WELFARE EFFECTS OF THE DECENTRALISATION OF THE INCOME TAX

(Preliminary version)

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I. INTRODUCTION

The main questions that this work tries to address are the following:

- How does decentralization towards regional governments of the income tax (under different assumptions) affect welfare (of the different agents), in comparison with other ways of funding decentralized expenditures (central grants)?
- Which individuals (rich or poor) and which regions (rich or poor) pay for the decentralization of the income tax?
- What is the harm for central governments´distributive goals of giving distributional power (via progressive income taxation) to regional governments? How does the use of progressive income taxation by two levels of government (nationwide and regionalwide respectively) affect interpersonal redistribution? Is national social welfare worse off after two rounds of distribution?
- Is there any system of decentralized funding which is unambiguously welfare superior to the others?

The purpose of this paper is to examine the welfare effects of the decentralization of the income tax towards regional governments in a decentralized country, assuming different degrees of possible redistributive autonomy for local authorities. The theoretical model assumes two classes of individuals and two regions. Each region has its own government that chooses its policies so as to maximize a welfare function defined over its citizens alone. The regions are united under a central government, which maximizes a social welfare function that includes all individuals in the country. We apply **numerical or simulation methods** that allow us to calculate the level of social and individual welfare under a wide range of assumptions regarding individual preferences, regional and central welfare functions, and, most significantly, the assignment of different instruments for funding decentralized governments. In most cases we find that the normative basis for decentralization of a linear income tax versus central grants funding is quite strong, whereas the decentralization of a proportional income tax is nationwide welfare superior to a decentralized progressive income tax.

II. THE THEORETICAL MODEL

Three models for funding regional governments´expenditures are proposed and their effects on the different agents´ welfare compared. In these three models each regional government (the lower level of government) provides a commodity (a public good), and the difference among the models resides in the different ways of funding the regionally-provided good:

- In the first model, regional-provided commodities are totally financed by central grants.
- In the second model, regional governments raise a proportional income tax from the residents in the region for the provision of the regional public good.
- The third model allows regional provision of this good to be financed by a progressive income tax (characterised by a constant tax rate and a lump-sum transfer to any individual) collected from the region´s residents.

The Federal System

Let there be a federal system consisting of two regions, each with its own regional government, and both united under a central government. Each regional government maximizes an individualistic social welfare function defined over the utility functions of its citizens alone. The policy instruments for each regional government for funding the regional public good are different in each model: none in the first model, as regional public goods are financed by central grants; the income tax rate in the second model of decentralization through proportional income taxation; and the income tax rate and a lump-sum transfer to the region´s residents in the third model of funding by progressive income taxation (that is, in the third case, the regional governments have redistributive power to alter income distribution among its citizens).

The central government in turn provides a national public good at a uniform level across regions, and it obtains its revenues from a progressive income tax (characterised by a constant tax rate and a lump-sum transfer to all individuals in the

country) in the three models, and in the first model, it also determines the grants to the regional governments.

The central government maximizes an individualistic social welfare function defined over the indirect utility functions of all individuals in all states, which allows us to introduce interpersonal redistributive goals of the central government.

The federal-state relationship is treated as a Stackelberg model, in which the regional governments are followers, and the central government is the leader: thus, each regional government chooses its policy instruments given the levels of the central government policies. The result of each region´s maximization is a set of reaction functions, giving the levels of its policy variables as a function of the central government´s instruments. The central government then maximizes its welfare function considering the regions´ reaction functions and its own budget constraint. The solution to this process determines the actual levels of central instruments, which, when substituted into the regions´ reaction functions, fixes their policy variables.

Individuals

Individual h in region i has an utility function U_i^h defined over consumption of a private good Y_i^h, labor supply L_i^h, consumption of the regional public good e_i and consumption of the central government-supplied public good, X_c.

(1) $$U_i^h = U_i^h (Y_i^h, L_i^h, e_i, X_c)$$

With a centrally determined linear income tax, the individual´s budget constraint is

(2) $$Y_i^h = a_c + (1-t_c) (w_i^h L_i^h)$$

where

w_i^h = wage of individual h in state i

a_c= lump-sum transfer in the central income tax, constant for all individuals in the country.

t_c = tax rate in the central income tax, constant for all individuals in the country.

