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Social Preferences and Redistribution Under Direct Democracy*

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Abstract

There is growing evidence on the roles of *fairness* and *social preferences* as fundamental human motives, in general, as well as in voting contexts. In contrast, models of political economy are based on *selfish-voters* who derive utility solely from 'own' payoff. We examine the implications of introducing voters with social preferences, as in Fehr and Schmidt (1999), in a simple general equilibrium model with endogenous labour supply. We demonstrate the existence of a Condorcet winner for voters, with heterogeneous social preferences (including purely selfish preferences), using the single crossing property of voters' preferences. Relatively small changes in the preference of voters can have relatively large redistributive consequences. We implications for the size of the welfare state; regional integration; and issues of culture, identity and immigration.

Keywords: Direct democracy, redistribution, other-regarding preferences, single-crossing property.

JEL Classification: D64 (Altruism); D72 (Economic Models of Political Processes: Rent-Seeking, Elections, Legislatures, and Voting Behavior); D78 (Positive Analysis of Policy-Making and Implementation).

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1. Introduction

Traditional economic theory relies on the twin assumptions of rationality and self-interested behavior. The latter is generally taken to imply that individuals are interested primarily in their own pecuniary payoffs (*selfish-preferences*). This view is not always in conformity with the evidence. The purely selfish individual model is unable to explain a range of phenomena from many diverse areas such as collective action, contract theory, the structure of incentives, political economy and the results of several experimental games. Individuals are also often motivated by the pecuniary and non-pecuniary payoffs of others. A substantial fraction of individuals exhibit *social-preferences*, i.e., care about the consumption and well being of others. Apparently conflicting evidence from a range of experimental games, such as the ultimatum game, the gift exchange game and the public-good game with punishment can easily be reconciled if we assume individuals to have social preferences.[1]

It seems plausible that issues of fairness and regard for others (or social-preferences) also motivative the human desire to redistribute. The experimental results of Ackert et al. (2007), Tyran and Sausgruber (2006) and Bolton and Ockenfels (2002) are strongly supportive of the importance of social preferences in the domain of voting models.

Tyran and Sausgruber (2006) examine pure transfers of income from the rich to the poor that do not affect the middle-income voter. Some rich voters, on account of their fairness, vote for transfers to the poor in circumstances where a rich, but selfish, voter would have voted otherwise. Hence, a majority of the fair voters might vote for redistribution when voting under selfish preferences would predict no redistribution.

Bolton and Ockenfels (2002) examine the preference for equity versus efficiency in a voting game. Groups of three subjects are formed and are presented with two alternative policies: one that promotes equity while the other promotes efficiency. The final outcome is chosen by a majority vote. About twice as many experimental subjects preferred equity as compared to efficiency. Furthermore, even those willing to change the status-quo for efficiency are willing to pay, on average, less than half relative to those who wish to alter the status-quo for equity.

In view of the growing recognition of fairness as a fundamental human motive as well as the increasing empirical evidence on fairness and social preferences as determinants of the redistributive motive, several questions arise quite naturally. What is an appropriate framework to model fairness concerns in humans, especially in a redistributive context? In the presence of fairness concerns, can one characterize some sort of political economy equilibrium, when deciding on the level of redistribution for a society? Conditional on an

[1] The modern literature on fairness is vast and expanding rapidly. For some recent surveys, see Fehr and Fischbacher (2002), Camerer (2003), Fehr and Schmidt (2005). For a flavour of some of the theories of fairness, see Rabin (1993), Fehr and Schmidt (1999), Bolton and Ockenfels (2000), Charness and Rabin (2002), Falk and Fischbacher (2006). For the neuroeconomic foundations of fairness, see Fehr at al. (2005).

affirmative answer to the first two questions one can then pose further questions. Does one expect societies with greater fairness to redistribute more? What sort of redistributive outcome does one expect, when, as the evidence suggest, there is a mixture of both selfish and fair voters?[2] What is a tractable economic framework which can provide an appropriate vehicle to model these issues? Are there interesting applications of the model that help us understand important real world economic issues? The aim of our paper is to addresses these questions. The remaining part of the introduction explains our approach.

1.1. Which model of fairness?

There are several models of fairness. We choose to use the Fehr-Schmidt (1999) (henceforth, FS) approach to fairness[3]. In this approach, voters care, not only about their own payoffs, but also their payoffs relative to those of others. If their payoff is greater than other voters then they suffer from *advantageous-inequity* (arising from, say, altruism) and if their payoff is lower than other voters they suffer from *disadvantageous-inequity* (arising from, say, envy).

Several reasons motivate our choice of the FS model. The FS model is tractable and explains the experimental results arising from several games where the prediction of the standard game theory model with selfish agents yields results that are not consistent with the experimental evidence. These games include the ultimatum game, the gift-exchange game, the dictator game as well as the public-good game with punishment[4].

The FS model focusses on the role of inequity aversion. However, a possible objection is that it ignores the role played by intentions that have been shown to be important in experimental results (Falk et al. (2002)) and treated explicitly in theoretical work (Rabin (1993), Falk and Fischbacher (2006)). However, experimental results on the importance of intentions come largely from bilateral interactions. Economy-wide voting, on the other hand, is impersonal and anonymous, thereby making it unlikely that intentions play any important role in this phenomenon.

Experimental results on voting lend support to the use of the FS model in such con-

[2] Experimental evidence indicates that the fraction of self interested individuals comprise about 40 percent of the population (also see below); for instance, Fehr and Fischbacher (2002).

[3] Bolton and Ockenfels (2000) provide yet another approach of inequity averse economic agents, but it cannot explain the outcome of the public good game with punishment, which is a fairly robust experimental finding (see below).

[4] In the first three of these games, experimental subjects offer more to the other party relative to the predictions of the Nash outcome with selfish preferences. In the public good game with punishment, the possibility of ex-post punishment dramatically reduces the extent of free riding in voluntary giving towards a public good. In the standard theory with selfish agents, bygones are bygones, so there is no ex-post incentive for the contributors to punish the free-riders. Foreseeing this outcome, free riders are not deterred, which is in disagreement with the evidence. Such behavior can be easily explained within the FS framework.

texts. Tyran and Sausgruber (2006) explicitly test for the importance of the FS framework in the context of direct voting. They conclude that the FS model predicts much better than the standard selfish-voter model. In addition, the FS model provides, in their words, "strikingly accurate predictions for individual voting in all three income classes." The econometric results of Ackert et al. (2007), based on their experimental data, lend further support to the FS model in the context of redistributive taxation. The estimated coefficients of altruism and envy in the FS model are statistically significant and, as expected, negative in sign. Social preferences are found to influence participant's vote over alternative taxes. They find evidence that some participants are willing to reduce their own payoffs in order to support taxes that reduce advantageous- or disadvantageous-inequity.

1.2. The political institutions and the economic model

All societies face the issue of aggregating individual preferences into social outcomes. In actual practice, such policies are chosen by the elected representatives of the citizens (which is referred to as *representative-democracy*). Furthermore, the political process is complicated by issues of political agency, information asymmetries, and legislative logrolling etc.[5]. However, in a range of applications in political economy, one often needs to abstract away from some of these issues. Indeed, there is a rich literature in public economics that relies on the simpler, and more tractable, notion of a *median voter*. Such a voter, if decisive, directly chooses the social outcome (this is often referred to as *direct-democracy*).[6] In this paper we will use direct democracy as our political institution. However, our model can be imbedded as a subgame within a larger model that has features of a representative democracy; as illustrated in an extension in section 6.

Recent experience in Western democracies suggests that direct democracy is more than a useful benchmark. Figures given in Matsusaka (2005a,b) (who terms the increasing trend in direct democracy as the "storm in ballot box lawmaking") are instructive. In the US, 70 percent of the population lives in a state or city where the apparatus of direct democracy is available. There have been at least 360 citizen initiated measures in the last 10 years in the US and at least 29 referenda on monetary and market integration in Europe have already been held.

The pioneering work on redistribution within a direct democracy framework was done by Romer (1975), Roberts (1977), Meltzer and Richard (1981).[7] The, commonly used, collective name for this class of models is the 'RRMR' model. We focus on this simple

[5] See, for instance, Persson and Tabellini (2000) for a comprehensive exposition of such issues.

[6] Persson and Tabellini (2000) survey the use of the median voter model to illuminate a wide range of economic issues.

[7] The pioneering work on the existence of a Condorcet winner in a unidimensional policy space is Black (1948).

canonical general equilibrium model with endogenous labour supply as the economic model through which we exposit our results.

Voters in the RRMR model care only about their narrow self-interest, hence, we call it the *selfish-voter model*. In the basic model, the problem is to choose a linear progressive income tax rate that accomplishes redistribution in the sense that the post tax distribution of income reflects relatively greater equality. Romer (1975) laid out the conditions for *single-peaked* preferences (which ensure a median voter equilibrium) when labor supply is endogenous. Roberts (1977) weakened the single-peakedness condition to *hierarchical-adherence*. Gans and Smart (1996) proposed the *single-crossing property* as an alternative method of determining a Condorcet winner and demonstrated that hierarchical-adherence and single-crossing are equivalent in a redistributive context.

We consider a two-stage game that is embedded within the general equilibrium RRMR model. In the first stage, voters (selfish and/or fair) vote on the redistributive tax rate, anticipating the outcome of the second stage. In the second stage voters, as worker-consumers, play a one-shot Nash game. Each voter chooses own-labour supply, given the labour supply choices of the other voters and given the tax rate determined from the first stage.

1.3. A critique of the literature on voting and fairness

There is a relatively small theoretical literature that considers fair voters. We concentrate below on the papers that are directly relevant to our work. The important model by Tyran and Sausgruber (2006) is not a general equilibrium model. These authors do not analyze the efficiency costs of redistribution and do not provide existence results for there to be a decisive median voter. Furthermore, they consider a more restricted tax policy choice than us. While we consider changes in a linear progressive income tax that affect all taxpayers they focus attention only on redistributions from the rich to the poor that leave the middle income voters unaffected[8].

Galasso (2003) modifies the RRMR model to allow for fairness concerns. However, his notion of fairness takes a very specific form. It is not fully consistent with any of the accepted models of fairness. In particular, in Galasso (2003), fair voters care about their own payoffs but suffer disutility through a term that is linear in their payoffs relative to the worse off voter in society.[9] Since this concern for fairness arises from a linear term,

[8] They do introduce a cost of such redistribution to the middle income voters, but it is not an integral part of the redistributive fiscal package considered.

[9] The latter term captures some notion of social justice. Others have included such a term to incorporate social justice e.g. Charness and Rabin (2002). However, they posit preferences, different from Galasso (2003), that are a convex combination of the total payoff of the group (this subsumes selfishness, in so far as one's own payoff is part of the total, and altruism) and a Rawlsian social welfare function. These sorts of models are able to explain positive levels of giving in dictator games, and reciprocity in trust and

preferences continue to be strictly concave and a median voter equilibrium exits. Within this framework there is greater redistribution when there is a mean preserving spread in inequality. However, this leaves open the question of whether a median voter equilibrium will exist in a standard model of fairness, such as the FS model, and what the properties of the resulting equilibrium will be?

1.4. Results and applications

Our main results are as follows. First, we demonstrate the existence of a Condorcet winner for an economy where voters have the FS-preferences for fairness. We allow the voters to differ in the extent of fairness (i.e. different degrees of envy and altruism). Insofar as one believes that issues of fairness and concern for others underpin the human tendency to redistribute, this result opens the way for modelling such concerns in the context of direct democracy. Second, the introduction of selfish poor (fair rich) voters in an economy where the median voter is fair (selfish) can have a large impact on the redistributive outcome and may actually reduce (increase) redistribution. In other settings, even in the presence of a majority of fair (selfish) voters the redistributive outcome is identical to that of an economy comprising solely of selfish (fair) voters. Third, we show how apparently inconsistent behavior can be accommodated within the model. In particular it is entirely consistent for fair voters to use social preferences when deciding on redistribution but act *as if* they maximized selfish preferences when choosing their own labour supply. Fourth, the model can be applied to several important economic issues such as the size of the welfare state; regional integration; and issues of culture, identity and immigration.

The plan of the paper is as follows. Section 2 describes the theoretical model and derives some preliminary results. Section 3 establishes the existence of a Condorcet winner for voters with heterogeneous social preferences. Section 4 considers an economy where there is a mixture of fair and selfish voters. Sections 5 and 6 discuss implications for the size of the welfare state, regional integration and issues of culture, identity and immigration. Finally, section 7 concludes. Proofs are relegated to the appendix.

