The redistributive effects of tax benefit systems in the enlarged EU

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Abstract

From a policy perspective, it is important to know to what extent differences in disposable income inequality levels are driven by different gross income distributions and to what extent by different redistributive policies. In this paper, we evaluate the redistributive effects of different tax benefit instruments in the enlarged EU based on two approaches. Inequality analysis based on the Gini accounting approach suggests that benefits are the most important factor in reducing inequality. According to the factor soure decomposition approach, only taxes and contributions seem to redistribute effectively. Benefits reveal to address other issues than income distribution. Finally, our cluster analysis shows that the new EU member states do not form a distinguished group from the traditional Western European welfare states. Instead, the Central Eastern European countries group together with the Continental European countries, the Baltic states show similarities with the Southern European countries.

JEL Codes: D31, D60, H20

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1 Introduction

The European Union (EU) can be seen as a rather prosperous and homogeneous group of countries - at least from a global perspective. One of the main targets of the EU is the enhancement of economic and social cohesion (see Article 2 of the Treaty on European Union). Therefore, convergence of the EU regions - in terms of growth, employment, sustainable development and social coherence - is a fundamental element of EU policies. Nonetheless there are sizeable differences across member states in the levels of within country income inequality. This is true especially since the enlargements of the EU in 2004 and 2007, when in total 12 additional countries, mostly from Eastern Europe, joined the EU. Inequality is usually measured in terms of disposable income which is affected by the pre-tax income distribution and various redistributive policies. Different sources of inequality need the application of different policy measures to counteract them. Therefore, from a policy perspective, it is important to know to what extent the differences in inequality levels between EU countries are driven by the gross income distribution and to what extent by different welfare state designs. With respect to the recent EU enlargement the question arises where the new member states fit in.

The analysis of income inequality, the design of the welfare state and the size of redistribution has a long tradition in economic and social science literature. Especially regarding the analysis of the development of income inequality across countries and time, there exist almost an infinite number of empirical studies (see Anand and Segal (2008) for a recent overview). In particular since the availability of comparable micro data sets, there has been much progress in cross-national inequality analyses. For instance, Gottschalk and Smeeding (1997) and recently Brandolini and Smeeding (2007) use data from the Luxembourg Income Study (LIS) to compare inequality trends in industrialized countries. Due to data limitations, the development of the size of redistribution across countries and time is not as extensively analysed as inequality. However, Mahler and Jesuit (2006) use LIS data for a detailed discussion of fiscal redistribution in developed countries, as well as the importance of taxes and benefits for redistribution. Similarly for the EU-15 Immervoll et al. (2005) analyse the equalising effects of taxes and benefits using the microsimulation model EUROMOD. Figari et al. (2008) extend this analysis by also including four new Eastern European member states.

The aim of this paper is to analyze the impact of different tax and transfer

instruments on income inequality. Specifically, we ask whether this role differs across countries and especially where the new member states fit in. We use EU-SILC (Statistics on Income and Living Conditions) micro data of 2007 to evaluate the design of the tax and transfer system in a comparable manner in the EU member states. In the first step, we compare the structure and the redistributive impact of the tax benefit systems across EU countries using a counterfactual approach based on Gini coefficients. In the second step, we apply the factor source decomposition approach as suggested by Shorrocks (1982, 1983) to analyse the impact of different disposable income components. As total disposable income can be exhaustively decomposed into different pre-tax income sources as well as taxes, social insurance contributions and benefits, it is possible to calculate the contribution (equalising or disequalising effect) of each factor to overall inequality in the status quo. This allows us to compare the contributions of different components to overall inequality across countries and to cluster countries with respect to their design of the welfare state and the importance of the pre-tax distribution. Particularly, we can identify the positions of the (Eastern European) new member states in the European inequality ordering.

Our results suggest that tax and transfer systems substantially reduce income inequality in all European countries. But our two approaches generate very different, partly contradictory results. Inequality analysis based on the Gini counterfactual approach suggests that benefits are the most important factor reducing inequality. The factor source decomposition approach, however, suggests that benefits play a negligible role and sometimes slightly increase inequality in the status quo. With regard to the country clustering we find that the Eastern European countries to not build a distinguished group as it has been suggested by, e.g., Fenger (2007). The Central Eastern European countries group together with the Continental European countries and the Baltic states show similarities with the Southern European countries.

The setup of the paper is organised as follows: Section 2 describes the data set and Section 3 characterises different European tax systems. Section 4 shows illustrative descriptive results about pre-tax and post-tax income inequality in the different countries using the standard Gini approach. In Section 5 we describe the methodology of factor source inequality decomposition and present the decomposition results. Section 6 reports the results of our hierarchical cluster analysis. Section 7 concludes by summarizing the main results and discussing their implications.

2 Data

The EU-SILC (European Union Statistics on Income and Living Conditions) micro data set provides harmonised cross-sectional and longitudinal multidimensional micro data on income and social exclusion in European countries. Since 2005, the dataset covers the EU-25 member states, plus Norway and Iceland, and it is the largest comparative survey of European income and living conditions. Our analysis is based on the 2007 EU-SILC wave which is the first wave with gross income information for all 27 countries.

To analyse the influence of the different sources of income on inequality, we decompose total household disposable income exhaustively into its different components: original income (earnings, income from self-employment and capital incomes), income taxes, social security contributions (employer and employee) and social transfers. Note that our concept of market or gross income includes social insurance contributions paid by the employer as they can be very different across countries. Transfers can be further decomposed by function into unemployment benefits, old-age benefits (public pensions), survivor' benefits, sickness benefits, disability benefits, education-related allowances, family/children related allowances, benefits for social exclusion not elsewhere classified and housing allowances.

In order to make incomes comparable across countries, we adjust national income amounts by the multilateral current purchasing power parities provided by Eurostat. Throughout the analysis, we use equivalised incomes to compensate for different household structures and possible economies of scales within households.[1]

3 Welfare state designs in Europe

3.1 Income tax systems

The existing income tax systems in the 26 European countries under consideration offer considerable variety. As Table 1 shows, all Western European countries except Iceland have graduated rate schedules with a number of brackets ranging from 2

[1] For each person, the equivalised (per-capita) total net income is its household total net income divided by the equivalised household size according to the modified OECD scale, which assigns a weight of 1.0 to the head of household, 0.5 to every household member aged 14 or more and 0.3 to each child aged less than 14. Summing up the individual weights gives the household specific equivalence factor.

(Ireland) to 16 (Luxembourg), with the top marginal income tax rate ranging from 38% (Luxembourg) to 59% in Denmark. Iceland is the only Western European country which has recently introduced a flat tax rate of 36% combined with a basic allowance of 7.860 Euro.

There are also considerable differences across the Eastern European countries. Half of these countries have adopted a flat tax system, with a single tax rate and a basic allowance. The flat tax rates vary from 15% (2008 in Czech Republic) to 27% in Lithuania. The basic allowances range from the very small amount of only 72 Euro in Latvia to 2.600 Euro in the Slovak Republic. Other Eastern European countries also apply graduated tax schedules, but with a comparatively small number of brackets (2-3) and relatively low top marginal rates. Interestingly, Slovenia and Poland have very similar income tax schedules as the Western European countries, with highest rates around 40%, but with a lower amount belonging to the 0% bracket.