For the model in which besides the centrally determined linear income tax, there is a regionally determined income tax, the individual´s budget constraint becomes:

(3) $$Y_i^h = (a_c) + (1-t_c-t_i)\,(w_i^h\, L_i^h)$$

(4) $$Y_i^h = (a_c + a_i) + (1-t_c-t_i)\,(w_i^h\, L_i^h)$$

for a proportional (3) and progressive (4) regional income tax respectively, where

a_i=lump-sum transfer in region i´s income tax, constant for all individuals in that region.

t_i = tax rate in the region i´s income tax, constant for all individuals in that region.

Utility maximization generates individual commodity demand and labor supply functions and indirect utility functions (5), (6) and (7) respectively, for our Model 1 (in which regional public goods are financed by central grants and therefore, there is only the central linear income tax), Model 2 (in which the central government raises a linear income tax, and the regional governments use a proportional income tax to obtain revenues), and Model 3 (in which besides the central linear income tax, the regional governments may use progressive income taxation to obtain revenues):

Model 1: National progressive income tax + Grants to Regional Governments:

(5) $$Y_i^{h*} = Y_i^h\,(a_c, t_c, w_i^h)\,,\quad L_i^{h*} = L_i^h\,(a_c, t_c, w_i^h)$$
$$V_i^h = U_i^h\,(Y_i^{h*}, L_i^{h*}, e_i^h, X_c) = V_i^h\,(a_c, t_c, w_i^h, e_i^h, X_c)$$

Model 2: National progressive income tax + Regional proportional income tax:

(6) $$Y_i^{h*} = Y_i^h\,(a_c, t_c, t_i, w_i^h)\,,\quad L_i^{h*} = L_i^h\,(a_c, t_c, t_i, w_i^h)$$
$$V_i^h = U_i^h\,(Y_i^{h*}, L_i^{h*}, e_i^h, X_c) = V_i^h\,(a_c, t_c, t_i, w_i^h, e_i^h, X_c)$$

Model 3: National progressive income tax + Regional progressive income tax:

(6) $$Y_i^{h*} = Y_i^h\,(a_c, t_c, a_i, t_i, w_i^h)\ ,\ \ L_i^{h*} = L_i^h\,(a_c, t_c, a_i, t_i, w_i^h)$$

$$V_i^h = U_i^h\,(Y_i^{h*}, L_i^{h*}, e_i^h, X_c) = V_i^h\,(a_c, t_c, a_i, t_i, w_i^h, e_i^h, X_c)$$

An individual´s wage is determined by his skill level. There are two levels of skill and so two types of individuals, denoted P and R for Poor and Rich, respectively. The ability of a given type of individual is assumed to be the same in the two regions. The number of individuals of type h in region i equals H^h_i, and total population in region i H_i, ($H_i = H^R_i + H^P_i$), and we assume that region 1 has a higher proportion of rich individuals (region 1 can be said to be a rich region, and region 2 a poor region). We also assume that there is no interregional movement of goods or individuals.

Production

Labour supplied by individuals in each region is applied, according to a linear constant returns to scale production function, identical in both regions, to the production of output, which can be used interchangeably for the production of the composite private good, the regional public good or the national public good. Under this assumptions, all markets (labour market of both types of individuals, and aggregate national output) clear. Labour and output are assumed to be non-tradable across regions.

Also on the production side of this economy, the level of production of the regional public good in region i is denoted X_i. Nevertheless, it is assumed that there are interregional spillovers arising from each regional government´s production of the public good. The amount eventually consumed by any individual h in region i equals X_i plus some fraction of the other state´s production, a fraction that may differ for the two states:

$$e_1^h = X_1 + d_2 X_2\ , \qquad h = P, R$$

$$e_2^h = X_2 + d_1 X_1, \qquad h = P, R$$

where

d_i = the fraction of public good produced in region i consumed by individuals in the other region.

