On the Size and Determinants of Inter-regional Redistribution in European Countries over the Period 1995-2009

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Abstract:

The aim of this paper is to analyse cross-country differences in the degree of inter-regional redistribution achieved by means of taxes and expenditures in 21 European countries over the period 1995-2009. We rely on a standard approach based on the observation and comparison of both primary and disposable household income at regional scale. Once the redistributive effect in each country is quantified, we try to explain the drivers of cross-country time-series differences. According to our estimates, cross-national standard deviation is significant and much higher than time variation. Secondly, inter-regional redistribution is strongly and positively related to personal redistribution by means of taxes and social benefits in cash; and is negatively related to both the extent of regional disparities in primary income and to the degree of political and fiscal decentralization.

Key words: Inter-regional redistribution, regional fiscal imbalance, European Union.

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1. INTRODUCTION

Taxes and social benefits in cash change the distribution of income. The analysis of this change can be focused on individuals, giving rise to studies on the incidence of taxes and expenditures. The amount of literature on this is huge, and is tightly connected to the research on income distribution. But the analysis can also focus on spatial incidence. In this case, the focus of interest is usually displayed on inter-regional redistribution and most often pays especial attention to highly decentralized countries with strong regional political arenas (Bosch Espasa, and Solé-Ollé, 2010).

There are a few comparative papers dealing with this spatial incidence, focusing on European countries. Cross-country analysis includes the so-called MacDougall report (MacDougall, 1977). This seminal reference was commissioned by the EU and covered France, United Kingdom, Italy, and Germany. It was then geographically extended by Davezies, Nicot and Prud'homme (1998) to Portugal, Spain and Sweden. Differences in methodology and data sources involve non-coincident results. France and the United Kingdom are again analysed by Melitz and Zumer (2002). The list of papers on single European country analyses is larger. It encompasses works for Spain (Lago-Peñas, 2001; Capo and Oliver, 2002; Capó, 2008), Germany (Duboz and Nicot, 1998), and Italy (Obstfeld and Peri, 1988; Decressin, 2002). Disparities in data sources and specifications again make it difficult to compare results. In sum, our knowledge on this issue remains partial and based on heterogeneous empirical evidence.

Hence the aim of this paper is to fill this gap. Our contribution to the literature is threefold.

Firstly, we use a wide and homogeneous database including 21 European countries and 277 regions observed over the period 1995-2009. This new data base for household accounts provided by Eurostat at NUTS2 level provides homogeneous data suitable for cross-country comparisons. Attention is paid to direct taxes and grants on families, meaning that other expenditure and revenue programs are set aside (public health care, business taxes, or European regional policy grants, for instance). The reason for this exclusion is the unavailability of homogeneous and official estimates for

regional fiscal imbalances[1]. Homogeneity and coverage of our data base is basic to perform cross-country comparisons and establish rankings of countries.

Secondly, we analyse the determinants of cross-country time-series differences on the inter-regional redistribution effect measured in the first step of our analysis. Both economic and institutional drivers are tested. In particular, we take into consideration the extent of welfare states, the diversity in regional *per capita* primary income to deal with, and the degree of political and financial decentralization. All of them are proven to be relevant. Other factors, such as national *per capita* GDP, the number of regions, or the European regional policy are not statistically significant.

Finally, the effect of being a rich region in a poor country is analysed. In some countries there are hot political debates on this issue, most often focused on the effects of equalization on regional fiscal menus. This is the case of the province of Ontario in Canada, or of the region of Catalonia in Spain. The most repeated argument is that they are net supporters of inter-regional fiscal flows in their countries, but they have to compete with regions with similar per capita GDP, but which are net receptors of fiscal flows, involving a sort of unfair competition. In the first case, the highly competitive northeast US supports significantly lower levels of equalization than Ontario (Courchene, 1999). In the second one, departments of the South of France with low *per capita* GDP for French standards are net receptors of fiscal flows while they have similar *per capita* GDP compared to Catalonia and are direct competitors in some sectors (Prud'homme, 1999). In order to correctly measure the relative efforts made by the different regions, variables are expressed in terms of European averages instead of national averages in this section. Moreover, it gives us the possibility of comparing results for regions with the same *per capita* primary income in different countries and to identify extreme cases. As before, our attention is focused on household income[2].

The remainder of this paper is structured as follows. Section 2 is devoted to measuring both cross-national and individual inter-regional redistribution effects.

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[1] Spain is one of the countries where more efforts have been made on this issue. Official estimates are available. On this issue, see again the collective book edited by Bosch, Espasa and Solé-Ollé (2010). Bosch, Espasa, and Sorribas (2002), Ambrosiano *et al* (2008), and Hepp and Hagen (2010) perform single-country analyses for Spain, Italy, and Germany, respectively.

[2] At the end of the day, arguments on unfair regional fiscal menus and unfair federal redistribution are mixed: if the contribution to federal budget drops, household disposable income increases in richer regions, regional taxes can increase and regional public services improve.

Section 3 analyses the drivers of cross-section time-series variation in the parameter estimates in the previous section. Section 4 is focused on the effect of borders on the relative treatment of regions. Section 5 is the conclusion.

