Institut d'Economia de Barcelona

Document de treball de l'IEB 2010/37

INTERREGIONAL TRANSFERS, GROUP LOYALTY AND THE DECENTRALIZATION OF REDISTRIBUTION

Sabine Flamand

Fiscal Federalism

INTERREGIONAL TRANSFERS, GROUP LOYALTY AND THE DECENTRALIZATION OF REDISTRIBUTION

Sabine Flamand

Postal Address:
Institut d'Economia de Barcelona
Facultat d'Economia i Empresa
Universitat de Barcelona
C/ Tinent Coronel Valenzuela, 1-11
(08034) Barcelona, Spain
Tel.: + 34 93 403 46 46
Fax: + 34 93 403 98 32
ieb@ub.edu
http://www.ieb.ub.edu

INTERREGIONAL TRANSFERS, GROUP LOYALTY AND THE DECENTRALIZATION OF REDISTRIBUTION*

Sabine Flamand

ABSTRACT: We study the decentralization of redistributive taxation in a political economy model assuming regional heterogeneity regarding both group identity and average income. If a centralized system permits a beneficial pooling of national resources, it might also decrease the degree of solidarity in the society. With no group loyalty, centralization Pareto-dominates decentralization even when regions are not identical. Furthermore, increased heterogeneity need not increase the relative efficiency of decentralization. If regions are equally rich, centralization Pareto-dominates decentralization whenever group loyalty is not perfect. Finally, centralization is always more efficient than decentralization even when allowing for interregional transfers.

JEL Codes: H77, D64, H23

Keywords: Redistribution, fiscal federalism, group loyalty.

Sabine Flamand
Departament d'Economia i d'Història Econòmica
Universitat Autònoma de Barcelona
Edifici B - Campus UAB
08193 Bellaterra (Barcelona), Spain
Phone: + 34 935811810
E-mail: sabine.flamand@uab.cat

* I would like to thank my supervisor, Caterina Calsamiglia, for her continuous support and for helpful comments and suggestions.

1. Introduction

Separatist and/or decentralizing pressures are very often associated to both interregional inequality and cultural heterogeneity between regions. Typically, there are two culturally homogeneous regions, and one of them is richer (such as Flanders in Belgium or Catalonia in Spain). As a result of one region being richer, a centrally implemented redistribution policy involves implicit interregional transfers taking place, and thus transfers of resources between individuals who do not share a common identity. The potential wish of the richer region to decentralize redistribution suggests two things: first, being richer, the region might want to implement its own redistribution policy which would be closer to the preferences of its population. Second, it might also be the case that the interregional transfers taking place through the centralized redistribution policy are not considered as legitimate by its population, and thus a decentralized system could be a way to get rid of it.

Fundamentally, the presence of this two-sided heterogeneity between regions, that is, in average income and group identity, gives rise to some trade-off regarding the choice between centralized versus decentralized redistribution. Indeed, if a centralized system allows for a potentially beneficial pooling of national resources, and thus permits to reduce interregional inequality, it also has a cost in the sense that individuals might be less willing to redistribute in a culturally divided society. That is, there might be a decrease in the degree of solidarity in the society under centralization. In order to capture this trade-off, we set up a political economy model where individuals vote over a one-dimensional redistributive parameter, assuming that voters are utilitarian altruists and care relatively more about the well-being of individuals of their own region (i.e. there is group loyalty). We assume that there are two (culturally homogeneous) regions, and that one of them is richer in the sense that it has a higher proportion of rich individuals. As a result, under a centralized system, there is a net transfer of resources from the rich to the poor region, this transfer being potentially undesirable from an individual point of view as a result of the lack of a common identity between the two regions.

The aim of the paper is both positive and normative. First, we characterize the equilibrium level of redistribution under both centralization and decentralization, and investigate its behavior as several parameters of the model vary. In particular, we show that while group loyalty always has a positive effect on redistribution under decentralization, it might either increase or decrease support for redistribution in a centralized system depending on whether the decisive voter is from the poor or the rich region. Second, using the solution of the social planner problem as a benchmark, we investigate which institutional system - centralized or decentralized - is best from a welfare perspective. It turns out that in this set up, due to the assumptions regarding individual preferences for redistribution, the maximization of total welfare is closely related to the minimization of inequality, both within and between regions. Finally, we investigate under which conditions the solution yielding higher total welfare is sustainable as an equilibrium in a direct democracy, and if not, whether there exists an accommodating policy such that the inefficient solution can be avoided.

There is a large body of experimental evidence showing that individuals tend to behave in an altruistic manner (see, for example, Fehr and Schmidt (1999) and Charness and Rabin (2002)). In this paper, we model preferences for redistribution based on utilitarian altruism, and, following Luttmer (2001), we assume that the strength of altruism towards specific individuals is determined by group loyalty. That is, individuals care mostly about the welfare of those belonging to their own group. As we assume a common identity within a region, this means that individuals care relatively more about redistribution patterns in their own region.

There is a growing literature studying the effects of fractionalization along religious, ethnic or linguistic lines on public policy. In particular, the idea that support for redistribution might be lower in culturally diverse societies has been documented both empirically (see, among others, Alesina et al. (1999) and Luttmer (2001)) and theoretically (see, for instance, Austen-Smith and Wallerstein (2006) and Lind (2004)). Alesina et al. (1999) show that ethnic diversity tends to reduce both the supply of public goods and redistribution, and explain this fact based on heterogeneity of tastes. More generally, several theoretical reasons have been advanced in order to explain the detrimental effect of cultural diversity on public policy. Cultural diversity here is relevant to create high intra-group loyalty and less between-group loyalty. That is, we assume that individuals care relatively more, if not only, about the well-being of members of their own group. In that sense, we are not concerned with the fact that *preferences* regarding public policy might differ between groups. A very related work is the one of Lind (2004). The author highlights the fact that heterogeneity between individuals regarding both identity and income might have a joint impact on support for redistribution. In particular, he shows that while inequality within groups has the usual effect of promoting redistribution, inequality between groups has the opposite effect of reducing support for redistribution. However, as he does not assume that groups are geographically segmented, his focus is not on centralized versus decentralized redistribution.

The fact of regions being differently rich and the effect that this can have on decentralizing redistribution has already been investigated in a political economy context. For example, Persson and Tabellini (1994) show that if regions differ in their average income, majority rule at the federal level will produce less redistribution than at the local level. In their seminal paper on the breakup of nations, Bolton and Roland (1997) focus on the effects of regional heterogeneity regarding both average and median income on the incentives of a region to secede, assuming that a breakup involves an efficiency cost. While in those papers, the authors assume heterogeneity regarding regional income distribution, they do not assume any kind of cultural heterogeneity between regions nor altruistic motives for redistribution.

Now, the possibility of individuals to exhibit altruistic preferences, this altruism being determined by group loyalty, and the effect this has on decentralizing redistribution, has also been investigated from a theoretical perspective. In his seminal paper, Pauly (1973) shows that if redistribution is a spatially limited public good, it can be efficiently implemented at the local level. However, he does not address the issue of redistribution between regions, which clearly calls for some centralization. In Pauly's model, a decentralized policy has the advantage of being closer to regional tastes regarding redistribution. In that sense, his result can be seen as an application of Oate's decentralization theorem. In contrast, in our model, decentralization has the advantage of potentially increasing the degree of solidarity in the society, and hence redistribution. Another related work is the one of Bjorvatn and Cappelen (2006), where it is assumed that voters care about the poor only in their own community (i.e. there is full group loyalty), while a decentralized system implies tax competition between jurisdictions and hence a possible race to the bottom. They show that the best level of government regarding redistribution is determined by a trade-off which depends on the nature of altruism (i.e. pure vs impure altruism). While Bjorvatn and Cappelen (2006) allow for tax competition under decentralization, they assume that jurisdictions are equally rich and hence abstract from all questions related to interregional inequality.

Therefore, while the separate effects of the two sources of regional heterogeneity - income and group identity - on the choice between a centralized versus decentralized system of redistribution have already been studied theoretically, their joint impact has not yet been investigated. As we have already argued earlier in this introduction, we believe that the *interactions* between regional differences regarding both income and identity have important implications concerning the issue of decentralizing redistribution both from a positive and a normative point of view.

Several conclusions arise from our analysis. First, there is no rationale for decentralization as long as only one source of heterogeneity is present. If the regions share a common identity (i.e. there is no group loyalty), everybody is better off under a centralized system, no matter if the regions are identical or not regarding their average income. Similarly, whenever the two regions are equally rich, centralization Pareto-dominates decentralization, even when individuals care more about their own region. Furthermore, the analysis of the symmetric case reveals that a centralized system has an additional benefit in terms of the positive effect it creates on the willingness of the median voter to pay taxes, just because redistribution is implemented at a larger scale. Second, increased heterogeneity between regions need not increase the relative attractiveness of decentralization from a welfare perspective. Third, with full group loyalty, that is, in the absence of spillovers, it is not generally true that a decentralized system is more efficient. Fourth, allowing for a transfer under decentralization need not increase total welfare. Furthermore, due to free riding, centralization welfare-dominates decentralization for all values of group loyalty for which the transfer is positive.

The rest of the paper is structured as follows: Section 2 describes the model, and characterizes the equilibrium level of redistribution under both decentralization and centralization. Section 3 describes the link between both intra- and interregional inequality and total welfare using the the social planner problem of this economy. Section 4 compares the welfare properties of the decentralized and centralized solutions in a direct democracy for both the symmetric and non-symmetric case. Section 5 analyzes the political economy of the choice between decentralization and centralization, and investigates whether the best solution from a welfare perspective is sustainable as an equilibrium in a direct democracy. Section 6 introduces the possibility of voluntary after-tax transfers between regions under decentralization, and compares the welfare levels of the three institutional arrangements. Finally, section 7 concludes.

2. The Model

There are two regions A and B of equal size. There are rich and poor individuals (voters) in both regions. All the poor individuals in the economy are endowed with income y^P and all the rich with income y^R, where $y^R > y^P$. There are n voters in total: n_A voters in region A and n_B voters in region B, where $n_A = n_B$. Furthermore, there are n_A^R rich and n_A^P poor voters in region A and n_B^R rich and n_B^P poor voters in region B. Therefore, we have that $n = n_A + n_B = \left(n_A^R + n_A^P\right) + \left(n_B^R + n_B^P\right)$. Only the rich voters pay taxes, and only the poor voters receive a transfer from taxation. The tax rate is linear and there is no deadweight loss from taxation.

The budget constraints of the rich and poor voters in region $j = A, B$ under decentralization are thus given by

$$c_j^R = (1 - t_j)\, y^R$$

$$c_j^P = y^P + \frac{n_j^R t_j y^R}{n_j^P}$$

Under centralization, those constraints become

$$c^R = (1 - t)\, y^R$$

$$c^P = y^P + \frac{\left(n_A^R + n_B^R\right)}{\left(n_A^P + n_B^P\right)} y^R t$$

In order to focus on donor motivation, we assume that the median voter is a rich individual[1]. Voters are utilitarian altruists, and the utility function of a rich individual from region A is given by

$$U_A^R = u\left(c_A^R\right) + \alpha \left\{ \beta \left[\frac{n_A^P}{n_A} u\left(c_A^P\right) + \frac{n_A^R}{n_A} u\left(c_A^R\right) \right] + (1-\beta) \left[\frac{n_B^P}{n_B} u\left(c_B^P\right) + \frac{n_B^R}{n_B} u\left(c_B^R\right) \right] \right\}$$

where $u(.)$ is strictly increasing and concave, and where $\beta \in \left[\frac{1}{2}, 1\right]$ is the group loyalty parameter. Therefore, when $\beta = \frac{1}{2}$, the individual cares equally about both regions, and when $\beta = 1$, he only cares about his own region. One verifies easily that preferences are single-peaked on the tax rate dimension under both centralization and decentralization, and thus the median voter theorem applies.

In this set up, average income heterogeneity between regions arises from the fact that $n_A^R \neq n_B^R$, so that there are interregional transfers taking place under a centralized system of redistribution. Furthermore, lack of common identity between the two regions is captured by the group loyalty parameter β.

2.1. Equilibrium Redistribution under Decentralization

In order to choose the regional equilibrium tax rate, the median voter in region $j = A, B$ maximizes U_j^R with respect to t_j. Deriving the expression with respect to the tax rate t_j and setting this quantity equal to zero yields

$$\frac{\partial U_j^R}{\partial t_j} = 0$$

$$\Leftrightarrow u'\left(c_j^R\right) = \alpha\beta \frac{n_j^R}{n_j} \left[u'\left(c_j^P\right) - u'\left(c_j^R\right) \right]$$

Assume for tractability that private utility is logarithmic, that is, $u(c) = \ln c$. In this case, the equilibrium under decentralization is described in Proposition 1 below.

Proposition 1: *The equilibrium tax rate in region $j = A, B$ under the decentralized solution is given by*

$$t_j = \frac{\alpha\beta}{(1+\alpha\beta)} \frac{n_j^P}{n_j} \frac{\left(y^R - y^P\right)}{y^R} - \frac{1}{(1+\alpha\beta)} \frac{n_j^P}{n_j^R} \frac{y^P}{y^R}$$

Furthermore, it has the following properties:
(i) $\frac{\partial t_j}{\partial n_j^P} > 0$ *if and only if* $\alpha\beta > \frac{y^P}{(y^R - y^P)} \left(\frac{n_j}{n_j^R}\right)^2$;

[1] Furthermore, if the poor was decisive, the equilibrium level of redistribution would be such that the poor ends up consuming more than the rich, which is unrealistic.

(ii) $\frac{\partial t_j}{\partial y^R} > 0$ *and* $\frac{\partial t_j}{\partial y^P} < 0$*;*
(iii) $\frac{\partial t_j}{\partial \alpha} > 0$ *and* $\frac{\partial t_j}{\partial \beta} > 0$*.*
Proof: *in appendix.*

From (i), the equilibrium tax rate is increasing in the number of poor individuals if and only if altruism and group loyalty are high enough[2]. In particular, the higher pre-tax income dispersion and the proportion of rich, or, in other words, the cheaper to redistribute both in terms of proportions and in terms of marginal utility, the more likely that the condition will be satisfied. From (ii), the regional tax rate is increasing in pre-tax income dispersion, that is, as in the standard model of voting on redistribution (Meltzer and Richards (1981)), more pre-tax income inequality leads to more redistribution in equilibrium. Finally, when α increases, the median voter becomes relatively more altruistic, which increases his preferred tax rate. Notice that when the group loyalty parameter β increases, it has exactly the same effect as an increase in α. Indeed, as here there is no possibility of interregional transfers, the group loyalty parameter does not differ in essence from the altruistic weight α. Stronger group loyalty is equivalent to stronger altruism in this case, meaning a higher willingness to redistribute in equilibrium.

2.2. Equilibrium Redistribution under Centralization

Assume, without loss of generality, that the decisive voter under centralization is from region A. As we assume that the median voter is rich, if $n_A = n_B$ and $n_A^R > n_B^R$, it follows directly that the rich region is decisive under centralization. However, in order to be more general, we would like to allow for the possibility of the poor region being decisive under the centralized solution. This could be the case, for instance, if we allow region sizes to differ. However, as we do not want a particular region to have more weight in the aggregate, we will keep the assumption of equal region size, and just assume that either the poor or the rich region can be decisive under centralization[3].

As in the case of decentralization, the median voter (from region A) will implement his preferred tax rate so as to maximize U_A^R. Deriving this expression with respect to the tax rate t and setting this quantity equal to zero yields

$$\frac{\partial U_A^R}{\partial t} = 0$$

$$\Leftrightarrow \frac{\left(n_A^R + n_B^R\right)}{\left(n_A^P + n_B^P\right)} \alpha \begin{bmatrix} \beta \frac{n_A^P}{n_A} u'\left(c_A^P\right) \\ +\left(1-\beta\right) \frac{n_B^P}{n_B} u'\left(c_B^P\right) \end{bmatrix} = u'\left(c_A^R\right) + \alpha \begin{bmatrix} \beta \frac{n_A^R}{n_A} u'\left(c_A^R\right) \\ +\left(1-\beta\right) \frac{n_B^R}{n_B} u'\left(c_B^R\right) \end{bmatrix}$$

[2]Notice that when taking the derivative with respect to the number of poor individuals, we keep region size constant. That is, we look at the effect of an increase in the regional *proportion* of poor individuals.

