

Preferences for redistribution and social structure

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Abstract We model inter-individual differences in preferences for redistribution as a function of (a) self-interest; (b) ideas about the deservingness of income differences due to luck, effort and talent; (c) subjective perceptions of the relative importance of these determinants for explaining the actual income distribution. Individuals base the latter on information obtained from their reference group. We analyse the consequences for redistributive preferences of homophilous reference group formation based on talent. Our model makes it possible to understand and integrate some of the main insights from the empirical literature. We illustrate with GSS data from 1987 how our model may help in structuring empirical work.

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1 Introduction

Recently, the evidence that citizens have preferences for redistribution that go beyond their own narrow self-interest has been accumulating (see [Alesina and Giuliano 2011](#)).¹ These preferences influence voting behavior and therefore redistributive government policies. Feedback mechanisms, with redistributive policies leading to economic outcomes that in their turn influence preferences again, may lead to multiple politico-economic equilibria ([Alesina and Angeletos 2005](#); [Benabou and Tirole 2006](#); [Cervellati et al. 2010](#); [Luttens and Valfort 2012](#)).

Redistributive preferences are to a large extent explained by values and beliefs about the causes of income differences. Citizens in Western societies seem to adopt a normative framework that is closely related to Roemer's approach to equality of opportunity with its distinction between "effort" and "circumstances" ([Roemer 1998](#)). In general, they perceive income differences due to luck as illegitimate, and those due to effort as legitimate ([Corneo and Grüner 2000, 2002](#); [Fong 2001](#); [Roemer and Trannoy 2015](#)). Ability falls somewhere in-between ([Isaksson and Lindskog 2009](#)), as it is partly under the control of individuals (certainly if it reflects investment in human capital), and partly the outcome of a natural lottery.

There are large interindividual differences in these preferences, however. In this respect, there is strong evidence for reference group effects ([Keely and Tan 2008](#); [Eugster et al. 2011](#)). Two mechanisms are at work. One is "identification": if people conform to the preferences prevailing in their reference group, this may lead to the formation of rather stable (sub)cultural differences. The importance of stable cultural traits is illustrated by the fact that redistributive preferences of immigrants and their offspring continue to be influenced by their country of origin ([Guiso et al. 2006](#); [Luttmer and Singhal 2011](#)). This has obvious implications for policy applications of the equality of opportunity approach. In one of his first publications on the topic, Roemer (1993, p. 166) stated that his proposal would implement different degrees of opportunity egalitarianism in different societies, because the set of factors for which individuals should be held responsible cannot but be influenced by a specific society's physiological, psychological, and social theories of man.

The second mechanism is emphasized less in the normative literature, but is crucial to understand redistributive preferences in any specific situation. It is linked to information, and more specifically, to the perception of the relative importance of different variables in the explanation of the actual situation.² One may be convinced that effort should be rewarded, but at the same time think that effort is unimportant in explaining real-world income differences. Here as well, reference groups may be crucial. As individuals are not perfectly informed, they derive information about the actual income distribution from what they observe in their own reference group (see, e.g., [Cruces et al. 2013](#)). There may also be direct effects of the neighborhood in which people

¹ [Corneo and Fong \(2008\)](#) estimate on data from the 1998 Gallup Social Audit that the monetary value of justice for US households amounts on average to about one fifth of their disposable income.

² There is a growing amount of evidence that people have wrong perceptions about inequality and its causes and that these perceptions strongly influence their ideas about whether more redistribution is needed. Recent examples include [Gimpelson and Treisman \(2015\)](#) and [Page and Goldstein \(2016\)](#).

are living. As an example, [Luttmer \(2001\)](#) found that support for welfare payments is lower for respondents living in a neighborhood with a larger welfare reciprocity rate. In line with the reference group effect, he also found that support increases as the share of local recipients from the respondent's own racial group rises.³

In this paper, we try to offer some insight in the large inter-individual preference differences *within* countries. We start from the model of individual preferences that has been proposed by [Alesina and Angeletos \(2005\)](#). In this model the individual's utility function is a linear combination of a self-interested and a social justice part. We introduce two extensions. First, while we follow Alesina and Angeletos in assuming that income differences due to luck are considered by everybody as illegitimate and those due to effort as legitimate, we introduce the possibility that income differences caused by ability may be seen as unjust. Individuals are therefore characterized by *two* stable cultural traits: the relative weight given in their utility function to self-interest versus justice, and the degree of acceptance of income differences due to ability. Second, we assume that individuals are not perfectly informed about the distribution of effort, ability and luck in society and that they derive information about this distribution from what they observe in their reference groups. We obtain additional insights from a simple model of homophilous reference group formation on the basis of ability indicators. We show how changes in the social structure, i.e., in the social stratification underlying reference group formation, may induce changes in redistributive preferences, even when individuals have stable cultural traits.

This paper is structured as follows. The next section describes our model of redistributive preferences. In Sect. 3, we explore the consequences of homophilous group formation. Section 4 presents an empirical analysis of data from the 1987 round of the general social survey (GSS). This analysis is only meant to be an illustration, as the database is too weak and too small to implement our theoretical model. Section 5 concludes and comments on the normative implications of our findings.

2 Preferences for redistribution, cultural traits and beliefs

Assume a unit mass infinite population of consumers $\mathcal{I}$. Denote the pre-tax income of individual $i \in \mathcal{I}$ by m_i . Redistribution is operationalized by a linear income tax scheme, with tax rate $\tau \in [0, 1]$ and a uniform lump sum transfer $\tau \bar{m}$, with $\bar{m}$ the average pre-tax income in society.⁴ Post-tax consumption c_i equals post-tax income, i.e.,

³ We understand the “reference group” of an individual as the group of people that he observes and from which he derives information about the overall income distribution. Note that in a different context, a reference group is commonly understood as the group of people to which an individual compares himself in order to evaluate his relative welfare position. [Corneo and Grüner \(2000, 2002\)](#) analyse the determinants of redistributive taxation in such a setting in which individuals are concerned about their relative consumption.

⁴ The assumption of a linear tax scheme is very common in the literature and it has also been shown that such a scheme may be a good empirical approximation of the more complex non-linear tax schemes that are found in the real world (see, e.g., [Roemer et al. 2003](#)). Nevertheless, exploring the consequences of relaxing this restriction is an interesting topic for future research. The assumption of a quadratic income tax scheme (as in [De Donder and Hindriks 2003](#)) may be an interesting starting point for this extension.

$$c_i = (1 - \tau) m_i + \tau \bar{m}. \quad (1)$$

We define preferences for redistribution in terms of preferences for τ .⁵ These preferences are linked to three sets of individual characteristics. The first set is related to the self-interest of the individuals, as captured by their own position within the income distribution. We assume that individual consumers differ in their talent (productive capacity) and in their luck.

Second, preferences for redistribution are also motivated by the individual's views regarding fairness. We assume that these views are relatively stable cultural or ideological traits of the individual. A first trait is the relative weight given to fairness versus self-interest. A second trait is linked to the content of fairness itself. Ideas about the fairness of the income distribution reflect a position on the relative deservingness of incomes related to talent, ambition and luck. In line with the empirical literature, we assume that all fairness-minded citizens consider income differences due to luck as undeserved⁶ and income differences due to taste for effort as ethically acceptable.⁷ However, empirical work (Konow 2003; Gaertner and Schokkaert 2012; Roemer and Trannoy 2015) suggests that there is no consensus about the deservingness of income differences due to natural talent. We will interpret different opinions in this regard as a second stable trait.

Third, individuals with the same fundamental ideas about fairness and the same self-interest, may still have different preferences about τ , depending on the characteristics of the society in which they are living. Since they are not perfectly informed about the distribution of talent and luck in their society, they form subjective beliefs about these population characteristics. We assume that they do this on the basis of the information they derive from their own reference group. We return to the structure of these reference groups in the next section. For the moment we simply state that for each consumer i , a reference group is a set of individuals $\mu(i) \subseteq \mathcal{I}$, observations of whom are used by i to estimate population characteristics. As an example, average income in society as perceived by individual i is $\bar{m}_{(i)} = \frac{1}{|\mu(i)|} \int_{j \in \mu(i)} m_j dj$. We will use the subscript (i) each time we refer to a variable that is "estimated" by individual i on the basis of observations in his reference group.⁸

⁵ In political economy models of the determination of tax rates, each individual voter has a zero impact on outcome. We focus on individual preferences: the optimal τ is then determined as if the individual is a dictator.

⁶ In the welfare economic literature, the treatment of luck is far from obvious—see, e.g., Lefranc et al. (2009). We follow the terminology in which "luck" stands for circumstances.

⁷ As one reviewer notes, the empirical literature has investigated the acceptability of income differences due to effort, not those due to *taste for effort*. However, in most models the former is monotonically related to the latter. At a more basic level, the distinction relates to the fundamental debate in the literature on responsibility-sensitive egalitarianism on the question for which factors individuals should be held responsible: for factors under their control, or for their preferences. Within the economic model, effort choices are determined by preferences and by constraints and there is no really free choice. See, e.g., Fleurbaey (2008) for a deeper discussion of these issues.

⁸ The index i is typically used for the consumer assessing his/her preferences for redistribution, and j concerns typically consumers observed by him/her.