2. MEASURING THE INTER-REGIONAL REDISTRIBUTION EFFECT

2.1. Cross-country analysis

Following the proposal by Bayoumi and Masson (1995), the point of departure to estimate the inter-regional redistribution effect is the following econometric specification:

$$\frac{DI_i}{DI_N} = \alpha + \beta \cdot \frac{PI_i}{PI_N} + \varepsilon_i \qquad [1]$$

, where *DI* is the household disposable income, *PI* is the household primary income, sub-index *i* indicates the region, and *N* the national total (=100). Both variables are expressed in current *per capita* Euros. Coefficient β captures the extent to which differences in primary income are reflected in disposable income. Hence $1-\beta$ summarizes the average redistribution involved by inter-regional transfers, most of them due to fiscal flows Specification [1] can be extended to capture different inter-regional redistribution parameters for each country, as we do in specification [2]:

$$\frac{DI_i}{DI_N} = \alpha_i + \beta_i \cdot \frac{PI_i}{PI_N} + \varepsilon_i \qquad [2]$$

Table 1 reports the list of countries and periods analysed. All data is gathered at NUTS2 level, yielding 277 regions for the 21 countries. For most countries the data is available for all years from 1995 to 2009. In order to control for potential simultaneity bias (disposable income can affect primary income via short-run demand effects), panel data estimates are discarded, and cross-section datasets built on time-series averages are used[3]. Hence, four estimates were performed: for the whole sample 1995-2009, and for each of the three five-year periods: 1995-1999, 2000-2004, and 2005-2009, in order to

[3]Moreover, the extremely low within-variation of variables implies that panel data based on annual data was mostly redundant.

analyse the existence of dynamics in the relationship, and to increase the sample size for the estimates in section 4.

[Table 1 near here]

According to the Eurostat methodology[4], *PI* shows the income of private households generated directly from market transactions, in particular from the purchase and sale of production factors. This includes the compensation of employees as the main item, i.e. income from the sale of labour as a production factor. Private households can also receive income on assets, particularly interests, dividends and rents. Then there is also income from net operating surplus and self-employment. Interest and rents payable are recorded as negative items for households. The disposable income (*DI*) of private households is the balance of *PI* and the redistribution of income in cash. These transactions comprise social contributions paid; cash social benefits received; current taxes on income and wealth paid; as well as other current transfers. Disposable income does not include social transfers in kind coming from public administrations or non-profit institutions that serve households.

Table 2 reports the main descriptive statistics of variables in specification [1] for the entire period. As expected, while means for both $\frac{DI_i}{DI_N}$ and $\frac{PI_i}{PI_N}$ are similar, the standard deviation and variable ranges are significantly lower in the former.

[Table 2 near here]

Table 3 shows the values for the Gini index for $\frac{DI_i}{DI_N}$ and $\frac{PI_i}{PI_N}$. This index is calculated on the average values for both ratios over the period 1995-2009. Again, as

[4] Available at: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tgs00036&plugin=1

expected, inequality is lower in the former. Bearing in mind that regional revenues are standardized by the corresponding national average and using data for the 277 regions, the Gini index drops from 0.99 for $\frac{DI_i}{DI_N}$, to 0.71 for $\frac{DI_i}{DI_N}$. Single-country analyses draw the same picture but also show significant cross-country disparities in primary revenues: Slovakia, Romania and Italy have the highest inequalities in regional revenues (both primary and disposable), whereas Denmark and Austria are the most levelled. Interestingly, regional disparities in Slovakia and Romania is due to the "capital effect". Bratislava and Bucharest concentrate a rising share of GDP and population, with increases in *per capita* GDP substantially higher than in the rest of the country. On the contrary, inequality in Italy is due to a bimodal distribution without outliers, but with a set of richer regions in the North plus the *Mezzogiorno*. In figure 1, inserted and explained below, both patterns of inequality are depicted.

[Table 3 near here]

The results from econometric estimates of equation [1] are synthesized in Table 4. In order to control for potential cross-country heteroskedasticity, robust errors instead of standard errors are computed. Despite the simplicity of the econometric model, the goodness of fit is very high in all cases, with R^2 coefficients ranging between 0.928 and 0.948. The statistical significance of the only regressor is extremely high. While the cross-country average inter-regional redistribution effect ($1-\beta$) for the entire period is 0.300, there is evidence that the intensity of this effect increases slightly over time, from 0.286 for the period 1995-1999, to 0.308 for 2005-2009.

[Table 4 near here]

2.2 Individual analysis

Figure 1 shows the relationship between $\frac{DI_i}{DI_N}$ and $\frac{PI_i}{PI_N}$ in all the 21 countries under analysis. The $\frac{DI_i}{DI_N}$ ratio is represented in the vertical axis, and $\frac{PI_i}{PI_N}$ in the horizontal axis. While the number of observations (regions) is quite different in each country, the slope of the fit line is positive in all cases and errors remain small. However, the slope of the fit line, and then the extent of inter-regional redistribution, changes. On one end, the fit line for countries like Italy (code 10), Greece (code 7) and Czech Republic (code 3) is close to 45º, meaning a proportional relationship between both variables and then no redistribution. However, Denmark is placed in the opposite extreme (code 4).