	No of brackets	Lowest (pos) rate	Highest rate	Form of main tax relief
AT	4	38.3%	50.0%	0% bracket (10,000 EUR)
BE	5	25.0%	50.0%	tax allowance (6,040 EUR)
CY	3	20.0%	30.0%	0% bracket (19,500 EUR)
CZ	4	12.0%	32.0%	tax credit
DE	formula	15,8%	44,3%	0% bracket (7,664 EUR)
DK	3	state 5.48%,	state 15%,	tax allowance
		local 24.6%	local 24.6%	+ municipality tax
EE	flat tax	22.0%	22.0%	basic allowance 1,304 EUR
ES	4	24.0%	43.0%	tax allowance (5,151 EUR)
FI	4	state 8.5%,	state 31.5%,	0% bracket (12,600 EUR), state
		local 16%	local 21%	tax allowance, local
FR	4	5.5%	40.0%	0% bracket (5,614 EUR)
GR	3	15.0%	40.0%	0% bracket (12,000 EUR)
HU	2	18.0%	36.0%	tax credit
IE	2	20.0%	41.0%	tax allowance
IS	flat tax	36.0%	36.0%	basic allowance (7860 EUR)
IT	5	23.0%	43.0%	tax credit
LT	flat tax	27.0%	27.0%	basic allowance 1,304 EUR
LU	16	8.0%	38.0%	0% bracket (10,335 EUR)
LV	flat tax	25.0%	25.0%	basic allowance 72 EUR
NL	4	33,6%	52.0%	tax credit
NO	3	state 13.5%,	state 19.5%	0% bracket (state)
		local 28%	local 28%	
PL	3	19.0%	40.0%	0% bracket (3,091 EUR)
PT	6	10.5%	40.0%	tax credit
SE	2	state 20%,	state 25%,	tax allowance
		local 31,6%	local 31,6%	
SI	3	16.0%	41.0%	tax allowance (2,800 EUR)
SK	flat tax	19.0%	19.0%	basic allowance 2,600 EUR
UK	3	10.0%	40.0%	tax allowance (5,225 EUR)

Table 1: Income tax systems, 2007

3.2 Tax benefit systems

European countries do not only differ in their income tax schedules but also differ in the design of their system of social protection and redistribution. In each country, direct and indirect taxes as well as social insurance contributions (SIC) are used to finance the welfare state (see Table 2 for an overview). The weight in the tax mix of these components depends on the structural design of the tax benefit system in each country. For the Continental countries it is evident that the SIC are more important to finance the welfare state than the direct taxes. This is also true for Eastern Europe. Only in the Baltic states Lativa and Lithuania the SIC play only a minor role, similar as in the Nordic countries. Denmark relies almost exclusively on taxes for financing the welfare state. In Southern European countries, indirect taxes tend to play the most important role. This is even more true for Eastern Europe and the Baltic states. The level of social protection (in terms of expenditures as % of GDP) is high in Nordic and Continental countries (exceptions are Norway and Luxembourg) and particularly low in the Eastern Europe and Baltic states (exception Slovenia) as well as Ireland. A perhaps trivial but still interesting observation from Table 2 is that the level of social expenditures is correlated with the level of taxes and contributions. Figure 1 plots these expenditures against the sum of all taxes and contributions and reveals an increasing trend (i.e. a positive correlation as the linear fit predicts), as expected. Still, there are some interesting observations from the Figure. First, the countries can almost perfectly be grouped according to their geographic grouping (see the circles). Then the spending in social protection of those countries placed above the linear fit is higher than the average expected level of social expenditure relative to total revenues. For the countries situated below the line, rather the opposite is true. It reveals that Continental countries have relatively high social expenditures compared to their tax revenues. The Southern countries have a middle level of tax revenues (35-40%) but comparatively high social expenditure levels (20-25%). This again supports the importance of indirect taxes in this group of countries. Nordic countries, on the other hand, have the highest tax revenues per GDP, but a comparatively lower part is spent on social protection than in the Continental countries. The Baltic (flat tax) countries emerge as the group of countries with very low tax revenues and their expenditure on social protection is clearly below the average expected level. The Eastern Europe countries reveal somewhat higher tax revenues and social expenditures. The two Anglo-Saxon countries, Ireland and the

UK, situate between the Southern and Eastern Europe countries.

	Total Taxes	Indirect Taxes	Direct Taxes	Social Contr.	Social Expen.
AT	42.0	14.7	12.9	14.5	28.8
BE	45.5	13.9	17.8	13.9	29.7
CY	35.6	17.1	10.2	8.3	18.2
CZ	36.3	11.9	9.3	15.1	19.1
DE	38.8	12.1	10.3	16.3	29.4
DK	50.3	17.9	31.4	1.1	30.1
EE	30.9	13.5	7.1	10.4	12.5
ES	35.6	12.5	11.4	12.2	20.8
FI	43.9	14.1	17.9	12.0	26.7
FR	44.0	15.8	11.9	16.4	31.5
GR	34.4	12.9	9.5	12.1	24.2
HU	38.5	15.8	9.1	13.6	21.9
IE	30.8	13.6	12.4	4.8	18.2
IS	.	.	.	.	.
IT	40.6	14.5	13.5	12.6	26.4
LT	28.9	11.5	9.1	8.2	13.2
LU	38.2	13.4	14.1	10.7	21.9
LV	29.4	12.9	8.0	8.5	12.4
NL	38.2	13.1	11.9	13.1	28.2
NO	44.3	12.5	22.9	9.1	23.9
PL	34.2	13.9	7.0	13.7	19.6
PT	35.3	15.3	8.6*	11.3	24.7*
SE	51.3	17.3	20.1	13.8	32.0
SI	40.5	16.4	9.3	14.8	23.4
SK	29.3	13.0	6.1	10.8	16.9
UK	37.0	13.3	16.8	6.9	26.8

Table 2: Tax benefit mix (as % of GDP) in 2005
Notes: * Numbers for Portugal are from 2004

