Voting for redistribution under responsibility-sensitive altruism*

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Abstract

We endow individuals that differ in skill levels and tastes for working with altruistic preferences for redistribution in a voting model where a unidimensional redistributive parameter is chosen by majority voting in a direct democracy. When altruistic preferences are responsibility-sensitive, i.e. when there is a reluctance to redistribute from the hard-working to the lazy, we show that lower levels of redistribution emerge in political equilibrium. We provide empirical evidence that preferences for redistribution are not purely selfish and that responsibility-sensitive motivations play a significant role. We estimate that preferences for redistribution are significantly more responsibility-sensitive in the US than in Europe. We believe that differences in responsibility-sensitive preferences for redistribution help explain the different social contracts that prevail between both continents.

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1 Introduction

The United States and continental Western Europe ('Europe' henceforth) show considerable differences in their social contracts despite similar economic and political fundamentals. Government expenditures on subsidies and transfers as a percentage of GDP have been consistently lower in the US between 1970 and

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1998 and the discrepancy between both continents has ever been increasing. At the same time, the US has a significantly higher pre-tax income inequality; see Alesina et al. (2001) for an extensive discussion. The coexistence of high (resp. low) pre-tax income inequality and low (resp. high) levels of redistribution constitutes an interesting puzzle for economists. It invalidates the theoretical predictions of Meltzer and Richard's seminal paper (1981) according to which —under realistic assumptions about the distribution of pre-tax income— higher income inequality makes the median voter benefit more from redistribution, leading to higher levels of redistribution in political equilibrium. Ever since, an increasing research has been devoted to identifying under which conditions politico-economic equilibria emerge where a low level of redistribution is chosen by rational agents in economies showing a high level of pre-tax income inequality; we refer to Cervelatti et al. (2006) for an overview. Following Piketty (1995), many contributions incorporate the effect of individuals' beliefs on income mobility. Rational agents can learn the relative importance of effort and luck in generating income inequalities through their own dynastic income mobility experience. 'Left-wing dynasties', who believe in the strong impact of luck in the income generating process and vote for high levels of redistribution, coexist in the long run with 'right-wing dynasties', who believe in the strong impact of individual effort in the income generating process and vote for low levels of redistribution. Benabou and Ok (2001) demonstrate how the 'prospect of upward mobility', i.e. the fact that effort is expected to be fairly rewarded in the long run, induces poor people to renounce of supporting high levels of redistribution as they hope that they or their offspring will make it up the income ladder. Hence, redistribution is expected to be low in a highly unequal but highly mobile society. Although empirical research does not provide strong evidence of higher income mobility in the US than in Europe —see Fields and Ok (1999) for an overview— it is observed that Americans much more believe that effort is rewarding than Europeans do. Alesina and Angeletos (2005) recall that, according to the World Value Survey, 71% of Americans versus 40% of Europeans believe that the poor could become rich if they just tried hard enough. Alesina et al. (2001) point out that social spendings are increasing (resp. decreasing) with the percentage of people believing that luck (resp. effort) determines income. The persistence of such beliefs —even when they are dissonant with empirical evidence— led to the emergence of a group of papers that focus on the role of psychological and ethical motivations in triggering off multiple politico-economic equilibria. Benabou and Tirole (2006) start from an evidence widely acknowledged by psychologists that people need to believe in a just world —where hard work pays back and everyone receives their just deserts in the long run— so as to motivate themselves and their children towards exerting effort. Two politico-economic equilibria emerge. A high prevalence of just-world beliefs is consistent with low redistribution which increases the cost of low effort and therefore reinforces the need for just-world beliefs (this stands for the American equilibrium). Reversely, a low prevalence of just-world beliefs is consistent with high redistribution levels that reduce the cost of low effort and therefore makes the need for just beliefs less essential (this stands for

the European equilibrium). Alesina and Angeletos (2005) concentrate on ethical motivations where voters' preferences are driven both by self-interest and a concern for fairness. They define this concern for fairness as 'a social preference for reducing the degree of inequality induced by luck and unworthy activities, while rewarding individual talent and effort'. Again, two politico-economic equilibria emerge. In a first (resp. second) equilibrium, redistribution is high (resp. low), which leads to a low (resp. high) labor supply. This in turn induces that a large component of income is due to luck (resp. effort), which ultimately makes high (resp. low) redistribution desirable for people concerned by fairness motivations.

The inclusion of fairness concerns in voters' preferences of Alesina and Angeletos (2005) is a promising track for future research that is backed by strong theoretical and empirical arguments. The concept of 'ethical voting' dates back to the seminal work of Goodin and Roberts (1975) who describe the 'ethical voter' as a rational agent who, contrary to Downs' *homo politicus* (1957), is not only motivated by self-interest but also by ethical concerns (what he considers as fair for the society as a whole) in his political choice. On the theoretical side, three main arguments can be distinguished. The standard argument states that, if civic duty plays the major role in citizens' decision to go to the poll —see Blais (2000) for strong empirical evidence— then why should people not vote in an ethical way once in the booth. Second, Goodin and Roberts (1975) stress that, since the probability of being pivotal is close to zero, voters may be indifferent between giving in to their self-interest or abiding their ethical concerns. In both cases, their expected benefit converges to zero. In other words, voters become comparable to Smith's *impartial spectator* (1790), who, following Hume (1739), is capable of showing benevolence towards his fellow citizens precisely because his own interests are not directly at stake. A third argument, proposed by Edlin et al. (2006), demonstrates that ethical voting enables to rationally explain why people massively go to the poll (without relying on the standard civic duty argument) since the expected benefit of voting may no longer converge to zero anymore when citizens vote ethically and therefore the social benefit at stake is large. On the empirical side, much evidence of ethical concerns has been given, irrespective of whether one considers Kramer's retrospective (1971) or Downs' prospective (1957) theory of voting. Concerning retrospective voting, Fiorina (1978) points out that citizens' decision to vote for the incumbent depends less on the evolution of their personal economic situation during the incumbent's political mandate than on the economic evolution of the country as a whole. Kinder and Kiewet (1986) and Lewis-Beck (1986) show that this assertion holds even when the country's economic evolution and the individual's economic evolution are not correlated, which betrays that ethical concerns are not a way to rationalize self-interest in an ethical manner. We refer to Lewin (1991) for a survey on ethical retrospective voting. Concerning prospective voting, Sears et al. (1980) show that the influence of ideology on citizens' votes is stronger than the impact of their short-term material self-interest. Here again, Hudson and Jones (1994, 2002) confirm that this assertion holds even when 'what is best for the society as a whole' (which drives ideology) and 'what is best for me' (which

drives selfishness) are very different.