2. Model

We consider a general equilibrium model as in Meltzer and Richard (1981). Let there be $n = 2m - 1$ voter-worker-consumers (henceforth, voters). Let the skill level of voter j be s_j, $j = 1, 2, ..., n$, where

$$0 < s_i < s_j < 1, \text{ for } i < j, \tag{2.1}$$

gift exchange games. However, they are not able to explain situations where an individual tries to punish others in the group at some personal cost, for instance, punishment in public good games.

Hence s_m is the median skill level. Denote the skill vector by $\mathbf{s} = (s_1, s_2, ..., s_n)$. Each voter has a fixed time endowment of one unit and supplies l_j units of labor and so enjoys $L_j = 1 - l_j$ units of leisure, where

$$0 \leq l_j \leq 1. \tag{2.2}$$

Labour markets are competitive and each firm has access to a linear production technology such that production equals $s_j l_j$. Hence, the wage rate offered to each voter coincides with the marginal product, i.e., the skill level, s_j. Thus, the before-tax income of voter j is given by

$$y_j = s_j l_j. \tag{2.3}$$

Note that 'skill' here need not represent any intrinsic talent, just ability to translate labour effort into income[10]. Let the average before-tax income be

$$\overline{y} = \frac{1}{n} \sum_{j=1}^{n} y_j. \tag{2.4}$$

We make the empirically plausible assumption that the income of the median-skill voter, y_m, is less than the average income,[11]

$$y_m < \overline{y}. \tag{2.5}$$

The government operates a linear progressive income tax that is characterized by a constant marginal tax rate, t, $t \in [0, 1]$, and a uniform transfer, b, to each voter that equals the average tax proceeds,

$$b = t\overline{y} \tag{2.6}$$

The budget constraint of voter j is given by

$$0 \leq c_j \leq (1 - t)\, y_j + b. \tag{2.7}$$

In view of (2.3), the budget constraint (2.7) can be written as

$$0 \leq c_j \leq (1 - t)\, s_j l_j + b. \tag{2.8}$$

[10] For example, a highly talented classical musician may be able to earn only a modest income, while a merely competent 'pop' musician may earn millions. In our model, the former would be classified as having a low s while the latter would be classified as having a high s. Similarly, in recent years, there has been a record level of skilled (in the ordinary sense of the word) migration into Britain from Eastern Europe. However, since they are predominantly accepting low pay work, they would be classified in our model as having low s.

[11] The assumption, that $y_m < \overline{y}$, is needed for Propositions 4, 5, 6 and 7 but not for Propositions 1, 2 or 3.

2.1. Preferences of Voters

We define a voter's preferences in two stages. First, let voter j have *own-utility* function, $\widetilde{u}_j(c_j, 1-l_j)$, defined over own-consumption, c_j, and own-leisure, $1-l_j$. We make the standard assumption that $\frac{\partial \widetilde{u}_j}{\partial c_j} > 0$. It follows that the budget constraint (2.8) holds with equality. Substituting $c_j = (1-t)\, s_j l_j + b$, from (2.8), into the utility function, $\widetilde{u}_j(c_j, 1-l_j)$, gives the following form for utility

$$u_j\left(l_j; t, b, s_j\right) = \widetilde{u}_j((1-t)\, s_j l_j + b, 1-l_j) \tag{2.9}$$

Second, and for the reasons stated in the introduction, voters have *other-regarding preferences* as in Fehr-Schmidt (1999). Under Fehr-Schmidt preferences the *FS-utility* of voter j, $U_j = U_j\left(l_j; \mathbf{l}_{-j}, t, b, \mathbf{s}\right)$, is as follows. Let $\mathbf{l}_{-j}$ be the vector of labour supplies of voters other than voter j. Then

$$\begin{aligned} U_j &= u_j\left(l_j; t, b, s_j\right) - \frac{\alpha_j}{n-1} \sum_{k \neq j} \max\left\{0, u_k\left(l_i; t, b, s_k\right) - u_j\left(l_j; t, b, s_j\right)\right\} \\ & \quad - \frac{\beta_j}{n-1} \sum_{i \neq j} \max\left\{0, u_j\left(l_j; t, b, s_j\right) - u_i\left(l_i; t, b, s_i\right)\right\}, \end{aligned} \tag{2.10}$$

where

$$\text{for } \textit{selfish} \text{ voters } \alpha_j = \beta_j = 0, \text{ so } U_j = u_j \tag{2.11}$$

$$\text{for } \textit{fair} \text{ voters } 0 < \beta_j < 1,\ \beta_j < \alpha_j, \text{ so } U_j \neq u_j \tag{2.12}$$

Thus, u_j is also the utility function of a selfish voter, as in the standard textbook model. From (2.10), the fair voter cares about own payoff (first term), payoff relative to those where inequality is disadvantageous (second term) and payoff relative to those where inequality is advantageous (third term). The second and third terms which capture respectively, *envy* and *altruism*, are normalized by the term $n-1$. Notice that in FS preferences, inequality is *self-centered*, i.e., the individual uses her own payoff as a reference point with which everyone else is compared to. Also, while the Fehr-Schmidt specification is directly in terms of monetary payoffs, it is also consistent with comparison of payoffs in utility terms. These and related issues are more fully discussed in Fehr and Schmidt (1999). From (2.12), β_j is bounded below by 0 and above by 1 and α_j. On the other hand, there is no upper bound on α_j.[12]

2.2. Sequence of moves

We consider a two-stage game. In the first stage all voters vote directly and sincerely on the redistributive tax rate. Should a median voter equilibrium exist, then the tax rate

[12] $\beta_j \geq 1$ would imply that individuals could increase utility by simply destroying all their wealth; this is counterfactual. The restriction $\beta_j < \alpha_j$ is based on experimental evidence. Finally the lack of an upper limit on α_j implies that 'envy' is unbounded.

preferred by the median voter is implemented. In the second stage all voters make their labour supply decision, conditional on the tax rate chosen by the median voter in the first stage. On choosing their labour supplies in the second stage, the announced first period tax rate is implemented and transfers made according to (2.6).

In the second stage the voters play a one-shot Nash game: each voter, j, chooses his/her labour supply, l_j, given the vector, $\mathbf{l}_{-j}$, of labour supplies of the other voters, so as to maximize his/her FS-utility (2.10). In the first stage, each voter votes for his/her preferred tax rate, correctly anticipating second stage play.

The solution is by backward induction. We first solve for the Nash equilibrium in labour supply decisions of voters conditional on the announced tax rates and transfers. The second stage decision is then fed into the first stage FS-utilities to arrive at the indirect utilities of voters, which are purely in terms of the tax rate. Voters then choose their most desired tax rates which maximize their indirect FS-utilities, with the proposal of the median voters being the one that is implemented.

2.3. Labour supply decision of taxpayers (second stage problem)

Given the tax rate, t, and the transfer, b, both determined in the first stage (see Section 2.5, below), the voters play a one-shot Nash game (in the subgame determined by t and b). Each voter, j, chooses own labour supply, l_j, so as to maximize his/her FS-utility (2.10), given the labour supplies, $\mathbf{l}_{-j}$, of all other voters.

Remark 1 *: (Weighted utilitarian preferences) First define the sets D_j and A_j as the set of voters with respect to whom voter j has respectively, disadvantageous and advantageous inequity. So $D_j = \{k : k \neq j \text{ and } u_k - u_j > 0\}$ and $A_j = \{i : i \neq j \text{ and } u_j - u_i > 0\}$. Denote the respective cardinalities of these sets by $|D_j|$ and $|A_j|$. Economists working in the area of redistribution, in a range of applications, like to think in terms of weighted utilitarian preferences when they formulate a social objective. In fact, FS-utility (2.10) can be written in a way that is reminiscent of the weighted utilitarian form:*

$$U_j\left(l_j; \mathbf{l}_{-j}, t, b, \mathbf{s}\right) = \omega_{jj} u_j\left(l_j; t, b, s_j\right) + \sum_{i \neq j}^{n} \omega_{ij} u_i\left(l_i; t, b, s_i\right), \tag{2.13}$$

where

$$\begin{array}{lll} i < j & \Rightarrow & \omega_{ij} = \frac{\beta_j}{n-1} > 0, \\ i = j & \Rightarrow & \omega_{jj} = 1 - \frac{|A_j|\beta_j}{n-1} + \frac{|D_j|\alpha_j}{n-1} > 0, \\ i > j & \Rightarrow & \omega_{ij} = -\frac{\alpha_j}{n-1} < 0. \end{array} \tag{2.14}$$

Furthermore, the weights sum up to one i.e.

$$\sum_{i=1}^{n} \omega_{ij} = 1. \tag{2.15}$$

In particular, for selfish voters (2.11) and (2.14) give

$$\textit{If voter } j \textit{ is selfish, then } \omega_{jj} = 1 \textit{ and } \omega_{ij} = 0 \;\; (i \neq j)\,. \tag{2.16}$$

Since in (2.13), $u(l_i; t, b, s_i)$, $i \neq j$, enter additively, and $\omega_{jj} > 0$, it follows that maximizing the FS-utility, $U_j(l_j; \mathbf{l}_{-j}, t, b, \mathbf{s})$, with respect to l_j, given $\mathbf{l}_{-j}$, t, b and $\mathbf{s}$, is equivalent to maximizing own-utility, $u_j(l_j; t, b, s_j)$, with respect to l_j, given t, b and s_j. We summarize this in the following Proposition.

Proposition 1 *: In the second stage of the game, voter j, whether fair or selfish, chooses own labour supply, l_j, so as to maximize own-utility, $u_j(l_j; t, b, s_j)$, given t, b and s_j.*

2.4. Simplifying assumptions

In common with the literature, we assume that all voters have the same own-utility function, $\widetilde{u}$, although, of course, their realized utility will depend on their realized consumption, c_i, and their realized leisure, $1 - l_i$. Thus

$$\widetilde{u}_i(c_i, 1 - l_i) = \widetilde{u}(c_i, 1 - l_i). \tag{2.17}$$

Furthermore, we assume that the own-utility function is quasi-linear, with constant elasticity of labour supply, which is the most commonly used functional form in various applications of the median voter theorems.

$$\widetilde{u}(c, 1 - l) = c - \frac{\epsilon}{1+\epsilon} l^{\frac{1+\epsilon}{\epsilon}}, \tag{2.18}$$

where ϵ is a constant satisfying

$$0 < \epsilon \leq 1, \tag{2.19}$$

and is the elasticity of labour supply.[13] The case $\epsilon = 1$ has special significance in the literature. In this case,

$$\widetilde{u}(c, 1 - l) = c - \frac{1}{2} l^2 \tag{2.20}$$

Meltzer and Richard (1981) use (2.20) to derive the celebrated result that the extent of redistribution varies directly with the ratio of the mean to median income. Piketty (1995) restricts preferences to the quasi-linear case with disutility of labour given by the quadratic form, (2.20). Benabou and Ok (2001) do not actually consider a production side and their model has exogenously given endowments which evolve stochastically. Benabou (2000)

[13] A large number of studies suggest labour supply elasticities consistent with (2.19) (see, for example, Pencavel (1986) and Killingworth and Heckman (1986)). Those that do not (for example, negative labour supply elasticities) may be due to estimating misspecified models (see Camerer and Loewenstein (2004), Chapter 1, 'Labor Economics', pp33-34).

considers the additively separable case with log consumption and disutility of labor given by the constant elasticity case, (2.18).

Substituting $c_j = (1-t)\, s_j l_j + b$ in (2.18), the own-utility function of voter j, we get

$$u_j\left(l_j; t, b, s_j\right) = u\left(l_j; t, b, s_j\right) = (1-t)\, s_j l_j + b - \frac{\epsilon}{1+\epsilon} l_j^{\frac{1+\epsilon}{\epsilon}}. \tag{2.21}$$

We list, in lemmas 1, 2, below, some useful results.

Lemma 1 *(Labour supply): Given t, b and s_j, the unique labour supply for voter j, $l_j = l\left(t, b, s_j\right)$, that maximizes utility (2.21), is given by*

$$l_j = l\left(t, b, s_j\right) = (1-t)^{\epsilon}\, s_j^{\epsilon},$$

and is independent of b.