Specification [2] captures and quantifies this diversity. Its econometric estimation provides the inter-regional redistributive effect reported in the first column of Table 5[5]. Countries are ranked by estimated values. As pointed out, Denmark is the country with the strongest inter-regional redistribution effect (0.632), and Italy the weakest (0.147). This exercise is replicated for each of the three five-year periods established above. While rankings do not significantly change, there are however some exceptions and, more interestingly, there is a certain diversity in terms of dynamics. Denmark, Sweden, Austria, United Kingdom, Ireland, Hungary, Slovenia, Poland, Czech Republic, and Italy follow the rising pattern pointed out in Table 3. While on the contrary, redistribution drops in the Netherlands, Romania, Slovakia, Portugal, Belgium, France, Bulgaria, Spain, and Greece. Finally, Germany and Finland follow a quite erratic path. Redistribution increases in Germany during the second period, and then returns to the departure point in the third period; and Finland drops in the second period (ranked 17th) to sharply rise in the last one (ranked 5th) .

[Figure 1 near here]

[Table 5 near here]

[5] To avoid inflation of Tables, original estimates are not included in the text. They are available upon request.

In Table 6, our results are related to those obtained in previous analysis for European countries, as cited above. Starting with France and the UK, Table 5 shows close coefficients for the five-year period 1995-1999, and similar to those reported by Melitz and Zumer (2002). However, trends are different. Redistribution increases over time in the case of the UK, and drops in France. While changes are not dramatic in both cases, the distance between countries increases from 0.051 to 0.077. All in all, this decline for France was already detected by MacDougall (1977), and by Melitz and Zumer (2002). Moreover, the observed trend for the UK extends the results obtained by MacDougall (1977), and by Davezies, Nicot and Prud'homme (1998) for the period 1997-1993.

In the case of Italy, inter-regional redistribution drops between 1977 (MacDougall, 1977) and 1993 (Davezies, Nicot and Prud'homme, 1998; Decressin, 2002). This trend extends itself to the period 1995-2009, according to our results. For Germany, our estimates show a redistribution effect significantly higher than in both studies. This fact could be explained by the reunification of Germany since 1990, due to the strong inter-regional differences in *per capita* GDP between western and eastern Länder. For Portugal and Spain, inter-regional redistribution would be much stronger in the latter according to Davezies, Nicot and Prud'homme (1998). On the contrary, econometric estimates reported in Table 5 reveal the opposite. Moreover, our results confirm a sharp decline in the redistribution effect in Spain, in the most recent period (Table 7). Finally, for Sweden we get a rising and stronger effect than in Davezies, Nicot and Prud'homme (1998).

[Table 6 and 7 near here]

3. ANALYSIS OF THE DETERMINANTS OF INTER-REGIONAL REDISTRIBUTION

The aim of this section is to shed light on the determinants of the coefficients reported in columns 2 to 4 of Table 5. As shown in table 7, cross-section differences are significantly higher than within variation. Sluggishness in adjustment implies that econometric specifications have to be dynamic, including lagged values of the endogenous variables as regressors. Hence, the following econometric specification is estimated:

$$IR_{it} = \beta_1 + \beta_2 \cdot IR_{t-1} + \beta_3 \cdot DISPARITY_{it} + \\ + \beta_4 \cdot PERSONAL_{it} + \beta_5 \cdot SOCIAL_{it} + \beta_6 \cdot SELFRULE_{it} + \varepsilon_{it} \quad [4]$$

Sub-index *i* indicates country (*i*=1 to 21), and sub-index *t* indicates the year (*t*=1 to 3). Five exogenous variables are included. Definitions of variables, data sources and expected signs are the following:

- The endogenous variable *IR* is defined as *1-β*. Its values are reported in Table 5.

- *DISPARITY* is the standard deviation of the ratio $\frac{PR_i}{PR_N}$. For each five-year period we compute the average of the available data. Our hypothesis is that inter-regional redistribution tends to be more difficult from a political standpoint when inequality is higher. Individuals from richer regions face significant incentives to limit the extent of redistribution, and inter-regional redistribution becomes a core issue in public debate, especially but not limited to decentralized countries (Lago-Peñas, 2008; Beramendi, 2012).

- *PERSONAL* is the sum of direct taxes and grants to households over national GDP. This variable proxies the extent of personal redistribution in each country. In preliminary estimates we include both variables (taxes and grants) separately. However, multi-collinearity was strong. For each five-year period we compute the average of the available data. The expected sign is positive. The dimension of inter-regional flows depends on the national size of both grants and taxes. The data source for this variable is the Eurostat Database-Regional statistics

classified by NUTS (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database).

- *SOCIAL* is the collection of social security payments over national GDP. This variable also tries to capture the scope of personal redistribution in each country, but in this case the correlation with *PERSONAL* (and with both taxes and grants) was not troublesome because of the cross-national diversity in social security arrangements. For each five-year period we compute the average of available data. The expected sign is positive. The data source for this variable is again the Eurostat Database-Regional statistics classified by NUTS.

