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Redistribution across Europe: How much and to whom?

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Governments face a potential trade-off between provision for the growing population in retirement and the support of working-age households with low income. Using EUROMOD-based microdata from 28 countries, we (a) quantify the redistribution to the pensioner and non-pensioner populations, (b) study the position of net beneficiaries in the overall income distribution and (c) analyse how taxes and benefits affect the working-age population with low income. Our results provide novel insights into the distributive role of tax-benefit systems across Europe. Interestingly, a strong overall redistribution between households is associated with generous pensions for a portion of the retirees but negatively related to support for low-income households.

Keywords: Redistribution, Welfare state, Inequality, Microsimulation, EUROMOD

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1. Introduction

Government redistribution differs considerably across European countries, most notably in the old-age provision and the support of working-age households with low income. However, most comparative studies of tax-benefit systems do not account for their distinct distributive roles. Some studies use macro-economic data, which provide very limited information about how redistribution affects selected groups in the population. Other studies use microdata, but evaluate government redistribution with regard to income inequality only. Both approaches miss important differences in the redistributive effects and functions of tax-benefit systems, potentially leading to misapprehensions regarding their strengths and shortcomings.

The availability of comparative microdata enables a detailed analysis of government redistribution, going well beyond a one-dimensional analysis of its effect on inequality. The European Statistics on Income and Living Conditions (EU-SILC), together with the EUROMOD microsimulation model, provide individual- and household-level information on income, taxes, benefits and socio-economic characteristics. We use these data to carry out a differentiated evaluation of European welfare states, including the extent of redistribution to pensioners and non-pensioners, the position of beneficiaries in the income distribution, and, more specifically, how taxes and benefits affect low-income households of working age.

1.1. Government redistribution and inequality

The most common approach for evaluating government redistribution compares inequality in pre-tax market income and post-benefit disposable income. This difference is often termed the Reynolds–Smolensky index (RSI), referring to Reynolds and Smolensky (1977). The RSI can be calculated with different inequality measures, but the most commonly used measure is the Gini index. In general, inequality in disposable income is found to be much lower than in market income in all countries, with pensions and direct taxes accounting for most of the difference (e.g. Avram et al., 2014; Kammer et al., 2012). Pensions are also the reason for a small increase of the RSI over time (Wang et al., 2014; Caminada et al., 2019).

However, the RSI provides an incomplete and potentially misleading picture of government redistribution. First, taxes and benefit programmes influence labour force participation and savings, and thereby affect the distribution of market income (Pedersen, 1994; Bergh, 2005). With taxes and benefits affecting inequality in market income, the RSI does not measure the net effect of government redistribution on income. Second, even if taxes and benefits did not influence the distribution of market income, the distribution of market income differs substantially between countries and results in varying amounts of redistribution. In other words, the RSI depends not only on the tax-benefit systems but also on the level of inequality that exists before government intervention, leading to

a bias in cross-national comparisons (Lambert et al., 2020). Third, as is pointed out in another major criticism of the RSI, the difference in inequality between market and disposable income is largely determined by government programmes that replace market income such as pensions (OECD, 2008). Benefits that merely top-up low market income have a comparably small influence.

Adjustments to the RSI methodology attempt to tackle these criticisms. Jesuit and Mahler (2010) exclude public pensions from the tax-benefit system and treat them as a private scheme. This approach accounts for the effect of pensions on inequality in market income and avoids allowing pensions to hide the effect of other programmes. It is nevertheless dissatisfying to exclude the largest transfer programme from analysis, especially as the contributions may constitute a considerable burden for working-age households with low income. Bergh (2005) suggests using model-based estimates for the distribution of income without public intervention, but highlights that this approach can be fruitful only for analysis of single programmes, as there is no hint of what the income distribution would look like without the welfare state. The transplant-and-compare method suggested by Dardanoni and Lambert (2002) and Lambert et al. (2020) evaluates the performance of tax-benefit systems if they were to be applied to a population with a similar level of inequality in market income. However, this method ignores the effects of taxes and benefits on the behaviour of individuals and its consequences for market income. While these adjustments deliver tools to answer specific questions, the main challenges can hardly be solved within this framework: the strong influence of pensions on the RSI and the behavioural effect of taxes and benefits on market income.

An interesting alternative for evaluating the effect of government redistribution on inequality is the use of methods that do not rely on assumptions about income distribution without government intervention, such as the decomposition of inequality by factor components (i.e. income components) suggested by Shorrocks (1982). This approach measures the contributions of all income components to inequality in disposable income, identifying a component as inequality reducing when the population with low disposable income receives more than the population with high disposable income. Market income is found to contribute the most to inequality, while taxes are the most important instrument to reduce inequality (Fuest et al., 2010; Rani et al., 2016). In contrast to analysis using the RSI, benefits are identified as neutral or adding slightly to inequality. The two approaches are not contradictory, but instead complement each other: the RSI shows that benefits are directed to households with low market income, while the decomposition by factor components shows that benefits are sufficiently high to push beneficiaries into the group with high disposable income and thereby contribute to inequality in disposable income.

1.2. Functions of government redistribution

Government redistribution cannot be evaluated by focusing on inequality alone. By analysing public redistribution along a single dimension, we lose information about the

distinct functions, with income provision for retired persons the most important example. Lynch (2001, 2006) uses macroeconomic data to classify countries according to their old-age orientation of public spending and identifies Southern and Western/Central European as most old-age oriented, with high spending on old-age-oriented programmes. Among the countries with the strongest old-age orientation are Greece, Italy and Spain, followed by Portugal, Austria and Luxembourg. These are also the countries with the most generous public pensions and high replacement rates even for high earners (e.g. OECD, 2019). Northern European countries, including the Scandinavian countries, as well as the UK, Ireland and the Netherlands, are found to be the least old-age oriented.

In contrast to high spending for the elderly, Southern European countries are characterised by low spending for the poor, and a particularly low percentage of total spending is directed to poor households in the working-age population (Collado and Iturbe-Ormaetxe, 2010). The contrast between the extent of old-age protection and the support for the population with low income highlights the importance of analysing these functions both separately and jointly. Vanhuysse et al. (2021) use such an approach and highlight that welfare states are mainly 'inter-age reallocation machines' with limited success in reducing inequality. However, they pool European data and do not analyse the differences between countries.

The age dimension in government redistribution and the potential trade-off with protecting the poor requires particular attention in regard to demographic developments. Population ageing will increase public spending on pensions, health and long-term care in most of the EU member states (European Commission, 2018a, 2021). This raises the question of whether tax benefit systems will still be able to secure redistribution to economically vulnerable groups in the future.

1.3. A detailed analysis of government redistribution using microdata

Our paper uses microdata from EU-SILC together with the EUROMOD to describe and quantify redistribution through the tax-benefit systems in 28 European welfare states (EU-27 and the UK). The use of these microdata enables several novel insights. First, the taxes and benefits information at the level of individual households allows us to measure net redistribution to/from specific groups in the population, simultaneously accounting for taxes and benefits. Second, the microdata enable us to analyse the position of net-beneficiaries in the overall income distribution, which turns out to be a very important aspect of the redistribution systems. And third, we are able to analyse specifically the income of low-income households of working age and how taxes and benefits affect their income. The variation between countries allows us to identify the relation between the distinct roles of tax-benefit systems, in particular the relation between retirement provision and support of working-age households with low income. Furthermore, the differences between countries enables us to study which of the distinct roles of government redistribu-

tion are captured in the RSI, the standard measure of redistribution. To summarise, our analysis addresses the following questions:

1. Extent of redistribution to pensioners and non-pensioners. What is the total share of income that is redistributed to pensioner and non-pensioner households?
2. Generosity of the pension systems towards people with high income. How generous is the tax-benefit system to households in the top quarter of the income distribution?
3. Protection of low-income households. How much of total income is redistributed to the quarter of the population with the lowest income? How are working-age households in the lowest quarter of the income distribution affected by taxes and benefits?
4. Relation between the different dimensions of government redistribution. Can we observe a trade-off between the size and generosity of pension systems and the protection of the population with low income? What is the relation between the RSI and the redistributive roles of tax-benefit systems?