To make these general ideas more specific, assume that the full utility of consumer i is a convex combination of private utility u_i and fairness (see [Alesina and Angeletos 2005](#)):

$$U_i = (1 - \gamma) u_i - \gamma \Omega_{(i)}^\zeta, \quad (2)$$

in which $\Omega_{(i)}^\zeta$ stands for the social injustice in society, as perceived by consumer i , and $\gamma \in [0, 1]$ is a parameter indicating the relative weight of social injustice in overall utility. As mentioned before, γ is assumed to be a stable individual trait.⁹

Private utility is specified in a quasi-linear form as the difference between consumption and the disutility of effort

$$u_i = c_i - \frac{(e_i)^2}{2\beta},$$

where e_i is a measure of effort and $\beta \in \mathbb{R}^+$ is the (homogeneous) taste for effort.¹⁰ This quasi-linear specification implies that there is no income effect in the supply of effort. Consumption c_i is given by Eq. (1) with

$$m_i = \alpha_i e_i + \varepsilon_i.$$

Talent is denoted by $\alpha_i \in \mathbb{R}^+$ and luck $\varepsilon_i \in \mathbb{R}$ enters the expression in an additive way. Luck is defined such that $\bar{\varepsilon}_{(i)} = 0$. Bringing all this together, anticipated private utility can be written as

$$u_i = (1 - \tau)(\alpha_i e_i + \varepsilon_i) + \tau \bar{m}_{(i)} - \frac{(e_i)^2}{2\beta}.$$

We assume that, when deciding on e_i (with the tax rate given), the consumers know their own ability and all fundamentals of the model, but estimate the distribution of income (determinants) at the level of the population. Therefore, they estimate the average income $\bar{m}_{(i)}$ on the basis of observations from their reference group.¹¹

⁹ To save on notation, we do not use subscripts for these cultural traits, but we will derive comparative statics results with respect to them.

¹⁰ In an earlier version of this paper ([Schokkaert and Truyts 2014](#)), we did not impose the assumption of an homogeneous taste for effort. This complicates the derivation and the interpretation of the results, without adding useful insights. The results derived in this paper still hold in the more general model.

¹¹ Note that this means that we confine ourselves to the voters' ex ante mental exercise of determining their preferred tax rate, based on local information. As one reviewer correctly noted, in our simplified model observing the true demogrant $\bar{m}$ would allow sophisticated voters to infer the society's true average ability. We keep to our simple setting for the present purposes, mainly because we want to stay close to what empirical research has revealed about the informational limitations of citizens in forming their opinion about redistributive policies. Similar results as in our model can be obtained with fully Bayesian voters observing the true demogrant in combination with less lenient other information assumptions, but we leave such a significantly more complicated analysis for a later paper.

Consumers choose their optimal effort level e_i^* to maximize their private utility. Assuming that they neglect the effect of their own effort choice on average income¹², this yields

$$e_i^* = (1 - \tau) \beta \alpha_i, \quad (3)$$

such that the resulting anticipated consumption level can be written as:

$$c_i = (1 - \tau)^2 \beta \alpha_i + (1 - \tau) \varepsilon_i + \tau(1 - \tau) \beta \bar{a}_{(i)}, \quad (4)$$

where we denote for notational simplicity $a_i \equiv (\alpha_i)^2$ and $\bar{a}_{(i)} \equiv \frac{1}{|\mu(i)|} \int_{j \in \mu(i)} (\alpha_j)^2 dj$.

Fairness is defined as in [Alesina and Angeletos \(2005\)](#), by taking as a measure of social injustice the average squared difference between each individual's actual consumption c_j and his deserved (or fair) consumption level $\hat{c}_j^\zeta$. Different ideas about what is a fair consumption level are captured by the superscript ζ . Taking into account that individuals i have to extrapolate the information they gather from their own reference group, their perceived unfairness can be written as:¹³

$$\Omega_{(i)}^\zeta = \frac{1}{|\mu(i)|} \int_{j \in \mu(i)} (c_j - \hat{c}_j^\zeta)^2 dj. \quad (5)$$

We assume that individuals judge the fairness of the distribution in terms of the deservingness of the different income components, and that the deserved (or fair) consumption level of individual j is defined before redistribution, i.e., involves a position on the acceptability of pre-tax income $m_j = (1 - \tau) \beta \alpha_j + \varepsilon_j$. To calculate the fair consumption level, circumstance factors for which individuals are not held responsible are put at their mean value.¹⁴ This definitely holds for luck.¹⁵ The effort parameter β is considered to be individual i 's own responsibility, but since we assume that there are no interindividual differences in the taste for effort it does not play an

¹² Since i has zero mass, this immediately follows from $|\mu(i)| > 0$.

¹³ Equation (5) might suggest that individuals take a parochial attitude and are only interested in justice within their reference group. This is *not* our interpretation, however. We could have started from a more general society-wide measure of injustice. However, as will become clear, only the means and the variances of the different variables will enter the expressions for the preferred tax. Since we assume that these are estimated by the individuals on the basis of their own reference group, choosing a more general formulation would not change any of our results. Moreover, in our theoretical analysis, reference groups can be interpreted very broadly, e.g., they can be seen as a (probably biased) sample of the overall population.

¹⁴ This is similar to the egalitarian equivalent approach in the theory of responsibility-sensitive egalitarianism—see, e.g., [Fleurbaey \(2008\)](#).

¹⁵ Our setting allows for more extreme positions. At one extreme, we have the laissez-faire or libertarian conviction that considers all income differences to be justified, such that fairness warrants no redistribution at all. This can be modelled as $\hat{c}_j^\zeta = m_j$ for all j . In this case, social injustice Ω_j equals the average income change due to taxation and it is minimized by setting $\tau = 0$. Note that this fairness ideal conflicts with self-interest for consumers with an income below average. At the other end of the spectrum, the pure egalitarian position corresponds to $\hat{c}_j^\zeta = \bar{m}_{(i)}$ for all j . We will not analyse this position as such (it is rarely defended explicitly).

important role in what follows. Individuals differ in their ideas about the deservingness of talent. We therefore write in general that

$$\hat{c}_j^\zeta = (1 - \tau) \beta [\zeta a_j + (1 - \zeta) \bar{a}_{(i)}]. \quad (6)$$

The cultural trait ζ indicates the degree to which talent is seen as resulting from deserving investments by the individual. A value $\zeta = 1$ represents the meritocratic view, in which all differences in talent are considered to reflect effort (the case considered in [Alesina and Angeletos 2005](#)). For $\zeta = 0$, talent is part of circumstances and just follows from the “natural lottery” (as would be more consistent with a Rawlsian perspective).

Throughout the analysis, we assume that the conditional means of the income determinants are independent of each other:

Assumption 1 $E(\varepsilon|\alpha) = 0$ and $E(\alpha|\varepsilon) = 0$.

In the remainder of this section, we derive the preferences for redistribution, i.e., the optimal value of τ for the situation in which reference groups are given. To gain some intuition, we start with two simple cases: first, that of a purely selfish individual; and second, that of a “naive” idealist, who only cares about fairness ($\gamma = 1$). We then summarize the effects of taking incentives into account and finally analyze the full model of a sophisticated consumer. Most derivations are trivial, and are relegated to the Appendix. The comparative static results are summarized in Table 1.

Table 1 Marginal effects on the desired tax rate

	Self-interest (1)	Naive fairness (2)	Incentive (3)	Sophisticated (4)
Self-interest				
a_i	≤ 0	0	0	≤ 0
Cultural traits				
ζ	0	< 0	$<(>) 0$, increasing with ζ	$<(>) 0$, increasing with ζ
γ	0	0	0	$<(>) 0$, increasing with m_i
Perceptions				
$Var(\varepsilon)_{(i)}$	0	> 0	0	> 0
$Var(a)_{(i)}$	0	< 0 if $\zeta \neq 0$	> 0	> 0 for $\zeta = 0$, < 0 for $\zeta = 1$, decreasing with ζ
β	0	< 0 if $\zeta \neq 0$	> 0	> 0 for $\zeta = 0$, < 0 for $\zeta = 1$, decreasing with ζ
$\bar{a}_{(i)}$	> 0	0	0	> 0
Actual tax rate				
τ^a	0	> 0	0	0

The different columns correspond to the different cases analysed in Sect. 2. “ > 0 ” (“ < 0 ”) implies that the row variable has a positive (negative) marginal effect on the desired tax rate

2.1 Preferences for redistribution of selfish consumers

The anticipated utility function of the purely self-interested consumer with $\gamma = 0$ reduces to¹⁶:

$$EU_i = (1 - \tau)^2 \beta a_i + \tau (1 - \tau) \beta \bar{a}_{(i)} - \frac{(1 - \tau)^2 \beta a_i}{2}.$$

The first order condition is:

$$\frac{\partial EU_i}{\partial \tau} = (1 - 2\tau^{SI}) \bar{a}_{(i)} - (1 - \tau^{SI}) a_i = 0, \quad (7)$$

resulting in the optimal tax rate τ^{SI} (where the superscript indicates the self-interested case)

$$\tau^{SI} = \frac{\bar{a}_{(i)} - a_i}{2\bar{a}_{(i)} - a_i}, \quad (8)$$

for an interior solution.

Individuals with zero pre-tax income ($a_i = 0$) prefer a tax rate $\tau^{SI} = 0.5$. This brings them at the top of the Laffer-curve, i.e., it is the tax rate maximizing the lump sum transfer $\tau(1 - \tau)\beta\bar{a}_{(i)}$. When the pre-tax income increases, the corresponding value of τ^{SI} decreases. The constraint $\tau \geq 0$ becomes binding at $a_i = \bar{a}_{(i)}$, i.e., for individuals who perceive themselves to have the average talent.¹⁷ All these results are well known from the many papers in the tradition of [Meltzer and Richard \(1981\)](#).

Cultural fairness traits, including ζ , obviously have no impact in this model. Differences in reference groups can have an impact. If, as can be expected, individuals with differing talents have different reference groups, talent and ambition will influence preferences for redistribution through the (perceived) mean $\bar{a}_{(i)}$. This will be the topic of the next section.