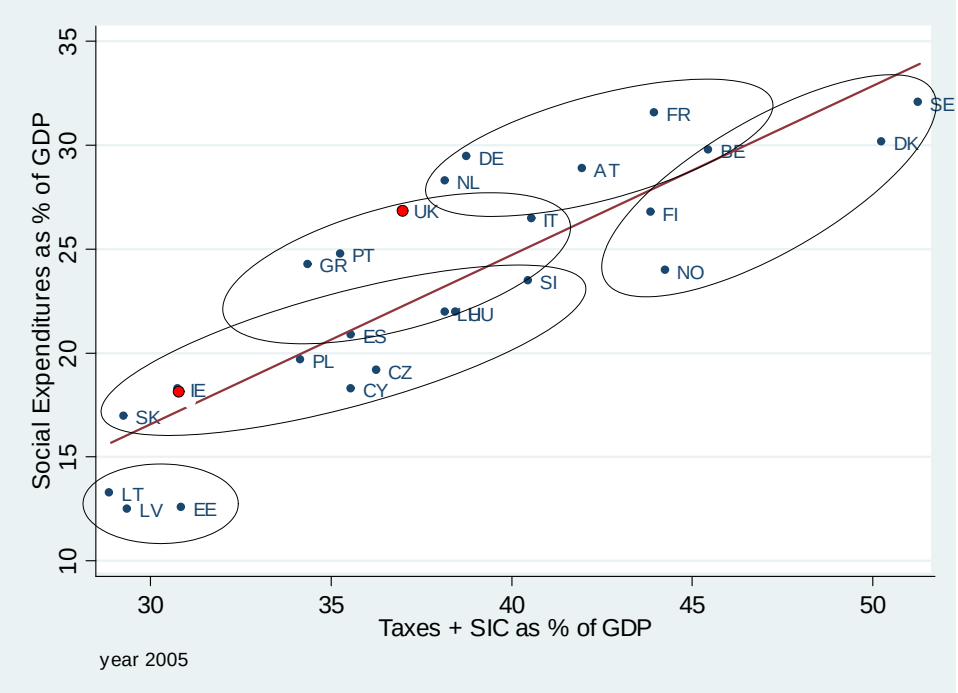


Figure 1: Correlation between social expenditures and government revenue

4 Income distribution and redistribution

To find further similarities or differences between European countries or groups of countries we compute a number of distributional measures. Table 3 presents the Gini coefficients for equivalised market and disposable incomes. Looking at the inequality of market incomes first, huge disparities among the European countries emerge, with Gini coefficients ranging from 0.38 in Iceland to 0.54 in Portugal. Market inequality is comparatively high in the Anglo-Saxon countries and the Baltic states, as well as in Germany, Greece, Portugal and Hungary (>0.50). Rather low inequality levels can be found in the Nordic countries and Cyprus. Within the group of Eastern European countries there are substantial differences. The group encompasses countries with very high market inequality such as Hungary and Poland but also countries with comparatively low market inequality such as the Slovak Repuplic (0.43) and Slovenia (0.44). Table 3 also reports the Gini coefficients of market income including pensions. The difference between the Gini coefficients of market income and the ones of market income plus pensions demonstrates the different strength of the redistributive character of pensions across European countries. It emerges, that

pensions have huge redistributive power in Germany and Austria, who now achieve a higher rank regarding the equality of incomes. On the other hand the inclusion of pensions leads to a lower ranking of the Nordic countries and Ireland, showing the lower redistributive importance of pensions in those countries.

Looking at the inequality of disposable income (DPI), first of all, it should be noted, that post-government inequality is significantly lower than the pre-government inequality, indicating a substantial degree of redistribution in all countries. Although there are significant differences in the size of redistribution, the overall inequality ranking of the countries basically remains the same. A closer look at the differences in the size of redistribution is useful and is also illustrated in Table **??**. Redistribution - here measured as the percentage change between the Gini coefficient of market income and disposable income - is particularly high in the Nordic countries (except Norway and Iceland) and the Continental countries (>40%) and rather low in Cyprus and Iceland, as well as in the Baltic States (around 30%). Looking at the Eastern European countries, again there are substantial differences in the size of redistribution. The redistributive effect is rather high in Hungary, Slovenia, the Slovak and the Czech Republic (around 45%) and rather low in the other Eastern European countries (around 35%).

After having measured the redistributive effect of the tax benefit system as a whole, we now look at the redistributive impact of each single tax benefit instrument. Obviously, when measuring the redistributive effect of single tax benefit instruments, the results are sensitive to the assumed sequence of instruments, since, for example, some benefits are also taxable. To avoid these problems we follow Immervoll et al. (2005) and start from the hypothetical situation without the instrument in question (DPI - instrument) and ask by how much inequality is reduced by introducing it. Table 3 illustrates the results of the redistributive effects of different tax benefit instruments for 26 European countries. Table 6 in the Appendix also illustrates the economic weights of the different tax benefit instruments. From Table 3 it becomes obvious, that the exclusion of any policy instrument in all countries results in an increase in inequality, as represented by larger Gini coefficients (only the exclusion of social contributions in Portugal increases inequality - however, according to Eurostat this is due to data problems). It also emerges, that in almost all countries, public pensions entail a larger redistributive effect than the sum of other social benefits. The only exceptions are Denmark and Hungary. On the other hand, the exclusion of social benefits results in a larger increase in Gini coefficients than

the elimination of income taxes and social contributions in almost all countries. The only exceptions are two of the Baltic states (Lithuania and Estonia) and the southern countries Greece, Italy and Portugal where benefits, taxes and contributions display similar redistributive effects. Regarding the other tax benefit instruments, unemployment benefits reveal a relatively high redistributive effect in Belgium and Denmark and family benefits in Austria, Ireland and Hungary. The benefits for social exclusion only seem to have a significant redistributive impact in the Netherlands. On the other hand, the residual category of benefits, which contains sickness, disability, education-related allowances and survivor benefits, display a substantial effect in all countries, particularly in the Nordic countries such as Denmark and Sweden. The factor shares in Table 6 show that these benefits have also relatively high factor share weights in those countries. Overall, the results reveal, that using this accounting approach of comparing Gini coefficients with and without different tax benefit instruments, public pensions and social benefits are the most important source of inequality reduction. Taxes and social contributions show substantially lower redistributive effects in almost all countries.

	Gini Coefficients			Redistributive Effect (% change in Gini)								
	DPI	Market	Market+ Pensions	all taxes	except pensions	taxes	SIC	benefits	pensions	unempl	family	social	other
EU	0.34	0.53	0.42	35.58	19.47	8.17	7.29	13.57	30.89	3.23	3.35	1.57	5.39
AT	0.26	0.48	0.36	45.94	26.86	12.59	10.04	20.53	44.07	6.41	9.05	0.85	6.49
BE	0.26	0.49	0.39	46.27	33.99	12.39	19.45	25.21	35.15	14.05	6.34	1.43	6.92
CY	0.30	0.39	0.33	23.16	10.44	4.88	1.23	6.17	17.02	-0.80	2.99	0.35	3.51
CZ	0.25	0.47	0.36	45.86	30.58	12.31	15.22	19.05	34.15	1.09	7.11	2.99	9.72
DE	0.30	0.51	0.39	41.68	23.07	8.56	7.55	18.36	37.78	6.81	5.42	2.69	4.59
DK	0.25	0.47	0.39	47.55	36.40	10.71	14.70	38.24	35.76	17.80	3.53	0.00	23.57
EE	0.33	0.48	0.40	30.60	17.29	8.04	8.19	7.76	23.94	0.18	3.70	0.03	3.94
ES	0.31	0.45	0.36	30.43	11.91	6.29	3.38	6.47	27.95	2.62	0.09	0.07	3.73
FI	0.26	0.49	0.39	46.14	33.55	13.55	12.65	29.33	35.45	10.69	7.56	1.83	14.43
FR	0.26	0.49	0.36	46.23	26.97	8.61	14.46	20.50	40.08	4.78	6.80	1.93	8.74
GR	0.34	0.51	0.41	34.59	17.98	9.81	11.53	5.01	30.77	0.97	0.90	0.64	2.56
HU	0.26	0.51	0.40	50.10	35.01	15.85	13.80	25.63	34.12	3.49	14.32	0.27	11.00
IE	0.31	0.52	0.46	39.60	32.52	12.43	7.19	25.50	16.14	6.53	12.83	0.18	8.89
IS	0.28	0.38	0.34	26.90	16.92	8.00	2.56	12.97	18.83	0.64	5.21	0.40	7.14
IT	0.32	0.49	0.37	34.41	13.58	11.18	4.45	3.20	36.75	1.14	1.74	0.16	0.09
LT	0.34	0.50	0.42	31.77	19.93	9.15	9.85	8.13	22.14	0.70	1.80	0.52	5.20
LU	0.27	0.46	0.36	41.06	23.36	11.90	4.59	17.38	34.64	3.01	7.89	2.33	5.93
LV	0.36	0.48	0.41	25.53	13.88	4.57	5.06	7.25	18.79	0.62	3.28	0.28	3.04
NL	0.27	0.47	0.37	43.31	28.68	12.66	15.44	23.34	39.24	3.83	2.68	7.91	11.96
NO	0.24	0.44	0.36	46.15	33.78	11.92	9.95	31.98	32.82	2.01	8.15	1.84	24.00
PL	0.32	0.52	0.39	38.15	17.87	2.98	8.17	15.36	35.54	2.51	4.40	0.77	8.71
PT	0.37	0.54	0.44	31.23	16.84	11.11	-0.27	8.80	24.26	2.87	1.91	0.69	3.59
SE	0.23	0.46	0.36	49.23	34.16	11.71	15.14	33.29	44.34	7.95	8.21	2.12	20.96
SI	0.22	0.44	0.34	48.98	35.45	10.72	21.13	22.30	31.88	1.44	7.45	3.33	12.72
SK	0.24	0.43	0.32	43.58	24.23	7.79	12.99	13.49	35.50	0.46	4.64	2.41	6.90
UK	0.33	0.53	0.44	38.22	25.82	13.07	5.44	17.69	26.22	0.80	5.44	4.13	7.87

