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**#9**

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# The Decomposition of Income Inequality in the EU-28

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# *The Decomposition of Income Inequality in the EU-28\**

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## ABSTRACT

Recently the social-economic divide increased in Europe which might endanger the European project. However, there is a lack of current research that provides results for policy implications to counteract this development. Therefore, this paper replicates the work of Beblo and Knaus (2001) and analyses the composition of income inequality for the EU-28 in 2014 by using data from the European Survey on Income and Living Conditions in two steps. First, I apply the Theil index and additively decompose the sources of inequality into a within- and between-component by countries, country groups and demographic groups. Second, I analyse the impact of government redistribution on income inequality. The results show that inequality is highest for households with household heads older than 59 years and lowest for households with children. Moreover, high income countries have lower inequality, higher social expenditures and redistribute more than low income countries. On country group level, I illustrate that Social-Democratic countries have the lowest income inequality and redistribute most, while the opposite holds true for Baltic countries.

**JEL Classification:** D31, D33

**Keywords:** Theil index, Income distribution, European Union, Social cohesion

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# 1 Introduction

According to the latest results of the OECD, “*the socio-economic divide has been on the rise in Europe*”, which hampers social cohesion, lowers social trust in institutions and fuels political and social inequality (OECD, 2017, p. 5). Therefore, income inequality is one of the most important concerns for the future of the European Union. High levels of social cohesion contribute to a continuation of the European project and income distribution is assumed to be one crucial factor for the setting up of a joint social policy at the European level. Results of Eurofound (2017) support the demand for a new European agenda, as they find an increasing role of welfare state redistribution for income inequality in Europe since the financial crisis in 2008. The impact of income disparities on social cohesion and the increasing influence of government redistribution on the income distribution motivates this study to analyse the composition of income inequality in the EU-28.

Hoffmeister (2009) clusters the relevant literature in two strands. The first strand covers literature with regard to within-country income inequality<sup>1</sup>, whereas the second deals with literature that analyses income distribution on the supranational level. As I analyse the aggregated inequality for the EU-28, this study contributes to the latter, in which income distribution across individuals is analysed jointly for different countries. The pivotal work of Atkinson (1996) provides an early approach of the second strand and measures income inequality in Europe by using data from the Luxembourg Income Study.<sup>2</sup> To analyse income distribution on a global level Milanovic (2002) introduced the *World Income Distribution Dataset*. Lakner and Milanovic (2016) improved this dataset and contribute results of the global income distribution for around 90% of the world’s population between 1988 and 2008. However, the most relevant study concerning social cohesion at the European level is carried out by Beblo and Knaus (2001). In their paper they measure income inequality for the founding countries of the European Monetary Union by calculating Theil indices, which they decompose into a within- and between-component. Using the 1995 wave of the European Community Household Panel their results show a Theil index of aggregated inequality in Europe of around 0.185. Moreover, differences between-countries account for 3.4% of market income inequality but increase their contribution significantly after transfers and taxes and contribute 9.3% to disposable income inequality. This induces the assumption that income levels differ remarkably between the analysed countries and that the welfare state regime plays an important role for social cohesion at the European level. A more recent approach that measures aggregated inequality in Europe is carried out by Hoffmeister (2009). He refers to the EU-25 and detects a convergence of national income levels and

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<sup>1</sup>Research with regard to this strand was carried out, amongst many others, by Atkinson et al. (1995), Gottschalk and Smeeding (1997), Smeeding and Grodner (2000), Beblo and Knaus (2001), Hoffmeister (2009) and Bouvet (2010).

<sup>2</sup>More recent results for Europe are presented by Beblo and Knaus (2001), Papatheodorou and Pavlopoulos (2003), Boix (2004), Morrisson and Murtin (2004), Brandolini (2007), Hoffmeister (2009), Papatheodorou and Pavlopoulos (2014) and Eurofound (2017).

within-country personal income inequality between 1994/1995 and 1999/2000. Furthermore, he states that inequality is rising in the Social-Democratic regime but decreasing in Mediterranean welfare states. Moreover, Papatheodorou and Pavlopoulos (2014) analyse the development of inequality in the EU-15 between 1996 and 2008. By calculating Theil indices they find that the contribution of between-country inequality decreases significantly from 14.8% in 1996 to 4.9% in 2008. Eurofound (2017) measures aggregated inequality for the EU-28 between 2005 and 2013 and reports a decrease in income convergence among European countries and an increase of income inequality in Europe since 2008.

This paper contributes to the findings of Beblo and Knaus (2001) and extends the focus on an enlarged EU and analyses whether the social cohesion could be triggered throughout the last 19 years. Therefore, I replicate the study of Beblo and Knaus (2001) and show how their results change when I use income data for 2014 and include all member states of the EU-28. In addition, I add an additional level of analysis to their approach and decompose income inequality by country groups with similar socio-economic policies and institutions. Thus, this study puts particular emphasis on the role of the welfare state on income inequality.<sup>3</sup> Based on the contributions the main research questions are the following: (1) *What is the composition of income inequality in the EU-28?* (2) *What is the effect of government redistribution on income inequality in the EU-28?* To answer the first research question, I use the Theil index and additively decompose income inequality into a within- and between-component by countries, country groups and demographic groups. With regard to the second research question I analyse the impact of taxes and social transfers by comparing the amount of income inequality for market and disposable income. The results are followed by comprehensive robustness checks that cover methodological as well as pension-system-related differences. As a result, this study detects the sources of income inequality in the EU-28, provides scientific foundation for a future social union and enables policy makers to implement appropriate policies to increase social cohesion.

The remainder of this paper is organised as follows. Section 2 describes the underlying data of this study. In section 3 I illustrate the characteristics of the Theil index and its decomposition. The composition of income inequality is analysed in section 4. Section 5 discusses the redistribution impact of taxes and social transfers. In section 6, I check the robustness of my results in a sensitivity analysis. Finally, section 7 summarises the main findings of this study.

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<sup>3</sup>The role of the welfare state regime on income distribution is argued, among others, by Atkinson et al. (1995), Gottschalk and Smeeding (1997), Smeeding and Grodner (2000) Beblo and Knaus (2001), Hoffmeister (2009) and Esping-Andersen and Myles (2011)

## 2 Data

The results in this study are based on the European Union Statistics on Income and Living Conditions (EU-SILC), which covers data of 555,405 observations with incomes greater than zero in 2014 for the EU-28.<sup>4</sup> The main variable of interest is *equivalised disposable household income* (HX090)<sup>5</sup> using the “OECD-modified scale”.<sup>6</sup> This income variable reflects income after transfers and taxes and is used for calculations with regard to disposable income. To account for price differentials among countries I convert incomes into a comparable base by using purchasing power parity exchange rates (2014) from Eurostat. Furthermore, all observations are weighted by using the *personal cross-sectional weight* (RB050). To cluster the observations in section 4.4 into demographic subgroups, I use the *age at the end of the income reference period* (PX020). Moreover, to measure the effect of government redistribution on income inequality in section 5 I calculate *equivalised market household incomes*, which are defined by taking the sum of *gross employee cash* (PY010G), *pensions from individual private plans* (PY080G) and *cash benefits or losses from self-employment* (PY050G) on the personal level as well as *income from rental of a property or land* (HY040G), *regular inter-household cash transfer received* (HY080G), *interests, dividends, profit from capital investment in unincorporated business* (HY090G) and *income received by people aged under 16* (HY110G) on the household level. According to Atkinson and Marlier (2010), the reference period for income data in the EU-SILC is a fixed 12-month period and normally the previous calendar year in which the survey-data collection is carried out. Moreover, they mention that the only two exceptions are the United Kingdom, which defines its income reference period in the current year, and Ireland, which defines its income reference period to the last twelve months prior to the interview.

The EU-SILC provides comparative data on income, poverty, social exclusion and living conditions in Europe. Like any survey, however, it suffers from problems with regard to data collection. Paturot et al. (2013) argue that low income households might not be reached, are less likely to respond and might understate benefit income or income earned in the informal sector. Moreover, they state that high income households are under-represented in household survey data because they do under-report or refuse to give any information about their income.<sup>7</sup>

To cluster the analysed countries into groups with similar socio-economic policies and institutions in Table 1, I follow an approach of Aristei and Perugini (2015).<sup>8</sup> Their framework

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<sup>4</sup>The nature of the Theil allows me only to use incomes greater than zero. Moreover, I only use observations with a personal base weight greater than zero.

<sup>5</sup>To facilitate the replication of my results I put the EU-SILC variable names in parenthesis.

<sup>6</sup>The “OECD-modified scale” was first proposed by Hagenars et al. (1994) who assume an equal distribution of resources within the household and assign a value of 1 to the first adult in the household, 0.5 to each additional adult member and 0.3 to each child younger than 14 years old (OECD, 2013).

<sup>7</sup>See Eckerstorfer et al. (2016) for a detailed discussion and a possible adjustment of this problem within the context of wealth distribution.

<sup>8</sup>As Bulgaria, Croatia, Germany, Romania and Malta are not in the framework of Aristei and Perugini

takes the institutional dimension of income inequality into account and will be used to identify patterns in income distribution and the construction of inequality on the national and European level. One main advantage compared to the pivotal work of Esping-Andersen (2013), who only distinguishes three types of welfare state regimes, is that Aristei and Perugini (2015) provide six categories of country groups. Thus, the categorization framework of Aristei and Perugini (2015) offers a more nuanced approach to cluster the member states of the EU-28. Their classification is based on the varieties of capitalism approach of Hall and Soskice (2001), who cluster countries by the distinction between liberal and coordinated market economies. This approach is extended by embedding the criticism of Coates (2000) and Amable (2003), that underlines the necessity of a broader institutional dimension. Furthermore, the classification considers literature on post-socialist states<sup>9</sup> and is based on institutional indicators.

