they supported in the previous presidential election. In addition, to understand views on redistribution, we measured agreement with the following two items from the International Social Survey (1987): "Differences in income in America are too large", and

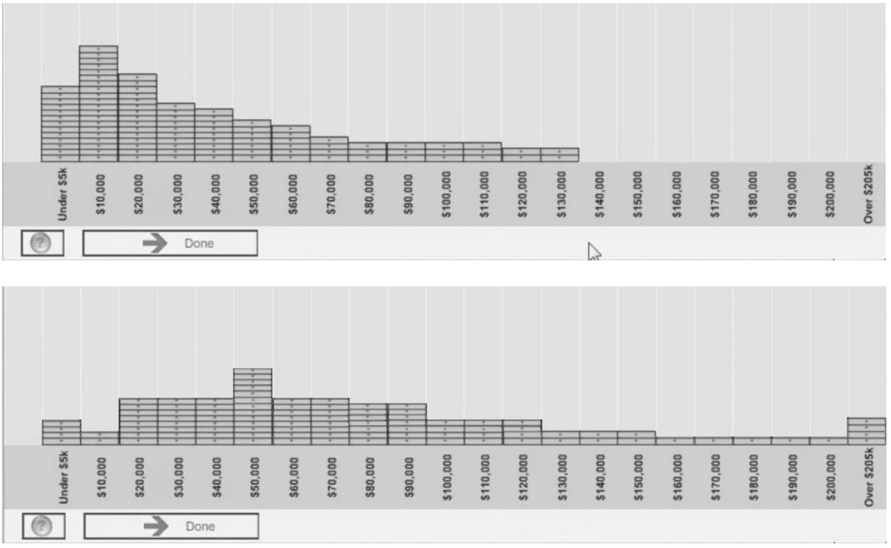

Fig. 1 Distribution Builder: participants draw a *histogram* with 100 markers via an interactive interface. The *left panel* displays an example of possible distribution, the *right panel* reflects the estimate of the US household income distribution

Table 1 Sample descriptive statistics

Variable	Mean	Min	Max	SD
Male	0.28	0	1	0.45
Age	46.95	19	80	13.42
Income	83,653	5000	650,000	55,720
White	0.93	0	1	0.26
Black	0.02	0	1	0.13
Asian	0.03	0	1	0.17
High school diploma or lower	0.29	0	1	0.45
Undergraduate degree	0.44	0	1	0.50
Graduate degree	0.27	0	1	0.44
Democrat	0.58	0	1	0.49
Right-wing	2.8	0	6	1.79

"It is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes". When not asking for exact numbers, we presented respondents with the original Likert scales found in the cited publications.

4.2 Participants

Participants were 1025 adult US residents who were recruited through a national survey sampling firm and paid for their time. In order to be able to test whether local inequality affects national perceptions (Li et al. 2011; Ansolabehere et al. 2014), we adopted a geographically based sampling scheme covering the most equal and unequal regions of the US in terms of income. Drawing upon US Census regional classifications that divide the country into four regions (Northeast, South, West, Midwest), we identified the 26 counties with the highest levels of inequality (as measured by Gini coefficient) and the 26 counties with the lowest levels of inequality such that at least 10 counties were sampled in each of the four regions. The firm targeted its panelists living in specified counties to participate in the survey. To favor an even representation from all areas, each county contributed at least 15 respondents and no more than 35 with a mean of 19.

Table 1 presents the main demographic characteristics of the sample. Our sample of participants tends to have a higher proportion of females, a higher household income, and a higher proportion of self-declared "White" participants than in the general US population. Furthermore, our selected sampling of the highest and lowest-Gini areas weights our sample toward the extremes of income dispersion. In comparison to the demographics of the panel of respondents from the sampling firm, our sample is slightly older, richer and more often female (see table in "Appendix"). Such selections are common in online experiments and in survey questionnaires with voluntary

participations. The average answers in our study should not be taken to represent the average view in the US population.[5]

Participants responded online, with the average respondent taking 20 min and 95 % taking between 12 and 35 min. After the survey, participants were asked whether they understood the instructions and whether they gave the task their best effort; these two items served as our a priori standard for inclusion in the analysis. 98 % of participants indicated comprehension and 99 % indicated that they gave their best effort. At the onset of the study, participants indicated their sex, age, race, citizenship, ZIP code, highest level of education attained, and political leaning. In addition to the surveys' answers, for each ZIP code area in which respondents lived, Census data contributed covariates such as population density, population, and beyond (as will be seen in the regression tables).

To draw generalizations for only those participants who appeared to follow instructions and to have taken the task seriously, we created a retained sample of participants by eliminating: participants who did not watch the entire instructional video (13 %), participants who made fewer than five clicks on the DB needed to draw an income distribution (4 %), and participants for whom the difference between the direct question about the 50th percentile and the 50th percentile in the DB distribution were above $80,000 (1 %). In what follows, we take a conservative approach and analyze this sample of 839 participants (82 % of the initial sample) who we believe understood the task. We note, however, that this selection makes little difference in the overall results, for instance, the estimate of the 50th percentile differs by less than 1 % between the full and retained samples.[6]

5 Beliefs about income inequalities

Result 1 *Respondents systematically misjudged the distribution of households' income in the USA. They overestimated the median income and underestimated the level of inequality.*

To show a summary of respondents' views on the income distribution, we average all the respondents' DB data. Figure 2 shows this average distribution over the whole sample (estimated by kernel density) and compares it to the actual distribution estimated from the Census data. The averaged DB distribution differs from the actual income distribution ($p < 0.001$, Kolmogorov–Smirnov test), however it is relatively close in shape. This result comes from the aggregation of individual distributions and

[5] This selection is however not necessarily an issue when discussing the effect of resondents' characteristics on their survey answers. Formally, Magee et al. (1998) show that this type of analysis is valid as long as there is no unobservable variable influencing the choice to self-select in the sample which is both correlated with the respondents' characteristics and with the dependent variables studied (here the beliefs about inequalities and political positions). This is an issue which has been investigated in depth in experimental economics where most samples are self-selected and non representative. Studies such as Von Gaudecker et al. (2008), Harrison et al. (2009), and Cleave et al. (2013) have found that while samples of participants may differ from the population sampled the differences between groups of different demographics are not biased. These studies conclude that there is no selection bias based on social and risk preferences.

[6] A table comparing the answers of the retained and non retained sample is included in "Appendix 1".

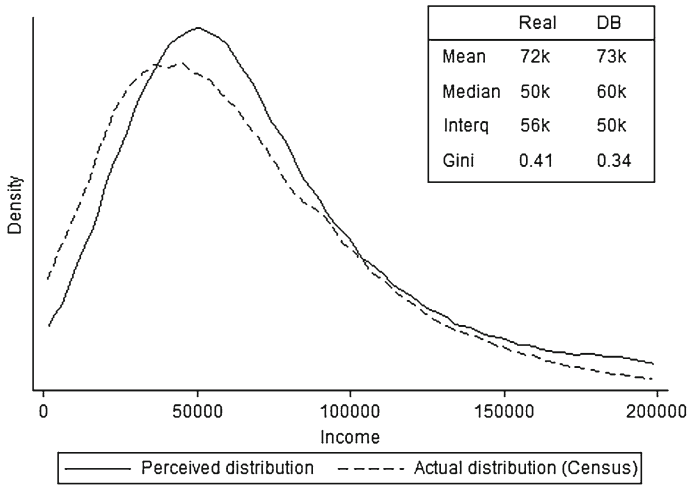

Fig. 2 Perceived and actual income distribution in the USA. Distributions are truncated at $200,000. Comparative statistics (mean, median, interquartile range and Gini coefficient) are included in the *top right frame*

evokes the "wisdom of the crowd", the effect by which the aggregation of individual subjective perceptions provides relatively good estimates of the quantity measured (Surowiecki 2004).

