the review of income and wealth

Review of Income and Wealth
Series 66, Number. 2 June 2020
DOI: 10.1111/roiw.12408

FOUR LEVERS OF REDISTRIBUTION: THE IMPACT OF TAX AND TRANSFER SYSTEMS ON INEQUALITY REDUCTION

BY ELVIRE GUILLAUD*

Université Paris 1 Panthéon-Sorbonne, CES and Sciences Po, LIEPP

MATTHEW OLCKERS

Université Paris 1 Panthéon-Sorbonne and Paris School of Economics

AND

MICHAËL ZEMMOUR

Université Lille, CNRS, UMR 8019—CLERSE and Sciences Po, LIEPP

We use harmonized survey data from the Luxembourg Income Study to assess the redistributive impact of taxes and transfers across 22 OECD countries over the 1999–2016 period. After imputing missing tax data (employer social-security contributions), we measure the reduction in income inequality from four key levers of tax and transfer systems: the average tax rate, tax progressivity, the average transfer rate, and transfer targeting. Our methodological improvements produce the following results. First, tax redistribution dominates transfer redistribution (excluding pensions) in most countries. Second, targeting explains very little of the cross-country variation in inequality reduction. In contrast, both tax progressivity and the average tax rate have large impacts on redistribution. Last, there seem to be political tradeoffs: high average tax rates are not found together with highly progressive tax systems.

JEL Codes: D31, H30, I38

Keywords: tax-transfer policies, social-security contributions, inequality, redistribution

1. INTRODUCTION

Households receive income from the market either through their labor or through ownership of capital. As the distribution of market income is extremely

Note: We acknowledge funding from EN3S—Ecole nationale supérieure de la sécurité sociale—and LIEPP Sciences Po (the REDINEQ project). LIEPP is supported by a public grant overseen by the French National Research Agency (ANR) as part of the "Investissements d'Avenir" program within the framework of the LIEPP centre of excellence (ANR-11-LABX-0091, ANR-11-IDEX-0005-02). We thank Silvia Avram, Thomas Breda, Laurent Caussat, Marie-Cécile Cazenave, Conchita D'Ambrosio, Bernhard Ebbinghaus, Jörg Neugschwender, Bruno Palier, and Denisa Sologhon for useful discussions about the data and methodology. We thank Victor Amoureux for his fantastic contribution on the most recent version of the code and the LIS team for answering our questions about the data. We are grateful for helpful feedback from participants at a number of seminars and conferences, including SASE 2016, AES 2016, the LIS users conference 2017, the OSE/EPCI workshop 2017, and the LIEPP Sciences Po workshop 2017. We are grateful for the comments from three anonymous referees, which led to a much-improved paper.

*Correspondence to: Elvire Guillaud, Université Paris 1 Panthéon-Sorbonne, Maison des Sciences Economiques, 106–112 boulevard de l'Hôpital, 75647 Paris Cedex 13, France (elvire.guillaud@univ-paris1.fr).

unequal in most countries, governments redistribute via taxation and social transfers. The extent of redistribution depends on four policy levers: the average tax rate, the progressivity of the tax schedule, the average rate of transfers, and the targeting of transfers.[1]

A wide variety of policy combinations can produce the same level of redistribution. For example, a country with a high average tax rate and little progressivity may redistribute as much as a country with a low average tax rate but very progressive taxes. In theory, the mapping from policy levers to redistribution offers the government many policy combinations with which to achieve its chosen level of redistribution. The purpose of this paper is to identify which policy combinations are used in practice, and which policy combinations, if any, are avoided.[2] Since policy is a result of political bargaining, we wish to identify tradeoffs—does pulling down on one lever push up another?

We use household survey data from the Luxembourg Income Study (LIS) to place 22 developed countries on a map of possible policy configurations. We provide a significantly improved measure of tax redistribution by imputing missing taxes. Employer (and some employee) social-security contributions are not measured in the underlying household surveys, which produces a bias as the balance between employee and employer contributions varies significantly across countries. The imputations are accurate: the average share of social-security contributions in household income is correlated at 92 percent with the share of social-security contributions in gross domestic product (GDP) from national accounts. And the improvement in coverage is significant: our tax data covers 54 percent of national tax revenue, as opposed to 35 percent in the initial LIS data.[3] These imputations are essential in order to compare tax systems across countries.

Many researchers have considered the combinations of tax and transfer policies used by countries to redistribute income. Often due to data constraints, taxation and transfers are studied separately. The seminal research on transfers suggest a tradeoff between the rate and targeting of transfers (Korpi and Palme, 1998; Moene and Wallerstein, 2001), referred to as the "paradox of redistribution." Countries with highly targeted transfers have lower transfer rates, resulting in less redistribution than countries with less-targeted transfers. The importance of the transfer rate has been shown repeatedly, but the existence of a negative relationship between targeting and redistribution is still contested (Marx *et al*., 2013; Brady and Bostic, 2015).

Research on taxation has found a negative correlation between the progressivity of the tax system and the macroeconomic aggregate of social spending (Kato, 2003; Lindert, 2004; Beramendi and Rueda, 2007; Prasad and Deng, 2009). Using household-level data, a tradeoff between progressivity and the average tax rate is identified in Joumard *et al*. (2012) and Verbist and Figari (2014). However, as

[1]We focus on monetary redistribution. Non-monetary forms of redistribution, such as in-kind redistribution and occupational welfare, fall outside of the scope of this analysis.

[2]We do not attempt to explain why market income is unequal or the political process behind the policy choices. Both of these questions are complex and have been tackled in distinct fields of research.

[3]The remaining tax revenue mostly comes from consumption taxes and corporate taxation. We consider consumption taxes in a companion paper.

Joumard *et al*. (2012) point out, further evidence is needed, as consumption taxes, corporate taxes, and employer social-security contributions are not measured in household surveys.

Only a few contributions have looked at tax and transfer policies simultaneously using household survey data. Most have found that there is more redistribution from transfers than from taxes (Immervoll and Richardson, 2011; Kenworthy, 2011; Wang *et al*., 2012; Joumard *et al*., 2012; Wang *et al*., 2014; Caminada *et al*., 2017). This likely reflects the classification of pensions as social transfers (Immervoll *et al*., 2006; Mahler and Jesuit, 2006). After distinguishing between pensions and transfers, Avram *et al*. (2014) find that there is more redistribution from pensions than from taxes, which is in turn larger than that from transfers.

We contribute to the literature in three ways. We first provide a unified framework in which to decompose redistribution into the four policy levers. Our approach, which is set out in Section 2, departs from previous descriptive work (Immervoll and Richardson, 2011; Joumard *et al*., 2012; Wang *et al*., 2012; Avram *et al*., 2014), as the multiplicative relationship between the average rate and progressivity of taxes (or the average rate and targeting of transfers) is clearly depicted.

Second, our main analysis is conducted on all households interviewed in the survey data. Much work has focused only on working-age households, in order to avoid the challenge of categorizing pensions. We choose to categorize pensions as income rather than a transfer. Given that pensions make up a large portion of the government budget in many countries, we carry out a specific analysis of pensions in Section 4.5.2, and repeat our analysis on the working-age subsample in Section 4.5.1.

Third, and most importantly, we provide an improved measure of taxation for the LIS dataset. Although LIS is the most extensive and detailed comparative income dataset, the data on taxation in the underlying household surveys are limited. Employer social-security contributions are not recorded in household surveys, and in certain countries, such as France and Italy, even employee social-security contributions are not available. As discussed in the Appendix (in the online Supporting Information), our imputations significantly improve the measurement of taxation.