However, Alesina and Angeletos (2005) model individuals' ethical preferences for redistribution in a rather ad hoc way. We believe that the literature on opinions about distributive justice should be taken into account when modelling altruistic preferences for redistribution. So far, mainly utilitarian and Rawlsian motives have been incorporated, mostly to explain ethical behavior in experimental allocation problems. 'Social welfare' models assume that people like to increase the social surplus (utilitarian motive), caring especially about individuals with low payoffs (Rawlsian motive). We refer to Charness and Rabin (2002) for a strong experimental justification of social welfare models over for example 'difference aversion' models where individuals are motivated to reduce differences between theirs and others' payoffs. Recently, economists and philosophers have proposed to incorporate notions of responsibility in the formulation of distributive justice; we refer to Fleurbaey (1998) for a survey. In experiments where respondents take the role of an objective social planner, Yaari and Hillel (1984), Schokkaert and Overlaet (1989) and Schokkaert (1999) provide evidence that individuals do not only use utility information in the evaluation of different social states but also care about the underlying sources that cause utility differences. Individuals tend to make a clear distinction between utility differences that are due to differences in characteristics within the responsibility of the individual (e.g. effort, preferences, tastes) and utility differences that are due to differences in characteristics beyond the responsibility of the individual (e.g. innate skills, talents, parental background). Individuals dislike these latter differences in general, whereas they are neutral towards the former differences. The consequence for social welfare models is that individuals no longer simply include all individuals (utilitarian motive) or the worst-off individual only (Rawlsian motive) in their altruistic concerns. Individuals now can exclude others from their altruistic concerns when they feel that these others have performed poorly compared to themselves in terms of responsibility characteristics. Following Schokkaert and Devooght (2003), we denote such altruistic preferences 'responsibility-sensitive' altruistic preferences. Support for responsibility-sensitive altruistic preferences is provided by Konow (2000) in experiments where participants' own interests are also at stake. In the context of modelling altruistic preferences for redistribution, responsibility-sensitivity implies that individuals support redistribution as long as those who gain from redistribution have at least the same entitlement to income generated by factors that lie within the personal responsibility. Broadly speaking, under responsibility-sensitive preferences for redistribution, hard-working individuals oppose redistribution from the hard-working to the lazy.

The main contribution of this paper is twofold. On a theoretical level, we study a simple voting model where a unidimensional redistributive parameter is chosen by majority voting in a direct democracy. We allow for heterogeneities in productivities and preferences for consumption and leisure and incorporate the incentive effects of taxation. We model individuals' altruistic preferences for redistribution as described by social welfare models; for an alternative approach,

we refer to Tyran and Sausgruber (2006) who study voting for redistribution in a model where altruistic preferences are based on difference aversion models. We basically study four different scenarios of altruistic preferences for redistribution and we thereby focus on extremes: we endow individuals with altruistic preferences that are either driven by a utilitarian motivation or by a Rawlsian motivation and altruistic preferences can be either responsibility-sensitive or not. We compare the different equilibrium levels of redistribution that emerge when individuals are endowed with these different altruistic preferences for redistribution. We show that in a society where altruistic preferences are responsibility-sensitive, lower levels of redistribution emerge in political equilibrium compared to a society where altruistic preferences are not responsibility-sensitive. On an empirical level, we first provide evidence that preferences for redistribution are not purely egoistic. Second, we find that responsibility-sensitive motivations play a significant role in individuals' preferences for redistribution. Third, we estimate that preferences for redistribution are significantly more responsibility-sensitive among individuals in the US than among individuals in Europe. We therefore believe that differences in responsibility-sensitivity help explain the different social contracts that prevail between both continents.

The paper is organized as follows. Section 2 presents the model and introduces the different scenarios of altruistic preferences for redistribution. Section 3 compares the different equilibrium levels of redistribution that emerge under these different scenarios. Section 4 deals with responsibility-sensitivity in practice and justifies responsibility-sensitive altruistic preferences for redistribution empirically. Section 5 summarizes our major conclusions and highlights different avenues for future research. In Appendix A, we return to the theoretical analysis of Section 3 and study the impact of incomplete information on the equilibrium levels of redistribution when altruistic preferences for redistribution are utilitarian and responsibility-sensitive. Appendix B provides a detailed descriptive summary of the data used in Section 4.

2 The model

2.1 Individual characteristics

To keep our analysis simple, all individuals in $N = \{1, \ldots, n\}$ can only differ in two dimensions. The first dimension is their productive skill level w: individuals are either '*low-skilled*' or '*high-skilled*', i.e. $w \in W = \{\underline{w}, \overline{w}\}$, with $0 < \underline{w} < \overline{w} \leq 1$. The second dimension is their taste for working e: individuals are either '*lazy*' or '*hard-working*', i.e. $e \in E = \{\underline{e}, \overline{e}\}$, with $0 < \underline{e} < \overline{e} \leq 1$. Hence, every individual belongs to one of four types $(w, e) \in W \times E$. We denote the set of individuals having type (w, e) as S_{we}. Crucial for the analysis is our assumption that the view of society is such that people believe that differences in w are linked to a genetic endowment and hence fall beyond the responsibility of the individual. On the other hand, people (may) hold individuals responsible for differences in the preference parameter e (cfr. infra). Because the interpretation

of responsibility for e becomes dubious when correlated with w, we assume that w and e are independently distributed. Denote $p_{we} = \frac{\#S_{we}}{n}$ the proportion of individuals of type (w, e); $\sum_{(w,e)\in W\times E} p_{we} = 1$. Table 1 summarizes:

p_{we}	$\underline{e}$	$\overline{e}$	
$\underline{w}$	$\alpha\beta$	$(1-\alpha)\beta$	β
$\overline{w}$	$(1-\beta)\alpha$	$(1-\alpha)(1-\beta)$	$1-\beta$
	α	$1-\alpha$	1

Table 1: proportions of types.

where α and β belong to the open interval between 0 and 1 and denote the proportion of lazy individuals and the proportion of low-skilled individuals respectively. A generic economy is described by $\varepsilon = (\alpha, \beta)$. Denote $\mathcal{E}$ the set of all economies. Throughout the paper we assume that neither type $(\underline{w}, \underline{e})$, nor type $(\bar{w}, \bar{e})$ comprises more than one half of the total population. Hence, our analysis focuses primarily on the following subsets of economies:

$\mathcal{E}' = \{\varepsilon \in \mathcal{E} : \alpha > 1/2 \text{ and } \alpha\beta < 1/2\}$ and
$\mathcal{E}'' = \{\varepsilon \in \mathcal{E} : \alpha < 1/2 \text{ and } (1-\alpha)(1-\beta) < 1/2\}$.

2.2 Private preferences for consumption and leisure

The productive skill level defines gross income in the usual multiplicative way: for any type (w, e), given an amount of labor $\ell_{we} \in [0, 1]$, gross income y_{we} equals $w\ell_{we}$. The government redistributes income through a basic income - flat tax schedule. Denote the constant marginal tax rate τ and the corresponding basic income $B(\tau) = \tau y_a$, where $y_a = \sum_{(w,e)\in W\times E} p_{we} y_{we}$ denotes average gross income. Denote median income by y_{med}.[1] Consumption c_{we} equals $B(\tau) + (1-\tau)\, w\ell_{we}$. Taking the redistributive policy of the government (i.e. τ and $B(\tau)$) as given, labor supply is determined on the basis of private preferences. For concreteness, for any type (w, e), we assume quasi-linear preferences to take the form:

$$u_e : \mathbb{R}_+ \times [0, 1] \to \mathbb{R}_+ : (c_{we}, \ell_{we}) \to c_{we} - \frac{1}{2}\frac{1}{e}\ell_{we}^2. \tag{1}$$

Hence, taste for working defines the marginal rate of substitution between consumption and supplied labor.[2]

[1] It is a stylized fact of real-life income distributions that $y_{med} < y_a$. It is not obvious that $y_{med} < y_a$ for all $\varepsilon \in \mathcal{E}' \cup \mathcal{E}''$. However, a sufficient (not necessary) condition to satisfy this requirement is that $\bar{e} - \underline{e} \geq \frac{\alpha\beta}{(1-\alpha)(1-\beta)}\underline{e}$. We assume that this condition is satisfied in the presentation of our model.