Substituting labour supply, $l\left(t, b, s_j\right)$, given by Lemma 1, into (2.3) gives before-tax income:

$$y_j\left(t, b, s_j\right) = (1-t)^{\epsilon}\, s_j^{1+\epsilon}. \tag{2.22}$$

Define $\overline{S}(n)$ to be the 'weighted average of skills' when there are n voters, in the following sense.

$$\overline{S}(n) = \frac{1}{n} \Sigma_{i=1}^{n} s_i^{1+\epsilon} \tag{2.23}$$

From (2.4), (2.5), (2.22) and (2.23) we get, for the median skill level, s_m,

$$s_m^{1+\epsilon} < \overline{S}(n), \tag{2.24}$$

Substituting labour supply in (2.6) we get,

$$b\left(t, \mathbf{s}\right) = t\,(1-t)^{\epsilon}\, \overline{S}(n). \tag{2.25}$$

Substituting labour supply in (2.21) we get the indirect utility function corresponding to the own-utility of voter j:

$$v_j = v\left(t, b, s_j\right) = u\left(l\left(t, b, s_j\right); t, b, s_j\right) = b + \frac{(1-t)^{1+\epsilon}}{1+\epsilon} s_j^{1+\epsilon}. \tag{2.26}$$

Lemma 2 *(Properties of the indirect utility function corresponding to own-utility):*
(a) $\frac{\partial v(t,b,s)}{\partial b} = 1$,
(b) $\frac{\partial v(t,b,s)}{\partial s} = (1-t)^{1+\epsilon}\, s^{\epsilon}$. *Hence,* $\left[\frac{\partial v(t,b,s)}{\partial s}\right]_{t=1} = 0$ *and* $t \in [0,1) \Rightarrow \frac{\partial v(t,b,s)}{\partial s} > 0$.

Lemma 2 shows that an increase in transfer payment, b, increase utility one for one and that for any interior tax rate, indirect utility is strictly increasing in the level of skill.

2.5. Preferences of voters over redistribution (the first stage problem)

Given the second stage choice of labor supplies by the voters (Proposition 1 and Lemma 1), the first stage problem is to choose the redistributive tax rate, t (and, consequently, the transfer, b, given by (2.3), (2.4) and (2.6)). For this purpose, we calculate the voters' indirect utility functions corresponding to their FS-preferences.

To find the indirect utility function, for voter j, $V_j = V_j\left(t, b, \alpha_j, \beta_j, \mathbf{s}\right)$, that corresponds to his/her FS-preferences, substitute labour supply (Lemma 1) into (2.10), and take account of (2.26) and Lemma 2b to get

$$\begin{aligned}
V_j &= u\left(l\left(t,b,s_j\right);t,b,s_j\right) - \frac{\alpha_j}{n-1}\sum_{k\neq j}\max\left\{0, u\left(l\left(t,b,s_k\right);t,b,s_k\right) - u\left(l\left(t,b,s_j\right);t,b,s_j\right)\right\} \\
&\quad -\frac{\beta_j}{n-1}\sum_{i\neq j}\max\left\{0, u\left(l\left(t,b,s_j\right);t,b,s_j\right) - u\left(l\left(t,b,s_i\right);t,b,s_i\right)\right\}, \\
&= v\left(t,b,s_j\right) - \frac{\alpha_j}{n-1}\sum_{k\neq j}\max\left\{0, v\left(t,b,s_k\right) - v\left(t,b,s_j\right)\right\} \\
&\quad -\frac{\beta_j}{n-1}\sum_{i\neq j}\max\left\{0, v\left(t,b,s_j\right) - v\left(t,b,s_i\right)\right\}, \\
&= v\left(t,b,s_j\right) - \frac{\alpha_j}{n-1}\sum_{k>j}\left[v\left(t,b,s_k\right) - v\left(t,b,s_j\right)\right] - \frac{\beta_j}{n-1}\sum_{i<j}\left[v\left(t,b,s_j\right) - v\left(t,b,s_i\right)\right], \\
&= b + \frac{(1-t)^{1+\epsilon}}{1+\epsilon}\left[s_j^{1+\epsilon} - \frac{\alpha_j}{n-1}\sum_{k>j}\left(s_k^{1+\epsilon} - s_j^{1+\epsilon}\right) - \frac{\beta_j}{n-1}\sum_{i<j}\left(s_j^{1+\epsilon} - s_i^{1+\epsilon}\right)\right]. \qquad (2.27)
\end{aligned}$$

For any voter j, define the following three useful constants[14], $S_j^-(n)$, $S_j^+(n)$ and $\phi_j(n)$:

$$S_j^-(n) = \frac{1}{n-1}\sum_{k>j}\left(s_k^{1+\epsilon} - s_j^{1+\epsilon}\right) > 0, \text{ for } j < n, \qquad (2.28)$$

$$S_j^+(n) = \frac{1}{n-1}\sum_{i<j}\left(s_j^{1+\epsilon} - s_i^{1+\epsilon}\right) > 0, \text{ for } j > 1, \qquad (2.29)$$

$$\phi_j(n) = s_j^{1+\epsilon} - \alpha_j S_j^-(n) - \beta_j S_j^+(n). \qquad (2.30)$$

The constants $S_j^-(n)$ and $S_j^+(n)$ are function of the exogenous parameters, n (number of voters) and $\mathbf{s}$ (the skills vector). In addition to these, $\phi_j(n)$ is also a function of ϵ (elasticity of labour supply), α_j (disadvantageous inequity parameter) and β_j (advantageous inequity parameter).

[14] We use the standard mathematical conventions that $\sum_{i\in\emptyset} x_i = 0$, where $\emptyset$ is the empty set. In particular,

$$\sum_{k>n}\left(v_k - v_j\right) = \sum_{i<1}\left(v_j - v_i\right) = S_1^+(n) = S_n^-(n) = 0.$$

Remark 2 : *From (2.27), (2.28) and (2.29), we see that S_j^- and S_j^+ are, respectively, directly proportional to disadvantageous and advantageous inequality experienced by voter j.*

Substitute from (2.28) - (2.30) into (2.27) to get

$$\begin{aligned} V_j\left(t, b, \alpha_j, \beta_j, \mathbf{s}\right) &= b + \frac{(1-t)^{1+\epsilon}}{1+\epsilon}\left[s_j^{1+\epsilon} - \alpha_j S_j^-(n) - \beta_j S_j^+(n)\right], \\ &= b + \frac{(1-t)^{1+\epsilon}}{1+\epsilon}\phi_j(n). \end{aligned} \tag{2.31}$$

When voter j votes on the tax rate, t, and the transfer, b, he/she takes into account the government budget constraint (2.25). Hence, substitute $b(t, \mathbf{s})$, given by (2.25), into (2.31), to get

$$W_j\left(t, \alpha_j, \beta_j, \mathbf{s}\right) = t(1-t)^\epsilon \overline{S}(n) + \frac{(1-t)^{1+\epsilon}}{1+\epsilon}\phi_j(n). \tag{2.32}$$

Voter j votes for that tax rate, t, that maximizes social welfare from his/her own point of view, as given by his/her FS-indirect utility function (2.32).

In Proposition 2, below, we give some results on the existence of optimal (or most preferred) taxes for any individual voter who at that first stage is asked to state his/her choice of the most preferred tax rate. The next section, Section 3, will look at the equilibrium tax rate that is actually implemented by society.

Proposition 2 *(Existence of optimal tax rates):*
(a) Given α_j, β_j and $\mathbf{s}$, $W_j\left(t, \alpha_j, \beta_j, \mathbf{s}\right)$ attains a maximum at some $t_j \in [0, 1)$.
(b) If $\overline{S}(n) - \phi_j(n) \leq 0$, then the tax rate preferred by voter j, is $t_j = 0$.
(c) If $\overline{S}(n) - \phi_j(n) > 0$, then the tax rate, t_j, preferred by voter j, is unique, satisfies $0 < t_j < 1$ and is given by

$$t_j = \frac{\overline{S}(n) - \phi_j(n)}{(1+\epsilon)\overline{S}(n) - \phi_j(n)}. \tag{2.33}$$

Furthermore, in this case, t_j is non-decreasing in α_j, β_j. In particular, for any $1 < j < n$, t_j is strictly increasing in α_j, β_j.
(d) $t_n < t_1$.

The results in Proposition 2 are mainly technical results, most of which follow directly from the first order conditions of the voters. The final result in Proposition 2(c) is, however, deserving of further comment. The intuition is that an increase in α_j increases disutility arising from disadvantageous inequity. By increasing the redistributive tax rate, the voter reduces, relatively, the utility of anyone who is richer, hence, reducing disadvantageous inequity. On the other hand, an increase in β_j increases disutility arising from advantageous inequity. An increase in the redistributive tax benefits everyone poorer than the voter relatively more, thus, reducing advantageous inequity.

Recall, from Proposition 1, that voter j, whether fair or selfish, chooses own labour supply so as to maximize own-utility. By contrast, from Proposition 2(c), we see that the tax rate preferred by voter j will depend on his/her fairness parameters , α_j and β_j. We elaborate on this point more fully in Section 2.6, below.

2.6. An explanation of (apparent) inconsistent behavior, based on Fehr-Schmidt preferences

From Proposition 1, a fair voter, despite having social preferences chooses labour supply exactly like a selfish voter who does not have social preferences. However, when making a decision on the redistributive tax rate, the same fair voter uses social preferences to choose the tax rate in a manner that the selfish voter does not. In other words, in two separate domains, labour supply and redistributive choice, the fair voter behaves *as if* he had selfish preferences in the first domain and social preferences in the second. We emphasize 'as if' because, of course, the voter has identical underlying social preferences in both domains.

Contrary to the assumption in standard economics, a large and emerging body of empirical evidence clearly suggest that individuals do not have a complete and consistent preference ordering over all states. The framing of choices can, for instance, have a very large impact on the outcome.[15] The problem does not go away once professionals are presented with choices that they must make on a regular basis.[16] The mental accounting literature pioneered by Richard Thaler raises similar issues of incomplete preferences.[17]

Individuals, when making a private consumption decision might act so as to maximize their selfish interest. But in a separate role as part of the government, as a school governor or as a voter, could act so as to maximize some notion of public well being. An individual, when buying an air ticket, might also buy travel insurance, thus exhibiting risk averse behavior. But, the same individual, when he reaches his holiday destination, may visit a gambling casino and exhibit risk loving behavior there. Individuals might, for instance, send their own children to private schools (self interest) but could at the same time vote for more funding to government run schools in local or national elections (public inter-

[15] The following is just one example out of hundreds described in Kahneman and Tversky (2000). It is problems 9 and 10 from Quattrone and Tversky (1988). In a survey, 64% of respondents thought that an increase in inflation from 12% to 17% was acceptable if it lead to a reduction in unemployment from 10% to 5%. However, only 46% of the respondents thought that exactly the same increase in inflation (from 12% to 17%) was acceptable if it increased employment from 90% to 95%.

[16] In a well known example, Kahneman and Tversky find, in the context of medical decisions, that the choice between various programs depends on whether the choices are posed in terms of *lives saved* or *lives lost* (see page 5 in Kahneman and Tversky (2000)).

[17] See Part 4 of the book by Kahneman and Tversky (2000).

est). Thus, individuals can put on different hats in different situations (a form of mental accounting).

We *do not* assume inconsistent preferences. Rather, a decision maker, despite having identical FS-preferences in two different domains, behaves *fairly* in one domain but *selfishly* in the other. This opens up yet another dimension to the literature on inconsistency of preferences. To the best of our knowledge, this point has not been recognized previously.

3. Existence of a Condorcet winner when voters have heterogenous social preferences

We now ask if a median voter equilibrium exists when voters have heterogenous social preferences?[18]

As expected, *single-peakedness* of preferences turns out to be a very strong restriction. We instead use the *single-crossing property* of Gans and Smart (1996).