2.2 Preferences for redistribution of naive idealists

Someone who cares exclusively about fairness will choose τ so as to minimize $\Omega_{(i)}^\zeta$. We first assume that he neglects incentive effects, i.e., that he observes the actual effort levels (for the actual observed tax rate τ^a) $(1 - \tau^a) \beta \alpha_j$ and assumes that these remain fixed when the tax rate changes. The same is then true for the “fair” values

¹⁶ We assume that when deciding about the tax rate, the consumer does not yet know the realization of luck ε_i and therefore estimates it as the average $\bar{\varepsilon}_{(i)} = 0$.

¹⁷ The condition for strict concavity of the optimization problem is that $a_i < 2\bar{a}_{(i)}$. We only consider individuals for which this assumption holds.

$\hat{c}_j^\zeta = (1 - \tau^a) \beta (\zeta a_j + (1 - \zeta) \bar{a}_{(i)})$.¹⁸ The anticipated consumption level becomes

$$c_j = (1 - \tau) (1 - \tau^a) \beta a_j + (1 - \tau) \varepsilon_j + \tau (1 - \tau^a) \beta \bar{a}_{(i)}, \quad (9)$$

which can be compared to Eq. (4). Perceived social injustice can, after some algebraic manipulations (see Appendix), be written as:

$$\Omega_{(i)}^{\zeta 0} = (1 - \tau)^2 \text{Var}(\varepsilon)_{(i)} + (1 - \tau^a)^2 (1 - \tau - \zeta)^2 \beta^2 \text{Var}(a)_{(i)}. \quad (10)$$

The “fair” tax rate τ_i^0 , where the superscript “0” indicates that incentive effects are neglected, results from solving the first order condition

$$\begin{aligned} \frac{\delta \Omega_{(i)}^{\zeta 0}}{\partial \tau} = & -2 \left(1 - \tau_i^0 \right) \text{Var}(\varepsilon)_{(i)} \\ & - 2 \left(1 - \zeta - \tau_i^0 \right) (1 - \tau^a)^2 \beta^2 \text{Var}(a)_{(i)} = 0. \end{aligned} \quad (11)$$

This yields

$$\tau_i^0 = \frac{\text{Var}(\varepsilon)_{(i)} + (1 - \zeta) (1 - \tau^a)^2 \beta^2 \text{Var}(a)_{(i)}}{\text{Var}(m)_{(i)}}, \quad (12)$$

where $\text{Var}(m)_{(i)}$ captures the overall perceived income variation. Equation (12) reflects a trade-off between, on the one hand, undoing unfairness by taxing away income variation which is due to circumstances (luck) and, on the other, generating a new kind of unfairness by taxing away deserved income differences.

The comparative statics can immediately be derived by differentiating Equation (12) and are summarized in column (2) of Table 1. Differences in talent do not have a direct influence on the fair tax rate: because consumer i has by assumption zero mass in $\mu(i)$, they only matter in the self-interested part of utility. The fair tax rate of naive idealists will increase with the actual tax rate. This is easy to understand, as a higher observed tax rate τ^a decreases efforts,¹⁹ and, thus, the relative importance of (perceived) deserved versus undeserved income inequality.²⁰ An increase in ζ increases the deservingness of talent, thus increasing the deserved fraction of income variation and therefore decreasing the fair tax rate. As one extreme, in the pure meritocratic case where $\zeta = 1$, the fair tax rate simply equals the share of luck in the overall income

¹⁸ An alternative approach would take as the reference a no-tax situation, with effort equal to $\alpha_j \beta$ and fair pre-tax income $\beta (\zeta a_j + (1 - \zeta) \bar{a}_{(i)})$. This would mean, however, that our “naive” consumer uses a sophisticated model to go from the observed situation to the counterfactual no-tax world. As a matter of fact, our comparative statics results remain valid under this assumption (simply set $\tau^a = 0$ in all expressions).

¹⁹ Note that the naive idealist in our model does not take into account incentive effects in determining his/her own preferred tax rate. However, if τ^a is large, (s)he will observe a lower contribution of effort in the actual process of income creation and this has an effect on what (s)he considers to be the fair tax rate.

²⁰ This mechanism is analogous to the one that is described by Alesina and Angeletos (2005) to explain the differences between the European and the US welfare states.

variation (Alesina and Angeletos 2005). At the other extreme for $\zeta = 0$, all income variation is “undeserved”, and the fair tax rate for the naive idealist equals 1.

Given ζ , the “fair” tax rate is determined by perceptions regarding the relative importance of different income determinants. If the variance of luck, i.e., the importance of undeserved income variation in the overall income variation, increases, the ideal tax rate increases. Taking the derivative of Eq. (12) with respect to $Var(a)_{(i)}$ yields

$$\frac{\partial \tau_i^0}{\partial Var(a)_{(i)}} = -\zeta (1/(Var(m)_{(i)})^2 (1 - \tau^a)^2 \beta^2 Var(\varepsilon)_{(i)}) \leq 0,$$

showing that an increase in the variance of talent decreases the fair tax rate, except if $\zeta = 0$. In the latter case, the distribution of the total income variation over luck and talent does not matter, since both income sources are “undeserved” anyway. As soon as $\zeta \neq 0$, however, an increase in the variance of talent increases the share of a deserved source of income differences. This also immediately explains why the effect of $Var(a)_{(i)}$ increases with the value of the uniform taste of effort β .

2.3 Preferences for redistribution of sophisticated consumers

We now bring together the insights from the two previous subsections and consider the preferences for redistribution of a sophisticated consumer, who is characterized by $\gamma \in]0, 1[$ and who does take incentive effects into account. This implies that he uses Eq. (6) as his definition of $\hat{c}_j^\zeta$, i.e., that changes in τ , leading to changes in effort levels (and thus pre-tax income), also imply a change in the deserved consumption level. In fact, since τ (and τ^a) are the same for all individuals, this is only a proportional shift compared to the naive position.²¹

Introducing *incentives in the fairness component* of the utility function yields

$$\Omega_{(i)}^\zeta = (1 - \tau)^2 Var(\varepsilon)_{(i)} + (1 - \tau)^2 (1 - \zeta - \tau)^2 \beta^2 Var(a)_{(i)},$$

which can be compared to Eq. (10). The first derivative of this expression with respect to τ is

$$\begin{aligned} \frac{\partial \Omega_{(i)}^\zeta}{\partial \tau} &= -2(1 - \tau) Var(\varepsilon)_{(i)} - 2(1 - \zeta - \tau)(1 - \tau)^2 \beta^2 Var(a)_{(i)} \\ &\quad - 2(1 - \tau)(1 - \zeta - \tau)^2 \beta^2 Var(a)_{(i)}. \end{aligned} \quad (13)$$

Using Eq. (11), we get:

$$\frac{\partial \Omega_{(i)}^\zeta}{\partial \tau} = \frac{\delta \Omega_{(i)}^{\zeta 0}}{\partial \tau} \Big|_{\tau=\tau^a} - 2(1 - \tau)(1 - \zeta - \tau)^2 \beta^2 Var(a)_{(i)}.$$

²¹ Alesina et al. (2012) mention that it is debatable whether or not $(1 - \tau)$ should enter the definition of the “fair” wealth. An alternative is to take as reference the no-tax situation $\tau = 0$. This alternative assumption does not change the fundamental results.

The first two terms on the right hand side of Eq. (13) thus represent the original fairness considerations in the absence of incentive effects, and the last term captures the (new) incentive effects on fairness. This latter term is negative. The strict concavity of $\Omega_{(i)}^\zeta$ then implies that sophisticated consumers (taking into account incentive effects) will have a higher preferred tax rate than naive consumers if they only focus on fairness.²² Taking into account incentives lowers the relative importance of deserved income determinants in the overall income inequality, and increases the relative contribution of luck (which is not affected by incentives). The negative effect on the fair tax rate of an increase in $Var(a)_{(i)}$ (if $\zeta \neq 0$) will therefore become smaller. The resulting effects are summarized in the column (3) of Table 1.

Equation (13) has to be combined with the *self-interest* component (Eq. (7)) to find the overall first-order condition for the maximization of the full utility function w.r.t. τ :

$$\Upsilon_i \equiv (1 - \gamma)\beta \left[(1 - 2\tau)\bar{a}_{(i)} - (1 - \tau)a_i \right] - \gamma \frac{\partial \Omega_{(i)}^\zeta}{\partial \tau} = 0. \quad (14)$$

Under strict concavity,²³ the comparative statics with respect to the different parameters of the problem can be obtained by the implicit function theorem (see Appendix). They are summarized in Table 1.

More talented individuals prefer a lower degree of redistribution because of considerations of self-interest, under the *caveat* that we control for differences in the perception of $\bar{a}_{(i)}$, due to differences in their reference groups. Indeed, through the self-interested component, perceived average talent will have a positive effect on the optimal tax rate as long as the economy has not yet reached the top of the Laffer-curve, i.e., when $\tau_i^* < 0.5$.

For a sophisticated consumer (contrary to a naive one), the actual tax rate will not influence his perceptions of the optimal tax rate, because he fully understands the link between taxes and effort choices and therefore will discount this influence in his perception of reality. The preferred tax rate will increase with the weight given to fairness γ for individuals with

$$a_i > \frac{(1 - 2\tau)}{(1 - \tau)} \bar{a}_{(i)}.$$

This condition obviously holds for all individuals with a higher than average pre-tax income, who would object to any taxation on purely self-interested grounds. However, for individuals with a low pre-tax income, who are striving for a large tax rate on self-interested grounds, increasing the weight of fairness decreases the selfish bias and hence also the preferred tax rate.

²² This result stands in sharp contradiction to the optimality result for linear redistributive taxation in the traditional approach with a welfarist (e.g., utilitarian) social welfare function. In fact, our sophisticated consumer is only concerned about fairness (and self-interest) and does not consider the society-wide trade-off between the global level and the distribution of income.

²³ The (reasonably weak) conditions for strict concavity can be obtained from the authors on request.