In spite of this, Fig. 2 shows that the average does not perfectly reflect the actual distribution: Respondents tend to overestimate the median level of household income and they tend to underestimate the level of inequality (lower interquartile range and lower Gini coefficient).

Figure 2 masks the heterogeneity of individual answers. To observe this heterogeneity, we look at each respondent's beliefs about the median and interquartile range of the distribution and we then plot the distribution of these values over the sample. Figure 3 represents these distributions; it reveals that participants tend both to overestimate the median income and to underestimate the overall level of inequality. These results are somewhat similar with those of Norton and Ariely (2011), however, where those authors found profound deviations from the objective *wealth* distribution, we find that lay estimates of the *income* distribution are reasonably accurate.[7]

Answers from multiple elicitation methods give qualitatively similar results. The correlation between the response to the direct question about the 50th percentile and 50th percentile observed in the DB is 0.6. The average estimate of the median household income in the direct question is $52,678 while the observed median extracted from the DB distributions is $62,067, a difference of about 15 %. Concerning beliefs

[7] The randomisation of the initial position of the markers on the left or on the right allows us to check whether the answers to the DB are very sensitive to the framing. Over the 839 participants retained, 1.61 % had the markers stacked on the left (proportion not significantly different from 50 %: $p = 0.35$). We did not find any significant differences in answers as a function of the markers initial location. A t test of means indicate that both groups gave very similar answers in average ($p = 0.69$). A plot of the two corresponding densities, similar to the one from Fig. 2 does not show any difference between the two distributions.

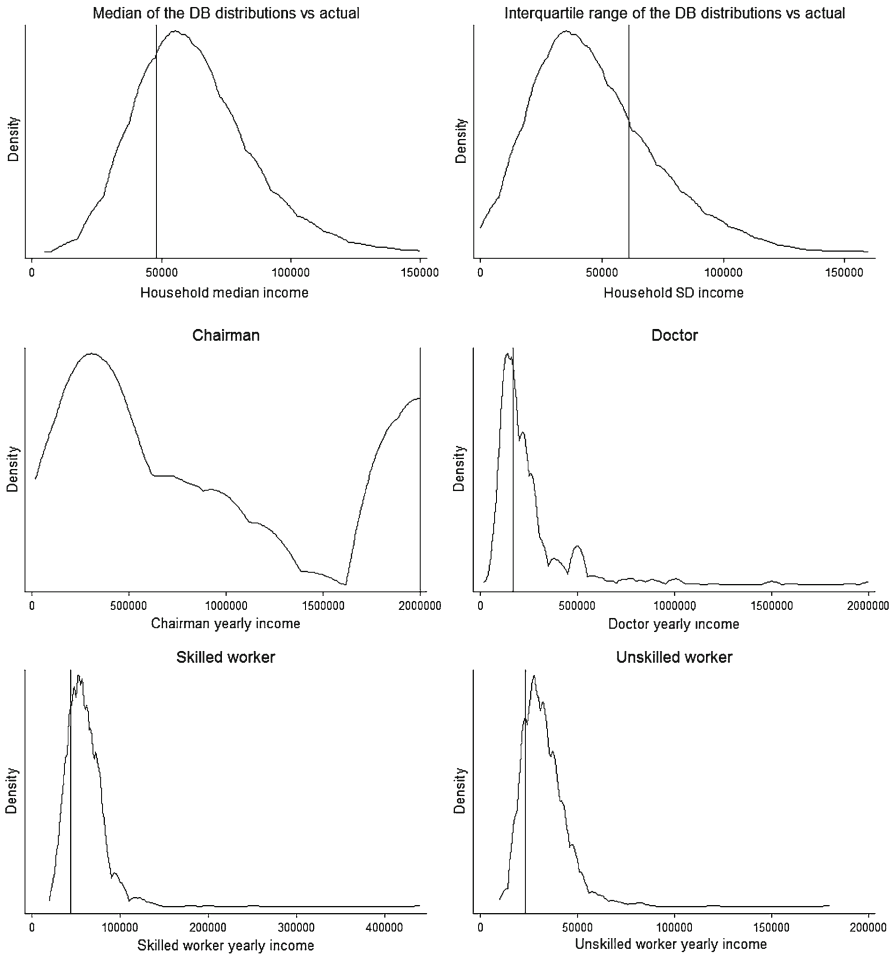

Fig. 3 Distribution of participants' beliefs. Centrality (median) and dispersion (interquartile range) of the DB distributions (*upward panels*) and beliefs about the income of each profession. Scales are not constant. Actual median and interquartile range are indicated by a *vertical line* in *top two panels*, median income values for each profession are given in the four *lower panels*

about the 95th percentile of income, the answers from the survey and DB are not directly comparable as the DB axis is censored upward: the top income category recorded by the DB is "$205,000 and above". To address this, we use a parametric model of the income distribution to estimate the 95th percentile from the observed DB distribution. We estimated such a model under the common assumption that the income distribution is lognormal (see details of the estimation in "Appendix"), and estimate the average 95th percentile from the DB at $181,228, which is just 10 % different from $200,000, the median answer to the direct question. The responses to the direct questions are noisier, with 25 % of participants giving answers equal or higher than $500,000. With the DB method, such high responses were not possible, and only

1 % of participants produced distributions such that the modeled 95th percentiles were higher than $370,000.

Overall, answers to the direct questions about the percentiles were noisier than the observed percentiles extracted from the DB.[8] These differences could have at least two likely explanations. On the one hand, the direct survey questions about percentiles may appear abstract and unfamiliar, leading to noise from miscomprehension, while the frequency format of the DB could help participants express their beliefs in an intuitive way. On the other hand, one could think that the DB provides an x-axis that gives the participants cues about the likely range of the true distribution (though this would not explain how participants were able to correctly infer the shape and skewness of the distribution within the range).[9] These possible caveats justify using multiple techniques to capture beliefs about income inequality, such as the items concerning the incomes of typical professions. These professional income questions also have the advantage of being more concrete than the DB task. Figure 3 shows the distribution of beliefs for the four professions. It is interesting to observe that the answers to these questions also indicate a tendency to underestimate inequalities. Using Bureau of Labor Statistics data to approximate the values of the answer to the questions, we find that more than 70 % of the participants provided incomes for chairpeople below the actual average income for chairpeople.[10] Furthermore, a majority of participants overestimated the income of skilled and unskilled workers, with 82 and 84 % of participants providing incomes higher than the average income of these groups. The data also show a significant dispersion of answers expressing the imprecision of the participants' level of knowledge about what various workers earn.

[8] This result is consistent with other studies. The DB estimates tend to be less variable and more accurate Goldstein and Rothschild (2014).

[9] Note that the cues provided by the DB would be limited: The upper end of the DB axis was labelled $205,000 and above, and participants were free to place any number of markers in this bin. Nonetheless, participants could try to read, through the choice of axis lablels, knowledge revealed by the experimenters. We tried to minimize this concern by choosing an upper label slightly above the true 95th percentile, not too far from the real value but unlikely to seem too low or too high. In practice, the tendency of respondents to draw skewed distribution with only few markers on the top category could suggest that they did not feel constrained by the x axis. A possible alternative to our choice of design for future studies would be to adopt as a 95th percentile the level from the answers to the questionnaire. The drawback of this alternative is that if participants do not understand the concept of 95th percentile, it can introduce noise in the elicitation procedure by creating an upper income category which is way off the mark.