Definition 1 : *Let $\prec$ be an ordering of $\{1, 2, ..., n\}$. Then the median voter, according to the ordering $\prec$, is the voter with skill level $s_{\widehat{m}}$, where $\widehat{m}$ is the median of $\{1, 2, ..., n\}$ according to the order $\prec$.*

Definition 2 : *(Gans and Smart, 1996) The 'single-crossing' property holds if for tax rates t, T and voters j, J,*

$$t < T,\ j \prec J,\ W_j\left(t, \alpha_j, \beta_j, \mathbf{s}\right) > W_j\left(T, \alpha_j, \beta_j, \mathbf{s}\right) \Rightarrow W_J\left(t, \alpha_J, \beta_J, \mathbf{s}\right) > W_J\left(T, \alpha_J, \beta_J, \mathbf{s}\right).$$[19]

Lemma 3 : *(Gans and Smart, 1996) The 'single-crossing' property holds if $-\frac{\partial V_j}{\partial t} / \frac{\partial V_j}{\partial b}$ is an increasing function of j (where j is ordered according to $\prec$).*

Lemma 4 : *(Gans and Smart, 1996) If the 'single-crossing' property holds, then the median voter, voter $\widehat{m}$, is decisive, i.e., a majority chooses the tax rate that is optimal for the voter with skill level $s_{\widehat{m}}$, where $\widehat{m}$ is the median of $\{1, 2, ..., n\}$ in the ordering $\prec$.*

The proofs of lemmas 3, 4 can be found in Gans and Smart (1996). The intuition behind these lemmas is straightforward to illustrate in the following diagram in (b, t) space. In Figure 3.1, the aggregate budget constraint of the economy, given in (2.6), is shown by the straight upward sloping line, BB', that has slope $\overline{y}$. We show two indifference curves

[18] For example, when j voters are selfish while $n - j$ voters are fair, where $j \in \{0, 1, ..., n\}$.

[19] Here we use "$<$" to denote the usual ordering of real numbers. In the more general setting of Gans and Smart (1996), "$<$" is used to denote several (possibly different) abstract orderings. Our "$<$" could be one of them. In particular, a literal translation of Gants and Smart (1996) would give: $T < t$, $j \prec J$, $W_j\left(t, \alpha_j, \beta_j, \mathbf{s}\right) > W_j\left(T, \alpha_j, \beta_j, \mathbf{s}\right) \Rightarrow W_J\left(t, \alpha_J, \beta_J, \mathbf{s}\right) > W_J\left(T, \alpha_J, \beta_J, \mathbf{s}\right)$, where "$W_j\left(t, \alpha_j, \beta_j, \mathbf{s}\right) > W_j\left(T, \alpha_j, \beta_j, \mathbf{s}\right)$ " has the usual meaning "$W_j\left(t, \alpha_j, \beta_j, \mathbf{s}\right)$ is greater than $W_j\left(T, \alpha_j, \beta_j, \mathbf{s}\right)$ " but "$T < t$ " means "t is less than T ".

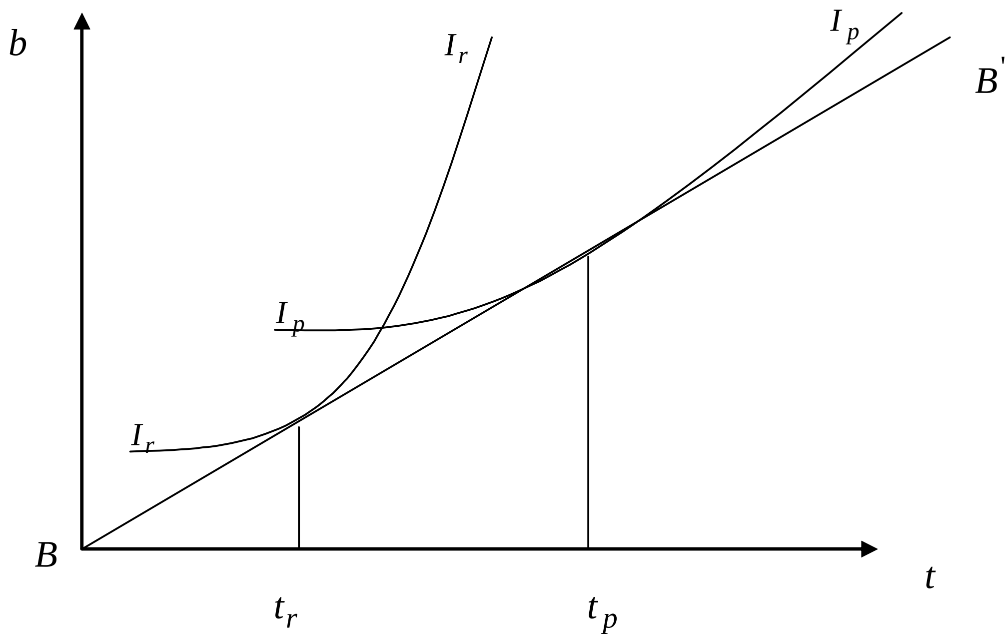

Figure 3.1: **Illustration of the Gans-Smart single crossing property.**

belonging to a poor (I_pI_p) and a rich (I_rI_r) voter respectively. Lemma 3 requires that $-\frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$ be an increasing function of j i.e. I_pI_p is relatively flatter (we show this in section 3.1 below). The most preferred tax rate of the poor, t_p, is greater than the most preferred tax rate of the rich, t_r. Hence, the preferred tax rates can be uniquely ordered from the rich to the poor. This monotonicity property gives rise to Lemma 4.

3.1. Existence of a Condorcet winner

Definition 3 *: A tie occurs if, for some $i, j, i \neq j$ and some $t \in [0, 1)$, we have $\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} = \frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$. Conversely, no tie occurs if for all $i, j, i \neq j$, we have $\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} \neq \frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$ for all $t \in [0, 1)$.*

Lemma 5 *: Suppose $i \neq j$. If $\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} < \frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$ for some $t \in [0, 1)$, then $\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} < \frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$ for all $t \in [0, 1)$.*

Lemma 6 *: If no tie occurs then, for each $i, j, i \neq j$, we have either $\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} < \frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$ for all $t \in [0, 1)$ or $\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} > \frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$ for all $t \in [0, 1)$.*

In view of Lemmas 5 and 6, the ordering defined in Definition 4, below, is well defined.

Definition 4 *(The Gans-Smart ordering): We define the order $\prec$ on $\{1, 2, ..., n\}$ by: $i \prec j$ if, and only if, for some $t \in [0, 1)$, we have $-\frac{\partial V_i}{\partial t}/\frac{\partial V_i}{\partial b} < -\frac{\partial V_j}{\partial t}/\frac{\partial V_j}{\partial b}$. We call this the Gans-Smart ordering of $\{1, 2, ..., n\}$.*

Lemma 7 *: $1 \prec n$.*

Lemma 7 is useful for small n. For example, for $n = 3$, we need not consider all six possible orderings, but only the three orderings $1 \prec 2 \prec 3$, $1 \prec 3 \prec 2$ and $2 \prec 1 \prec 3$.

Proposition 3 *(Existence of a Condorcet winner): If no tie occurs, then a majority prefers the tax rate that is optimal for the median-voter in the Gans-Smart ordering.*

Remark 3 *: In the light of Lemmas 5 and 7, Proposition 3 holds in general for our model, except for those $\frac{n(n-1)}{2} - 1$ special cases, where the parameters are such as to yield ties.*

In light of the emerging evidence, it increasingly appears that issues of fairness and concern for others are important human motivations that play a significant part in the actual design of redistributive tax policies. Insofar as actual applications of a direct democracy framework largely use quasi-linear preferences and constant elasticity of labour supply, Proposition 3 establishes the existence of a Condorcet winner when voters have heterogenous social preferences. Hence, the result in Proposition 3 is of potential significance for political economy models that seek to incorporate social preferences.

4. Voter Heterogeneity in a three-voting-classes model

Experimental evidence indicates the following:[20] (1) There is a large fraction (roughly 40-60 percent depending on the experiment) of purely self-interested individuals. (2) The behavior of these self-interested individuals accords well with the predictions of the selfish preferences model, even in bilateral interactions. Therefore, an important and interesting issue for theoretical and empirical research is to examine the implications of heterogeneity of preferences in the population. A range of theoretical and experimental work indicates that even a minority of individuals with social preferences can significantly alter the standard predictions[21].

The techniques developed in this paper apply to an n-voter model (for any positive odd integer, n). However, to keep the analysis simple, we concentrate on a 3-voter economy ($n = 3$). If we can interpret the three voters as being representative voters belonging to three classes: low-income, middle-income and high-income, then our analysis is more than merely illustrative. These classes correspond to the low-skill, middle-skill and high-skill voters and so we shall use the skill and income ranking interchangeably.

[20] See for intance, Fehr and Fischbacher (2002).

[21] For one (of many) such result, see, for instance, Fehr et al. (2007). They show that when selfish workers are paired with reciprocal firms who are expected to reward good performance with bonus contracts, then such workers behave (out of pure self interest) as if they have social preferences.

Subsection 4.1 is a prelude to the main results in subsection 4.2. In subsection 4.1 we consider the general 3-voter model (α_j, β_j are general). To derive sharper results, in subsection 4.2, we restrict α_j and β_j for fair voters so that $\alpha_j = \alpha$ and $\beta_j = \beta$ (as before, for selfish voters $\alpha_j = \beta_j = 0$).

4.1. Preliminary Results

Suppose that there is heterogeneity among the voters in the sense that the fairness parameters α_j, β_j, $j = 1, 2, 3$ could be different across the three voters. Proposition 3 guarantees the existence of a Condorcet winner. But there is no guarantee that the median skill voter is decisive in making the redistributive policy choice. Proposition 4, below, establishes that in this case, all three outcomes, i.e. the decisive median voter is respectively a low-income, middle-income and a high-income voter, are possible.

Proposition 4 : *Define the two constants λ_1 and λ_2 as follows*

$$\lambda_1 = (2 - 2\beta_3 + \alpha_2 + \beta_2)\left(s_3^{1+\epsilon} - s_2^{1+\epsilon}\right) + (\beta_2 - \beta_3)\left(s_2^{1+\epsilon} - s_1^{1+\epsilon}\right),$$

$$\lambda_2 = (2 - \beta_2 + \alpha_1)\left(s_2^{1+\epsilon} - s_1^{1+\epsilon}\right) + (\alpha_1 - \alpha_2)\left(s_3^{1+\epsilon} - s_2^{1+\epsilon}\right),$$

then the following hold:
(a) $\lambda_1 \leq 0 \Rightarrow \beta_3 > \frac{2}{3}$.
(b) If $\lambda_1 > 0$ *and* $\lambda_2 > 0$, *then the median-skill voter is decisive and* $t_3 < t_2 < t_1$.
(c) If $\lambda_2 < 0$, *then the low-skill voter is decisive and* $t_3 < t_1 < t_2$.
(d) If $\lambda_1 < 0$, *then the high-skill voter is decisive and* $t_2 < t_3 < t_1$.

Corollary 1 : *If* $\alpha_1 \geq \alpha_2$ *and* $\beta_2 \geq \beta_3$, *then the median-skill voter is decisive and* $t_3 < t_2 < t_1$. *This result holds, in particular, if lower skill voters are fairer than higher skill voters.*

The result in Proposition 4 is fairly intuitive. Consider, for instance, part (c). It is easy to see that $\lambda_2 < 0$ is equivalent to

$$\alpha_1 + (2 - \beta_2 + \alpha_1)\frac{S_2^+(3)}{S_2^-(3)} < \alpha_2. \tag{4.1}$$

Thus, $\lambda_2 < 0$ if α_2 is high enough, in the sense made precise by (4.1), in which case the poorest skill voter becomes decisive.[22] The intuition is that if α_2 is high enough, then the middle income voter derives a huge negative disutility from envy (which arises from

[22]Other factors which are conducive to the inequality in (4.1) holding true are as follows. A high α_1, low β_2 and a low values of $\frac{S_2^+(3)}{S_2^-(3)}$ (which is the ratio of advantageous to disadvantageous inequality for voter 2).

having a lower income relative to the high income voter). In order to moderate the effect of envy, the middle income voter's optimal tax rate is even higher than that chosen by the low income voter. In affect, one gets the following ordering of the most preferred tax rates, $t_3 < t_1 < t_2$. In a pairwise contest, the tax rate preferred by the low income voter will defeat the tax rate preferred by any of the other two voters.

Analogously, in part (d) when $\lambda_1 < 0$, in a pairwise contest, the tax rate preferred by the high income voter will defeat the tax rate preferred by any of the other two voters. Part (b) of the proposition and the corollary show the (standard) cases where the median skill voter is also the decisive median voter.■

4.2. Main Results

We now give the main results of this section. For tractability of analysis, we modify our earlier assumption of heterogeneity among fair voters by the following assumption. For fair voters:

$$\alpha_j = \alpha \text{ and } \beta_j = \beta,\ j = 1, 2, 3. \tag{4.2}$$

However, for selfish voters $\alpha_j = \beta_j = 0$ (see 2.11), as before. Hence, there is intra-group homogeneity of preferences within the groups of fair and selfish voters but inter-group heterogeneity across the two groups. A second source of heterogeneity across all voters is, of course, the level of skill.