TABLE 1 — Country groups, based on Aristei and Perugini (2015)

Country Group	Abbreviation	Countries
Baltic countries	BC	Estonia, Latvia, Lithuania
Continental European economies	CEE	Austria, Belgium, France, Germany, Luxembourg, The Netherlands
Eastern European countries	EEC	Bulgaria, Croatia, The Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia
Liberal market economies	LME	Ireland, United Kingdom
Mediterranean countries	MC	Cyprus, Greece, Italy, Malta, Portugal, Spain
Social-Democratic countries	SDC	Denmark, Finland, Sweden

Notes: Bulgaria, Croatia, Germany, Romania and Malta are not in the framework of Aristei and Perugini (2015). Thus, I cluster these countries by taking the specific characteristics of the country groups into account.

### 3 Methodology

To measure inequality in Europe I choose the Theil index  $T(1)$ , an inequality measure from the generalised entropy family. First introduced by the seminal work of Theil (1967), this index can be written as

$$T(1) = \frac{1}{N} \sum_{i=1}^N \left( \frac{y_i}{\mu} \right) \ln \left( \frac{y_i}{\mu} \right) \quad (1)$$

with

$N$  size of the population

$y_i$  individual income

$\mu$  mean income of the population

(2015), I cluster these countries by taking the specific characteristics of the country groups into account.

<sup>9</sup>See Nölke and Vliegenthart (2009), Lane (2007), Bohle and Greskovits (2007) or Drahokoupil et al. (2008).

In the case of perfect equality each individual in the sample has exactly the same income and the Theil index is zero, which represents its minimum value. On the other hand, if there is total inequality one individual has all the income and the Theil index equals  $\ln(N)$ , its maximum value. Bourguignon (1979) points out that Theil indices have several favourable characteristics as they “[...] (a) are continuous and differentiable in all individual incomes; (b) are symmetric; (c) are income-homogeneous of degree zero; (d) satisfy the symmetry axiom for population; (e) satisfy the Pigou-Dalton condition; and (f) are decomposable” Bourguignon (1979, p. 902).<sup>10</sup> The last property enables me to express  $T(1)$  as the sum of a within- and between-group component, which is shown in equation 2. This is what Cowell (2000) describes as the “accountant’s approach”, which is of great concern when I choose the Theil index, as it does not only take an individual country’s inequality into consideration but also the heterogeneity between countries at the European level. Moreover, Bourguignon (1979), Cowell (1980) and Shorrocks (1980) state that  $T(1)$  can be decomposed into subgroups such that

$$T(1) = \underbrace{\sum_{k=1}^K s_k \times T(1)_k}_{\text{within component}} + \underbrace{\sum_{k=1}^K s_k \ln\left(\frac{\mu_k}{\mu}\right)}_{\text{between component}} \quad (2)$$

with

- $K$  population subgroup
- $s_k$  share of total income of subgroup  $k$
- $T(1)_k$  Theil index of subgroup  $k$
- $\mu$  mean income
- $\mu_k$  mean income of subgroup  $k$

The first term in equation 2 illustrates the within-component, which is the weighted sum of the subgroup Theils  $T(1)_k$ . The second term describes the inequality that arises due to differences between subgroups  $K$ , which depends on the variation in mean income levels  $\mu_k$ . To weight the contribution of the respective subgroup, which are in my case countries, country groups and demographic groups, I make use of its total income share  $s_k$ , that expresses its economic weight in the total population.

As an alternative to the Theil index, Hoffmeister (2009) calculates the Mean Logarithmic Deviation (MLD), which uses purely population based weights instead of income share based weights. However, this study follows the argumentation of Beblo and Knaus (2001), who underline that income share based weights are more convenient because they reflect each country’s political power with regard to its economic standing in the EU-28 better than population based weights. Political power also reflects the level of influence a country has

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<sup>10</sup>For more information about the nature of additive decomposable inequality measures see, among others, Shorrocks (1980).



on building a future social union and the development of social cohesion at the European level. Thus, I put the main emphasis on calculating inequality measures by using the Theil instead of the MLD. Nevertheless, this study tests the robustness of its results by using the MLD in a sensitivity analysis in section 6.

According to Hoffmeister (2009), the Gini coefficient is also widely used for measuring inequality but is unsuitable for this study as it is not easily additive decomposable. He argues that, when decomposed, the Gini falls, beside a within- and between-component, into an overlap-component. Moreover, he states that the more important the overlap-component compared to the within- and between-component, the more homogeneous the population.<sup>11</sup> Therefore, Hoffmeister (2009) underlines that the Gini provides information about the population's stratification but does not account for the relative importance of inequality resulting within and between subgroups. However, to analyse the sources of income inequality, the latter characteristic is essential. Thus, I calculate Theil indices in the following section of this study and show how much of the income inequality is due to differences within and between countries, country groups and demographic groups.

## 4 The decomposition of income inequality in the EU-28

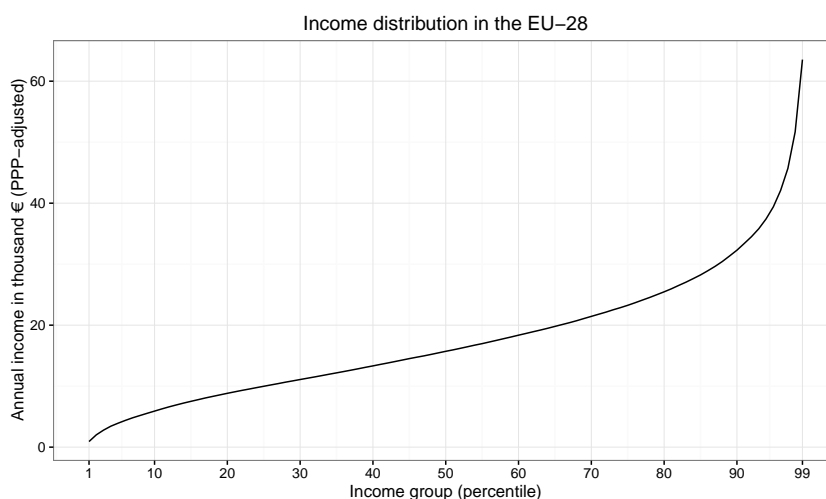
To answer the first research question of this paper, this section provides results about the decomposition of income inequality in the EU-28 by using equivalised disposable household income. In a first step, I give a short overview of how income is distributed in the EU-28 and among country groups. Moreover, I decompose the Theil index into a within- and between-component for three different subgroups, which are defined as countries, country groups and demographic groups. This approach illustrates the contribution of inequality within and between subgroups to the aggregated inequality of the EU-28. These findings identify the main drivers behind income inequality on country and European level.

### 4.1 The income distribution in Europe

To draw a general picture of the income distribution in the EU-28, Figure 1 illustrates how annual mean incomes range among income percentiles. Treating the EU-28 as one country the results show that the annual median income amounts 15,713€. Moreover, I find a tremendous gap between the bottom and the top of the income distribution as the 1<sup>st</sup> percentile has an annual income of around 919€, while the 99<sup>th</sup> percentile has an income of 63,540€. Thus, income is more than 69 times higher at the top compared to the bottom of the distribution. However, to know more about the structure of this distribution, I now analyse in which income decile the single countries are located.

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<sup>11</sup>For more information about the Gini decomposition see Pyatt (1976), Yitzhaki and Lerman (1991), Yitzhaki (1994), Lambert and Aronson (1993), or Yao and Liu (1996).



Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

This Figure illustrates the income distribution in the EU-28 and shows that annual mean incomes range from 919€ at the 1<sup>st</sup> to 63,540€ at the 99<sup>th</sup> income percentile.

FIGURE 1 — Income Distribution in the EU-28 per percentile, 2014

Table 10 (appendix) gives an overview of each nation's population share within the European income distribution. Using these numbers and following an approach by Beblo and Knaus (2001) I calculate an index which illustrates a country's relative representation in a certain income decile of the EU-28. A value above (below) one illustrates that the country is over-represented (under-represented) with regard to its relative population share. Germany for example amounts for around 16% of the EU-28 population. However, 4.98% of its population is in the first income decile whereas 27.65% contribute to the top income decile. Thus, Figure 2 shows that Germany is under-represented in the lowest income decile, with an index of 0.31 but over-represented at the top, with an index of 1.72. This means that Germany has 69% less inhabitants in the lowest and 72% more inhabitants in the highest European income decile as we would expect if its population would be equally distributed among the European income distribution.

To test if countries with similar socio-economic policies and institutions show a comparable pattern in their income distribution, this study clusters the results with regard to the relative representation among income deciles in the EU-28, into six country groups. The results are plotted in Figure 2 and illustrate highly similar patterns for four of the six country groups. Thus, all Social-Democratic countries (SDC), continental European economies (CEE) and liberal market economies (LME) are under-represented in the first and over-represented in the tenth income decile, while Baltic countries (BC) show the opposite result. However, Mediterranean countries (MC) and eastern European countries (EEC) show a rather heterogeneous picture in their relative representation. Within EEC Slovenia and the Czech Republic are both under-represented at the bottom and the top of the income distribution, whereas

the rest in this country groups is over-represented at the bottom and under-represented at the top. Moreover, especially with regard to the lowest income decile, MC split into two poles as Cyprus, Italy and Malta are heavily under-represented, while Greece, Portugal and Spain are over-represented at the bottom of the income distribution. On country level, the results show two significant outliers, which picture the gap in prosperity between the member states of the EU. In the first decile, Romania is heavily over-represented and shows an index of 6.6, whereas Luxembourg shows an index of 4.3 for the top income decile.

## 4.2 Decomposition by countries

However, to extend the analysis of the composition of the European income inequality, this study now turns to the decomposition of the Theil index. Table 2 refers to country-Theils which vary between a value of 0.099 in Slovakia and 0.430 in Romania. Moreover, Table 2 shows each country's contribution to the aggregated inequality of 0.215 in the EU-28. The results indicate that the largest five countries Germany, the United Kingdom, France, Italy and Spain are responsible for 56.6% of the aggregated Theil index. The between-component accounts for 21.7%, which means that 21.7% of the total inequality in the EU-28 is due to the other 23 countries.