[10] We took the data from the Bureau of labor statistics (2010). While our survey questions asked for average income, the BLS only give data for median income. This is likely to give a lower bound for the average income in the profession, in particular for doctors and chairpeople where a negative skew in the distribution is likely to exist. For each category, we took a representative profession listed by the BLS (overall results are not sensitive to the choice of other specific professions. The BLS data gives: (1) unskilled factory worker (food processing workers) $23,000 per year, (2) skilled factory workers (industrial machinery mechanics and maintenance workers) $44,000 per year, (3) doctors (physicians and surgeons) $166,400 per year and (4) chairman of a large national corporation (based on 158 Standard & Poors 500 index companies) $9, 000, 000 per year.

Table 2 Beliefs about the shape of the income distribution

	(1) 10th Percentile	(2) 25th Percentile	(3) 50th Percentile	(4) 75th Percentile	(5) 90th Percentile	(6) 95th Percentile	(7) Interquartile	(8) 50th Percentile Q	(9) 95th Percentile Q
Education	−1916.92**	−1611.10*	−2797.30**	−3436.17*	−1425.47	1997.46	−0.04	−2746.96**	8.32e+07
	(680.69)	(779.15)	(966.83)	(1394.08)	(1725.78)	(1764.24)	(0.04)	(1016.69)	(6.60e+07)
Income	0.03***	0.04***	0.06***	0.07***	0.07**	0.04	−0.00	0.05***	−613.59
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.00)	(0.01)	(479.66)
Male	75.23	−687.19	−1771.05	−2582.94	−2164.78	−1618.98	−0.04	−4623.94**	9.66e+07
	(1121.90)	(1219.15)	(1540.45)	(2208.14)	(2740.66)	(2856.19)	(0.06)	(1519.81)	(1.29e+08)
Age	−143.00***	−84.16*	77.94	367.14***	612.41***	667.70***	0.01***	−80.16	2.09e+06
	(34.91)	(41.30)	(55.56)	(76.99)	(97.15)	(100.06)	(0.00)	(55.24)	(1.44e+06)
Local pop. dens.	51,955.37	82,759.45	99,530.00	175,841.14	136,886.77	403,052.11	5.79	47,742.43	−9.11e+09
	(208,316.26)	(219,480.23)	(246,939.62)	(259,634.41)	(266,338.12)	(266,634.19)	(6.36)	(202,819.61)	(7.70e+09)
Local avg. inc.	21.22	14.06	−18.13	−75.44	−85.45	−53.83	−0.00	−37.88	2.72e+06
	(29.62)	(32.83)	(41.15)	(59.61)	(74.51)	(80.53)	(0.00)	(44.09)	(3.54e+06)
Local st. dev. inc.	0.02	0.07	0.10	0.07	0.17	0.25	0.00	0.13	123.35
	(0.09)	(0.10)	(0.13)	(0.19)	(0.24)	(0.26)	(0.00)	(0.15)	(2271.35)
Local black pop.	−0.16*	−0.18*	−0.11	−0.03	0.30	0.43	0.00	−0.17	9790.70
	(0.07)	(0.08)	(0.12)	(0.18)	(0.24)	(0.24)	(0.00)	(0.14)	(10084.31)
Local Asian pop.	0.14	0.26	0.38	0.55	0.87	0.55	−0.00	0.19	12587.45
	(0.21)	(0.20)	(0.23)	(0.38)	(0.59)	(0.55)	(0.00)	(0.29)	(13277.84)

Table 2 continued

	(1) 10th Percentile	(2) 25th Percentile	(3) 50th Percentile	(4) 75th Percentile	(5) 90th Percentile	(6) 95th Percentile	(7) Interquartile	(8) 50th Percentile Q	(9) 95th Percentile Q
Constant	39,087.33***	47,056.44***	59,917.51***	79,771.11***	96,192.39***	104,404.27***	1.80***	59,898.00***	−4.29e+08
	(3963.03)	(4371.96)	(5911.59)	(8472.48)	(10,930.51)	(11,250.73)	(0.22)	(6287.20)	(4.15e+08)
R-squared	0.04	0.02	0.02	0.04	0.05	0.06	0.03	0.02	−0.00
N	825	825	825	825	825	825	825	825	825

The dependent variables are at the top of each column. Columns (1)–(7) use the answers from the DB, columns (8) and (9) use the answers to the survey questionnaire. SE in brackets

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

The results of the varied elicitation methods suggest that even though each method may present some limitations, their use in conjunction allows for a better understanding of individuals' beliefs about the income distribution.

Result 2 *We find a correlation between respondents' personal characteristics and beliefs about the income distribution. Older and more educated respondents tend to give a more accurate picture of the income distribution while wealthier respondents tend to overestimate the income of the bottom 90 % of the population. However we only find limited evidence of correlation between local area characteristics and respondents' beliefs in the income distribution.*

To assess whether differences in subjective beliefs are associated with differences in individual characteristics, we use OLS regressions to look at the correlations between the subjective beliefs about the income distribution and participants' characteristics. While we find that several characteristics are correlated with beliefs, we find only limited correlations between beliefs and local economic variables.

We use the estimates from the DB to look at the individual differences in beliefs about percentiles (namely the 10th, 25th, 50th, 75th, and 90th percentiles) of the income distribution. In Table 2, columns 1–6 show the results of OLS regressions with these variables as explained variables. As a measure of income dispersion, we use the interquartile range (column 7) and we also use the two direct questions from the survey about the 50th and 95th percentiles. We find that older and more educated people tend to give a more accurate picture of the income distribution with lower income estimates for lower percentiles and higher income estimates for higher percentiles. As a consequence, the distribution of the interquartile range for older and more educated people is more concentrated around the actual value. Personal income correlates positively with the beliefs about the level of almost all percentiles except the highest ones. Our results suggest that wealthier participants tend to overestimate the income of the bottom 90 % of the population.

Most local variables, such as local income inequality, are not strongly correlated with beliefs elicited with the DB.[11] This stands in contrast to recent studies finding that local situations affect perceptions of global conditions (Li et al. 2011; Cruces et al. 2013; Ansolabehere et al. 2014). One exception is that the number of African Americans in a ZIP code does correlate with beliefs about income inequalities, with people living in areas with more African Americans being less likely to overestimate the lowest percentiles of the income distribution.[12]

Once again, the results from the multiple elicitation methods lend support for the use of the DB. When comparing the regression results using answers about the 50th percentiles from the DB and from the direct questions, the results are

[11] In addition, we also tested for possible correlations between more elaborate measures of inequality, such as the Gini coefficient, between the DB distribution and the local income distribution at the zip level or in the county (using both income standard deviation and local Gini coefficients). We did not find any correlation.

[12] Our sample does not contain enough African American or Asian American participants to estimate significant differences between these categories and White Americans in terms of beliefs.