For the n-voter model, there are 2^n cases to consider. Here, there are $2^3 = 8$ possible combinations of voters. Denoting by S and F respectively, a selfish and a fair voter, the 8 possible combinations of the voters (each combination arranged in order of increasing skill level from left to right) are: SSS, SSF, SFS, SFF, FSS, FSF, FFS, FFF.[23] Since the experimental evidence is that 1/3 to 2/3 of subjects are selfish, the most important cases are SSF, SFS, SFF, FSS, FSF, FFS.

We first collect some intermediate results in Proposition 5, which enables us to derive the main result in this section in Proposition 6 below.

Proposition 5 : *Let t_j^S be the tax rate preferred by the j-th voter, if that voter is selfish ($\alpha_j = \beta_j = 0$) and let t_j^F be the tax rate preferred by the j-th voter, if that voter is fair ($\alpha_j = \alpha$, $\beta_j = \beta$, $0 < \beta < 1$, $\beta < \alpha$). Then, for the three voter model:*
(a) A lower skill selfish voter prefers a higher tax rate than a higher skill selfish voter, $t_3^S < t_2^S < t_1^S$.
(b) A lower skill fair voter prefers a higher tax rate than a higher skill fair voter, $t_3^F < t_2^F < t_1^F$.

[23] For instance, SFF denotes an economy in which the lowest skill voter is selfish and the middle and high skill voters are both fair.

(c) A fair voter prefers a higher tax rate than a selfish voter of the same skill level, $t_j^S \leq t_j^F$, where the inequality is strict in, and only in, the following cases:
(i) $j = 1$, (ii) $j = 2$, (iii) $j = 3$ and $\beta_3 > \frac{2}{3}$.

Proposition 5, parts (a) and (b) hold because a lower skill voter, whether selfish or fair, benefits more from a redistributive tax than a higher skill voter. Part (c) holds because, in addition to the usual selfish reasons for desiring a redistributive tax, a fair voter cares about lower-skill voters and is envious of higher skill voters.

In any mixture of the two types of voters, the redistributive outcome is altered if and only if, relative to the case of purely selfish or purely fair voters, the identity of the median voter alters. Proposition 6, below, checks the various cases.

Using (2.28), (2.29), define the two constants θ_1, θ_2 respectively as

$$\theta_1 = \frac{s_2^{1+\epsilon} - s_1^{1+\epsilon}}{s_3^{1+\epsilon} - s_2^{1+\epsilon}} = \frac{S_2^+(3)}{S_2^-(3)};\ \theta_2 = \frac{2}{2+\theta_1}.$$

The constant θ_1 is, for the three voter case, directly proportional to the ratio of advantageous to disadvantageous inequality for voter 2. θ_2 depends inversely on θ_1.

Proposition 6 *: For the three voter model,*
(a) The median-skill voter is decisive, and $t_3 < t_2 < t_1$, in the following cases:
(i) SSS, FSS, FFS and FFF,
(ii) SFS and SFF, if $\frac{\alpha}{2-\beta} < \theta_1$,
(iii) SSF and FSF, if $\beta < \theta_2$,
(b) The low-skill voter is decisive, and $t_3 < t_1 < t_2$, in cases SFS and SFF, if $\frac{\alpha}{2-\beta} > \theta_1$,
(c) The high-skill voter is decisive, and $t_2 < t_3 < t_1$, in cases SSF and FSF, if $\beta > \theta_2$.

In cases SSS, FSS, FFS and FFF the median-skill voter is decisive in the redistributive tax choice (Proposition 6 a(i)). Hence, in these four cases, the redistributive outcome in the case of a mixture of voter types is identical to an economy in which all voters are of the same type as the median-skill voter. So, for instance, the redistributive outcome in the FSS economy is the same as that in a SSS economy while that in the FFS economy is identical to the FFF economy.

The same is also true for the other four cases SFS, SFF, SSF and FSF provided that the relevant upper bounds on α and/or β are satisfied (Proposition 6a(ii) and a(iii)). In each of these eight cases, the tax rate implemented is the tax rate, t_2, preferred by the median-skill voter.

However, if the upper bounds in Proposition 6 a(ii) and a(iii) are not satisfied, then the median-skill voter is no more decisive. In cases SFS and SFF, the low-skill (and selfish) voter becomes decisive, and the implemented tax rate is t_1, (Proposition 6b). In cases

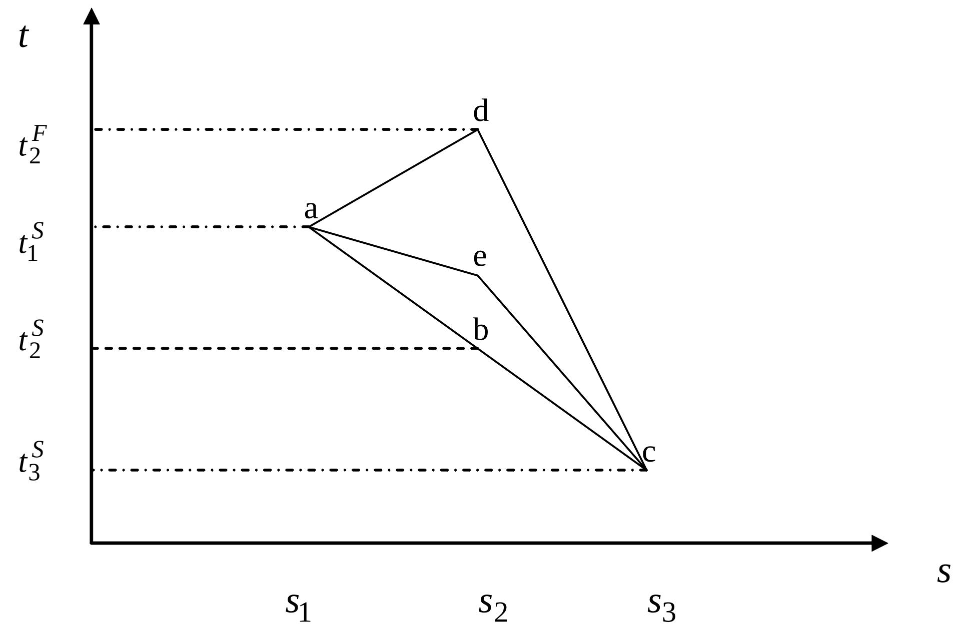

Figure 4.1: The SSS and SFS economies

SSF and FSF the high skill (and fair) voter becomes decisive, and the implemented tax rate is t_3, (Proposition 6c). Note that in all cases, *the implemented tax rate is the median tax rate and not, necessarily, the tax rate preferred by the median-skill voter.*

Before we proceed to discuss the intuition, consider the results in the following four particularly striking cases.

1. For SFS, the majority of voters are *selfish* yet, if $\frac{\alpha}{2-\beta} < \theta_1$, then a majority vote for the tax rate preferred by the median-skill *fair* voter (Proposition 6a(ii)).

2. For SFF, the majority of voters are *fair* yet, if $\frac{\alpha}{2-\beta} > \theta_1$, then a majority vote for the tax rate preferred by the low-skill *selfish* voter (Proposition 6b).

3. For SSF, the majority of voters are *selfish* yet, if $\beta > \theta_2$, then a majority vote for the tax rate preferred by the high-skill *fair* voter (Proposition 6c).

4. For FSF, the majority of voters are *fair* yet, if $\beta < \theta_2$, then a majority vote for the tax rate preferred by the median-skill *selfish* voter (Proposition 6 a(iii)).

In order to understand the intuition behind the results more fully, consider the SFS economy when the restriction $\frac{\alpha}{2-\beta} > \theta_1$ is satisfied (see Proposition 6b). We show the relevant information in Figure 4.1.

Denote by t_j^S and t_j^F to be the most preferred tax rates of voter j if he is respectively, selfish and fair.[24] From Proposition 6a(i), in an SSS economy, the median skill voter is decisive and so $t_3^S < t_2^S < t_1^S$. This is shown in figure 4.1 by the curve labelled *abc*.

Now suppose that we replace the representative *selfish* median skill voter in an SSS economy by a representative *fair* voter to generate the SFS economy. Since we assume that the inequality $\frac{\alpha}{2-\beta} > \theta_1$ holds, from Proposition 6b, for the SFS economy, we get the ranking of most preferred tax rates to be $t_3^S < t_1^S < t_2^F$. This is shown in figure 4.1 by the curve *adc*. The tax rate of the low skill voter, t_1^S, is now able to defeat any of the other two tax rates in a pairwise contest (either of the other two classes of voters finds it optimal to align with the low skill voter against a tax proposal of the third voter). The optimal tax rate of the lowest skill voter becomes the decisive redistributive choice. Hence, in moving from the SSS to the SFS economy, there is a potentially large jump in the tax rate from t_2^S to t_2^F.

If the restriction $\frac{\alpha}{2-\beta} > \theta_1$ is not satisfied, say, $\frac{\alpha}{2-\beta} < \theta_1$, then we get the case in Proposition 6a(ii). In this case, the ranking of tax rates, for the SFS economy, is $t_3^S < t_2^F < t_1^S$ and so the median skill voter is also the decisive median voter. In the figure, this ranking of tax rates is shown by the curve *aec*.

From Proposition 6b, the crucial inequality in this case is $\frac{\alpha}{2-\beta} > \theta_1$. To see why this inequality is important, suppose that there is pairwise voting between the two tax rates, t_1^S, t_2^F. For the high skill voter (whose skill level is s_3) to prefer the tax rate of the low skill voter, t_1^S, the optimal tax rate of the middle skill voter, t_2^F, should be 'too high' in the sense that $t_1^S < t_2^F$. In this case, a majority (the rich and the poor) will prefer the tax rate t_1^S to t_2^F.[25] The following factors help to satisfy the inequality $\frac{\alpha}{2-\beta} > \theta_1$, and, hence, are conducive to t_2^F being 'too high' as we now show.

(a) High inequity aversion, as captured by the magnitudes of α, β: From Proposition 2c, higher magnitudes of the inequity aversion parameters, α, β, increase the optimal tax rate for fair voters and so increase t_2^F.

(b) High inequality at the upper end of the skill distribution $(s_3 - s_2)$ and low inequality at the lower end of the income distribution $(s_2 - s_1)$ reduce θ_1 and increase t_2^F: To see, this, suppose that $s_3 - s_2$ increases because of an increase in s_3. Selfish voters would like to redistribute more when the rich get richer because average incomes increase and so the lumpsum available for redistribution is higher. Fair voters have an additional motive to redistribute more, namely, that it reduces disadvantageous inequity. This facilitates an increase in t_2^F.

For selfish voters, a decrease in the low skill level reduces the redistributive tax rate.

[24] These are the tax rates that would maximize (2.32) for respectively, a selfish and fair voter.

[25] Analogously, in a pairwise contest between the tax rates t_1^S, t_3^S a majority (the middle class and the poor) prefer the tax rate t_1^S to t_3^S.

The intuition is that reduction in low skill income reduces average income available for redistribution, hence, reducing the marginal benefits of increasing the tax rate. For fair voters, however, the results can go either way. The reason is that on the one hand, the fair voter is influenced by very similar considerations to the selfish voter (because the fair voter also cares about 'own' payoff). However, on the other hand, the empathy/concern for poorer voters, on account of the disutility arising from advantageous inequity induces the fair voter in the opposite direction i.e. greater redistribution. The interplay between these two opposing factors determines if the fair voter will respond, unlike the selfish voter, by redistributing more in response to poverty. The restriction $\frac{\alpha}{2-\beta} > \theta_1$ ensures that overall, one gets the ranking $t_3^S < t_1^S < t_2^F$ for the optimal tax rates of the three voting classes.