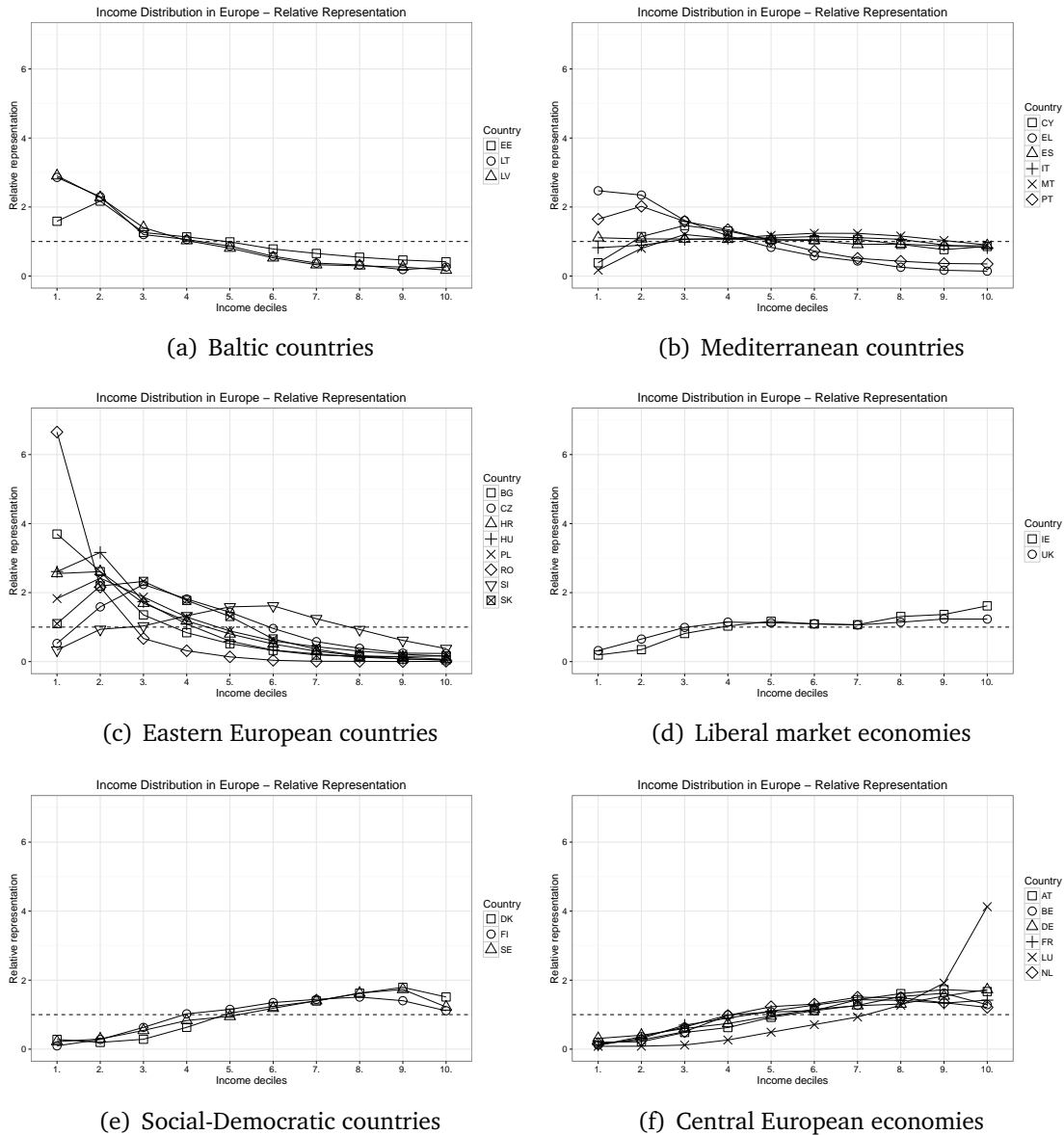
A former result of Beblo and Knaus (2001) who analyse the founding countries of the European Monetary Union for 1995 shows that between-country inequality account for 9.3% to the inequality measure of 0.185. A more recent study of Papatheodorou and Pavlopoulos (2014) for the EU-15 in 2008 shows a Theil index of 0.148 and a contribution of between-country differences of 4.9%. Therefore, my results show that income inequality and the relative contribution of between-country differences increased significantly for an enlarged EU-28.

## 4.3 Decomposition by country groups

This study now analyses the contribution of inequality within- and between-country-groups with similar socio-economic policies and institutions.<sup>12</sup> Table 3 illustrates that country groups divide into two poles. The lowest inequality is found in SDC (0.125) followed by CEE (0.158) and LME (0.175), which are the three country groups with the highest annual mean incomes. On the other hand, inequality is highest in BC (0.233), EEC (0.223) and MC (0.198), which are the country groups with the lowest annual mean incomes. Thus, high income country groups show lower income inequality compared to low income country groups. To analyse the roots of this finding, this study evaluates the effect of governmental redistribution in section 5.

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<sup>12</sup>All inhabitants of a country group are treated as they would live in a single country. Moreover, personal cross-sectional weights are used to adjust for the country size.



Source: Own calculations, EU-SILC 2014 & 2015

Notes: Based on Aristei and Perugini (2015), countries are clustered into country groups with regard to similar socio-economic policies and institutions.

Income is defined as equalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

The index on the y-axis illustrates a country's relative representation in a certain income decile of the EU-28. A value above (below) one illustrates that the country is over-represented (under-represented) with regard to its relative population share.

The results show that CEE, LME and SDC are overrepresented at the tenth and underrepresented at the first income decile, whereas BC show the opposite result. Moreover, two countries stand out significantly. Luxembourg has more than four times more people at the top, while Romania shows over six times more people at the bottom of the income distribution, as we would expect if their populations would be equally distributed among the European income distribution.

FIGURE 2 — Income distribution in the EU-28 per decile among country groups - Relative Representation, 2014

TABLE 2 — Sources of income inequality in the EU-28 by country, 2014

Country	Theil index	Annual Mean Income	Inequality Share <sup>a</sup> (%)	Economic weight <sup>b</sup> (%)
AT	0.141	23,953	1.5	2.2
BE	0.121	21,852	1.5	2.6
BG	0.251	8,930	0.8	0.7
CY	0.233	18,387	0.2	0.2
CZ	0.114	13,340	0.8	1.5
DE	0.162	23,409	15.3	20.3
DK	0.158	23,757	1.1	1.5
EE	0.196	13,363	0.2	0.2
EL	0.211	10,567	1.2	1.2
ES	0.195	17,291	7.9	8.7
FI	0.112	21,320	0.7	1.3
FR	0.165	22,821	12.0	15.6
HR	0.156	9,690	0.3	0.4
HU	0.138	9,105	0.6	1.0
IE	0.152	22,424	0.8	1.1
IT	0.178	18,000	9.8	11.9
LT	0.258	10,972	0.4	0.3
LU	0.143	33,212	0.1	0.2
LV	0.211	10,366	0.2	0.2
MT	0.136	19,066	0.1	0.1
NL	0.133	21,856	2.5	4.0
PL	0.163	11,135	3.5	4.6
PT	0.204	12,734	1.4	1.4
RO	0.430	5,404	2.3	1.2
SE	0.110	21,977	1.2	2.3
SI	0.102	16,473	0.2	0.4
SK	0.099	11,084	0.3	0.6
UK	0.177	20,642	11.6	14.2
Between countries	–	–	21.7	–
Europe	0.215	18,371	100	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> The inequality share represents the contribution of a country to the overall inequality of the EU-28.

<sup>b</sup> The economic weight describes the income share of a country with regard to the overall income of the EU-28.

TABLE 3 — Sources of income inequality in the EU-28 by country group, 2014

Country group	Theil index	Annual Mean Income	Inequality Share <sup>a</sup> (%)	Economic weight <sup>b</sup> (%)
BC	0.233	11,282	0.8	0.8
CEE	0.158	23,015	33.0	45.0
EEC	0.223	9,866	10.7	10.4
LME	0.175	20,764	12.5	15.3
MC	0.198	16,710	21.7	23.5
SDC	0.125	22,288	2.9	5.1
Between country groups	0.040	–	18.4	–
Europe	0.215	18,371	100	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> The inequality share represents the contribution of a country group to the overall inequality of the EU-28.

<sup>b</sup> The economic weight describes the income share of a country group with regard to the overall income of the EU-28.

## 4.4 Decomposition by demographic groups

This subsection shows the influence of demographic subgroups on income inequality with a decomposition by household types. Moreover, it analyses whether inequality between-demographic-groups or between-countries contribute more to the aggregated income inequality of the EU-28. Therefore, I follow Beblo and Knaus (2001) and split the sample into three groups with regard to the household structure. The first group consists of households with household heads<sup>13</sup> (hh) older than 59 years. Households with hh younger than 60 are divided into households without and with children respectively.

### 4.4.1 Demographic groups on country level

Table 4 shows that hh with children (0.200) have the lowest, whereas hh above 59 (0.229) have the highest income inequality in the EU-28. The same result is found by Beblo and Knaus (2001), who argue that in most social protection systems, pensions depend on former gross-earnings and therefore reflect past income inequality. Moreover, income inequality of households with hh above 59 years show also the largest span among demographic groups and range between a Theil index of 0.070 in Slovakia and 1.098 in Romania. The other two demographic groups show a significant smaller span and range between a Theil index of 0.085 in Slovakia and 0.234 in Lithuania, for hh without children, and between 0.078 in Sweden and 0.300 in Lithuania, for hh with children. Interestingly, in Estonia the overall Theil index is higher than the indices of each demographic subgroup. Comparing the mean incomes of each subgroup, I detect that they vary tremendously between 9,805€ for hh above 59 years and 13,945€ for hh without children. Thus, it seems that between-demographic-group inequality is responsible that overall inequality exceeds inequality within any of the three demographic groups. However, as pension payments seem to play a crucial role for the construction of income inequality, this study will analyse the impact of the pension system on income inequality in a sensitivity analysis in section 6.