Table 3: Redistributive effect of separated tax-benefit instruments

Note: The question here is: starting from the situation without the instrument in question (DPI - instrument) how much inequality is reduced by introducing it?

5 Inequality contribution of tax transfer components

5.1 Decomposition approach

Consider a population of n persons (or households), $i = 1, ...n$, with x_i as the income of individual i, $\overline{x}$ be the average income and a population weight w_i ($N = \sum_{i=1}^{n} w_i$). Following Atkinson (1970) and Kolm (1969), a relative measure of inequality can be derived from a relationship between inequality, mean income and social welfare as:

$$I = 1 - \frac{W(\mathbf{x})}{\overline{x}} \tag{1}$$

where $W(\mathbf{x})$ is the average or mean social welfare function (see Maasoumi (1999)). The Generalized Entropy (GE) class of inequality indices (Shorrocks (1980)) is given by:

$$I_\alpha = \frac{1}{\alpha(\alpha-1)} \int_0^\infty \frac{x_i}{\overline{x}} \left[\left(\frac{x_i}{\overline{x}} \right)^\alpha - 1 \right] dF \tag{2}$$

where F is the CDF of income and α being a parameter indicating the sensitivity towards a particular part of the income distribution.[2] The discretized formula of the GE family used for empirical applications is given by

$$I_\alpha = GE(\alpha) = \begin{cases} \frac{1}{\alpha(\alpha-1)} \left(\sum_{i=1}^{n} \left[\frac{w_i}{N} \left(\frac{x_i}{\overline{x}} \right)^\alpha \right] - 1 \right) & , \alpha \in R - \{0, 1\} \\ \sum_{i=1}^{n} \frac{w_i}{N} \log \frac{\overline{x}}{x_i} & , \alpha = 0 \\ \sum_{i=1}^{n} \frac{w_i}{N} \frac{x_i}{\overline{x}} \log \frac{x_i}{\overline{x}} & , \alpha = 1 \end{cases} \tag{3}$$

$GE(0)$ is also known as the mean log deviation and $GE(1)$ as the Theil index (see Theil (1967)). The GE measures of inequality can be interpreted in an economic way (Dahlby (1987)) using the Harsanyi (1953, 1977) framework which is a particular form of utilitarianism based on the veil of ignorance and equiprobability assumption (expected utility: $EU = \frac{1}{n} \sum U(x_i)$ with U a Neumann-Morgenstern utility function

[2] See, e.g., Cowell and Kuga (1981). The more positive (negative) α is, the more sensitive I_α is to changes at the top (bottom) of the income distribution.

with $U\prime > 0$ and $U"< 0$). Using a constant relative risk aversion (CRRA) utility function it has been shown that

$$I_\alpha = \frac{U(\overline{x}) - EU}{\overline{x}U'(\overline{x})} \frac{1}{1-\alpha} \tag{4}$$

where $\frac{U(\overline{x})-EU}{\overline{x}U'(\overline{x})}$ is an approximation to the relative risk premium divided by the coefficient of relative risk aversion in the Harsanyi framework.

Decomposition by factor source: Total income is usually composed from several sources: labour earnings, capital and business income, private and public transfers, etc. Therefore, it is useful to express total inequality as the sum of these factor's contributions (Shorrocks (1982, 1983)). The exact decomposition procedure depends on the measure of inequality used, but whichever measure is used must naturally be decomposable and, given the large number of income sources, it must be defined for zero incomes. In practice, the easiest measure to decompose in this way is GE(2) which can also be expressed as half the squared coefficient of variation CV :

$$\begin{aligned} GE(2) &= \frac{1}{2}\left(\sum_{i=1}^{n}\left[\frac{w_i}{N}\left(\frac{x_i}{\overline{x}}\right)^2\right] - 1\right) \\ &= \frac{1}{2}(CV)^2 = \frac{1}{2}\left(\frac{\sqrt{Var(x)}}{\overline{x}}\right)^2 = \frac{1}{2}\frac{Var(x)}{\overline{x}^2} \end{aligned} \tag{5}$$

Suppose total income X can be written as the sum of $f = 1, ..., K$ different income sources x_f: $x = \sum_{f=1}^{K} x_f$ and ρ_f is the correlation between x and x_f and $\mu_f = \frac{\overline{x}_f}{\overline{x}}$ is is f's factor share.

$$I_2 = GE(2) = \sum_{f=1}^{K} S_f = \sum_{f=1}^{K} s_f I_2 = \sum_{f=1}^{K} \rho_f \mu_f \sqrt{GE_2 GE_2^f} \tag{6}$$

where GE_2^f denotes the inequality for factor source f and S_f the (absolute) contribution of factor f to total inequality. Note that income source f provides a disequalising effect if $S_f > 0$, and an equalising effect if $S_f < 0$. $s_f = \frac{S_f}{I}$ is the relative contribution of f to total inequality and indicates the importance of f.