[2] The marginal rates of substitution for two types of individuals with different tastes for working are always a constant multiple of each other. Therefore, their indifference curves satisfy the (Spence-Mirrlees) single crossing property.

However, we impose an explicit additional simplification to the model. Similar to Boadway et al. (2002), we assume that the high-skilled lazy individuals and the low-skilled hard-working individuals are indistinguishable in terms of gross income. Formally, for any type (w, e), let v_{we} represent preferences in the consumption-gross income space, more precisely $v_{we} : \mathbb{R}_+ \times [0, w] \to \mathbb{R}_+ : (c_{we}, y_{we}) \to v_{we}(c_{we}, y_{we}) \equiv u_e\left(c_{we}, \frac{y_{we}}{w}\right)$. Then there exists a continuous and strictly increasing function $\phi : \mathbb{R} \to \mathbb{R}$ such that $v_{\underline{w}\bar{e}} = \phi \circ v_{\bar{w}\underline{e}}$ in $\mathbb{R} \times [0, \underline{w}]$.

It is important to clarify the informational structure of the model. Individuals (and the government) only observe the three different gross income levels $y_{\underline{we}}, y_{\bar{w}\underline{e}} (= y_{\underline{w}\bar{e}})$ and $y_{\bar{w}\bar{e}}$, together with their respective proportions $p_{\underline{we}}, p_{\bar{w}\underline{e}} + p_{\underline{w}\bar{e}}$ and $p_{\bar{w}\bar{e}}$. They know the generic form of all the functions presented. They know the supports of w and e but they cannot observe w, e and ℓ_{we} on an individual basis. As a result, they can infer types $(\underline{w}, \underline{e})$ and $(\bar{w}, \bar{e})$ from observing $y_{\underline{we}}$ and $y_{\bar{w}\bar{e}}$ respectively, but they cannot distinguish types $(\bar{w}, \underline{e})$ from $(\underline{w}, \bar{e})$, since $y_{\bar{w}\underline{e}}$ equals $y_{\underline{w}\bar{e}}$. For the moment, we leave the question open whether individuals know that w and e are independently distributed or not. As we show in Appendix A, knowing whether w and e are independently distributed or not plays a crucial role in forming beliefs about the separate proportions $p_{\bar{w}\underline{e}}$ and $p_{\underline{w}\bar{e}}$ of the indistinguishable middle types $(\bar{w}, \underline{e})$ and $(\underline{w}, \bar{e})$.

2.3 Altruistic preferences for redistribution

We consider a direct democracy in which the redistributive parameter τ is chosen by simple majority voting. Individuals fully anticipate the disincentive effects of income taxation on labor supply. Individuals' evaluation of alternative redistributive policies are based on altruistic preferences that take the form of an additive extended utility function. We present throughout the paper different specifications of altruistic preferences for redistribution, but the generic form follows the social welfare model of Charness and Rabin (2002).

Denote the vector

$$\mathbf{v} \equiv \begin{pmatrix} v_{\underline{we}} \\ v_{\bar{w}\underline{e}} \\ v_{\underline{w}\bar{e}} \\ v_{\bar{w}\bar{e}} \end{pmatrix}$$

the type-profile of private utilities. Let $\gamma \in [0, 1]$ be a parameter (the same for all individuals) that reflects the weight put on the own private utility in the social utility function. Let (w, e) and $(w, e)'$ be two (possibly identical) types. Denote $\pi_{we,we'}$ the weight that an individual of type (w, e) assigns in her social utility function to the private utility of an individual of type $(w, e)'$. For any type (w, e), $\sum_{(w,e)' \in W \times E} \pi_{we,we'} = 1$. Let the vector

$$\boldsymbol{\pi}_{we} \equiv \begin{pmatrix} \pi_{we,\underline{we}} \\ \pi_{we,\bar{w}\underline{e}} \\ \pi_{we,\underline{w}\bar{e}} \\ \pi_{we,\bar{w}\bar{e}} \end{pmatrix}$$

collect type (w,e)'s weights and let $\boldsymbol{\pi}_{we}^{\mathbf{T}}$ be the transpose of $\boldsymbol{\pi}_{we}$. Then, for any type (w,e), preferences for redistribution take the form:

$$V_{we} : \mathbb{R}_{+}^{4} \rightarrow \mathbb{R}_{+} : \mathbf{v} \rightarrow \gamma v_{we} + (1-\gamma)\boldsymbol{\pi}_{we}^{\mathbf{T}}\mathbf{v}. \tag{2}$$

We denote preferences for redistribution *altruistic* whenever $\gamma \neq 1$.

2.4 Different scenarios of altruism

We discuss different altruistic preferences for redistribution. We therefore assume that we can write $\pi_{we,we'}$ as

$$\pi_{we,we'} = \frac{\delta_{we,we'} p_{we'}}{\sum_{(w,e)' \in W \times E} \delta_{we,we'} p_{we'}}$$

where $\delta_{we,we'} \in \{0,1\}$ is a dummy variable that represents the type-specific *concern* that individuals of type (w,e) have for individuals of type $(w,e)'$.

Whether the concern of one individual for another individual takes the value of 0 or 1 —or, in other words, whether another individual's private utility enters one individual's social utility or not— depends on two factors: 1) whether individuals are *utilitarian altruist* or *Rawlsian altruist* and 2) whether individuals are *responsibility-sensitive* or not. We clarify both factors. We qualify individuals' altruistic preferences for redistribution *utilitarian altruist* in case individuals do not discriminate on the basis of private utilities and hence *all* other individuals' well-being levels are taken up in their own social utility function. We qualify individuals' altruistic preferences for redistribution *Rawlsian altruist* in case individuals do discriminate on the basis of private utilities and *only* individuals with the lowest well-being levels are taken up in their own social utility function. In addition, we qualify individuals' altruistic preferences for redistribution *responsibility-sensitive* when individuals do discriminate on the basis of taste for working and *only* well-being levels of individuals with *at least the same* taste for working are taken up in their own social utility function. We qualify individuals' altruistic preferences for redistribution *not responsibility-sensitive* when individuals do not discriminate on the basis of taste for working when taking up other well-being levels in their own social utility function (in other words, taste for working is considered —just like productive skill— to be a genetic endowment).