An alternative to LIS data is the EU-SILC comparative database used with the EUROMOD microsimulation model. Although this approach provides an improved measure of taxation, it limits the analysis to European countries after 2004. It is also difficult to model the take-up of transfers via simulations (Avram *et al*., 2014; Sutherland and Figari, 2013). We prefer to rely only on cross-country comparisons to avoid assumptions regarding the take-up of counterfactual transfer policies.

Our methodological contributions confirm some existing results and add a number of original findings. In contrast to the literature, but along the lines of Avram *et al*. (2014), redistribution from taxes is generally stronger than that from transfers. Our tax imputations alter the balance in certain countries. For example, France and Sweden redistribute primarily through taxes in our data. As in Marx *et al*. (2013) and Brady and Bostic (2015), we find a positive but weak relationship between the targeting of transfers and redistribution. The impact of targeting is limited by the size of the transfer budget, as measured by the average transfer

rate. Most importantly, we find strong evidence of a tradeoff between the average tax rate and progressivity. This stylized fact, first measured by Verbist and Figari (2014) in 15 European countries (30 country-years), remains robust after we include non-European developed countries, use multiple years for each country, measure employer social-security contributions, and restrict the sample to working-age households.

2. Four Levers of Monetary Redistribution

Our analysis of monetary redistribution is sequential (see Figure 1). Our starting concept is *market income*, which is the sum of labor, capital, and pension income before any transfers or taxes. We then add transfers, which converts market income to *gross income*. Finally, we subtract taxes to obtain *disposable income*. This sequential approach allows us to compare redistribution through taxes with redistribution through transfers for each country-year observation.[4]

The work of Reynolds Smolensky (1977) and Kakwani (1984) identifies the links between redistribution, progressivity (or targeting), and the average rate of taxes (or transfers). We rewrite these results in a form that contains the four levers of redistribution in a single formula:

$$\text{Redistribution} = \text{Transfer rate} * \text{Targeting} + \text{Tax rate} * \text{Progressivity} - \epsilon.$$

The higher the average transfer rate and the more intensively these transfers are targeted at the poor, the greater is the redistribution. Similarly, the higher the average tax rate and the more progressive the tax system, the greater is the redistribution. Algebraically, the impact of the four policy levers on redistribution is given by

$$\text{Gini}_{\text{market}} - \text{Gini}_{\text{disposable}} = \frac{s}{1-s}\text{Kakwani}_{\text{transfer}} + \frac{t}{1-t}\text{Kakwani}_{\text{tax}} - \epsilon.$$

Redistribution is measured by the difference between the Gini index for market income and that for disposable income—the Reynolds–Smolensky index. The contribution of the transfer rate is $\frac{s}{1-s}$, where s is the average transfer rate; this comes from the algebraic relationship between the Reynolds–Smolensky and Kakwani indices. Similarly, the contribution of the tax rate is $\frac{t}{1-t}$, where t is the average tax rate. $\text{Kakwani}_{\text{transfer}}$ and $\text{Kakwani}_{\text{tax}}$ are the Kakwani indices measuring transfer targeting and tax progressivity, respectively. The Kakwani index is the difference between the concentration index and the Gini index. Concentration indices

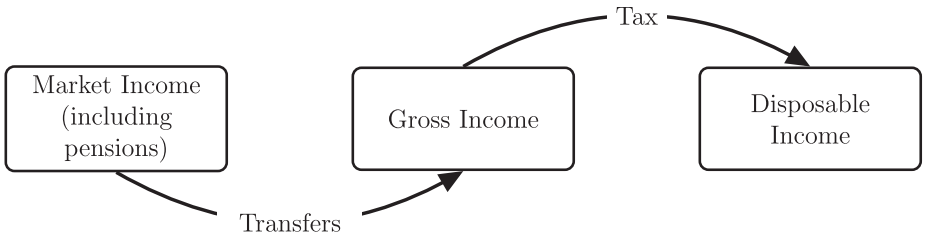

Figure 1. The Sequential Contribution of Taxes and Transfers to Inequality Reduction

are calculated on pre-tax income and pre-transfer income. If transfers fall and taxes rise with income, $\text{Kakwani}_{\text{transfer}}$ is negative and $\text{Kakwani}_{\text{tax}}$ is positive.[5] As shown by Kakwani (1984), ε, also known as the Atkinson–Plotnick index of re-ranking, captures the change in the household ranking in the income distribution.[6]

The redistribution from taxes or transfers depends on the interaction between the average rate and progressivity (or targeting). As such, the marginal effect of progressivity is not constant. For example, an increase in progressivity will have a greater impact on redistribution when coupled with a higher average tax rate. The converse also applies: the marginal effect of the average tax rate varies by progressivity.

We are interested in the connections that go beyond the *ceteris paribus* assumption of the marginal effect of a change in one parameter. A change in progressivity or targeting may coincide with movements in average tax and transfer rates, for example. Ultimately, the analysis of these co-movements requires accurate data on income, taxes, and transfers at the household level.

3. Data

3.1. *The Luxembourg Income Study (LIS) Dataset*

We use the micro data provided by the Luxembourg Income Study (LIS), which is a harmonized version of national household surveys. The data includes different types of household income, including individual earnings, monetary transfers, direct taxes, employee contributions, and household consumption. LIS data have become the benchmark for the analysis of the redistributive impacts of tax and transfer systems (Ferreira *et al*., 2015). The data are comprehensive, comparable, and measure the *ex post* effect of the transfer system—since the recipient reports the amount of transfers actually received rather than the amount the government intends to provide.

A common alternative to LIS data is EU-SILC data in combination with the EUROMOD microsimulation model.[7] We here choose to use LIS data for two reasons. First, EU-SILC has a more restricted time and geographic coverage, as it only concerns European Union countries, starting in 2004. Second, we focus on the *ex post* impact of a wide array of tax and transfer configurations. The microsimulation method of EUROMOD is well suited to estimating the effect of one specific policy change on a given population. Here, we prefer to compare the actual outcomes between countries with a wide range of tax-transfer combinations rather than using assumptions to simulate a change in the tax-transfer mix.

[5]Note that s is negative: transfers can be thought of as negative taxes. In our sample, transfers are always targeted at the poor; that is, $\text{Kakwani}_{\text{transfer}}$ is always negative. This means that all terms in the equation are positive. Also note that targeting appears in the equation in an analogous way to progressivity. Even a universal transfer (where every household receives the same monetary amount) produces a negative Kakwani index, as the transfer rate (transfers divided by income) falls as income rises.

[6]For details on inequality decomposition and re-ranking, see Urban (2009).

[7]On the comparison of inequality measures in LIS and SILC/EUROMOD, see Marx *et al*. (2013).