	Market	Taxes	SIC	Benefits	Pensions	Unempl	Family	Social	Other
EU	1.462	-0.337	-0.211	-0.001	0.087	0.006	-0.013	0.004	0.008
AT	1.446	-0.351	-0.294	-0.034	0.234	-0.012	-0.017	-0.003	-0.003
BE	1.825	-0.276	-0.517	-0.027	-0.005	-0.005	-0.003	-0.006	-0.013
CY	0.890	-0.114	-0.054	0.070	0.208	0.075	-0.004	-0.001	-0.001
CZ	1.743	-0.344	-0.312	-0.034	-0.054	-0.002	-0.017	-0.010	-0.004
DE	1.364	-0.224	-0.169	-0.021	0.050	-0.011	-0.005	-0.002	-0.003
DK	1.697	-0.489	-0.152	-0.030	-0.026	-0.012	-0.002	-0.000	-0.016
EE	1.543	-0.299	-0.226	0.012	-0.029	0.000	0.014	-0.000	-0.002
ES	1.374	-0.210	-0.202	0.010	0.029	0.000	0.003	0.000	0.006
FI	1.663	-0.423	-0.196	-0.037	-0.006	-0.016	-0.006	-0.004	-0.012
FR	1.599	-0.337	-0.418	0.004	0.152	0.031	-0.012	-0.004	-0.010
GR	1.650	-0.440	-0.332	-0.007	0.129	-0.002	0.000	-0.001	-0.003
HU	1.738	-0.427	-0.368	-0.018	0.075	0.006	-0.024	-0.001	0.001
IE	1.416	-0.290	-0.113	-0.030	0.017	0.006	-0.019	-0.000	-0.017
IS	1.402	-0.295	-0.100	-0.013	0.007	-0.001	-0.007	-0.001	-0.003
IT	1.470	-0.468	-0.169	0.015	0.153	0.018	-0.003	0.000	0.000
LT	1.708	-0.295	-0.412	0.020	-0.021	-0.001	0.017	-0.002	0.006
LU	1.514	-0.341	-0.230	-0.017	0.074	0.003	-0.009	-0.008	-0.003
LV	1.442	-0.199	-0.263	0.021	-0.002	0.006	0.012	-0.001	0.004
NL	1.583	-0.303	-0.311	-0.032	0.063	0.000	-0.004	-0.016	-0.013
NO	1.679	-0.421	-0.221	-0.030	-0.007	-0.003	-0.010	-0.007	-0.010
PL	1.448	-0.280	-0.219	-0.024	0.075	-0.000	-0.010	-0.002	-0.011
PT	1.289	-0.451	-0.056	-0.003	0.223	0.002	-0.003	-0.002	0.000
SE	2.060	-0.609	-0.392	-0.051	-0.008	-0.014	-0.007	-0.008	-0.022
SI	1.887	-0.219	-0.701	-0.034	0.068	-0.003	-0.010	-0.017	-0.004
SK	1.540	-0.181	-0.346	-0.011	-0.002	0.003	-0.005	-0.011	0.002
UK	1.530	-0.437	-0.133	-0.030	0.070	-0.002	-0.007	-0.008	-0.013

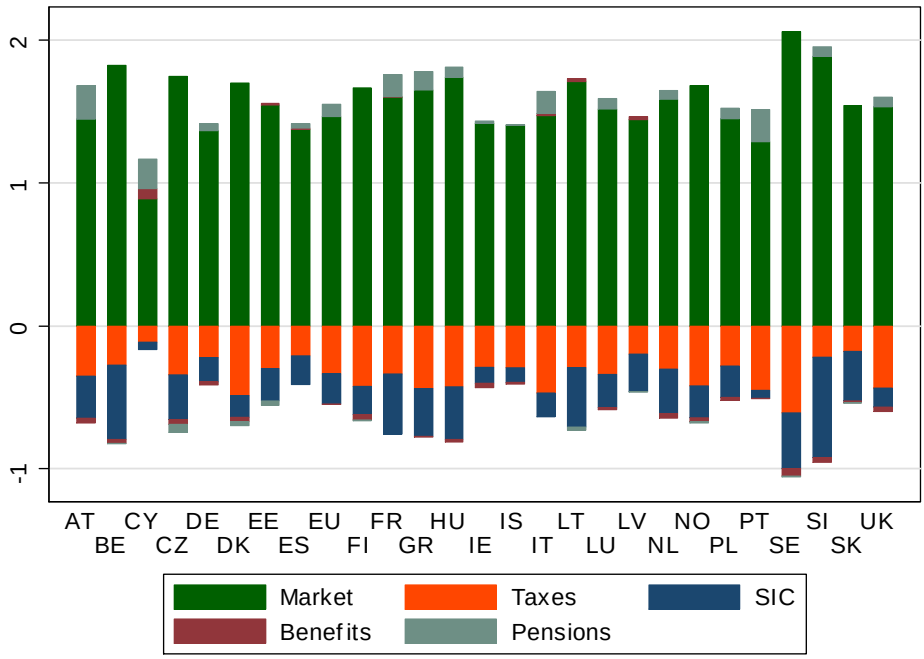
Table 4: Relative Inequality Contribution of the Tax Benefit System

5.2 Results

This section reports the results of the inequality decomposition analysis by factor components as suggested by Shorrocks, i.e. determining the inequality contribution of the different tax benefit instruments to overall inequality.

Here it is to mention, that bars above the 0.0 axis represent an disequalising effect, bars below the x-axis an equalising impact on income inequality in disposable incomes.

The left hand side of Table 4 reports the relative inequality contribution s_f of different tax benefit instruments, when overall inequality in equivalised disposable



Source: Own calculations based on EU-SILC. Note that values above (below) 0 represent a disequalising (equalising) impact on income inequality in disposable incomes.

Figure 2: Relative Inequality Contribution of Tax Benefit Instruments

household income (DPI) is exhaustively decomposed into market income, income taxes, social insurance contributions, social benefits and public pensions, based on the following identity:

$$DPI = \underbrace{(orig\ income + SIC\ employer)}_{market\ income} - taxes - SIC + benefits + pensions \quad (7)$$

We consider the role of public pensions separately because one can argue that public pensions are not really part of the redistributive system but should rather be seen as deferred earnings or the result of compulsory savings. This function of public pensions is particularly true for countries which apply insurance-based systems.

The results reveal that interestingly, while taxes and social insurance contributions have a highly inequality decreasing effect in all countries, the effect of social benefits and public pensions is not so clear across countries. Particularly, whereas taxes and contributions reduce income inequality by on average about 30%, social benefits do not seem to have any significant impact on inequality (<5% in all countries

except Cyprus and Sweden), also the influence of public pensions is comparatively small. In fact, in the majority of countries public pensions have disequalizing effects on the inequality in disposable incomes. On average they increase inequality by 6%. The positive effect of public pensions on inequality is particularly large in Austria, Portugal and Cyprus (>20%). Also, social benefits positvely contribute to the inequality in disposable incomes in at least seven countries (CY, EE, ES, FR, IT, LT, LV). This general picture also holds true if the EU is seen as one single country (as indicated in the first row of Table 4). The equalising effect of taxes is highest in the Nordic Countries. However, in Greece, Italy, Hungary, Poland and the UK taxes also reduce inequality by more then 40%, as suggested by the Shorrocks decomposition method. The equalising effect of taxes is comparatively small in Cyprus, Lativa and the Slovak Republic. Regarding the inequality contribution of social insurance contributions, the equalising effect is particularly high in Slovenia, Belgium, France and Lativa (>40%). The effect is small in *Portugal*, Cyprus, Iceland, Denmark and the Anglo Saxon countries.