Regional Governments

Each regional government maximizes an individualistic social welfare function W_i defined over the indirect utility functions of its citizens alone. The regional government i´s optimization must be consistent with each individual´s optimal decisions, and with the regional production of a public good and its budget constraint.

In the second and third models, the fiscal instruments of each regional government are the regional linear income tax elements (the tax rate, t_i only, or the tax rate and lump-sum transfer, a_i) respectively. Let R_i be the revenue requirements of regional government i unrelated to production, the regional government i´s optimization problem, for the second and third model, are then:

Model 2: National progressive income tax + Regional proportional income tax

$$Max_{t_c} W_i = W_i(V_i^h(a_c, t_c, t_i, w_i^h, L_i^h, e_i, X_c))$$

$$\text{s.t.} \qquad X_i = t_i \sum_h^H w_i^h L_i^h - R_i$$

Model 3: National progressive income tax + Regional progressive income tax

$$Max_{t_c} W_i = W_i(V_i^h(a_c, t_c, a_i, t_i, w_i^h, L_i^h, e_i, X_c))$$

$$\text{s.t.} \qquad X_i = t_i \sum_h^H w_i^h L_i^h - a_i H_i - R_i$$

In the first model, however, as the regional public goods are financed by central grants, which are chosen by the central government, the regional governments do not have any choice to do.

Central Government

The central government chooses the parameters of the central linear income tax in the three models, t_c, a_c, and the amount of unconditinal lump-sum grants to each regional government in the first model, in order to maximize a social welfare function Θ defined over all citizens in the country´s welfare. Thus, we analyse the case in which the central government cares about individuals´ inequalities across the country[1].

The federal actions must be consistent with the optimizing behavior of all individuals and of both regional governments, and it must satisfy its own production and budget constraint. Denoting R_c as the revenue requirements non related to production nor to grants of the central government, and G_i the unconditional grants transferred from the central government to regional government i, the central government´s problem for each of the three models we propose (funding regional public goods by central grants, by a proportional income tax or by a linear progressive income tax) is:

Model 1: National progressive income tax + Grants to regional governments

$$Max_{t_c,a_c,G_1,G_2}\Psi = \Psi(V_i^h(a_c,t_c,w_i^h,L_i^h,e_i(G_i),X_c))$$

$$\text{s.t} \qquad X_c = t_c\sum_i^2\sum_h^H(w_i^hL_i^h) - a_c 2H - R_c - G_1 - G_2$$

Model 2: National progressive income tax + Regional proportional income tax

$$Max_{t_c,a_c}\Psi = \Psi(V_i^h(a_c,t_c,t_i,w_i^h,L_i^h,e_i,X_c))$$

$$\text{s.t} \qquad X_c = t_c\sum_i^2\sum_h^H(w_i^hL_i^h) - a_c 2H - R_c$$

[1] We also consider in the simulations the case in which the central government cares about regional inequalities along with individuals´ inequalities within each region, that is, central government maximizes a national welfare function defined over the regions´ welfare, which in turn, is defined over its

Model 3: National progressive income tax + Regional progressive income tax

$$Max_{t_c,a_c} \Psi = \Psi(V_i^h(a_c, t_c, a_i, t_i, w_i^h, L_i^h, e_i, X_c))$$

$$\text{s.t} \qquad X_c = t_c \sum_i^2 \sum_h^H (w_i^h L_i^h) - a_c 2H - R_c$$

where $H = \sum_i H_i$ (i=1,2), is the national population.

III. SPECIFICATION OF THE SIMULATION MODEL

Individual Utility Function

We use a log Cobb-Douglas utility function, the parameters of which are assumed to be identical for all individuals:

$$U_i^h = A \log Y_i^h + B \log (L_o - L_i^h) + C \log e_i^h + D \log X_c$$

where A+B=1. The individual´s endowment of leisure is L_o, and is meant to represent the maximum number of hours that he can work in one day. L_o is assumed to equal 12 hours per day (or 3120 hours per year: 5 days per week times 52 weeks per year). In choosing the parameter A, we set A=0.75, value that gives rise to calculated labor supplies approximately equal to the actual labor supplies of individuals (from 6 to 8 hours per day). With respect to C and D, their values are major determinants of the amount of regional and central government expenditures respectively. We set the values C=D=0.05, that is, all individuals have the same preference for the regionally and the centrally-provided public goods. These values, together with the assumptions about the size of the central and regional governments´ respective revenue requirements, give rise to total public sector expenditures (central and regional) that range from 25 to 40 per cent of national income in most simulations.