In addition, the results in Table 5 show that between-country inequality (21.7%) contributes significantly more to the overall inequality of the EU-28 than between-demographic-group inequality (0.82%). Moreover, hh without children account for about two fifths (44.46%) of the overall inequality, followed by hh with children (31.05%) and hh above 59 years (23.67%). However, differences among countries regarding the contribution of each demographic group are significant. The contribution of hh above 59 years ranges from around 10% in Slovakia to around 60% in Romania. The same holds true for hh without children, for which the range lies between around 20% in Romania and around 52% in Germany. Finally, the span for hh with children ranges from around 19% in Romania to around 45% in Ireland. These findings illustrate that inequality within demographic groups as well as their

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<sup>13</sup>The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

contribution to overall inequality vary tremendously among member states. Therefore, an European wide social policy should consider each country's specific situation. Nevertheless, the next subsection focuses on country groups and should detect which framework of socio-economic policies and institutions provide the best foundation for low income inequality.

#### 4.4.2 Demographic groups on country group level

Table 6 presents the results on country group level and shows that SDC have the lowest income inequality among all demographic groups. However, inequality for hh above 59 years is highest in EEC (0.311), while BC have the highest inequality for hh without (0.214) and with (0.248) children. The same as on country level income inequality among country groups ranges most for hh above 59 and least for hh without children, which again indicates the influence of the pension system on income inequality.

Furthermore, Table 7 shows the contribution of demographic subgroups to country group inequality. The results illustrate that in all country groups, hh without children contribute the most, while hh above 59 years contribute the least to total income inequality. Nonetheless, the contribution of each demographic group varies significantly among country groups. Households older than 59 years account for 13.54% of inequality in BC, compared to 26.27% in CEE. Moreover, the contribution for hh with children varies between 27.08% in CEE and 41.05% in BC.

Thus, I find a heterogeneous situation regarding income inequality and the contribution of demographic groups to inequality among countries and country groups. The results show that SDC have the lowest inequality among all demographic groups. Socio-economic policies and institutions in SDC seem to offer a good environment for low income inequality independently of household characteristics. Hence, social policies at the national level seem to have a significant impact on income inequality in the EU-28 and may be a driver of economic disparities. To test this hypothesis, I follow Beblo and Knaus (2001) and assume that the amount of social expenditures influence income inequality and illustrate in the appendix the relationship between social security expenditures in percent of GDP on the y-axes and country-Theils on the x-axes in Figure 5. The results show a significant negative relationship between the two and illustrate that the lower social expenditures of a member state regarding its GDP, the higher is its income inequality. Yet, this relationship says anything about the degree of redistribution in a country. Thus, the impact of government redistribution, by comparing inequality with regard to pre- and post-transfer incomes, is analysed in section 5.

TABLE 4 — Sources of income inequality in the EU-28 by country and demographic type, 2014

Country	Age of the Household Head <sup>a</sup>			all
	< 60, without children	< 60, children	≥ 60	
AT	0.135	0.122	0.161	0.141
BE	0.116	0.099	0.157	0.121
BG	0.210	0.275	0.259	0.251
CY	0.218	0.215	0.307	0.233
CZ	0.109	0.127	0.075	0.114
DE	0.174	0.147	0.147	0.162
DK	0.161	0.147	0.165	0.158
EE	0.183	0.190	0.171	0.196
EL	0.209	0.230	0.182	0.211
ES	0.184	0.211	0.187	0.195
FI	0.122	0.081	0.133	0.112
FR	0.166	0.125	0.209	0.165
HR	0.148	0.135	0.183	0.156
HU	0.144	0.131	0.120	0.138
IE	0.152	0.144	0.166	0.152
IT	0.166	0.176	0.187	0.178
LT	0.234	0.300	0.188	0.258
LU	0.147	0.148	0.120	0.143
LV	0.190	0.206	0.227	0.211
NL	0.137	0.120	0.145	0.133
PL	0.161	0.162	0.161	0.163
PT	0.206	0.186	0.223	0.204
RO	0.199	0.241	1.098	0.430
SE	0.128	0.078	0.125	0.110
SI	0.099	0.094	0.120	0.102
SK	0.085	0.115	0.070	0.099
UK	0.194	0.151	0.149	0.177
Europe	0.215	0.200	0.229	0.215

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

TABLE 5 — Contribution to income inequality in the EU-28 by country and demographic group, 2014

Country	Contribution to Country Inequality in %			
	Age of the Household Head <sup>a</sup>			variation between hh
	< 60, without children	< 60, children	≥ 60	
AT	48.98	25.16	22.80	3.05
BE	43.02	30.00	24.37	2.61
BG	40.20	38.94	16.85	4.01
CY	42.44	34.96	22.17	0.43
CZ	44.29	40.28	11.59	3.84
DE	51.62	25.77	21.26	1.35
DK	42.99	33.27	23.34	0.40
EE	40.73	39.80	13.58	5.90
EL	43.97	34.80	20.43	0.79
ES	42.52	36.15	20.59	0.75
FI	46.38	24.75	27.90	0.97
FR	38.70	27.19	32.51	1.60
HR	44.74	30.35	20.54	4.37
HU	51.22	29.69	17.29	1.80
IE	36.39	44.58	18.04	0.99
IT	41.86	29.87	26.47	1.79
LT	42.31	42.45	12.13	3.11
LU	47.31	37.29	14.73	0.67
LV	40.40	38.88	16.43	4.29
NL	43.20	32.57	24.03	0.19
PL	43.06	39.82	16.31	0.81
PT	42.36	31.11	26.00	0.54
RO	20.05	18.77	59.71	1.48
SE	45.57	26.64	26.49	1.30
SI	44.58	34.60	19.99	0.83
SK	43.73	40.17	9.85	6.26
UK	50.51	29.57	16.53	3.40
Variation between countries, %	21.69	24.47	21.05	–
Europe	44.46	31.05	23.67	0.82

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.



TABLE 6 — Sources of income inequality in the EU-28 by country group and demographic type, 2014

Country group	Age of the Household Head <sup>a</sup>			
	< 60, without children	< 60, children	≥ 60	all
BC	0.214	0.248	0.198	0.233
CEE	0.164	0.132	0.175	0.158
EEC	0.190	0.214	0.311	0.223
LME	0.192	0.152	0.151	0.175
MC	0.188	0.202	0.205	0.199
SDC	0.137	0.100	0.139	0.125
Europe	0.215	0.200	0.229	0.215

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

TABLE 7 — Contribution to income inequality in the EU-28 by country group and demographic group, 2014

Country group	Contribution to Country Group Inequality in %			
	Age of the Household Head <sup>a</sup>			variation between hh
	< 60, without children	< 60, children	≥ 60	
BC	41.56	41.05	13.54	3.85
CEE	45.94	27.08	26.27	0.70
EEC	38.82	35.53	24.67	0.98
LME	49.53	30.70	16.64	3.13
MC	42.38	32.24	24.35	1.02
SDC	44.68	28.85	25.63	0.83
Variation between country groups, %	18.33	20.37	17.56	–
Europe	44.46	31.05	23.67	0.82

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used. Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

## 5 The effect of government redistribution on income inequality in the EU-28

This section tackles the second research question and analyses the effect of government redistribution on income inequality in the EU-28. I compare the measured Theil<sup>14</sup> of equivalised market household income (income before social transfers and taxes) and equivalised disposable household income (income after social transfers and taxes). The results provide insights about how social cohesion in the EU-28 is affected by income redistribution at the national level.

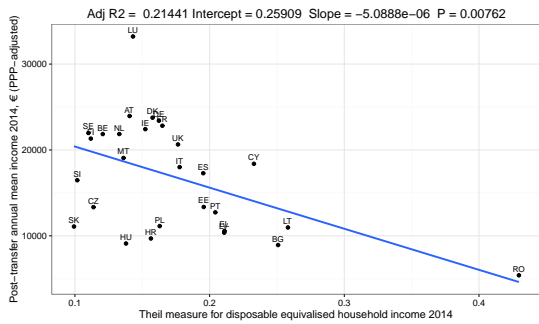
### 5.1 Redistribution on country level

The results in Table 8 illustrate that after social transfers and taxes income inequality in the EU-28 decreases significantly from 0.533 (pre-transfers) to 0.215 (post-transfers). Nevertheless, the relative contribution of between-country inequality to the aggregated inequality increases from 10.1% (pre-transfers) to 21.7% (post-transfers). Thus, government redistribution increases the relative contribution of between-country differences, which indicates that the degree of redistribution varies among member states. This is driven by differences in income levels as the results in section 4 show that country groups with high annual mean incomes show the lowest income inequality.

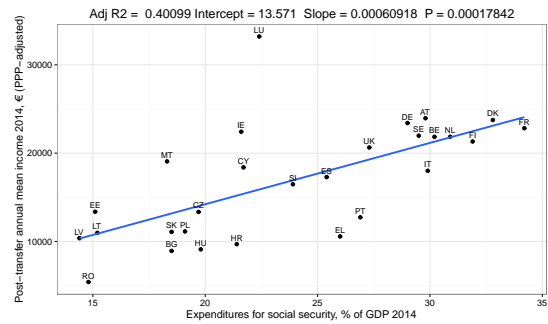
Thus, I follow the conjecture of Beblo and Knaus (2001) who assume “[...] *that richer countries have more extensive social protection schemes in order to lower the gap between high and low income earners*” (Beblo and Knaus, 2001, p. 317) and test their hypothesis for the countries of the EU-28. Hence, Figure 3 compares the relationship between post-transfer annual mean incomes and (a) inequality, (b) expenditures for social security and (c) redistribution. The results show a significant negative relationship between post-transfer annual mean incomes and inequality. Furthermore, Figure 3 illustrates a significant positive relationship between post-transfer annual mean incomes and expenditures for social security with regard to GDP. In addition, I find a significant positive relationship between post-transfer annual mean incomes and the relative reduction of the Theil index after redistribution. Therefore, the results underline the assumption that high income countries show lower inequality, invest more in social expenditures and reduce inequality at a larger extent than low income countries.