[3]Note that the two regions having different sizes does not have any effect on voting decisions, as it is the regional *proportions* of rich and poor that enter individual preferences.

Assuming that private utility is logarithmic, the equilibrium tax rate is described in Proposition 2.

Proposition 2: *The equilibrium tax rate under the centralized solution is given by*

$$t = \frac{1}{(1+\alpha)} \left\{ \alpha \left[\beta \frac{n_A^P}{n_A} + (1-\beta) \frac{n_B^P}{n_B} \right] - \frac{y^P}{y^R} \frac{\left(n_A^P + n_B^P\right)}{\left(n_A^R + n_B^R\right)} \left[1 + \alpha\beta \frac{n_A^R}{n_A} + \alpha (1-\beta) \frac{n_B^R}{n_B} \right] \right\}$$

Furthermore, it has the following properties:
(i) $\frac{\partial t}{\partial n_A^P} > 0$ *if and only if* $\beta > \widetilde{\beta}$
(ii) $\frac{\partial t}{\partial n_B^P} > 0$ *if and only if* $\beta < \widehat{\beta} < 1$
(iii) $\frac{\partial t}{\partial y^R} > 0$ *and* $\frac{\partial t}{\partial y^P} < 0$
(iv) $\frac{\partial t}{\partial \alpha} > 0$
(v) $\frac{\partial t}{\partial \beta} > 0$ *if and only if* $\frac{\left(n_A^P - n_B^P\right)}{\left(n_A^P + n_B^P\right)} > \frac{y^P}{y^R} \frac{\left(n_A^R - n_B^R\right)}{\left(n_A^R + n_B^R\right)}$
Proof: *in appendix.*

From (i), the centralized tax rate is increasing in the proportion of local poor if β is strictly higher than some threshold. From (ii), it is increasing in the proportion of poor in B if β is strictly lower than some (other) threshold. In fact, as $\frac{\partial^2 t}{\left(\partial n_A^P\right)^2} < 0$ and $\frac{\partial^2 t}{\left(\partial n_B^P\right)^2} < 0$, the tax rate is concave in both proportions of poor. Notice that when $\beta = 1$, $\frac{\partial t}{\partial n_B^P}$ is strictly negative for any other parameter values. That is, with full group loyalty, and given that region A is decisive, the centralized tax rate is decreasing in the proportion of poor in B. Furthermore, this is true no matter if region A is the rich or the poor region. Finally, as in the decentralized case, the tax rate is increasing in both pre-tax income dispersion and general altruism.

From (v), if region A is the rich (and decisive) region in the sense that the proportion of rich people is higher than in B, an increase in group loyalty will decrease the equilibrium tax rate. As the median voter cares relatively more about his own poor, the fact that most (i.e. more than 50%) of the tax revenue goes to the other region induces him to implement a lower tax rate in equilibrium. Conversely, if region A is the poor region (i.e. $n_A^P > n_B^P$), an increase in β increases the equilibrium tax rate, as the decisive voter wants to exploit the rich voters in the rich region to a greater extent[4].

In order to see what would be a first best solution in this economy, we now turn to the social planner problem under both centralization and decentralization.

[4] Whether the centralized tax rate is increasing or not in β only depends on whether $n_A^P > n_B^P$, and not on regional incomes, even when allowing for $y_A \neq y_B$. However, this feature is due to the logarithmic form of private utilities. See the appendix for the effect of β on the centralized tax rate for the general case.

3. Inequality and Welfare: the Social Planner Problem

Our criterion to compare centralization and decentralization will be total welfare. Assuming that the poor has the same utility function as the rich[5], total welfare under decentralization is given by

$$W(t_A, t_B) = n_A^R U_A^R(t_A, t_B) + n_A^P U_A^P(t_A, t_B) + n_B^R U_B^R(t_A, t_B) + n_B^P U_B^P(t_A, t_B)$$

Simplifying this expression, total welfare becomes

$$W(t_A, t_B) = (1+\alpha)\left[n_A^R u\left(c_A^R\right) + n_A^P u\left(c_A^P\right) + n_B^R u\left(c_B^R\right) + n_B^P u\left(c_B^P\right)\right]$$

Similarly, total welfare under centralization is given by

$$W(t) = (1+\alpha)\left[u\left(c^R\right)\left(n_A^R + n_B^R\right) + u\left(c^P\right)\left(n_A^P + n_B^P\right)\right]$$

We define inequality as the total dispersion of final consumptions (i.e. consumption variance). The average consumption in the economy is given by $\overline{c} = \frac{n_A^R y_A^R + n_B^R y_B^R + n_A^P y^P + n_B^P y^P}{n_A + n_B}$ and is the same under both institutional arrangements as there is no efficiency cost from taxation. Therefore, variance under decentralization and centralization are respectively given by

$$\begin{cases} V(t_i, t_j) = \frac{1}{n_A+n_B}\sum_{j=A,B}\sum_{i=R,P} n_j^i \left(c_j^i(t_j) - \overline{c}\right)^2 \\ V(t) = \frac{1}{n_A+n_B}\sum_{i=R,P}\left(n_A^i + n_B^i\right)\left(c^i(t) - \overline{c}\right)^2 \end{cases}$$

Suppose that a benevolent social planner has to choose a uniform tax rate t so as to maximize $W(t)$ subject to $c^R = (1-t)\,y^R$ and $c^P = y^P + \frac{\left(n_A^R + n_B^R\right)}{\left(n_A^P + n_B^P\right)} y^R t$. As total welfare is simply the sum of private utilities, which are logarithmic, we have the following result:

Proposition 3: *The uniform tax rate that minimizes total inequality (i.e. such that $V(t^*) = 0$) and the one that maximizes total welfare coincide, and is given by*

$$t^* = \frac{\left(y^R - y^P\right)}{y^R}\frac{\left(n_A^P + n_B^P\right)}{\left(n_A + n_B\right)}$$

Proof: *Direct by solving the corresponding maximization problems.*

Therefore, maximizing total welfare under a centralized system of redistribution means minimizing total inequality. Notice that this means minimizing both

[5] That is, the final utility of a poor individual in region A is given by

$$U_A^P = u\left(c_A^P\right) + \alpha\left\{\beta\left[\frac{n_A^P}{n_A}u\left(c_A^P\right) + \frac{n_A^R}{n_A}u\left(c_A^R\right)\right] + (1-\beta)\left[\frac{n_B^P}{n_B}u\left(c_B^P\right) + \frac{n_B^R}{n_B}u\left(c_B^R\right)\right]\right\}$$

intraregional and interregional inequalities, that is, such that $c^R = c^P$ in both regions and $\bar{c}_A = \bar{c}_B$. As we did not include any efficiency cost associated to taxation, and as private utilities are strictly concave, total welfare is maximized when consumption of the rich and of the poor are equalized both within and between regions. Observe, furthermore, that the tax rate that t^* is independent of group loyalty.

Interregional transfers from the poor to the rich region are beneficial up to the point where $c^R = c^P$ in both regions. In this formulation, therefore, more redistribution is always better from the point of view of total welfare under centralization. In particular, total redistribution is best, that is, such that all the poor and the rich in the economy have the same final consumption. Furthermore, this is true no matter the strength of group loyalty. In other words, interregional transfers are beneficial in that they permit to maximize total welfare, even though voters in both regions care more about their own people. However, observe that this is true only when the strength of group loyalty is the same in both regions. Indeed, assume that $\beta_A \neq \beta_B$. In this case, total welfare under centralization is given by

$$W(t) = (1+\alpha)\left[\begin{array}{c} u\left(c^R\right)\left(n_A^R + n_B^R\right) \\ +u\left(c^P\right)\left(n_A^P + n_B^P\right) \end{array}\right] + (\beta_A - \beta_B)\left[\begin{array}{c} u\left(c^R\right)\left(n_A^R - n_B^R\right) \\ +u\left(c^P\right)\left(n_A^P - n_B^P\right) \end{array}\right]$$

The tax rate that maximizes total welfare is now given by some $\widetilde{t}$ that depends on both group loyalty parameters. In particular, we will have that $\frac{\partial \widetilde{t}}{\partial \beta_i} > 0$ if $n_i^P > n_j^P$ for $i, j = A, B$. Therefore, eliminating both intra and inter-regional inequalities is optimal only if the strength of group loyalty is the same in both regions. If $\beta_A \neq \beta_B$ and $n_A^P \neq n_B^P$, the first best solution involves some strictly positive level of inequality.

Assume now that $\beta_A = \beta_B$. We just saw that, in a centralized system, the tax rate that maximizes total welfare is the one such that there remains no inequality in the economy. However, as the regions differ regarding their proportion of poor individuals, they also differ regarding their optimal level of redistribution in a decentralized system. Suppose now the social planner has to choose (t_A, t_B) so as to maximize $W(t_A, t_B)$ subject to $c_j^R = (1 - t_j)\, y^R$ and $c_j^P = y^P + \frac{n_j^R t_j y^R}{n_j^P}$, $j = A, B$ (i.e. there are no transfers between regions). The solution to this problem is described in Proposition 4.

Proposition 4: *The regional tax rates that maximize total welfare are given by* $(t_A^*, t_B^*) = \left(\frac{n_A^P}{n_A}\frac{\left(y^R - y^P\right)}{y^R}, \frac{n_B^P}{n_B}\frac{\left(y^R - y^P\right)}{y^R}\right)$. *Furthermore, they are such that intra-regional inequalities are minimized, that is, such that* $V_A(t_A^*) = V_B(t_B^*) = 0$. *This remains true when* $\beta_A \neq \beta_B$.

Proof: *Direct by solving the corresponding maximization problems.*

Comparing the two solutions, we then get the following result:

Proposition 5: *Assume that* $n_i^P < n_j^P$ *and all other parameters are the same across regions. In this case,* $t_i^* < t^* < t_j^*$ *and total welfare is strictly higher under the uniform solution, that is,* $W\left(t_i^*, t_j^*\right) < W\left(t^*\right)$.

Proof: *Assume* $n_A^P \neq n_B^P$. *It follows that* $W\left(t_A^*, t_B^*\right) > W\left(t^*\right)$ *if and only if* $n_A^R \ln \frac{c_A^R}{c^R} + n_A^P \ln \frac{c_A^P}{c^P} + n_B^R \ln \frac{c_B^R}{c^R} + n_B^P \ln \frac{c_B^P}{c^P} > 0$. *We know that* t_A^* *and* t_B^* *are such that* $c_A^P = c_A^R = c_A$ *and* $c_B^P = c_B^R = c_B$. *Furthermore,* t^* *is such that* $c^P = c^R = c$ *in both regions. Therefore,* $W\left(t_A^*, t_B^*\right) > W\left(t^*\right)$ *if and only if* $c_B c_A > (c)^2$, *or, equivalently,* $\left(1 - t_A^*\right)\left(1 - t_B^*\right) > \left(1 - t^*\right)^2$, *which is never satisfied when* $n_A^P \neq n_B^P$. *Therefore, total welfare is strictly higher under the uniform solution.*

Therefore, the first best solution is such that no inequality remains, both within and between regions. Observe that neither the first-best solution t^* nor the second best one $\left(t_A^*, t_B^*\right)$ will be attained in a direct democracy, the reason being that the decisive voter is partly self-interested. Under the uniform solution t^*, all voters in the economy enjoy a final utility of $U\left(t^*\right) = (1+\alpha)\ln c$. Under the non-uniform solution, all voters in region i enjoy a final utility of $U_i\left(t_i^*, t_j^*\right) = \ln c_i + \alpha\left[\beta \ln c_i + (1-\beta)\ln c_j\right]$, $i, j = A, B$. As $\frac{\partial U_i\left(t_i^*, t_j^*\right)}{\partial \beta} > 0$ if and only if $n_i^P < n_j^P$ it follows that when $n_i^P < n_j^P$, we will have that $U_i\left(t_i^*, t_j^*\right) > U\left(t^*\right)$ whenever $\beta > \frac{1}{\alpha} \frac{\left[\ln\left(\frac{c}{c_i}\right) + \alpha \ln\left(\frac{c}{c_j}\right)\right]}{\ln\left(\frac{c_i}{c_j}\right)}$, $i, j = A, B$. In fact, it turns out that if $n_i^P > n_j^P$, a voter in region i is strictly better off under the uniform solution, and a voter in region j is strictly better off under the non-uniform solution.

The result in Proposition 5 is striking, as it basically states that when the two regions are not identical, even though the spillovers can be fully internalized, the uniform solution yields higher total welfare. This contrasts with the traditional result according to which decentralization should be better in that case. Observe that $W\left(t_A^*, t_B^*\right) > W\left(t^*\right)$ if and only if $U_A\left(t_A^*, t_B^*\right) + U_B\left(t_A^*, t_B^*\right) > U\left(t^*\right)$, which is never satisfied when $n_A^P \neq n_B^P$. Again, the benefits of pooling national resources from a total welfare point of view imply that the best solution is always perfect equality.

In order to compare the relative benefits of the centralized and decentralized solutions, we now go back to the equilibrium under a direct democracy in both the symmetric and non-symmetric case.

4. Centralization versus Decentralization in a Direct Democracy

4.1. The Symmetric Case: $n_A^P = n_B^P$

Assume now that all parameters are the same across the two regions, and in particular that $n_A^P = n_B^P$. Under decentralization, the regional tax rates will be given by

$$t_A = \frac{\alpha\beta}{(1+\alpha\beta)} \frac{n_j^P}{n_j} \frac{\left(y^R - y^P\right)}{y^R} - \frac{1}{(1+\alpha\beta)} \frac{n_j^P}{n_j^R} \frac{y^P}{y^R} = t_B$$

Under centralization, no matter to which region the median voter belongs, the uniform tax rate will be given by

$$t = \frac{\alpha}{(1+\alpha)} \frac{n_j^P}{n_j} \frac{\left(y^R - y^P\right)}{y^R} - \frac{1}{(1+\alpha)} \frac{n_j^P}{n_j^R} \frac{y^P}{y^R}$$

As the burden of redistribution is shared equally among the rich in the 2 regions (both in terms of income and proportions of poor), the centralized tax rate is now independent of β. Hence, the existence of group loyalty per se cannot explain why redistribution would be lower in culturally diverse societies, a point already made by Bjorvatn and Cappelen (2006). In addition to group loyalty, some heterogeneity between the regions is needed regarding how rich they are, implying that interregional transfers take place through a centralized system of redistribution[6]. We then have the following result:

Proposition 6: *When $n_A^P = n_B^P$, it follows that $t_A = t_B < t$ unless $\beta = 1$, in which case they are equal. Then, as long as $\beta < 1$, total inequality is higher under the decentralized solution, and total welfare is higher under the centralized solution. Furthermore, all individuals in the economy are strictly better off under the centralized solution, that is, centralization Pareto-dominates decentralization when $\beta < 1$.*

Proof: *A voter i is better off under decentralization if and only if $U^i(t_A, t_B) > U^i(t)$, $i = R, P$. When $n_A^P = n_B^P$* and $\beta = 1$, *it follows that $U^i(t_A, t_B) = U^i(t)$, $i = R, P$, so that all voters are indifferent between centralization and decentralization. As we have $\frac{\partial U^i(t)}{\partial \beta} = 0$* and *$\frac{\partial U^i(t_A,t_B)}{\partial \beta} > 0$, $i = R, P$, all voters are strictly better off under centralization whenever $\beta < 1$, which in turn implies that total welfare is strictly higher under the centralized solution whenever $\beta < 1$. Finally, as $t_A = t_B < t$ when $\beta < 1$, it follows directly that total inequality is strictly lower under centralization.*

[6] Note that if we allow $y_A^R \neq y_B^R$, we obtain $t = \frac{\alpha}{(1+\alpha)} \frac{n_j^P}{\left(n_j^P + n_j^R\right)} \left[1 - 2\frac{y^P}{\left(y_A^R + y_B^R\right)}\right] - \frac{2}{(1+\alpha)} \frac{y^P}{\left(y_A^R + y_B^R\right)} \frac{n_j^P}{n_j^R}$. As we saw, the fact that the tax rate remains independent of β when $y_A^R \neq y_B^R$ comes from the logarithmic form of the private utility function.