We also use a constant elasticity of substitution (CES) utility function:

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individuals´ welfare. But only the results of maximization of national welfare over individuals´ utilities are reported.

$$U_i^h = (A(Y_i^h)^s + B(L_o - L_i^h)^s + C(e_i^h)^s + D(X_c)^s)^{\frac{1}{s}}$$

where A+B=1 and 1/(1-s)=(, the elasticity of substitution. We use the values A=0.95, s=0.5, calibrated for the Spanish economy. As for the choice of C and D, we use the same values 0.05.

Wages

The data on wages are obtained from the Spanish Statistical National Institute´ Salaries Survey for 1996, and they correspond to the average salary of a representative individual of the poorest and richest region in Spain that year, respectively:

W_R = &12/hour
W_P = &5/hour

Population Distribution

The total populations of the two regions are assumed to be equal , and set to be 5 individuals in each region. However, the proportions of rich and poor individuals in the two regions differ, being region 1 the one with higher proportion of rich individuals. We run simulations for two sets of proportions of rich and poor individuals in the regions: 3/5 and 2/5 of rich individuals in regions 1 and 2 respectively in the first set, and 4/5 and 1/5 of rich individuals in regions 1 and 2 respectively in the second set. The results do not vary considerably with the initial inequality among regions

Externalities in Regional Governments´ Provision of Public Goods

We run simulations for the following combinations of d_1, d_2, that represent the external benefits of regional public goods: (0,0), (0.25,0.25), (0.1,0.4), (0.4,0.1), (0.5,0.5).

Central and Regional Revenue Requirements

Two sets of government revenue requirements are used, one in which each government sector is "small" and one in which each is "large". In the first, we set governments external revenue requirements, for other reasons than spendings on the publicly provided goods, to be approximately 3% of total regional personal income and 6% of total national income for the regional and central governments respectively. Combined with other parameter values, these assumptions yield a size of the public sector of around 25% of the economy. The figures for the second set are 6% and 10% approximately, which generate a total government sector whose expenditures average 40% of total personal income.

Governments Social Welfare Functions

We assume that the welfare functions of the regional governments take the traditional additively separable form:

$$W_i = \sum_h^H \frac{1}{1-\rho_i} U_i^{h(1-\rho_i)} \qquad \text{i=1,2}$$

For the central government, the social welfare function, defined over the utility functions of all the citizens, takes the following form:

$$\Psi = \sum_i^2 \sum_h^{H_i} \frac{1}{1-\rho_c} U_i^{h(1-p_c)}$$

The parameters $\Delta_c \exists 0$, $\Delta_i \exists 0$ represent the central and region i government´s aversion to inequality. When Δ_c (or Δ_i) equals zero, the social welfare is equal to the sum of individuals´utilities, and the government is indifferent to inequality. As Δ_c (or Δ_i) increases, the government´s aversion to interpersonal inequality increases.

It is important to examine cases in which both levels of governments are indifferent to inequality, in which both are equally averse to inequality, and in which

central and regional governments have different redistributive goals. We use the following sets of combinations of the inequality aversion parameters: (0,0,0), (0.5,0.5,0.5), (0.5,0.5,0), (0,0,0.5), (2,2,2), for (Δ_1, Δ_2, Δ_c).

IV. THE RESULTS OF THE SIMULATIONS

We determine the level of national and regional social welfare, along with rich and poor individuals in rich and poor region´s utility level for each of our three models:

- In the first model, regional governments´ provision of the regional public good is financed by **central grants (SL1)**.
- In the second model, regional governments´ expenditures are financed by **proportional regional income taxation (SL2).**
- In the third model, regional provision is financed by **progressive linear regional income taxation (SL3).**

We then compare social welfare (central and regional) and individual welfare for these cases in this way:

- (SL3)-(SL1): progressive regional income tax *versus* central grants.
- (SL2)-(SL1): proportional regional income tax *versus* central grants.
- (SL2)-(SL3): proportional *versus* progressive regional income tax.

trying to rank these three ways of funding decentralized governments for the three types of agents: central government, regional governments and rich and poor individuals in each region.