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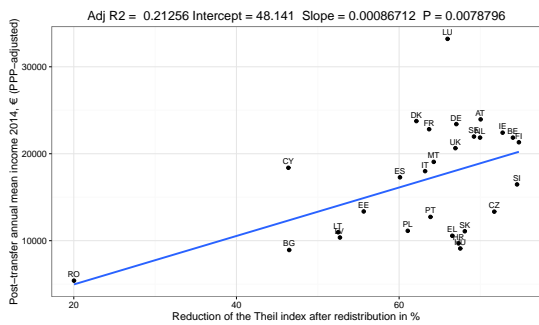
<sup>14</sup>The nature of the Theil allows me to consider only incomes greater than zero. Calculating pre-transfer Theil indices would therefore lead to a loss of many observations as a great number of individuals do not consider any market income. To have a balanced sample when comparing pre-transfer and post-transfer Theil indices, I assign each individual with a market income of zero an artificial income of  $1 * 10^{-8}$ .



(a) Post-transfer mean incomes and income inequality



(b) Post-transfer mean incomes and social expenditures



(c) Post-transfer mean incomes and redistribution

Source: Own calculations, EU-SILC 2014 & 2015, Eurostat

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

- (a) In this Figure I find a significant negative relationship between annual mean incomes and the amount of income inequality.
- (b) This Figure illustrates a significant positive relationship between annual mean incomes and expenditures for social security.
- (c) In this Figure the results show a significant positive relationship between annual mean incomes and the reduction of income inequality due to government redistribution.

FIGURE 3 — The relationship between post-transfer annual mean incomes and redistribution among countries, 2014

## 5.2 Redistribution on country group level

To analyse the impact of socio-economic policies and institutions on income inequality, this subsection investigates the effect of government redistribution on country group level. Table 9 shows that all country groups reduce their inequality significantly after social transfers and taxes. However, after social transfers and taxes the relative contribution of between-country-group inequality increases tremendously from 8.6% (pre-transfers) to 18.4% (post-transfers), which indicates a higher variation in country group mean income incomes. To test the impact of the annual mean income on redistribution I analyse the relationship between post-transfer annual mean incomes and (a) inequality, (b) social expenditures and (c) redistribution on country group level in Figure 4.

Figure 4 illustrates the same relationships on country group level and shows that country

TABLE 8 — Sources of income inequality in the EU-28 before and after government redistribution by country, 2014

Country	Pre-Transfer Theil <sup>a</sup>	Pre-Transfer Share <sup>c</sup> (%)	Post-Transfer Theil <sup>b</sup>	Post-Transfer Share <sup>c</sup> (%)
AT	0.469	2.0	0.141	1.5
BE	0.464	2.3	0.121	1.5
BG	0.469	0.6	0.251	0.8
CY	0.434	0.1	0.233	0.2
CZ	0.402	1.1	0.114	0.8
DE	0.492	19.8	0.162	15.3
DK	0.416	1.3	0.158	1.1
EE	0.441	0.2	0.196	0.2
EL	0.630	1.5	0.211	1.2
ES	0.489	7.3	0.195	7.9
FI	0.442	1.0	0.112	0.7
FR	0.454	12.5	0.165	12.0
HR	0.478	0.4	0.156	0.3
HU	0.425	0.7	0.138	0.6
IE	0.558	1.2	0.152	0.8
IT	0.483	10.6	0.178	9.8
LT	0.544	0.3	0.258	0.4
LU	0.420	0.1	0.143	0.1
LV	0.446	0.2	0.211	0.2
MT	0.381	0.1	0.136	0.1
NL	0.442	3.8	0.133	2.5
PL	0.418	3.6	0.163	3.5
PT	0.565	1.5	0.204	1.4
RO	0.537	1.1	0.430	2.3
SE	0.357	1.6	0.110	1.2
SI	0.399	0.3	0.102	0.2
SK	0.311	0.4	0.099	0.3
UK	0.534	14.4	0.177	11.6
Between countries	0.054	10.1	0.047	21.7
Europe	0.533	100	0.215	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: All income are PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> Income is defined as equivalised market household income.

<sup>b</sup> Income is defined as equivalised disposable household income.

<sup>c</sup> The share represents the contribution of a country to the overall inequality of the EU-28.

TABLE 9 — Sources of income inequality in the EU-28 before and after government redistribution by country group, 2014

Country	Pre-Transfer Theil <sup>a</sup>	Pre-Transfer Share <sup>c</sup> (%)	Post-Transfer Theil <sup>b</sup>	Post-Transfer Share <sup>c</sup> (%)
BC	0.493	0.7	0.233	0.8
CEE	0.474	40.8	0.158	33.0
EEC	0.474	8.9	0.223	10.7
LME	0.535	15.6	0.175	12.5
MC	0.507	21.4	0.198	21.7
SDC	0.403	4.0	0.125	2.9
Between country groups	0.046	8.6	0.040	18.4
Europe	0.533	100	0.215	100

Source: Own calculations, EU-SILC 2014 & 2015

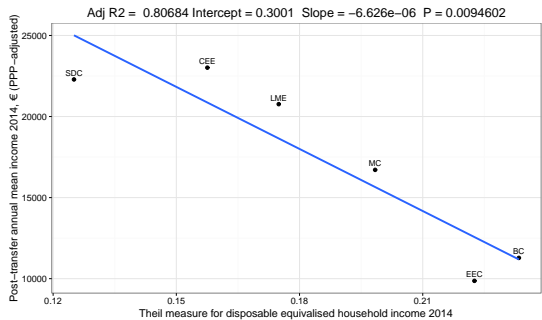
Notes: All income are PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> Income is defined as equivalised market household income.

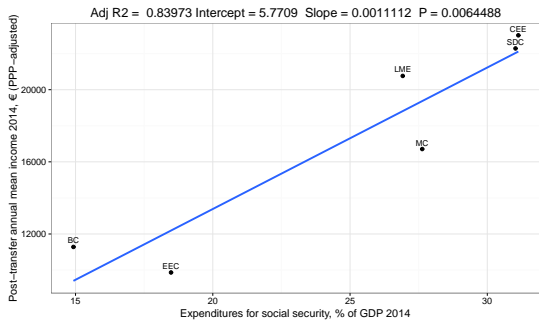
<sup>b</sup> Income is defined as equivalised disposable household income.

<sup>c</sup> The share represents the contribution of a country group to the overall inequality of the EU-28.

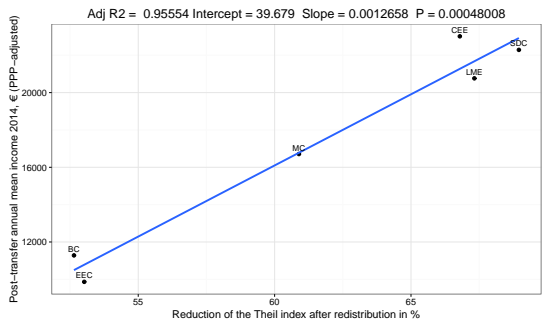
groups with high post-transfer annual mean incomes have lower inequality, higher rates of social expenditures and redistribute more than low income country groups. Regarding redistribution country groups split into two poles. CEE, LME and SDC show the highest annual mean incomes, social expenditures and reduction in inequality, while BC and EEC show the opposite result. MC lie between these two extremes and show a moderate degree of redistribution.



(a) Post-transfer mean incomes and inequality



(b) Post-transfer mean incomes and social expenditures



(c) Post-transfer mean incomes and redistribution

Source: Own calculations, EU-SILC 2014 & 2015, Eurostat  
 Notes: Based on Aristei and Perugini (2015), countries are clustered into country groups with regard to similar socio-economic policies and institutions.  
 Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.  
 (a) In this Figure I find a significant negative relationship between annual mean incomes and the amount of income inequality.  
 (b) This Figure illustrates a significant positive relationship between annual mean incomes and expenditures for social security.  
 (c) In this Figure the results show a significant positive relationship between annual mean incomes and the reduction of income inequality due to government redistribution.

FIGURE 4 — The relationship between post-transfer annual mean incomes and redistribution among country groups, 2014

The results in this section support the hypothesis of Beblo and Knaus (2001) and show that the richer a country, as measured by annual mean income, the more it invests in social expenditures and the more it reduces inequality. Thus, I find that differences in economic power among the member states of the EU-28 have a crucial impact on social cohesion. An European wide social policy needs therefore to aim for income convergence among member states and to support economic growth in low income countries, especially in BC and EEC.

## 6 Sensitivity analyses

To test the robustness of my results, I carry out two sensitivity analyses and report the results in the appendix. The first replicates the results in section 4 and 5 by using the Mean Logarithmic Deviation (MLD). This approach investigates if the conclusions in sections 4 and 5 change when population based weights are used instead of income share based weights. In a second sensitivity analysis, I include old age benefits into market incomes to isolate the effect of the pension system on income inequality.