Hence, in the symmetric case, as long as individuals care about the well-being in the other region, the centralized tax rate is strictly higher than the regional tax rates. Why is this so? As no interregional transfers are allowed under decentralization, even though the median voter in each region might want to transfer part of the regional tax revenue to the poor in the other region, he cannot. This constraint imposed by the decentralized system could make him vote for a strictly lower tax rate. However, this is more likely to be the case when regions are heterogeneous regarding their proportion of poor and/or income. Indeed, voluntary regional transfers are more likely to arise when there is a poor and a rich region. Therefore, there seems to be some other mechanism at work in the symmetric case yielding to lower redistribution under decentralization. Under centralization, the decisive voter can force every other rich to pay his preferred tax rate, the revenue of which will be transfered homogeneously to the poor everywhere in the country. Under decentralization, each median voter can only force the rich inside the region to pay the tax, the revenue of which will be transferred to the poor inside the region. Thus, under the centralized regime, and given that $n_A^P = n_B^P$, there are twice as many rich redistributing to twice as many poor. Knowing that redistribution is implemented at this larger scale, the decisive voter (as any other rich) is willing to redistribute more, which is beneficial to everyone. The fact of *all* voters being better off under centralization no matter the strength of group loyalty is due to the fact that $n_A^P = n_B^P$, which implies no net transfers between the two regions.

Observe that here, the mechanism through which centralization yields a better outcome, in the sense of increased redistribution (which is profitable for everybody), is very different than the one highlighted in the traditional - social planner - approach on fiscal federalism. Traditionally, the benefit of centralization lies in the fact that, under such a system, the social planner internalizes all the regional spillovers. In our model, the voter choosing the tax rate under both centralization and decentralization is the same person, who "selfishly" maximizes his own utility function when doing so. Therefore, this decisive voter, when choosing the centralized tax rate, is not internalizing anything. In particular, he does not internalize the fact that voters in the other region also care about his own region (i.e. the regional spillovers in redistribution). As explained above, the reason why the median voter chooses to redistribute more under centralization (as long as $\beta < 1$) is linked to the fact that he can force more rich to redistribute to more poor. Said in other words, the underprovision of redistribution under decentralization here comes from the reduced scale at which redistribution is implemented, while it comes from the non-internalization of spillovers in the standard approach, or from tax competition between regions under the assumption of mobility of taxpayers and/or welfare recipients.

4.2. The Non-Symmetric Case: $n_A^P \neq n_B^P$

As before, let assume that the decisive voter under centralization is from region A. If $n_A^P < n_B^P$, the median voter now faces some trade off when choosing the tax rate under the centralized regime. On the one hand, he can force the whole population of rich to pay a given tax rate in order to help the poor. On the other hand, he knows that most contributions will go to the region about the one he cares the least. Whether, as a result of this trade-off, total inequality is still lower under centralization (as in the symmetric case) depends on the parameters of the model. In particular, the stronger group loyalty, the higher the implicit disutility arising from the transfer to the poor region, the lower the centralized tax rate, and the more likely that total inequality is higher under centralization. If $n_A^P > n_B^P$, there is no such a trade-off, and total inequality is always lower under the centralized solution. Finally, note that we can potentially have any ordering between the three tax rates, depending on which region is decisive and on the strength of group loyalty given the other parameters.

Proposition 7 below describes the properties of total welfare regarding group loyalty under both centralization and decentralization:

Proposition 7: *Total welfare under decentralization is increasing in group loyalty, that is,* $\frac{\partial W(t_A,t_B)}{\partial \beta} > 0$*. Assume region A is decisive under centralization. If* $n_A^P > n_B^P$*, total welfare is increasing in group loyalty, that is,* $\frac{\partial W(t)}{\partial \beta} > 0$*. If* $n_A^P < n_B^P$*, the opposite holds, that is,* $\frac{\partial W(t)}{\partial \beta} < 0$*.*

Proof: *As the median voter is partly selfish under any institutional arrangement, he will always implement a tax rate such that the rich consume strictly more than the poor. As total welfare under decentralization is maximized when* $c_A^R = c_A^P$ *and* $c_B^R = c_B^P$*, the result follows directly from the fact that* $\frac{\partial t_A}{\partial \beta} > 0$ *and* $\frac{\partial t_B}{\partial \beta} > 0$*. Similarly, as total welfare under centralization is maximized when* $c^R = c^P$*, the result follows directly from the fact that* $\frac{\partial t}{\partial \beta} > 0$ *when* $n_A^P > n_B^P$ *and* $\frac{\partial t}{\partial \beta} < 0$ *when* $n_A^P < n_B^P$*.*

We know from the social planner problem that total welfare is highest when total inequality is minimized. Centralization has an advantage over decentralization, as the pooling of resources permits to smooth consumption between rich and poor across regions (i.e. $c_A^R = c_B^R$ and $c_A^P = c_B^P$). The costs of centralization from a total welfare point of view lie in the fact that $c^R \neq c^P$ (intra-regional inequality) and $\bar{c}_A(t) \neq \bar{c}_B(t)$ (inter-regional inequality). The costs of decentralization also come from the fact that $c_i^R \neq c_i^P$ (intra-regional inequality), but the inter-regional inequality cost now has two component: First, it will also be true that $\bar{c}_A(t_A, t_B) \neq \bar{c}_B(t_A, t_B)$, the difference being strictly higher than in the centralized case, but also that $c_A^R \neq c_B^R$ and $c_A^P \neq c_B^P$. Therefore, whenever $V(t) < V(t_A, t_B)$, it follows that $W(t) > W(t_A, t_B)$. However, even though $V(t) > V(t_A, t_B)$ (when the rich region is decisive and β is high), it will still be the case that $W(t) > W(t_A, t_B)$ for some range of β (or for the whole range), as the benefits coming from the pooling of resources more than offset the cost of a lower preferred tax rate by the median voter (and thus possibly higher total inequality). We thus have the following claim:

Claim 1: *If* $V(t) < V(t_A, t_B)$*, it follows that* $W(t) > W(t_A, t_B)$*, that is,* $V(t) < V(t_A, t_B)$ *is a sufficient (but not necessary) condition for* $W(t) > W(t_A, t_B)$ *to hold.*

We then have the following result in the absence of group loyalty:

Proposition 8: *Assume* $n_A^P \neq n_B^P$*. In the absence of group loyalty, total welfare is strictly higher under the centralized solution. This is true no matter whether it is the rich or the poor region that is decisive. That is, if* $\beta = \frac{1}{2}$*, it follows that* $W(t) > W(t_A, t_B)$*.*

Proof: *Assume* $n_A^P \neq n_B^P$*. In the absence of group loyalty, total inequality is strictly higher under the decentralized solution, no matter which region is decisive (see appendix). From Claim 1, it follows that* $W(t) > W(t_A, t_B)$*.*

Observe that if there is no group loyalty, the preferred centralized tax rate of a rich voter in A and in B is the same, even though $n_A^P \neq n_B^P$. This is only true when $\beta = \frac{1}{2}$, as the potential disutility of interregional transfers disappears in that case. As individuals no longer give priority to their own region, they give the same weight to reducing intra-regional inequalities (in both regions) and inter-regional inequalities. In other words, interregional inequalities arising from decentralization (i.e. the fact that both $c_A^R \neq c_B^R$ and $c_A^P \neq c_B^P$) constitute a pure loss from the point of view of any individual, and thus from a total welfare point of view.

When $\beta = \frac{1}{2}$, the final utility of any voter $i = R, P$ in region $j = A, B$ is an increasing function of total welfare under the corresponding solution, that is,

$$U_j^i = u\left(c_j^i\right) + \frac{\alpha}{(1+\alpha)} \frac{W}{2n_j}$$

Therefore, when $\beta = \frac{1}{2}$, each individual cares about two things: himself and total welfare. Given that each individual weights equally total welfare in the two regions, the median voter, whoever it is, would like to pool national resources and choose his preferred tax rate so as to implement his preferred redistribution policy everywhere in the country. Indeed, as $\beta = \frac{1}{2}$, the median voter does not wish to discriminate the individuals according to the region they come from. The fact that all the rich (and also the poor) in the nation would choose the same centralized tax rate confirms this intuition: the fact that $n_A^P \neq n_B^P$ is not relevant anymore when choosing t, given that $\beta = \frac{1}{2}$, as the only thing that matters now from the point of view of any individual is the national proportion of poor, and, as a consequence, the median voter would like to smooth their consumption across the nation. In other words, voters now only care about *total* inequality, to an extent depending on the weight they put on selfish versus altruistic motives. A decentralized system just adds a constraint to the choice of the median voter here, as he can only choose redistribution in his region, even though he cares equally about the other region.

Proposition 9: *Assume region A is decisive under centralization. (i) If $n_A^P > n_B^P$, total welfare is strictly higher under the centralized solution for all β; (ii) if $n_A^P < n_B^P$, total welfare is strictly higher under the centralized solution whenever β is below some threshold $\widetilde{\beta}$, where $\widetilde{\beta}$ is strictly increasing in income dispersion. Furthermore, $\widetilde{\beta}$ is possibly higher or equal to* 1*, so that total welfare might be always higher under centralization.*

Proof: *(i) If $n_A^P > n_B^P$, we have $V(t) < V(t_A, t_B)$ for all β (see appendix). From Claim 1, it follows that $W(t) > W(t_A, t_B)$; (ii) from Proposition 8, we know that when $\beta = \frac{1}{2}$, $W(t) > W(t_A, t_B)$. From Proposition 7, as β increases, $W(t_A, t_B)$ increases and $W(t)$ decreases, so that they will possibly be equal for some $\widetilde{\beta} < 1$. The properties of $\widetilde{\beta}$ can be proven using the implicit function theorem (see appendix).*

One of the traditional arguments against centralization is that such a system is less sensitive to regional preferences - the so-called *preference matching* argument. Typically, such an inefficiency is generated by the "uniformity" assumption under centralization. However, this *ad hoc* assumption is not necessary to generate reduced preference matching under centralization. For example, Lockwood (2002) highlights a similar inefficiency in a political economy model where the full political process is modeled and where no uniformity is assumed under centralization. While this uniformity assumption has been much criticized both on empirical and theoretical grounds (see, for instance, Besley and Coate (2003)), we believe that it remains appropriate in our set up. Indeed, as the purpose of policy is pure redistribution, it is quite natural to assume a rule of horizontal equity inside the geographical area in which the policy is implemented. That is, voters should be treated the same way under centralization no matter the region they belong to.

How does, then, the preference matching argument translate in our set up? In the literature, the cost of centralization typically arises because the regions value public goods differently. In particular, if there are two regions, one of them values the public good more than the other, and the social planner, when setting the uniform level under centralization, consequently under-provides or over-provides the public good in a given region. In our model, all voters value redistribution the same way (i.e. α is the same for all voters, both within and between regions) and the only source of heterogeneity is the fact that one region has a higher proportion of poor individuals than the other. As a result of this heterogeneity, the equilibrium regional tax rates under decentralization differ, that is, $t_A \neq t_B$ as long as $n_A^P \neq n_B^P$. Now, in the absence of group loyalty, the centralized equilibrium tax rate would always be the same, *no matter whether it is the poor or the rich region that is decisive.* The median voter, irrespective of the region he belongs to, has the same redistributive preferences as long as he's able to pool resources nationally. When $\beta > \frac{1}{2}$, redistributive preferences differ between regions under both centralization and decentralization.

What does this tell us? There are fundamentally two kinds of heterogeneity between regions that interact here: regional average income and identity. If the decisive voter under centralization belongs to the rich region, he would prefer a decentralized system only to the extent that he cares more about his own region, and thus implicitly dislikes interregional transfers to take place through the redistribution policy. In other words, it is not the differences in regional average income *per se* that generate a cost under centralization, but rather the fact that together with group loyalty, those differences might cause a decrease in the degree of solidarity in the society. Similarly, in the absence of group loyalty, the interregional transfers that take place under centralization are beneficial to everyone (they increase the utility of each single voter), as the pooling of national resources permits to smooth consumption of rich and poor across regions. In this case, the only remaining source of heterogeneity (regional average income) does not constitute a rationale for decentralization, neither from an individual nor from a total welfare point of view. The rationale for decentralization only arises when both sources of heterogeneity are present, given that the decisive region is the rich one (recall that in the social planner problem, centralization is always better, even though the two forms of heterogeneity are there).

Oate's decentralization theorem states that *(i) If there are no spillovers and regions are identical, then centralization and decentralization are equally efficient;*

(ii) If there are no spillovers and regions are not identical, then decentralization is more efficient than centralization;

(iii) If there are spillovers and regions are identical, then centralization is more efficient than decentralization.

In our set up, the theorem would become that *(i) If there are no spillovers ($\beta = 1$) and regions are identical ($n_A^P = n_B^P$), then centralization and decentralization are equally efficient;*

(ii) If there are no spillovers ($\beta = 1$) and regions are not identical ($n_A^P \neq n_B^P$), then centralization is more efficient than decentralization provided that the poor region is decisive under centralization. Otherwise, it is ambiguous which institutional arrangement yields higher total welfare;

(iii) If there are spillovers ($\beta < 1$) and regions are identical ($n_A^P = n_B^P$), then centralization is more efficient than decentralization;

(iv) If spillovers are total ($\beta = \frac{1}{2}$), centralization is always more efficient than decentralization, no matter whether the regions are identical or not.

Points (i) and (iii) are identical to the ones in Oate's theorem. However, from point (ii), it turns out that even when there are no spillovers, the poor region can gain from a centralized policy (always if it is decisive, but sometimes even when it is not), meaning that decentralization will not be Pareto preferred to centralization. This is because the resources pooling will nearly always benefit the poor region, which might make total welfare strictly higher under centralization. From point (iv), even though there are spillovers and regions are not identical, implying some kind of trade-off in the traditional approach, centralization will always be more efficient than decentralization. As explained, the fact that $\beta = \frac{1}{2}$ makes the regional heterogeneity regarding average incomes irrelevant from an individual point of view. In fact, in that case, centralization always Pareto-dominates decentralization. More importantly, it turns out that increased heterogeneity need not increase the attractiveness of decentralization from a welfare perspective. Indeed, when $n_A^P = n_B^P$ and $\beta < 1$, decentralization is Pareto-dominated but as $t_A = t_B$, rich and poor end up with the same final consumption in both regions. In contrast, when $n_A^P \neq n_B^P$ (and thus $(t_A \neq t_B)$, centralization becomes even more attractive as the fact that final consumptions differ between regions constitute an additional loss from a total welfare point of view, which is avoidable under centralization, although in that case, depending on β, decentralization need not be Pareto-dominated[7].

Bolton and Roland (1997) show that income-based redistribution has three effects on the incentives to secede: (i) a political effect, as the regional and national median incomes differ; (ii) a tax base effect, as average income differs between regions and (iii) an efficiency effect, as total income is lower as a result of a breakup. The political effect reflects differences in preferences for redistribution and induces a given region to secede, independently of the existence of interregional transfers. Such transfers arise when regional average incomes differ, and typically induce richer regions to secede (the tax-base effect). In our set up, we do not really have the political effect. Such an effect is related to the preference-matching argument described above, and the presence of altruism in our model sort of cancels regional differences in preferences as long as the regions share a common identity. Still, even when $\beta = \frac{1}{2}$, we will have $t_A \neq t_B$ as long as $n_A^P \neq n_B^P$, but those differences are only due to the fact that the median voters are not able to pool national resources, as they would otherwise vote for the same uniform tax rate under a centralized system, and would be strictly better off by doing so. That is, the two median voters do not differ in their *tastes*, but rather in their *ability* to redistribute. As group loyalty gets stronger, both regions might strictly prefer a decentralized system. The rich region, because it dislikes the transfers to take place. And the poor region, because the centralized tax rate might be so low (if the other region is decisive) that it actually prefers to implement its own redistribution policy even though it will not benefit from a transfer. Once again, it is the interaction between group loyalty and regional differences in average income that generate the incentives to decentralize. Notice, also, that it is so because we did not assume any other kind of heterogeneity between regions. Indeed, if we had assumed different regional weights for altruistic motives ($\alpha_A \neq \alpha_B$) or, alternatively, different median incomes ($y_A^R \neq y_B^R$), this would create such a political effect as in Bolton and Roland (1997). That is, in the absence of transfers, the regions still have an

[7] Notice, however, that if $\beta = 1$ and the rich region is decisive, the relative efficiency of decentralization is actually increasing in heterogeneity, as this heterogeneity is really harmful under the centralized solution.

incentive to secede as their preferences for redistribution differ. Fundamentally, what we mean here by group loyalty is the fact that a given individual values redistribution relatively more in his own region. Hence, we do not allow for a potential heterogeneity in *preferences* regarding redistribution.