TABLE 1
INCOME DEFINITIONS

Income Concept	Definition	Transition	LIS Variables
Market income	gross labor income + capital income + employer ssc + pensions		hil + (hic − hicvip) + hsscer + (pension − hitsap)
Gross income	gross labor income + capital income + employer ssc + pensions + social transfers (other than pensions)	Market income + monetary transfers (other than pensions)	hil + (hic − hicvip) + hsscer + (pension − hitsap) + (hits − hitsil − hitsup)
Disposable income	gross labor income + capital income + pensions + social transfers (other than pensions) − employee ssc − income taxation	Gross income − income taxation and social security contributions (employer and employee)	hil + (hic − hicvip) + (pension − hitsap) + (hits − hitsil − hitsup) − hxits − hxiti

Notes: The unit of observation is the household with a correction for household size using the square-root scale. Employer social-security contributions are imputed for all country-years, as the underlying household surveys do not measure taxes on employers. For certain surveys, employee social-security contributions are also missing and these missing observations are imputed. Pensions include public pensions (work-related and universal) and private pensions, but exclude assistance pensions. The U.K. and Ireland are exceptions. Due to uncertainty in the data coding, we included assistance pensions (hitsap) in pensions. Transfers include all cash transfers but exclude pensions as defined above. *Source*: Based on LIS data.

3.2. *Detailed Income Measures*

Taxes and transfers can be separated from labor, capital, and pension income to define three stages of income. *Market income* is the sum of labor, capital, and pension income before any taxes. Adding transfers produces *gross income*, and then deducting income tax and social-security contributions last yields *disposable income*. The details of the LIS variables used at each income stage appear in Table 1. We focus on the changing income distribution from market to gross to disposable income—that is, the impact of transfers and taxes.[8]

All income, tax, and transfer variables are standardized at the household level using the square-root equivalence scale. We always compare transfers to market income and taxes to gross income. This is consistent with most legislation, as the eligibility criteria for transfers refer to market income while the tax base often includes part of transfer income.

As transfers and taxes are benchmarked to different income concepts, we cannot compare the extent of targeting versus progressivity or that of the average transfer rate to the average tax rate (Urban 2014). However, we can compare the size of the changes in inequality—the outcome variable—due to taxes and transfers.

We calculate the Gini index for each income concept, the Kakwani index of tax progressivity and transfer targeting, and the average rates of taxes and transfers over household income. The choice of income concept can influence the Kakwani index. Previous work has used pre-tax income as the reference income. We adhere to this convention by using market income for the Kakwani index of transfer targeting and gross income for the Kakwani index of tax progressivity.

We make two particular measurement choices in our analysis. First, we include retirement pensions (including occupational and universal pensions, but excluding assistance pensions) in market income. We acknowledge that public pensions do help reduce inequality. For example, pay-as-you-go public pension schemes redistribute from working-age households to pensioners. However, pensions should be analyzed separately from transfers, as the differences between public and private pensions create comparability problems. If public pensions are excluded from market income, pensioners in countries that use public pensions will have zero income before transfers. These pensioners would be identified as poor, in the same way as if they had zero private-pension savings in a country without public pensions. In this case, inequality would be artificially high in countries with many pensioners and a higher share of public pensions.

Previous work has applied two different adjustments: restricting the analysis to the working-age population or including public pensions in market income (Jesuit and Mahler, 2010). We chose the latter solution, following recent literature (Marx *et al*., 2016).[9] By doing so, the market income of pensioners can be compared between countries with funded pensions and those with pay-as-you-go

[8]We exclude remittances between households from our analysis.

[9]Note that pension contributions are included in social-security contributions in our data, while their counterparts, pension benefits, are excluded from social transfers. We would ideally like to deduct the specific part of social-security contributions referring to pensions, but this is not possible in the LIS data.

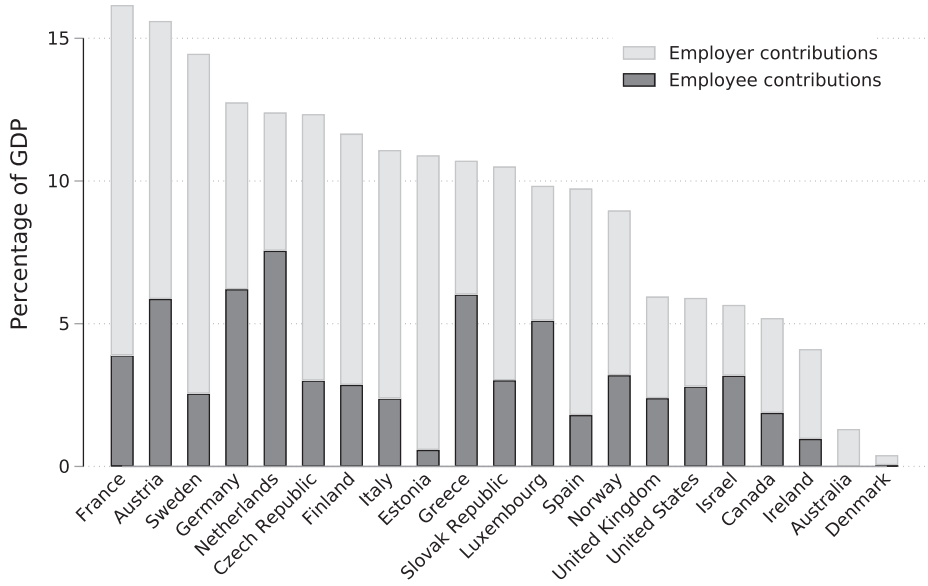

Figure 2. The Split Between Employer and Employee Social-Security Contributions

Source: Revenue Statistics, OECD.

Notes: There are minor differences between OECD macro data on social-security contributions and our imputations from LIS household surveys. We omit Iceland from this graph because the OECD macro data do not separate Iceland's social security contributions (4 percent of GDP) into employer and employee contributions.

systems.[10] Pensioners make up a large share of most national populations, with this share varying by country. The inclusion of pensions in market income is the only adjustment that can provide insights for the whole national population.

Our sample thus includes the whole population, in contrast to the majority of existing work, which restricts the sample to the working-age population. To see how excluding pensions from transfers affects the results, we restrict the sample to working-age households (Section 4.5.1) and analyze the redistributive impact of pensions (Section 4.5.2). In the working-age subsample, transfers and taxes contribute equally to redistribution, while the tradeoff between the average tax rate and progressivity is more pronounced.

Our second measurement choice is that we measure market income before deducting employer social-security contributions. Previous work has only looked at employee contributions and income tax. There are important reasons to include employer contributions in the analysis. The majority of the incidence (between two thirds and 90 percent) falls on the employee, even though the contributions are labeled as being paid by the employer (for reviews, see Fullerton and Metcalf, 2002; Melguizo and González-Páramo, 2013). The incidence of social

[10]A different rationale for including pensions in market income is suggested by Smeeding and Weinberg (2001): pensions can be considered as deferred compensation, which is not the case for other benefits covering social risks, such as unemployment or sickness.

contributions is similar to that of the personal income tax, so there is no economic reason to treat personal income tax, employee contributions, and employer contributions differently. This choice makes comparisons easier, as the split between employer and employee contributions varies from one country to another. Note in Figure 2 that many countries, such as Sweden, rely mostly on employer contributions, while others, such as the Netherlands, rely on employee contributions. The following section describes how we imputed employer contributions and other missing taxes.

3.3. *The Imputation of Social Contributions*

The LIS data provide only partial coverage of household taxation (Nieuwenhuis *et al*., 2017). Employee social-security contributions and personal income tax are missing for some country-years, and employer social-security contributions and consumption taxes are missing in all country-years. This limitation is common to databases constructed using household surveys, and is also found in the OECD Income Distribution and Poverty Database (Joumard *et al*., 2012).