Putting both factors together, we consider throughout the paper four different altruistic scenarios: not responsibility-sensitive utilitarian altruism (in short: utilitarian altruism (U)), not responsibility-sensitive Rawlsian altruism (in short: Rawlsian altruism (R)), responsibility-sensitive utilitarian altruism (rsU) and responsibility-sensitive Rawlsian altruism (rsR). When we, in addition, denote the scenario where all preferences for redistribution are egoistic ($\gamma = 1, \forall i \in N$) by Ego, the set of all different scenarios considered in this paper is $\Xi = \{Ego, U, R, rsU, rsR\}$. Generically, let $\boldsymbol{\delta}_{we}^{i}$ be the vector of concern-parameters of an individual of type (w,e) for a scenario $i \in \Xi \backslash \{Ego\}$:

$$\boldsymbol{\delta}^{i}_{we} \equiv \begin{pmatrix} \delta_{we,\underline{we}} \\ \delta_{we,\overline{w}\underline{e}} \\ \delta_{we,\underline{w}\overline{e}} \\ \delta_{we,\overline{we}} \end{pmatrix}.$$

- Utilitarian altruism

Under *utilitarian altruism*, every individual's social utility is a convex combination of her own private utility and the average private utility of all other individuals. Hence, all concern-parameters take the value of 1, or

$$\forall (w,e) \in W \times E : \boldsymbol{\delta}^{U}_{we} = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}.$$

- Rawlsian altruism

Under *Rawlsian altruism*, every individual's social utility is a convex combination of her own private utility and the lowest private utility in society. It is easy to check that individuals of type $(\underline{w},\underline{e})$ have the lowest private utility. Hence,

$$\forall (w,e) \in W \times E : \boldsymbol{\delta}^{R}_{we} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix}.$$

- Responsibility-sensitive utilitarian altruism

Under *responsibility-sensitive utilitarian altruism*, every individual's social utility is a convex combination of her own private utility and the average private utility of all individuals that have at least the same taste for working. Hence, the vector of concern-parameters of lazy individuals does not change compared to the utilitarian altruism scenario. On the other hand, the vector of concern-parameters of hard-working individuals changes since these individuals exclude under this scenario lazy individuals from their social utility function. Hence, we get:

$$\boldsymbol{\delta}^{rsU}_{\underline{we}} = \boldsymbol{\delta}^{rsU}_{\bar{w}\underline{e}} = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix} \text{ and } \boldsymbol{\delta}^{rsU}_{\underline{w}\bar{e}} = \boldsymbol{\delta}^{rsU}_{\bar{w}\bar{e}} = \begin{pmatrix} 0 \\ 0 \\ 1 \\ 1 \end{pmatrix}.$$

- Responsibility-sensitive Rawlsian altruism

Under *responsibility-sensitive Rawlsian altruism*, every individual's social utility is a convex combination of her own private utility and the lowest private utility of individuals that have at least the same taste for working. Hence, the vector of

concern-parameters of lazy individuals does not change compared to the Rawlsian altruism scenario. On the other hand, the vector of concern-parameters of hard-working individuals changes since these individuals under this scenario (i) exclude lazy low-skilled individuals from their social utility function and (ii) take up hard-working low-skilled individuals instead. Hence, we get:

$$\boldsymbol{\delta}^{rsR}_{\underline{w}\underline{e}} = \boldsymbol{\delta}^{rsR}_{\bar{w}\underline{e}} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} \text{ and } \boldsymbol{\delta}^{rsR}_{\underline{w}\bar{e}} = \boldsymbol{\delta}^{rsR}_{\bar{w}\bar{e}} = \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \end{pmatrix}.$$

3 Political equilibrium

In this section we show that responsibility-sensitive altruism reduces the amount of redistribution in political equilibrium when the median voter is of the hard-working low-skilled type.

Maximization of (1) with respect to ℓ yields for an individual of type (w, e):

$$\ell_{we} = we\,(1-\tau).$$

and thus the following gross income:

$$y_{we} = w^2 e\,(1-\tau).$$

Denote $\tau^{i,\varepsilon}_{we}$ the preferred tax rate of an individual of type (w, e) under scenario $i \in \Xi$ in economy $\varepsilon \in \mathcal{E}$. The preferred tax rates follow from maximization of (2) with respect to τ, using the appropriate vector of concern parameters for each type (w, e). Table 2 presents $\tau^{i,\varepsilon}_{\bar{w}\underline{e}}$ and $\tau^{i,\varepsilon}_{\underline{w}\bar{e}}$ for all $i \in \Xi$ and all $\varepsilon \in \mathcal{E}$:

$\tau^{i,\varepsilon}_{we}$	$\overline{w}\underline{e}$	$\underline{w}\overline{e}$
Ego	$\frac{y_a - \gamma y_{\overline{w}\underline{e}}}{2y_a - y_{\overline{w}\underline{e}}}$	$\frac{y_a - y_{\underline{w}\overline{e}}}{2y_a - y_{\underline{w}\overline{e}}}$
U	$\frac{y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_a}{2y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_a}$	$\frac{y_a - \gamma y_{\underline{w}\overline{e}} - (1-\gamma)y_a}{2y_a - \gamma y_{\underline{w}\overline{e}} - (1-\gamma)y_a}$
R	$\frac{y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_{\underline{w}\underline{e}}}{2y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_{\underline{w}\underline{e}}}$	$\frac{y_a - \gamma y_{\underline{w}\overline{e}} - (1-\gamma)y_{\underline{w}\underline{e}}}{2y_a - \gamma y_{\underline{w}\overline{e}} - (1-\gamma)y_{\underline{w}\underline{e}}}$
rsU	$\frac{y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_a}{2y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_a}$	$\frac{y_a - \gamma y_{\underline{w}\overline{e}} - \frac{(1-\gamma)}{p^b_{\underline{w}\overline{e}} + (1-\alpha)(1-\beta)}\left(p^b_{\underline{w}\overline{e}} y_{\underline{w}\overline{e}} + (1-\alpha)(1-\beta) y_{\overline{w}\overline{e}}\right)}{2y_a - \gamma y_{\underline{w}\overline{e}} - \frac{(1-\gamma)}{p^b_{\underline{w}\overline{e}} + (1-\alpha)(1-\beta)}\left(p^b_{\underline{w}\overline{e}} y_{\underline{w}\overline{e}} + (1-\alpha)(1-\beta) y_{\overline{w}\overline{e}}\right)}$
rsR	$\frac{y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_{\underline{w}\underline{e}}}{2y_a - \gamma y_{\overline{w}\underline{e}} - (1-\gamma)y_{\underline{w}\underline{e}}}$	$\frac{y_a - y_{\underline{w}\overline{e}}}{2y_a - y_{\underline{w}\overline{e}}}$

Table 2: Preferred tax rates of middle types $(\bar{w}, \underline{e})$ and $(\underline{w}, \bar{e})$.

where $p^b_{\underline{w}\overline{e}}$ denotes the beliefs of individuals of type $(\underline{w}, \overline{e})$ about the proportion of individuals of type $(\underline{w}, \overline{e})$ in the population. Indeed, in the responsibility-sensitive utilitarian scenario, individuals of type $(\underline{w}, \overline{e})$ take up in their social utility function both individuals of their own type $(\underline{w}, \overline{e})$ and individuals of type $(\bar{w}, \overline{e})$. While they observe the latter's proportion $p_{\bar{w}\bar{e}}$, they only observe