### 6.1 Mean Logarithmic Deviation

As discussed in section 3, I test the reliability of my result by calculating the Mean Logarithmic Deviation (MLD) which is defined as

$$T(0) = \frac{1}{N} \sum_{i=1}^N \ln\left(\frac{\mu}{y_i}\right) \quad (3)$$

with

$N$  size of the population

$\mu$  mean income

$y_i$  individual income

According to Bourguignon (1979), Cowell (1980) and Shorrocks (1980)  $T(0)$  can be decomposed as follows

$$T(0) = \underbrace{\sum_{k=1}^K p_k \times T(0)_k}_{\text{within component}} + \underbrace{\sum_{k=1}^K p_k \ln\left(\frac{\mu}{\mu_k}\right)}_{\text{between component}} \quad (4)$$

with

$K$  population subgroup

$p_k$  population share of subgroup  $k$

$T(0)_k$  MLD of subgroup  $k$

$\mu$  mean income

$\mu_k$  mean income of subgroup  $k$

From equation 4 we see that the MLD uses population based weights,  $p_k$ , for calculating each country's contribution to overall inequality, compared to income share based weights when calculating the Theil index. The main results of this study remain unaltered when using the MLD, rather than the Theil index. However, some results are sensitive to the choice of measure used to calculate inequality. First, the use of population based weights of the MLD, instead of income share based weights, changes the contribution of single countries signif-

icantly. For example, Romania has an income share of 1.2% but represents around 3.9% of the EU-28 population. Therefore, when using the MLD, Romania's contribution to the aggregated inequality of the EU-28 more than doubles from 2.3% (Theil) to 4.9% (MLD). However, the MLD indicates an income inequality of 0.229 points in 2014 for the EU-28, which is slightly higher than the finding of Hoffmeister (2009), who calculates a MLD of 0.216 points for the EU-25 in the year 2000. Second, the results show that the relative contribution of between-country inequality increases significantly from 21.7% (Theil) to 24.7% (MLD) for disposable income but decreases sharply from 10.1% (Theil) to 2% (MLD) for market incomes. Third, when I decompose the MLD by demographic groups results change and households with hh older than 59 years of age show the lowest, while households with hh without children show the highest income inequality. Forth, analysing the impact of redistribution reveals that inequality decreases significantly more after transfers and taxes, using the MLD (−92.9%) compared to the Theil (−59.7%). Moreover, the results find no significant relationship between post-transfer annual mean incomes and redistribution on country group level. To summarise, the main conclusions regarding social cohesion for the EU-28 remain unaltered, whether using the MLD or the Theil index. Nevertheless, I find that the use of the MLD changes the contribution of single countries, the relative contribution of between-country inequality, the results regarding demographic subgroups and the degree of redistribution.

## 6.2 The effect of old age benefits on income inequality

According to results of Eurofound (2017), pensions are the most important element of social benefits with regard to redistribution. They state that notably in BC, EEC and MC the pension system has a significant role in reducing inequality. Therefore, I include old age benefits into market incomes and illustrate the impact of the pension system on income inequality. The results show that inequality for market income significantly decreases from 0.533 to 0.346, when old age benefits are taken into account. However, Table 19 indicates that the relative contribution of between-country differences increases from 10.1% to 14.7%. The same holds true when considering country groups in Table 20, where the relative contribution of between-country-group inequality increases from 8.6% to 12.7%. Therefore, the results show that the inclusion of old age benefits in market incomes lowers inequality but increases the relative contribution of between-country and between-country-group inequality.

## 7 Conclusion

In this paper, I analysed the composition of income inequality in the EU-28 for 2014 in two steps. First, I decomposed income inequality into a within- and between-component by

three subgroups, which are defined as countries, country groups and demographic groups. This approach shows the construction and identifies the sources of income inequality in Europe. In a second step, I analysed the effect of government redistribution on income inequality in the EU-28. For the empirical analysis I used the Theil index, an inequality measure that is additively decomposable, and data from the European Survey on Income and Living Conditions comprising income data for over half a million observations for the year 2014.

Decomposing income inequality in the EU-28 shows that between-country inequality contributes around 21.7%, whereas within-country inequality contributes 78.3% to the aggregated Theil index of 0.215. Clustering countries into groups with similar socio-economic policies and institutions reveals that income inequality is particularly low in Social-Democratic countries, while Baltic countries show the highest inequality. Income inequality decomposition by demographic groups shows the highest inequality for households with household heads older than 59 years and the lowest income inequality for household heads with children. Furthermore, Social-Democratic countries have the lowest income inequality among all demographic groups, which indicates the high effectiveness of their social policy. Moreover, government redistribution at the national level reduces income inequality significantly from 0.533 (pre-transfers) to 0.215 (post-transfers) but leads to an increase in the contribution of between-country inequality from 10.1% (pre-transfers) to 21.7% (post-transfers). The latter indicates that the amount of redistribution varies tremendously among member states, which can be explained by the finding that high income countries have lower income inequality, higher social expenditures and redistribute more than low income countries. In addition, when testing the robustness of my results by applying the Mean Logarithmic Deviation, the results illustrate changes in the contribution of the within- and between-component and show a decrease in the reduction of inequality after government redistribution. Moreover, the inclusion of old age benefits into market incomes illustrates differences in the performance of pension systems within the EU-28 as it increases the relative contribution of between-country and between-country-group inequality.

The results of this study offer two important implications to increase social cohesion for the EU-28: First, after government redistribution Social-Democratic countries show the strongest relative reduction in income inequality and the lowest income inequality among country groups. Therefore, they seem to have the most effective socio-economic policies and institutions and should work as a role model for the setting up of an European wide social policy framework. Second, the economic power of a country, as measured by annual mean income, plays an important role to reduce income inequality. Thus, an EU-28 wide social policy should aim for income convergence among member states and support economic growth especially in Baltic and Eastern European countries.



# Appendix

## Tables

TABLE 10 — Income distribution in the EU-28 per decile among countries - Population share in %, 2014

Country	Income decile										Mean <sup>a</sup>
	1	2	3	4	5	6	7	8	9	10	
AT	0.34	0.36	0.82	1.06	1.57	1.90	2.43	2.73	2.93	2.84	1.70
BE	0.26	0.80	1.42	2.20	2.39	2.47	2.82	3.39	3.59	2.86	2.22
BG	5.35	3.77	1.96	1.21	0.75	0.47	0.28	0.23	0.21	0.24	1.45
CY	0.06	0.19	0.25	0.22	0.18	0.18	0.18	0.15	0.13	0.15	0.17
CZ	1.09	3.28	4.63	3.76	2.96	1.99	1.20	0.80	0.51	0.49	2.07
DE	4.98	6.47	9.59	11.91	15.38	18.55	20.18	20.97	24.67	27.65	16.03
DK	0.32	0.22	0.32	0.71	1.18	1.40	1.57	1.83	2.02	1.71	1.13
EE	0.41	0.57	0.33	0.30	0.26	0.20	0.17	0.14	0.12	0.11	0.26
EL	5.31	5.04	3.46	2.51	1.79	1.25	0.93	0.55	0.36	0.30	2.15
ES	10.23	9.92	9.88	9.84	9.70	9.48	8.44	8.54	8.03	8.14	9.22
FI	0.10	0.30	0.68	1.11	1.25	1.46	1.56	1.63	1.52	1.20	1.08
FR	1.45	3.90	8.70	11.25	13.78	15.99	17.94	17.70	16.71	17.77	12.52
HR	2.14	2.19	1.42	0.99	0.67	0.43	0.25	0.14	0.11	0.05	0.84
HU	5.07	6.15	3.37	2.12	1.15	0.65	0.43	0.25	0.15	0.09	1.94
IE	0.18	0.32	0.76	0.96	1.09	1.02	1.00	1.22	1.27	1.50	0.93
IT	10.02	10.89	12.94	13.26	13.44	13.94	13.56	12.97	10.96	9.99	12.20
LT	1.67	1.35	0.70	0.62	0.51	0.34	0.22	0.19	0.11	0.15	0.59
LU	0.01	0.01	0.01	0.03	0.05	0.07	0.10	0.13	0.20	0.43	0.10
LV	1.14	0.89	0.55	0.40	0.32	0.21	0.13	0.12	0.10	0.07	0.39
MT	0.01	0.07	0.10	0.09	0.10	0.10	0.10	0.10	0.09	0.08	0.08
NL	0.54	0.91	1.70	3.28	4.13	4.39	5.06	5.01	4.52	4.07	3.36
PL	13.69	18.11	14.02	9.67	6.65	4.50	3.22	2.28	1.59	1.19	7.49
PT	3.42	4.20	3.29	2.79	2.14	1.51	1.07	0.89	0.75	0.73	2.08
RO	26.44	8.58	2.66	1.25	0.54	0.15	0.04	0.03	0.00	0.04	3.97
SE	0.43	0.57	1.06	1.62	1.85	2.31	2.73	3.17	3.38	2.39	1.95
SI	0.13	0.38	0.42	0.53	0.64	0.65	0.50	0.37	0.25	0.15	0.40
SK	1.15	2.30	2.44	1.86	1.38	0.69	0.37	0.17	0.08	0.06	1.05
UK	4.05	8.25	12.50	14.45	14.17	13.84	13.40	14.41	15.58	15.55	12.62

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

The numbers in this table illustrate a country's population in the respective income decile of the EU-28 in percentage terms.

<sup>a</sup> The mean represents a country's population share within the EU-28.

TABLE 11 — Sensitivity analysis: Sources of income inequality in the EU-28 by country, 2014

Country	MLD	Annual Mean Income	Inequality Share <sup>a</sup> (%)	Population weight <sup>b</sup> (%)
AT	0.140	23,953	1.0	1.7
BE	0.117	21,852	1.1	2.2
BG	0.246	8,930	1.6	1.4
CY	0.191	18,387	0.1	0.2
CZ	0.106	13,340	1.0	2.1
DE	0.159	23,409	11.1	15.9
DK	0.140	23,757	0.7	1.1
EE	0.207	13,363	0.2	0.3
EL	0.219	10,567	2.1	2.2
ES	0.220	17,291	8.9	9.2
FI	0.108	21,320	0.5	1.1
FR	0.144	22,821	7.9	13.0
HR	0.170	9,690	0.6	0.8
HU	0.139	9,105	1.2	1.9
IE	0.151	22,424	0.6	0.9
IT	0.195	18,000	10.4	12.0
LT	0.251	10,972	0.6	0.6
LU	0.139	33,212	0.1	0.1
LV	0.221	10,366	0.4	0.4
MT	0.131	19,066	0.0	0.1
NL	0.125	21,856	1.8	3.3
PL	0.166	11,135	5.5	7.5
PT	0.209	12,734	1.9	2.1
RO	0.283	5,404	4.9	3.9
SE	0.120	21,977	1.0	1.9
SI	0.104	16,473	0.2	0.4
SK	0.114	11,084	0.5	1.1
UK	0.167	20,642	9.3	12.7
Between countries	–	–	24.7	–
Europe	0.229	18,371	100	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> The inequality share represents the contribution of a country to the overall inequality of the EU-28.