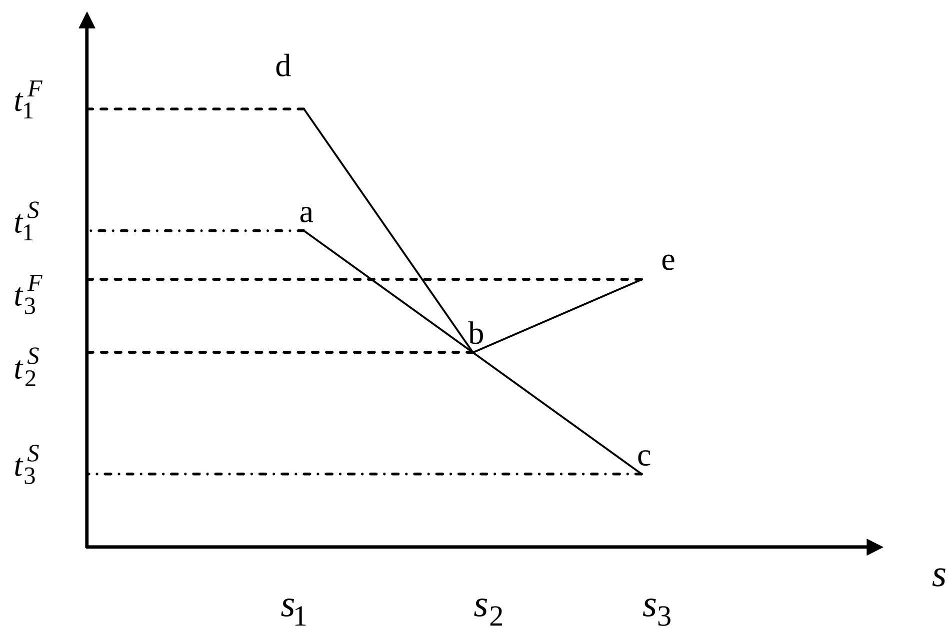

Figure 4.2: The SSS, SSF, and FSF economies

In Figure 4.2, we illustrate the second generic case when $\beta > \theta_2$ (see Proposition 6c). The benchmark SSS economy is represented by the line abc. For the SSS economy, we know from Proposition 6a(i), that the median skill voter, of skill s_2, is decisive and so $t_3^S < t_2^S < t_1^S$. Under the restriction specified in Proposition 6c ($\beta > \theta_2$), the economy SSF is shown in Figure 4.2 by the curve *abe* and one gets the ordering of tax rates to be $t_2^S < t_3^F < t_1^S$. In this case, the rich but fair voter is decisive because the proposed tax rate, t_3^F, can beat any of the other two proposed tax rates in a pairwise contest.

Under the restriction $\beta > \theta_2$, the FSF economy is also shown in Figure 4.2, by the curve *dbe*. The decisive median voter is again the rich-fair voter, who is not the median skill voter.

Why does the restriction $\beta > \theta_2$ not involve α? The reason is that for the cases shown in Figure 4.2 to arise, we need the most preferred tax rate of the rich-fair voter to be high enough, in the sense that $t_2^S < t_3^F$. The rich-fair voter faces no disadvantageous inequality (hence, the absence of the parameter α in the critical condition). However, if β is high enough, then the rich-fair voter suffers sufficiently highly from disadvantageous inequality with respect to the other two class of voters. Raising the tax rate, which ensures that the utility of the rich is affected relatively more as compared to the poorer voting classes is the optimal outcome. In particular if $\beta > \theta_2$ then $t_2^S < t_3^F$, which leads to the surprising outcome in Proposition 6c.

5. Potential applications of the model

The model has several testable implications which empirical researchers could examine in due course as more data becomes available. From Proposition 2c, in democracies, we would expect secular changes in attitudes to fairness of the median voter to result in a larger size of the welfare state. However, we are not aware of estimates of the Fehr-Schmidt inequality parameters α, β for any country across time.

There seem to variations in estimates of α, β across countries and cultures. Dannenberg et al (2007) find that the Fehr-Schmidt preference parameters are different for the G-77 group of countries relative to the non G-77 group of countries. Roth et al. (1991) find significant differences in offers and rejection rates for the ultimatum game in Japan, Israel, Slovenia, and the USA. Henrich et al. (2001) find huge differences across cultures in the ultimatum game. Buchan, Croson and Dawes (2002) find significant differences in investors' and in trustees' behavior across China, Japan, South Korea, and the USA. Insofar as the behavior in the ultimatum and trustee games often hinges on norms of fairness, one would also expect differences in the α, β parameters across these countries.

These observation lead to some testable predictions as well as applications of the model, which we now turn to.

5.1. Fairness and size of the welfare state

Other things constant, a prediction of the model is that countries with higher values of α, β will have larger welfare states (see Proposition 2c). Testing this prediction requires one to construct some empirical measure of fairness. Measuring fairness presents a challenging, and understandably contentious, set of issues. Dhami and al-Nowaihi (2006) partially address this problem through an illustrative empirical exercise. Several measures of fairness seem plausible.[26] Dhami and al-Nowaihi (2006) use aid given to other countries, particularly, developing countries, as their measure of fairness.[27] They also control for strategic motives for giving aid, as well as for ageing populations and for broad region effects, but not country specific effects. Using data from OECD economies, they show that fairness is an extremely important determinant of redistribution and even more important than factor income distribution, which has been traditionally identified as the main determinant.

5.2. Culture, identity, bounded rationality and the economics of immigration

A full discussion of immigration issues requires a fully specified model of immigration, which is beyond the scope of our paper. We offer a framework, which seems to have the potential of being incorporated in a fully specified model.

The effect of immigration on the size of the welfare state has been studied from a range of viewpoints that are, however, different from ours. The literature stresses full rationality which is incorporated through several assumptions. So, for instance, immigrants migrate to regions with better economic opportunities. The population in the host country makes no mistakes in judging the extent of actual migration. Furthermore, host country residents can decide whether or not to allow franchise to the immigrants. Within these sort of models, Dolmas and Huffman (2004) find that the effect of immigration on the size of the welfare state depends on the level of initial income inequality in the host country. Razin et al (2002) find that low skill immigration can reduce the level of redistribution. They present data from 11 European countries which seems to support their result. Mayr (2007) finds on the other hand that redistribution can increase as well as decrease in response to immigration.

In contrast to the existing literature, we stress here the roles of *culture*, *identity* and *bounded rationality*, which have been shown to be important in the context of immigration issues. To the best of our knowledge these have not been formally modelled. The evidence suggests that it is not necessarily important that immigration be of a considerable magnitude or even that immigrants actively vote. It seems sufficient that a *perception* holds sway in the host country that immigration is significant, and that immigrants are culturally different. There is good evidence for all these things; see for instance, Card et al

[26] One could possibly use charitable giving per capita as an indicator of fairness. However, charitable contributions are endogenous in a model with fair voters. So, for instance, if government redistribution is perceived to be inadequate, citizens might attempt to compensate by donating more to charity. For that reason, we do not believe, for instance, that relatively greater per capita giving to charity (as, say, in the US relative to the European average) necessarily indicates greater inequity aversion.

[27] A criticism, of aid as a proxy for fairness could be made along lines similar to our objection against using charitable contributions as a proxy. This is because aid given by a country to developing countries might reflect the low volume of aggregate giving to that country in the first place. However, crucially, this applies equally to all giving countries. Hence, relative giving of countries potentially reflects relative fairness/ inequity aversion.

(2005), based on European Social Survey data. These authors derive several insights based on the data. First, the tendency to overestimate immigration could arise from ignorance or a dependence on anecdotal but not actual evidence (bounded rationality).[28] Second, conditional on the history between countries, altruistic feelings towards immigrants depends on which source-country they originate from. Third, immigrants often have very different religious, political and cultural backgrounds relative to the host country population. Fourth, there is greater support for ethnically similar immigrants. The existing literature on immigration does not incorporate these issues.

It has been argued that if immigrants are poorer than the average population and perceived to be culturally or ethnically different, then support for redistribution in the host country is likely to drop. The economist Bryan Caplan summarizes some of these views for a lay audience as follows.[29] When the poor are culturally very similar to the rich as in Denmark and Sweden, support for the welfare state is strong. However, in the converse case, white Americans might be less receptive on average in supporting the welfare state if they view that the recipients will largely by black Americans or immigrants from Latin America.

In terms of our model, immigration of poorer, culturally different people can, in light of the empirical evidence presented above, be viewed as a reduction in the β parameter of the richer host country majority. In other words, and consistent with the evidence, the altruism parameter of fair individuals in the host country, which captures empathy towards the poor, reduces in response to culturally distinct immigration. This can effect the critical inequalities, $\frac{\alpha}{2-\beta} \gtrless \theta_1$, and $\beta \gtrless \theta_2$ in Proposition 6. For pedagogical clarity, suppose that β falls to zero. There are four possibilities.

1. No change in any of the inequalities: In this case, whenever the decisive median voter is a fair voter, on account of the fall in β, redistribution falls (Proposition 2(c)). If the decisive median voter is selfish then redistribution is unchanged.

2. Both inequalities change direction. Suppose that (1) $\frac{\alpha}{2-\beta} > \theta_1$ changes to $\frac{\alpha}{2-\beta} < \theta_1$, and (2) $\beta > \theta_2$ changes to $\beta < \theta_2$. From Proposition 6 we would then move from cases (b), (c) to case (a) where the median skill voter is decisive.
   (i) From Proposition 6 (a), (b), in economies SFS and SFF, the decisive voter will now be the middle skill fair voter (rather than the low skill selfish voter). In each of these cases, in response to culturally distinct immigration, redistribution, and so

[28] The following finding is typical and has been replicated in dozens of studies. A Washington Post article dated October 8, 1995 said that most whites, blacks, Hispanics and Asian Americans reported in a survey that the black population, which is about 12 percent, was twice that size.

[29] See the interview of Bryan Caplan titled 'Interview with Trent McBride, including the political consequences of Immigration' at http://econlog.econlib.org/archives/2007/06/interview_with.html.

the size of the welfare state, decreases (using (2.33)).[30]

(ii) In economies SSF and FSF, the decisive voter will now be the middle skill selfish voter (rather than the high skill fair voter). In each of these cases, it is straightforward to see, using (2.33), that in response to culturally distinct immigration, redistribution (or the size of the welfare state) will increase.[31]

3. The final two cases involve a change in the direction of one of the inequalities, $\frac{\alpha}{2-\beta} > \theta_1$ or $\beta > \theta_2$. In this case, in response to culturally distinct immigration, we get one of the two cases in 2(i) or 2(ii).

Thus, one cannot give unambiguous results on the effect of immigration on the size of the welfare state. Results are dependent on the type of the economy (in terms of its skill-fairness composition), the configuration of the parameters, and if immigration is culturally distinct. This framework can illuminate further the effects of immigration on the size of the welfare state.

An intriguing puzzle in public economics is the secular increase in the size of the welfare state. Several solutions have been offered.[32] We suggest an additional viewpoint. The evidence presented in Card et al. (2005) shows that older people have stronger anti-immigrant views relative to younger ones. One possible, but not the only, interpretation is that there has been a secular decrease in average anti-immigrant views in European countries. If one accepts this possibility, then in terms of the argument that we have developed above, there is a secular increase in β over time. In economies where the decisive median voter is a fair voter, then we know, from Proposition 2(c), that this will increase the size of the welfare state. Whilst we do not argue that this is the only important factor, it could be a contributory factor that has been missed so far by the literature. The increase in β can again lead to a reversal of the inequalities $\frac{\alpha}{2-\beta} < \theta_1$, and $\beta < \theta_2$ leading to further analysis along the lines sketched out above.

The model of immigration that we have sketched can also potentially explain why different countries might have different entry barriers. A fuller treatment will require a more fully specified model. We sketch an outline. The entry system for some countries, such as the US, is a 'points based system'. In this system, potential immigrants have to fulfil certain desirable criteria (skill, education etc.), gain a minimum number of points and then qualify. The entry system in the UK and in many other countries in Western Europe is not a 'points based system' but based more on notions of accepting political refugees, asylum seekers etc. Why do we have these different entry requirements. We offer a conjecture. From 2(i) and 2(ii), in certain cases, the entry of immigrants, by

[30] To derive this result we use the condition $\frac{\alpha}{2} < \theta_1$.

[31] In deriving this result, note that $S_3^- = 0$, $\beta = 0$ (for the rich, subsequent to immigration) and $\frac{\partial t_j}{\partial \phi_j} < 0$.

[32] See Persson and Tabellini (2002) for a survey.

altering the two critical inequalities, affects the political equilibrium. In particular, it affects the identity of the decisive median voter in the economy. Should the interest groups representing the originally decisive median voter in the host country be strong enough, they can alter immigration rules in important ways, including the entry requirement as well as the type of immigrants that will be allowed to enter the host country.