$p_{\bar{w}\underline{e}}+p_{\underline{w}\bar{e}}$ and hence have to make an 'estimate' of the former's proper proportion $p_{\underline{w}\bar{e}}$. We return to the exact formation of $p^b_{\underline{w}\overline{e}}$ in Appendix A, where we study the impact of incomplete information about the separate proportions $p_{\bar{w}\underline{e}}$ and $p_{\underline{w}\bar{e}}$ on the preferred tax rate of individuals of type $(\underline{w},\overline{e})$ in the responsibility-sensitive utilitarian scenario. Notice once more that being responsibility-sensitive or not does not alter the preferred tax rate of individuals of type $(\bar{w},\underline{e})$, i.e. $\tau^{U,\varepsilon}_{\overline{w}\underline{e}} = \tau^{rsU,\varepsilon}_{\overline{w}\underline{e}}$ and $\tau^{R,\varepsilon}_{\overline{w}\underline{e}} = \tau^{rsR,\varepsilon}_{\overline{w}\underline{e}}$. Also note that for individuals of type $(\underline{w},\overline{e})$, there is no difference between the egoistic scenario and the responsibility-sensitive Rawlsian altruism scenario, i.e. $\tau^{Ego,\varepsilon}_{\underline{w}\overline{e}} = \tau^{rsR,\varepsilon}_{\underline{w}\overline{e}}$. Finally, due to our assumption of indistinguishable middle types, the preferred tax rates between the middle types $(\bar{w},\underline{e})$ and $(\underline{w},\bar{e})$ coincide in the egoistic scenario, the utilitarian altruism scenario and the Rawlsian altruism scenario.

Denote $\tilde{\tau}^{i,\varepsilon}$ the Condorcet winner tax rate under scenario $i \in \Xi$ in economy $\varepsilon \in \mathcal{E}$. The following lemma states that, for all scenarios considered, the preferred tax rates of types $(\bar{w},\underline{e})$ and $(\underline{w},\bar{e})$ of table 2 are also the Condorcet winner tax rates for all economies in $\mathcal{E}'$ and $\mathcal{E}''$ respectively.

Lemma (identification Condorcet winner tax rate): $\forall i \in \Xi$:

$\forall \varepsilon \in \mathcal{E}', \tilde{\tau}^{i,\varepsilon} = \tau^{i,\varepsilon}_{\overline{w}\underline{e}}$
$\forall \varepsilon \in \mathcal{E}'', \tilde{\tau}^{i,\varepsilon} = \tau^{i,\varepsilon}_{\underline{w}\overline{e}}$.

Proof: The negative second derivatives of (2) with respect to τ for all types $(w,e) \in W \times E$ show that for each scenario and for each type altruistic preferences are single peaked over the τ-dimension. It is also easy to check that for each scenario the preferred tax rates of individuals of type $(\underline{w},\underline{e})$ are strictly larger than the preferred tax rates of individuals of type $(\bar{w},\underline{e})$, i.e. $\tau^{i,\varepsilon}_{\underline{w}\underline{e}} > \tau^{i,\varepsilon}_{\overline{w}\underline{e}}$ for all $i \in \Xi$ and that for each scenario the preferred tax rates of individuals of type $(\bar{w},\bar{e})$ are strictly lower than the preferred tax rates of individuals of type $(\underline{w},\bar{e})$, i.e. $\tau^{i,\varepsilon}_{\underline{w}\overline{e}} > \tau^{i,\varepsilon}_{\bar{w}\overline{e}}$ for all $i \in \Xi$. To ensure that the median voter has type $(\bar{w},\underline{e})$ for all $\varepsilon \in \mathcal{E}'$ and that the median voter has type $(\underline{w},\bar{e})$ for all $\varepsilon \in \mathcal{E}''$, it remains to show that $\tau^{i,\varepsilon}_{\overline{w}\underline{e}} \geq \tau^{i,\varepsilon}_{\underline{w}\overline{e}}$ for all $i \in \Xi$ (in some scenarios the inequality may hold strict). The only non-trivial case is $\tau^{rsU,\varepsilon}_{\overline{w}\underline{e}} > \tau^{rsU,\varepsilon}_{\underline{w}\overline{e}}$, which boils down to showing that $y_a < \frac{p^b_{\underline{w}\overline{e}} y_{\underline{w}\overline{e}} + (1-\alpha)(1-\beta) y_{\overline{w}\overline{e}}}{p^b_{\underline{w}\overline{e}} + (1-\alpha)(1-\beta)} = RHS$. Since $p^b_{\underline{w}\overline{e}}$ cannot lie outside the interval $[0, 1-p_{\underline{w}\underline{e}}-p_{\bar{w}\bar{e}}]$ (see also Appendix A), $p^b_{\underline{w}\overline{e}}+(1-\alpha)(1-\beta) < 1$. Hence, it can easily be seen that $y_a < RHS$ when noting that the weight given to $y_{\overline{w}\overline{e}}$ in RHS is greater than the weight $(1-\alpha)(1-\beta)$ given to $y_{\overline{w}\overline{e}}$ in y_a and when noting that $y_{\underline{w}\underline{e}}$ receives no weight in RHS, whereas $y_{\underline{w}\underline{e}}$ receives weight $\alpha\beta$ in y_a. $\square$

We now compare the Condorcet winner tax rates over the different scenarios. We start by comparing the Condorcet winner tax rates in the egoistic scenario, the utilitarian altruism scenario and the Rawlsian altruism scenario. Remember that for these scenarios, the Condorcet winner tax rates coincide for all economies in $\mathcal{E}'$ and $\mathcal{E}''$. Proposition 1 states that the Condorcet winner tax

rate is the highest under the Rawlsian altruism scenario and the lowest under the utilitarian altruism scenario for all economies in $\mathcal{E}' \cup \mathcal{E}''$. The intuition behind proposition 1 is that under the Rawlsian altruism scenario, the median voter middle type individuals (only) take up the private utilities of type $(\underline{w}, \underline{e})$ individuals in their social utility function. These type $(\underline{w}, \underline{e})$ individuals egoistically prefer a higher tax rate than the tax rate egoistically preferred by the middle type individuals. As a result, the Condorcet winner tax rate under the Rawlsian altruism scenario is also higher. Given our quasi-linear preferences defined in (1), the disincentive effect of taxation is minimized —and therefore the total sum of utilities maximized— under a tax rate equal to zero. As a result, the Condorcet winner tax rate under the utilitarian altruism scenario is lower than the tax rate egoistically preferred by the middle type individuals.

Proposition 1 (ranking Condorcet winner tax rates under Ego, U and R):

$\forall \varepsilon \in \mathcal{E}' \cup \mathcal{E}'', \tilde{\tau}^{U,\varepsilon} < \tilde{\tau}^{Ego,\varepsilon} < \tilde{\tau}^{R,\varepsilon}$.

Proof: Straightforward, since (i) $y_{\overline{w}\underline{e}} = y_{med}$, $\forall \varepsilon \in \mathcal{E}'$, (ii) $y_{\underline{w}\overline{e}} = y_{med}$, $\forall \varepsilon \in \mathcal{E}''$ and (iii) $y_{\underline{we}} < y_{\overline{w}\underline{e}} = y_{\underline{w}\overline{e}} = y_{med} < y_a$ (cfr. footnote 1).