- *SELFRULE* is one of the global political, institutional and fiscal decentralization indexes compiled by Hooghe, Marks, and Schakel (2008). For each five-year period we compute the average of the available data. This variable measures the authority exercised by a regional government over those who live in the region, and it is calculated by adding four partial indexes: Fiscal autonomy (the extent to which a regional government can tax its population in an independent way); Policy scope (the range of policies for which a regional government is responsible); the extent to which a regional government is autonomous rather than de-concentrated; and the extent to which a region is endowed with independent legislative and executive powers. In all cases, variables are ordinal and with several categories. Our hypothesis is that inter-regional redistribution is stronger in centralized countries. While in centralized countries individual redistribution by means of taxes and grants are country-wide, in decentralized countries fiscal frontiers may be relevant (Beramendi, 2012). Decentralization of tax and grant programs without full fiscal equalization tends to reduce inter-regional flows. Besides, subnational political actors tend to be stronger in decentralized countries. Regional and nationalist parties in richer regions are prone to limit inter-regional redistribution. As stated by Hicken, Kollman, and Simmons (2010), when political competition at national level occurs between parties that represent specific sub-national constituencies, then the outcomes of policy debates and conflicts can lead to an oversupply of pork-barrel policies and an undersupply of nationally-focused public services.

A few other variables were also included in preliminary estimates, but their

statistical significance was very low and hence they were excluded. In particular, we checked national *per capita* GDP[6], the number of regions[7], and the percentage of objective 1-regions over total regions in each country (Espasa, 2001). Finally, Table 8 reports basic descriptive statistics for all regressors.

[Table 7 near here]

[Table 8 near here]

The econometric results are summarised in Table 9. Because lagged values of the endogenous variables are used, we only have two cross-sections for all estimates. Missing values in Table 5 explain the number of observations in columns 1 to 3 (39 instead of 21*2=42). In column 1, a benchmark specification without exogenous variables is estimated by Ordinary Least Squares (OLS). The coefficient on the lagged endogenous is very high (0.909), the goodness of fit is high, and the linear correlation between errors, with t=3 and t=2, is quite low. The remaining regressors are included in column 2. The goodness of fit increases up to R^2=0.86.

The sign of the coefficients on *PERSONAL* and *SELFRULE* are as expected. On the contrary, *DISPARITY* and *SOCIAL* are barely significant. In order to control for influential observations (see the boxplot of variable *IR* in Figure 2), in column 3 the specification is re-estimated performing a robust regression using iteratively reweighted least squares (IRWLS)[8]. The results are basically the same: the statistical significance of *SELFRULE* increases and the coefficient on the lagged endogenous variable drops.

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[6] So we test the correlation between economic growth and inter-regional redistribution efforts made by governments (Kuznets, 1995)

[7] Disparity in *per capita* household income can differ depending on the level of aggregation. The number of NUTS2 regions and the average size widely differs between countries.

[8] The method begins by fitting the regression, calculating Cook's D and excluding any observation for which D > 1. Thereafter the method works iteratively: it performs a regression, calculates case weights from absolute residuals, and regresses again using those weights. Iterations stop when the maximum change in weights drops below tolerance. This method was implemented using the STATA command *rreg*. The software used was STATA 12.1. See Li (1985).

[Table 9 near here]

[Figure 2 near here]

Regarding the variable *DISPARITY*, we analyse its distribution in-depth. Figure 3 reveals the existence of four outliers (data for Romania and Slovakia), and Figure 4 shows that those observations are very influential on the relationship between *IR* and *DISPARITY*. In fact, the linear correlation coefficient increases from -0.19 to -0.62 when the four observations are excluded. Columns 4 and 5 of Table 9, replicate the estimates in columns 2 and 3 excluding those observations. *DISPARITY* is significant and its coefficient shows the expected sign. Concerning the variable *SOCIAL*, the results are explained by the fact that the relevance of social contributions in tax systems is very different across countries, without a clear pattern related to inter-regional redistribution. For instance, for the five top countries in terms of inter-regional redistribution in Table 5, the comparative size of *SOCIAL* is small for Denmark and Romania, big for the Netherlands and Austria, and medium for Sweden.

[Figure 3 near here]

[Figure 4 near here]

Summarizing, inter-regional redistribution is positively related with the amount of individual direct taxes and government grants, and negatively related with the degree of decentralization and the size of inter-regional divergence in primary income. Inter-regional fiscal flows tend to be stronger in centralized countries with strong welfare states and moderate regional divergences in economic development.

4. BEING A RICH REGION IN A POOR COUNTRY: SOME ESTIMATES

In order to analyse the effect of borders in redistribution, the first step is to standardize variables by the European Union averages instead of using national averages. A second step is to estimate specification [1] using this new statistical definition of variables. Results are shown in Figure 5 and Table 10.

Not surprisingly, the estimated redistributive effect $(1-\hat{\beta})$ is much lower than in Table 4 (0.300 *versus* 0.068). Insofar as inter-regional redistribution is basically a national matter, cross-border divergences are not levelled. Regions with the same *per capita* primary income are subject to significantly different fiscal flows.

To quantify the redistributive effort or reward (negative effort) of each region, the following index is defined and computed as $Effort_i = \frac{\frac{DI_i}{DI_{EU}} - \frac{PI_i}{PI_{EU}}}{\frac{PI_i}{PI_{EU}}}$. A positive value means that the region benefits from inter-regional redistribution, and the other way around. By construction, the size of the benefit or cost is defined with respect to the level of primary income of each region.