A considerable percentage of transfers is financed from indirect taxes such as social contributions from employers and consumption taxes (Kato, 2003; Beramendi and Rueda, 2007). Evaluation of the effects of transfers without taking into account the taxes that fund these transfers risks distorting the measure of redistribution. In addition, social-security contribution exemptions, especially for low wages, have become one of the most common progressive elements of the tax system in countries such as France and Belgium (Zemmour, 2015; Bozio, *et al*., 2016).

We impute employer social contributions at the individual level using OECD data on statutory rules.[11] Our imputation greatly improves the tax coverage of the dataset, as we now cover 54 percent of national tax revenue, as opposed to 35 percent in the initial LIS data.[12] The remaining tax revenue mostly comes from consumption taxes and corporate taxation, which fall outside the scope of the LIS household survey data. For some countries, we also impute employee contributions.[13]

Our imputation method applies the statutory rates provided by the OECD Taxing Wages series to individual wages.[14] To the extent that wages are accurately measured, the application of statutory rates allows us to correctly simulate employer social contributions. When employee social-security contributions are also missing, we impute using the same method. Our imputations allow us to reconstruct the pre-tax labor income of each individual. Last, the imputed measures are aggregated at the household level.

[11]Our code is available at https://github.com/matthewolckers/lis-tax-transfer.

[12]This is the theoretical LIS coverage: actual LIS coverage is even lower, as employee contributions are missing in France and Italy.

[13]For this paper, we exclude the net datasets (country-years for which even personal income-tax information is missing).

[14]For France, we take the tax rates from the reference files of TAXIPP, the microsimulation model of the *Institut des politiques publiques*. The reference files include information on CSG and CRDS, a flat tax levied on labor and capital income, and social-insurance benefits. The tax revenue from CSG and CRDS is greater than that from income tax.

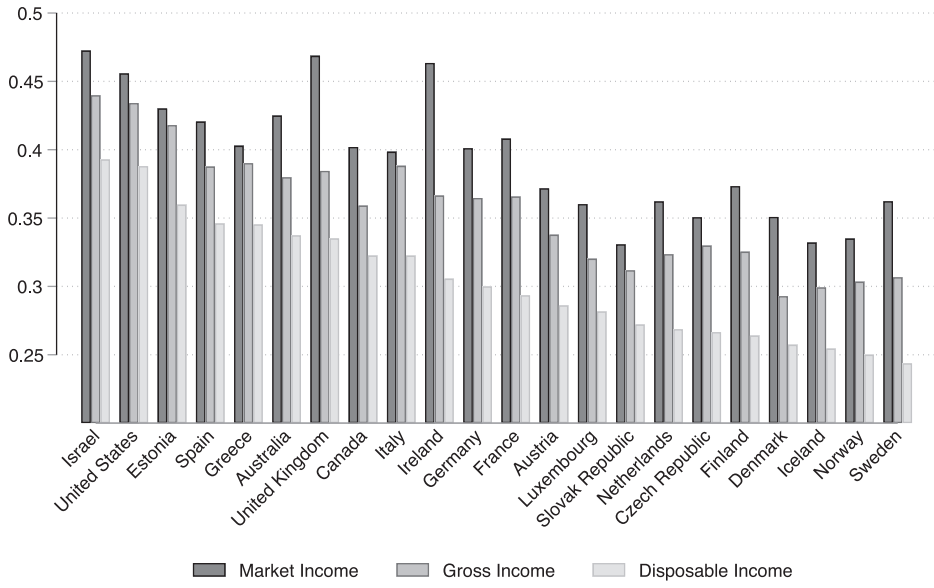

Figure 3. Inequality (the Gini Coefficient) at Different Income Stages

Source: Authors' calculations based on LIS micro data with imputations.

Notes: Market income is the sum of all labor and capital income, including private and public pensions. Gross income = market income + transfers. Disposable income = gross income − taxes. Countries are ranked by decreasing order of disposable-income inequality. We display the most recent year for each country, which is between 2010 and 2016 with two exceptions. For Ireland, we use the pre-crisis year of 2007, and the most recent year for Sweden is 2005. More details on the data are available at https://www.lisdatacenter.org/our-data/lis-database/.

3.4. *Measuring the Four Levers of Redistribution*

Our variables of interest are the four levers of income redistribution described in Section 2: the average tax rate, tax progressivity, the average transfer rate, and transfer targeting.

Tax and transfer rates are calculated by dividing mean taxes and transfers by mean household gross income and market income, respectively. Note that the tax and transfer rates are not directly comparable, as the denominator differs.[15] We choose the denominator so that we can decompose redistribution using the formula described in Section 2.

Following recent work, we use the Kakwani index (Kakwani, 1977, 1984) rather than the concentration index to measure tax progressivity and transfer targeting.[16] The concentration index summarizes the distribution of a variable over households, ranked by household income. This measure is sensitive to the initial level of inequality, so the Kakwani index provides a correction by subtracting the Gini index from

[15]We have assessed the robustness of our results to this convention by calculating all rates on the same reference income (i.e., the disposable income): the results continue to hold.

[16]The Kakwani index is also used, for instance, in Verbist and Figari (2014), Avram *et al.* (2014), and Joumard *et al.* (2012).

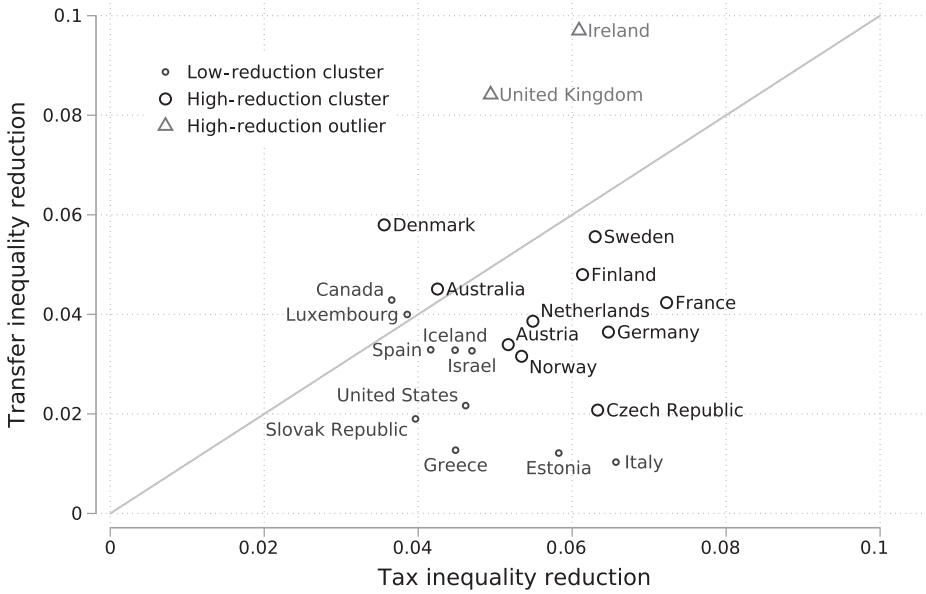

Figure 4. Tax and Transfer Contributions to Inequality Reduction

Source: Authors' calculations based on LIS micro data with imputations.