If decentralized funding through the regional income tax, with or without the lump-sum element (that is, progressive or proportional), is inferior to centralized funding by grants ((SL3)-(SL1)<0, or, (SL2)-(SL1)<0) this makes the case for **centralized funding**, and the central government should be able to attain his distributive goals. But if social welfare levels from the second and third model are higher than for the first ((SL3)-(SL1)>0, or, (SL2)-(SL1)>0), we judge this as making

the case for **decentralization of revenues**. We should also compare the second and third model to make the case for the optimal system of income tax decentralization, with or without redistributional power to regional governments ((SL2)-(SL3)>0?), from the national, regional and individual welfare points of view.

For the national welfare, the relevant question is how harmful can be for the central government´s distributive objectives giving redistributive power to the regions.

It is possible to calculate the monetary value of these differences in welfare levels. The lagrange multiplier of the governments and individuals´ budget constraints measures the welfare cost for them of raising one additional unit in income tax. In other words, the lagrange multiplier of each agent´s maximization problem is the marginal utility of income for each agent (central government, regional governments or individuals). Therefore, its inverse can be thought to be a measure of the monetary value that each agent places on one additional unit of welfare. So if we divide the difference in welfare (national, regional or individual) from any two simulations by the lowest lagrange multiplier of the two simulations, we obtain a measure of the monetary value that each agent places on the difference in welfare from the comparison of any two models. The difference calculated in this way determines the amount of revenue (governments revenue or individual´s income) that the agents (governments or individuals) must give up in order to achieve the higher level of welfare.

We present below the results on the differences in welfare at a national, regional and individual level for one of the sets of simulations of our three different models: using the log Cobb-Douglas individuals´utility function, the population distribution being 3/5 and 2/5 of rich individuals in region 1 and 2 respectively, the revenue requirements of the two levels of governments being "small", and the national government welfare function being individualistic.

The sensitivity analysis of the results shows that the conclusions drawn below are not essentially altered by changes in the specification of the individuals´ utility function, national welfare function, initial distribution of income or size of the governments.

NATIONAL SOCIAL WELFARE COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	6.0632	5.6100	-6.2703	-47.0352	2.0618
d1=d2=0.25	-1.6441	-2.0508	-6.9232	-28.0671	-5.5589
d1=0.1d2=0.4	-3.4263	-3.8719	-8.1032	-25.2689	-7.5100
d1=0.4d2=0.1	4.3243	-1.8965	-6.0413	-26.9888	-5.2962
d1=d2=0.5	-6.9666	-7.3394	-7.2584	-14.7650	-10.8142
	(SL2)-(SL1)				
d1=d2=0	11.2511	11.1481	-0.4824	53.6127	8.4460
d1=d2=0.25	4.1058	4.1003	-0.2855	34.7536	1.6548
d1=0.1d2=0.4	2.4001	2.3668	-1.3367	31.9553	-0.1580
d1=0.4d2=0.1	4.1631	4.1917	0.5307	33.5654	1.8397
d1=d2=0.5	-0.7827	-0.7113	-0.0435	21.4406	-2.9533
	(SL2)- (SL3)				
d1=d2=0	5.0011	5.3554	5.7066	4.6887	6.3164
d1=d2=0.25	5.7910	6.2035	6.5618	5.4712	7.3387
d1=0.1d2=0.4	5.9033	6.3262	6.6776	5.5900	7.4896
d1=0.4d2=0.1	ERR	6.1385	6.5081	5.4000	7.2620
d1=d2=0.5	6.3312	6.7819	7.1466	6.0050	8.0313