When incentives are neglected, consumers with a larger ζ , i.e., those who consider differences in talent to be more deserving, prefer a smaller degree of redistribution. Taking into account incentives introduces an additional effect, that is increasing with ζ . For sufficiently large ζ , taxation reduces the deserved inequality enough for the incentive effects to come to dominate the direct fairness effect.

The effect of an increase in the perceived importance of luck is unambiguously positive. It is identical to the effect for a naive idealistic consumer, since luck does not enter the self-interested part of the utility function, nor does it influence incentives.

The effect of $Var(a)_{(i)}$ depends on the value of ζ . Obviously, if $\zeta = 0$, i.e., when talent is seen as merely the result of the natural lottery, an increase in its variance will increase the optimal tax rate (as long as $\tau_i^* < 1$). In the situation without incentives, $\frac{\partial \tau_i^*}{\partial Var(a)_{(i)}}$ was negative for $\zeta \neq 0$. Yet the incentive component works in the other direction and becomes larger if ζ increases: a higher tax rate induces lower effort levels, and thus a lower share of deserved income variation. The overall effect therefore becomes indeterminate. The effects of changes in $Var(a)_{(i)}$ increase with the value of the taste for effort parameter β .

3 Social interactions and formation of beliefs

The model of the previous section establishes a link between redistributive preferences and the perceived variances $Var(\varepsilon)_{(i)}$, $Var(a)_{(i)}$ and mean $\bar{a}_{(i)}$. This relationship may lead to inter-country differences in preferences even if there are no ideological differences and if individuals are perfectly informed. However, it is more realistic to assume that individuals are not perfectly informed. Boundedly rational consumers may then derive the needed information from what they observe in their own reference group and act as if this reference group were representative of the entire population (Cruces et al. 2013).²⁴

The informational approach is especially relevant when there is no clear a priori explanation for the occurrence of ideological differences. Commonly-found regional differences within a country offer a straightforward example. It is more natural to assume that different regions are characterized by different socioeconomic environments, rather than to assume that they have different ideologies. As a specific example, the information channel may contribute to explaining the findings of Luttmer (2001) that the support for welfare payments is lower among respondents living in a neighborhood with a larger welfare reciprocity rate. In such a neighborhood, the perceived average income is likely to be smaller, such that selfish voters in such a neighborhood are less supportive of redistribution (see Table 1).

More specific insights can be obtained by explicitly modelling the process of network formation. In traditional societies, networks remain rather stable over time. In modern societies, stable factors such as ethnicity admittedly still play an important role. Yet, when social mobility increases, individuals get the opportunity to choose to

²⁴ Consumers may use other information sources, such as what they see and hear in mass media. Of course, this information is also biased. The (interesting) question of how consumers may combine different biased information sources is an open question for further research.

a larger extent their own reference groups. It is well documented that social networks tend to be homophilous: like tend to meet like much more than proportionally (see, e.g., McPherson et al. (2001) for a survey). To model this in the simplest way, we assume that reference groups are formed on the basis of two relevant characteristics: natural talent a_i and an income-irrelevant quality q_i (examples being religion, skin color, geographical location or lifestyle). The former is related to education and is a natural candidate as a factor of social stratification. Talent and the income irrelevant quality are distributed according to a joint distribution function $\Phi(a, q)$, with marginal distributions $\Phi^a(a)$ and $\Phi^q(q)$. We will focus on the case where talent and the quality q are independently and uniformly distributed.²⁵ The uniformity assumption is less unrealistic than may seem at first sight, at least in a model of perceptions and subjective beliefs. One natural interpretation is that a and q are measured as the rank individuals occupy in the ordering of respectively talent and the income irrelevant-quality. This is consistent with Roemer (1998)'s proposal to measure the degree of effort as the rank that someone occupies in the income distribution of all individuals with the same talent.

Assume that maintaining a social relation comes at a constant disutility cost $c > 0$, and that the benefits $B(i, j)$ for consumer i from a relationship with consumer j are decreasing with the distance between them:

$$B(i, j) = \frac{\xi}{\delta |a_i - a_j| + (1 - \delta) |q_i - q_j|},$$

with ξ a parameter indicating the constant marginal utility of $\frac{1}{\delta |a_i - a_j| + (1 - \delta) |q_i - q_j|}$ and $\delta \in [0, 1]$ indicating the relative importance of talent in the formation of social relationships. If the consumer establishes only worthwhile relationships, his reference group will be given by

$$\mu(i) = \{j | \delta |a_i - a_j| + (1 - \delta) |q_i - q_j| \leq \pi\}. \quad (15)$$

with $\pi \equiv \xi/c$. This parameter π can be seen as a measure of network size. In the Cartesian (a, q) plane, if $\delta \in]0, 1[$, $\mu(i)$ is a rhombus with edges (see Fig. 1)

$$\left\{ \left(a_i - \frac{\pi}{\delta}, q_i \right), \left(a_i, q_i + \frac{\pi}{(1 - \delta)} \right), \left(a_i + \frac{\pi}{\delta}, q_i \right), \left(a_i, q_i - \frac{\pi}{(1 - \delta)} \right) \right\}.$$

If $\delta = 1$, we are in a one-dimensional situation with $\mu(i) = \{j | a_j \in [a_i - \pi, a_i + \pi]\}$, i.e., a vertical band of width 2π around a_i . If $\delta = 0$, the social network is a horizontal band around q_i , i.e., $\mu(i) = \{j | q_j \in [q_i - \pi, q_i + \pi]\}$. Figure 1 illustrates what happens if $\delta \in]0, 1[$ increases, i.e., if the productive dimension a becomes more salient for social network formation. The four points $\{(a_i \pm \pi, q_i \pm \pi)\}$ are always on the frontier and the edges of the rhombus pivot around these four points.

²⁵ A discussion of reference group formation for generic distribution functions in the case where only natural talent matters is presented in Appendix.

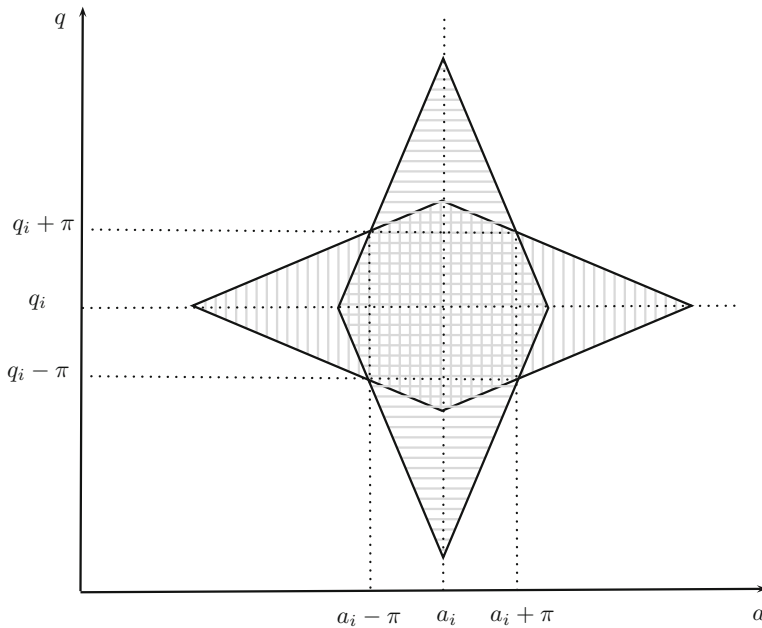


Fig. 1 Network structure in the two-dimensional case

The individual's network will influence his redistributive preferences if it affects his perception of the variables $\bar{a}_{(i)}$ and $Var(a)_{(i)}$. If $\delta = 0$, i.e., if the network formation is only driven by income-irrelevant variables, network differences will not affect redistributive preferences since $\forall i, j \in \mathcal{I} : Var(a)_{(i)} = Var(a)_{(j)}$ and $\bar{a}_{(i)} = \bar{a}_{(j)}$ if a and q are independently distributed. If $0 < \delta \leq 1$, the effects of the network on the perceived average $\bar{a}_{(i)}$ and the perceived variance $Var(a)_{(i)}$ depend in a complex way upon the shape of the distribution function $\Phi(a, q)$. As mentioned before, we focus on the special case in which $\Phi^a(a)$ and $\Phi^q(q)$ are independent and uniform, with compact support on a rectangle $[\theta_L, \theta_R] \times [\theta_D, \theta_U]$.²⁶ The perceived density function then becomes a symmetric triangular density function with density $(\delta/\pi)^2 ((\pi/\delta) - |a - a_i|)$ for $a \in [a_i - (\pi/\delta), a_i + (\pi/\delta)]$ and 0 elsewhere. For this density we can derive that

$$\bar{a}_{(i)} = a_i \quad \text{and} \quad Var(a)_{(i)} = \frac{1}{6} \left(\frac{\pi}{\delta} \right)^2.$$

The relevant comparative statics can then easily be derived. It is obvious that $\frac{\partial \bar{a}_{(i)}}{\partial a_i} = 1$ and $\frac{\partial \bar{a}_{(i)}}{\partial \pi} = \frac{\partial \bar{a}_{(i)}}{\partial \delta} = 0$. Moreover, we have that $\frac{\partial Var(a)_{(i)}}{\partial \delta} < 0$, $\frac{\partial Var(a)_{(i)}}{\partial \pi} > 0$, and $\frac{\partial Var(a)_{(i)}}{\partial a_i} = 0$. We summarize these results in Table 2.

²⁶ Hence, we restrict our attention to cases where the support of $\mu(i)$ is in the interior of $[\theta_L, \theta_R] \times [\theta_D, \theta_U]$.