Notes: The vertical axis shows the fall in inequality between market income and gross income (the Reynolds–Smolensky index). The horizontal axis shows the reduction in inequality between gross income and disposable income. Countries below the 45-degree line rely more on taxes than transfers for redistribution. The total redistribution between market and disposable income is centred around 0.07 Gini points in the low-reduction cluster of countries and 0.11 Gini points in the high-reduction cluster.

the concentration index. Intuitively, the Kakwani index measures the distance from proportionality. The index ranges from $-1-Gini$ to $1-Gini$. For transfers, the lower the Kakwani index, the higher is the rate at which transfers fall as income rises. The transfer system redistributes from rich to poor when the index is negative. For taxes, the higher the Kakwani index, the higher is the rate at which tax rises as income rises. The tax system redistributes from rich to poor when this index is positive.

4. Results

4.1. *Comparing the Impact of Transfers and Taxes*

The calculation of the Gini index at different income stages allows us to assess the reduction in inequality due to transfers and taxes for each country-year in our dataset. The comparative impact of taxes and transfers is depicted in Figure 3, where the step from market to gross income reflects transfers and that from gross to disposable income reflects taxes. In most countries, taxation makes a greater contribution to inequality reduction than do transfers (excluding public pensions). There are notable exceptions, such as the United Kingdom (U.K.), Ireland, and Denmark, where there is a considerable fall in inequality from transfers relative to that from taxes.

Our data confirm the stylized fact that the main predictor of disposable-income inequality is market-income inequality. Taxes and transfers do not suffice to remove the correlation between market-income inequality and disposable-income inequality, which is 0.82 in our sample. Taxes and transfers do reduce inequality but countries with high market-income inequality also generally have high disposable-income inequality.[17]

Figure 4 provides more detail on the different combinations of taxes and transfers. It shows the relative contribution of taxes and transfers to the fall in inequality from market to disposable income. There are low and high inequality-reduction clusters, plus two outliers, Ireland and the U.K. The standard welfare-state grouping generally holds (the Mediterranean, continental Europe, and Nordic countries), but the group of "liberal" or "English-speaking countries" is scattered—especially due to the position of Ireland and the U.K.

In the low-reduction country cluster, the Gini coefficient drops by approximately 0.07 between market and disposable income. This cluster includes Estonia, several Mediterranean countries (Greece, Israel, Italy, and Spain), as well as two liberal countries (Canada and the United States [U.S.]) and Luxembourg, Iceland, and the Slovak Republic. In this group, tax redistribution exceeds transfer redistribution (except in Canada and Luxembourg). The mean tax reduction is 0.04 points of the Gini index and that for transfers 0.02 points.

In the high-reduction country cluster, the Gini coefficient falls by about 0.10 between market and disposable income. This cluster includes Nordic and continental European countries (Denmark, Sweden, Norway, Austria, Germany, France, the Netherlands, and the Czech Republic) as well as Australia. In this group, a broad range of arrangements lead to the same size drop in inequality. In Denmark and Australia transfers play the dominant role, whereas in the other countries taxes are more important. At the extreme, in the Czech Republic the tax system accounts for over three quarters of inequality reduction. The U.K. and Ireland are outliers in this respect, with a remarkably high level of inequality reduction, 60 percent of which is due to transfers.

These results differ from those in the original LIS data, before the imputation of employer contributions (for this comparison, see the Appendix). The inclusion of employer social-security contributions raises the tax system's average contribution to inequality reduction and slightly reduces that of transfers. This imputation makes the most difference in the Czech Republic, France, the Slovak Republic, and Sweden. In contrast, the position of certain countries, such as Canada, Denmark, and the U.S., remains almost unaffected.[18] Employer social-security contributions not only change the redistribution measure but also reveal a bias in the original redistribution analysis, which over-emphasized the role of the transfer system in a subset of countries.

Existing work has considered tax and transfer redistribution using LIS data. In some respects, we repeat this existing analysis (see, e.g., Mahler and Jesuit, 2006; Wang *et al.*, 2014). However, existing work does not consider employer contributions, and combines countries where employee contributions are measured and

[17]Ireland is an outlier for all of the dimensions considered here. This is not particular to our data: for a discussion of the high market-income inequality and the size of transfers there, see Nolan and Smeeding (2005).

[18]According to OECD data, Denmark has no employer contributions (see Figure 2).

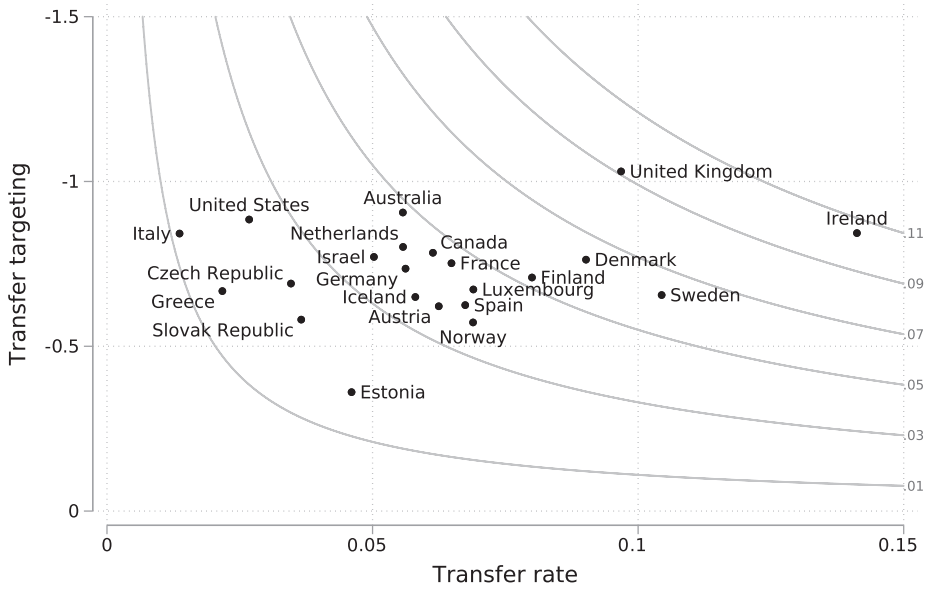

Figure 5. Vertical Redistribution Due to Transfers: Rates versus Targeting

Source: Authors' calculations based on LIS micro data with imputations.

Notes: The closer the targeting index is to zero, the lower is the intensity at which transfers are targeted at poor households. The curves show the resulting vertical redistribution measured in Gini points, shown at the end of each curve. Vertical redistribution does not measure re-ranking and might slightly overstate the effective redistribution from transfers. Two points on the same curve represent the same vertical redistribution obtained by different combinations of average rates and targeting. For instance, Australia and Finland both achieve a reduction of 0.05 Gini points, but with different combinations of transfer rates and targeting. Australia has a low transfer rate (6 percent of market income) and transfers are highly targeted (a Kakwani index of −0.91). Finland has a higher transfer rate (8 percent), but transfers are less-intensively targeted (−0.71).

those where they are not. This work concludes that the tax system is, on average, far less redistributive than the transfer system (even if we recalculate the results after the exclusion of pensions) and that certain countries (France, Sweden, Finland, the Netherlands, the U.K., the Czech Republic, and the Slovak Republic) rely less on tax redistribution than do others. Our results here differ from those in the existing literature as we measure the role of taxation far more accurately. The secondary role of taxation in previous research is an artifact due to missing employee contributions (France) or the exclusion of employer contributions (Sweden, Finland, the Czech Republic, and the Slovak Republic).

4.2. *The Inequality Reduction from Transfers*

Our data allow us to analyze the contribution of both the average transfer rate and the intensity of targeting to inequality reduction.[19] Figure 5 shows this decomposition. The downward-sloping curves represent different extents of

[19]We do not further decompose transfers. For an analysis of different transfer types, see Marx *et al.* (2016).