REGION 1 (RICH REGION) SOCIAL WELFARE COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	Pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	12.3840	12.5936	1.9670	87.5992	10.9302
d1=d2=0.25	3.9558	4.2131	1.0516	54.8942	2.6094
d1=0.1d2=0.4	8.6233	8.8389	3.8574	61.7639	7.1394
d1=0.4d2=0.1	ERR	-1.8261	-1.8107	41.8419	-3.3506
d1=d2=0.5	-3.1067	-2.8074	-0.1761	28.5708	-4.3535
	(SL2)-(SL1)				
d1=d2=0	11.4060	11.4537	1.2161	86.4228	9.3339
d1=d2=0.25	3.5548	3.6964	0.5947	54.7734	1.7719
d1=0.1d2=0.4	8.2380	8.3421	3.6475	61.6567	6.3277
d1=0.4d2=0.1	-2.5706	-2.3905	-2.4661	41.6518	-4.2347
d1=d2=0.5	-2.8341	-2.6075	-0.3175	29.7136	-4.3528
	(SL2)-(SL3)				
d1=d2=0	-0.5575	-0.6542	-0.8786	-0.3766	-0.9314
d1=d2=0.25	-0.2270	-0.2941	-0.5280	-0.0377	-0.4830
d1=0.1d2=0.4	-0.2202	-0.2858	-0.5171	-0.0337	-0.4743
d1=0.4d2=0.1	ERR	-0.3175	-0.5534	-0.0586	-0.5021
d1=d2=0.5	0.1533	0.1130	-0.1294	0.3502	0.0004

REGION 2 (POOR REGION) SOCIAL WELFARE COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	Pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	-0.2577	-1.2801	-7.4368	-74.1035	-6.3712
d1=d2=0.25	-7.2440	-8.2326	-7.1958	-42.6947	-13.3336
d1=0.1d2=0.4	-15.4759	-16.4164	-11.2827	-26.3993	-21.4548
d1=0.4d2=0.1	ERR	-1.9659	-3.3723	-51.6768	-7.1483
d1=d2=0.5	-10.8265	-11.8127	-6.3035	-21.6772	-16.9676
	(SL2)-(SL1)				
d1=d2=0	10.4235	10.1481	-1.3548	93.2102	7.0772
d1=d2=0.25	4.4569	4.2962	-0.6153	64.0740	1.4724
d1=0.1d2=0.4	-3.5432	-3.6343	-4.5682	48.2130	-6.3262
d1=0.4d2=0.1	10.6869	10.4726	3.1460	72.9726	7.5384
d1=d2=0.5	1.3012	1.1894	0.4608	44.1756	-1.5309
	(SL2)-(SL3)				
d1=d2=0	5.3413	5.7629	5.6039	5.4541	6.9161
d1=d2=0.25	5.8484	6.3098	6.1215	5.9894	7.5883
d1=0.1d2=0.4	5.8772	6.3333	6.1530	6.0108	7.5922
d1=0.4d2=0.1	ERR	6.3567	6.1581	6.0358	7.6679
d1=d2=0.5	6.0714	6.5563	6.3469	6.2328	7.9135

RICH INDIVIDUAL IN REGION 1 (RICH REGION) : UTILITY COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	-2.9845	-3.0304	-3.8703	0.8433	-3.4258
d1=d2=0.25	-3.9581	-3.9999	-4.0593	-1.2555	-4.3888
d1=0.1d2=0.4	-3.4529	-3.4995	-3.4626	-0.8775	-3.9004
d1=0.4d2=0.1	ERR	-4.6638	-4.6661	-2.0131	-5.0408
d1=d2=0.5	-4.7647	-4.8017	-4.3169	-2.8515	-5.1814
	(SL2)-(SL1)				
d1=d2=0	-0.2591	-0.2278	-0.7355	3.4682	-0.4201
d1=d2=0.25	-1.0253	-0.9862	-0.7147	1.4632	-1.1560
d1=0.1d2=0.4	-0.2952	-0.2567	0.1073	2.1059	-0.4288
d1=0.4d2=0.1	-1.8723	-1.8323	-1.5161	0.4590	-1.9978
d1=d2=0.5	-1.6834	-1.6360	-0.8298	-0.0874	-1.7825
	(SL2)-(SL3)				
d1=d2=0	2.7826	2.8618	3.0752	2.5845	3.0657
d1=d2=0.25	2.9848	3.0673	3.2850	2.7822	3.2822
d1=0.1d2=0.4	3.2347	3.3222	3.5404	3.0316	3.5529
d1=0.4d2=0.1	ERR	2.8469	3.0655	2.5660	3.0470
d1=d2=0.5	3.1170	3.2028	3.4226	2.9122	3.4275