Our analysis focuses only on income taxes (including social security contributions) and public cash benefits. The analysis disregards indirect taxes and in-kind benefits, two components which do play an important role in the public redistribution system (Christl et al., 2020). Nevertheless, by measuring and identifying the effects of public redistribution on the disposable income of households we capture central dimensions of the redistribution system, which enables us to identify strengths and weaknesses of tax benefits systems.

2. Methodology and Data

2.1. EUROMOD

The microdata used for the analysis are based on EUROMOD, the tax-benefit microsimulation model of the European Union. The model uses EU-SILC as input data, as it is representative of the population in each country and provides information on income together with characteristics of individuals and households. EUROMOD adds detailed information on the tax-benefit systems of a country for each year and complements the data by simulating income taxes, capital gains taxes, social security contributions and social benefits. The output data include information on gross income, detailed information on taxes, social contributions and social benefits, and the resulting disposable income at the individual and household level. Use of EUROMOD allows for a consistent, comparative analysis of tax-benefit systems across all EU member states, despite their significant differences (Sutherland and Figari, 2013; Sutherland, 2007). Our analysis is based on the EUROMOD tax-benefits system for the year 2018, using individual and household data from EU-SILC 2018.

Our analysis provides a snapshot of government redistribution in the year 2018. This standard approach assumes the equal treatment of taxes and social insurance contributions. Social insurance contributions constitute a transfer from the employed population to the receiver of government benefits in exactly the same way as taxes on income. However, taking a life-cycle perspective, social security contributions to the pension system can be interpreted as future benefit-rights. This aspect is typically neglected in multi-country analyses of the redistributive effect of tax-benefit systems as the focus is on redistribution in a given year. We decided to also include social contributions paid by the employer into market income and consider them as a component of direct taxes.

2.2. Net benefits and net benefit ratios (NBRs)

The EU-SILC/EUROMOD microdata contain information on direct taxes and cash benefits at the household level. Our focus is on the net redistribution, i.e. on the difference between taxes paid and benefits received. We use the term *net benefits* if total benefits received by a household exceed taxes paid, and *net contributions* if the taxes exceed benefits. The size of taxes or benefits alone do not represent net redistribution between households, as most households are paying taxes and receiving benefits at the same time. For example, welfare systems with universal benefits are characterised by high taxes, but also by significant benefits paid to the contributors themselves. Consider working-age parents who pay income taxes and social contributions and at the same time receive childcare allowances. Liberal systems with a higher share of means-tested benefits are characterised by lower taxes but also less benefits directed to the taxpayers themselves. The net benefits and net contributions account for these differences across welfare systems and capture the effective redistribution between households.

For comparing total redistribution between countries, we use *net benefit ratios (NBRs)*, which are defined as total net benefits in relation to total disposable income (DI). The *total-NBR* measures the net benefits of all households relative to disposable income. We calculate NBRs for particular groups of households by summing up the net benefits of all households belonging to the particular group (see Table 1 for an overview). The *Q1-NBR* and the *Q4-NBR* measure net benefits directed to the quarter of the population with the lowest and highest equivalised household income, respectively. The Q1-NBR and Q4-NBR serve as an indicator of the generosity of public transfers towards the income-poor and income-rich populations. Because pensions dominate the total redistribution, we additionally distinguish within each of the NBRs between a *pensioner-NBR* and a *non-pensioner-NBR*. Pensioner households are defined as households with higher income from public and private pensions than from earnings. These ratios simply divide the NBRs according to the share of net benefits directed to the population living in pensioner households and the population in non-pensioner households, and are therefore additive: the total-NBR is the sum of the pensioner-NBR and the non-pensioner-NBR.

NBRs are particularly appealing when analysing redistribution to particular groups

Table 1: Types of net benefit ratios (NBRs)

Net benefit ratio	Description	Formula
Total-NBR Pension-NBR Non-pension-NBR	Total net benefits relative to total disposable income (DI). The pensioner- and non-pensioner-NBR divide the total-BR into the parts that are directed to pensioners and non-pensioners, respectively.	Total-NBR = $\frac{\sum \mathrm{nb}_i}{DI}, \forall\, i$ ($\mathrm{nb_i}$ refer to net benefits of individual i; $\mathrm{nb_i}$ are equal for members of the same household and calculated as net benefits of households divided by the number of its members). The pensioner and non-pensioner-NBRs are calculated as the sum of nb_i over all members of households that are classified as pensioner or non-pensioner, respectively.
Q1-NBR Q1-pension-NBR Q1-non-pension-NBR	Net benefits received by the quarter of the population with the lowest equivalised income, relative to total DI	Q1-NBR = $\frac{\sum \mathrm{nb}_i}{DI}, \forall\, i\ with\ i \in Q1$
Q4-NBR Q4-pension-NBR Q4-non-pension-NBR	Net benefits received by the quarter of the population with the highest equivalised income, relative to total DI	Q4-NBR = $\frac{\sum \mathrm{nb}_i}{DI}, \forall\, i\ with\ i \in Q4$

in the population. Several studies aggregate contributions and benefits. For example, Christl et al. (2020) show for Austria that households with low income are, as a whole, net receivers, while high-income households are net contributors. However, such an approach filters out the differences between households within different income groups. Our analysis shows that tax benefits systems differ considerably in the share of households who are net contributors despite having low income, and in the share of income-rich households that are net receivers. These are central aspects to understand the total extent of redistribution and its effectiveness in supporting vulnerable households.

NBRs reflect not only the design of tax-benefit systems, but also the population structure. We decompose the pensioner-NBRs and non-pensioner-NBRs into two components: the share of net beneficiaries in the respective group and the mean benefits per net beneficiary relative to mean disposable income. We thereby distinguish the effect of the population structure from the generosity of benefits to single beneficiaries. The corresponding NBRs can be calculated as the product of the two components. Equation 1 shows this decomposition for the total-NBR; it can be carried out in an analogous manner for the NBRs of subgroups. The term n represents the number of persons who are living in households with positive net benefits, referred to as net beneficiaries, N represents the population number, $\overline{\mathrm{nb}}$ represents mean net benefits per net beneficiary and $\overline{\mathrm{di}}$ represents per capita disposable income. The ratio $\frac{n}{N}$ represents the share of beneficiaries in the total population and $\frac{\overline{\mathrm{nb}}}{\overline{di}}$ the mean benefits per beneficiary relative to mean disposable income.

$$\text{Total-NBR} = \frac{\sum_i^n \mathrm{nb}_i}{\sum_i^N \mathrm{di}_i} = \frac{n * \frac{1}{n} * \sum_i^n \mathrm{nb}_i}{N * \frac{1}{N} * \sum_i^N di_i} = \frac{n}{N} * \frac{\overline{\mathrm{nb}}}{\overline{di}} \tag{1}$$

2.3. Using the potential of microdata: The effect of taxes and benefits on low-income households

When evaluating redistribution within tax-benefit systems particular attention should be directed to the effect of taxes and benefits on the income of low-income households. Social benefits targeted to low-income households can improve their situation considerably, while high taxes and social contributions may cause their economic situation to deteriorate even further. NBRs alone provide no information about the situation of low-income households, which also depends on the size of net contributions and on the initial market income. For example, low benefits for non-pensioners may simply indicate a lack of need for such benefits because of relative high market income in this group.