6. An extension: Regional integration and the size of regions

The optimal size of regions/federations and issues of regional integration have traditionally been of great interest to economists. In recent times, interest has also centered on the problems of transition economies in this respect. Whilst there are several dimensions of the problem that are of interest, we focus here on one that is relevant to our model and has not been considered in the existing literature. What does one expect if regions that are disparate with respect to the distribution of fair and selfish voters, combined? In order to answer this question, we need to specify the outcome of the model when there are more than one voters in each skill class and the type (selfish or fair) of these voters can differ. Since, these issues take us beyond the scope of our model, we propose an extension. We introduce a prior stage, stage 0, where each skill class chooses a representative.

Let there be 3 skill levels $s_1 < s_2 < s_3$. Within each skill level there are n_i voters, $i = 1, 2, 3$ and $\sum_i n_i = n$, the total number of voters in the economy. The type of a voter is defined to be either selfish or fair (S or F). Each voter has the utility function given in (2.10). Within each skill class there can be mixture of fair and selfish voters. The political institutions specify a three stage process.

Stage 0 : Each skill class chooses a representative voter (or an agenda) for stages 1 and 2 of the process. Each voter proposes his/her ideal or most preferred tax rate (the agenda), on the supposition that he/she will be the representative voter for the second stage (sincere voting). The representative voter (or agenda) is then chosen for the skill class by using majority voting (for that skill class).

Stages 1 and 2 : These are as in subsection 2.2. In stage 1 the representative voter from each skill class votes on the redistributive tax rate. The tax rate preferred by the median voter is implemented. In stage 2 all voters make their labour supply decision, conditional on the tax rate chosen by the median voter in stage 1. On choosing their labour supplies in stage 2, the announced stage 1 tax rate is implemented and the transfers made.

Example 1 *: In stage* 0*, individual countries first democratically elect MEP's (members of European parliament). In stage* 1 *these representatives vote on European-wide policies. These policies are implemented in stage* 2*.*

Example 2 : *Suppose that a university must decide between high and low levels (H or L) of expenditure on a library. In stage 0 each individual department chooses between the options H or L. A representative from each department then takes this agenda on to the senate. In stage 1, the representatives by voting over H, L determine the University-wide decision for H or L. In stage 2 the winning option (H or L) is implemented.*

Proposition 7 : *In stage 0, for any skill class, the representative voter is the one whose type is in a majority in that skill class.*

So, for instance, for the low skill class, let there be 5 individuals in total i.e. $n_1 = 5$. Let there be 2 selfish and 3 fair individuals which comprise the low skill level population. Then the representative individual for the low skill class is a fair individual.

Example 3 : *Consider two economies. Economy 1 is an SSS economy with a total population of 9 individuals such that $n_1 = n_2 = n_3 = 3$. From Proposition 7, in stage 0 the representative voter in each class is a selfish voter. From Proposition 6(a) we know that (in stage 1) the decisive voter is the median skill selfish voter. Economy 2 is an SFS economy such that $\frac{\alpha}{2-\beta} > \theta_1$. The total population in economy 2 is 6 and $n_1 = n_2 = n_3 = 2$. Using Proposition 7, in economy 2, the representative voters in the three income classes, low, middle, high, are respectively selfish, fair and selfish.[33] From Proposition 6(c), we know that when $\frac{\alpha}{2-\beta} > \theta_1$, in stage 1, the low skill selfish voter is decisive in economy 2.*
Now suppose that there is regional integration of the two economies. The total population of the integrated region is 15 and $n_1 = n_2 = n_3 = 5$. Using Proposition 7, the representative voter for each voting class (in stage 0) is now a selfish voter. From Proposition 6(a) we know that in stage 1, the decisive voter is now the median skill selfish voter. For citizens of economy 1, there is no change in fiscal policy after the integration of the two regions. However, for economy 2, there is a change in fiscal policy after the integration. Fiscal policy is now chosen by a selfish middle class voter rather than by a fair middle class voter. Hence, post-integration, citizens of economy 2 will observe a decline in the size of the welfare state (see Proposition 5(c)). If the decision to integrate is a voluntary one, then residents of economy 2 might not wish to be part of a larger region with a smaller welfare state. Perhaps economy 1 will then be required to give guarantees to economy 2 that post-integration, the welfare state will not fall below a certain level. Otherwise, integration might fail. The analysis obviously raises issues that one does not take account of when one ignores issues of fairness.

[33] Since economy 2 has an even number of voters in each class (2), a tie-breaking rule may have to be used in stag 0.

Example 4 *: Consider the same set-up as in example 3. However suppose now that we reverse the assumptions on population sizes in the two economies. So let total population in economy* 1 *be* 6 *such that* $n_1 = n_2 = n_3 = 2$ *and let total population in economy* 2 *be* 9 *such that* $n_1 = n_2 = n_3 = 3$. *Proceeding as in example 3, post-integration, the decisive median voter is a middle skill fair voter. Post-integration, there is no change in the size of the welfare state for citizens of economy* 2*, but citizens of economy* 2 *find that there is an an increase in the size of the welfare state. For voluntary integration, economy* 2 *might now have to give some guarantees to economy* 1 *that post-integration, the welfare state will not increase too much, otherwise integration might fail. This is reminiscent (in spirit) to the growth and stability pact that European nations entered into a few years ago.*

7. Conclusions

We replace the self-interested voters in the Romer-Roberts-Meltzer-Richard (RRMR) framework with voters who have a preference for fairness (as in Fehr-Schmidt (1999)) and ask the following sorts of questions. Does a median voter equilibrium exist? What are the features of the equilibrium redistributive policy when there is a mixture of fair and selfish voters? Are there interesting applications of the model that help us understand important real world economic issues?

Some of our findings are as follows. The single-crossing property of Gans-Smart (1996) can be used to demonstrate the existence of a Condorcet winner when n voters (where n is any odd positive integer) have heterogenous social preferences. Other things remaining fixed, greater fairness induces greater redistribution. When voters differ in their degree of fairness, then the Condorcet winner need not necessarily be the one with the median skill level. Small changes in the composition of the types (selfish or fair) of voters can induce large redistributive consequences. The model can be used to provide important and interesting insights into a range of phenomena. These include the size of the welfare state, regional integration and issues of culture, identity and immigration.

The implications of having a mixture of selfish and fair voters within the same economy has interesting, important and hitherto unnoticed implications.[34] A flavour of the results is as follows. For the three voting classes model, and for the 6 interesting cases[35], parameter configurations allow small changes (with no more than a third of the voters) to have potentially large redistributive effects. In each of these four cases (SFS, SFF, SSF, FSF)[36]

[34] We give the results for three voting classes, however, the results are in principle capable of being extended to more than three classes.

[35] The case of all selfish and all fair voters (which comprise the remaining two cases) are less interesting because experimental evidence indicates that about 40% of subjects are selfish.

[36] The symbols S, F respectively denote a selfish and a fair voter. The voters are arranged in increasing levels of skills.

the Condorcet winner is not the median skill voter. For instance, introducing selfish poor (fair rich) voters in an economy populated by fair (selfish) voters can result in a *reduction* (*increase*) in redistribution from rich to poor. On the other hand, introducing rich selfish (poor fair) voters in an economy populated by fair (selfish) voters will have no effect.

8. Appendix (Proofs)

Proof of Lemma 1 (derivation of labour supply): From (2.21) we see that, given t, b and s_j, $u(l_j; t, b, s_j)$ is a continuous function of l_j on the non-empty compact set $[0, 1]$. Hence, a maximum exists. From (2.21), we also get

$$\frac{\partial u}{\partial l_j}(l_j; t, b, s_j) = (1-t)s_j - l_j^{\frac{1}{\epsilon}}, \tag{8.1}$$

$$\frac{\partial u}{\partial l_j}(0; t, b, s_j) = (1-t)s_j, \tag{8.2}$$

$$\frac{\partial u}{\partial l_j}(1; t, b, s_j) = (1-t)s_j - 1, \tag{8.3}$$

$$\frac{\partial^2 u}{\partial l_j^2}(l_j; t, b, s_j) = -\frac{1}{\epsilon} l_j^{\frac{1-\epsilon}{\epsilon}}. \tag{8.4}$$

First, consider the case $t = 1$. From (2.21), or (8.1), we see that $u(l_j; 1, b, s_j)$ is a strictly decreasing function of l_j for $l_j > 0$. Hence, the optimum must be

$$l_j = 0 \text{ at } t = 1. \tag{8.5}$$

Now, suppose $t \in [0, 1)$. From (2.1), (2.2), (8.2) and (8.3) we get that $\frac{\partial u}{\partial l_j}(0; t, b, s_j) > 0$ and $\frac{\partial u}{\partial l_j}(1; t, b, s_j) < 0$. Hence an optimal value for l_j must lie in $(0, 1)$ and, hence, must satisfy $\frac{\partial u}{\partial l_j}(l_j; t, b, s_j) = 0$. From (8.1) we then get

$$l_j = (1-t)^{\epsilon} s_j^{\epsilon}, \tag{8.6}$$

which, therefore, must be the unique optimal labour supply (this also follows from (8.4)). For $t = 1$, (8.6) is consistent with (8.5). Hence, for each consumer, j, (8.6) gives the optimal labour supply for each $t \in [0, 1]$. ■

Proof of Lemma 2 (properties of labour supply): The proof follows from (2.26) by direct calculation. ■

Proof of Proposition 2 (existence of optimal tax rates): (a) From (2.32), we see that $W_j(t, \alpha_j, \beta_j, \mathbf{s})$ is a continuous function of $t \in [0, 1]$, for $i = 1, 2, ..., n$. Hence, $W_j(t, \alpha_j, \beta_j, \mathbf{s})$ attains a maximum at some $t_j \in [0, 1]$. From (2.32), for the case $0 \leq t \leq$

$1, \epsilon = 1$ we get:

$$\frac{\partial W_j}{\partial t}\left(t, \alpha_j, \beta_j, \mathbf{s}\right) = -\frac{t}{n}\sum_{i=1}^{n} s_i^2$$

$$+ (1-t)\left[\frac{1}{n}\sum_{i=1}^{n} s_i^2 - s_j^2 + \frac{\alpha_j}{n-1}\sum_{k>j}\left(s_k^2 - s_j^2\right) + \frac{\beta_j}{n-1}\sum_{i<j}\left(s_j^2 - s_i^2\right)\right], \quad (8.7)$$

whereas for the case $0 \leq t < 1, \epsilon < 1$ we get

$$\frac{\partial W_j}{\partial t}\left(t, \alpha_j, \beta_j, \mathbf{s}\right) = -\epsilon t\left(1-t\right)^{\epsilon-1}\overline{S}(n) + (1-t)^{\epsilon}\left[\overline{S}(n) - \phi_j(n)\right] \quad (8.8)$$

From (8.7) we see that, for $\epsilon = 1$, $\frac{\partial W_j}{\partial t}\left(1, \alpha_j, \beta_j, \mathbf{s}\right) = -\frac{t}{n}\sum_{i=1}^{n} s_i^2 < 0$. Hence, the optimal tax rate, t_j, for voter j satisfies $t_j < 1$. For $\epsilon < 1$, we see, from (8.8), that the limit of $\frac{\partial W_j}{\partial t}$, as $t \to 1$ (from below) is $-\infty$. Hence, again, the optimal tax rate, t_j, for voter, j satisfies $t_j < 1$.

(b) If $\overline{S}(n) - \phi_j(n) \leq 0$, we see, from (8.7) and (8.8), that $\frac{\partial W_j}{\partial t} < 0$ for all $t \in [0, 1)$. Hence, the optimal tax rate, t_j, for voter j, must be $t_j = 0$.

(c) If $\overline{S}(n) - \phi_j(n) > 0$, we see, from (8.7) and (8.8), that $\frac{\partial W_j}{\partial t} > 0$ at $t = 0$. Hence, the optimal tax rate, t_j, for voter j satisfies $t_j > 0$. Combining this with $t_j < 1$ (from (a)), we get that, necessarily, $\frac{\partial W_j}{\partial t} = 0$ at $t = t_j$. From (8.7) and (8.8) we then get (2.33). Since an optimum, t_j, exists (from (a)), since it must satisfy $\frac{\partial W_j}{\partial t} = 0$ and since the latter has the unique solution (2.33), it follows that (2.33) gives the unique global optimum (this can also be derived by showing that $\frac{\partial^2 W_j}{\partial t^2} < 0$ for $t \in (0, 1)$). Differentiating (2.33) successively with respect to α_j, β_j we get the following.

$$\frac{\partial t_j}{\partial \alpha_j} = \frac{\epsilon\overline{S}(n)}{(1+\epsilon)\overline{S}(n)} S_j^-(n) \geq 0$$

$$\frac{\partial t_j}{\partial \beta_j} = \frac{\epsilon\overline{S}(n)}{(1+\epsilon)\overline{S}(n)} S_j^+(n) \geq 0$$

From (2.28) and (2.29) we know that for $j = n$, $S_n^-(n) = 0$ while for $j < n$, $S_j^-(n) > 0$ and for $j = 1$, $S_n^+(n) = 0$ while for $j > 1$, $S_j^-(n) > 0$. Hence, for any $1 < j < n$, t_j is strictly increasing in α_j, β_j.