Table 3 Beliefs about the income level of typical professions

	(1) Unskilled	(2) Unskilled	(3) Skilled	(4) Skilled	(5) Doctor	(6) Doctor	(7) Chairman	(8) Chairman
Education	−1.91***	−1.84***	−1.53	−1.39	−21.66	−23.68*	89.63**	81.54*
	(0.56)	(0.56)	(1.26)	(1.22)	(11.17)	(11.11)	(33.80)	(33.87)
Income	0.02*	0.03*	0.04*	0.05**	−0.01	−0.02	0.82	0.49
	(0.01)	(0.01)	(0.02)	(0.02)	(0.15)	(0.16)	(0.42)	(0.42)
Male	0.86	0.78	4.82	4.64	−37.33*	−37.27*	149.01**	155.65**
	(0.94)	(0.94)	(2.50)	(2.47)	(15.38)	(15.39)	(54.27)	(54.20)
Age	0.14***	0.14***	0.33***	0.34***	3.07***	3.09***	13.61***	13.11***
	(0.03)	(0.03)	(0.07)	(0.07)	(0.71)	(0.71)	(1.81)	(1.82)
Local black pop.	−0.00	−0.00	0.00	−0.00	−0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Local Asian pop.	−0.00	−0.00	−0.00	−0.00	0.00	0.00	0.02	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Local pop. dens.		−67.11		−94.04		1615.66		3700.03
		(70.62)		(146.70)		(1395.34)		(6130.16)
Local avg. inc.		−0.05*		−0.10*		−0.28		3.01*
		(0.03)		(0.04)		(0.38)		(1.48)
Local st. dev. inc.		0.00		−0.00		0.00		0.01
		(0.00)		(0.00)		(0.00)		(0.00)
Constant	30.40***	31.97***	44.95***	49.54***	189.39***	123.81*	−1.93	−334.60
	(2.21)	(3.68)	(6.08)	(10.40)	(37.41)	(56.81)	(132.77)	(200.00)
R-squared	0.04	0.04	0.05	0.05	0.03	0.03	0.09	0.09
N	839	839	839	839	839	839	839	839

The dependent variables are at the top of each column. SE in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 Regression of preference for redistribution and political position on beliefs about inequality of the income distribution (all income variables in thousands of dollars)

	(1) Ineq. large	(2) Ineq. large	(3) Ineq. large	(4) Ineq. large	(5) Left leaning	(6) Left leaning	(7) Left leaning	(8) Left leaning
Median DB 000s	0.01	0.01			−0.01*	−0.01		
	(0.01>)	(0.01>)			(0.01>)	(0.01>)		
Interquantile range	0.07*	0.06*			−0.01	0.01		
	(0.03)	(0.03)			(0.05)	(0.06)		
Income 000s		0.01**		0.01**		− 0.01*		−0.01*
		(0.01>)		(0.01>)		(0.01>)		(0.01>)
Male		−0.11		−0.10		−0.15		−0.11
		(0.10)		(0.10)		(0.13)		(0.13)
Age		0.01		0.01		−0.01*		−0.01
		(0.01>)		(0.01>)		(0.01>)		(0.01>)
Education		0.12*		0.10		0.42***		0.37***
		(0.06)		(0.06)		(0.09)		(0.08)
Black		0.01		0.01		−0.01		−0.01
		(0.01>)		(0.01>)		(0.01>)		(0.01>)
Asian		0.01		0.01		−0.01		−0.01
		(0.01>)		(0.01>)		(0.01>)		(0.01>)
Local pop. dens.		26.63**		26.61**		62.35***		61.10***
		(9.57)		(9.57)		(12.33)		(11.77)
Local avg. inc. 000s		0.01		0.01		−0.01		−0.01
		(0.01>)		(0.01>)		(0.01>)		(0.01>)
Local st. dev. inc.		0.01		0.01		−0.01		−0.01
		(0.01>)		(0.01>)		(0.01>)		(0.01>)

Table 4 continued

	(1) Ineq. large	(2) Ineq. large	(3) Ineq. large	(4) Ineq. large	(5) Left leaning	(6) Left leaning	(7) Left leaning	(8) Left leaning
Chairman yearly income 000s			0.01	0.01			−0.01	−0.01
			(0.01>)	(0.01>)			(0.01>)	(0.01>)
Doctor yearly income 000s			0.01	0.01			−0.01*	−0.01
			(0.01>)	(0.01>)			(0.01>)	(0.01>)
Skilled worker yearly income 000s			0.01	0.01			−0.01	−0.01
			(0.01>)	(0.01>)			(0.01>)	(0.01>)
Unskilled worker yearly income 000s			−0.02***	−0.02***			−0.03***	−0.03***
			(0.01)	(0.01)			(0.01)	(0.01)
Constant	3.48***	3.27***	3.98***	3.71***	−3.34***	−4.18***	−2.49***	−3.47***
	(0.17)	(0.39)	(0.15)	(0.39)	(0.26)	(0.54)	(0.22)	(0.53)
R-squared	0.01	0.02	0.01	0.03	0.01	0.08	0.05	0.11
N	818	818	818	818	825	825	825	825

SE in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

reasonably close (see Table 2). Looking at the correlation between participants' characteristics and their beliefs about the typical level of income of the four specific professions gives results that are largely in line with those collected with the DB (see Table 3). More educated participants made more accurate inferences about the average income of professions, providing lower estimates for skilled and unskilled workers and higher estimates for chairpeople. Participants with higher incomes overestimated the incomes of unskilled and skilled workers. Older respondents tended to give higher estimates for each profession instead of giving lower estimates for low income professions and higher estimates for high income professions. The inclusion of local variables in these regressions shows that in areas where the average income per household is higher, participants tended to have lower estimates of the yearly income of unskilled and skilled workers and tended to provide higher estimates of a chairperson's yearly income. It is not clear a priori whether this reflects an effect of the local income distribution. A reference-group approach (Cruces et al. 2013) would on the contrary suggest that people living in richer neighborhoods overestimate the income of poorer households in the country. It is possible that this effect only reflects better knowledge of the distribution by households living in richer neighborhoods—note that the signs of the coefficients follow the same patterns as for the education variable.

Overall, our results are globally consistent and do not indicate any substantial misalignment between questions and answers across the DB and the survey questions. One limitation of the above approach is that it only allows studying the link between individual characteristics and specific parts of the distribution or specific statistics of dispersion. This can be misleading as there can be a link between statistics of centrality and dispersion. This is the case in particular for skewed distributions such as the income distribution. To address this issue, we use maximum likelihood estimation of the parameters of a lognormal distribution that best fits the distributions participants submitted with the DB. We can then estimate jointly the measures of centrality μ and dispersion σ for each participant's DB distribution and can then model these two parameters as a function of individuals' characteristics. The results of this estimation (provided in the "Appendix") provide qualitatively similar results to those of Table 2.

6 Beliefs about income inequalities and political position

The large range of beliefs elicited (e.g., beliefs about the overall level of inequality, belief in social mobility in general, personal experience of social mobility) allows us to study how these different beliefs relate to political positions. To do so, we use beliefs to predict answers to two questions: a question about the preference for income redistribution, and a question about positioning oneself on a traditional left–right scale.

Result 3 *Preference for redistribution and left-leaning political position are not correlated with beliefs about overall levels of income inequality or income dispersion. However, beliefs about the incomes of the poorest households matters. Preference for redistribution is lower for respondents giving higher estimates of the lowest household income level in the society.*

Table 5 Beliefs about different percentile of the distribution of income and rightwing position

Percentile	5	10	25	50	75	90	95
No control (1)	0.15**	0.15**	0.12**	0.08*	0.04†	0.02	−0.00
Demographics controls (2)	0.13**	0.13*	0.11**	0.06†	0.03	0.01	0.00
Demographic and beliefs controls (4)	0.13*	0.13*	0.11*	0.06†	0.03	0.01	0.00

For an increase of $10,000 in the perceived income percentile from the DB (in column), each number in the table represents the marginal effect on the variable indicating a right wing position. The first column represents the marginal increase of $10,000 in the 5th percentile, and so on. These coefficients are estimated by replacing the DB median by each percentile in the regressions (5) and (6) of Table 4 and regression (4) of Table 6 coefficients significant at † 10 %, * 5 %, ** 1 %

To study preferences for redistribution, we analyse respondents' beliefs about whether income differences are currently too large in America. Political position was measured with a Likert scale item in which higher values indicate a tendency of be on the political left. Similar results to those we report below are obtained when looking at partisanship for the Democrats or Republicans.