Figure 6 captures the relationship between *Effort* and the ratio $\frac{PI_i}{PI_{EU}}$. As expected, there is a negative and significant relationship (r = -0.67). Negative primes tend to be concentrated in the right part of the figure. However, some regions exhibit negative primes in spite of the relative low level of primary income. The cases of capital cities Bucharest and Bratislava, with primary income 60% below the EU average, are the most notable. Secondly, there is a wide variation in primes for regions with similar *per capita* primary income. For each 20-point interval, the extreme cases are reported. Differences in the value for prime exceed 0.3 in some cases and it is around 0.2 in most intervals. Thirdly, regions with very different *IP* record the same value for *Effort*. Some striking comparisons are Bremen in Germany (*IP*>160) with Jugozapaden in Bulgaria (*IP*<20); Lisbon in Portugal with Surrey, East and West Sussex in UK; and Catalonia in Spain with Hamburg in Germany.

5. CONCLUSIONS

According to our results, inter-regional redistribution is significantly different across-countries and it also varies over time. However, between-variation is three times higher than within-variation over the period 1995-2009. For instance, redistribution in Denmark is four times stronger than in Italy or Greece. Definitely there is not something like a "European style" concerning this issue.

Concerning the drivers of differences in redistribution between countries and over time, our estimates show that these effects change slowly. Hence the main driver of the redistribution effect for a given country in period *t* is the effect in *t-1*. All in all, we show that inter-regional redistribution tends to be lower in countries with wider inter-regional disparities and with higher levels of both political and fiscal decentralization. On the contrary, and as expected, redistribution is positively related to strong personal taxes and personal grants programs, insofar as the main actor implementing those policies is the central government.

We also found that the number of regions, the percentage of objective 1-regions over total regions in each country national *per capita* GDP, and the weight of social security payments on GDP are not relevant variables. While there is no clear relationship between national *per capita* GDP and inter-regional redistribution (Table 5), results also reflect that the relevance of social contributions as an instrument to finance Welfare State programs is quite different across-countries, and not as determinant for convergence in disposable income as personal taxes and social benefits in cash.

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Table 1: List of countries and periods analysed

Country code	Country name	Number of regions (NUTS2)	Period
1	Belgium	13	1995-2009
2	Bulgaria	8	2000-2009
3	Czech Rep.	8	1995-2009
4	Denmark	5	2000-2009
5	Germany	45	1995-2009
6	Ireland	2	1995-2009
7	Greece	16	1995-2009
8	Spain	19	1995-2009
9	France	24	1995-2009
10	Italy	21	1995-2006
11	Hungary	9	2000-2009
12	Netherlands	12	1995-2009
13	Austria	9	1995-2009
14	Poland	16	1995-2009
15	Portugal	7	1995-2009
16	Romania	8	1995-2009
17	Slovenia	2	1999-2009
18	Slovakia	4	1995-2009
19	Finland	5	1995-2009
20	Sweden	8	1995-2009
21	U. Kingdom	36	1995-2009

Table 2: Descriptive statistics for cross-country averages (1995-2009)

Mean $\frac{DI_i}{DI_N}$	Mean $\frac{PI_i}{PI_N}$	S.D. $\frac{DI_i}{DI_N}$	S.D. $\frac{PI_i}{PI_N}$	Min $\frac{DI_i}{DI_N}$	Min $\frac{PI_i}{PI_N}$	Max $\frac{DI_i}{DI_N}$	Max $\frac{PI_i}{PI_N}$
97.8	96.6	12.8	17.8	60.7	56.0	148.6	183.9

Table 3: The Gini index for $\frac{DI_i}{DI_N}$ and $\frac{PI_i}{PI_N}$. Averages for the whole period 1995-2009

Country	$\frac{DR_i}{DR_N}$ (1)	$\frac{PR_i}{PR_N}$ (2)	(1)-(2)
Belgium	0.054	0.079	-0.025
Bulgaria	0.070	0.100	-0.030
Czech Rep.	0.053	0.065	-0.012
Denmark	0.015	0.042	-0.027
Germany	0.058	0.090	-0.032
Ireland	0.038	0.058	-0.020
Greece	0.057	0.067	-0.010
Spain	0.085	0.105	-0.020
France	0.045	0.063	-0.018
Italy	0.116	0.138	-0.022
Hungary	0.085	0.124	-0.039
Netherlands	0.032	0.053	-0.021
Austria	0.025	0.040	-0.015
Poland	0.071	0.092	-0.021
Portugal	0.069	0.095	-0.026
Romania	0.096	0.151	-0.055
Slovenia	0.037	0.052	-0.015
Slovakia	0.106	0.162	-0.056
Finland	0.062	0.091	-0.029
Sweden	0.032	0.059	-0.027
U Kingdom	0.062	0.096	-0.034
Overall	**0.071**	**0.099**	**-0.028**

Table 4: Econometric estimates of specification [1]

Period	1995-2009	1995-1999	2000-2004	2005-2009
Intercept	30.2* (29.69)	28.8* (16.26)	29.8* (21.50)	31.0* (20.63)
$\frac{PI_i}{PI_N}$	0.700* (67.59)	0.714* (38.43)	0.703* (48.65)	0.692* (43.95)
$1-\hat{\beta}$	0.300	0.286	0.297	0.308
R^2	0.943	0.928	0.942	0.948
Observations	277	251	277	277

Notes: *Indicates statistical significance at 1%. Estimated by OLS, with robust t-statistics in parenthesis.