Table 2 Effect of network characteristics on the perception of the distribution of talent

	$Var(a)_{(i)}$	$\bar{a}_{(i)}$
a_i	0	1
π (network size)	>0	0
δ (weight given to talent)	<0	0

Although our model is simple, it offers rich interpretational possibilities. Consider first the effect of a variable such as education. As we have seen, in a simple self-interest model, education should have a negative effect on the willingness-to-redistribute, *if* one controls for reference group effects—see Table 1. However, in a world with homophilous group formation on the basis of ability, higher educated people will have a larger perceived $\bar{a}_{(i)}$ than lower educated people—and it is even likely that they overestimate the average productivity in society. This theoretical prediction is corroborated in the empirical results of [Cruces et al. \(2013\)](#). The positive effect of a_i on $\bar{a}_{(i)}$ will generate a more positive attitude towards redistribution among higher educated self-interested citizens. The interplay between the different factors may then generate the non-monotonic relationship between education and distributive preferences that has been found in empirical work ([Georgiadis and Manning 2012](#); [Pittau et al. 2013](#)).

Second, while the existence of stable cultural traits explains why migrants keep—to a large extent—the redistributive preferences prevailing in their native country, the gradual assimilation to the values in the country of destination may reflect a shift in their perceptions about the relative importance of talent, effort and luck. The longer the immigrants live in their new country, the less important their origin will become for network formation—and the more representative their network will be for the relevant distributions in the country of destination. If, in addition, gradual assimilation implies that they form more homophilous networks in terms of talent (in our model this is represented by an increase in δ), this will decrease their perception of the variance of talent. The effect on their (reduced form) redistributive preferences will then depend on the value of ζ . Immigrants in the US will often come from countries that are less meritocratic (i.e., have a lower value of ζ). A reduction in the perceived variance because of the integration in more homophilous networks will then lead to a decrease in the desired level of redistribution over time, even when their ideological background does not change.

Third, an increase in regional social capital (measured by participation in community activities, as in [Yamamura \(2012\)](#)) can be interpreted as a decrease in δ (since more participation in community activities likely implies that the network is less homogeneous with respect to ability) and an increase in network size π . Both effects lead to an increase in the perceived variance of talent and, hence, to an increase in redistributive preferences for the less meritocratic individuals who are not exclusively concerned about fairness (see column (4) in Table 1).

Fourth, long run changes in the social structure of societies can also be interpreted in terms of changes in the network formation parameters π and δ . Sociologists have documented the downfall of the great ideologies and the rise of secularization. Moreover, the revolutionary improvement of transport and communication infrastructure has reduced the salience of the location of consumers. Both phenomena have dimin-

ished the importance of non-productive individual characteristics (such as religion, ideology or location) for the formation of networks and have increased the potential to form networks that are more homophilous in talent a . In our model, this is translated as an increase in δ , implying in its turn a smaller perceived variation in productive talents. Our model (see again column (4) in Table 1) then predicts a decrease in the preferences for redistribution within the less meritocratic (more “Rawlsian”) societies. This is exactly what has been observed during recent decades within Western Europe.

4 Empirical illustration

We are unaware of any dataset that is sufficiently rich to implement our full model, i.e., that includes convincing empirical counterparts for our theoretical parameters (talent, cultural traits, perceived variances, etc.) and explicit information on the characteristics of individual networks. As a first illustration, we focus on the US and make use of the 1987 round of the General Social Survey (GSS), because it contains two topical modules which cover part of our data needs: the GSS topical module on “Sociopolitical Participation” and the 1987 International Social Survey Program (ISSP) module on “Social Inequality”.²⁷ The former module provides detailed data about group membership and social interactions. The latter does not only contain a broad variety of indicators of the support for redistribution, but also questions on the respondents’ beliefs about the relative importance of various determinants of income. The 1987 round of the GSS contains data for 1819 randomly selected respondents. Obviously, with cross-sectional data it is nearly impossible to identify any causal relationships. This empirical analysis is only an illustration and definitely not a “test” of the theory. A detailed description of all the variables used, including descriptive statistics, is provided in the Data Appendix (Tables 6, 7, 8, 9, 10, 11, 12, 13). In this section, we concentrate on the most interesting findings.

Definition of the variables We measure preferences for redistribution (τ) as the first principal component obtained from four variables, described in Tables 6 and 7. Factor analysis yields a unique factor *FactRedis*, for which the factor loadings and specific variances after a traditional varimax rotation are shown in Table 7. We take the factor scores for *FactRedis*, obtained through regression scoring, as our preferred measure of preferences for redistribution, as we believe that this is the best way to exploit the richness of the data and to filter out idiosyncratic noise.²⁸

Ideological parameters and perceptions of the relative importance of the various income determinants play a crucial role in our explanatory framework. The GSS 1987 contains many variables that are relevant in this context. The descriptions and the summary statistics of these beliefs and perceptions are displayed in Tables 8, 9 and 10. Again, we use factor analysis to structure this information. The variables

²⁷ The General Social Survey was set up by the National Opinion Research Center at the University of Chicago in 1972, and collected its 30th round in 2014. See: <http://www.gss.norc.org>.

²⁸ The previous literature has often made use of *redist1*, one of the four variables that make up our factor (see, e.g., Alesina and Giuliano 2011). The results with that variable are very similar to the ones obtained with *FactRedis*, and can be obtained from the authors on request.

belabil (the importance of natural ability for the explanation of income differences) and *polviews* (the respondent's self-rated position on the political spectrum, from 1 -extremely liberal- to 7 -extremely conservative) are kept out of this factor analysis, as their unique variance is too high (respectively more than 66 and 74 % of their variance). They can be interpreted as such in our theoretical framework. We interpret *polviews* as a cultural trait (related to γ). The importance of natural ability (*belabil*) can be seen as an approximation of the relative share of $Var(a)_i$ in the explanation of income differences. For the other 18 variables, we retain five factors with an eigenvalue greater than 1 on the basis of a principal-component factor analysis. The factor scores obtained by regression scoring are used in the further analysis. The factor loadings, again after varimax rotation, are depicted in Table 11. With due caution, we can link these variables also to our theoretical concepts. Respondents score high on *factorEff* if they consider ambition, education and hard work as important determinants of income: all these are obviously related to effort and, hence, to the deserved part of income variation. If one is willing to interpret as "luck" all income determinants that are neither effort nor ability, then one could venture to interpret the perceived importance of discrimination (*FactorDi*—high score if respondents believe strongly that race, religion, sex, region and political views matter) and of social capital by parentage (*FactorPa*—belief in the importance of coming from a wealthy family, having well educated parents and knowing the right people) as related to $Var(\varepsilon)_{(i)}$. The perception of incentive effects, both the particular ones in *FactorPIn* (effect of pay differences on particular effort decisions) and the general ones in *FactorGIn* (effect of pay differences on general prosperity) do not appear as such in our theoretical model, because we did not allow for inter-individual differences in beliefs about incentives. However, it seems important to control for them in our regressions.

Finally, we include a number of socioeconomic control variables. Detailed descriptions and summary statistics are provided in Tables 12 and 13.

Beliefs, ideology and preferences for redistribution Table 3 presents a set of regressions explaining preferences for redistribution. Tables 4 and 5 report the results of regressions of individual beliefs and perceptions on our extended set of control variables. For the overall interpretation of our results, these different tables have, of course, to be combined, but we focus first on the former.

The first column of Table 3 shows the result of the simplest regression possible, in which we introduce the most essential demographic and economic variables. In the second column, we add the respondents' beliefs and perceptions. In the third column, we add a number of interaction terms. In the fourth column, finally, we directly introduce some variables relating to the respondent's social network into the regression equation. We base our interpretation on the results in this last column.

The beliefs and perceptions add much to the explanatory power of the regression.²⁹ They all go in the expected direction. A higher believed role of effort (*FactorEff*) decreases the desired degree of redistribution. The factors related to luck (discrimination and parentage) increase the preferences for redistribution. Following our

²⁹ "Explanatory" is meant to refer to statistical features and does not imply causality. Indeed, one does not have to be particularly cynical to note that regressing "attitudes" on other "attitudes" is bound to lead to strong associations.

Table 3 Explaining preferences for redistribution

	FactRedis		FactRedis		FactRedis		FactRedis
rlincome	-0.00527*** (0.00134)		-0.00421*** (0.00136)		0.00641* (0.00368)		0.00273 (0.00381)
prospect	-0.170*** (0.0312)		-0.109*** (0.0334)		-0.113*** (0.0331)		-0.121*** (0.0345)
educ	-0.0136 (0.0105)		-0.0244** (0.0119)		0.0396 (0.0390)		0.0419 (0.0418)
age	0.00282 (0.00179)		0.00340* (0.00193)		0.00323* (0.00191)		0.00893** (0.00413)
female	0.0531 (0.0565)		0.114* (0.0596)		0.628*** (0.207)		0.678*** (0.219)
black	0.391*** (0.0674)		0.368*** (0.0731)		0.381*** (0.0725)		-0.0526 (0.206)
raceoth	0.289* (0.173)		0.108 (0.197)		0.0474 (0.196)		-0.584** (0.277)
FactorDi			0.0575* (0.0315)		0.0536* (0.0312)		0.0722** (0.0333)
FactorPa			0.0938*** (0.0308)		0.0821*** (0.0306)		0.0670** (0.0325)
FactorPin			0.122*** (0.0299)		0.119*** (0.0296)		0.124*** (0.0310)
FactorEff			-0.0800*** (0.0301)		-0.0811*** (0.0299)		-0.0803** (0.0313)
FactorGin			-0.155*** (0.0302)		-0.147*** (0.0300)		-0.155*** (0.0315)
belabil			0.0916** (0.0407)		0.495*** (0.188)		0.485*** (0.202)
polviews			-0.0984*** (0.0222)		-0.0129 (0.0352)		-0.0429 (0.0373)
incpovi					-0.00270*** (0.000870)		-0.00191** (0.000895)