Table 4 shows the regression results of the answers to the question asking respondents whether they think that income differences are currently too large in America (columns 1–4) and to the question about left–right position. With regard to individual demographics, the results are in line with common patterns in which participants with higher incomes are significantly less favorable to redistribution while participants with higher levels of education and those from urban areas are more favorable to it. When looking at beliefs about income inequality, we find that the beliefs about the level of inequality measured with an overall index of dispersion (here the interquartile range[13] from the DB) is significantly correlated with redistribution preferences (columns 1–2) but not with a left leaning position (columns 5–6).

Interestingly, when we use the items about the incomes of specific professions as a way to measure beliefs about income dispersion, we find that the belief about the lowest income profession (unskilled worker in a factory) is always strongly significant: Participants are more likely to be in favor of income redistribution when they believe that unskilled workers in a factory have lower incomes ($p < 0.001$). This suggests that redistribution preferences may be more sensitive to beliefs about the lower tail of the income distribution.

To further investigate this possibility, we use the rich information elicited with the DB. Instead of only extracting the median in the distribution, we extract a wider range of percentiles in the subjective distributions. This allows us to study whether various parts of the subjective distributions are more correlated with political positions than others. If a left-wing position is linked with the view that inequality is too great, this could be driven either by a concern for the poorest households, or by a reprobation for the incomes of the richest people, or by both. In Table 5, we show the results of replacing the median in models (5) and (6) from Table 4 and (4) from Table 6 by key percentiles. The coefficients for each percentile are displayed for the three regression models. The

[13] The results are robust to other specifications.

Table 6 Regression of preference for redistribution and political position on beliefs about inequality of the income distribution and beliefs about social mobility (all income variables in thousands of dollars)

	(1) Ineq. large	(2) Ineq. large	(3) Left leaning	(4) Left leaning
Median DB	0.01		0.01	
	(0.01>)		(0.01>)	
Interquantile range	0.04		−0.02	
	(0.03)		(0.06)	
Income 000s	−0.01*	−0.01*	0.01	0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Male	−0.14	−0.13	−0.21	−0.18
	(0.10)	(0.10)	(0.13)	(0.13)
Age	0.01	0.01	−0.01*	−0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Education	0.08	0.07	0.37***	0.34***
	(0.06)	(0.06)	(0.08)	(0.08)
Black	0.01	0.01	0.01	0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Asian	0.01	0.01	0.01	0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Local pop. dens.	18.29*	18.46*	52.71***	52.42***
	(9.11)	(9.04)	(11.41)	(10.73)
Local average income per household 000s	0.01	0.01	0.01	0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Local st. dev. inc.	0.01	0.01	0.01	0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Parent	0.02	0.01	−0.02	−0.03
	(0.03)	(0.03)	(0.04)	(0.04)
Open society	−0.14***	−0.13***	−0.14***	−0.12**
	(0.03)	(0.03)	(0.04)	(0.04)
Hard work	−0.34***	−0.34***	−0.53***	−0.50***
	(0.07)	(0.07)	(0.10)	(0.10)
Income increase next 5 years 000s	0.01	0.01	0.01	0.01
	(0.01>)	(0.01>)	(0.01>)	(0.01>)
Chairman yearly income 000s		0.01		0.01
		(0.01>)		(0.01>)
Doctor yearly income 000s		0.01		0.01*
		(0.01>)		(0.01>)
Skilled worker yearly income 000s		0.01		0.01
		(0.01>)		(0.01>)
Unskilled worker yearly income 000s		−0.01**		−0.03***
		(0.01)		(0.01)

Table 6 continued

	(1) Ineq. large	(2) Ineq. large	(3) Left leaning	(4) Left leaning
Constant	4.84***	5.14***	−2.03***	−1.63**
	(0.43)	(0.42)	(0.58)	(0.58)
R-squared	0.09	0.10	0.13	0.16
N	808	808	814	814

SE in brackets
* p < 0.05, ** p < 0.01, *** p < 0.001

results confirm those from Tables 4 and 6, namely, that the beliefs about the income of the poorest households in the society are those which correlate most highly with political positions. Providing high estimates of the poorest people's income predicts being on the right, while beliefs about the income of wealthier groups do not correlate with political positions. This pattern persists and stays significant even when covariates from models (2) and (4) of Table 6 are included in the regression. These results bring support to those from Tables 5 and 6 where the beliefs about unskilled workers income have a strong and very significant effect on preferences for redistribution an political positions, respectively.[14]

Result 4 *Preferences for redistribution and political positions are not clearly correlated with beliefs about ones personal chances of upward mobility. However, beliefs in the existence of substantial opportunities for upward social mobility are associated with lower preferences for redistribution.*

When we include variables about the beliefs about social mobility, the median income and interquartile range cease to be significant for predicting preferences for redistribution. This result is robust to a wide range of inequality measures (eg., variance, Gini coefficients). On the contrary, the beliefs about the average income of unskilled workers stays significantly correlated with political positions. Lower estimates of unskilled factory workers income are positively associated with left-wing leanings. We also find that, to a lower degree, this is true for estimates of doctors' incomes.

[14] One possible explanation could be that higher income respondents are both less informed about low household incomes (and as a consequence overestimated them) and more conservative. In that case, the correlation between beliefs and political position would just be a spurious link created by the correlation between the political position of the respondent and his/her degree of error made when asked to guess the level of income of the poorest households. We checked for such a possible explanation by running the same regression on the subsample of respondents with an income lower than $50,000 (median of the US distribution of household incomes) and on the subsample of those whose income is higher than $80,000 (75th percentile of the distribution) poorest respondents in our sample. In both samples, beliefs about the income of the poorest had a similarly positive marginal effect on political positions. This indicates that the observed correlation between beliefs about the lowest incomes in society and political positions is not reflecting different errors from respondents.

The prospect of upward mobility, measured by expectations of an income increase over the next 5 years, is not significant. Social mobility already experienced (i.e., the question about present success relative to one's parents) is not significantly correlated with preferences for redistribution when controlling for individuals characteristics. On the contrary, we find that the beliefs about social mobility in general (questions about the US being an open society and whether hard work or luck is an explanation for social success) are the main predictors of preferences for redistribution. The significance of these beliefs as predictors is very strong ($p < 0.001$) even when controlling for individual characteristics, individual experience, and personal prospects of social mobility.

Overall, our results lend support to social mobility or reciprocity explanations, and suggest that the personal prospects of upward mobility are unlikely to be the main drivers of redistribution preferences. In regard to the possible existence of an "aversion to inequality", our results suggest that respondents are not so much averse to inequality or dispersion in general—as would be suggested by certain behavioral models (Fehr and Schmidt 1999; Bolton and Ockenfels 2000)—as they are to low incomes for the poorest members of the society, consistent with quasi-maximin preferences and a concave altruistic utility function (Charness and Rabin 2002; Andreoni and Miller 2002; Cox and Sadiraj 2006).[15]

Overall, our results suggest that, while political positions are not very sensitive to the centrality and dispersion of the perceived income distribution, they are influenced by beliefs about the incomes of the poorest. This result stands in contrast to views in which self-interest or a philosophical objection to inequality largely governs redistribution preferences. Interestingly, our results with the DB indicate that the beliefs about the top 5th percentile of the distribution are not correlated with political position. A limit of the DB is that it has an upper bound at $205,000. The answers from the survey about a chairman income seemed to back this lack of correlation between beliefs about high income and political position. The beliefs about doctors' incomes do not respect this pattern. Even though this result is less robust and significant than the link observed for unskilled workers' income, it may suggest that more research is warranted about beliefs about high incomes.[16]

[15] A possible concern could be that low income respondents are more knowledgeable about the income of low income households than high income respondents who may overestimate the income from the poorest households in society. Such a situation would create the observed correlation if low income respondents tend to be in favor of redistribution and high income respondents tend to be against redistribution. The fact that the coefficient on the belief about unskilled workers' income does not change between column (5) and column (6) when the income of the respondent is included as a covariate tends to suggest that it is not what is driving the results. The coefficient from the income variable should partially capture the correlation between income and political position in column (6). The link between participants income and political position could however be non linear and be imperfectly captured by the inclusion of the income variable in the regression. We therefore constructed a set of four dummies for the quartiles of the income distribution and we included them in the regression. The results show that the coefficients and their level of significance are almost unchanged. This suggest that for respondents of different income levels, estimates of income of unskilled workers is positively correlated with being against redistribution.