Finally, in Bolton and Roland (1997), the tax-base effect always induces the richer region to secede. In contrast, this is true in our model only to the extent that the median voter in the richer region cares more (or only) about his own region. Otherwise, if there is no group loyalty, the pooling of national resources is beneficial to everyone. As in Bolton and Roland (1997), the tax-base effect always reduces the incentives to break up for the poor region in our model. However, when the rich region is decisive and group loyalty is very strong, the poor region might be better off under the decentralized system, even though it receives a positive transfer under centralization.

5. The choice between Centralization and Decentralization

After having investigated which institutional arrangement yields higher total welfare, a natural question that arises is whether the best solution is sustainable as an equilibrium in a direct democracy. Obviously, this requires making assumptions regarding the rule under which a given system (centralized or decentralized) can be implemented. Suppose centralization is the status quo. Implementing a decentralized system could require, for instance, the following: unanimity in both regions, simple majority in both regions, simple majority in one region. Then, if the best solution is not sustainable as an equilibrium under the corresponding rule, another question that arises is whether there exists an accommodating policy (i.e. a tax rate) such that the inefficient solution (i.e. the one that yields lower total welfare) can be avoided. In this section, in order to answer these questions, we compare individual utility levels under both the centralized and decentralized solutions.

We already saw that when the two regions are equally rich ($n_A^P = n_B^P$), centralization Pareto-dominates decentralization (Proposition 6). It turns out that the same result holds for "cultural" homogeneity ($\beta = \frac{1}{2}$). Proposition 10 below states that in the absence of group loyalty, all voters are strictly better off under a centralized system of redistribution. As already explained, when cultural heterogeneity disappears, every individual is strictly better off when resources are pooled nationally.

Proposition 10: *Assume region A is decisive under centralization and $n_A^P \neq n_B^P$. If $\beta = \frac{1}{2}$, all voters are strictly better off under the centralized solution. That is, centralization Pareto-dominates decentralization whenever there is no group loyalty.*

Proof: *In appendix.*

Suppose the decisive voter under centralization is from the rich region. Implicit in our formulation is that decentralization has a cost in terms of interregional inequality, this cost being decreasing in β from the point of view of the decisive voter. Then, from the point of view of this same voter, centralization has a cost in terms of interregional transfers, this cost being increasing in β. Therefore, the decisive voter faces some trade-off when he's from the rich region. Decentralization makes reducing intra-regional inequality cheaper, but does not allow for inter-regional transfers. Centralization allows to reduce interregional inequality, but makes reducing intraregional inequality more costly. Therefore, whether the decisive voter in the rich region is better off under a decentralized system depends on the resolution of this trade-off, and hence on β.

Proposition 11: *Assume region A is decisive under centralization and* $\beta = 1$. *If* $n_A^P < n_B^P$,

(i) all voters in region A are strictly better off under the decentralized solution, that is, $U_A^j(t_A, t_B) > U_A^j(t)$, $j = P, R$. *In other words, centralization never Pareto-dominates decentralization;*

(ii) if the other parameters are such that $W(t) > W(t_A, t_B)$ *and the rich in A can unilaterally choose to decentralize, there exists no accommodating tax rate such that decentralization can be avoided.*

If, on the contrary, $n_A^P > n_B^P$,

(iii) all voters in region A are strictly better off under the centralized solution, that is, $U_A^i(t_A, t_B) < U_A^i(t)$, $i = P, R$;

(iv) the rich in region B are strictly better off under the decentralized solution, that is, $U_B^R(t_A, t_B) > U_B^R(t)$. *In other words, decentralization never Pareto-dominates centralization, and centralization never Pareto-dominates decentralization;*

(v) if region B can unilaterally choose to decentralize, there exists no accommodating tax rate such that decentralization can be avoided.

Proof: *In appendix.*

When the rich region is decisive and there is full group loyalty, decentralization will always obtain in equilibrium provided that the rich region can unilaterally decide to decentralize. In particular, as no accommodating tax rate exists, decentralization will obtain even when the other parameters are such that $W(t) > W(t_A, t_B)$. However, as no voter cares about the voters in the other region in that case, it seems hard to justify a centrally implemented redistributive policy when there is full group loyalty.

Proposition 12: *Assume region A is decisive under centralization. If* $n_A^P < n_B^P$, *there is some range of* β *for which total welfare is strictly higher under the centralized solution but for which decentralization obtains in equilibrium, provided that the rich in A can unilaterally choose to decentralize. Furthermore, for this same range of* β, *there exists no accommodating tax rate such that decentralization can be avoided.*

Proof: *In appendix.*

Therefore, with imperfect group loyalty, and provided that the rich region is decisive, the same kind of inefficiency arises, that is, for some range of β (the size of which depends on the other parameters), decentralization obtains in equilibrium although it is strictly dominated from a total welfare point of view.

When there is full group loyalty, centralization never Pareto-dominates decentralization, no matter whether it is the poor or the rich region that is decisive under centralization. More importantly, if $n_A^P > n_B^P$, decentralization never Pareto-dominates centralization, that is, even though there are no spillovers in the redistribution policy, the choice of decentralization can never be unanimous when the decisive region is the poor one.

When the poor region is decisive and there is full group loyalty, even though $W(t) > W(t_A, t_B)$, the question arises whether it is reasonable to promote a centralized system. Indeed, the higher total welfare arising under centralization here comes from the poor region selfishly exploiting the rich region. If a majority in each region is required to implement a decentralized system, the rich region will never be able to stop making implicit transfers to the poor region through the redistribution policy. Such a situation might be rather unstable, as separatist tensions are very likely to arise (recall that $\beta = 1$). More importantly, it turns out that no uniform tax rate exists such that the rich in B would be better off under a uniform solution[8]. However, as described in Proposition 13 below, such an accommodating tax rate might exist when the poor region is decisive provided that group loyalty is not perfect.

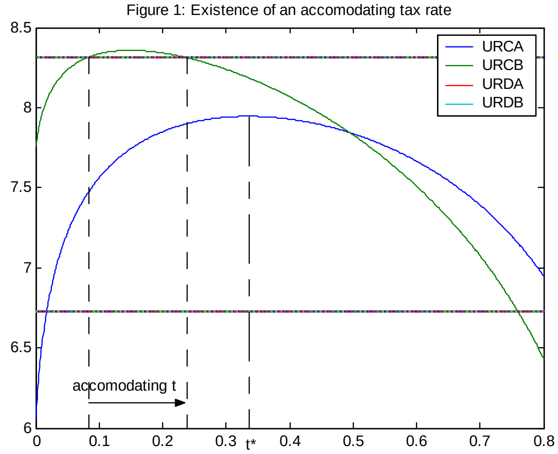
Proposition 13: *Assume region A is decisive under centralization and $n_A^P > n_B^P$. If a majority in only one region is required to implement a decentralized system, and β is such that decentralization obtains in equilibrium, there might exist an accommodating (uniform) tax rate $\widetilde{t} < t$ such that both regions are in favor of centralization with $\widetilde{t}$, and such that total welfare is strictly higher under the accommodating tax rate than under the decentralized solution.*

Proof: *From the example below. A necessary condition for an accommodating tax rate to exist is that the rich in B would be better off under centralization if he was decisive. In other words, β cannot be too high given the other parameters.*

[8] More generally, the question arises whether group loyalty is something valuable for the general well-being. Under decentralization, it is clearly beneficial, as it increases solidarity (i.e. the less spillovers, the more efficient the decentralized solution). It is also clearly harmful under centralization when the rich region is decisive, precisely for the same reason (i.e. the more spillovers, the more efficient the centralized solution). Now, even though total welfare is increasing in group loyalty under centralization when the poor region is decisive, observe that the fact that t is increasing in β means that redistribution is actually *decreasing* in the level of spillovers under centralization, which should not be considered as an efficient characteristic. Notice however that, as already mentioned, voters are never internalizing anything in this set up under any arrangement, as the equilibrium always arises from the maximization of some voter's individual utility (i.e. there is no social planner nor legislative process under centralization through which spillovers could be at least partly internalized).

In order to illustrate Proposition 13, lets look at an example. Suppose there are 100 voters in each region, region A is decisive under centralization, $n_A^P = 90$ and $n_B^P = 10$. Suppose furthermore that $\alpha = 1$, $y^P = 1$, $y^R = 100$ and $\beta = 0.75$ (i.e. there is imperfect group loyalty). Figure 1 depicts individual utility levels of the rich in both regions under decentralization and centralization for $t \in [0, 0.8]$. Given the value of those parameters, $W(t) > W(t_A, t_B)$ as long as $t > 0.04$. At the equilibrium t^*, we have $W(t^*) > W(t_A, t_B)$ but $U_B^R(t_A, t_B) > U_B^R(t^*)$, so that decentralization obtains in equilibrium if the rich in B can unilaterally decide to decentralize. However, as can be seen in the figure, there exists $t < t^*$ such that both $U_j^R(t) > U_j^R(t_A, t_B)$, $j = A, B$, and $W(t) > W(t_A, t_B)$, so that decentralization - the inefficient solution - can be avoided.

Figure 1: Existence of an accomodating tax rate



To sum up, three conclusions emerge from this section: first, if there is no group loyalty nor differences in regional average incomes, centralization Pareto-dominates decentralization, and thus centralization obtains. Second, when the rich region is decisive under centralization, in the cases where the decentralized solution is dominated from a welfare perspective, there will never exist an accommodating tax rate to avoid decentralization, provided that it obtains in equilibrium. In other words, if the rich region is decisive and can unilaterally decide to decentralize, the political economy equilibrium might be inefficient. Third, when the poor region is decisive, and given that group loyalty is not "too" strong, there might exist an accommodating tax rate such that decentralization can be avoided when it is inefficient (and such that total welfare remains higher under the accommodating tax rate than under decentralization).

6. Voluntary Interregional Transfers under Decentralization

As the cost of decentralization lies in the fact that no transfers between regions occur under such a system, a natural question that arises is whether - for the cases where $W(t) > W(t_A, t_B)$ - centralization still dominates decentralization when allowing the rich region to transfer part of its tax revenue to the poor region under the decentralized system. Such a transfer allows for some beneficial pooling of resources, while it permits the median voter in the rich region to control the amount to be transferred to the poor region (and thus such a system might be easier to implement politically than a centralized system). However, the possibility of a transfer also creates an incentive for the rich in the poor region to free ride on the generosity of the rich region. That is, knowing that their poor will receive a transfer from outside, the rich in the poor region are less willing to contribute to the regional redistribution policy. Therefore, it is not obvious whether a decentralized system with transfer dominates a centralized system from a welfare perspective. We now turn to investigate this issue.

Suppose that after the regional tax rates have been implemented, the rich region (region A) is allowed to transfer some proportion of its tax revenue to the poor region (region B). The rich region will be willing to do so provided that the median voter cares about the other region, that is, provided that $\beta_A < 1$. The individuals' budget constraints will now be given by

$$c_A^R = (1 - t_A)\, y^R$$

$$c_B^R = (1 - t_B)\, y^R$$

$$c_A^P = y^P + t_A n_A^R y^R \frac{\theta}{n_A^P}$$

$$c_B^P = y^P + \frac{t_B n_B^R y^R}{n_B^P} + t_A n_A^R y^R \frac{(1-\theta)}{n_B^P}$$

where θ is the proportion of tax revenue in A that stays in the region and is to be determined endogenously. We consider a two-stage game: in the first stage, the regional tax rates are implemented, and in the second stage the median voter in the rich region chooses θ. Solving backwards, we first determine the choice of θ for given (t_A, t_B) before solving for the equilibrium tax rates.

6.1. The Social Planner Problem

Suppose a social planner has to choose (t_A^*, t_B^*, θ) so as to maximize total welfare. Solving the game backwards, we get

$$(1 - \theta(t_A^*, t_B^*)) = \frac{n_A^P n_B^P (t_B^* - t_A^*) + n_B \left(n_B^P t_A^* - n_A^P t_B^*\right)}{n_A^R \left(n_A^P + n_B^P\right) t_A^*}$$

The reaction functions are strictly decreasing, and

$$t_A^* = \frac{\left(y^R - y^P\right)}{y^R}\frac{\left(n_A^P + n_B^P\right)}{\left(n_A + n_B\right)} = t_B^*$$

Therefore, the optimal transfer is given by

$$(1-\theta^*) = \frac{n_A}{n_A^R}\frac{\left(n_B^P - n_A^P\right)}{\left(n_A^P + n_B^P\right)}$$

Proposition 14: *The optimal values of* (t_A^*, t_B^*, θ^*) *are such that* $t_A^* = t_B^*$ *and* $c_A^R = c_B^R = c_A^P = c_B^P = c$.

Proof: *Direct by solving the corresponding maximization problem.*

As expected, the optimal solutions of the centralized system and the decentralized system with transfer coincide, that is, total welfare is maximized when perfect equality among individuals is achieved, both within and between regions.

6.2. Direct Democracy

Solving now the second stage of the game for the median voter in region A, we get $\theta(t_A, t_B)$:

$$\frac{\partial U_A^R}{\partial \theta} = 0$$

$$\Leftrightarrow \alpha\beta_A\left[\frac{n_A^P}{n_A}u'\left(c_A^P\right)\frac{t_A n_A^R y^R}{n_A^P}\right] - \alpha\left(1-\beta_A\right)\left[\frac{n_B^P}{n_B}u'\left(c_B^P\right)\frac{t_A n_A^R y^R}{n_B^P}\right] = 0$$

$$\Leftrightarrow \beta_A u'\left(c_A^P\right) = \left(1-\beta_A\right)u'\left(c_B^P\right)$$

Assuming that utilities are logarithmic, we get the following result:

Proposition 15: *The transfer to the poor region has the following properties:* $\frac{\partial(1-\theta)}{\partial t_A} > 0$, $\frac{\partial(1-\theta)}{\partial t_B} < 0$, $\frac{\partial(1-\theta)}{\partial \beta_A} < 0$, $\frac{\partial(1-\theta)}{\partial y^R} > 0$, $\frac{\partial(1-\theta)}{\partial y^P} < 0$, $\frac{\partial(1-\theta)}{\partial n_A^P} < 0$ *and the sign of* $\frac{\partial(1-\theta)}{\partial n_B^P}$ *is ambiguous.*

Proof: *In appendix.*

The properties of the transfer are intuitive. As expected, there is a threshold value of β_A above which the transfer would be negative. Obviously, an increase in group loyalty in the second period has a negative effect on the transfer to the poor region. In fact, when $\beta_A = 1$, $(1-\theta) < 0$, which we do not admit. Observe that the effect of an increase in the proportion of poor in the poor region has an ambiguous effect on the transfer. Indeed, as more poor in B will benefit from the transfer, the median voter in the rich region would like to transfer more.

However, precisely because the poor in B are more numerous, the median voter also realizes that the transfer will have to be shared among more individuals, meaning that it is now more expensive to help those poor, which induces him to decrease the size of the transfer.

Suppose β_A is low enough so that the transfer is positive (otherwise, we are back to the decentralized case without transfer). Substituting for $\theta(t_A, t_B)$ in U_A^R and U_B^R and solving for the first stage of the game, we get t_A and t_B as a function of one another. That is, we get reaction functions. Furthermore, we have that $\frac{\partial t_A(t_B)}{\partial t_B} < 0$ and $\frac{\partial t_B(t_A)}{\partial t_A} < 0$. As we just saw, if a higher tax rate is implemented in region B in the first period, region A will decrease the size of the transfer to the poor in B in the second period. Therefore, as it keeps a higher proportion of its tax revenue for the transfer to its own poor, region A can decrease its local tax rate. Similarly, given that t_A is higher, the median voter in the poor region correctly foresees that the rich region will be willing to increase the transfer. As a result, he chooses a lower tax rate in equilibrium.