POOR INDIVIDUAL IN REGION 1 (RICH REGION) : UTILITY COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	4.4946	4.3889	3.3545	7.9844	3.9165
d1=d2=0.25	3.7514	3.6573	3.2051	6.3041	3.2105
d1=0.1d2=0.4	4.2058	4.1047	3.7014	6.7010	3.6382
d1=0.4d2=0.1	ERR	3.0984	2.7094	5.6103	2.6741
d1=d2=0.5	3.1308	3.0470	2.9982	5.0073	2.6238
	(SL2)-(SL1)				
d1=d2=0	2.1623	2.0783	0.8611	5.7928	1.6909
d1=d2=0.25	1.3795	1.3164	0.6675	4.0913	0.9781
d1=0.1d2=0.4	1.6417	1.5775	0.9788	4.2932	1.2344
d1=0.4d2=0.1	0.9744	0.9154	0.3292	3.5652	0.5887
d1=d2=0.5	0.7853	0.7379	0.4845	2.8347	0.4371
	(SL2)-(SL3)				
d1=d2=0	-2.2975	-2.2789	-2.4788	-2.1079	-2.2039
d1=d2=0.25	-2.3503	-2.3216	-2.5266	-2.1554	-2.2207
d1=0.1d2=0.4	-2.5372	-2.5030	-2.7059	-2.3445	-2.3887
d1=0.4d2=0.1	ERR	-2.1699	-2.3776	-1.9971	-2.0784
d1=d2=0.5	-2.3338	-2.2989	-2.5075	-2.1353	-2.1820

RICH INDIVIDUAL IN REGION 2 (POOR REGION) : UTILITY COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	-6.2277	-6.3113	-7.4701	-2.0768	-6.7866
d1=d2=0.25	-6.9893	-7.0724	-7.4131	-3.9223	-7.5508
d1=0.1d2=0.4	-7.8613	-7.9410	-8.2390	-4.8419	-8.4109
d1=0.4d2=0.1	ERR	-6.4092	-6.6368	-3.4450	-6.8955
d1=d2=0.5	-7.3825	-7.4667	-7.2267	-5.1672	-7.9510
	(SL2)-(SL1)				
d1=d2=0	-1.3633	-1.3351	-1.9434	2.4227	-1.5365
d1=d2=0.25	-1.6472	-1.6135	-1.4199	0.9159	-1.7973
d1=0.1d2=0.4	-2.8507	-2.8189	-2.6153	-0.4231	-3.0155
d1=0.4d2=0.1	-0.5614	-0.5246	-0.2209	1.8938	-0.7015
d1=d2=0.5	-1.6815	-1.6465	-0.8851	-0.0095	-1.8244
	(SL2)-(SL3)				
d1=d2=0	4.9522	5.0652	5.3946	4.6411	5.3258
d1=d2=0.25	5.4404	5.5583	5.8918	5.1252	5.8376
d1=0.1d2=0.4	5.0084	5.1185	5.4525	4.6927	5.3727
d1=0.4d2=0.1	ERR	6.0634	6.3972	5.6213	6.3701
d1=d2=0.5	5.8197	5.9399	6.2774	5.5004	6.2310