To gain insight into how taxes and benefits affect low-income households of working age we consider the average income, net contributions, net benefits, and disposable income of the non-pensioner households in Q1. All these quantities are measured relative to the mean disposable income (mean DI) in their respective country. Such standardised components facilitate comparison between countries.

2.4. Decomposing the Reynolds–Smolensky index (RSI)

The different benefits ratios allow us to analyse their relation with the RSI based on the Gini index. We calculate the RSI between market income and disposable income. By comparing the RSI with the NBRs we identify its relation with the distinct distributive dimensions, in particular, how strong the RSI is relative to the size of the pension system and if it is related to support for low-income households.

Furthermore, we decompose the RSI into the part that can be explained by taxes, pensions and other type of benefits, similarly to Paulus et al. (2017). Starting from the Gini coefficient of market income, we see the change when also including i) pensions, ii) pensions and other benefits and iii) pensions, other benefits and direct taxes including social contributions (i.e. disposable income). This approach allows us to see how pensions, other benefits and taxes affect the RSI. Note that the estimates of the redistributive effect of these three components could be slightly different depending on the order in which they are added to market income.

3. Results

Our results illuminate the differences in government redistribution across Europe, most notably in its role for retirement provision and its effect on low-income households of working age. Anticipating some of our results, we classify all European countries into five groups according to the total share of income distributed to pensioners, the generosity of

pensions towards high-income beneficiaries and the size of benefits directed to the non-pensioner population with low income. The countries in each of the groups share many characteristics, so this classification enables a more concise presentation of our findings.

The *old-age-oriented* countries are characterised by generous public pensions but limited support for non-pensioners. Several Southern European countries belong to this group, among them Greece, Italy and Portugal. The *Western European–style* countries, including Germany and France, also have generous pensions, but match this with considerable support for the low-income population of working age. Finland and Belgium are special cases, with *comprehensive social support* for pensioners and non-pensioners alike, but less generous pensions for those with high income compared to the Western European–style countries. Ireland, the UK, the Netherlands and Denmark belong to the *low-income-oriented* welfare states with basic pensions and a strong protection of low-income households. Several Eastern European countries are characterised by a *low redistribution* through the public sector, comparable with the level of the low-income-oriented countries, but with lower support of working-age households. An overview of the types and the associated countries is provided in Table 2.

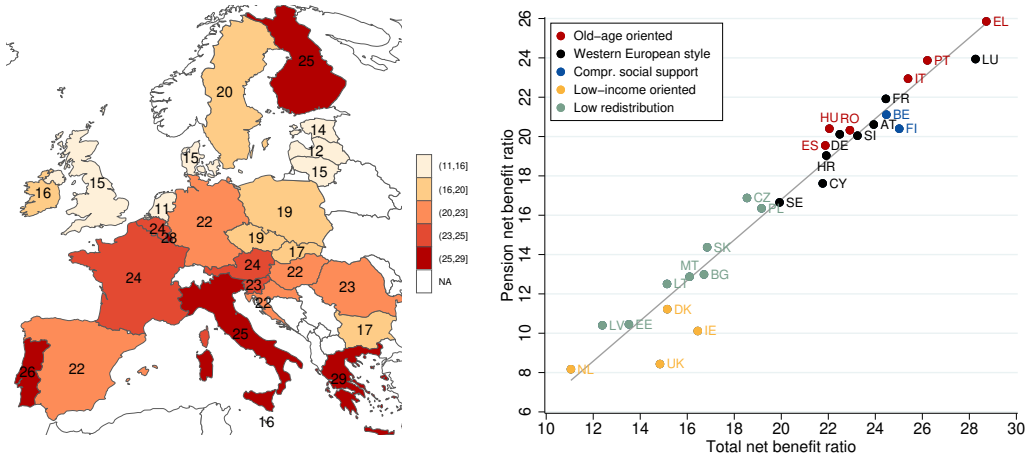
Table 2: Classification of European Tax-Benefit Systems

Type	Size of old-age benefits	Generosity of pensions	Size of non-pens. benefits	Countries
Old-age oriented	High	High	Low	Greece (EL), Spain (ES), Italy (IT), Portugal (PT), Hungary (HU), Romania (RO)
Western European–style	Medium	High	Medium	Austria (AT), Cyprus (CY), Germany (DE), France (FR), Luxembourg (LU), Sweden (SE), Slovenia (SI)
Compr. social supp.	High	Medium	High	Belgium (BE), Finland (FI)
Low-income oriented	Low	Low	High	Denmark (DK), Netherlands (NL), Ireland (IE), United Kingdom (UK)
Low redistribution	Low	Low	Low	Bulgaria (BG), Czechia (CZ), Estonia (EE), Lithuania (LT), Latvia (LV), Poland (PL), Slovakia (SK)

3.1. Redistribution to pensioners and non-pensioners

The total extent of net redistribution via direct taxes and cash transfers varies across Europe, with a low net redistribution in the northeast of Europe with the exception of Finland, and a high redistribution in the southwest (Figure 1a). The lowest values of the total-NBR are found in the low-income-oriented and the low-redistribution countries, with values of 15% or less in Ireland, the UK, the Netherlands, Denmark and the Baltic countries. The countries with the highest total-NBR belong to the old-age-oriented and the Western European–style categories, with values of 26% in Portugal, 28% in Luxembourg and 29% in Greece.

The size of total redistribution is determined by pensions. The non-pension-benefit ratio corresponds to merely 2–4% of DI; only in Finland, the Netherlands and the UK does it exceed 4% of DI. Because of the low values of the non-pension-NBR, we observe an almost linear relation between the total-NBR and the pension-NBR (Figure 1b; the exact values for all the ratios are provided in Table 3). In the low-income-oriented countries the pension-NBR correspond to 11% or less of DI. By contrast, in the old-age-oriented and Western European–style countries the net benefits received by pensioner households correspond to more than 20% of DI, with particularly high values in Italy (23%), Portugal and Luxembourg (24%) and Greece (26%).



(a) Total-NBR

(b) Pension-NBR vs. total-NBR

Figure 1: Total government redistribution in 28 European countries and its relation with redistribution to pensioners

The proportion of pensioners in the general population is an important determinant of the pension-NBR and ranges from 16% in Ireland and Slovakia and 18% in the Netherlands, the UK and Estonia, to 25% in Portugal, 26% in Italy, and 31% in Greece (Table 3, Column 3). Note that in this context *pensioner* refers to a person living in a pensioner household, i.e. a household that derives more income from pension benefits than from work. However, it is not the share of pensioners alone that determines the large pensioner-NBR in the old-age-oriented countries, but also mean net benefits per pensioner. In Denmark, the Netherlands, the UK, the Baltic countries and Bulgaria the public net benefits per pensioner correspond to less than 60% of mean DI (Table 3, Column 4). Our focus is on redistribution between households. Consequently, net benefits include only pensions from the public pay-as-you-go systems, not pensions from funded occupational and private systems, which play an important role in the low-income-oriented countries (Table C.7 in the Appendix distinguishes income sources of pensioners). By contrast, net benefits per pensioner correspond to more than 80% of mean DI in the old-age-oriented and Western European–style countries, reaching more than 100% in Luxembourg. This demonstrates a very interesting pattern: the countries with the highest proportion of pensioners have

the most generous public pension systems, while the countries with a low proportion of pensioners and the youngest population have the least generous ones.