Substituting for $t_A(t_B)$ and $t_B(t_A)$ into one another, we can finally solve for (t_A, t_B, θ) as a function of the exogenous parameters. Doing so, we get the results in Proposition 16[9]:

Proposition 16: *In equilibrium, (i) the tax rates in region $j = A, B$ have the following properties: $\frac{\partial t_j}{\partial y^R} > 0$, $\frac{\partial t_j}{\partial y^P} < 0$ and the sign of $\frac{\partial t_j}{\partial \alpha}$, $\frac{\partial t_j}{\partial \beta_B}$, $\frac{\partial t_j}{\partial n_A^P}$ and $\frac{\partial t_j}{\partial n_B^P}$ is ambiguous. Furthermore, $\frac{\partial t_A}{\partial \beta_A} < 0$ and $\frac{\partial t_B}{\partial \beta_A} > 0$;*

(ii) the absolute transfer $T = (1-\theta)\, t_A y^R n_A^R$ has the following properties: $\frac{\partial T}{\partial \beta_A} < 0$, $\frac{\partial T}{\partial \beta_B} > 0$ if $\frac{n_A^P}{n_A} > \frac{n_B^P}{n_B^P + n_B^R(1+\alpha)}$, and when $\beta_A = \beta_B = \beta$, it follows that $\frac{\partial T}{\partial \alpha} < 0$, $\frac{\partial T}{\partial y^P} < 0$ and $\frac{\partial T}{\partial \beta} < 0$.

Proof: *In appendix.*

Observe that the tax rate in the poor region is increasing in the strength of group loyalty in the rich region. Indeed, if β_A increases in the first period, the median voter in B foresees that the transfer in the second period will be lower. As a result, he votes for a higher tax rate in the first period. In contrast, an increase in β_B has an ambiguous effect on t_B in the first period. On the one hand, an increase in β_B induces the median voter to redistribute more, as in the case without transfer. On the other hand, the median voter realizes that by doing so, he will provoke a decrease in the transfer in the second period, which induces him to decrease the tax rate. Therefore, the total effect depends on the relative magnitude of those two effects. Finally, notice that the effect of

[9] The comparative statics on the equilibrium value of the transfer $(1-\theta)$ are quite cumbersome. Indeed, as the total effect of the exogenous variables on the transfer depends on both their direct effect in the second period and their indirect effect through the regional tax rates in the first period, it turns out to be a truly hard task to disentangle all those effects in order to understand its behaviour. However, we can instead get some comparative statics results for the *absolute* transfer.

an increase in α is also ambiguous, which is due to the fact that β_A and β_B might be different. Observe, furthermore, that neither α nor β_B have a direct effect on the transfer in the second period. Therefore, the final effect of those variables on the transfer are indirect and due to their effect on the tax rates.

When β_A increases, the median voter wants to transfer a smaller share of the local tax revenue to the poor region in the second period. As a result, he implements a lower tax rate in the first period. Notice that the effect of an increase in β_B on t_A is also ambiguous, as it obviously depends on how t_B will react to this increase in the first place, which is also ambiguous.

Quite strikingly, it turns out that the transfer is decreasing in general altruism. Why is this so? Being less selfish, the median voter in the poor region has less incentives to free ride on the generosity of the rich region through the transfer[10]. As a result, the median voter in A will reduce its transfer to the poor region in the second period. When $\beta > \frac{1}{2}$, the derivative of the transfer with respect to α is given by $\frac{\partial T}{\partial \alpha} = y^R n_A^R \left[\frac{\partial (1-\theta)}{\partial \alpha} t_A + \frac{\partial t_A}{\partial \alpha} (1-\theta) \right]$ As the second term is positive, it follows that the first term is negative and higher in absolute value than the second term. That is, free riding decreases in α. Notice also that when $\beta_A = \beta_B$, the total effect of an increase in β on the size of the transfer is always negative. In other words, the "increased free riding effect" (i.e. β_B increases) never compensates the fact that the median voter in A wishes to transfer less to the poor region (i.e. β_A increases).

Proposition 17: *Assume region A is decisive under centralization and $n_A^P < n_B^P$. If $\beta = \frac{1}{2}$, it follows that*

(i) $t_A > t_B$ and the transfer is strictly positive and such that $c_A^P = c_B^P < c^P$;

(ii) total inequality is strictly lower under centralization than under decentralization with transfer, that is, $V(t) < V(t_A, t_B, \theta)$;

(iii) total welfare is strictly higher under the centralized solution than under the decentralized solution both with and without transfer. Furthermore, total welfare is strictly higher under decentralization when allowing for the transfer, that is, $W(t) > W(t_A, t_B, \theta) > W(t_A, t_B)$. This remains true when the poor region is decisive under centralization.

Proof: *(i) and (ii) in appendix; (iii) as total welfare under both centralization and decentralization with transfer is maximized when total inequality is minimized (i.e. $V(.) = 0$), it follows that we can use the total variance as a criterion to compare the two systems. From (ii), $V(t) < V(t_A, t_B, \theta)$ for $\beta = \frac{1}{2}$, and thus $W(t) > W(t_A, t_B, \theta)$. The fact that $W(t_A, t_B, \theta) > W(t_A, t_B)$ can be proven analytically (see appendix). Finally, as t is the same whether region A or B is decisive when there is no group loyalty, the result extends to the case in which the poor region is decisive under centralization.*

When $\beta = \frac{1}{2}$, region A, being richer, implements a higher tax rate in the first period, while it transfers part of its tax revenue to the poor region in the

[10] Note that $\frac{\partial t_B}{\partial \alpha} > 0$ when $\beta_A = \beta_B$.

second period, so that $c_A^P = c_B^P$. Notice that the final consumption of the poor will be strictly lower than under the centralized system. Indeed, the median voter in A, as he cannot force the rich in B to contribute as much as he would like, chooses to redistribute less in equilibrium. Furthermore, it turns out that both $t_B(\theta) < t$ and $t_B(\theta) < t_B$. In other words, the rich in B, knowing that there will be a transfer, chooses to contribute less to the redistribution policy (i.e. there is free riding even though $\beta = \frac{1}{2}$). This is because the rich in B, even though he cares equally about both regions, is still partly self-interested. As he knows his poor will benefit from a transfer, the rich in B votes for a strictly lower tax rate than he would without the existence of the transfer. As a result, the median voter in A chooses to redistribute strictly less than he would under a centralized system. Therefore, the decentralized solution with transfer yields less redistribution, and will produce inequality between the rich across regions (i.e. $c_A^R < c_B^R$). As a result, total welfare will be strictly higher under the centralized solution.

Observe that with no group loyalty, $\frac{\partial(t_A - t_B)}{\partial\alpha} < 0$, that is, the more altruism, the lower the difference between the two tax rates. Notice, furthermore, that when $\beta = \frac{1}{2}$, the absolute transfer is always given by $\frac{(n_B^P - n_A^P)(y^R - y^P)}{2}$, and is independent of α. Thus, when α increases, t_A has to increase less than t_B in order to have $c_A^P = c_B^P$. In other words, and as already mentioned, more altruism in the society creates less free riding behavior. As a result, when altruism decreases, total inequality under decentralization increases faster when allowing for an after-tax transfer. In fact, it is not clear whether allowing for a transfer under decentralization yields to more or less total inequality. However, when $\beta = \frac{1}{2}$, total welfare is always strictly higher under the system with transfer, as the benefits of the transfer more than offset the potential cost of increased inequality.

Proposition 18: *Assume region A is decisive under centralization and $n_A^P < n_B^P$. For all values of β, and in particular for the values for which the transfer is positive, total inequality is strictly lower under the centralized solution. Therefore, it follows directly that for all values of β, total welfare is strictly higher under the centralized solution. That is, $V(t) < V(t_A, t_B, \theta)$ and $W(t) > W(t_A, t_B, \theta)$ for all β.*

Proof: *In appendix.*

For the whole range of β for which the transfer is strictly positive, it turns out that centralization strictly dominates decentralization from a welfare perspective. Of course, this does not mean that all voters are better off under centralization as long as the transfer is positive. Indeed, for example, the higher β, the more likely that the rich in A is better off under the decentralized system, as it gives him a better control of the amount of regional resources that will be transferred to the poor region than under the uniformity imposed by the centralized system. On the other hand, the free riding behavior of the rich in B induces him to prefer the centralized system. Therefore, it is not trivial whether the rich in A (as well as the other voters) is better off under a centralized system or not when $\beta > \frac{1}{2}$. Now, when there is no group loyalty, we do get the following results regarding individual utility levels:

Proposition 19: *Assume region A is decisive under centralization and $n_A^P < n_B^P$. If $\beta = \frac{1}{2}$,*

(i) The rich in B is strictly better off than the rich in A in the system with transfer, that is, $U_B^R(t_A, t_B, \theta) > U_A^R(t_A, t_B, \theta)$;

(ii) The poor in both regions are strictly better off under the centralized system than under the decentralized system with transfer, that is, $U^P(t) > U^P(t_A, t_B, \theta)$;

(iii) The rich in A is strictly better off under the centralized system than under the decentralized system with transfer, that is, $U_A^R(t) > U_A^R(t_A, t_B, \theta) > U_A^R(t_A, t_B)$;

(iv) The rich in B is strictly better off under the decentralized system with transfer than under the centralized system, that is, $U_B^R(t_A, t_B, \theta) > U_B^R(t) > U_B^R(t_A, t_B)$.

Proof: *in appendix.*

With no group loyalty, except from the rich in the poor region, all voters reach the highest final utility level under the centralized system. The rich in A, even though he can control the amount of resources to be transferred to the poor region under the decentralized system with transfer, is strictly better off under centralization as such a system allows him to force the rich in B to contribute more to redistribution. In contrast, the rich in B reaches the highest utility level under the decentralized system with transfer, as such an arrangement gives him the opportunity to free ride on the generosity of region A.

Proposition 20: *Assume $n_A^P < n_B^P$ and $\beta > \frac{1}{2}$ is low enough so that the transfer is strictly positive. Depending on the parameters, we can have either $W(t_A, t_B, \theta) > W(t_A, t_B)$ or $W(t_A, t_B, \theta) < W(t_A, t_B)$.*

Proof: *From simulations (see appendix).*

Therefore, it turns out that it is not even generally true that total welfare under decentralization increases when allowing for the transfer. As already mentioned, if the transfer allows for a beneficial pooling of resources, beneficial in the sense that it reduces interregional inequality (i.e. W increases), it also creates free riding behavior in the poor region, which increases total inequality (i.e. W decreases).

7. Concluding Remarks

We showed that in the presence of group loyalty and average income heterogeneity between regions, it is very often more efficient to implement redistribution at the centralized level. It is always more efficient when the poor region is decisive under centralization, and it is also more efficient when it is the rich region that is decisive, given that group loyalty is not too strong. However, even when group loyalty is perfect, the other parameters might be such that centralization still dominates decentralization from a welfare perspective, as the benefits of pooling more than offset the costs of reduced redistribution.

It is clear, however, that those results need to be nuanced. If there is full group loyalty, even though a centralized system might be better in the aggregate, it does not seem truly reasonable to promote such a system, as it is very likely that it will lead to potentially strong separatist tensions. Furthermore, if the poor region is decisive, the higher welfare under centralization fundamentally comes from the poor region selfishly exploiting the rich region, which should not be considered as something desirable. After all, if individuals in the two regions do not care at all about each other, why should the rich region pay a transfer to the poor region? However, if group loyalty is not perfect, individuals in the rich region actually care about interregional inequality, and thus centralization becomes attractive not only in the aggregate, but also from an individual perspective. Furthermore, the fact of redistribution being implemented at a larger scale induces the median voter to increase the equilibrium level of redistribution under centralization.

If the decisive voter under centralization is from the rich region and group loyalty is not too strong, a centralized system of redistribution Pareto-dominates a decentralized system. However, the higher group loyalty, the more likely that centralization will not be sustainable as an equilibrium, given that the rich region can unilaterally decide to decentralize. If the poor region is decisive under centralization, the centralized system always dominates the decentralized one from a welfare perspective. In this case, however, if the parameters are such that decentralization obtains in equilibrium, there might exist an accommodating tax rate such that every individual is better off under that solution, and hence decentralization can be avoided.

Implicit in our formulation is that decentralization has a cost in terms of interregional inequality. Always in the aggregate, but also from an individual perspective when group loyalty is not perfect. That is, to some extent, individuals in the rich region might want to transfer resources to the poor region. Allowing the rich region to transfer resources voluntarily to the poor region under a decentralized system is not efficient, though: a centralized system will always be better as it can address the free rider problem. Furthermore, not only does a centralized system allow for reducing interregional inequality (pooling effect), but is also permit to reduce further (intra)regional inequality due to the scale effect it has on the willingness of the decisive voter to redistribute (as opposed to the traditional internalization of spillovers argument).

The rationale to decentralize in our set up is a negative one: given that the individuals in the rich region dislike the interregional transfers taking place through a centralized system, they will be more willing to redistribute under decentralization, as they know that regional taxes will be spent locally. If group loyalty is not too strong, however, there is some justification for a centrally implemented system of redistribution. Furthermore, decentralizing redistribution is likely to increase further interregional inequality in the long run, which might also increase group loyalty due to segregation and polarization.

In order to focus on donor motivation, and as the poor do not pay taxes in our set up, we have assumed that the median voter is always a rich individual. Furthermore, for tractability, we made the extreme simplifying assumption that all the rich and poor individuals have the same pre-tax income. In the spirit of Bolton and Roland (1997), a possible extension would be to assume instead a whole distribution of income within a region, while every voter pays taxes and receives a transfer. Then, assuming that income distribution differs between regions (e.g. in the sense of first- or second-order stochastic dominance), it would be interesting to investigate how the identity of the median voter might change under a centralized system, and how this affects the choice between centralized or decentralized redistribution.

More generally, we could assume additional sources of heterogeneity between regions, such as the strength of altruism ($\alpha_A \neq \alpha_B$) or group loyalty ($\beta_A \neq \beta_B$). Intuitively, this would create more rationale for decentralization, as individual preferences for redistribution would now have regional specificities (preference-matching). For example, if region A is poorer (i.e. $n_A^P > n_B^P$) but values redistribution more than region B (i.e. $\alpha_A > \alpha_B$), it could well be the case that individuals in the poor region are better off under a decentralized system, if this allows them to redistribute more, even though they will not benefit from a transfer from the rich region (as they would under centralization). A possibility is that the decentralized system with transfer now dominates the centralized one. Indeed, the decentralized system would have the additional advantage of accommodating regional tastes regarding redistribution, while the transfer would allow to reduce interregional inequality. Of course, the free riding problem would still be there, but it might not be true anymore that centralization always welfare-dominates decentralization with transfer.

A traditional argument against a decentralized system of redistribution is the fact that under mobility, such a system might create tax competition between jurisdictions, and/or stratification of individuals by income. We did not assume mobility neither of tax payers nor of welfare recipients in this paper, as we believe that individual mobility motivated by tax/transfer differences between jurisdictions might be very limited in practice, especially in a context of cultural diversity, and given that groups are geographically segmented. However, a possible extension would be to assume imperfect mobility, and that the cost of moving for a given individual depends positively on the strength of group loyalty. For example, if $\beta_i = \frac{1}{2}$, there is no cost of moving, and if $\beta_i = 1$, the individual never wants to move (and the cost is strictly positive for $\frac{1}{2} < \beta_i < 1$). Intuitively, this could reinforce the fact that less group loyalty increases the relative efficiency of centralization. Indeed, the less group loyalty, the more the median voter is willing to redistribute under centralization, the more mobility under decentralization, and hence the (even) more attractive a centralized system of redistribution. Furthermore, if individuals are mobile, group loyalty might have a negative effect on redistribution also under decentralization, which would decrease the rationale for such a system.

8. References

1. Austen-Smith, D., and Wallerstein, M. (2006), Redistribution and Affirmative Action, *Journal of Public Economics*, Vol. 90, Issue 10-11, pp. 1789-1823.

2. Alesina, A., Baqir, R. and Easterly, W. (1999), Public Goods and Ethnic Divisions, *Quarterly Journal of Economics*, Vol. 114, Issue 4, pp. 1243-1284.

3. Besley, T. and Coate, S. (2003), Centralized versus Decentralized Provision of Local Public Goods: a Political Economy Approach, *Journal of Public Economics*, Vol. 87, Issue 12, pp. 2611-2637.

4. Bolton, P. and Roland, G. (1997), The Breakup of Nations: A Political Economy Analysis, *Quarterly Journal of Economics*, Vol. 112, No. 4, pp. 1057-1090.

5. Bjorvatn, K. and Cappelen, A. W. (2006), Redistribution and the Nature of Altruism: Should Welfare Programs Be Centralized or Decentralized?, *Economics of Governance*, Vol. 7, Issue 2, pp. 133-142.

6. Charness, G and Rabin, M. (2002), Understanding Social Preferences with Simple Tests, *Quarterly Journal of Economics*, Vol. 117, No. 3, pp. 817-869.