The main result of this section is proposition 2 which states that the introduction of responsibility-sensitivity in altruistic preferences for redistribution decreases the amount of redistribution in the political equilibrium when the median voter is a hard-working low-skilled individual. The intuition behind proposition 2 is that hard-working low-skilled individuals essentially drop the private utilities of type $(\underline{w}, \underline{e})$ individuals, who have the highest egoistically preferred tax rate, from their social utility function under responsibility-sensitive scenarios. This results in lower Condorcet winner tax rates compared to non responsibility-sensitive scenarios.

Proposition 2 (ranking Condorcet winner tax rates under rsU and U and under rsR and R):

$\forall \varepsilon \in \mathcal{E}'', \tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{U,\varepsilon}$ and $\tilde{\tau}^{rsR,\varepsilon} < \tilde{\tau}^{R,\varepsilon}$.

Proof: The proof that $\tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{U,\varepsilon}$ follows from (i) noting that $\tau^{U,\varepsilon}_{\underline{w}\overline{e}} = \tau^{rsU,\varepsilon}_{\overline{w}\underline{e}}$ for all $\varepsilon \in \mathcal{E}$, (ii) the proof of the lemma where we show that $\tau^{rsU,\varepsilon}_{\underline{w}\overline{e}} < \tau^{rsU,\varepsilon}_{\overline{w}\underline{e}}$ for all $\varepsilon \in \mathcal{E}$ and (iii) the lemma itself. The proof that $\tilde{\tau}^{rsR,\varepsilon} < \tilde{\tau}^{R,\varepsilon}$ follows from proposition 1 when noting that $\tilde{\tau}^{rsR,\varepsilon} = \tilde{\tau}^{Ego,\varepsilon}$ for all $\varepsilon \in \mathcal{E}''$. □

4 Responsibility-sensitive altruism in practice

In the previous section, we showed that responsibility-sensitive altruism reduces the amount of redistribution in political equilibrium when the median voter is of the hard-working low-skilled type. When thinking of both the American and European economy in the simplified four-types setting introduced above, it does not seem unreasonable that in both economies the qualitative results of our theoretical model hold. The difference between the American and the European

social contract can be explained by the fact that Americans are significantly more responsibility-sensitive than Europeans are. In this section we show that differences in responsibility-sensitivity indeed hold between both continents. We present estimates for an encompassing model of individual attitudes toward political redistribution. Like Corneo and Grüner (2002), we use the International Social Survey Programme (ISSP) 1992 dataset which contains questionnaire responses that reveal opinions on social inequality. This source provides representative samples of the following countries: Austria, (West-)Germany, Italy, Norway, Sweden and the US. Here, we introduce our different variables shortly and refer to Appendix B for a more detailed descriptive summary of our data. Our dependent variable 'redistribution' ranges from 1 to 4 —which induces us to estimate an ordered logit model— and indicates the support given by individuals to political redistribution. It measures how strongly individuals feel that the government should reduce income inequality. We categorize our explanatory variables in three groups. First, the variable 'self-interest' captures the self-interest incentive of individuals to support redistribution. It measures how much individuals themselves gain from redistribution. Second, the variables 'responsibility' and 'compensation' are derived from individuals' opinions on how strongly characteristics within individuals' responsibility and characteristics beyond individuals' responsibility influence the income generating process respectively. Third, the socio-demographic variables 'gender', 'age' and 'employment' report individuals' sex, age and whether they are employed or not. In order to test for differences in the influence of the self-interest, responsibility and compensation variables across both continents, we interacted these variables with a dummy (dum) that takes the value of 1 when individuals come from the US. Table 3 presents our ordered logit estimates:

<insert table 3 around here>

Three important conclusions can be drawn from Table 3. First, although the self-interest variable has strongly significant explanatory power, it is not the only driving force behind individuals' support for redistribution. The strongly significant positive coefficient of the compensation variable betrays that, besides the self-interest motive, a strong belief in the importance of non-responsibility characteristics raises the demand for redistribution. Remark that this belief does not statistically differ between Europe and the US, since the coefficient of the interaction variable compensation*dum is not statistically significant. It is also notable that this belief is equally shared by both individuals who gain or lose from redistribution as the overall correlation between the self-interest variable and the compensation variable is close to zero (-0.011). This result suggests to depart from modelling individuals' preferences for redistribution as solely egoistic as it indicates that altruistic concerns do exist. Second, there is clear indication of responsibility-sensitivity in individuals' attitudes towards redistribution. The strongly significant negative coefficient of the responsibility variable indicates that, besides the self-interest motive, there is a reluctance for

redistribution from the hard-working to the lazy. This supports the idea that individuals exclude the lazy from their altruistic concerns. Third, preferences for redistribution are significantly more responsibility-sensitive among individuals in the US than among individuals in Europe. This is indicated by the significantly negative coefficient of the interaction variable responsibility*dum. In other words, we find empirical confirmation that differences in responsibility-sensitivity result in different demands for redistribution, which can help explain the two different politico-economic equilibria of both continents. Note that we do not find other statistical differences between the US and Europe with respect to neither self-interest nor continental fixed effects, since the coefficients of the interaction variable self-interest*dum and of the dummy are not statistically significant. Concerning the socio-demographic variables, we find that, in general, being female, being young and being unemployed significantly enhances the demand for redistribution.

5 Conclusion

Following Alesina and Angeletos (2005), we endow individuals that differ in skill levels and tastes for working with preferences for redistribution that are not purely egoistic. However, we rely on opinions on distributive justice in the exact formulation of these preferences. In our model, individuals care about others, but possibly only as long as these others have at least the same entitlement to income generated by factors that lie within their personal responsibility. We denote such a selective concern responsibility-sensitive altruism. In a voting model where a unidimensional redistributive parameter is chosen by majority voting in a direct democracy, we demonstrate how responsibility-sensitive preferences for redistribution can induce lower levels of redistribution in the political equilibrium. We justify responsibility-sensitive preferences empirically. Using a representative sample that contains respondents of both the US and Europe, we provide evidence that preferences for redistribution are not purely egoistic. We find that responsibility-sensitive motivations play a significant role in individuals' preferences for redistribution. We estimate that preferences for redistribution are significantly more responsibility-sensitive among individuals in the US than among individuals in Europe. We think that differences in responsibility-sensitivity help explain the different social contracts that prevail between both continents.

We believe that our analysis can be extended in a number of promising ways. We highlight five possible avenues for future research. First, while recently an increasing number of theoretical papers depart from modelling individuals' preferences for redistribution as purely egoistic, an extensive empirical validation for altruistic preferences for redistribution in general and for responsibility-sensitive altruistic preferences for redistribution in particular needs to be developed. Such an analysis should not only be limited to the study of participants behavior in an experimental setting, nor be solely based on the use of questionnaire data, but focus more directly on actual voting behavior in real world elections, if possible.