Table 3: Total-net benefit ratio, share of beneficiaries and size of net benefits per beneficiary

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country	**Total-NBR**	**Pens.-NBR**	**Share of pens.**	**Avg. NB per pens. in % of mean DI**	**Non-pens. NBR**	**Share of non-pens.**	**Avg. NB per non-pens. in % of mean DI**
				Old-age oriented			
EL	**29**	26	30	86	3	16	17
ES	**22**	20	23	84	2	13	18
HU	**22**	20	22	95	2	13	13
IT	**25**	23	26	88	2	13	19
PT	**26**	24	25	94	2	14	17
RO	**23**	20	22	93	3	18	15
Avg.	**25**	**22**	**25**	**90**	**2**	**14**	**16**
				Western European–style			
AT	**24**	21	22	94	3	14	24
CY	**22**	18	19	94	4	23	18
DE	**22**	20	24	84	2	10	24
FR	**24**	22	24	90	3	13	20
HR	**22**	19	23	81	3	16	17
LU	**28**	24	24	101	4	20	22
SE	**20**	17	21	79	3	13	26
SI	**23**	20	22	92	3	15	21
Avg.	**23**	**20**	**22**	**89**	**3**	**16**	**21**
				Comprehensive social support			
BE	**24**	21	25	85	3	13	26
FI	**25**	20	25	80	5	17	28
Avg.	**25**	**21**	**25**	**83**	**4**	**15**	**27**
				Low-income oriented			
DK	**15**	11	19	58	4	15	26
IE	**16**	10	16	63	6	27	24
NL	**11**	8	18	46	3	11	26
UK	**15**	8	18	48	6	23	28
Avg.	**14**	**9**	**18**	**54**	**5**	**19**	**26**
				Low redistribution			
BG	**17**	13	22	58	4	23	16
CZ	**19**	17	21	79	2	10	16
EE	**14**	10	18	57	3	17	18
LT	**15**	13	21	59	3	16	16
LV	**12**	10	19	54	2	14	14
MT	**16**	13	19	67	3	20	16
PL	**19**	16	22	74	3	17	16
SK	**17**	14	16	89	2	14	18
Avg.	**16**	**13**	**20**	**67**	**3**	**16**	**16**

NB refers to net benefits, NBR to net benefit ratio.
The group averages (Avg.) are simple means, i.e. not weighted by population size.

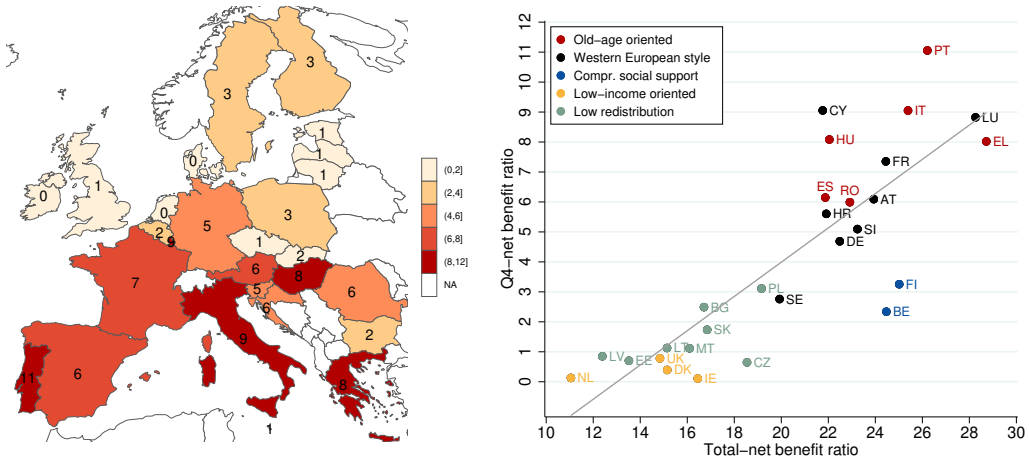
The low values of the non-pension-NBR can be explained by low net benefits per net receiver compared to pensions. The proportion of non-pensioner beneficiaries ranges between 10% of the population in Czechia and Germany to 27% in Ireland. However, the average size of these benefits ranges between only 13% of mean DI in Hungary to 28% in the UK and 29% in the Netherlands. The function of most non-pension benefits is clearly different from pensions. In most households the non-pension benefits, such as unemployment benefits or child allowances, replace market income over a short time span, or add to

market income, but do not fully replace it.

3.2. The generosity of tax-benefit systems towards the income rich

It is usually assumed that public transfers redistribute to the population with low income; redistribution to the high-income population receives little attention. As it turns out, understanding the differences between European welfare states requires a focus on how generous they are towards the income rich. The low-income-oriented countries, as well as some of the low-redistribution countries, provide little net benefits to the top quarter of the income distribution, reflected in a low Q4-NBR of about 1% or less. By contrast, the countries with a high total redistribution are characterised by a high Q4-NBR (Figure 2). In Italy, Greece, Portugal and Luxembourg the Q4-NBR corresponds to more than 9% of DI and to about 1/3 of total net benefits.

The extent of redistribution to the population with the highest income is determined by the number of pensioners with high income and the size of their benefits. Table A.5 in the Appendix shows the Q4-pensioner-NBR and Q4-non-pensioner-NBR, and for each of the NBRs the proportion of net beneficiaries and the mean benefits per beneficiary relative to mean DI. In the low-income-oriented countries, pensioners account for a small part of the Q4-population and the average size of benefits corresponds to less than 35% of mean DI. In these countries the public pension system provides only a basic pension; Q4 pensioners must have other sources of income. The Western European–style and the old-age-oriented countries are characterised by a high share of pensioners in Q4, accounting for more than 20% of the total Q4-population in Greece, Italy, Portugal, France and Luxembourg. In these countries the benefits are the reason for being among the high-income population: the Q4-pensioners receive generous public pensions, corresponding to more than 140% of mean DI (except in Sweden and France). The non-pension benefits directed to Q4 are negligible in all countries, and the Q4-non-pension-benefit ratio does not exceed 1% of DI in any country.