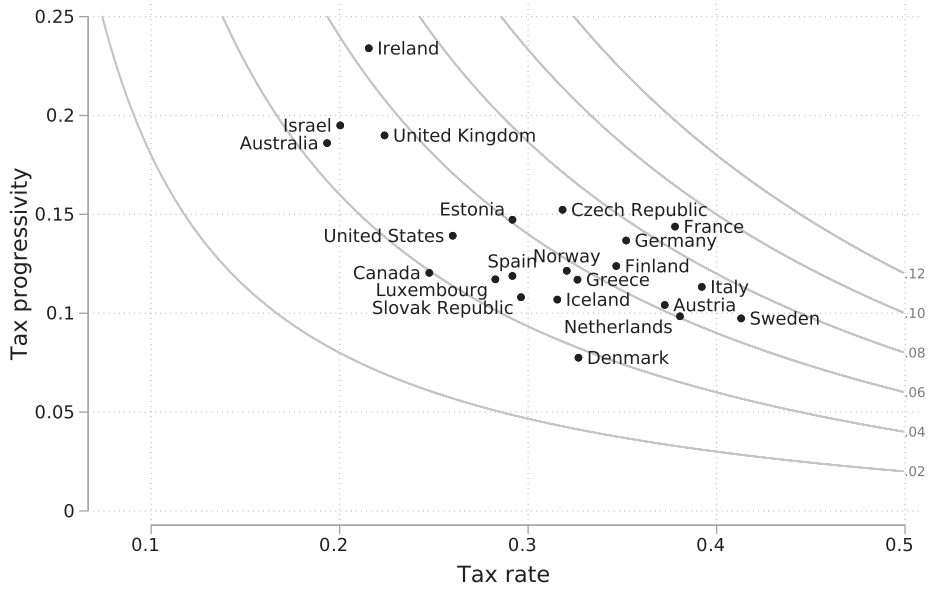

Figure 6. Vertical Redistribution Due to Taxes: Average Tax Rate versus Progressivity

Source: Authors' calculations based on LIS micro data with imputations.

Notes: The curves show the resulting vertical redistribution from combinations of average tax rates and tax progressivity, measured by the reduction in the Gini index. Vertical redistribution does not measure re-ranking and might slightly overstate the effective redistribution from taxes. Two points on the same curve represent the same redistribution obtained by different combinations of progressivity and average rates. For instance, Australia and Denmark achieve the same tax redistribution of 0.04 Gini points with different combinations of tax rate and progressivity. Australia has a low tax rate (19 percent of gross income) and taxes are highly progressive (a Kakwani index of 0.19). In contrast, Denmark has a high tax rate (33 percent), but progressivity is much lower (0.08).

vertical redistribution, showing inequality reduction without correcting for changes in the income ranking. Inequality reduction increases to the northeast of the graph. Note that transfers fall with income, as the targeting index is negative for all country-years. There is wide variation in the intensity of targeting across the sample. The Kakwani index varies from −1.03 to −0.36, with a mean of −0.72 and a standard deviation of 0.13. Ireland and the U.K. are outliers by combining intensively targeted transfers with a relatively high average transfer rate.

The impact of targeting is constrained by the average transfer rate. The U.S. targets more intensively than the Slovak Republic, but both have a low average transfer rates (around 3 percent of market income), producing little redistribution. Targeting matters little when there is not much money to redistribute. Conversely, at a much higher transfer rate (around 10 percent of market income), the redistributive difference between the stronger targeting in the U.K. and the weaker targeting in Sweden is considerable. We can interpret this relationship using the equation in Section 2. Vertical redistribution comes from targeting multiplied by the transfer rate, so that the redistributive effect of targeting is conditional on the transfer rate.

Our results again match the usual welfare state clustering. Mediterranean countries redistribute less (Spain being an exception), while Nordic countries and

continental Europe redistribute more. The liberal countries (the U.S., Australia, the U.K., Ireland, and Canada) are rather scattered. They target intensively, but a wide variety of transfer rates causes significant differences in redistributive performance.

Our results here contribute to the existing literature on the "paradox of redistribution" (Korpi and Palme, 1998), that universal transfers (weak targeting) have a greater impact on redistribution. We show that the extent of transfer redistribution is driven by the transfer rate, and this is often too low for targeting to matter. A one-standard-deviation change in the transfer rate yields much more (2.5 times more) redistribution than a one-standard-deviation change in targeting.[20]

4.3. *The Inequality Reduction from Taxes*

Figure 6 shows the contribution of the average tax rate and tax progressivity to inequality reduction. Tax redistribution ranges from 0.02 to 0.09 Gini points. We can see, for instance, that Canada and the U.K. have similar average tax rates (25 percent and 22 percent, respectively) but the latter's tax system is much more progressive. The strictly positive range of the Kakwani index indicates that all countries have globally progressive tax systems, although individual tax features may still be regressive.

In contrast to transfers, where the average transfer rate is the most important feature of redistribution, neither the average tax rate nor tax progressivity dominates.[21] In the full sample, a one-standard-deviation rise in tax progressivity increases redistribution by 26 percent of average tax redistribution. A one-standard-deviation rise in the average tax rate also increases redistribution by 26 percent.[22]

Liberal countries have low tax rates and greater progressivity—most of the tax burden is borne by the upper half of the income distribution. Canada and the U.S. are an exception, with moderate progressivity. Nordic countries and continental Europe have relatively high average tax rates. Progressivity is relatively high in certain European countries (Germany, France, the Czech Republic, Norway, and Finland), but lower for others (Denmark, Sweden, the Netherlands, and Austria).[23]

4.4. *Typical Patterns and Incompatible Policy Choices*

Given that tax and transfer systems result from political bargaining, we are interested in the typical patterns in the data. These will help inform new theories of redistribution that include both the marginal effects and the political connections between each lever of redistribution.

[20]In the full sample, a one-standard-deviation rise in the intensity of targeting increases redistribution by 0.008 points (20 percent of the average redistribution from transfers), while a one-standard-deviation rise in the transfer rate increases redistribution by 0.020 points (50 percent of the average redistribution from transfers). These marginal effects are calculated with the other parameters at their sample means. This calculation is carried out using 84 observations.

[21]The change in the Gini coefficient from gross to disposable income is correlated at 0.42 with the tax rate and at 0.46 with tax progressivity.

[22]The marginal effects are calculated with the other parameters at their sample means. The calculation is carried out using 84 observations. The average vertical-redistribution figure from taxes is 0.057. One standard deviation of progressivity is 0.04 and one standard deviation of the average tax rate is 0.06.

[23]For the sample of working-age households, there are no progressivity differences between Nordic and continental European countries. See Section 4.5.1.