The results for the inequality contribution of the different tax benefit instruments are also graphically illustrated in Figure 5.2. It becomes again evident, that the results substantially differ from the previous analysis based on the Gini accounting approach in Section 4. In all countries taxes and social contributions are by far the most important source of income inequality reductions, the contribution of benefits is almost negligible.

On the right hand side of Table 4 we further decompose state benefits into unemployment benefits, family/child related benefits, benefits for "social exclusion not elsewhere" classified and a residual category embedding the other benefits.

In the following we compute the different factors which determine the relative inequality contribution in order to explain our findings. As equation 6 suggests, the size of a factor´s inequality contribution depends on its within factor inequality, the income share of the corresponding factor source and its correlation with disposable income. Therefore, beside the relative inequality contribution (s_f) of the different tax benefit system components f, Table 5 also reports the factor source inequality of the different components I_2^f, the income share in total disposable income μ_f and most importantly the correlation between income component f and disposable income, measured by ρ_f. From the Table it becomes obvious, that in those countries in which benefits positively contribute to inequality, the correlation coefficient ρ_f displays a positive sign in contrast to the other countries where they

have an equalising effect. Also, the correlation between disposable income and social benefits is weak. For example, if the EU is seen as a single economic unit, the correlation almost equals zero. The correlation between disposable income and public pensions is of a comparatively small magnitude as well. Taxes, on the other hand show a substantial negative correlation with disposable incomes in all countries. So this further decomposition of the results reveals, that the negligible effect of social benefits on income inequality is due to the effect that they are hardly correlated with income. The disequalizing impact of pensions in most countries is due to the positive correlation (ρ_f) between disposable income and public pensions.

	DPI	Market				Taxes				SIC				Benefits				Pensions			
	I_2	I_2^f	μ_f	ρ_f	s_f	I_2^f	μ_f	ρ_f	s_f	I_2^f	μ_f	ρ_f	s_f	I_2^f	μ_f	ρ_f	s_f	I_2^f	μ_f	ρ_f	s_f
EU	0.787	1.134	1.183	0.858	1.462	-1.853	-0.197	-0.722	-0.337	-1.246	-0.284	-0.472	-0.211	1.913	0.093	-0.003	-0.001	2.108	0.205	0.157	0.087
AT	0.573	0.970	1.118	0.764	1.446	-1.621	-0.193	-0.639	-0.351	-1.085	-0.293	-0.531	-0.294	1.441	0.112	-0.122	-0.034	2.094	0.256	0.248	0.234
BE	0.558	0.918	1.374	0.808	1.825	-1.384	-0.183	-0.605	-0.276	-0.987	-0.495	-0.593	-0.517	1.472	0.140	-0.075	-0.027	2.176	0.164	-0.010	-0.005
CY	0.803	0.867	1.010	0.816	0.890	-1.947	-0.071	-0.659	-0.114	-0.856	-0.125	-0.405	-0.054	3.540	0.064	0.248	0.070	3.353	0.122	0.408	0.208
CZ	0.590	0.947	1.208	0.899	1.743	-2.054	-0.108	-0.911	-0.344	-0.995	-0.353	-0.524	-0.312	1.471	0.096	-0.142	-0.034	1.716	0.158	-0.117	-0.054
DE	0.724	1.033	1.186	0.805	1.364	-1.906	-0.182	-0.461	-0.224	-0.966	-0.322	-0.396	-0.169	1.633	0.103	-0.088	-0.021	2.014	0.214	0.080	0.050
DK	0.750	1.117	1.304	0.881	1.697	-1.202	-0.413	-0.731	-0.489	-1.759	-0.228	-0.325	-0.152	1.400	0.201	-0.082	-0.030	2.535	0.136	-0.058	-0.026
EE	0.964	1.184	1.299	0.968	1.543	-1.638	-0.183	-0.965	-0.299	-0.946	-0.313	-0.737	-0.226	1.623	0.070	0.103	0.012	1.656	0.126	-0.135	-0.029
ES	0.627	0.853	1.167	0.865	1.374	-1.446	-0.134	-0.677	-0.210	-0.941	-0.254	-0.533	-0.202	2.611	0.050	0.047	0.010	1.948	0.171	0.053	0.029
FI	0.713	1.065	1.241	0.896	1.663	-1.287	-0.281	-0.834	-0.423	-0.974	-0.276	-0.521	-0.196	1.293	0.157	-0.130	-0.037	2.224	0.158	-0.012	-0.006
FR	0.602	1.073	1.148	0.781	1.599	-1.687	-0.162	-0.745	-0.337	-1.320	-0.345	-0.552	-0.418	1.662	0.119	0.013	0.004	1.977	0.239	0.194	0.152
GR	0.737	1.120	1.279	0.851	1.650	-2.307	-0.191	-0.734	-0.440	-1.371	-0.356	-0.505	-0.332	2.592	0.032	-0.061	-0.007	1.849	0.237	0.214	0.129
HU	0.571	1.070	1.111	0.834	1.738	-1.632	-0.196	-0.760	-0.427	-1.112	-0.281	-0.672	-0.368	1.205	0.155	-0.055	-0.018	1.665	0.211	0.122	0.075
IE	0.779	1.155	1.024	0.932	1.416	-2.012	-0.138	-0.813	-0.290	-1.380	-0.134	-0.474	-0.113	1.251	0.152	-0.123	-0.030	2.572	0.095	0.055	0.017
IS	0.763	0.875	1.341	0.910	1.402	-1.017	-0.329	-0.673	-0.295	-0.781	-0.164	-0.596	-0.100	2.068	0.067	-0.069	-0.013	2.836	0.086	0.021	0.007
IT	0.693	1.024	1.178	0.843	1.470	-1.516	-0.246	-0.871	-0.468	-1.140	-0.243	-0.422	-0.169	2.764	0.038	0.099	0.015	1.730	0.273	0.224	0.153
LT	0.702	0.997	1.309	0.919	1.708	-1.493	-0.205	-0.675	-0.295	-1.102	-0.308	-0.853	-0.412	1.831	0.077	0.100	0.020	1.748	0.127	-0.067	-0.021
LU	0.605	0.977	1.094	0.858	1.514	-2.024	-0.140	-0.726	-0.341	-0.923	-0.246	-0.613	-0.230	1.564	0.102	-0.065	-0.017	2.109	0.190	0.110	0.074
LV	0.747	0.972	1.198	0.925	1.442	-1.378	-0.149	-0.723	-0.199	-1.161	-0.252	-0.670	-0.263	1.780	0.075	0.118	0.021	1.551	0.128	-0.009	-0.002
NL	0.703	0.976	1.386	0.826	1.583	-2.370	-0.149	-0.592	-0.303	-0.942	-0.538	-0.436	-0.311	1.847	0.108	-0.120	-0.032	2.344	0.193	0.087	0.063
NO	0.531	0.889	1.170	0.856	1.679	-1.126	-0.281	-0.706	-0.421	-0.905	-0.207	-0.624	-0.221	1.279	0.186	-0.066	-0.030	2.394	0.132	-0.013	-0.007
PL	0.728	1.122	1.076	0.873	1.448	-1.092	-0.247	-0.757	-0.280	-1.605	-0.169	-0.586	-0.219	1.790	0.085	-0.112	-0.024	1.666	0.255	0.129	0.075
PT	0.830	1.227	1.023	0.852	1.289	-1.629	-0.255	-0.903	-0.451	-2.297	-0.047	-0.428	-0.056	2.085	0.061	-0.023	-0.003	2.452	0.218	0.346	0.223
SE	0.516	0.948	1.268	0.885	2.060	-0.997	-0.355	-0.889	-0.609	-0.933	-0.295	-0.733	-0.392	1.217	0.187	-0.115	-0.051	2.138	0.195	-0.010	-0.008
SI	0.441	0.856	1.209	0.810	1.887	-3.357	-0.057	-0.501	-0.219	-0.948	-0.451	-0.736	-0.701	1.323	0.125	-0.095	-0.034	1.770	0.173	0.085	0.068
SK	0.496	0.788	1.156	0.839	1.540	-2.199	-0.053	-0.775	-0.181	-0.815	-0.369	-0.571	-0.346	1.713	0.075	-0.043	-0.011	1.554	0.191	-0.006	-0.002
UK	0.848	1.206	1.164	0.924	1.530	-1.932	-0.211	-0.910	-0.437	-1.018	-0.195	-0.566	-0.133	1.702	0.087	-0.172	-0.030	2.247	0.154	0.171	0.070