Table 5: Estimated inter-regional redistribution effects ($1-\beta$) from Specification [2].

Country	1995-2009	1995-1999	2000-2004	2005-2009
Denmark	0.632	NA	0.593	0.674
Sweden	0.430	0.418	0.432	0.440
Netherlands	0.421	0.447	0.438	0.395
Romania	0.402	0.462	0.363	0.373
Austria	0.394	0.309	0.398	0.489
Germany	0.382	0.363	0.411	0.368
Slovakia	0.367	0.425	0.355	0.331
United Kingdom	0.353	0.331	0.348	0.372
Ireland	0.334	0.318	0.335	0.347
Portugal	0.318	0.324	0.317	0.308
Belgium	0.309	0.324	0.297	0.307
Cross-country average	**0.300**	**0.286**	**0.297**	**0.308**
France	0.302	0.319	0.292	0.295
Bulgaria	0.298	NA	0.359	0.252
Finland	0.298	0.287	0.234	0.380
Hungary	0.283	NA	0.271	0.296
Slovenia	0.280	0.212	0.274	0.310
Poland	0.262	0.245	0.253	0.288
Spain	0.205	0.229	0.211	0.155
Czech republic	0.190	0.126	0.203	0.222
Greece	0.155	0.187	0.160	0.154
Italy	0.147	0.134	0.153	0.170

Notes: Original estimates were computed using OLS with robust errors.

Table 6: Studies on inter-regional redistribution. Main results

Author	Period	Number of countries/regions	Method	Coefficient	Country Ranking
MacDougall (1977)	1969, 1970 1973 1964 1970, 1973	France Italy UK Germany	Primary income/ Disposable income	Gini	France (54%) Italy (47%) UK (36%) Germany (29%)
Obstfeld and Peri (1998)	1969-1985 1971-1995 1979-1993	Italy (10 regions)	Primary income/ Disposable income	1-β	8%
Davezies, Nicot and Prud'homme (1998)	1993	7 countries (UK. Spain, Italy, Sweden, Germany, Portugal and France)	Fiscal Balance	Gini	UK (43%) Spain (36%) Italy (23%) Sweden (20%) Germany (20%) Portugal (13%) France (8%)
Duboz and Nicot (1998)	1984-1995	Germany (11-16 Länder)	Primary income/ Disposable income	1-β	40%
Lago-Peñas (2001)	1967-1975 1977-1985 1987-1993	Spain (17 regions)	Primary income/ Disposable income	1-β	10% 22% 27%
Melitz and Zumer (2002)	1982-1993	2 countries (France, UK)	Primary income/ Disposable income	1-β	France (38%) UK (26%)
Decressin (2002)	1983-1992	Italy (20 regions)	Primary income/ Disposable income	1-β	21%
Capó and Oliver (2002)	1967-1997 1967-1977 1979-1997 1967-1997 1967-1977 1979-1997	Spain (17 regions) Spain (50 provinces)	Primary income/ Disposable income Primary income/ Disposable income	1-β 1-β	25% 22% 27% 27% 23% 29%
Capó (2008)	1995-2002 1995-2002	Spain (17 regions) Spain (50 provinces)	Primary income/ Disposable income	1-β	24% 24%

Lago-Peñas, Prada and Vaquero (2013)	1995-2009	21 UE countries, 277 regions	Primary income/ Disposable income	1-β	Sweden (43%) Germany (38%) UK (35%) Portugal (32%) France (30%) Spain (21%) Italy (15%)
Lago-Peñas, Prada and Vaquero (2013)	1995-2009	21 UE countries, 277 regions	Primary income/ Disposable income	Gini (1)	Sweden (46%) Germany (36%) UK (35%) Portugal (27%) France (29%) Spain (19%) Italy (16%)

Source: Authors own calculation.

Table 7: Main statistics of the redistribution effect reported in columns 2 to 4 of Table 4

	Mean	Standard deviation	Min	Max
Overall	0.318	0.107	0.126	0.674
Between		0.108	0.152	0.633
Within		0.034	0.228	0.408

Table 8: Main statistics of exogenous variables in specification [4]. Stacked data.

	Mean	Standard deviation	Min	Max
DISPARITY	18.9	10.1	5.43	55.3
PERSONAL	25.3	7.71	12.7	45.8
SOCIAL	15.1	4.00	7.90	25.4
SELFRULE	3.50	3.01	0.00	9.60

Table 9: Econometric estimates of specification [3]

	(1)	(2)	(3)	(4)	(5)
Intercept	0.034 (1.29)	-0.034 (0.65)	-0.047 (0.90)	0.086 (1.23)	0.114* (1.80)
IR-1	0.909*** (11.13)	0.797*** (10.40)	0.736*** (9.74)	0.725*** (8.30)	0.630*** (7.94)
DISPARITY		-0.0002 (0.21)	0.0003 (0.38)	-0.0047** (2.42)	-0.0053*** (3.01)
PERSONAL		0.0053*** (3.52)	0.0069*** (4.61)	0.0049*** (3.21)	0.0061*** (4.39)
SOCIAL		-0.00005 (0.03)	-0.0004 (0.20)	-00.14 (0.68)	-00.19 (1.03)
SELFRULE		-0.0069** (2.37)	-0.0097*** (3.39)	-0.0056* (2.00)	-0.0079*** (3.06)
R^2	0.770	0.858		0.890	
Observations	39	39	39	35	35
Method	OLS	OLS	IRWLS	OLS	IRWLS