(a) Q4-NBR (net benefits of the income-richest quarter)

(b) Q4-NBR vs. total-NBR

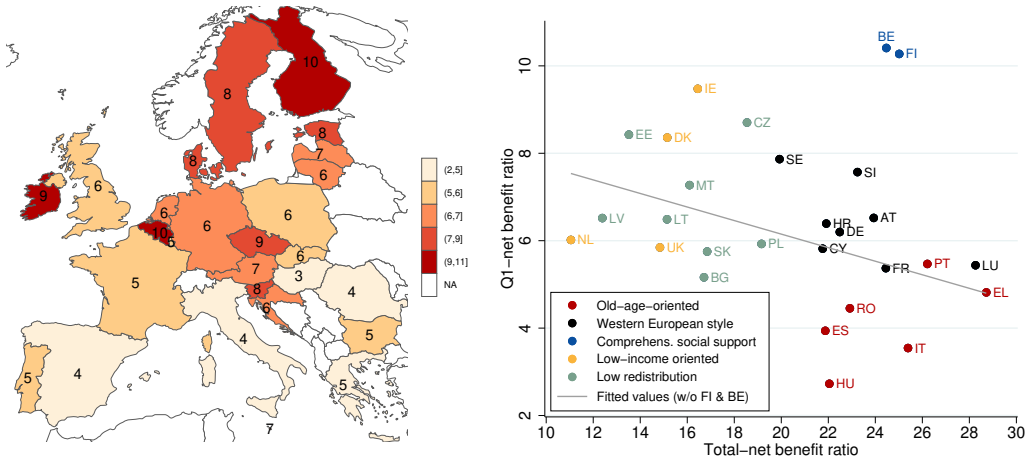
Figure 2: Public redistribution to the income rich: The Q4-net benefit ratio and its relation with the total-net benefit ratio

3.3. Protection of households with low income

Countries with a strong redistribution and a high total-NBR redistribute little to the population with low income (Figure 3a). For instance, in Greece, Italy and Spain, the Q1-NBR corresponds to less than 6% of disposable income and to less than 1/5 of total net benefits. By contrast, in Czechia, Denmark, Estonia, Ireland and the Netherlands, the Q1-NBR corresponds to 8–10% of DI, representing more than 1/2 of total net benefits. Higher values are found only in Belgium and Finland, where the Q1-NBR corresponds to 10% of DI. Consequently, we observe a negative relationship between the total-NBR and Q1-NBR (Figure 3a). Finland and Belgium are outliers, as they achieve a high total-NBR and Q1-NBR.

The distinction between pensioners and non-pensioners shows important differences among the countries with a high redistribution to the population with low income, as measured by the Q1-NBR (Table A.6 in the Appendix). In Belgium, Czechia, Estonia and Finland the high Q1-NBR of 7–8% of DI is a consequence of the high proportion of pensioners, amounting to more than 40% of the Q1-population. Ireland, the Netherlands and Denmark are characterised by a comparably low share of pensioners in Q1, but also by high net benefits directed to non-pensioners in Q1, amounting to 3–4% of DI. The old-age-oriented countries are characterised by low Q1-NBRs because of generally low transfers to non-pensioners and a low share of pensioners in Q1.

To evaluate how taxes and benefits affect the Q1-non-pensioner population we consider average market income, net contributions, net benefits and disposable income (Table 4). The table includes additional activity status information. Regarding market income and



(a) Q1-net benefit ratio

(b) Q1-NBR vs. total-NBR

Figure 3: Public redistribution to the poor: the Q1-NBR across Europe and its relation with the total-NBR

proportion of the population in employment, we observe wide variation within the different groups of countries, and no clear differences between them. However, clear differences are found regarding contributions and benefits. In the old-age oriented countries and some of the low-redistribution countries the net contributions exceed net benefits, resulting in a very low DI of Q1-non-pensioners, with the average less than 40% of mean DI. In Belgium, Finland and the low-income-oriented countries the net benefits exceed the net contributions by far, resulting in an average DI of Q1-non-pensioners of more than 45% of mean DI. In the Western European–style countries disposable income is also high compared to the old-age-oriented countries, as high contributions are accompanied by either high market incomes or high net benefits.

To illustrate the relation between the generosity towards income-rich pensioners and the protection of low-income households of working age we plot the Q1-non-pension-NBR vs. the Q4-NBR in Figure 4. This figure clearly shows the differences between our five groups of countries. The low-income-oriented countries and Finland provide large net-benefits to the Q1-non-pension population, corresponding to more than 3% of DI, and few benefits to the population in the top quarter of the income distribution (Q4). The Western European–style welfare states have generous pensions and a high Q4-benefit ratio, but do also provide support for Q1-non-pensioners. The low-redistribution countries are characterised by a low Q4-NBR and a low Q1-non-pension-NBR. The most interesting group is the old-age-oriented-countries, characterised by generous benefits for income-rich pensioners, but very low net benefits to the working-age population with low income, corresponding to less than 1% of total DI.

Table 4: Income, taxes and benefits of the non-pensioner population in Q1

	in % of mean DI				% of the non-pensioner pop. in Q1			
Country	**Market inc.**	**Net contributions**	**Net benefits**	**Disp. inc.**	**Employed**	**Unemployed**	**Inactive other**	**Children & education**
				Old-age oriented				
EL	42	8	6	**39**	31	22	14	31
ES	37	8	5	**34**	34	23	10	31
HU	51	21	3	**34**	41	9	10	33
IT	37	8	3	**32**	35	13	16	33
PT	42	8	6	**40**	41	17	7	31
RO	29	6	6	**29**	38	1	22	37
Avg.	**40**	**10**	**5**	**35**	**37**	**14**	**13**	**33**
				Western European–style				
AT	44	9	13	**48**	39	12	8	35
CY	36	3	9	**43**	34	18	10	36
DE	49	12	9	**47**	42	11	7	36
FR	47	12	9	**45**	36	10	8	42
HR	41	7	7	**41**	25	26	7	33
LU	41	4	12	**50**	42	9	10	35
SE	40	9	15	**46**	31	10	3	54
SI	53	10	11	**55**	40	18	3	34
Avg.	**44**	**8**	**11**	**47**	**36**	**15**	**7**	**38**
				Comprehensive social support				
BE	37	7	17	**48**	26	13	17	41
FI	37	5	22	**54**	26	17	6	50
Avg.	**37**	**6**	**20**	**51**	**26**	**15**	**11**	**45**
				Low-income oriented				
DK	37	5	19	**51**	31	10	5	52
IE	18	0	24	**42**	21	12	13	45
NL	46	10	13	**50**	36	4	13	41
UK	28	3	16	**40**	30	6	15	39
Avg.	**32**	**5**	**18**	**46**	**30**	**8**	**11**	**44**
				Low redistribution				
BG	30	5	5	**30**	32	35	20	32
CZ	62	15	5	**52**	39	43	9	39
EE	44	8	7	**43**	33	47	9	33
LT	36	8	7	**35**	34	35	17	34
LV	37	7	6	**35**	30	34	16	30
MT	40	3	8	**44**	32	35	3	32
PL	55	14	5	**46**	27	37	8	27
SK	66	20	6	**52**	38	38	13	38
Avg.	**46**	**10**	**6**	**42**	**33**	**38**	**12**	**33**