[16] We checked here again that this result could not simply reflect a better information from higher income respondents who tend to be more conservative. The magnitude of the coefficient does not decrease when the regressions are made within samples of richer and poorer respondents.

7 Discussion

The political economy and political science literatures have suggested several potential links between income inequality and preferences for wealth redistribution. In this study, we have elicited subjective beliefs about several dimensions of income inequality and investigated both the possible factors influencing these beliefs as well as the role these beliefs may play in determining political positions.

First, in contrast to recent studies finding evidence that local variables influence individual's beliefs about the state of the economy nationally, we find only limited evidence that beliefs about the national income distribution are influenced by the characteristics of the local income distribution (such as local average income or income dispersion). However, we do find that wealthier people assume that incomes are higher (their subjective distributions are shifted to the right) suggesting a kind of hyper-local influence on subjective estimates: neighbors' incomes do not seem to affect one's impressions, but one's own income does. This result is somewhat different than that of Cruces et al. (2013), which suggests that the relative position in the local income distribution influences a household's beliefs in its relative position in the national income distribution. Several reasons could explain these differences such as the different countries where the studies take place (USA and Argentina) or the different set of controls used in each study (we controlled for a wide range of local characteristics). One of the possible limitations of our strategy to study the role of local variables is that we may have failed to identify the right level of "locality" by using the characteristics of the ZIP code area. In that sense, our lack of results with local variables should not be seen as proof that local variables do not matter.[17] Noticeably, Cruces et al. (2013)'s study used as a local reference group a fairly small set of street blocks containing only 26 households on average. These different results suggest that there is room for future research to investigate the role of different levels of geographical "neighborhood" in influencing individuals' beliefs about the country at large. Beyond geographical definitions of neighborhood, modern ways of interactions create other proximal sources of information which would be worth investigating, for instance social networks (friends, workplace) and reference groups generated by media consumption.

Second, we looked at the possible role of these beliefs in shaping preferences for redistribution. We find that beliefs about the income distribution are correlated with individual preferences for redistribution. Interestingly, we do not find any effect of the standard statistics of centrality or variance of the distribution. The main link between the perceived income distribution and political position on a left–right axis is the belief about income of the poorest members of society. We find that higher estimates of the incomes of the poorest (whether directly stated or extracted from the lower percentiles of people's DB rendering of the income distribution) are strongly correlated with a right-wing political leaning. Notably, this specific link between beliefs about the income distribution and political preferences is not what would

[17] We also investigated the effect of inequalities at the county level, with the same limited results. If another level of locality is appropriate, we suspect it may be a level closer to the respondent.

naturally stem from the models of inequality aversion (Fehr and Schmidt 1999; Bolton and Ockenfels 2000) which suggest a rejection of distributions with larger inequality. On the other hand, this result is in line with quasi-maximin and concave altruistic utility preferences in which individuals' utility over income distributions includes a trade off between efficiency and the conditions of those who are the worst off (Charness and Rabin 2002; Andreoni and Miller 2002; Cox and Sadiraj 2006). Such preferences are close to Rawls' maximin preferences (Rawls 1971), in which people care primarily about ensuring the highest level of resources for the poorest members of society.[18] Experimental evidence has also shown that people labelled as "poor" benefit from higher transfers in dictator games (Braas-Garza 2006).

In addition to beliefs about inequalities, we find favorable support for the theory that a belief in the existence of social mobility may determine attitudes towards redistribution (Piketty 1995; Alesina and Angeletos 2005; Bénabou and Tirole 2006). Previous empirical studies have used survey data to provide support to this idea (Piketty 1996; Corneo and Grüner 2002). The present study provides further evidence by estimating the correlation between these beliefs and preference for redistribution while controlling for a wider range of beliefs about income inequality. Not only does this approach test the robustness of past studies, it also permits for the testing of more theories than was possible with existing surveys. In particular, we tested the joint role of beliefs about inequality and respondents' prospects of upward mobility (Hirschman and Rothschild 1973; Ravallion and Lokshin 2000; Bénabou and Ok 2001; Fillippin and Checchi 2004). While a belief in *social mobility in general* predicts political positions, it is not the case for one's own personal chances of upward mobility.

In the television program *The West Wing*, the US President is asked "Who gives a damn, sir? This is a tax cut that benefits only 4500 families". The President replies, "It doesn't matter if most voters don't benefit. They all believe that someday they will. That's the problem with the American dream: it makes everyone concerned for the day they're going to be rich". In contrast to this opinion, which suggests that voters are concerned for the day they will become rich, the present investigation finds empirical support for the idea that people oppose further redistribution when they believe that *anyone* can become rich.

[18] The recent "Occupy Wall Street" political movement, rallying under the cry of "We are the 99 %", used the high level of inequality at the top of the income distribution to mobilize support. Our results suggest that people may be more influenced towards redistribution by focusing on the lower end of the distribution instead.

Appendix 1: Variables description

See Table 7.

Table 7 Description of the explaining variables

Education	Categorical	{1, no high school diploma; 2, high school diploma; 3, undergraduate degree; 4, graduate degree}
Income	Numerical	5000–650,000
Local dens	Numerical	Density per square meter at the zip level
Local avg. inc.	Numerical	Average household income at the zip level
Local st. dev. inc.	Numerical	Standard deviation of household income at the zip level
Local black pop.	Numerical	Population of black people living in the area
Local Asian pop.	Numerical	Population of Asian people living in the area
Median DB 000s	Numerical	Value of the 50th marker in the drawn DB distribution
Interquantile range	Numerical	Difference between the value of he 80th marker and the 20th marker in the DB distribution
Chairman yearly income 000s	Numerical	Answer in thousand dollars to the question "What do you think is the average income in the USA of a chairman of a large national corporation?"
Doctor yearly income 000s	Numerical	Answer in thousand dollars to the question "What do you think is the average income in the USA of a medical doctor?"
Skilled worker yearly income 000s	Numerical	Answer in thousand dollars to the question and "What do you think is the average income in the USA of a skilled worker in a factory?"
Unskilled worker yearly income 000s	Numerical	Answer in thousand dollars to the question and "What do you think is the average income in the USA of an unskilled worker in a factory?"
Parent	Categorical	Answer on a 7 point Likert scale (from strongly agree to strongly disagree) to the question "Would you say that your current position and prospects in life are better than those of your parents at that age?"
Open society	Categorical	Answer on a 7 point Likert scale (from strongly agree to strongly disagree) to the question "America has an open society. What one achieves in life no longer depends on one's family background, but on the abilities one has and the education one acquires"
Hard work	Categorical	{1, luck is the most important; 2, hard work and luck are equally important; 3, hard work is the most important}
Income increase next 5 years 000s	Numerical	Difference between answer to the question "What is your best guess of what your household income will be 5 years from today?" and stated current income

Appendix 2: Description of the sampled counties

See Table 8 and Fig. 4.