Table 3 continued

	FactRedis	FactRedis	FactRedis	FactRedis
abil_fem				(0.0795)
abil_edu		-0.193**	(0.0747)	-0.217***
whi_age		-0.0226*	(0.0135)	-0.0217
occmob				-0.00963**
comsize				0.0877**
racehome				0.00312
granborn				0.00437
mobile16				0.0608***
attend				-0.0660*
_cons	0.517***	(0.197)	0.553**	0.000417
N	1150		934	-0.639
R ²	0.103		0.234	854
				0.249

Definition of variables in Data Appendix. Interaction effects are captured by *incpovi* (*rlincome*polviews*), *abil_fem* (*belabil*female*), *abil_edu* (*belabil*educ*) and *whi_age* (*age*(1-black-raceoth)*)
 Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 Explaining beliefs and perceptions (part 1)

Importance of:	FactorDi discrimination		FactorPa parentage		FactorEff effort	
rlincome	−0.00313**	(0.00143)	−0.00381***	(0.00145)	−0.000945	(0.00146)
prospect	−0.000490	(0.0348)	−0.0527	(0.0353)	0.224***	(0.0355)
educ	−0.00432	(0.0124)	0.0104	(0.0126)	0.0216*	(0.0126)
age	0.00248	(0.00421)	0.0132***	(0.00426)	−0.00361	(0.00430)
female	−0.0683	(0.0636)	−0.211***	(0.0643)	0.204***	(0.0648)
black	0.665***	(0.208)	−0.350*	(0.211)	−0.146	(0.212)
raceoth	0.350	(0.283)	−0.614**	(0.286)	−0.0688	(0.288)
whi_age	0.00893*	(0.00466)	−0.0178***	(0.00472)	0.000164	(0.00475)
occmobi	−0.00357	(0.0426)	0.0266	(0.0432)	0.0732*	(0.0435)
comsize	0.00214	(0.00251)	0.00461*	(0.00254)	0.00161	(0.00256)
racehome	−0.126*	(0.0701)	0.0526	(0.0710)	0.0747	(0.0715)
granborn	−0.0241	(0.0222)	0.0393*	(0.0224)	−0.0226	(0.0226)
mobile16	0.0648*	(0.0369)	0.0133	(0.0374)	−0.0132	(0.0376)
attend	0.0267**	(0.0129)	−0.0430***	(0.0131)	−0.0130	(0.0132)
_cons	−0.581**	(0.229)	0.387*	(0.231)	−0.803***	(0.233)
<i>N</i>	946		946		946	
<i>R</i> ²	0.076		0.090		0.066	

Definition of variables in Data Appendix

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

suggestion that *belabil* is positively correlated with $Var(a)_{(i)}$, its significantly positive effect suggests that respondents are *not* meritocratic and rather treat ability differences as resulting from the natural lottery (see Table 1). The positive effect of *FactorPIn* (the importance of particular incentives) may seem surprising at first, but this factor is heavily influenced by the perception that skills and education are important in explaining income differences and is therefore also related to *belabil*.

One of the innovations in our theoretical model is the scope for different ideas about the deservingness of talent (through the parameter ζ). We do not have a variable that measures this trait directly, but, rather than assuming that *belabil* has the same effect for everybody, we have tried to measure differences in opinions by introducing interaction effects with gender and education (*abil_fem* and *abil_edu*). Given the small number of observations, caution is needed when interpreting these results, but they are still suggestive and promising. Females are less inclined than males to increase the degree of redistribution if they believe that talent is more important for the explanation of income differences. Moreover, there is a significant interaction effect with education. As a matter of fact, *belabil* has a negative effect on redistributive preferences for highly educated females.³⁰ The direct effect of being female is significantly positive, but the interaction effect with *belabil* implies that the net effect becomes negative for women who believe that $Var(a)_{(i)}$ is large.

³⁰ As shown in Table 13, the range of the education variable is from 0 to 20.

Table 5 Explaining beliefs and perceptions (part 2)

	belabil importance of ability		polviews left-right position: γ	
rlincome	-0.00154	(0.00104)	-0.000647	(0.00187)
prospect	-0.00361	(0.0247)	0.0521	(0.0440)
educ	-0.0309***	(0.00868)	-0.0228	(0.0159)
age	0.00331	(0.00282)	0.00603	(0.00520)
female	-0.0413	(0.0453)	-0.136*	(0.0811)
black	0.180	(0.143)	-0.629**	(0.260)
raceoth	0.226	(0.190)	-0.152	(0.350)
whi_age	-0.000772	(0.00315)	-0.00504	(0.00577)
occmobi	0.0290	(0.0297)	-0.0718	(0.0533)
comsize	0.00339*	(0.00181)	-0.00477	(0.00327)
racehome	-0.0264	(0.0495)	-0.268***	(0.0888)
granborn	0.0287*	(0.0158)	-0.0828***	(0.0282)
mobile16	0.0226	(0.0261)	-0.0138	(0.0469)
attend	-0.00630	(0.00912)	0.0822***	(0.0164)
_cons	2.919***	(0.160)	4.282***	(0.287)
N	1124		1092	
R ²	0.061		0.079	

Definition of variables in Data Appendix

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The prospect of being better off in the future decreases *ceteris paribus* support for redistribution. A higher income³¹ and being more right wing (*polviews*) show a strong interaction effect. If *polviews* is understood as a proxy for γ , it is not so much the household income or the political orientation of the respondent that determine his support for redistribution, but the combination of both: the support for redistribution decreases with the household's income for the right wing respondents. Interaction terms are also crucial to interpret the effects of age and ethnicity. Indeed, the estimate of the interaction term between age and white (i.e., $1 - (\text{black} + \text{raceoth})$) suggests that the effect of age is entirely due to the non-white respondents. This may reflect to some extent the fact that the group of older non-white respondents in 1987, more than other groups, grew up with limited opportunities.

Respondents who have faced a greater intergenerational occupational mobility are more supportive towards redistribution. In line with earlier work on the persistence of preferences for redistribution among the offspring of recent migrants, we observe, on average, more support for redistribution if more of the respondent's grandparents were born outside the U.S. The other variables relating to social network structure play no statistically significant direct role.

³¹ As can be seen from Table 12, income is just household income measured in 1986 dollars. However, the combination of *rlincome* with *prospect* can arguably be interpreted as a proxy measure of permanent income, which may better fit the income concept in our theoretical model.

Beliefs and network formation The results in Table 3 confirm that beliefs and perceptions are important to explain inter-individual differences in redistributive preferences. It is therefore interesting to take the following step and to look for a possible explanation of differences in these beliefs. We therefore now consider Tables 4 and 5.

Richer respondents believe less in the role of discrimination and parentage, and respondents who believe to be better off in the future believe more in the importance of efforts and hard work to be successful in life. The first column of Table 4 suggests that black and older white respondents and frequent churchgoers believe more in the importance of discrimination on racial, regional and religious grounds. The perceived importance of parentage increases with age for non-white respondents, and is *ceteris paribus* lower for females, blacks and respondents from other race groups. Possibly, social networks were in 1987 on average more important for the sort of professions that white men were more often active in.

Respondents with higher education levels believe on average less in the importance of natural abilities, and more in the importance of effort and hard work. This can suggest that in their social reference groups, natural ability needs to be developed into productivity by means of study and years of training. Respondents with more grandparents born outside the U.S. believe more in the importance of natural ability. This can be understood along the lines of our theoretical model. If a social reference group is composed more in terms of a particular ethnic origin, one expects to see more variation in terms of ability.

The most popular explanation of such socioeconomic differences in preferences is in terms of underlying ideological traits. Our model suggests that informational aspects should not be neglected. Different beliefs will induce differences in redistributive preferences, even when individuals have the same underlying cultural traits. Surely, ethnicity has an important effect on network formation. If black citizens perceive in their social neighbourhood that luck is more important in the explanation of income differences and that effort is not rewarded, they will be more in favour of redistribution than white citizens who believe that effort is the dominant factor in explaining income differences.

The available data offer only poor proxies for the variables in our model of network formation in Sect. 3. To thoroughly test our theory, direct measurement of the essential variables (as in Cruces et al. 2013) is necessary.

5 Conclusion

We propose a theoretical model of redistributive preferences that is able to integrate many findings from the empirical literature. We follow Alesina and Angeletos (2005) in assuming that income differences due to luck are considered illegitimate and those due to effort legitimate, but we introduce the possibility that income differences caused by ability are seen as unjust. Individuals are characterized by two stable cultural traits: the relative weight given to self-interest versus justice arguments in their utility function and the degree of acceptance of income differences due to ability. Their desired degree of redistribution will then depend on the importance of luck, effort and ability for the explanation of income differences. We assume that individuals are not perfectly informed about the relative importance of luck and ability in the process of income

creation and that they derive information from what they observe within their reference groups. We obtain additional insights from a simple model of homophilous reference group formation on the basis of ability indicators.

Modelling the interplay between self-interest, stable cultural traits and (imperfect) information acquisition seems a promising approach to get a better insight into inter-individual differences in redistributive preferences. Yet it is clear that our model is only a very first step in that direction. The most obvious shortcoming is on the empirical side. To really test our model, a specific survey must be set up to collect direct measures of the relevant theoretical concepts. Such a survey should make a clear distinction between values (e.g., how far should redistribution go? should ability be rewarded?) and perceptions (e.g., how large is inequality nowadays? how important is relative ability as an explanation of income differences?). Moreover, the most important lacuna in the available surveys are questions about the channels through which respondents obtain information about the process of income creation, including of course their reference group.³²

From a theoretical perspective, extensions and refinements are possible in at least three directions. First, redistributive preferences have implications for instruments other than the marginal tax rate τ in a linear income tax scheme. In fact, as soon as one distinguishes different individuals on the basis of personal characteristics related to effort, talent and need, redistributive instruments such as tagging, social insurance, the provision of public goods and the public provision of private goods such as education and health care, immediately become relevant. Second, the description of individual preferences could be refined to go beyond the responsibility-sensitive egalitarian approach that has been modelled in this paper. Libertarian and utilitarian perspectives may not be very popular amongst the population, but they have dominated the academic literature until now. Third, and most importantly, our model of information acquisition and learning should be refined. It would be useful to model explicitly a process of Bayesian updating of a priori information (e.g., obtained from one's parents or "imported" from a home country) on the basis of the actual observations in the reference group. This would also make it possible to relate our approach to the alternative model that has been introduced by [Piketty \(1995\)](#), in which individuals learn about the relative importance of effort from their dynastic income mobility experiences. Our simple model of network formation could be expanded. Last but not least, individuals do not only acquire information through their social neighborhood, but they use also other informational sources (e.g., mass media), and it is an open question how they combine the pieces of information obtained from these different sources.