7. Fehr, E. and Schmidt, K. (1999), A Theory of Fairness, Competition, and Cooperation, *Quarterly Journal of Economics*, Vol. 114, No. 3, pp. 817-868.

8. Lind, J. T. (2004), Fractionalization and the Size of Government, *Journal of Public Economics*, Vol. 91, Issue 1-2, pp. 51-76.

9. Luttmer, E. F. P. (2001), Group Loyalty and the Taste for Redistribution, *Journal of Political Economy*, Vol. 109, Issue 3, pp. 500-528.

10. Lockwood, B. (2002), Distributive Politics and the Costs of Centralization, *Review of Economic Studies*, Vol. 69, No. 2, pp. 313-337.

11. Meltzer, A. H. and Richard, S.F. (1981), A Rational Theory of the Size of Government, *Journal of Political Economy*, Vol. 89, No. 5, pp. 914-927.

12. Oates, W.E. (1972), Fiscal Federalism, New York: Harcourt Brace Jovanovich.

13. Pauly, M. V. (1973), Redistribution as a Local Public Good, *Journal of Public Economics*, Vol. 2, Issue 1, pp. 35-58.

14. Persson, T. and Tabellini, G. (1994), Does Centralization Increase the Size of Government?, *European Economic Review*, Vol. 38, Issue 3-4, pp. 765-773.8.

9. Appendix

Proof of Proposition 1: The equilibrium tax rate in region $j = A, B$ under the decentralized solution is given by

$$t_j = \frac{\alpha\beta}{(1+\alpha\beta)} \frac{n_j^P}{n_j} \frac{\left(y^R - y^P\right)}{y^R} - \frac{1}{(1+\alpha\beta)} \frac{n_j^P}{n_j^R} \frac{y^P}{y^R}$$

Taking derivatives, we get

(i) $\frac{\partial t_j}{\partial n_j^P} = \frac{-\left[(1+\alpha\beta)n_j^2 - 2\alpha\beta n_j n_j^P + \alpha\beta\left(n_j^P\right)^2\right] y^P + \alpha\beta\left(n_j^R\right)^2 y^R}{(1+\alpha\beta) n_j \left(n_j^R\right)^2 y^R} > 0$ if and only if $\alpha\beta > \frac{y^P}{(y^R - y^P)} \left(\frac{n_j}{n_j^R}\right)^2$

(ii) $\frac{\partial t_j}{\partial y^R} = \frac{n_j^P\left(n_j + \alpha\beta n_j^R\right) y^P}{(1+\alpha\beta) n_j n_j^R (y^R)^2} > 0$ and $\frac{\partial t_j}{\partial y^P} = -\frac{n_j^P\left(n_j + \alpha\beta n_j^R\right)}{(1+\alpha\beta) n_j n_j^R y^R} < 0$

(iii) $\frac{\partial t_j}{\partial \alpha} = \frac{\beta n_j^P\left(n_j^P y^P + n_j^R y^R\right)}{(1+\alpha\beta)^2 n_j n_j^R y^R} > 0$ and $\frac{\partial t_j}{\partial \beta} = \frac{\alpha n_j^P\left(n_j^P y^P + n_j^R y^R\right)}{(1+\alpha\beta)^2 n_j n_j^R y^R} > 0$

Proof of Proposition 2: The equilibrium tax rate under the centralized solution is given by

$$t = \frac{1}{(1+\alpha)} \left\{ \alpha \left[\beta \frac{n_A^P}{n_A} + (1-\beta) \frac{n_B^P}{n_B}\right] - \frac{y^P}{y^R} \frac{\left(n_A^P + n_B^P\right)}{\left(n_A^R + n_B^R\right)} \left[1 + \alpha\beta \frac{n_A^R}{n_A} + \alpha(1-\beta) \frac{n_B^R}{n_B}\right] \right\}$$

Taking derivatives, and given that $n_A = n_B$, we get

(i) $\frac{\partial t}{\partial n_A^P} \gtreqless 0$ if and only if $\beta \gtreqless \widetilde{\beta} = \frac{2n_A\left(n_A + \alpha n_A^R\right) y^P}{\alpha y^P \left[4 n_A n_A^P - \left(n_A^P + n_B^P\right)^2\right] + \alpha y^R \left(n_A^R + n_B^R\right)^2}$

(ii) $\frac{\partial t}{\partial n_B^P} \gtreqless 0$ if and only if $\beta \lesseqgtr \widehat{\beta} = \frac{\left[2(1+\alpha) n_B^2 + \alpha\left(n_A^P + n_B^P\right)^2 - 2\alpha n_B \left(n_A^P + 2 n_B^P\right)\right] y^P - \alpha y^R \left(n_A^R + n_B^R\right)^2}{\alpha y^P \left[-4 n_B n_B^P + \left(n_A^P + n_B^P\right)^2\right] - \alpha y^R \left(n_A^R + n_B^R\right)^2}$

and $\frac{\partial t}{\partial n_B^P} = -\frac{2\left(n_A + \alpha n_A^R\right) y^P}{(1+\alpha)\left(n_A^R + n_B^R\right)^2 y^R} < 0$ if $\beta = 1$

(iii) $\frac{\partial t}{\partial y^R} = \frac{\left(n_A^P + n_B^P\right)\left[n_A + \alpha n_B^R + \alpha\beta\left(n_B^P - n_A^P\right)\right] y^P}{(1+\alpha) n_A \left(n_A^R + n_B^R\right)(y^R)^2} > 0$

and $\frac{\partial t}{\partial y^P} = \frac{\left(n_A^P + n_B^P\right)\left\{\alpha\left[\beta\left(n_A^P - n_B^P\right) + n_B^P\right] - (1+\alpha) n_A\right\}}{(1+\alpha) n_A \left(n_A^R + n_B^R\right) y^R} < 0$

(iv) $\frac{\partial t}{\partial \alpha} = -\frac{\left[\beta\left(n_A^P - n_B^P\right) + n_B^P\right]\left[\left(n_A^P + n_B^P\right)\left(y^P - y^R\right) + 2 n_A y^R\right]}{(1+\alpha)^2 n_A \left(n_A^R + n_B^R\right) y^R} > 0$

(v) $\frac{\partial t}{\partial \beta} = \frac{\alpha}{(1+\alpha)} \frac{\left(n_A^P - n_B^P\right)}{n_A} \left[1 + \frac{\left(n_A^P + n_B^P\right) y^P}{\left(n_A^R + n_B^R\right) y^R}\right] > 0$ if and only if $\frac{\left(n_A^P - n_B^P\right)}{\left(n_A^P + n_B^P\right)} > \frac{y^P}{y^R} \frac{\left(n_A^R - n_B^R\right)}{\left(n_A^R + n_B^R\right)}$

The Effect of Group Loyalty on t: General Case

Whether the centralized tax rate is increasing or not in β only depends on whether $n_A^P > n_B^P$, and not on regional incomes, even when allowing for $y_A \neq y_B$. Notice, however, that this feature is due to the logarithmic form of private utilities. In general, the centralized equilibrium tax rate is implicitly defined by

$$\Phi(t) = \alpha \frac{\left(n_A^R y_A^R + n_B^R y_B^R\right)}{\left(n_A^P + n_B^P\right)} \left[\begin{array}{c} \beta \frac{n_A^P}{n_A} u'\left(c_A^P\right) \\ +(1-\beta) \frac{n_B^P}{n_B} u'\left(c_B^P\right) \end{array} \right] - u'\left(c_A^R\right) y_A^R - \alpha \left[\begin{array}{c} \beta \frac{n_A^R}{n_A} u'\left(c_A^R\right) y_A^R \\ +(1-\beta) \frac{n_B^R}{n_B} u'\left(c_B^R\right) y_B^R \end{array} \right] = 0$$

Using the implicit function theorem, we have that

$$\frac{\partial t}{\partial \beta} = -\frac{\partial \Phi / \partial \beta}{\partial \Phi / \partial t}$$

Computing the derivatives, we obtain that $\frac{\partial \Phi}{\partial t} < 0$ and $\frac{\partial \Phi}{\partial \beta} > 0$ (and thus $\frac{\partial t}{\partial \beta} > 0$) if and only if

$$\frac{\left(n_A^R y_A^R + n_B^R y_B^R\right)}{\left(n_A^P + n_B^P\right)} \left[\frac{n_A^P}{n_A} u'\left(c_A^P\right) - \frac{n_B^P}{n_B} u'\left(c_B^P\right) \right] > \frac{n_A^R}{n_A} u'\left(c_A^R\right) y_A^R - \frac{n_B^R}{n_B} u'\left(c_B^R\right) y_B^R$$

We see from the condition that if $y_A^P = y_B^P$ and $y_A^R = y_B^R$, we will have, as before, $\frac{\partial t}{\partial \beta} < 0$ whenever the rich region is decisive. However, if we allow incomes to differ accross regions, we might well have that the tax rate is increasing in group loyalty, even though the decisive region is the one with the lowest proportion of poors. For example, this is likely to be the case when $y_A^P < y_B^P$. Indeed, the poors in A being poorer than the ones in B, they have a higher marginal utility, somehow compensating the fact that they are less numerous than in B. Regarding the incomes of the rich, things are less clear. Indeed, the rich being richer in region A (i.e. $y_A^R > y_B^R$) has two different effects. First, the median voter, being richer than the rich in B, realizes that each rich in his own region will contribute more (in absolute terms) to redistribution than each rich in region B, which induces him to decrease his preferred tax rate when group loyalty gets higher. However, another effect is that, being richer, the rich in A has a lower marginal disutility from giving than the rich in B, somehow compensating the fact that region A has a higher proportion of rich (and so more people in A contribute to redistribution than in B). Therefore, the total effect of group loyalty on the centralized tax rate depends on the relative magnitude of those two effects.

Proof of Proposition 8: In the absence of group loyalty, that is, when $\beta = \frac{1}{2}$, $V(t_A, t_B) - V(t) > 0$ if and only if

$$\begin{aligned}
&-\frac{2\left(n_A^P+n_B^P\right)\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]^2}{(1+\alpha)^2\left(n_A^R+n_B^R\right)} \\
&+\frac{n_A^P\left\{\left[(-2+\alpha)n_A^P-(2+\alpha)n_B^P\right]\left(y^P-y^R\right)-4n_B y^R\right\}^2+n_B^P\left\{\left[(2+\alpha)n_A^P-(-2+\alpha)n_B^P\right]\left(y^P-y^R\right)+4n_B y^R\right\}^2}{(2+\alpha)^2 n_B} \\
&+\frac{\left\{\left[-(2+\alpha)n_B n_A^P+(2+\alpha)\left(n_B+n_A^P\right)n_B^P-(-2+\alpha)\left(n_B^P\right)^2\right]y^P+n_B^R\left[(2+\alpha)n_A^P-(-2+\alpha)n_B^P\right]y^R\right\}^2}{(2+\alpha)^2 n_B^R n_B} \\
&+\frac{n_A^R}{n_A}\left\{\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R+\frac{2\left[-(2+\alpha)n_B+\alpha n_A^P\right]\left(n_A^P y^P+n_A^R y^R\right)}{(2+\alpha)n_A^R}\right\}^2 > 0
\end{aligned}$$

which is satisfied for all $\alpha \in [0,1]$ (checked on *Mathematica*). Therefore, when $\beta = \frac{1}{2}$, total inequality is strictly higher under the decentralized solution.

Proof of Proposition 9: (i) When $\beta = \frac{1}{2}$, we know from Proposition 8 that $V(t) < V(t_A, t_B)$. Then, when $\beta = 1$, $V(t_A, t_B) - V(t) > 0$ if and only if

$$\begin{aligned}
&-\frac{2\left(n_A^P-\alpha n_A^P+n_B^P+\alpha n_B^P\right)^2\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]^2}{(1+\alpha)^2\left(n_A^R+n_B^R\right)\left(n_A^P+n_B^P\right)} \\
&+\frac{n_A^P\left\{\left[(-1+\alpha)n_A^P-(1+\alpha)n_B^P\right]\left(y^P-y^R\right)-2n_B y^R\right\}^2+n_B^P\left\{\left[(1+\alpha)n_A^P-(-1+\alpha)n_B^P\right]\left(y^P-y^R\right)+2n_B y^R\right\}^2}{(1+\alpha)^2 n_B} \\
&+\frac{\left\{-(1+\alpha)n_B\left(n_A^P-n_B^P\right)y^P+n_B^P\left[(1+\alpha)n_A^P-(-1+\alpha)n_B^P\right]\left(y^P-y^R\right)+n_B\left[(1+\alpha)n_A^P-(-1+\alpha)n_B^P\right]y^R\right\}^2}{(1+\alpha)^2 n_B^R n_B} \\
&+\frac{n_A^R}{n_A}\left\{\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R-\frac{2\left(n_A+\alpha n_A^R\right)\left(n_A^P y^P+n_A^R y^R\right)}{(1+\alpha)n_A^R}\right\}^2 > 0
\end{aligned}$$

which is satisfied for all $\alpha \in [0,1]$ (checked on *Mathematica*). Therefore, when $n_A^P > n_B^P$, we have that $V(t) < V(t_A, t_B)$ for both $\beta = \frac{1}{2}$ and $\beta = 1$. Now, we know that both $\frac{\partial t}{\partial \beta} > 0$ and $\frac{\partial t_j}{\partial \beta} > 0$, $j = A, B$ when $n_A^P > n_B^P$, so that both $\frac{\partial V(t)}{\partial \beta} < 0$ and $\frac{\partial V(t_A, t_B)}{\partial \beta} < 0$ in that case. Then, as

$$\frac{\partial^2 V(t)}{\partial \beta \partial \beta} = \frac{2\alpha^2\left(n_A^P-n_B^P\right)^2\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]^2}{(1+\alpha)^2\left(n_A^R+n_B^R\right)\left(n_A^P+n_B^P\right)n_B^2} > 0$$

and

$$\frac{\partial^2 V(t_A, t_B)}{\partial \beta \partial \beta} = -\frac{\begin{array}{c} 3\alpha^2\left[n_A^P n_B^P\left(\left(n_A^P\right)^2+\left(n_B^P\right)^2\right)-n_B\left(\left(n_A^P\right)^3+\left(n_B^P\right)^3\right)\right]\left(y^P\right)^2 \\ -2n_A^R n_B^R\left(\left(n_A^P\right)^2+\left(n_B^P\right)^2\right)y^P y^R \\ -n_A^R n_B^R\left(y^R\right)^2\left[-\left(n_A^P\right)^2-\left(n_B^P\right)^2+n_B\left(n_A^P+n_B^P\right)\right] \end{array}}{(1+\alpha\beta)^4 n_B^2 n_A^R n_B^R} > 0$$

it follows that $V(t) < V(t_A, t_B)$ for all β, and hence $W(t) > W(t_A, t_B)$ for all β.

(ii) The threshold $\widetilde{\beta}$ is implicitly defined by

$$\Phi(\beta) = W(t_A, t_B) - W(t) = 0$$

Using the implicit function theorem, we have that

$$\frac{\partial \widetilde{\beta}}{\partial x} = -\frac{\partial \Phi / \partial x}{\partial \Phi / \partial \beta}$$

Given that $n_A^P < n_B^P$, it follows directly that $\frac{\partial \Phi}{\partial \beta} = \frac{\partial W(t_A, t_B)}{\partial \beta} - \frac{W(t)}{\partial \beta} > 0$. Then, taking derivatives, we have that

$$\frac{\partial \Phi}{\partial y^R} = \frac{(1+\alpha) n_B^2 \left(n_A^P - n_B^P\right)^2 y^P \left(y^P - y^R\right)}{\left(n_A^P y^P + n_A^R y^R\right)\left(n_B^P y^P + n_B^R y^R\right)\left[\left(n_A^P + n_B^P\right) y^P + \left(n_A^R + n_B^R\right) y^R\right]} < 0$$

and

$$\frac{\partial \Phi}{\partial y^P} = (1+\alpha) n_B \left[\begin{array}{c} \frac{2\left(n_A^P + n_B^P\right)}{\left[\left(n_A^P + n_B^P\right) y^P + \left(n_A^R + n_B^R\right) y^R\right]} \\ + \frac{n_A^P}{\left(n_A^P y^P + n_A^R y^R\right)} + \frac{n_B^P}{\left(n_B^P y^P + n_B^R y^R\right)} \end{array} \right] > 0$$

Therefore, it follows that $\frac{\partial \widetilde{\beta}}{\partial y^R} = -\frac{\partial \Phi / \partial y^R}{\partial \Phi / \partial \beta} > 0$ and $\frac{\partial \widetilde{\beta}}{\partial y^P} = -\frac{\partial \Phi / \partial y^P}{\partial \Phi / \partial \beta} < 0$.