Second, where we endowed all individuals with the same altruistic concern in our analysis, a straightforward extension would be to study the equilibrium outcomes resulting from the prevalence of different altruistic concerns among the population; we refer to Cappelen et al. (2005) for an experimental study of pluralism in fairness ideals. Third, another possible extension of our model would be to introduce dynamics, study the endogenous formation of (responsibility-sensitive) altruistic preferences and analyze the (different) steady-state(s) resulting from this process; see Cervellati et al. (2006) for a first attempt. Fourth, we believe that by endowing individuals with altruistic preferences for redistribution, the qualitative results of positive voting models come closer to the recommendations of the normative optimal fair income tax literature; we refer to Schokkaert et al. (2004) for the derivation of optimal linear tax rates under a responsibility-sensitive social planner. In fact, the (hypothetical) benevolent social planner of normative analysis is being replaced by ethically inspired voters in our analysis. Finally (and well aware of the technical difficulties it imposes), the development of models in which individuals with (responsibility-sensitive) altruistic preferences vote over non-linear income tax schedules would obviously be an improvement; see Kranich (2001) for an analysis with altruistic preferences over quadratic income tax schedules. It would for example enable to study whether (responsibility-sensitive) altruistic individuals are in favor of welfare programmes that subsidize the poor.

Appendix A: impact of incomplete information

We focus on the responsibility-sensitive utilitarian scenario for all economies in $\mathcal{E}''$, as only here (possibly wrong) beliefs about the proportion of hard-working low-skilled individuals influence the amount of redistribution in the political equilibrium. We take the Condorcet winner tax rate $\tilde{\tau}^{rsU,\varepsilon}$ under the (correct) belief that $p^b_{\underline{w}\bar{e}} = (1-\alpha)\beta$ as a benchmark. Denote this tax rate $\tilde{\tau}^{rsU,\varepsilon}_{benchmark}$. From propositions 1 and 2 in Section 3, we know that for all economies in $\mathcal{E}''$, $\tilde{\tau}^{rsU,\varepsilon}$ is the lowest Condorcet winner tax rate of the five scenarios considered. We now ask the question in which economies wrong beliefs ($p^b_{\underline{w}\bar{e}} \neq (1-\alpha)\beta$) lead to a $\tilde{\tau}^{rsU,\varepsilon}$ that is even smaller than $\tilde{\tau}^{rsU,\varepsilon}_{benchmark}$. In other words, we try to identify how imperfect information can further increase the difference between the Condorcet winner tax rate in the responsibility-sensitive utilitarian scenario and the Condorcet winner tax rates in the other scenarios. The necessary condition to have that $\tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{rsU,\varepsilon}_{benchmark}$ is that individuals of type $(\underline{w},\bar{e})$ underestimate the true proportion of individuals of their own type, i.e. $p^b_{\underline{w}\bar{e}} < (1-\alpha)\beta$. The intuition is clear: this underestimation leads individuals of type $(\underline{w},\bar{e})$ to an underestimation in their social utility function of the proportion of their own type $(\underline{w},\bar{e})$ relative to the proportion of individuals of type $(\bar{w},\bar{e})$. As individuals of type $(\bar{w},\bar{e})$ egoistically prefer a lower tax rate than individuals of type $(\underline{w},\bar{e})$ (cfr. the proof of the lemma in Section 3), the underestimation of the proportion of the latter type leads to a lower preferred tax rate of individuals of type $(\underline{w},\bar{e})$ in the responsibility-sensitive utilitarian altruism scenario.

In order to study the exact formation of beliefs, it is important to distinguish between the case where individuals *know* that w and e are independently distributed and the case where individuals *do not know* that w and e are independently distributed.

Individuals know that w and e are independently distributed

When individuals know that w and e are independently distributed (i.e. individuals know that $p_{\bar{w}\underline{e}} + p_{\underline{w}\bar{e}} = (1-\beta)\alpha + (1-\alpha)\beta$), beliefs can only take two different values, namely $p^b_{\underline{w}\bar{e}} = (1-\alpha)\beta$ (which is correct) or $p^b_{\underline{w}\bar{e}} = (1-\beta)\alpha$ (which is wrong). Let $\widehat{\mathcal{E}}'' = \{\varepsilon \in \mathcal{E}'' : \alpha < \beta\}$ be a proper subset of $\mathcal{E}''$ that comprises all economies in $\mathcal{E}''$ where there are more low-skilled individuals than lazy individuals. The following proposition states that exactly for those economies wrong beliefs lead to even lower levels of redistribution in the political equilibrium. This stems from the fact that in these economies $(1-\beta)\alpha < (1-\alpha)\beta$, which leads to an underestimation of the proportion of individuals of type $(\underline{w}, \bar{e})$ and as a result to a smaller Condorcet winner tax rate (cfr. supra).

Proposition A1 (impact of imperfect information): When individuals know that w and e are independently distributed and $p^b_{\underline{w}\bar{e}} \neq (1-\alpha)\beta$:

$\forall \varepsilon \in \widehat{\mathcal{E}}'' : \tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{rsU,\varepsilon}_{benchmark}$.

Proof: The proof follows from a direct comparison between $\tilde{\tau}^{rsU,\varepsilon}$ when $p^b_{\underline{w}\bar{e}} = (1-\alpha)\beta$ and $\tilde{\tau}^{rsU,\varepsilon}$ when $p^b_{\underline{w}\bar{e}} = (1-\beta)\alpha$. The latter is smaller than the former when $\alpha < \beta$, which is the case for all economies in $\widehat{\mathcal{E}}''$. □

Individuals do not know that w and e are independently distributed

When individuals do not know that w and e are independently distributed, beliefs can be situated anywhere in the closed interval between zero and $1 - p_{\underline{w}\underline{e}} - p_{\overline{w}\overline{e}}$, i.e. $p^b_{\underline{w}\bar{e}} \in [0, \alpha+\beta-2\alpha\beta]$. Let $\widehat{\widehat{\mathcal{E}}}'' = \{\varepsilon \in \widehat{\mathcal{E}}'' : \beta > 1/2\}$ be a proper subset of $\widehat{\mathcal{E}}''$ that comprises all economies in $\widehat{\mathcal{E}}''$ where more than one half of the population is low-skilled. The following proposition summarizes sufficient (not necessary) conditions to have $\tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{rsU,\varepsilon}_{benchmark}$. The most general result (which holds for all economies in $\mathcal{E}''$) states that, in order to obtain $\tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{rsU,\varepsilon}_{benchmark}$, it is sufficient that individuals of type $(\underline{w}, \bar{e})$ believe that the majority of low-skilled individuals are lazy or that individuals of type $(\underline{w}, \bar{e})$ believe that there are more lazy individuals than hard-working individuals in society. Moreover, for all economies in $\widehat{\mathcal{E}}''$, it is sufficient that individuals of type $(\underline{w}, \bar{e})$ believe that most of the middle type individuals are lazy. Further, for all economies in $\widehat{\widehat{\mathcal{E}}}''$, it is sufficient that individuals of type $(\underline{w}, \bar{e})$ believe that the majority of hard-working individuals are also high skilled or that individuals of type $(\underline{w}, \bar{e})$ believe that there are more high-skilled individuals than low-skilled individuals in society. In all of these cases, these beliefs lead to an underestimation of the proportion of individuals of type $(\underline{w}, \bar{e})$ and as a result to a smaller Condorcet winner tax rate (cfr. supra).