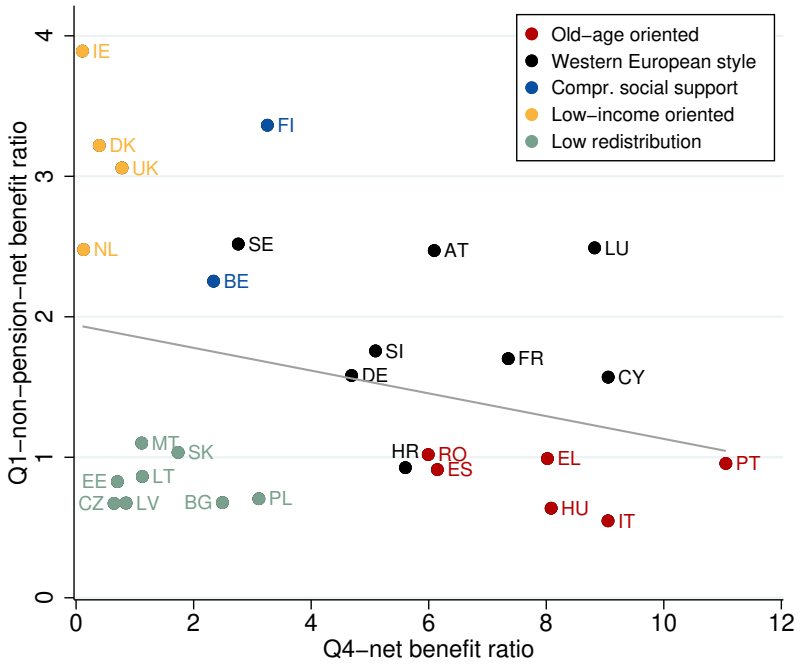


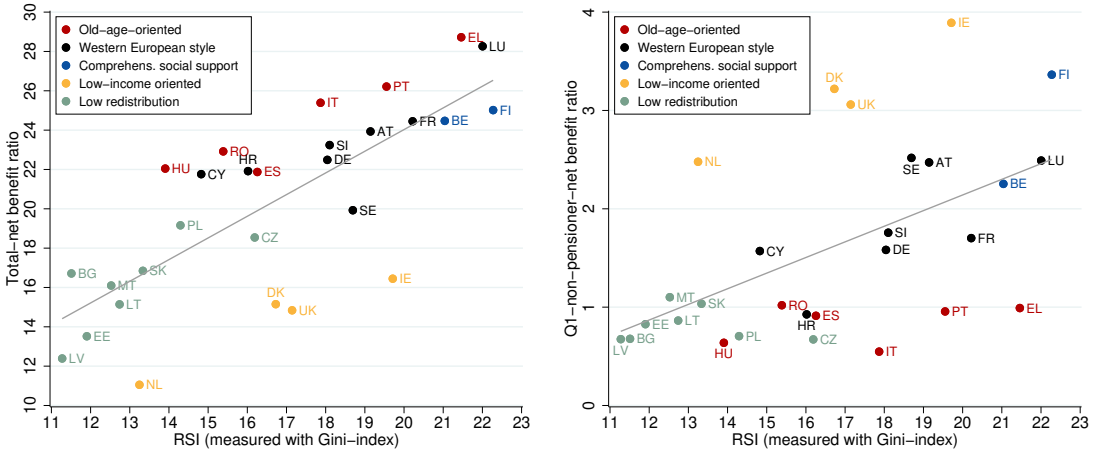
Figure 4: Net benefits of non-pensioners with low income (Q1-non-pension-NBR) and its relation with redistribution to the income rich

3.4. Relation between net benefit ratios (NBRs) and the Reynolds-Smolensky index (RSI)

The RSI between market income and disposable income is closely related to the total extent of public redistribution, in particular the size of the pension system (Figure 5, left). Finland, Luxembourg, Greece and Belgium are the countries with the highest RSI and among the countries with the highest total-NBR. By contrast, among the countries with the lowest RSI are the low-redistribution countries, which are also characterised by low total- and pension-NBRs. Outliers in this pattern are Ireland, Denmark, and the UK, with average RSIs but very low total-NBRs and pension-NBRs. These results are reflected in the decomposition of the RSI into components, which is applied in most studies, with comparably low contributions of pensions in the UK, the Netherlands and Ireland (Figure B.6 in the Appendix).

We observe a weak relation between the RSI and redistribution to the non-pension population with low income as measured by the Q1-non-pension-NBRs (Figure 5, right graph). The slight positive relation between RSI and the non-pension-Q1-NBR, indicated by the regression line, is mainly driven by the cluster of low-redistribution countries with low values on both indicators. We do not observe a clear relation among the other countries. We have examples of a low or moderate RSI, but a high redistribution to non-pensioners with low income (e.g. NL, DK, UK) and also countries with a high RSI and a very low Q1-non-pension-NBR (e.g. PT, EL). The strong correlation of the RSI with the total-NBR

(and pension-NBR) and weak relation with with the Q1-non-pension-NBR support the critics who claim that the RSI is merely an indicator of the size of pension systems and not of redistribution to households with low income.



(a) RSI vs. total-NBR

(b) RSI vs. Q1-non-pensioner-NBR

Figure 5: The The Reynolds-Smolensky index (RSI) and its correlation with specific NBRs

4. Discussion

European countries follow different models in the design of their tax-benefit systems, with the old-age-oriented and low-income-oriented models as polar-opposite cases. The old-age-oriented countries redistribute the largest share of income in total, providing generous benefits to a subset of the pensioners but little support to non-pensioner households. The low-income-oriented countries redistribute a small share of income in total but provide strong support to the population with low income. The other countries are between these cases, with the exception of Finland and Belgium, who provide comparably high benefits to pensioners and non-pensioners. One of our most striking results is the negative relation between total redistribution and support for the population with low income: the size of welfare states is determined by redistribution to income-rich pensioners not by support of low-income households.

Our findings are in line with Lynch (2006), who carried out a comprehensive analysis of the old-age orientation of welfare states. Her analysis is of particular interest, as it contributes to a better understanding of our results. She argues that the degree of old-age orientation is an effect of the long-term development of welfare states starting in the 19^{th} century. At that time some occupation-related insurance programmes were in place, such as unemployment or invalidity benefits, while most social support was provided by charities or the family. In some countries the government took an increasing role in providing support to all citizens, including those outside the occupational insurance system such as

non-insured elderly persons and children. In other countries the government took over the occupational systems and left the outsiders to family and charities. With more and more people having access to occupation-related pensions and the extension of retirement, the occupation-based systems became increasingly old-age oriented, while the citizen-based systems also provided support to the working-age population, including families. European welfare states are still organized along these lines: the old-age-oriented countries provide generous public pensions for those with a long work history, but little support for outsiders. But why have some countries adopted *citizen-based* programmes, while other countries continue extending occupational programmes? Lynch explains the different development as the result of political competition: countries with particular interest parties tend to extend benefits directed to particular groups, rather than broad welfare benefits.

The particular organisation of welfare states creates advantages for some groups in the population and disadvantages for others. A strong old-age-orientation provides decent income for some pensioners, but the old-age focus results in an increasingly difficult situation for the younger population. Old-age orientation is also reflected in low expenditure on in-kind benefits (Eurostat, 2018b) such as childcare and elderly-care facilities, and in strong two-tier labour markets. The older, permanent employees are strongly protected, while the insecurity due to a flexibilisation of the labour market has been placed on young cohorts (Barbieri, 2011; Chauvel and Schröder, 2014). Economic crises and the ageing of the population aggravates inequalities even further. Hammer et al. (2021) show that the income of the younger population declined strongly in the aftermath of the financial and sovereign debt crises in Italy, Greece and Spain, while income increased for the older population due to higher employment and higher pensions. Consequently, poverty rates among the young increased, while they declined for the elderly population (Chen et al., 2018). Because benefits are strongly tied to work history, poverty rates are high not only among the younger population, but also among pensioners, indicating that only a select group of retirees profit from generous pensions (Eurostat, 2018a). Given the difficulties for the young it is not surprising that the old-age-oriented countries are also among those with the lowest fertility rates in Europe. Chauvel and Schröder (2014) use a bold description of the old-age focus: 'In trying to protect older cohorts, these countries may well sacrifice their future, as they seem to have durably scarred younger generations.'