<sup>b</sup> The population weight describes the population share of a country with regard to the overall population of the EU-28.

TABLE 12 — Sensitivity analysis: Sources of income inequality in the EU-28 by country group, 2014

Country group	MLD	Annual Mean Income	Inequality Share <sup>a</sup> (%)	Population weight <sup>b</sup> (%)
BC	0.237	11,282	1.3	0.8
CEE	0.147	23,015	23.2	45.0
EEC	0.227	9,866	19.1	10.4
LME	0.167	20,764	9.9	15.3
MC	0.219	16,710	24.7	23.5
SDC	0.123	22,288	2.2	5.1
Between country groups	0.045	–	19.6	–
Europe	0.229	18,371	100	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> The inequality share represents the contribution of a country group to the overall inequality of the EU-28.

<sup>b</sup> The population weight describes the population share of a country group with regard to the overall population of the EU-28.

TABLE 13 — Sensitivity analysis: Sources of income inequality in the EU-28 by country and demographic group, 2014

Country	Age of the Household Head <sup>a</sup>			all
	< 60, without children	< 60, children	≥ 60	
AT	0.138	0.113	0.167	0.140
BE	0.123	0.102	0.117	0.117
BG	0.212	0.276	0.216	0.246
CY	0.198	0.165	0.233	0.191
CZ	0.104	0.120	0.066	0.106
DE	0.173	0.138	0.150	0.159
DK	0.163	0.120	0.127	0.140
EE	0.211	0.206	0.144	0.207
EL	0.227	0.245	0.164	0.219
ES	0.215	0.242	0.183	0.220
FI	0.129	0.078	0.112	0.108
FR	0.148	0.118	0.169	0.144
HR	0.168	0.143	0.186	0.170
HU	0.150	0.137	0.104	0.139
IE	0.162	0.136	0.162	0.151
IT	0.189	0.206	0.178	0.195
LT	0.240	0.292	0.165	0.251
LU	0.147	0.137	0.118	0.139
LV	0.203	0.224	0.204	0.221
NL	0.140	0.111	0.117	0.125
PL	0.170	0.169	0.145	0.166
PT	0.211	0.198	0.216	0.209
RO	0.218	0.291	0.368	0.283
SE	0.156	0.085	0.114	0.120
SI	0.103	0.096	0.116	0.104
SK	0.096	0.138	0.069	0.114
UK	0.183	0.148	0.144	0.167
Europe	0.232	0.225	0.221	0.229

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

TABLE 14 — Sensitivity analysis: Contribution to income inequality in the EU-28 by country and demographic group, 2014

Country	Contribution to Country Inequality in %			
	Age of the Household Head <sup>a</sup>			variation between hh
	< 60, without children	< 60, children	≥ 60	
AT	46.26	26.53	24.11	3.10
BE	43.47	32.53	21.28	2.72
BG	36.78	40.00	18.91	4.30
CY	45.03	34.53	19.92	0.52
CZ	42.19	40.52	13.05	4.25
DE	48.90	25.57	24.15	1.38
DK	47.31	30.63	21.60	0.46
EE	40.31	38.68	14.97	6.04
EL	43.12	37.34	18.79	0.76
ES	42.73	39.65	16.95	0.67
FI	48.17	25.02	25.80	1.01
FR	39.12	31.90	27.15	1.83
HR	41.79	30.65	23.46	4.10
HU	49.32	33.74	15.14	1.80
IE	36.54	43.12	19.34	1.00
IT	40.28	35.64	22.42	1.66
LT	40.89	41.57	14.15	3.39
LU	47.28	37.77	14.26	0.69
LV	38.08	38.61	18.91	4.40
NL	45.93	32.89	20.97	0.21
PL	42.15	41.45	15.60	0.79
PT	40.12	33.65	25.71	0.53
RO	31.60	39.70	26.43	2.27
SE	47.85	27.66	23.31	1.18
SI	44.12	34.46	20.59	0.83
SK	38.59	46.41	9.56	5.44
UK	44.41	33.40	18.64	3.55
Variation between countries, %	24.41	26.55	26.09	–
Europe	42.25	35.32	21.66	0.77

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

TABLE 15 — Sensitivity analysis: Sources of income inequality in the EU-28 by country group and demographic group, 2014

Country group	Age of the Household Head <sup>a</sup>			
	< 60, with-out children	< 60, children	≥ 60	all
BC	0.227	0.256	0.176	0.237
CEE	0.158	0.124	0.156	0.147
EEC	0.211	0.247	0.210	0.227
LME	0.182	0.148	0.145	0.167
MC	0.215	0.231	0.200	0.219
SDC	0.151	0.094	0.118	0.123
Europe	0.232	0.225	0.221	0.229

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

TABLE 16 — Sensitivity analysis: Contribution to income inequality in the EU-28 by country group and demographic group, 2014

Country group	Contribution to Country Inequality in %			
	Age of the Household Head <sup>a</sup>			variation between hh
	< 60, with-out children	< 60, children	≥ 60	
BC	39.98	40.23	15.72	4.07
CEE	45.10	28.83	25.32	0.75
EEC	39.38	41.77	17.89	0.96
LME	43.86	34.19	18.70	3.26
MC	41.47	36.54	21.05	0.94
SDC	47.60	28.20	23.36	0.85
Variation between country groups, %	19.18	20.08	21.22	–
Europe	42.25	35.32	21.66	0.77

Source: Own calculations, EU-SILC 2014 & 2015

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used. Malta had to be excluded because it does not report information about the age of individuals.

<sup>a</sup> The household head is defined as the person with the highest income of at least 18 years of age. When two household members have the same income, the oldest person is chosen to be the household head.

TABLE 17 — Sensitivity analysis: Sources of income inequality in the EU-28 before and after government redistribution by country, 2014

Country	Pre-Transfer MLD <sup>a</sup>	Pre-Transfer Share <sup>c</sup> (%)	Post-Transfer MLD <sup>b</sup>	Post-Transfer Share <sup>c</sup> (%)
AT	2.487	1.0	0.140	1.0
BE	3.637	1.9	0.117	1.1
BG	3.468	1.2	0.246	1.6
CY	2.522	0.1	0.191	0.1
CZ	3.470	1.7	0.106	1.0
DE	2.684	10.3	0.159	11.1
DK	1.307	0.3	0.140	0.7
EE	4.070	0.3	0.207	0.2
EL	5.887	3.0	0.219	2.1
ES	2.568	5.6	0.220	8.9
FI	2.201	0.6	0.108	0.5
FR	1.526	4.6	0.144	7.9
HR	5.030	1.0	0.170	0.6
HU	4.100	1.8	0.139	1.2
IE	5.660	1.3	0.151	0.6
IT	3.201	9.4	0.195	10.4
LT	4.872	0.7	0.251	0.6
LU	2.417	0.1	0.139	0.1
LV	3.495	0.3	0.221	0.4
MT	0.923	0.0	0.131	0.0
NL	1.616	1.3	0.125	1.8
PL	4.090	7.3	0.166	5.5
PT	4.951	2.5	0.209	1.9
RO	5.205	5.0	0.283	4.9
SE	1.569	0.7	0.120	1.0
SI	2.622	0.3	0.104	0.2
SK	3.667	0.9	0.114	0.5
UK	3.985	12.0	0.167	9.3
Between countries	0.065	2.0	0.057	24.7
Europe	3.214	100	0.229	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: All income are PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> Income is defined as equivalised market household income.

<sup>b</sup> Income is defined as equivalised disposable household income.

<sup>c</sup> The share represents the contribution of a country to the overall inequality of the EU-28.

Cross-sectional weights from the EU-SILC are used.

TABLE 18 — Sensitivity analysis: Sources of income inequality in the EU-28 before and after government redistribution by country group, 2014

Country group	Pre-Transfer MLD <sup>a</sup>	Pre-Transfer Share <sup>c</sup> (%)	Post-Transfer MLD <sup>b</sup>	Post-Transfer Share <sup>c</sup> (%)
BC	4.271	1.7	0.237	1.3
CEE	2.232	25.0	0.147	23.2
EEC	4.247	25.4	0.227	19.1
LME	4.100	17.3	0.167	9.9
MC	3.339	26.9	0.219	24.7
SDC	1.678	2.1	0.123	2.2
Between country groups	0.051	1.6	0.045	19.6
Europe	3.214	100	0.229	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: All income are PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> Income is defined as equivalised market household income.

<sup>b</sup> Income is defined as equivalised disposable household income.

<sup>c</sup> The share represents the contribution of a country group to the overall inequality of the EU-28.