One can wonder about the relevance of empirical approaches such as the one in this paper for the normative analysis of equality of opportunity (as proposed by [Roemer 1998](#)). Surely, the empirical results (even with our very limited data) confirm that the general setting of that approach (with its distinction between effort and circum-

³² Note that these data requirements w.r.t. the reference groups go well beyond the data used in the previous section. The 1987 round of the GSS contains detailed information about different memberships of organisations (sports clubs, science clubs...), but this does not allow for a characterization of the sample of society that individuals meet in such an organization. Even if individuals from all parts of society are members of sports clubs, this does not mean that they meet each other in these clubs, because the individual sports clubs can be very homogenous in terms of their members' socio-economic and other characteristics.

stances) is close to the way most people think about redistribution. Yet, the move from the theoretical welfare economic framework to real-world policy analysis requires the use of empirical information on the importance of the different characteristics for the explanation of income differences. We have suggested that people may have a wrong perception of these empirical magnitudes, and that these perceptions may be influenced by the structure of social networks in society. Introducing (mis)perception and reference groups in the analysis leads to a better understanding of real-world phenomena, that otherwise would simply be ascribed to ideological differences. (Mis)perceptions may have a crucial influence on the political feasibility of income redistribution and, more generally, on the acceptance of the policy prescriptions than can be derived within an equality of opportunity-framework. If we want to avoid confusion in the political debate on the values underlying income redistribution, we first have to agree about the facts.

Appendix

Data appendix: description of the variables

See Tables 6, 7, 8, 9, 10, 11, 12 and 13.

Table 6 Description of redistribution variables

redist1	“Some people think that the government in Washington ought to reduce the income differences between the rich and the poor, perhaps by raising the taxes of wealthy families or by giving income assistance to the poor. Others think that the government should not concern itself with reducing this income difference between the rich and the poor” (0–6 scale)
redist2	“It is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes”, with responses ranging from 0 (disagree strongly) to 4 (agree strongly)
redist3	“Do you think that people with high incomes should pay a larger share of their income in taxes than those with low incomes, the same share, or a smaller share...”, with responses ranging from 0 (much lower share) to 4 (much higher share)
redist4	“Differences in income in America are too large” (ranging from 0 (disagree strongly) to 4 (agree strongly))

Factredis Factor score, summarizing the answers on the four previous variables (see Table 7)

We renormalized all variables such that a higher value stands for a more positive attitude towards redistribution

Table 7 Dependent variables and factor loadings

Summary statistics							Redistribution factor: FactRedis	
Variable	Mean	SD	p50	Min	Max	N	Rotated factor loading	Uniqueness
redist1	3.4	2	3	0	6	1786	0.7417	0.4498
redist2	1.9	1.2	2	0	4	1484	0.8010	0.3584
txshrri	2.9	0.8	3	0	4	1454	0.5572	0.6895
incdiff	2.5	1	3	0	4	1490	0.7411	0.4507

Table 8 Description of variables: beliefs about determinants of success in life

Opening statement:	“To begin, we have some questions about opportunities for getting ahead... Please show for each of these how important you think it is for getting ahead in life...” (The variables were redefined such that responses range from 0 (not important at all) to 4 (essential))
belabil	Natural ability?
belambit	Ambition?
belcnnct	Knowing the right people?
beledu	Having a good education yourself?
beledupa	Having well educated parents?
belpolcn	Having political connections?
belpolvi	A person’s political beliefs?
belrace	A person’s race?
belregio	A person’s region?
belrelig	A person’s religion?
belsex	Being born a man or a woman?
belwealf	Coming from a wealthy family?
belwork	Hard work?
Factor Di	Factor score “Discrimination”, mainly determined by belpolcn, belrace, belrelig, belregio, belsex, belpolvi (see Table 11)
FactorPa	Factor score “Parentage”, mainly determined by belwealf, beledupa, beledu, belcnnct, belpolcn (see Table 11)
FactorEff	Factor score “Effort”, mainly determined by beledu, belambit, belwork (see Table 11)

Table 9 Description of variables: perceptions of incentives

incbuspr	“Allowing business to make good profits is the best way to improve everyone’s standard of living”. Responses from 0 (strongly disagree) to 4 (strongly agree)
incedu	“No one would study for years to become a lawyer or doctor unless they expected to earn a lot more than ordinary workers”. Responses from 0 (strongly disagree) to 4 (strongly agree)
incmoti	“Some people earn a lot of money while others do not earn very much at all. In order to get people to work hard, do you think large differences in pay are...” with responses ranging from 0 (definitely not necessary) to 3 (absolutely necessary)
incprosp	“Large differences in income are necessary for America’s prosperity”. Responses from 0 (strongly disagree) to 4 (strongly agree)
incresp	“People would not want to take extra responsibility at work unless they were paid extra for it”. Responses from 0 (strongly disagree) to 4 (strongly agree)
incskil	“Workers would not bother to get skills and qualifications unless they were paid extra for having them”. Responses from 0 (strongly disagree) to 4 (strongly agree)
FactorPin	Factor score “effect of pay differences on particular effort decisions”, mainly determined by incresp, incskil, incedu (see Table 11)
FactorGIn	Factor score “effect of pay differences on general prosperity”, mainly determined by incmoti, incprosp and incbuspr (see Table 11)

Table 10 Summary statistics of perceptions and beliefs

Variable	Mean	SD	p50	Min	Max	N
belwealf	1.6	1.1	2	0	4	1514
beledupa	2.2	0.95	2	0	4	1533
beledu	3.2	0.72	3	0	4	1542
belambit	3.3	0.7	3	0	4	1530
belabil	2.7	0.76	3	0	4	1529
belwork	3.2	0.69	3	0	4	1547
belcnct	2.4	0.86	2	0	4	1539
belpolcn	1.6	1	2	0	4	1485
belrace	1.4	1.1	1	0	4	1498
belrelig	1.2	1.2	1	0	4	1508
belregio	.98	0.99	1	0	4	1510
belsex	1.3	1.1	1	0	4	1494
belpolvi	1.2	1	1	0	4	1486
incmoti	1.9	0.81	2	0	3	1459
incresp	2.7	1	3	0	4	1519
incskil	2.4	1.1	3	0	4	1506
incedu	2.8	1.1	3	0	4	1519
incprosp	2	1	2	0	4	1458
incbuspr	2.3	1.1	2	0	4	1477

Table 11 Beliefs: rotated factor loadings and uniqueness

Variable	FactorDi (discrimination)	FactorPa (parentage)	FactorPIn (particular incentives)	FactorEff (effort)	FactorGIn (general incentives)	Uniqueness
belwealf	0.2054	0.7249	0.0176	−0.0940	−0.0039	0.4232
beledupa	0.0307	0.7228	0.0383	0.1074	0.0980	0.4541
beledu	−0.0839	0.4067	0.0094	0.6008	−0.0656	0.4623
belambit	−0.0541	0.0596	−0.0206	0.7409	0.0092	0.4441
belwork	0.0314	−0.1552	0.1144	0.7703	0.0561	0.3653
belcnnct	0.2973	0.6371	0.1219	0.0588	0.0264	0.4867
belpolcn	0.4326	0.5884	0.0849	−0.0386	0.0413	0.4563
belrace	0.6554	0.2736	0.0760	−0.0603	−0.0932	0.4775
belrelig	0.7554	−0.0173	0.0185	−0.0113	0.0849	0.4214
belregio	0.7684	0.1064	0.1028	0.0046	0.0423	0.3859
belsex	0.6513	0.2118	0.0022	−0.0340	0.0297	0.5289
belpolvi	0.7357	0.1827	0.0125	−0.0120	0.1188	0.4109
incmoti	0.1312	0.0869	0.1959	0.1026	0.4984	0.6780
incresp	0.0517	0.0567	0.8001	0.0801	0.0849	0.3403
incskil	0.0466	0.0042	0.8031	0.0191	0.0578	0.3491
incedu	0.0553	0.1205	0.6502	−0.0130	0.1602	0.5339
incprosp	0.0784	0.0386	0.1773	−0.0100	0.7814	0.3502
incbuspr	0.0216	0.0196	0.0119	0.0180	0.7523	0.4327

See Tables 8, 9 and 10 for the definition of the variables and the descriptive statistics. In bold: factor loadings > 0.30

Table 12 Description of socioeconomic variables

age	Respondent's age
attend	Church attendance, answers to the question "How often do you attend religious services?", ranging from 0 (never) to 7 (every week)
black	Dummy variable = 1 if respondent is black
comsize	Size of the respondent's commune or city, expressed in 100,000's of inhabitants
educ	Years of education, derived from answers to the question "What is the highest grade in elementary school or high school that you finished and got credit for?"
female	Dummy variable = 1 if respondent is female
granborn	Number of the respondent's grandparents born outside the US
mobile16	Respondent's geographical mobility compared to where (s)he lived at the age of 16. Answers ranging from 1 (same city) to 3 (different state)
occmob	Differences in professional status from father, derived from answer to the question "Please think of your present job (or your last one if you don't have one now). If you compare this job with the job your father had when you were 16, would you say that the level or status of your job is (or was)..." with responses either 0 (about equal), 1 (higher or lower) or 2 (much higher and much lower)
polviews	Self-rated position on a political spectrum, from 1 (extremely liberal) to 7 (extremely conservative)
prospect	Expectations for the future standard of living, responses to the statement "The way things are in America, people like me and my family have a good chance of improving our standard of living", with responses ranging from 0 (strongly disagree) to 4 (strongly agree)
racehome	Dummy variable = 1 if respondents answered "yes" to the question "During the last few years, has anyone in your family brought a friend who was a (negro/black/African-American) home for dinner?"
raceoth	Dummy variable = 1 if respondent is non-white and non-black
rlincome	Household income in 1986 dollars