Table 5: Factor shares and Factor Correlations

6 Cluster Analysis

As outlined above, we are particularly interested in how the new member states can be integrated in the EU, when focusing on the redistribution via different tax benefit systems. Therefore, we conduct a hierarchical cluster analysis to group countries that have similar characteristics across a set of variables. When performing a cluster analysis, a number of technical decisions have to be made. First, all variables have been standardized from 0 to 1 using z-scores, to prevent that the results are driven by large absolute values of some variables. Our method of grouping the countries is Ward's linkage, which combines such clusters which minimally increase the squared sum of errors. Our results will be illustrated in so-called dendrograms, which graphically present the information concerning which observations are grouped together at various levels of (dis)similarity. At the bottom of the dendrogram, each observation is considered as its own cluster. Vertical lines extend up for each observation, and at various (dis)similarity values these lines are connected to the lines from other observations with a horizontal line. The observations continue to combine, until, at the top of the dendrogram, all observations are grouped together. The heigth of the vertical lines and the range of the (dis)similarity axis give visual clues about the strength of the clustering. In our case, the measure for the distance between cases is the common 'squared Euclidean'. Generally, long vertical lines indicate more distinct separation between groups, short lines more similarity, respectively.[3]

First we perform a cluster analysis on the basis of the redistributive effects of tax benefit instruments, as computed by the % change in Gini coefficients (Section 4) The dendrogram is illustrated in Figure 3. To the very right of the dendrogram we see the Southern European countries (IT, PT, ES, GR, CY) which group together with the Baltic countries (LT, LV, EE) and Iceland. As illustrated by a compartively high dissimilarity measure, this group of countries is rather distinct from the countries which are placed at the left and the middle of the dendrogram. However, these groups can again be divided into two rather separated subgroups. At the left we basically find the Continental countries (AT, DE, LU, FR, NL) which join a couple of Eastern European countries (CZ, SI, SK, PL) and the UK. In the middle, we see the Nordic countries (DK, FI, SE, NO) together with Belgium, Hungary and Ireland. Therefore from this hierarchical cluster analysis based on the redistributive

[3]Note that the general clustering results presented here are robust to different linkage or dissimilarity measure specifications.

effects of tax benefit instruments measured by the Gini accounting approach, the new Eastern European member states do not form a clearly distinguished group from the traditional European welfare states. Instead, the Baltic states show similar characteristics as the Southern European countries and the Central Eastern European countries seem to perform similar to the continental countries.

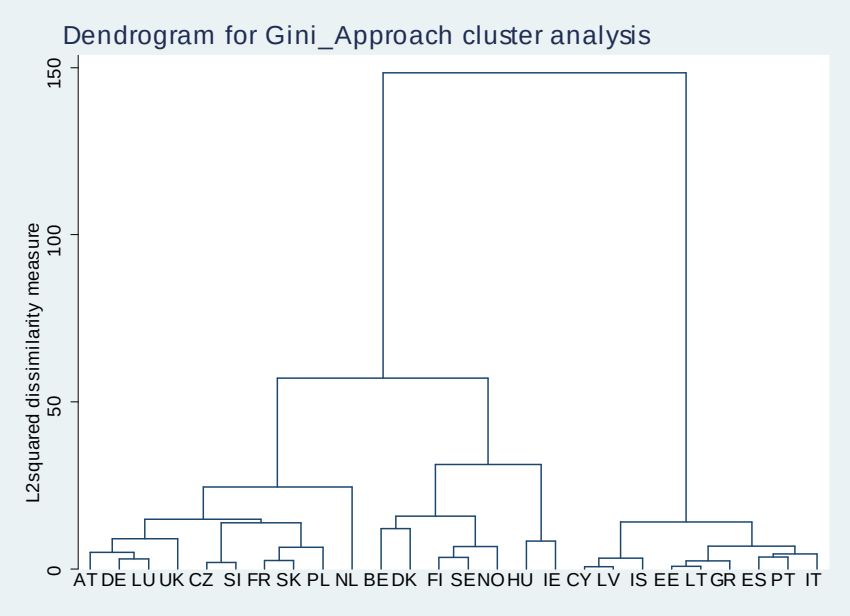


Figure 3: Cluster Analysis using the Gini Accounting Approach

In the next step, we perform the cluster analysis on the basis of the inequality contribution of the different tax benefit instruments as computed with the Shorrocks factor source deomposition approach. Figure 4 shows the dendrogram which presents the outcomes of this cluster analysis. First, the dendrogram reveals that with regard to these variables the countries have become more similar, as the maximum of the dissimilarity measure decreases to 100. Now the Baltic countries on the very right, joined by Spain and Cyprus, form a rather distinct group from the other countries. Then, a bit further to the left, we find the Continental European countries Belgium and the Netherlands which group together with the Eastern European countries Czech Republic, Slovak Republic and Slovenia. In the middle there is again the rather distinct group of Nordic countries (DK, FI, NO, SE) which is joined by the UK. At a later stage these countries are joined by the rather mixed group of Germany, Iceland, Luxembourg, Poland and Ireland. At the very left we then find Austria and France which join the Southern European countries (GR, IT, PT) and Hungary. Overall, the cluster analysis based on the Shorrocks approach reveals

the Baltic countries as a rather distinguished group, still with similarities to at least two Southern European countries (CY, ES). However, the Central Eastern European countries again seem to very naturally group together with the traditional Western European welfare states