Proof of Proposition 10: When $\beta = \frac{1}{2}$, the preferred tax rate and final utilities of the rich and poor in A and B under centralization coincide. Therefore, we can assume without loss of generality that $n_A^P < n_B^P$. As we know that when $\beta = \frac{1}{2}$, $W(t) > W(t_A, t_B)$, and as $c_B^P < c^P$, it follows directly that $U_B^P(t) > U_B^P(t_A, t_B)$. It is also direct that $U_A^R(t) > U_A^R(t_A, t_B)$ from Proposition 19 by transitivity. TO BE COMPLETED

Proof of Proposition 11: (i) With full group loyalty, the final utility of a given voter $j = P, R$ in region A is given by

$$U_A^j(.) = u\left(c_A^j(.)\right) + \alpha \left[\frac{n_A^P}{n_A} u\left(c_A^P(.)\right) + \frac{n_A^R}{n_A} u\left(c_A^R(.)\right)\right]$$

From the logarithmic form of the private utility function, it follows that the second term of this expression is decreasing in intra-regional inequality. When $\beta = 1$ and $n_A^P < n_B^P$, we know that $t_A > t$ and intra-regional inequality is strictly higher under the centralized solution, so that the latter term is correspondingly smaller (observe, furthermore, that $\overline{c}_A(t_A, t_B) > \overline{c}_A(t)$, so that the "average" effect goes in the same direction, and hence no ambiguities). As in this case, $c_A^P(t_A, t_B) > c^P(t)$, it follows directly that $U_A^P(t_A, t_B) > U_A^P(t)$. Finally, as the median voter does not care about the other region (and thus does not want interregional transfers to take place) and t_A maximizes $U_A^R(t_A, t_B)$, it follows that $U_A^R(t_A, t_B) > U_A^R(t, t_B) > U_A^R(t)$;

(ii) as t maximizes $U_A^R(t)$ and $U_A^R(t_A, t_B) > U_A^R(t)$, there is no $\widetilde{t} \neq t$ such that $U_A^R(\widetilde{t}) > U_A^R(t_A, t_B)$ (and possibly $W(\widetilde{t}) > W(t_A, t_B)$);

(iii) when $\beta = 1$ and $n_A^P < n_B^P$, we know that $t_A < t$ and intra-regional inequality is strictly higher under the decentralized solution (observe, furthermore, that $\overline{c}_A(t_A, t_B) < \overline{c}_A(t)$, so that the "average" effect goes in the same direction, and hence no ambiguities). As in this case, $c_A^P(t_A, t_B) < c^P(t)$, it follows directly that $U_A^P(t_A, t_B) < U_A^P(t)$. Finally, as the median voter does not care about the other region (and thus wants interregional transfers to take place) and t maximizes $U_A^R(t)$, it follows that $U_A^R(t) > U_A^R(t_A) > U_A^R(t_A, t_B)$;

(iv) as $n_A^P > n_B^P$ and $\beta = 1$, it follows directly that $U_B^R(t_A, t_B) > U_B^R(t_A, t) > U_B^R(t)$;

(v) direct from the fact that $U_B^R(t_A, t_B) > U_B^R(t_A, \widetilde{t}) > U_B^R(\widetilde{t})$ holds for any $\widetilde{t}$.

Proof of Proposition 12: The function U_A^R depends on β, and in particular, the higher β, the higher the relative weight put on intraregional inequality relative to interregional inequality from the decisive voter point of view. In contrast, the total welfare function W weights equally inter- and intraregional inequality, whatever the value of β. Said in other words, the higher β, the less weight put on the well-being in region B from the decisive voter point of view. In contrast, whatever the value of β, the well-being in the two regions is always weighted equally in W. Therefore, it follows that the $\widetilde{\beta}$ such that $U_A^R(t) = U_A^R(t_A, t_B)$ is strictly smaller than the $\widehat{\beta}$ such that $W(t) = W(t_A, t_B)$. Then, as t maximizes $U_A^R(t)$ and $U_A^R(t_A, t_B) > U_A^R(t)$ for $\beta > \widetilde{\beta}$, there is no $\widetilde{t} \neq t$ such that $U_A^R(\widetilde{t}) > U_A^R(t_A, t_B)$ for $\beta \in (\widetilde{\beta}, \widehat{\beta})$ (and possibly $W(\widetilde{t}) > W(t_A, t_B)$).

Proof of Proposition 15: Assuming that private utilities are logarithmic, the transfer to region B will be given by

$$(1-\theta) = \frac{(1-2\beta_A)\, n_A^P n_B^P y^P + y^R\left[(1-\beta_A)\, n_A^R n_B^P t_A - \beta_A n_A^P n_B^R t_B\right]}{n_A^R\left[\beta_A\left(n_A^P - n_B^P\right) + n_B^P\right] t_A y^R}$$

Taking derivatives,

$$\frac{\partial(1-\theta)}{\partial t_A} = \frac{(2\beta_A - 1)\, n_A^P n_B^P y^P + y^R t_B \beta_A n_A^P n_B^R}{n_A^R\left[\beta_A\left(n_A^P - n_B^P\right) + n_B^P\right](t_A)^2 y^R} > 0$$

$$\frac{\partial(1-\theta)}{\partial t_B} = -\frac{\beta_A n_A^P n_B^R}{n_A^R\left[\beta_A\left(n_A^P - n_B^P\right) + n_B^P\right] t_A} < 0$$

$$\frac{\partial(1-\theta)}{\partial \beta_A} = -\frac{n_A^P n_B^P\left[n_B(t_A + t_B)\, y^R + n_A^P\left(y^P - t_A y^R\right) + n_B^P\left(y^P - t_B y^R\right)\right]}{n_A^R\left[\beta_A\left(n_A^P - n_B^P\right) + n_B^P\right]^2 t_A y^R} < 0$$

$$\frac{\partial\left(1-\theta\right)}{\partial y^R}=\frac{\left(2\beta_A-1\right)n_A^P n_B^P y^P}{n_A^R\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right]t_A\left(y^R\right)^2}>0$$

$$\frac{\partial\left(1-\theta\right)}{\partial y^P}=\frac{\left(1-2\beta_A\right)n_A^P n_B^P}{n_A^R\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right]t_A y^R}<0$$

$$\frac{\partial\left(1-\theta\right)}{\partial n_A^P}=\frac{\begin{array}{c}\left(2\beta_A-1\right)n_B^P\left[-\beta_A\left(n_A^P\right)^2+\left(\beta_A-1\right)n_B n_B^P\right]y^P\\ +\beta_A\left\{\left(\beta_A-1\right)\left(n_A^R\right)^2 n_B^P t_A+n_B^R\left[-\beta_A\left(n_A^P\right)^2+\left(\beta_A-1\right)n_B n_B^P\right]t_B\right\}y^R\end{array}}{\left(n_A^R\right)^2\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right]^2 t_A y^R}<0$$

$$\frac{\partial\left(1-\theta\right)}{\partial n_B^P}=\frac{\beta_A n_A^P\left\{\begin{array}{c}-\left(\beta_A-1\right)n_B\left(t_A+t_B\right)y^R\\ +n_A^P\left[y^P-2\beta_A y^P-t_A y^R+\beta_A\left(t_A+t_B\right)y^R\right]\end{array}\right\}}{n_A^R\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right]^2 t_A y^R}\lesseqgtr 0$$

Proof of Proposition 16: (i) Taking derivatives of the equilibrium values of (t_A, t_B), we get

$$\begin{cases}\frac{\partial t_A}{\partial y^R}=-\frac{\left(n_B+\alpha\beta_A n_A^R\right)\left(n_A^P+n_B^P\right)y^P\left[(\beta_B-1)n_A^P-\beta_B n_B^P\right]}{n_A^R\left\{-\alpha(\beta_A+\beta_B-1)n_A^P n_B^P+n_B\left[(1+\beta_A+\alpha\beta_A-\beta_B)n_A^P+(1-\beta_A+\beta_B+\alpha\beta_B)n_B^P\right]\right\}(y^R)^2}>0\\ \frac{\partial t_B}{\partial y^R}=\frac{\left(n_B+\alpha\beta_B n_B^R\right)\left(n_A^P+n_B^P\right)y^P\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right]}{n_B^R\left\{-\alpha(\beta_A+\beta_B-1)n_A^P n_B^P+n_B\left[(1+\beta_A+\alpha\beta_A-\beta_B)n_A^P+(1-\beta_A+\beta_B+\alpha\beta_B)n_B^P\right]\right\}(y^R)^2}>0\end{cases}$$

$$\begin{cases}\frac{\partial t_A}{\partial y^P}=\frac{\left(n_B+\alpha\beta_A n_A^R\right)\left(n_A^P+n_B^P\right)\left[(\beta_B-1)n_A^P-\beta_B n_B^P\right]}{n_A^R\left\{-\alpha(\beta_A+\beta_B-1)n_A^P n_B^P+n_B\left[(1+\beta_A+\alpha\beta_A-\beta_B)n_A^P+(1-\beta_A+\beta_B+\alpha\beta_B)n_B^P\right]\right\}y^R}<0\\ \frac{\partial t_B}{\partial y^P}=-\frac{\left(n_B+\alpha\beta_B n_B^R\right)\left(n_A^P+n_B^P\right)\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right]}{n_B^R\left\{-\alpha(\beta_A+\beta_B-1)n_A^P n_B^P+n_B\left[(1+\beta_A+\alpha\beta_A-\beta_B)n_A^P+(1-\beta_A+\beta_B+\alpha\beta_B)n_B^P\right]\right\}y^R}<0\end{cases}$$

$$\begin{cases}\frac{\partial t_A}{\partial \beta_A}=-\frac{\begin{array}{c}\left[n_B+\alpha\beta_B n_B-\alpha\left(\beta_B-1\right)n_A^P\right]\left[\left(\beta_B-1\right)n_A^P-\beta_B n_B^P\right]\\ \left[-\alpha n_A^P n_B^P+n_B\left(-n_A^P+n_B^P+\alpha n_B^P\right)\right]\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]\end{array}}{n_A^R\left\{\alpha(\beta_A+\beta_B-1)n_A^P n_B^P-n_B\left[(1+\beta_A+\alpha\beta_A-\beta_B)n_A^P+(1-\beta_A+\beta_B+\alpha\beta_B)n_B^P\right]\right\}^2 y^R}<0\\ \frac{\partial t_B}{\partial \beta_A}=\frac{\begin{array}{c}\left(n_B+\alpha\beta_B n_B^R\right)\left[n_A^P-\beta_B n_A^P+\beta_B n_B^P\right]\\ \left[-\alpha n_A^P n_B^P+n_B\left(-n_A^P+n_B^P+\alpha n_B^P\right)\right]\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]\end{array}}{n_B^R\left\{\alpha(\beta_A+\beta_B-1)n_A^P n_B^P-n_B\left[(1+\beta_A+\alpha\beta_A-\beta_B)n_A^P+(1-\beta_A+\beta_B+\alpha\beta_B)n_B^P\right]\right\}^2 y^R}>0\end{cases}$$

The other derivatives (with respect to α, β_B, n_A^P and n_B^P) are very long and their sign is ambiguous.

(ii) Taking derivatives of the equilibrium value of $T=\left(1-\theta\right)t_A y^R n_A^R$, we get

$$\frac{\partial T}{\partial \beta_A}=-\frac{\begin{array}{c}n_B\left[\left(\beta_B-1\right)n_A^P-\beta_B n_B^P\right]\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]\\ \left\{\alpha\left[-1+\alpha\left(\beta_B-1\right)\right]n_A^P n_B^P-\left(1+\alpha\beta_B\right)n_B\left(-n_A^P+n_B^P+\alpha n_B^P\right)\right\}\end{array}}{\left\{\alpha\left(\beta_A+\beta_B-1\right)n_A^P n_B^P-n_B\left[\begin{array}{c}\left(1+\beta_A+\alpha\beta_A-\beta_B\right)n_A^P\\ +\left(1-\beta_A+\beta_B+\alpha\beta_B\right)n_B^P\end{array}\right]\right\}^2}<0$$

$$\frac{\partial T}{\partial \beta_B} = -\frac{\begin{array}{c} n_B\left(1+\alpha\beta_A\right)\left[\beta_A\left(n_A^P-n_B^P\right)+n_B^P\right] \\ \left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]\left[\left(1+\alpha\right)n_B n_A^P-\left(n_B+\alpha n_A^P\right)n_B^P\right]\end{array}}{\left\{\alpha\left(\beta_A+\beta_B-1\right)n_A^P n_B^P-n_B\left[\begin{array}{c}\left(1+\beta_A+\alpha\beta_A-\beta_B\right)n_A^P \\ +\left(1-\beta_A+\beta_B+\alpha\beta_B\right)n_B^P\end{array}\right]\right\}^2} > 0$$

$$\text{if } \frac{n_A^P}{n_A} > \frac{n_B^P}{n_B^P+n_B^R\left(1+\alpha\right)},$$

and when $\beta_A = \beta_B = \beta$, we have

$$\frac{\partial T}{\partial \beta} = \frac{\begin{array}{c} n_B\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right] \\ \left\{\begin{array}{c}\left(1+\alpha\beta_B\right)^2 n_B\left(n_A^P-n_B^P\right)\left(n_A^P+n_B^P\right) \\ -\alpha n_A^P n_B^P\left[\begin{array}{c}\left(1+\alpha\left(1+2\left(\beta_B-1\right)\beta_B\right)\right)n_A^P \\ +n_B^P-2\alpha\left(\beta_B-1\right)\beta_B n_B^P\end{array}\right]\end{array}\right\}\end{array}}{\left[\alpha\left(1-2\beta_B\right)n_A^P n_B^P+\left(1+\alpha\beta_B\right)n_B\left(n_A^P+n_B^P\right)\right]^2} < 0$$

$$\frac{\partial T}{\partial \alpha} = \frac{\begin{array}{c}\left(2\beta_B-1\right)n_B n_A^P n_B^P\left[\left(\beta_B-1\right)n_A^P-\beta_B n_B^P\right] \\ \left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]\end{array}}{\left[\alpha\left(1-2\beta_B\right)n_A^P n_B^P+\left(1+\alpha\beta_B\right)n_B\left(n_A^P+n_B^P\right)\right]^2} < 0$$

$$\frac{\partial T}{\partial y^P} = \frac{\begin{array}{c}\beta_B\left(1+\alpha\right)\beta_B n_B\left(n_A^P\right)^2 \\ +\alpha\left(1-2\beta_B\right)\left(n_A^P\right)^2 n_B^P-\beta_B\left(1+\alpha\beta_B\right)n_B\left(n_B^P\right)^2\end{array}}{\alpha\left(1-2\beta_B\right)n_A^P n_B^P+\left(1+\alpha\beta_B\right)n_B\left(n_A^P+n_B^P\right)} < 0$$

Proof of Proposition 17: (i) Given that $\beta = \frac{1}{2}$, we have that

$$t_A - t_B = \frac{\left(n_B^P-n_A^P\right)\left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]}{\left(2+\alpha\right)n_A^R n_B^R y^R} > 0$$

$$c_A^P = \frac{\alpha\left(n_A^P+n_B^P\right)y^P+\alpha\left(n_A^R+n_B^R\right)y^R}{2\left(2+\alpha\right)n_B} = c_B^P$$

Comparing the centralized solution with the decentralized solution with transfer when $\beta = \frac{1}{2}$ we get

$$c^P - c_A^P = \frac{\alpha\left(n_A^P+n_B^P\right)y^P+\alpha\left(n_A^R+n_B^R\right)y^R}{2\left(2+\alpha\right)\left(1+\alpha\right)n_B} > 0$$

(ii) Given that $\beta = \frac{1}{2}$, we have that $V\left(t_A, t_B, \theta\right) - V\left(t\right)$ is given by

$$\frac{1}{4n_B^2}\left\{\begin{array}{c}\left[-\frac{\left(n_A^P+n_B^P\right)}{\left(n_A^R+n_B^R\right)\left(1+\alpha\right)^2}+\frac{2\left[-2n_A^P n_B^P+n_B\left(n_A^P+n_B^P\right)\right]}{n_A^R n_B^R\left(2+\alpha\right)^2}\right] \\ \left[\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R\right]^2\end{array}\right\} > 0$$