Redistribution systems do not necessarily need to be large to provide effective support to the poor. In the low-income-oriented countries, including Ireland, the UK, Denmark and the Netherlands, social benefits target the population with low income and benefits targeted to income-rich pensioners are limited. The reason for the low total redistribution is that their public pensions scheme provides basic support through a flat-rate pension, which is supplemented with funded private schemes (see e.g. OECD, 2019, Table 5.3) and (European Commission, 2018b, Table II.1.1). The supplementary schemes secure the income of high earners without relying on public transfers. Clearly, many fewer pensioners are found in the quarter of the population with the highest income. But the support of the population with low income works well; in Denmark and the Netherlands the poverty

rates among the older population are the lowest in Europe (Eurostat, 2018a).

Our results contradict the *paradox of redistribution* of Korpi and Palme (1998), who claim that the more benefits are targeted to the poor, the less likely the reduction of poverty and inequality, because such systems are not supported by the population and the redistributive budget remains low. Our results show that the countries with the largest redistribution serve particular groups but are among the countries least successful in supporting low-income households. By contrast, the low-income-oriented countries are those with low total redistribution but a strong support of low-income households. Belgium and Finland, with the strongest redistribution to the population with low income, are characterised by a low redistribution to income-rich pensioner households compared with old-age-oriented and Western European–style countries.

Evaluating welfare states along a single dimension cannot provide meaningful information about the effect of public redistribution; it requires at least a distinction between old-age provision and the support of working-age households with low income. Because of the different orientation of welfare states in Europe, one-dimensional indicators such as the RSI are prone to misinterpretations, as it is unclear which dimension they actually capture. Both some old-age-oriented countries and some low-income-oriented countries are found among the countries with a high RSI, although the function of taxes and benefits are completely different. Any analysis of welfare state redistribution must include a specific analysis of how taxes and benefits affect low-income households of working age. The RSI primarily captures programmes that replace market income, even when they pose a high burden for households with low market income and further decrease their already low disposable income.

The old-age orientation of tax-benefit systems and the size of the pension-NBR is likely to increase with the ageing of the population and the increase in the proportion of pensioners. Given that additional government revenues are limited due to the generally high tax burden in European countries, our analysis highlights the challenges for European tax-benefit systems in supporting vulnerable groups of working age in the future. The cross-national comparison suggests that a reduction of the generosity towards retired high-income beneficiaries, as well as the provision of basic support for all citizens, constitutes a efficient strategy for providing effective support with a limited redistributive budget.

5. Summary

Our study reveals significant differences in the extent and direction of government redistribution between European countries. An understanding of these differences is necessary for the evaluation of tax-benefit systems and the identification of their strengths and weaknesses. The central indicator in our analysis is the net benefit ratio (NBR), which measures the net redistribution at the household level by accounting for taxes paid and benefits re-

ceived. The total extent of government redistribution is high in southwestern Europe and comparably low in northeastern Europe. The total-NBR ranges between 11% of disposable income (DI) in the Netherlands to 29% in Greece. Only 2–4% of the total-NBR represents net benefits for non-pensioners; the difference between this value and total-NBR represent the net benefits directed to pensioners. Consequently, the difference in total redistribution between countries is determined by the size of the pension system.

The pension-NBR is determined by the proportion of pensioners in the population and the generosity of the system. In the old-age-oriented countries such as Italy, Greece and Spain more than 20% of the population with the highest equalised income consists of pensioners, whose average benefits correspond to more than 140% of mean disposable income. In the low-income-oriented countries and low-redistribution countries the benefits for the top quarter of the income distribution are negligible.

The support of households with low income is an important function of welfare systems – and is not related to the extent of redistribution. If a tax-benefit system fulfills this function, it is most visible in how taxes and benefits affect the non-pensioner population in the poorest quarter of the population. Net benefits directed to non-pensioners in the poorest quarter of the population amount to 1–4% of disposable income. Interestingly, the lowest values (1%) are seen in the old-age-oriented countries with a strong total redistribution, and the highest values (3-4%) are seen in the low-income-oriented countries with a low total redistribution. Despite the low values, these differences affect the economic situation of low-income households of working age. In the old-age-oriented countries these groups are net contributors to the tax system and end up with a low mean disposable income, about 30-40% of the overall mean. By contrast, in the low-income-oriented countries and the Western-European–style countries mean disposable income ranges between 40–50% of mean DI.

The old-age-oriented countries with a strong total redistribution provide little support to low-income households. By contrast, the low-income-oriented countries with a small total net-redistribution are characterised by a comparably high share of income redistributed to low-income households. Given that there are few resources used for non-pensioners in general, this pattern can hardly be framed as a trade-off. We argue that this pattern reflects different goals of tax-benefit system, ranging from securing retirement income for particular groups in the population to alleviation of poverty for all.

One-dimensional measures of government redistribution, in particular the standard redistribution measures such as the Reynolds-Smolensky index (RSI), provide a highly incomplete and misleading picture. Importantly, we show that while there is a strong relation between the RSI and the size of the pension system there is only a very weak relation between the RSI and support for low-income groups. Our results highlight the importance of distinguishing between the distinct roles and goals of tax-benefit systems in order to evaluate them separately. The RSI is a very general redistribution measure, indicating

how much tax-benefit systems redistribute between households. However, to evaluate in detail the redistributive outcome of tax-benefit systems, it is important to know who pays into and who benefits from the system. The approach used in this paper, calculating net benefit ratios (NBRs) for distinct groups of the society, provides a useful tool to evaluate the redistributive efficiency of tax-benefit systems.

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Appendix A. Decomposition of the Q4- and Q1-net benefit ratio

Table A.5: Redistribution to households with high income: The Q4-net benefit ratio and its components

Country	(1) **Total-NBR**	(2) **Pens.-NBR**	(3) **Share of pens.**	(4) **Avg. NB per pens. in % of mean DI**	(5) **Non-pens. NBR**	(6) **Share of non-pens.**	(7) **Avg. NB per non-pens. in % of mean DI**
Old-age oriented							
EL	**8**	7	21	137	1	11	25
ES	**6**	6	16	138	1	6	33
HU	**8**	8	18	166	0	6	31
IT	**9**	8	22	149	1	10	44
PT	**11**	11	23	184	0	5	28
RO	**6**	5	11	186	1	8	32
Avg.	**8**	**7**	**19**	**160**	**1**	**8**	**32**
Western-European style							
AT	**6**	6	16	146	0	3	18
CY	**9**	8	16	195	1	11	39
DE	**5**	4	12	139	0	4	36
FR	**7**	7	23	126	0	3	29
HR	**6**	5	12	167	1	9	27
LU	**9**	8	21	161	0	5	25
SE	**3**	3	10	98	0	3	22
SI	**5**	5	13	148	0	5	26
Avg.	**6**	**6**	**16**	**148**	**0**	**5**	**28**
Comprehensive social support							
BE	**2**	2	7	118	0	3	51
FI	**3**	3	12	103	0	4	23
Avg.	**3**	**3**	**9**	**111**	**0**	**3**	**37**
Low-income oriented							
DK	**0**	0	4	34	0	1	17
IE	**0**	0	1	31	0	2	14
NL	**0**	0	2	19	0	0	18
UK	**1**	1	8	28	0	3	39
Avg.	**0**	**0**	**4**	**28**	**0**	**2**	**22**
Low redistribution							
BG	**2**	1	4	120	1	17	29
CZ	**1**	0	2	98	0	4	28
EE	**1**	0	0	54	1	7	39
LT	**1**	1	3	112	0	7	23
LV	**1**	1	2	132	0	5	22
MT	**1**	1	3	102	0	7	17
PL	**3**	3	8	128	1	9	24
SK	**2**	1	4	133	0	6	26
Avg.	**1**	**1**	**3**	**110**	**1**	**8**	**26**

NB refers to net benefits, NBR to net benefit ratio.
The group averages (Avg.) are simple means, i.e. not weighted by population size.