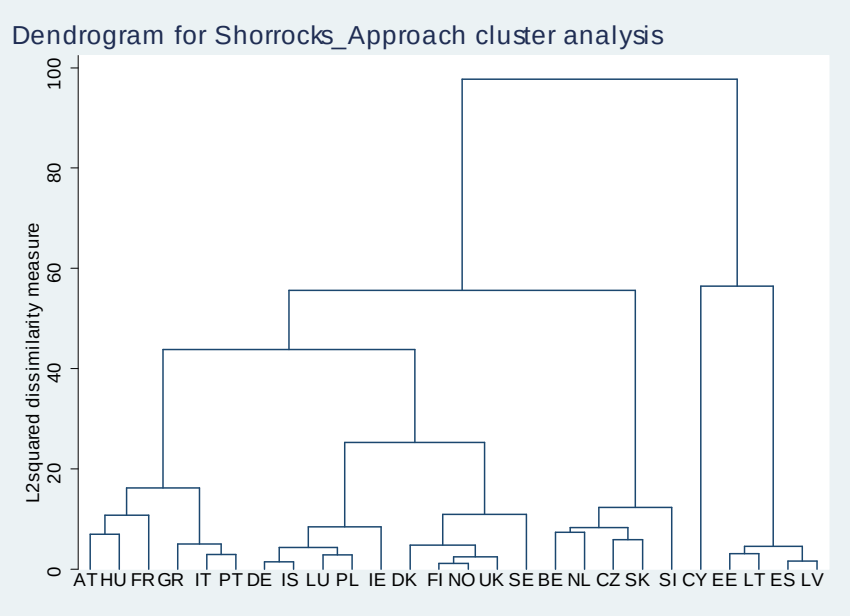


Figure 4: Cluster Analysis using the Shorrock´s Decomposition Approach

7 Conclusion

The enhancement of economic and social cohesion is a key target of EU policies. Nonetheless, the descriptive evidence suggests that there are sizeable differences across EU member states in the levels of within country income inequality - especially since the recent enlargement towards Eastern Europe. This holds true for the inequality in disposable incomes as well as the inequality in pre-tax incomes, hinting at the substantial variety in the national income tax and transfer systems. From a policy perspective, differences in the inequality of disposable incomes and, in particular, factors explaining these differences, including the tax and transfer system, are of particular interest in order to evaluate the different welfare state designs of European countries. In this paper, we have evaluated the impact of different tax benefit instruments (income taxes, social contributions, pensions, transfers) on income inequality and specifically ask the question if the role of instruments differs across countries. Particularly the question arises where the new member states fit

in.

Our results reveal that according to the Gini accounting approach, benefits are the most important source of inequality reduction in most European tax and transfer systems, taxes are less important. Also public pensions play an important role in lowering the inequality in disposable incomes, when comparing the hypothetical situation without public pensions. The factor source decomposition approach as suggested by Shorrocks, however, leads to very different results: taxes and social insurance contributions are by far the most important source of income inequality and the contribution of benefits is close to zero. Public pensions even positively contribute to the inequality in disposable incomes in most countries.

As explanation for these partly contradictory results serves the argument that many transfers have purposes other than income distribution. Wheras taxes and social contributions are clearly correlated with income and redistribute effectively, transfers have a much less clear effect on the income distribution, but they address other issues. This is clearly illustrated by the almost negligible correlation between social benefits and disposable income. A clear negative correlation to disposable income can be found only for some specific transfers like benefits for the long term unemployed and benefits for social exclulsion; but these are only a small part of overall transfers.

Furthermore, we performed a hierarchical cluster analysis to see in how far the redistributive importance of tax benefit instruments differs across countries and particularly, how the new member states integrate in the group of traditional European welfare states. First we find that although the country grouping slightly differs across our two approaches, the overall results are quite robust. With regard to Western Europe, we basically observe the 'typical' welfare state clustering as suggested by Esping-Andersen (1990) and later modified by Ferrera (1996). Particularly the Nordic countries reveal very similar characteristics with regard to the redistributive effects of their tax benefit instruments in both approaches. Also the Continental and Southern European countries group together. However, as opposed to the sociological welfare state literature (e.g. Fenger (2007)) we do not find the Eastern European countries to be a clear distinguished group when we cluster according to the redistributive importance of tax benefit instruments. Instead, the Central Eastern European countries seem to naturally group together with the traditional Continental Western European welfare states. The Baltic flat tax countries are distinct from the other countries, but as the cluster analysis shows, they still have

some similarlities to Southern European countries. This finding seems plausible, since both, the southern and baltic countries can be characterised by rather small welfare states.

Note, however, that there are limitations to our analysis. First and most importantly, the analysis only assesses the direct effects of taxes and transfers on household incomes. But, the tax system has both a direct effect on the post-government income distribution and an indirect effect as it may also influence the pre-tax income distribution. However, any behavioural effects caused be redistributive policies are not captured, neither any in-kind transfers from governments to households. Second, the study is static which means that the distribution of lifetime incomes is not taken into account.

Appendix

	Market	Taxes	SIC	Unempl	Family	Social	Other	Pensions
EU	1.183	-0.197	-0.284	0.042	0.057	0.014	0.061	0.205
AT	1.118	-0.193	-0.293	0.026	0.055	0.003	0.029	0.256
BE	1.374	-0.183	-0.495	0.062	0.047	0.003	0.027	0.164
CY	1.010	-0.071	-0.125	0.016	0.020	0.001	0.027	0.122
CZ	1.208	-0.108	-0.353	0.005	0.030	0.007	0.053	0.158
DE	1.186	-0.182	-0.322	0.029	0.042	0.010	0.023	0.214
DK	1.304	-0.413	-0.228	0.072	0.027	0.000	0.102	0.136
EE	1.299	-0.183	-0.313	0.002	0.042	0.000	0.026	0.126
ES	1.167	-0.134	-0.254	0.019	0.004	0.001	0.027	0.171
FI	1.241	-0.281	-0.276	0.044	0.044	0.005	0.064	0.158
FR	1.148	-0.162	-0.345	0.034	0.037	0.006	0.041	0.239
GR	1.279	-0.191	-0.356	0.006	0.008	0.004	0.014	0.237
HU	1.111	-0.196	-0.281	0.016	0.079	0.001	0.060	0.211
IE	1.024	-0.138	-0.134	0.035	0.075	0.001	0.041	0.095
IS	1.341	-0.329	-0.164	0.003	0.026	0.001	0.037	0.086
IT	1.178	-0.246	-0.243	0.025	0.011	0.001	0.001	0.273
LT	1.309	-0.205	-0.308	0.004	0.027	0.002	0.044	0.127
LU	1.094	-0.140	-0.246	0.015	0.056	0.006	0.025	0.190
LV	1.198	-0.149	-0.252	0.010	0.036	0.002	0.028	0.128
NL	1.386	-0.149	-0.538	0.018	0.018	0.023	0.050	0.193
NO	1.170	-0.281	-0.207	0.008	0.046	0.005	0.127	0.132
PL	1.076	-0.247	-0.169	0.015	0.021	0.003	0.046	0.255
PT	1.023	-0.255	-0.047	0.020	0.014	0.003	0.024	0.218
SE	1.268	-0.355	-0.295	0.031	0.049	0.005	0.101	0.195
SI	1.209	-0.057	-0.451	0.007	0.040	0.010	0.069	0.173
SK	1.156	-0.053	-0.369	0.005	0.030	0.006	0.035	0.191
UK	1.164	-0.211	-0.195	0.003	0.033	0.016	0.036	0.154

Table 6: Factor Shares of Tax Benefit System

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