Proposition A2 (impact of imperfect information): When individuals do not know that w and e are independently distributed, any of the following beliefs are sufficient to have $\tilde{\tau}^{rsU,\varepsilon} < \tilde{\tau}^{rsU,\varepsilon}_{benchmark}$:

$\forall \varepsilon \in \mathcal{E}'' : p^b_{\underline{w}\overline{e}} < p_{\underline{w}\underline{e}}$, $p^b_{\underline{w}\overline{e}} < p_{\underline{w}\underline{e}} + p^b_{\overline{w}\underline{e}} - p_{\overline{w}\overline{e}}$

$\forall \varepsilon \in \widehat{\mathcal{E}}'' : p^b_{\underline{w}\overline{e}} < p^b_{\overline{w}\underline{e}}$

$\forall \varepsilon \in \widehat{\widehat{\mathcal{E}}}'' : p^b_{\underline{w}\overline{e}} < p_{\overline{w}\overline{e}}$, $p^b_{\underline{w}\overline{e}} < p^b_{\overline{w}\underline{e}} + p_{\overline{w}\overline{e}} - p_{\underline{w}\underline{e}}$.

Proof: To prove that $p^b_{\underline{w}\overline{e}} < p_{\underline{w}\underline{e}}$ is sufficient, note that $p_{\underline{w}\underline{e}} = \alpha\beta$ is smaller than $(1-\alpha)\beta$ when $\alpha < \frac{1}{2}$, which is the case for all economies in $\mathcal{E}''$. To prove that $p^b_{\underline{w}\overline{e}} < p_{\underline{w}\underline{e}} + p^b_{\overline{w}\underline{e}} - p_{\overline{w}\overline{e}}$ is sufficient, note that this amounts to $p^b_{\underline{w}\overline{e}} < \alpha+\beta-\alpha\beta-\frac{1}{2}$, since $p^b_{\overline{w}\underline{e}} = \alpha+\beta-2\alpha\beta-p^b_{\underline{w}\overline{e}}$. Then $\alpha+\beta-\alpha\beta-\frac{1}{2}$ is smaller than $(1-\alpha)\beta$ when $\alpha < \frac{1}{2}$, which is the case for all economies in $\mathcal{E}''$. To prove that $p^b_{\underline{w}\overline{e}} < p^b_{\overline{w}\underline{e}}$ is sufficient, note that this amounts to $p^b_{\underline{w}\overline{e}} < \frac{\alpha+\beta-2\alpha\beta}{2}$ and that $\frac{\alpha+\beta-2\alpha\beta}{2}$ is smaller than $(1-\alpha)\beta$ when $\alpha < \beta$, which is the case for all economies in $\widehat{\mathcal{E}}''$. To prove that $p^b_{\underline{w}\overline{e}} < p_{\overline{w}\overline{e}}$ is sufficient, note that $p_{\overline{w}\overline{e}} = (1-\alpha)(1-\beta)$ is smaller than $(1-\alpha)\beta$ when $\beta > \frac{1}{2}$, which is the case for all economies in $\widehat{\widehat{\mathcal{E}}}''$. To prove that $p^b_{\underline{w}\overline{e}} < p^b_{\overline{w}\underline{e}} + p_{\overline{w}\overline{e}} - p_{\underline{w}\underline{e}}$ is sufficient, note that this amounts to $p^b_{\underline{w}\overline{e}} < \frac{1}{2} - \alpha\beta$ and that $\frac{1}{2} - \alpha\beta$ is smaller than $(1-\alpha)\beta$ when $\beta > \frac{1}{2}$, which is the case for all economies in $\widehat{\widehat{\mathcal{E}}}''$.□

Appendix B: descriptive summary

Table 4 provides a detailed descriptive summary of the data used in the ordered logit estimation presented in Section 4. It reports the exact questions used to define the variables and indicates for each variable the proportion of answers given.

<insert table 4 around here>

The variable responsibility is computed as an arithmetic average of the variable ambition and the variable hard work. Similarly, the variable compensation is computed as an arithmetic average of the variable natural ability and the variable family background. It is worthwhile to mention the relatively low correlation between the variable ambition and the variable hard work of 0.407 and the relatively low correlation between the variable natural ability and the variable family background of 0.203. Taking up either the variable ambition or the variable hard work instead of the variable responsibility does not change the qualitative conclusions; it only decreases the overall explanatory power of the model. The same holds true for taking up the variable natural ability or the variable family background instead of the variable compensation. Constructing the dependent variable as a dummy and estimating a binary logit model yields

similar results as estimating an ordered logit model. The same holds true when estimating an ordered or a binary probit model.[3]

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Variable	Coefficient
SELF-INTEREST	0.482***
	(0.048)
SELF-INTEREST*DUM	0.083
	(0.088)
RESPONSIBILITY	-0.203***
	(0.054)
RESPONSIBILITY*DUM	-0.380**
	(0.135)
COMPENSATION	0.176***
	(0.055)
COMPENSATION*DUM	0.175
	(0.110)
GENDER	-0.294***
	(0.068)
AGE	-0.005**
	(0.002)
EMPLOYMENT	-0.340***
	(0.074)
DUM	-0.336
	(0.695)
Number of observations	3220
Prob>chi2	0.000
Pseudo R2	5.69%

Standard errors between parentheses
*** significant at 1%; ** significant at 5%

Table 3: Ordered logit estimates

Variable	Question	Coding	Proportion (in %)
REDISTRIBUTION	"It is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes"	=1: strongly disagree =2: disagree =3: agree =4: strongly agree	=1: 8.9 =2: 23.7 =3: 47.8 =4: 19.6
SELF-INTEREST	"If incomes became more equal, some people would get higher incomes and some would get lower incomes. Do you think that your income…"	=1: would definitely go down =2: would probably go down =3: would stay the same =4: would probably go up =5: would definitely go up	=1: 1.2 =2: 6.5 =3: 43.7 =4: 33.8 =5: 14.9
	"For getting ahead in life, how important is…"		
AMBITION	« … having ambition ? »	=1: not important at all =2: not very important =3: fairly important =4: very important =5: essential	=1: 0.9 =2: 2.9 =3: 19.8 =4: 46.9 =5: 29.4
HARD WORK	« … hard work ? »	the same as for AMBITION	=1: 1.4 =2: 6.0 =3: 24.8 =4: 44.4 =5: 23.4
NATURAL ABILITY	« … natural ability ? »	the same as for AMBITION	=1: 1.3 =2: 7.3 =3: 39.1 =4: 40.4 =5: 12
FAMILY BACKGROUND	« … coming from a wealthy family ? »	the same as for AMBITION	=1: 15.9 =2: 35.5 =3: 31.5 =4: 12.8 =5: 4.3
EMPLOYMENT		=1 if employed =0 if unemployed	=1: 60.5
AGE		= age of the respondent	average age: 44.1
GENDER		=1 if male =0 if female	=1: 49.3
DUM		=1 if US =0 if Europe	=1: 25.3

Table 4: Descriptive statistics