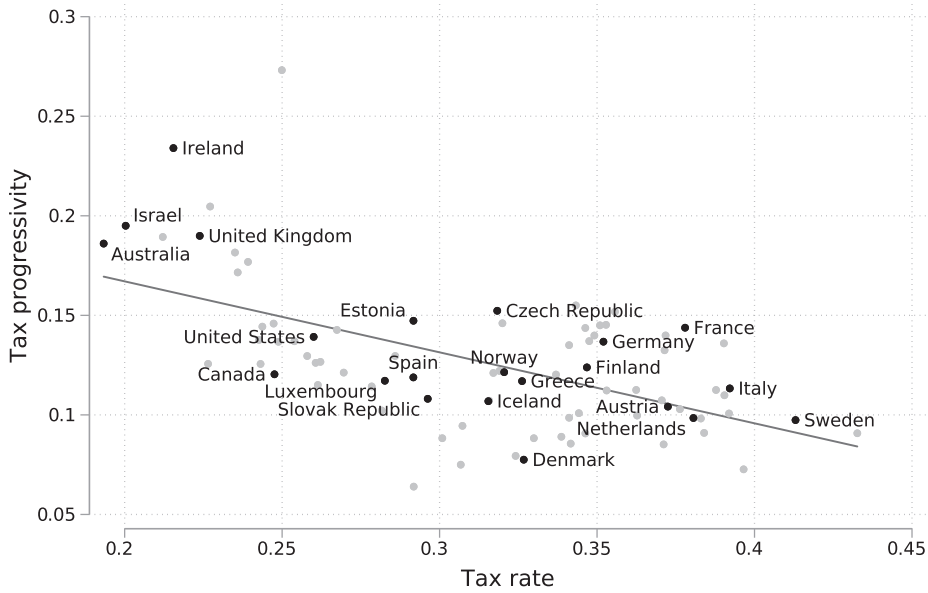

Figure 7. High Average Tax Rates Are Incompatible with Progressivity

Source: Authors' calculations based on LIS micro data with imputations.

Notes: There is a negative relationship between progressivity and the average tax rate. The most recent year is highlighted for each country, which is between 2010 and 2016 with two exceptions. For Ireland, we use the pre-crisis year of 2007 and the most recent year for Sweden is 2005.

4.4.1 *Strong Progressivity Is Incompatible with High Tax Rates*

We find a tradeoff between tax progressivity and average tax rates (see Figure 7), as found by Verbist and Figari (2014) in a sample of 15 European countries. None of the ten country-years (four different countries) in which the Kakwani index is above 0.16 have a tax rate of over 0.2. Symmetrically, none of the 25 country-years (nine different countries) in which the tax rate is above 0.35 have a Kakwani index of over 0.15. For transfers, there is no clear relationship between targeting and the average transfer rate (Brady and Bostic, 2015).

The incompatibility of strong progressivity and high taxes is not a statistical artifact. In the range of progressivity and average tax rates that we observe, a country could apply the maximum average tax rate and maximum progressivity without marginal tax rates exceeding 100 percent. Consider the following thought experiment. Say that Israel, with an average tax rate of around 20 percent, wanted to increase taxes to Sweden's 42 percent but retain its progressive tax schedule. Without any behavioral or political response—that is, pre-tax income is unchanged—Israel could simply double the household tax rate to attain Sweden's tax level. By definition, the Kakwani index would be left unchanged.[24] It follows

[24] $\text{Kakwani}_{\text{tax}} = 2\sum_{k=1}^{n}\frac{1}{n}\left(\frac{k}{n} - \sum_{i=1}^{k}\gamma_i\right) - G_{\text{before tax}}$, where n is the number of households in the population and γ_i is the share of taxes paid by household i. Progressivity depends only on the pre-tax distribution of income and the share of taxes paid by each household, ranked by their income. If a country has the same $\gamma_i \forall\, i$ and $G_{\text{beforetax}}$ at two different points in time, then it will also have the same value of $\text{Kakwani}_{\text{tax}}$.

that all marginal tax rates would also double. Since Israel's marginal tax rates are below 50 percent, the new marginal rates would not be above 100 percent. As there is therefore no mathematical reason to stop a country from having Israel's progressivity and Sweden's average tax rate, we conclude that the pattern that we observe reflects political or behavioral constraints.

The link between inequality and the political process is an extremely active area of research (for a review, see McCarty and Pontusson (2011)). As in Korpi's (1983) *power resource theory*, the incompatibility between strong progressivity and high average tax rates may reflect bargaining between the Left, representing workers, and the Right, representing employers. Alternatively, the phenomenon may come from employers' attempts to regulate the labor market (Swenson, 2002). If employers attract workers by offering above-market wages, very progressive taxation will thwart these incentives, while high average tax rates on labor may prevent new firms entering the market. Determining which of the possible political explanations is most likely would require a detailed analysis that is beyond the scope of the present work.

4.4.2 *Market-Income Inequality Is Correlated with Progressivity and Targeting*

The second pattern that we observe is a positive correlation between market-income inequality and the intensity of both tax progressivity and transfer targeting. While the focus is generally on whether targeting and progressivity reduce inequality, the relationship appears stronger in the opposite direction: countries with greater market-income inequality use more progressive taxation and more-targeted transfers. The correlation with market-income inequality is −0.66 for targeting and 0.70 for progressivity. Remember that the targeting index is negative, as the poor receive a larger share of transfers, whereas the progressivity index is positive, as the rich pay a larger share of taxes.

The correlation between market-income inequality and targeting or progressivity is not deterministic. Consider taxes. The Kakwani index corrects the concentration index for the pre-tax level of inequality. As the pre-tax Gini rises, starting from a point with progressive taxation, there is no mathematical reason (in the Kakwani formula) why the Kakwani index should also increase.[25] A positive correlation shows that in countries with greater market-income inequality, the departure from proportionality of taxes or transfers is greater.

We hypothesize that progressivity and targeting may be substitutes for labor-market regulations. The negative relationship between labor-income inequality and both minimum wages and active labor-market policies has been well documented (Salverda and Checchi, 2015). In our data, there is a negative correlation of −0.61 between the market-income inequality of working-age households and the OECD index of employment protection.[26]

[25]The Kakwani index for taxes can also be written as $K_t = \frac{2}{n}\sum_{k=1}^{n}\left(\sum_{i=1}^{k}\alpha_i - \gamma_i\right)$, where n is the number of households, α_i the share of pre-tax income received, and γ_i the share of taxes paid by household i. As the share of taxes is compared to the share of income, there is no deterministic relationship that would make the pre-tax level of inequality be positively correlated with the progressivity index.

[26]This index is available at https://stats.oecd.org/Index.aspx?DataSetCode=EPL_OV.

As expected given the correlations above, we find both progressivity and targeting to be negatively correlated with the strictness of labor-market regulations. Our results suggest a political tradeoff, where countries either compress the market-income distribution via labor-market restrictions, such as minimum wages, or inequality is reduced *ex post* by taxing the rich and giving to the poor. However, the two approaches do not produce the same results. Targeting and progressivity do not allow very unequal countries to reduce inequality to the levels of countries starting with lower figures (as shown in Figure 3). The tradeoff between labor-market policies and tax and transfer policies is a complex political phenomenon, and more detailed analysis is beyond the scope of our work here.

4.5. *The Impact of Pensions*

4.5.1 *Restricting the Sample to Working-Age Households*

As noted in Section 3.2, the results are sensitive to our decision to categorize pensions as income rather than social transfers. We prefer to consider the impact of taxes and transfers on the whole population, rather than just working-age households. Households whose "head" is not of working age make up over 27 percent of the population on average in the countries included here, and most of these households receive pensions. This significant share of the population should not be excluded from our inequality and redistribution calculations.

To make our results comparable to those focusing only on working-age households, we repeat our analysis on this subsample. We define working-age households as those whose head is aged between 25 and 60 years at the survey date. There are two main differences from the results for the whole population.