TABLE 19 — Sensitivity analysis: Sources of income inequality in the EU-28 before and after government redistribution by country (including old-age benefits in market income), 2014

Country	Pre-Transfer Theil <sup>a</sup>	Pre-Transfer Share <sup>c</sup> (%)	Post-Transfer Theil <sup>b</sup>	Post-Transfer Share <sup>c</sup> (%)
AT	0.267	1.8	0.141	1.5
BE	0.267	2.0	0.121	1.5
BG	0.292	0.5	0.251	0.8
CY	0.337	0.1	0.233	0.2
CZ	0.201	0.8	0.114	0.8
DE	0.284	17.4	0.162	15.3
DK	0.277	1.3	0.158	1.1
EE	0.273	0.1	0.196	0.2
EL	0.331	1.3	0.211	1.2
ES	0.347	7.8	0.195	7.9
FI	0.257	0.9	0.112	0.7
FR	0.266	11.7	0.165	12.0
HR	0.324	0.4	0.156	0.3
HU	0.221	0.6	0.138	0.6
IE	0.414	1.2	0.152	0.8
IT	0.293	10.3	0.178	9.8
LT	0.355	0.3	0.258	0.4
LU	0.242	0.1	0.143	0.1
LV	0.282	0.2	0.211	0.2
MT	0.230	0.1	0.136	0.1
NL	0.269	3.6	0.133	2.5
PL	0.231	3.1	0.163	3.5
PT	0.362	1.6	0.204	1.4
RO	0.529	1.8	0.430	2.3
SE	0.209	1.4	0.110	1.2
SI	0.234	0.2	0.102	0.2
SK	0.153	0.3	0.099	0.3
UK	0.361	14.4	0.177	11.6
Between countries	0.051	14.7	0.047	21.7
Europe	0.346	100	0.215	100

Source: Own calculations, EU-SILC 2014 & 2015

Notes: All income are PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> Income is defined as equivalised market household income.

<sup>b</sup> Income is defined as equivalised disposable household income.

<sup>c</sup> The share represents the contribution of a country to the overall inequality of the EU-28.

TABLE 20 — Sensitivity analysis: Sources of income inequality in the EU-28 before and after government redistribution by country group (including old-age benefits in market income), 2014

Country group	Pre-Transfer Theil <sup>a</sup>	Pre-Transfer Share <sup>c</sup> (%)	Post-Transfer Theil <sup>b</sup>	Post-Transfer Share <sup>c</sup> (%)
BC	0.316	0.6	0.233	0.8
CEE	0.276	36.7	0.158	33.0
EEC	0.302	8.8	0.223	10.7
LME	0.364	15.6	0.175	12.5
MC	0.327	21.8	0.198	21.7
SDC	0.245	3.7	0.125	2.9
Between country groups	0.044	12.7	0.040	18.4
Europe	0.346	100	0.215	100

Source: Own calculations, EU-SILC 2014 & 2015

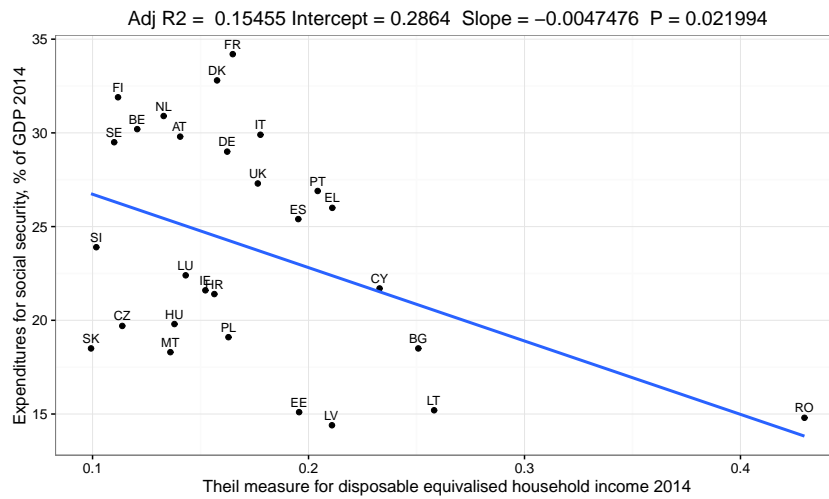
Notes: All income are PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

<sup>a</sup> Income is defined as equivalised market household income.

<sup>b</sup> Income is defined as equivalised disposable household income.

<sup>c</sup> The share represents the contribution of a country group to the overall inequality of the EU-28.

## Figures

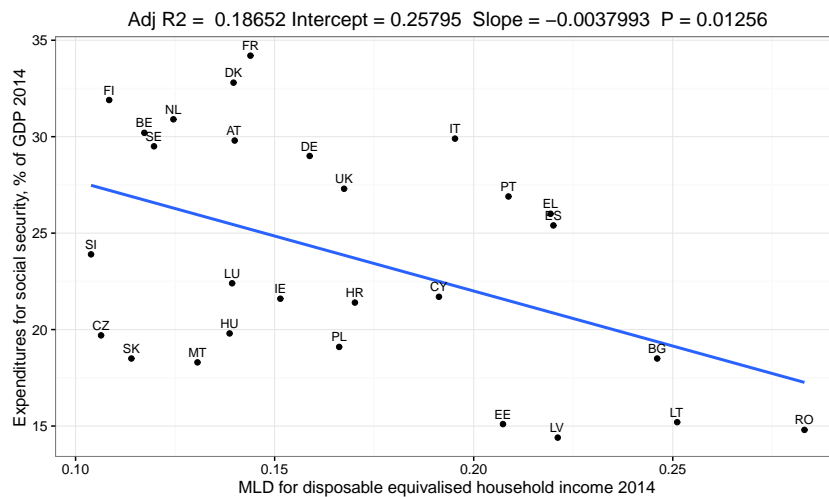


Source: Own calculations, EU-SILC 2014 & 2015, Eurostat

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

This Figure illustrates a significant negative relationship between social expenditures for social security and the value of the Theil index.

FIGURE 5 — The relationship between social expenditures and income inequality among countries, 2014

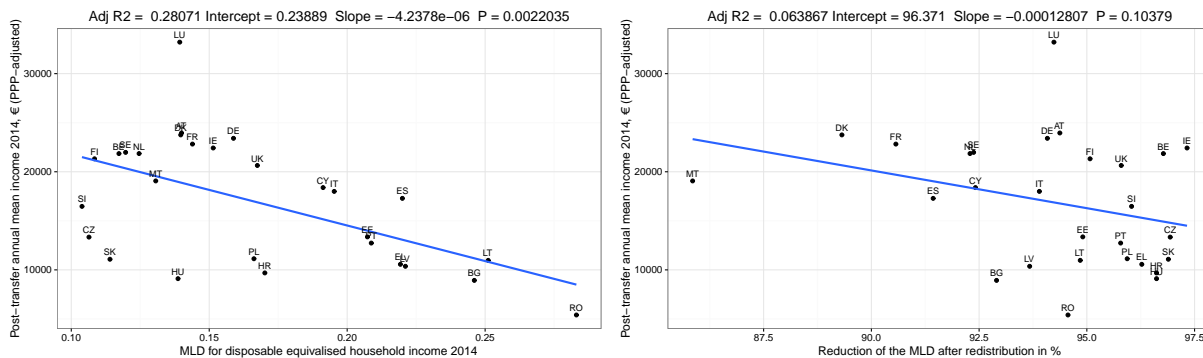


Source: Own calculations, EU-SILC 2014 & 2015, Eurostat

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

This Figure illustrates a significant negative relationship between social expenditures for social security and the value of the MLD.

FIGURE 6 — Sensitivity analysis: The relationship between social expenditures and income inequality among countries, 2014



(a) Post-transfer mean incomes and income inequality (b) Post-transfer mean incomes and redistribution

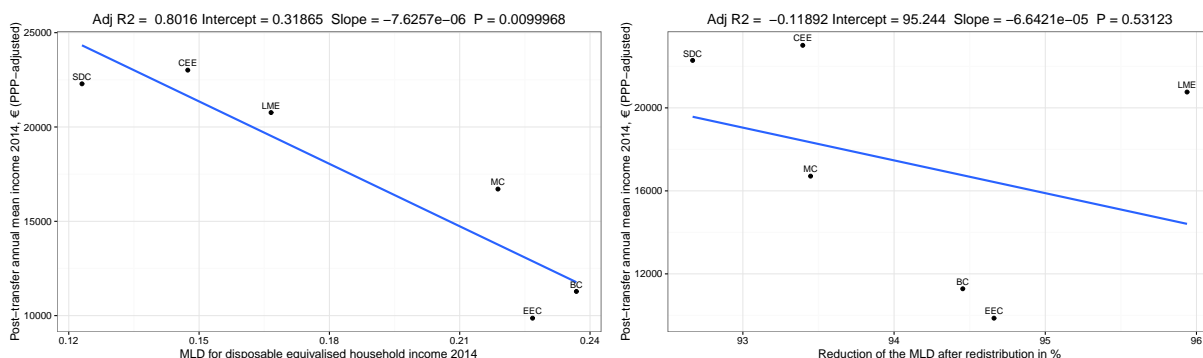
Source: Own calculations, EU-SILC 2014 & 2015, Eurostat

Notes: Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

(a) In this Figure I find a significant negative relationship between annual mean incomes and the amount of income inequality.

(b) This Figure illustrates an insignificant relationship between annual mean incomes and the reduction of income inequality due to government redistribution.

FIGURE 7 — Sensitivity analysis: The relationship between post-transfer annual mean incomes and redistribution among countries, 2014



(a) Post-transfer mean incomes and income inequality (b) Post-transfer mean incomes and redistribution

Source: Own calculations, EU-SILC 2014 & 2015, Eurostat

Notes: Based on Aristei and Perugini (2015), countries are clustered into country groups with regard to similar socio-economic policies and institutions.

Income is defined as equivalised disposable household income and PPP-adjusted (EU-28=1). The income reference year for Germany is 2013. Cross-sectional weights from the EU-SILC are used.

(a) In this Figure I find a significant negative relationship between annual mean incomes and the amount of income inequality.

(b) This Figure illustrates an insignificant relationship between annual mean incomes and the reduction of income inequality due to government redistribution.

FIGURE 8 — Sensitivity analysis: The relationship between post-transfer annual mean incomes and redistribution among country groups, 2014



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