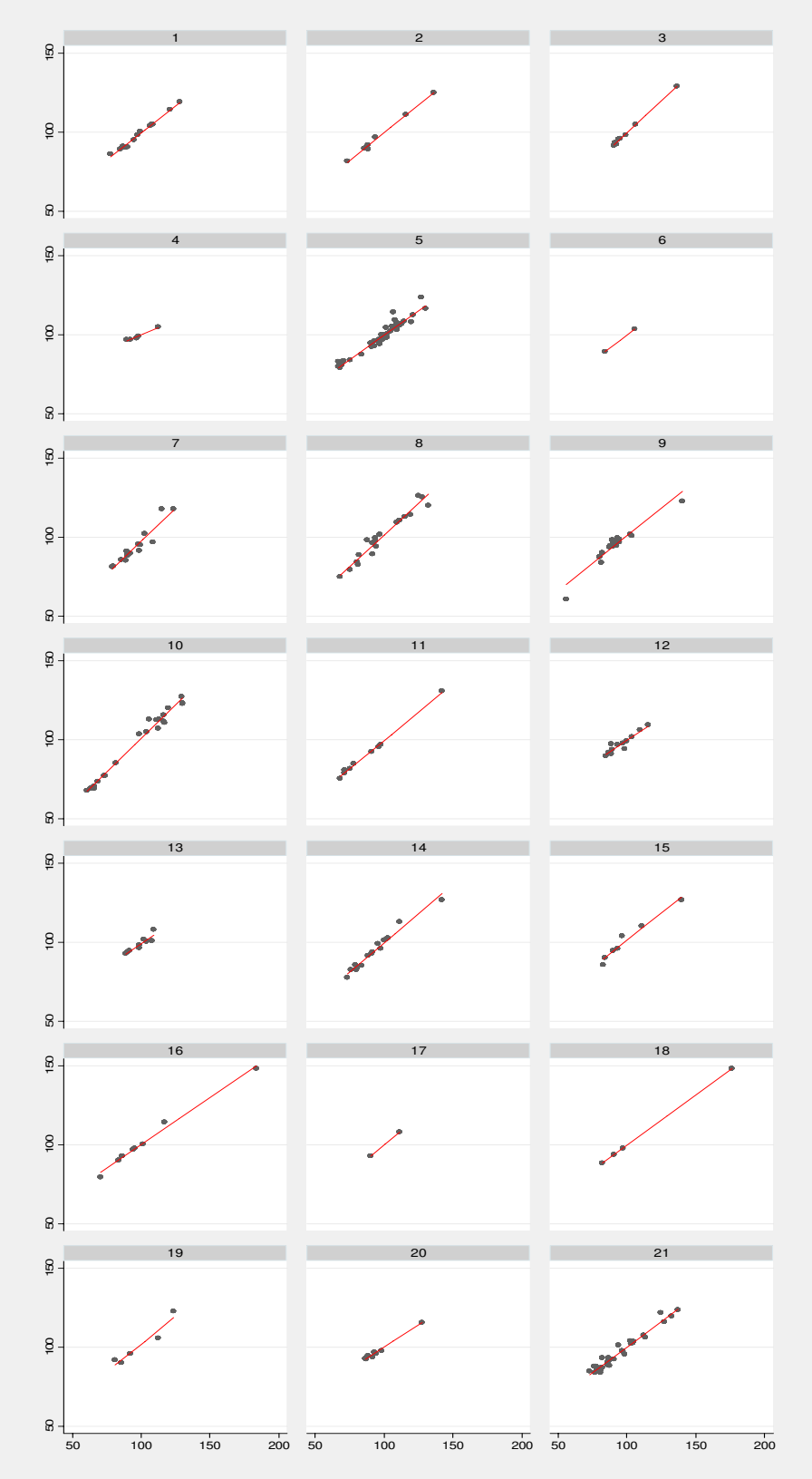
Notes: ***. **, * Indicates statistical significance at 1%, 5%, and 10% respectively. t-statistics are shown in parenthesis.

Table 10: Econometric estimates of specification [1]

Period	1995-2009
Intercept	10.6* (9.64)
$\frac{PI_i}{PI_N}$	0.932* (86.42)
$1-\hat{\beta}$	0.068
R^2	0.961
Observations	277

Notes: Variables standardized by using EU averages. *Indicates statistical significance at 1%. Estimated by OLS, with robust t-statistics in parenthesis.

Figure 1: Relationship between $\frac{DI_i}{DI_N}$ and $\frac{PI_i}{PI_N}$ by countries. Average values for the whole period 1995-2009.