(d) From (2.1), (2.11) and (2.12) we get: $\overline{S}(n) - s_1^{1+\epsilon} + \alpha_1 S_1^-(n) > 0$ (for $j = 1$, there are no terms in β_j). Hence, from part (c) and (2.33), we get $t_j > 0$ and

$$t_1 = \frac{\overline{S}(n) - s_1^{1+\epsilon} + \alpha_1 S_1^-(n)}{(1+\epsilon)\overline{S}(n) - s_1^{1+\epsilon} + \alpha_1 S_1^-(n)}. \quad (8.9)$$

If $\overline{S}(n) - s_n^{1+\epsilon} + \beta_n S_n^+ \leq 0$ (for $j = n$, there are no terms in α_j), then, from (b), it follows that $t_n = 0$. Hence, $t_n < t_1$. Now, suppose $\overline{S}(n) - s_n^{1+\epsilon} + \beta_n S_n^+ > 0$. It then follows, from

(c) and (2.33), that

$$t_n = \frac{\overline{S}(n) - s_n^{1+\epsilon} + \beta_n S_n^+(n)}{(1+\epsilon)\,\overline{S}(n) - s_n^{1+\epsilon} + \beta_n S_n^+(n)}. \tag{8.10}$$

A simple calculation, using (8.9) and (8.10), shows that

$$t_n < t_1 \Leftrightarrow \frac{s_n^{1+\epsilon} - s_1^{1+\epsilon}}{n-1} - \beta_n S_n^+(n) + \alpha_1 S_1^-(n) > 0.$$

Another simple calculation shows that

$$\frac{s_n^{1+\epsilon} - s_1^{1+\epsilon}}{n-1} - \beta_n S_n^+(n) + \alpha_1 S_1^-(n) > \frac{(1-\beta_n)\left(s_n^{1+\epsilon} - s_1^{1+\epsilon}\right)}{n-1} + \alpha_1 S_1^-(n) > 0.$$

Hence, $t_n < t_1$. ■

Proof of Lemma 5: We first state an intermediate result, Result 1, which follows directly from (2.27) and so we omit its proof.

Result 1 : *(a)* $\frac{\partial V_j}{\partial b} = 1$.
(b) For $1 \leq j < j+l \leq n$, *we have* $-\frac{\partial V_{j+l}}{\partial t} - \left(-\frac{\partial V_j}{\partial t}\right) =$
$\frac{(1-t)^\epsilon}{n-1}[(n-1)\left(s_{j+l}^{1+\epsilon} - s_j^{1+\epsilon}\right) + (\alpha_j - \alpha_{j+l}) \sum_{k>j+l} \left(s_k^{1+\epsilon} - s_{j+l}^{1+\epsilon}\right)$
$+ \left(\beta_j - \beta_{j+l}\right) \sum_{i<j} \left(s_{j+l}^{1+\epsilon} - s_i^{1+\epsilon}\right) + \alpha_j \sum_{k=j+1}^{k=j+l} \left(s_k^{1+\epsilon} - s_j^{1+\epsilon}\right) - \beta_{j+l} \sum_{i=j}^{i=j+l-1} \left(s_{j+l}^{1+\epsilon} - s_i^{1+\epsilon}\right)]$.

From Result 1(b) it follows that if $\frac{\partial V_i}{\partial t} < \frac{\partial V_j}{\partial t}$ for some $t \in [0,1)$, then $\frac{\partial V_i}{\partial t} < \frac{\partial V_j}{\partial t}$ for all $t \in [0,1)$. Analogously, if $\frac{\partial V_i}{\partial t} > \frac{\partial V_j}{\partial t}$ for some $t \in [0,1)$, then $\frac{\partial V_i}{\partial t} > \frac{\partial V_j}{\partial t}$ for all $t \in [0,1)$. To complete the proof note that, from Result 1(a), $\frac{\partial V_j}{\partial b} = 1$. ■

Proof of Lemma 6: Follows immediately from Lemma 5. ■

Proof of Lemma 7: For $j = 1$ and $l = n-1$ Result 1(b) gives:

$$-\frac{\partial V_n}{\partial t} - \left(-\frac{\partial V_1}{\partial t}\right) = (1-t)^\epsilon \left[\left(s_n^{1+\epsilon} - s_1^{1+\epsilon}\right) - \beta_n S_n^+(n) + \alpha_1 S_1^-(n)\right] > 0$$

By Result 1(a) $\frac{\partial V_j}{\partial b} = 1$. Hence, $-\frac{\partial V_1}{\partial t} / \frac{\partial V_1}{\partial b} < -\frac{\partial V_n}{\partial t} / \frac{\partial V_n}{\partial b}$ and so, using definition 4, it follows that $1 \prec n$. ■

Proof of Proposition 3 (existence of a Condorcet winner): By construction of the Gans-Smart order (Definition 4), it follows that $i \prec j \Rightarrow -\frac{\partial V_i}{\partial t} / \frac{\partial V_i}{\partial b} < -\frac{\partial V_j}{\partial t} / \frac{\partial V_j}{\partial b}$. Hence, from Lemma 4, it follows that a majority of voters choose the tax rate $t_{\widehat{m}}$, that is optimal for the median voter in the Gans-Smart ordering of $\{1, 2, ..., n\}$ (the voter with skill level $s_{\widehat{m}}$). ■

Proof of Proposition 4: We first state two intermediate results in Lemmas 8, 9.

Lemma 8 *(Existence of optimal tax rates): (a) $\overline{S}(3) - \phi_j(3) > 0$ holds in each of the following three cases*[37]*:*
(i) $j = 1$, (ii) $j = 2$, (iii) $j = 3$ and $\beta_3 > \frac{2}{3}$.
(b) If $\beta_3 \leq \frac{2}{3}$, then the tax rate preferred by the high-skill voter is $t_3 = 0$.
(c) If one of the following conditions holds:
(i) $j = 1$, (ii) $j = 2$, (iii) $j = 3$ and $\beta_3 > \frac{2}{3}$,
then the tax rate, t_j, preferred by voter j, is unique, satisfies $0 < t_j < 1$ and is given by

$$t_j = \frac{\overline{S}(3) - \phi_j(3)}{(1+\epsilon)\,\overline{S}(3) - \phi_j(3)}. \tag{8.11}$$

(d) $t_3 < t_1$.

Proof of Lemma 8: Part (a) can be verified by a simple calculation, using (2.1), (2.4), (2.5), (2.23), (2.11), (2.12), (2.28), (2.29) and (2.30). In the light of part (a), parts (b), (c) and (d) are simple corollaries of parts (b), (c) and (d), respectively, of Proposition 2.

Lemma 9 *: (a)$-\frac{\partial V_2}{\partial t} - \left(-\frac{\partial V_1}{\partial t}\right) = \frac{(1-t)^\epsilon}{2}\left[(2 - \beta_2 + \alpha_1)\left(s_2^{1+\epsilon} - s_1^{1+\epsilon}\right) + (\alpha_1 - \alpha_2)\left(s_3^{1+\epsilon} - s_2^{1+\epsilon}\right)\right]$,*
(b)$-\frac{\partial V_3}{\partial t} - \left(-\frac{\partial V_2}{\partial t}\right) = \frac{(1-t)^\epsilon}{2}\left[(2 - 2\beta_3 + \alpha_2 + \beta_2)\left(s_3^{1+\epsilon} - s_2^{1+\epsilon}\right) + (\beta_2 - \beta_3)\left(s_2^{1+\epsilon} - s_1^{1+\epsilon}\right)\right]$.

Proof of Lemma 9: Follows from Result 1(b).

Using Lemmas 8, 9 we now prove parts (a)-(d) of Proposition 4.

(a) The assertion can be verified by a simple calculation.

(b) From Lemma 9 we get $-\frac{\partial V_3}{\partial t} - \left(-\frac{\partial V_2}{\partial t}\right) > 0$ and $-\frac{\partial V_2}{\partial t} - \left(-\frac{\partial V_1}{\partial t}\right) > 0$. By Result 1(a) $\frac{\partial V_j}{\partial b} = 1$. Hence, $-\frac{\partial V_3}{\partial t} / \frac{\partial V_3}{\partial b} - \left(-\frac{\partial V_2}{\partial t} / \frac{\partial V_2}{\partial b}\right) > 0$ and $-\frac{\partial V_2}{\partial t} / \frac{\partial V_2}{\partial b} - \left(-\frac{\partial V_1}{\partial t} / \frac{\partial V_1}{\partial b}\right) > 0$. Hence, $1 \prec 2 \prec 3$. It follows that the median-skill voter is decisive. A simple calculation, using Lemma 8c(ii), then shows that $t_3 < t_2 < t_1$.

(c) From Lemma 9(a) we get $-\frac{\partial V_2}{\partial t} - \left(-\frac{\partial V_1}{\partial t}\right) < 0$. By Result 1(a) $\frac{\partial V_j}{\partial b} = 1$. Hence, $-\frac{\partial V_2}{\partial t} / \frac{\partial V_2}{\partial b} - \left(-\frac{\partial V_1}{\partial t} / \frac{\partial V_1}{\partial b}\right) < 0$. Hence, $2 \prec 1 \prec 3$. It follows that the low-skill voter is decisive. A simple calculation, using Lemma 8c(i), then shows that $t_3 < t_1 < t_2$.

(d) From Lemma 9(b) we get $-\frac{\partial V_3}{\partial t} - \left(-\frac{\partial V_2}{\partial t}\right) < 0$. By Result 1(a) $\frac{\partial V_j}{\partial b} = 1$. Hence, $-\frac{\partial V_3}{\partial t} / \frac{\partial V_3}{\partial b} - \left(-\frac{\partial V_2}{\partial t} / \frac{\partial V_2}{\partial b}\right) < 0$. Hence, $1 \prec 3 \prec 2$. It follows that the high-skill voter is decisive. A simple calculation, using part (a) and Lemma 8c(iii), then shows that $t_2 < t_3 < t_1$. ■

Proof of Corollary 1: Follows from Proposition 4(b). ■

Proof of Proposition 5: Part (a) is the special case of Corollary 1 with $\alpha_j = \beta_j = 0$, for all j. Part (b) is the special case of Corollary 1 with $\alpha_j = \alpha$ and $\beta_j = \beta$, for all j.

[37] Recall that from (2.30), $\phi_j(3) = s_j^{1+\epsilon} - \alpha_j S_j^-(3) - \beta_j S_j^+(3)$.

Now, turn to part (c). If $\beta_3 \leq \frac{2}{3}$ then, from Lemma 8(b), we get $t_3^F = t_3^S = 0$. Now, suppose one of the conditions (i), (ii) or (iii) hold. Then, in the light of Lemma 8(a) and (b), we can rewrite the tax rate, t_j, preferred by voter j as $t_j = 1/\left(1 + \frac{\epsilon}{x}\overline{S}(3)\right)$, where $x = \overline{S}(3) - \phi_j(3) > 0$. It follows that t_j is a strictly increasing function of x and, hence, also of α_j, β_j. In particular, it follows that $t_j^S < t_j^F$, $j = 1, 2, 3$. ■

Proof of Proposition 6: Parts (a), (b) and (c) follow, by simple calculations, from parts (b), (c) and (d), respectively, of Proposition 4. ■

Proof of Proposition 7: Suppose that for some skill class there are n_i voters. Of these, $n_i^S \leq n_i$ are selfish, while the remaining $n_i - n_i^S$ are fair. For any subsequent path of play (and given the assumptions in stage 0), we know (from Proposition 5(c)) that fair voters will propose higher tax rates than selfish voters of the same skill level. Thus we have a situation where n_i^S selfish voters propose an identical but lower tax rate relative to the remaining $n_i - n_i^S$ fair voters who propose an identical tax rate. Clearly, the agenda carried forward by the representative voter is simply determined by which of n_i^S, $n_i - n_i^S$ is larger. If they are equal, which can occur if n_i is even, then a tie braking rule is needed (we assume such a tie braking rule is in place). ■

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