Table A.6: Redistribution to households with low income: the Q1-net benefit ratio and its components

Country	(1) Total-NBR	(2) Pens.-NBR	(3) Share of pens.	(4) Avg. NB per pens. in % of mean DI	(5) Non-pens. NBR	(6) Share of non-pens.	(7) Avg. NB per non-pens. in % of mean DI
Old-age oriented							
EL	**5**	4	31	49	1	29	14
ES	**4**	3	25	48	1	25	15
HU	**3**	2	25	33	1	27	9
IT	**4**	3	27	44	1	22	10
PT	**5**	5	37	49	1	26	15
RO	**4**	3	31	44	1	39	10
Avg.	**4**	**3**	**29**	**45**	**1**	**28**	**12**
Western European–style							
AT	**7**	4	26	61	2	37	26
CY	**6**	4	32	52	2	41	15
DE	**6**	5	33	55	2	26	24
FR	**5**	4	25	59	2	36	19
HR	**6**	5	45	49	1	24	16
LU	**5**	3	20	58	2	49	20
SE	**8**	5	31	69	3	36	28
SI	**8**	6	35	66	2	31	23
Avg.	**6**	**5**	**31**	**59**	**2**	**35**	**21**
Comprehensive social support							
BE	**10**	8	47	70	2	33	28
FI	**10**	7	40	70	3	41	33
Avg.	**10**	**8**	**43**	**70**	**3**	**37**	**30**
Low-income oriented							
DK	**8**	5	32	64	3	46	28
IE	**9**	6	36	62	4	55	28
NL	**6**	4	26	55	2	36	28
UK	**6**	3	24	47	3	50	25
Avg.	**7**	**4**	**29**	**57**	**3**	**47**	**27**
Low redistribution							
BG	**5**	4	43	41	1	28	10
CZ	**9**	8	45	71	1	18	15
EE	**8**	8	55	55	1	23	14
LT	**6**	6	48	47	1	25	14
LV	**7**	6	53	44	1	23	12
MT	**7**	6	45	55	1	29	15
PL	**6**	5	41	51	1	22	13
SK	**6**	5	27	70	1	24	17
Avg.	**7**	**6**	**45**	**54**	**1**	**24**	**14**

NB refers to net benefits, NBR to net benefit ratio.
The group averages (Avg.) are simple means, i.e. not weighted by population size.

Appendix B. Decomposition of RSI

The decomposition of the RSI into the effect of taxes, pensions and other benefits shows the components of transfer systems that contribute to their total size. Figure B.6 highlights the total size of the RSI and the importance of pensions, other benefits and taxes. In line with previous literature, this analysis shows that pensions are responsible for more than half of the reduction in inequality between market income and disposable income in almost all countries. As indicated by our results using NBRs, exceptions are the Netherlands, the UK and Ireland, where pensions play a comparably small role (see also Table C.7).

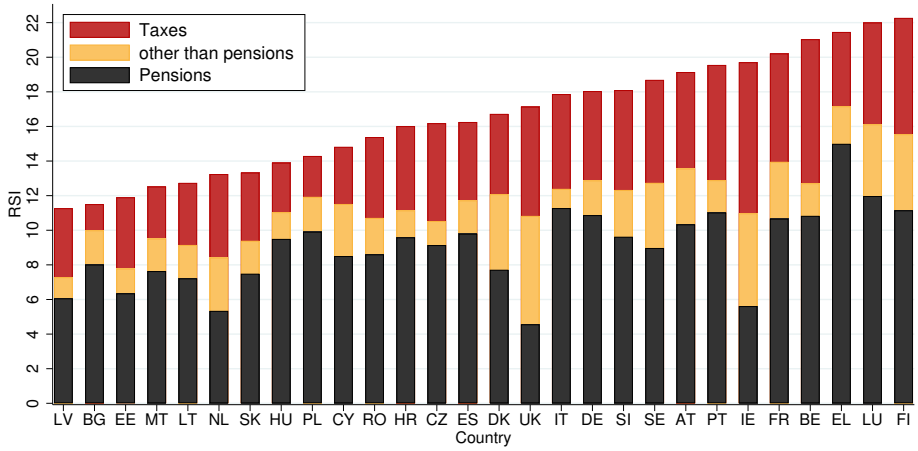

Figure B.6: Decomposition of the RSI

Appendix C. Decomposition of the income of pensioner households

Table C.7: Income source of pensioners in percent of per-capita mean disposable income

Country	Market inc. earnings	Market inc. other incl. priv. pens.	Market inc. total	Net benefits	Disp. inc.
		Old-age oriented			
EL	9	5	**14**	86	**100**
ES	11	9	**19**	84	**103**
HU	14	0	**14**	95	**108**
IT	12	8	**20**	88	**107**
PT	9	5	**14**	94	**109**
RO	4	0	**4**	93	**97**
Avg.	**10**	**5**	**14**	**90**	**104**
		Western European–style			
AT	7	5	**12**	94	**106**
CY	10	4	**13**	94	**107**
DE	5	6	**11**	84	**95**
FR	6	17	**23**	90	**114**
HR	7	3	**10**	81	**91**
LU	7	7	**14**	101	**116**
SE	9	10	**19**	79	**99**
SI	7	4	**11**	92	**103**
Avg.	**7**	**7**	**14**	**89**	**104**
		Comprehensive social support			
BE	4	5	**8**	85	**93**
FI	7	9	**16**	80	**96**
Avg.	**5**	**7**	**12**	**83**	**95**
		Low-income oriented			
DK	5	32	**36**	58	**94**
IE	5	4	**9**	63	**72**
NL	3	41	**45**	46	**91**
UK	4	41	**45**	48	**93**
Avg.	**4**	**29**	**34**	**54**	**87**
		Low redistribution			
BG	7	4	**11**	58	**69**
CZ	5	1	**6**	79	**85**
EE	5	1	**6**	57	**63**
LT	7	1	**8**	59	**67**
LV	6	2	**9**	54	**62**
MT	5	8	**13**	67	**80**
PL	13	1	**13**	74	**87**
SK	8	1	**9**	89	**98**
Avg.	**7**	**2**	**9**	**67**	**76**

Appendix C.1. Acknowledgement

We are indebted to the many people who have contributed to the development of EUROMOD, especially to our colleagues at the B2 unit at JRC Seville. We are especially grateful to Andrzej Stasio, Daniel Stöhlker, Jorge Durán Laguna, Alexia Prskawetz, the participants of the Ninth Meeting of the Society for the Study of Economic Inequality (ECINEQ), as well as the participants of the B2 Seminar Series at JRC Seville and the participants of the internal seminar at the Wittgenstein Centre for Demography and Global Human Capital for helpful comments.

Appendix C.2. Conflict of interest

The content of this article does not reflect the official opinion of the European Commission. Responsibility for the information and views expressed in the article lies entirely with the author(s).