Notes: Country codes in Table 1. *DI* in the vertical axis, and *PI* in the horizontal axis

Figure 2: Boxplot for variable *IR*

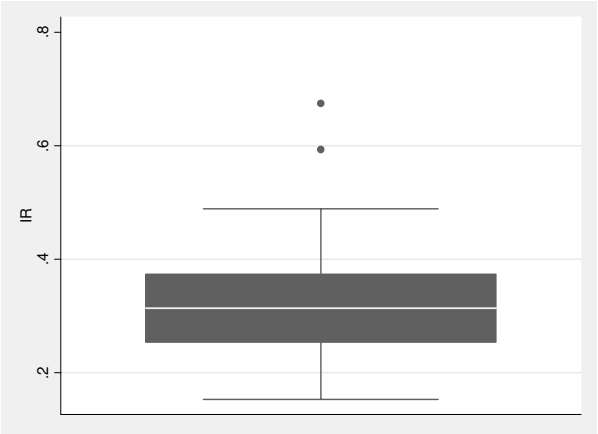


Figure 3: Boxplot for variable *DISPARITY*

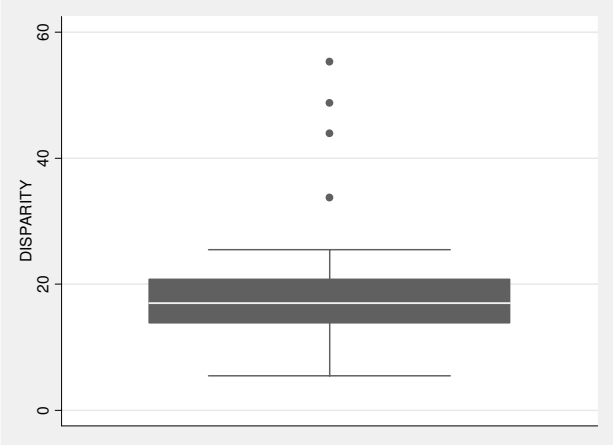


Figure 4: Relationship between *IR* and *DISPARITY*

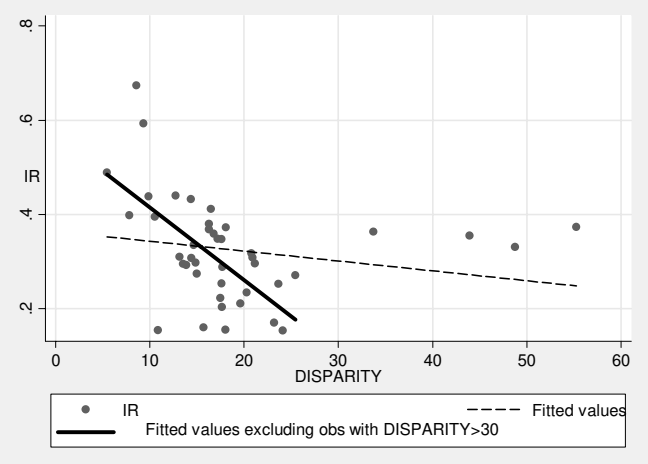


Figure 5: Relationship between DI and PI. Data standardized by the EU average.

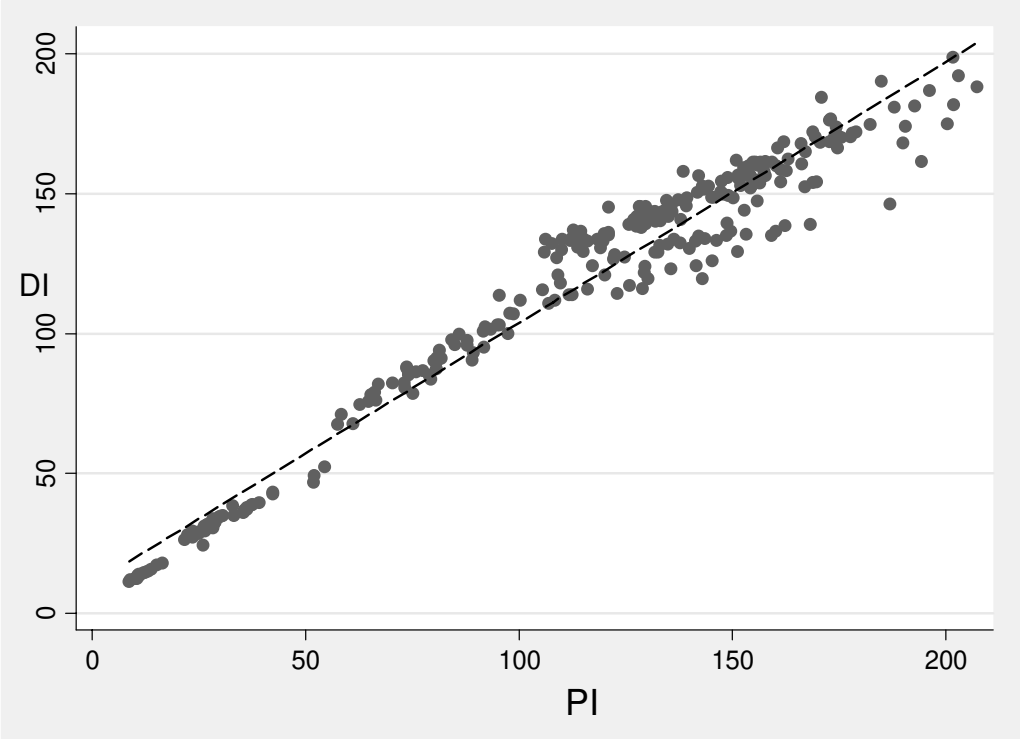


Figure 6: Relationship between *Effort* and *PI*