Table 8 Detail of the selected counties

Region	Division	State	County	Population 2010	Racial dissimilarity	Gini 2007	Inequality
West	Mountain	Arizona	Pinal	375,770	55.5	0.389	Low
South	West South Central	Arkansas	Saline	107,118	45.2	0.383	Low
West	Pacific	California	Los Angeles	9,800,000	69	0.493	High
West	Pacific	California	Marin	252,409	56.8	0.497	High
West	Pacific	California	San Francisco	805,235	59.4	0.519	High
West	Mountain	Colorado	Denver	600,158	64.6	0.514	High
Northeast	New England	Connecticut	Fairfield	916,829	69.6	0.534	High
Northeast	New England	Connecticut	Tolland	152,691	51	0.395	Low
Northeast	New England	Connecticut	Windham	118,428	45.5	0.389	Low
South	South Atlantic	District of Columbia	District Of Columbia	601,723	80.3	0.542	High
South	South Atlantic	Florida	Alachua	247,336	41.5	0.533	High
South	South Atlantic	Florida	Collier	321,520	66.1	0.53	High
South	South Atlantic	Georgia	Paulding	142,324	18.6	0.311	Low
Midwest	East North Central	Illinois	Kendall	114,736	33.7	0.329	Low
Midwest	East North Central	Indiana	Hancock	70,002	33.7	0.361	Low
Midwest	East North Central	Indiana	Hendricks	145,448	63.2	0.352	Low
Midwest	East North Central	Indiana	Monroe	137,974	34.6	0.491	High
Midwest	West North Central	Kansas	Douglas	110,826	27.6	0.507	High
South	East South Central	Kentucky	Boone	118,811	24.6	0.367	Low
South	West South Central	Louisiana	Orleans	343,829	66	0.543	High
South	West South Central	Louisiana	Tangipahoa	121,097	37.2	0.527	High
Northeast	New England	Massachusetts	Franklin	71,372	26.9	0.394	Low
Northeast	New England	Massachusetts	Norfolk	670,850	48.5	0.475	High
Northeast	New England	Massachusetts	Suffolk	722,023	71.5	0.521	High
Midwest	West North Central	Minnesota	Anoka	330,844	41.5	0.35	Low

Table 8 continued

Region	Division	State	County	Population 2010	Racial dissimilarity	Gini 2007	Inequality
Midwest	West North Central	Minnesota	Hennepin	1,200,000	58.6	0.475	High
Midwest	West North Central	Minnesota	Sherburne	88,499	65.6	0.35	Low
South	East South Central	Mississippi	Desoto	161,252	23.3	0.386	Low
South	East South Central	Mississippi	Lee	82,910	26.4	0.509	High
Midwest	West North Central	Missouri	Cass	99,478	36.8	0.351	Low
Midwest	West North Central	Missouri	St. Louis	998,954	69.5	0.478	High
Northeast	Middle Atlantic	New Jersey	Essex	783,969	81.1	0.53	High
West	Mountain	New Mexico	Santa Fe	144,170	33.4	0.492	High
Northeast	Middle Atlantic	New York	New York	1,600,000	76.9	0.603	High
Northeast	Middle Atlantic	New York	Oswego	122,109	33.9	0.388	Low
Northeast	Middle Atlantic	New York	Wayne	93,772	38.7	0.387	Low
Northeast	Middle Atlantic	New York	Westchester	949,113	66.8	0.531	High
Midwest	East North Central	Ohio	Belmont	70,400	53.3	0.503	High
Midwest	East North Central	Ohio	Hamilton	802,374	68.1	0.502	High
West	Pacific	Oregon	Linn	116,672	33.2	0.392	Low
Northeast	Middle Atlantic	Pennsylvania	Adams	101,407	42.9	0.377	Low

Table 8 continued

Region	Division	State	County	Population 2010	Racial dissimilarity	Gini 2007	Inequality
South	East South Central	Tennessee	Madison	98,294	56.1	0.522	High
South	East South Central	Tennessee	Shelby	927,644	69.8	0.51	High
South	East South Central	Tennessee	Wilson	113,993	34.6	0.368	Low
South	West South Central	Texas	Brazos	194,851	48.5	0.547	High
South	West South Central	Texas	Coryell	75,388	28.5	0.38	Low
South	West South Central	Texas	Williamson	422,679	34.7	0.355	Low
West	Mountain	Utah	Washington	138,115	31	0.39	Low
South	South Atlantic	Virginia	Frederick	78,305	24.5	0.35	Low
South	South Atlantic	Virginia	Prince William	402,002	32	0.351	Low
West	Pacific	Washington	Chelan	72,453	31	0.389	Low
West	Pacific	Washington	Cowlitz	102,410	31	0.382	Low
West	Mountain	Wyoming	Natrona	75,450	29.8	0.501	High
USA						0.45	

Regions and divisions are defined by the US Census Bureau. The index of racial dissimilarity is computed for the white and black population at the tract level (http://enceladus.isr.umich.edu/)

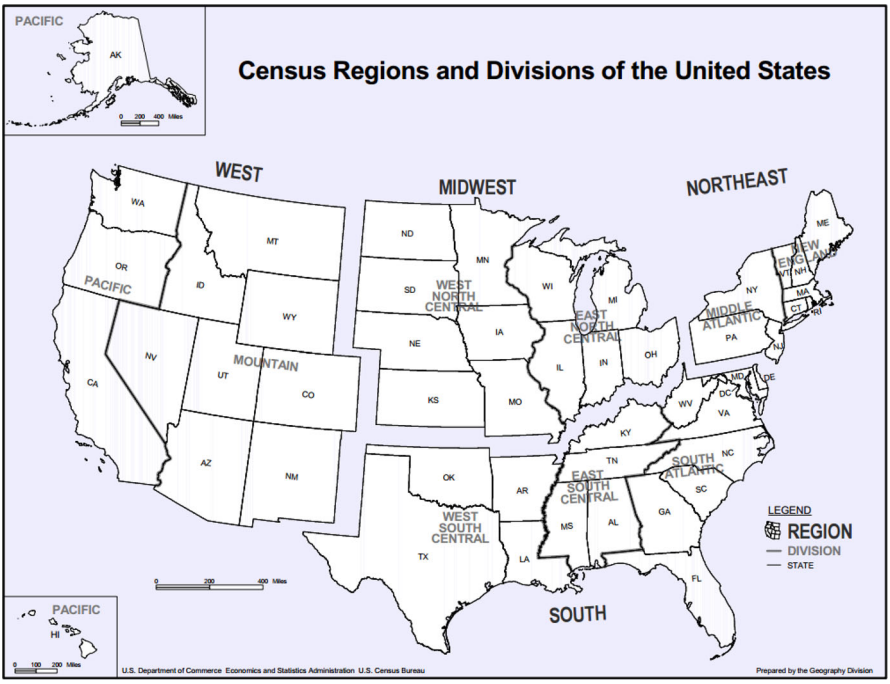

Fig. 4 Census regions and divisions

Appendix 3: Survey sample

Tables 9 and 10 below compares the survey sampling firms panel demographics to our sample. The largest differences is observed for gender with more female respondents than in the overall panel. We have already experienced such a gender imbalance in previous uses of this firms panel as well as other commercial panels and panels we have curated ourselves. This suggests that it may be due to a general gender differences in the propensity to participate to a survey rather than a selection induced specifically by our topic. We also observe a smaller number of young participants, a larger number of participants with high income. We have now added this information to the description of our sample.