(iii) Given that $\beta = \frac{1}{2}$, we have that $W(t_A, t_B, \theta) - W(t_A, t_B)$ is given by

$$n_B \left\{ \begin{array}{c} -\ln 4 + \ln\left[\frac{\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R}{n_A^P y^P + n_A^R y^R}\right] \\ +\ln\left[\frac{\left(n_A^P+n_B^P\right)y^P+\left(n_A^R+n_B^R\right)y^R}{n_B^P y^P + n_B^R y^R}\right] \end{array} \right\} > 0$$

Proof of Proposition 18: $V(t_A, t_B, \theta) - V(t) > 0$ if and only if

$$-\frac{\begin{array}{c} 2\left(n_A^P + \alpha n_A^P - 2\alpha\beta n_A^P + n_B^P - \alpha n_B^P + 2\alpha\beta n_B^P\right)^2 \\ \left[\left(n_A^P + n_B^P\right)y^P + \left(n_A^R + n_B^R\right)y^R\right]^2 \end{array}}{\left(n_A^P + n_B^P\right)(1+\alpha)^2\left(n_A^R + n_B^R\right)}$$

$$+n_B \left\{ \begin{array}{c} n_B^P\left[\frac{1}{n_B} + \frac{2\alpha(\beta-1)\left[(\beta-1)n_A^P - \beta n_B^P\right]}{\alpha(2\beta-1)n_A^P n_B^P - (1+\alpha\beta)n_B\left(n_A^P+n_B^P\right)}\right]^2 \\ +n_A^P\left[\frac{1}{n_B} + \frac{2\alpha\beta\left[(1-\beta)n_A^P + \beta n_B^P\right]}{\alpha(2\beta-1)n_A^P n_B^P - (1+\alpha\beta)n_B\left(n_A^P+n_B^P\right)}\right]^2 \\ +n_A^R\left[\frac{1}{n_B} + \frac{2\left(n_B+\alpha\beta n_A^R\right)\left[(\beta-1)n_A^P - \beta n_B^P\right]}{n_A^R\left[\alpha(1-2\beta)n_A^P n_B^P + (1+\alpha\beta)n_B\left(n_A^P+n_B^P\right)\right]}\right]^2 \\ +n_A^R\left[\frac{1}{n_B} - \frac{2\left[\beta\left(n_A^P-n_B^P\right)+n_B^P\right]\left(n_B+\alpha\beta n_B^R\right)}{n_B^R\left[\alpha(1-2\beta)n_A^P n_B^P + (1+\alpha\beta)n_B\left(n_A^P+n_B^P\right)\right]}\right]^2 \end{array} \right\}$$

is strictly positive, which is satisfied for all values of β (checked on *Mathematica*). Therefore, $V(t_A, t_B, \theta) > V(t)$ for all values of β for which the transfer is positive.

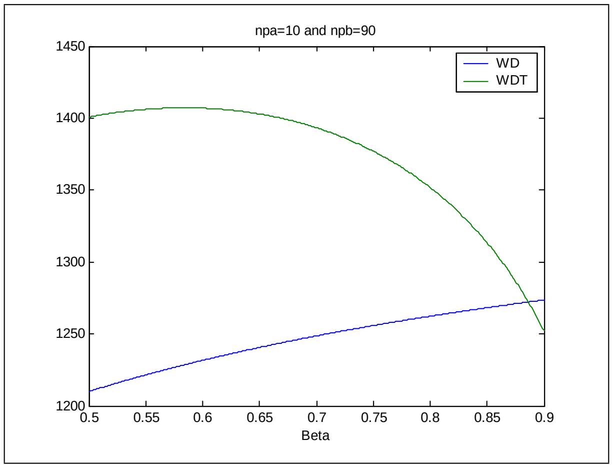
Proof of Proposition 19: (i) Direct from the fact that $c_B^R(t_A, t_B, \theta) > c_A^R(t_A, t_B, \theta)$;

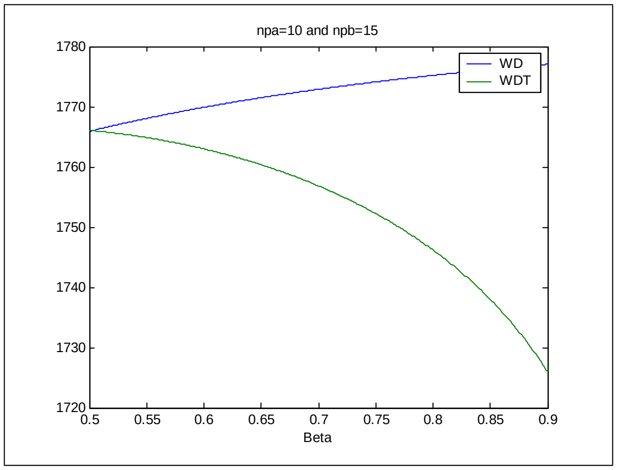
(ii) direct from the fact that $W(t) > W(t_A, t_B, \theta)$ and $c^P(t) > c^P(t_A, t_B, \theta)$;

(iii) if the median voter had the possibility to choose all the parameters (t_A, t_B, θ), he would choose $\left(\widetilde{t}_A, \widetilde{t}_B, \widetilde{\theta}\right)$ such that $c^P(t) = c^P\left(\widetilde{t}_A, \widetilde{t}_B, \widetilde{\theta}\right)$, that is, he would choose the same level of consumption of the poor as he would under centralization. Furthermore, he would choose $\widetilde{t}_A < t_A$, $\widetilde{t}_B > t_B$, and $\widetilde{t}_A < t < \widetilde{t}_B$, and $\widetilde{t}_B$ such that $c_B^R\left(\widetilde{t}_A, \widetilde{t}_B, \widetilde{\theta}\right) = c^P\left(\widetilde{t}_A, \widetilde{t}_B, \widetilde{\theta}\right)$. This would be a first-best for the median voter, as he would control the contribution of the rich in B and the transfer to the poor region, and he would be able to discriminate between himself and the rich in B (which he wants to as he's partly self-interested). Under centralization, the median voter implements his first-best level of consumption for the poor, which he doesn't under decentralization with transfer. Furthermore, he can force the rich in B to pay a strictly higher tax rate than under decentralization with transfer. If $t < t_A$, it follows directly that the median voter is better off under centralization. However, even though $t > t_A$, he's still better off under such a system. Indeed, given that he can force the rich in B to contribute more, the median voter is willing himself to end up with less consumption, as the benefit from increased total welfare more than offsets his personal loss of consumption. The median voter, ideally, would like to set $\widetilde{t}_A < \widetilde{t}_B$. However, under the decentralized system, he ends up paying more than the rich in B, as $t_A > t_B$. Therefore, the best he can do is to set $t > t_B$ (and possibly $t_A > t > t_B$) to implement his preferred level of consumption for the poor, even though he might contribute more himself;

(iv) if the rich in B was decisive under centralization, given that $\beta = \frac{1}{2}$, he would choose the same t as the rich in A, this t being strictly smaller than t_B and such that $c^P(t) > c^P(t_A, t_B, \theta)$. If the rich in B wanted to contribute more under decentralization with transfer, so that the poor ends up with the same consumption as under centralization, he would. Given that he doesn't, it follows that he's strictly better off under the decentralized system with transfer. That is, the loss in total welfare less than offsets the benefit of increased consumption from his point of view.

Proof of Proposition 20: Simulations of the model show that, depending on the parameter values, we can have either $W(t_A, t_B, \theta) > W(t_A, t_B)$ or $W(t_A, t_B, \theta) < W(t_A, t_B)$ for $\beta > \frac{1}{2}$:





2009

2009/1. Rork, J.C.; Wagner, G.A.: "Reciprocity and competition: is there a connection?"
2009/2. Mork, E.; Sjögren, A.; Svaleryd, H.: "Cheaper child care, more children"
2009/3. Rodden, J.: "Federalism and inter-regional redistribution"
2009/4. Ruggeri, G.C.: "Regional fiscal flows: measurement tools"
2009/5. Wrede, M.: "Agglomeration, tax competition, and fiscal equalization"
2009/6. Jametti, M.; von Ungern-Sternberg, T.: "Risk selection in natural disaster insurance"
2009/7. Solé-Ollé, A; Sorribas-Navarro, P.: "The dynamic adjustment of local government budgets: does Spain behave differently?"
2009/8. Sanromá, E.; Ramos, R.; Simón, H.: "Immigration wages in the Spanish Labour Market: Does the origin of human capital matter?"
2009/9. Mohnen, P.; Lokshin, B.: "What does it take for and R&D incentive policy to be effective?"
2009/10. Solé-Ollé, A.; Salinas, P..: "Evaluating the effects of decentralization on educational outcomes in Spain?"
2009/11. Libman, A.; Feld, L.P.: "Strategic Tax Collection and Fiscal Decentralization: The case of Russia"
2009/12. Falck, O.; Fritsch, M.; Heblich, S.: "Bohemians, human capital, and regional economic growth"
2009/13. Barrio-Castro, T.; García-Quevedo, J.: "The determinants of university patenting: do incentives matter?"
2009/14. Schmidheiny, K.; Brülhart, M.: "On the equivalence of location choice models: conditional logit, nested logit and poisson"
2009/15. Itaya, J., Okamuraz, M., Yamaguchix, C.: "Partial tax coordination in a repeated game setting"
2009/16. Ens, P.: "Tax competition and equalization: the impact of voluntary cooperation on the efficiency goal"
2009/17. Geys, B., Revelli, F.: "Decentralization, competition and the local tax mix: evidence from Flanders"
2009/18. Konrad, K., Kovenock, D.: "Competition for fdi with vintage investment and agglomeration advantages"
2009/19. Loretz, S., Moorey, P.: "Corporate tax competition between firms"
2009/20. Akai, N., Sato, M.: "Soft budgets and local borrowing regulation in a dynamic decentralized leadership model with saving and free mobility"
2009/21. Buzzacchi, L., Turati, G.: "Collective risks in local administrations: can a private insurer be better than a public mutual fund?"
2009/22. Jarkko, H.: "Voluntary pension savings: the effects of the finnish tax reform on savers' behaviour"
2009/23. Fehr, H.; Kindermann, F.: "Pension funding and individual accounts in economies with life-cyclers and myopes"
2009/24. Esteller-Moré, A.; Rizzo, L.: "(Uncontrolled) Aggregate shocks or vertical tax interdependence? Evidence from gasoline and cigarettes"
2009/25. Goodspeed, T.; Haughwout, A.: "On the optimal design of disaster insurance in a federation"
2009/26. Porto, E.; Revelli, F.: "Central command, local hazard and the race to the top"
2009/27. Piolatto, A.: "Plurality versus proportional electoral rule: study of voters' representativeness"
2009/28. Roeder, K.: "Optimal taxes and pensions in a society with myopic agents"
2009/29, Porcelli, F.: "Effects of fiscal decentralisation and electoral accountability on government efficiency evidence from the Italian health care sector"
2009/30, Troumpounis, O.: "Suggesting an alternative electoral proportional system. Blank votes count"
2009/31, Mejer, M., Pottelsberghe de la Potterie, B.: "Economic incongruities in the European patent system"
2009/32, Solé-Ollé, A.: "Inter-regional redistribution through infrastructure investment: tactical or programmatic?"
2009/33, Joanis, M.: "Sharing the blame? Local electoral accountability and centralized school finance in California"
2009/34, Parcero, O.J.: "Optimal country's policy towards multinationals when local regions can choose between firm-specific and non-firm-specific policies"
2009/35, Cordero, J,M.; Pedraja, F.; Salinas, J.: "Efficiency measurement in the Spanish cadastral units through DEA"
2009/36, Fiva, J.; Natvik, G.J.: "Do re-election probabilities influence public investment?"
2009/37, Haupt, A.; Krieger, T.: "The role of mobility in tax and subsidy competition"
2009/38, Viladecans-Marsal, E; Arauzo-Carod, J.M.: "Can a knowledge-based cluster be created? The case of the Barcelona 22@district"

2010

2010/1, De Borger, B., Pauwels, W.: "A Nash bargaining solution to models of tax and investment competition: tolls and investment in serial transport corridors"
2010/2, Chirinko, R.; Wilson, D.: "Can Lower Tax Rates Be Bought? Business Rent-Seeking And Tax Competition Among U.S. States"
2010/3, Esteller-Moré, A.; Rizzo, L.: "Politics or mobility? Evidence from us excise taxation"
2010/4, Roehrs, S.; Stadelmann, D.: "Mobility and local income redistribution"

2010/5, Fernández Llera, R.; García Valiñas, M.A.: "Efficiency and elusion: both sides of public enterprises in Spain"
2010/6, González Alegre, J.: "Fiscal decentralization and intergovernmental grants: the European regional policy and Spanish autonomous regions"
2010/7, Jametti, M.; Joanis, M.: "Determinants of fiscal decentralization: political economy aspects"
2010/8, Esteller-Moré, A.; Galmarini, U.; Rizzo, L.: "Should tax bases overlap in a federation with lobbying?"
2010/9, Cubel, M.: "Fiscal equalization and political conflict"
2010/10, Di Paolo, A.; Raymond, J.L.; Calero, J.: "Exploring educational mobility in Europe"
2010/11, Aidt, T.S.; Dutta, J.: "Fiscal federalism and electoral accountability"
2010/12, Arqué Castells, P.: "Venture capital and innovation at the firm level"
2010/13, García-Quevedo, J.; Mas-Verdú, F.; Polo-Otero, J.: "Which firms want PhDS? The effect of the university-industry relationship on the PhD labour market"
2010/14, Calabrese, S.; Epple, D.: "On the political economy of tax limits"
2010/15, Jofre-Monseny, J.: "Is agglomeration taxable?"
2010/16, Dragu, T.; Rodden, J.: "Representation and regional redistribution in federations"
2010/17, Borck, R; Wimbersky, M.: "Political economics of higher education finance"
2010/18, Dohse, D; Walter, S.G.: "The role of entrepreneurship education and regional context in forming entrepreneurial intentions"
2010/19, Åslund, O.; Edin, P-A.; Fredriksson, P.; Grönqvist, H.: "Peers, neighborhoods and immigrant student achievement - Evidence from a placement policy"
2010/20, Pelegrín, A.; Bolance, C.: "International industry migration and firm characteristics: some evidence from the analysis of firm data"
2010/21, Koh, H.; Riedel, N.: "Do governments tax agglomeration rents?"
2010/22, Curto-Grau, M.; Herranz-Loncán, A.; Solé-Ollé, A.: "The political economy of infraestructure construction: The Spanish "Parliamentary Roads" (1880-1914)"
2010/23, Bosch, N.; Espasa, M.; Mora, T.: "Citizens' control and the efficiency of local public services"
2010/24, Ahamdanech-Zarco, I.; García-Pérez, C.; Simón, H.: "Wage inequality in Spain: A regional perspective"
2010/25, Folke, O.: "Shades of brown and green: Party effects in proportional election systems"
2010/26, Falck, O.; Heblich, H.; Lameli, A.; Südekum, J.: "Dialects, cultural identity and economic exchange"
2010/27, Baum-Snow, N.; Pavan, R.: "Understanding the city size wage gap"
2010/28, Molloy, R.; Shan, H.: "The effect of gasoline prices on household location"
2010/29, Koethenbuerger, M.: "How do local governments decide on public policy in fiscal federalism? Tax vs. expenditure optimization"
2010/30, Abel, J.; Dey, I.; Gabe, T.: "Productivity and the density of human capital"
2010/31, Gerritse, M.: "Policy competition and agglomeration: a local government view"
2010/32, Hilber, C.; Lyytikäinen, T.; Vermeulen, W.: "Capitalization of central government grants into local house prices: panel data evidence from England"
2010/33, Hilber, C.; Robert-Nicoud, F.: "On the origins of land use regulations: theory and evidence from us metro areas"
2010/34, Picard, P.; Tabuchi, T.: "City with forward and backward linkages"
2010/35, Bodenhorn, H.; Cuberes, D.: "Financial development and city growth: evidence from Northeastern American cities, 1790-1870"
2010/36, Vulovic, V.: "The effect of sub-national borrowing control on fiscal sustainability: how to regulate?"

UNIVERSITAT DE BARCELONA

ieb@ub.edu
www.ieb.ub.edu

Fiscal Federalism

Document de treball de l'IEB