POOR INDIVIDUAL IN REGION 2 (POOR REGION) : UTILITY COMPARISONS

	pc=pi=0	pc=pi=0.5	pi=0.5;pc=0	pi=0;pc=0,5	pi=pc=2
	(SL3)-(SL1)				
d1=d2=0	2.0473	1.8542	0.7718	5.5193	1.1789
d1=d2=0.25	1.5136	1.3289	0.8081	4.0862	0.6700
d1=0.1d2=0.4	0.8721	0.6980	0.2221	3.3434	0.0667
d1=0.4d2=0.1	ERR	1.8262	1.3570	4.5137	1.1448
d1=d2=0.5	1.2457	1.0643	0.9377	3.1692	0.4106
	(SL2)-(SL1)				
d1=d2=0	1.6498	1.5644	0.3177	5.3039	1.1744
d1=d2=0.25	1.0594	0.9927	0.3107	3.8086	0.6461
d1=0.1d2=0.4	0.5556	0.4930	-0.1353	3.2009	0.1572
d1=0.4d2=0.1	1.4195	1.3522	0.7253	4.0908	1.0028
d1=d2=0.5	0.7100	0.6546	0.3701	2.8036	0.3342
	(SL2)-(SL3)				
d1=d2=0	-0.4333	-0.3261	-0.4535	-0.3134	-0.0339
d1=d2=0.25	-0.4830	-0.3645	-0.4982	-0.3567	-0.0421
d1=0.1d2=0.4	-0.3329	-0.2196	-0.3538	-0.2062	0.0888
d1=0.4d2=0.1	ERR	-0.5140	-0.6479	-0.5125	-0.1742
d1=d2=0.5	-0.5602	-0.4333	-0.5715	-0.4294	-0.0880

We analyse first the implications for national social welfare of each of these systems of funding the regional governments. The results show that, generally, regional provision of a public good accompanied by central grants is welfare superior to a regional linear progressive income tax for national welfare. There are not clear linear relationships between increases in the degree of externalities or in the governments´ aversion to inequality and national welfare gains from using central grants.

Superiority of central grants is reversed in most cases when regional provision of the public good is financed through a proportional tax on residents´ income. In most cases, decentralized revenues that do not alter central government´s preferences for inequality, yield to greater levels of national welfare than central grants fundings. Generally, there are exceptions to this result when there are substantial externalities across regions and when regional governments´ aversion to inequality is greater than the central government´s. The differences in welfare gains do not depend on the degree of externalities or governments´aversion to inequality.

A major result is the superiority for social national welfare of the system of decentralization based on a proportional income tax (SL2) over the decentralization of revenues giving redistributional power to regional governments (SL3). The positive difference between the cases 2 and 3 can be thought to be a measure of the nation´s gain from preventing regional governments from using a redistributive instrument, such as a progressive income tax. So, no matter which is the degree of interpersonal inequality aversion of the central government (higher or lower than the regional governments´), it is harmful for its objectives to decentralize distributional power towards regional governments *via* a progressive income tax: after two rounds of distribution, national social welfare is worse off.

By looking at the regions´ social welfare, the following ranking of the three systems can be said to be generally the cases:

- For the rich region (region 1): (SL3) > (SL2) > (SL1)
- For the poor region (region 2): (SL2) > (SL1) > (SL3)

That is: the rich region would prefer being able to redistribute income among its citizens when obtaining resources for funding the regional public good, whereas funding it *via* central grants lead it to the lowest regional welfare. The poor region would obtain the lowest level of welfare by decentralization of a progressive income tax and its best option would be to use a proportional income tax, which leads to even higher welfare than being financed by central grants. So, poor regions are not worse off by decentralization of the income tax, as far as this does not give distributional power to regional governments

Whereas the ranking of these three systems for individuals´ welfare is for most cases the following:

- For the rich individuals (in the rich and poor region): (SL1) > (SL2) > (SL3)
- For the poor individuals (in the rich and poor region): (SL3) > (SL2) > (SL1)

When we look at the results at an individual level, we find that funding the regional public goods by central grants is the most harmful system for the poor individuals of the country, while it is the most advantageous system for the rich individuals of the country. (Why? Isn´t it contradictory with the intuition that centralized funding is better to redistributive income? Why do the poors prefer redistributive decentralization?). (There is an important exception for the ranking 3>2 for the poor individuals: when the initial distribution of income is more unequal (4/5 and 1/5 rich individuals in region 1 and 2 respectively), then 2>3, also for the poor).

(FURTHER INTERPRETATIONS OF ALL THESE RESULTS REMAIN TO BE DONE)