We retained 82 % of the initial sample and eliminated respondent who looked that they may not have taken the task seriously. Table 10 compares the answers of both samples (retained and not retained). On most answers, there are no significant differences. The standard deviation of the distribution elicited by the DB is significantly higher in the retained sample relative to the non retained sample. It is likely to be a mechanical effect of the rule we chose: we eliminated participants who clicked less than 5 times on the DB. This is likely to eliminate participants who created DB distributions with only limited dispersion. The retained sample also display a belief which is (marginally) significantly higher than for the non retained sample. Overall, our choice to retain the sample does not lead to a sample of respondents with very

Table 9 Comparison of the study sample with the sampling firm panel demographics

Variable	Retained sample (%)	Overall sampling firm panel (%)
Age 18–24	2.5	14
Age 25–34	20.6	18
Age 35–44	21.5	20
Age 45–54	23.4	19
Age 55–64	22	19
Age 65+	10.1	10
Female	72	51
Income −$15k	3.2	10
Income $15–$25k	4.6	19
Income $25–$50k	22.8	29
Income $50–$75k	23.5	20
Income $75–$100k	20	10
Income $100–$150k	18.3	8
Income $150k+	7.5	5

Table 10 Comparison of the retained sample with the non retained sample

	Retained sample	Non retained sample	*t* test, p value
Mean DB	72,749	73,205	0.78
Median DB	52,938	51,117	0.30
St. dev. DB	39,925	32,428	<0.001*
Income chairman	1,031,365	889,892	0.02*
Income doctor	258,879	258,753	0.99
Income skilled w.	60,369	56,478	0.05*
Income unsk. w.	32,872	31,263	0.11
Open society	5.23	5.15	0.54
Hard work	2.36	2.40	0.47
Parent	5.35	5.42	0.33
Right wing	3.83	3.64	0.18
Democrat	57.6 %	58.3 %	0.88
N	839	186	

different answers. In particular, there are no significant differences in regard to the answers to the political questions.

Appendix 4: Structural estimation

Estimating a parametric distribution from DB data requires taking into account that the DB allows participants to give an estimate of the percentage of households in a series

of brackets 10,000 dollars wide each, up to the highest bracket "$205k and above". To summarize beliefs about the income dispersion in one parameter, we model the DB observations as coming from a lognormal distribution with mean and standard deviation μ and σ. To estimate these parameters for each participant, we maximise the log-likelihood function for each individual i:

$$\ell(\mu_i, \sigma_i | M_i) = \sum_{k=1}^{100} \sum_{j=1}^{22} \ln \left(\Phi \left(\frac{\ln(\overline{b}_j) - \mu_i}{\sigma_i} \right) - \Phi \left(\frac{\ln(\underline{b}_j) - \mu_i}{\sigma_i} \right) \right) \mathbb{1}_{\{m_{ki} \in [\underline{b}_j, \overline{b}_j]\}}$$

where M_i is the vector of observed marker values m_{ki} for the individual i, with k being the id of the marker for each participant, j the id of the bracket and $\underline{b}_j, \overline{b}_j$ respectively the lower and upper bounds of bracket j (with $\underline{b}_1 = 0$ and $\overline{b}_{22} = +\infty$).

This model allows us to estimate how different participant characteristics correlate with participants' beliefs about the shape of the distribution. To do so, we sum the individual log likelihood over the whole sample:

$$\mathcal{L}(\mu, \sigma | M) = \sum_{i=1}^{N} \ell(\mu_i, \sigma_i | M_i) \tag{5}$$

where M is the vector of all observed marker values m_{ki} in the sample. In order to estimate links between individual and local characteristics of participants and their beliefs, we parametrize the coefficients as linear functions of vectors of observed variables X_1 and X_2 respectively:

$$\begin{aligned} \mu &= \beta_1 X_1 \\ \sigma &= \beta_2 X_2 \end{aligned} \tag{6}$$

Table 11 shows the results of the estimations of parameters μ and σ from the lognormal distribution by maximizing the likelihood (5). The parameters are written as linear functions of variables characterizing the individual and local characteristics following Eq. (6). To take the non-independence of observations within participants into account, we use a robust matrix of variance clustered by participants. We find that education and age are significant, while no local variable is significant.

Appendix 5: Median comparison

An interesting feature of our design is the elicitation of the subjective beliefs about the median household income using two different methods: a direct question and the Distribution Builder. Figure 5 shows the scatterplot of the individual answers to these two methods. There is clearly substantial variation across the two elicitation methods reflected in the overall correlation of 0.6 between the two types of answers. We think that these difference can be due to the abstract nature of the direct question which requires participants to think about the notion of percentiles. This may lead to more

Table 11 Beliefs about the moments of the distribution from the distribution builder

	(1)	(2)	(3)	(4)	(5)
μ					
Education		−0.028*	−0.028*	−0.031*	−0.032*
		(0.043)	(0.043)	(0.031)	(0.027)
Income		0.001***	0.001***	0.001***	0.001***
		(<0.001)	(<0.001)	(<0.001)	(<0.001)
Male		−0.018	−0.018	−0.021	−0.019
		(0.412)	(0.412)	(0.340)	(0.375)
Age		0.001	0.001	0.001	0.001
		(0.403)	(0.403)	(0.351)	(0.323)
Local avg. inc.					−0.000
					(0.817)
Local pop. dens.					2.091
					(0.431)
Local black pop.				−0.167*	−0.170*
				(0.041)	(0.039)
Local Asian pop.				0.041	0.038
				(0.421)	(0.451)
Constant	10.995***	10.982***	10.982***	10.988***	10.993***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
σ					
Education		0.012	0.012	0.012	0.010
		(0.188)	(0.188)	(0.176)	(0.266)
Income		>−0.001**	>−0.001**	>−0.001*	>−0.001*
		(0.009)	(0.009)	(0.011)	(0.010)
Male		−0.011	−0.011		
		(0.449)	(0.449)		
Age		0.003***	0.003***	0.003***	0.003***
		(<0.001)	(<0.001)	(<0.001)	(<0.001)
Local avg. inc.					<0.001
					(0.881)
Local st. dev. inc.					−0.000
					(0.711)
Local pop. dens.					2.906*
					(0.024)
Local black pop.				0.049	0.039
				(0.340)	(0.452)
Local Asian pop.				−0.012	−0.012
				(0.688)	(0.687)
Constant	0.679***	0.516***	0.516***	0.514***	0.529***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
R-squared					
N	825	825	825	825	825

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

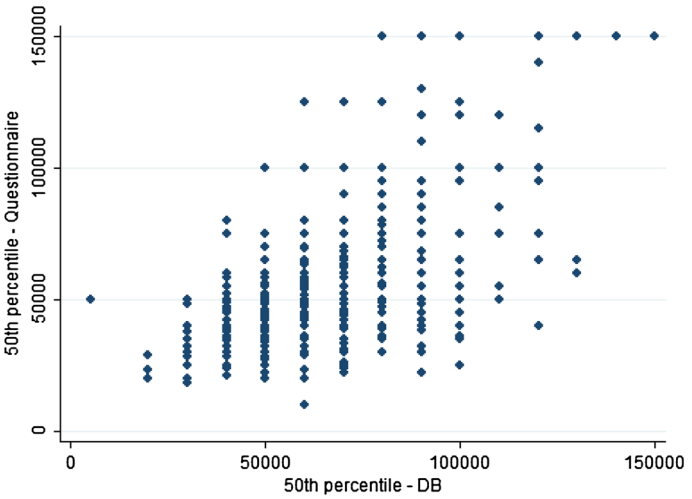

Fig. 5 Individual answers about the median in the questionnaire and in the DB. p values indicated in *brackets*

noisy answer from guesses. Another possibility is that people may take more or less care in answering each question. Overall 60 % of participants estimates about the median via these two methods are within $10,000 from each other and 78

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