Table 13 Descriptive statistics independent variables

Variable	Mean	SD	p50	Min	Max	>N
rlincome	28	23	21	.5	90	1665
prospect	2.8	.92	3	0	4	1509
educ	12	3.3	12	0	20	1809
age	45	18	41	18	89	1807
female	.57	.49	1	0	1	1819
black	.3	.46	0	0	1	1819
raceoth	.029	.17	0	0	1	1819
occmob	1.1	.74	1	0	2	1367
comsize	4.7	14	.23	0	71	1819
racehome	.34	.47	0	0	1	1819
granborn	.92	1.5	0	0	4	1693
mobile16	1.9	.88	2	1	3	1795
attend	4.1	2.5	4	0	8	1806

Mathematical appendix: proofs

A. Derivation of equation (10)

Implementing Eq. (5) for the naive idealist gives

$$\Omega_{(i)}^{\xi 0} = \frac{1}{|\mu(i)|} \int_{j \in \mu(i)} \left\{ (1 - \tau)(1 - \tau^a)(\beta a_j + \varepsilon_j) + \tau(1 - \tau^a)\beta \bar{a}_{(i)} - \zeta(1 - \tau^a)\beta a_j - (1 - \zeta)(1 - \tau^a)\beta \bar{a}_{(i)} \right\}^2 dj$$

or

$$\Omega_{(i)}^{\xi 0} = \frac{1}{|\mu(i)|} \int_{j \in \mu(i)} \left\{ (1 - \tau)\varepsilon_j + \beta(1 - \tau^a)(1 - \tau - \zeta)(a_j - \bar{a}_{(i)}) \right\}^2 dj$$

Using condition 1, this immediately yields Eq. (10).

B. Comparative statics for sophisticated consumers

Because $\text{sgn}\left[\frac{\partial \tau_i^*}{\partial \zeta}\right] = \text{sgn}\left[\frac{\partial (\Upsilon_i = 0)}{\partial \zeta}\right]$, and

$$\Upsilon_i \equiv (1 - \gamma)\beta \left[(1 - 2\tau)\bar{a}_{(i)} - (1 - \tau)a_i \right] - \gamma \frac{\partial \Omega_{(i)}^{\xi}}{\partial \tau} = 0$$

with

$$\frac{\partial \Omega_{(i)}^{\xi}}{\partial \tau} = -2(1 - \tau) \text{Var}(\varepsilon)_{(i)} - 2(1 - \zeta - \tau)(2 - \zeta - 2\tau)(1 - \tau)\beta^2 \text{Var}(a)_{(i)},$$

we have for self interest

$$\frac{\partial (\Upsilon_i = 0)}{\partial a_i} = -(1 - \gamma)(1 - \tau_i^*)\beta \leq 0$$

For the cultural traits

$$\frac{\partial (\Upsilon_i = 0)}{\partial \zeta} = (2\gamma(1 - \tau_i^*)\beta^2 \text{Var}(a)_{(i)} [2\zeta - 3(1 - \tau_i^*)]) > 0 \Leftrightarrow \frac{2}{3}\zeta > (1 - \tau_i^*)$$

$$\begin{aligned} \frac{\partial (\Upsilon_i = 0)}{\partial \gamma} &= -\beta \left[(1 - 2\tau)\bar{a}_{(i)} - (1 - \tau)a_i \right] - \frac{\partial \Omega_{(i)}^{\xi}}{\partial \tau} \\ &= \frac{\Upsilon_i - \beta \left[(1 - 2\tau)\bar{a}_{(i)} - (1 - \tau)a_i \right]}{\gamma} \\ &= \frac{\beta[(1 - \tau_i^*)a_i - (1 - 2\tau_i^*)\bar{a}_{(i)}]}{\gamma}. \end{aligned}$$

For the perceptions and beliefs

$$\begin{aligned}\frac{\partial (\Upsilon_i = 0)}{\partial \text{Var}(\varepsilon)_{(i)}} &= (2\gamma (1 - \tau_i^*)) \geq 0 \\ \frac{\partial (\Upsilon_i = 0)}{\partial \bar{a}_{(i)}} &= (1 - \gamma) (1 - 2\tau_i^*) \beta. \\ \frac{\partial (\Upsilon_i = 0)}{\partial \text{Var}(a)_{(i)}} &= 2\gamma\beta^2 (1 - \tau_i^*) (1 - \zeta - \tau_i^*) (2 - 2\tau_i^* - \zeta).\end{aligned}$$

C. Unidimensional reference group formation based on talent

Let the joint and marginal density functions of $\Phi(a, q)$ be denoted respectively $\phi(a, q)$, $\phi^a(a)$ and $\phi^q(q)$. If $\delta = 1$, individual i only takes into account professional talent in the formation of his reference group, so that Eq. (15) reduces to $\mu(i) = \{j \mid |a_i - a_j| \leq \pi\}$. We derive for the perceived mean and variance of a :

$$\begin{aligned}\bar{a}_{(i)} &= \frac{\int_{a_i - \pi}^{a_i + \pi} s \phi^a(s) ds}{\Phi^a(a_i + \pi) - \Phi^a(a_i - \pi)} \\ \text{Var}(a)_{(i)} &= \frac{\int_{a_i - \pi}^{a_i + \pi} (z - \bar{a}_{(i)})^2 \phi^a(z) dz}{\Phi^a(a_i + \pi) - \Phi^a(a_i - \pi)}.\end{aligned}$$

These expressions immediately show that the beliefs of individual i will be influenced by his position in the distribution of talents. It is obvious that $\partial \bar{a}_{(i)} / \partial a_i > 0$. The sign of $\partial \text{Var}(a)_{(i)} / \partial a_i$ is less straightforward, as it depends on the shape of $\phi^a(a)$. If $\phi^a(a)$ is the uniform density, natural talent a_i has no effect on the perceived variance.

An increase in π (i.e., an increase in the marginal utility of social relations ξ or a decrease in the cost c) will lead to an extension of the reference group of the individual. This results in

$$\begin{aligned}\frac{\partial \bar{a}_{(i)}}{\partial \pi} &= \frac{((a_i + \pi) \phi^a(a_i + \pi) + (a_i - \pi) \phi^a(a_i - \pi))}{\Phi^a(a_i + \pi) - \Phi^a(a_i - \pi)} \\ &\quad - \frac{(\phi^a(a_i + \pi) + \phi^a(a_i - \pi)) \bar{a}_{(i)}}{\Phi^a(a_i + \pi) - \Phi^a(a_i - \pi)},\end{aligned}$$

which is positive iff

$$\frac{\bar{a}_{(i)} - (a_i - \pi)}{(a_i + \pi) - \bar{a}_{(i)}} < \frac{\phi^a(a_i + \pi)}{\phi^a(a_i - \pi)}.$$

Again, the effect of changes in π will depend on the shape of $\phi^a(a)$. If $\phi^a(a)$ is uniform and if $\mu(i)$ is strictly within the support of $\phi^a(a)$, the perceived mean $\bar{a}_{(i)}$ obviously does not change with changes in π .

The effect on the perceived variance is

$$\begin{aligned} \frac{\partial \text{Var}(a)_{(i)}}{\partial \pi} &= \frac{\left(-2 \int_{a_i - \pi}^{a_i + \pi} (z - \bar{a}_{(i)}) \frac{\partial \bar{a}_{(i)}}{\partial \pi} \phi^a(z) dz \right. \\ &\quad \left. + \left((a_i + \pi) - \bar{a}_{(i)} \right)^2 \phi^a(a_i + \pi) \right. \\ &\quad \left. + \left((a_i - \pi) - \bar{a}_{(i)} \right)^2 \phi^a(a_i - \pi) \right) \\ &\quad - (\phi^a(a_i + \pi) + \phi^a(a_i - \pi)) \text{Var}(a)_{(i)}}{\Phi^a(a_i + \pi) - \Phi^a(a_i - \pi)} \\ &= \frac{\left((a_i + \pi - \bar{a}_{(i)})^2 - \text{Var}(a)_{(i)} \right) \phi^a(a_i + \pi) \\ &\quad + \left((a_i - \pi - \bar{a}_{(i)})^2 - \text{Var}(a)_{(i)} \right) \phi^a(a_i - \pi)}{\Phi^a(a_i + \pi) - \Phi^a(a_i - \pi)}. \end{aligned}$$

This expression is positive iff

$$\begin{aligned} &((a_i + \pi - \bar{a}_{(i)})^2 - \text{Var}(a)_{(i)}) \phi^a(a_i + \pi) \\ &+ ((a_i - \pi - \bar{a}_{(i)})^2 - \text{Var}(a)_{(i)}) \phi^a(a_i - \pi) > 0 \end{aligned}$$

A sufficient condition for this is that Φ^a is not too skewed around a_i , so that both

$$\text{Var}(a)_{(i)} - ((a_i + \pi) - \bar{a}_{(i)})^2 < 0$$

and

$$\text{Var}(a)_{(i)} - ((a_i - \pi) - \bar{a}_{(i)})^2 < 0.$$

This condition is definitely satisfied if Φ^a is uniform.

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