First, the contribution of transfers and taxes to redistribution is more equal in the working-age subsample. In the Appendix, we repeat Figure 4 for the working-age subsample. In contrast to Figure 4, countries are no longer clustered below the 45-degree line (where redistribution is stronger from taxes than from transfers). Some countries, such as Sweden, Finland, and Spain, rely more on taxes for redistribution across the whole population but more on transfers for redistribution within the working-age subsample.

Second, the tradeoff between the average tax rate and progressivity is more pronounced in the working-age subsample. The correlation between tax progressivity and the average tax rate is −0.57 in the full sample and −0.65 in the working-age subsample. In the Appendix, we repeat Figure 7 for the working-age subsample. The more pronounced tradeoff is driven by countries, such as France, Germany, and the Czech Republic, with lower progressivity and higher average tax rates in the working-age subsample.

The comparison of the full sample and the working-age subsample suggests that a significant share of the tax redistribution is from working-age households to pensioners (whose income is on average lower and whose tax burden is on average lighter). The difference in the tax burden likely partly reflects public-pension contributions, but not only so, as this also holds for countries with private pension systems.

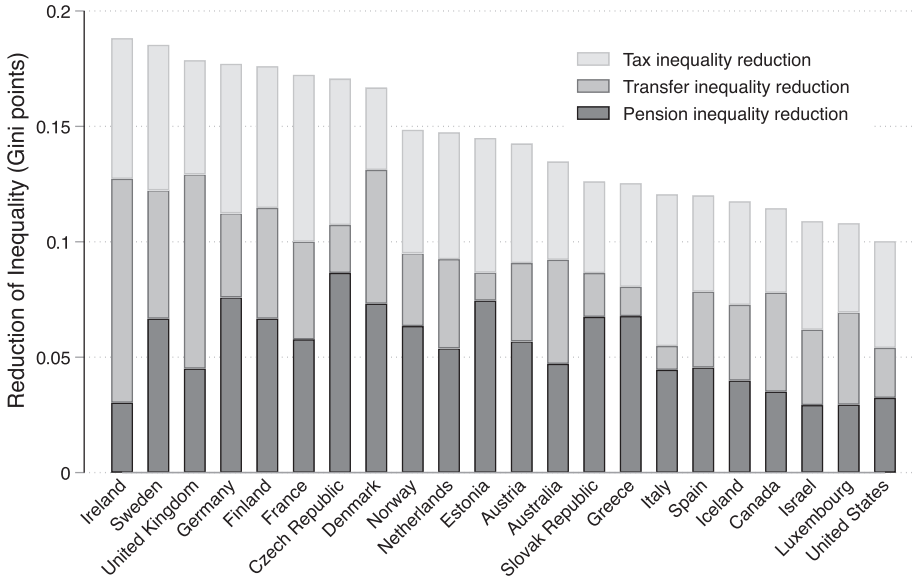

Figure 8. The Reduction in Inequality from Pensions, Taxes, and Transfers

Source: Authors' calculations based on LIS micro data with imputations.

Notes: We display the most recent year for each country, which is between 2010 and 2016 with two exceptions. For Ireland, we use the pre-crisis year of 2007 and the most recent year for Sweden is 2005.

4.5.2 *The Redistributive Impact of Pensions*

We categorize pensions as market income, which is our starting measure before adding transfers and deducting taxes. Given this methodological choice, the redistributive impact of pensions is not analyzed. This section focuses on the redistributive impact of public pensions.

We calculate the share of public pensions in factor income by country-year, where factor income is market income excluding pensions and is the sum of labor and capital incomes. We also calculate the Kakwani index of public pensions ranked by market income. The Kakwani index measures the degree to which public pensions are targeted at the poor. We find a negative correlation between the average pension rate and pension targeting, as suggested by Korpi and Palme (1998).[27]

Figure 8 shows the drop in inequality, measured in Gini points, that is attributable to pensions, transfers, and taxes. For most countries, the impact of pensions is comparable to that of taxes, but greater than that of transfers. The considerable redistributive impact of pensions is not mechanical. Many public-pension schemes are earnings related, so that households that earn more have larger pensions. It is indeed possible for pensions to increase, rather than reduce, inequality. However, in every country that we analyzed, pensions are more equally distributed than labor and capital income, and so help to reduce inequality.

[27]For a decomposition of the redistribution from pensions into that from the average pension rate and that from pension targeting, see the Appendix.

5. Discussion

We have decomposed redistribution into four key levers: the progressivity and average rate of taxes, and the targeting and average rate of transfers. Our aim was to place countries on a map of possible policy mixes and see if certain configurations are avoided or certain policy levers are incompatible.

We have three main findings. First, when excluding pensions, tax redistribution dominates transfer redistribution in most countries. Focusing only on working-age households, transfer and tax redistribution are of similar size—in contrast to previous work showing a dominant role for transfers in the same subsample. Second, cross-country differences in targeting explain very little of the observed variation in inequality reduction. For transfers, most of the redistributive effect comes from the transfer rate; on the contrary, both tax progressivity and average tax rates have significant effects on tax redistribution. Third, we observe the trace of political tradeoffs: high average tax rates are not found together with very progressive tax systems.

We have highlighted the bias that arises from restricting the analysis to the taxes that are paid by households (and appear in household surveys). The tax incidence of employer social-security contributions often falls on households despite being paid by employers. With respect to inequality reduction, income taxes and employee and employer contributions are perfect substitutes in moving from gross to disposable income. Our work here is a step forward as it provides far more comparable data on the tax side via the imputation of employer contributions.

We could improve our analysis by using administrative data (Meyer and Mittag, forthcoming). Recent work on a country-by-country basis has matched the income distribution over households to national accounts (Bozio *et al*., 2018; Piketty *et al*., 2018). Further research is also needed to include consumption taxes and transfers in kind (Figari and Paulus, 2015) in the analysis. These improvements may well alter our findings, as consumption taxes are thought to be regressive (Warren, 2008), while transfers in kind likely have strong redistributive effects (Sutherland and Tsakgloglou, 2012).

In the common welfare-state clustering of countries, continental Europe and Nordic countries redistribute more than do Mediterranean and most liberal countries. In general, liberal countries have lower, but more progressive, tax rates than Nordic and continental countries. However, the tax progressivity in the U.S. and Canada is only moderate, while progressivity in Germany, France, and Norway appears much more marked than that in Sweden, Denmark, and the Netherlands. Liberal countries share common features such as intensive transfer targeting and tax progressivity, but the great variation in tax and transfer rates translates into diverse redistributive outcomes. Ireland and the U.K. achieve considerable reductions in inequality, while the U.S. and Canada redistribute far less. The liberal welfare-state cluster does not therefore correspond directly to the clusters that appear in our analysis.

In conclusion, the paradox of redistribution requires more careful consideration. Analyses that focus on only one or two particular levers of redistribution of the four that we have identified may not only lead to biased results but also provide misleading policy recommendations. As shown in our decomposition, the

relative importance of each lever depends on its combination with other levers. For example, the marginal contribution of targeting on redistribution depends on the average transfer rate. As already emphasized in research on the paradox of redistribution, redistributive policies are the outcome of a political balance between these four levers. Here, we identify an incompatibility between strong progressivity and high rates of taxation. This indicates that governments cannot change redistributive policies in isolation. New theories of redistribution should recognize that pulling down one lever may well also shift another.

References

Avram, S., H. Levy, and H. Sutherland, "Income Redistribution in the European Union," *IZA Journal of European Labor Studies*, 3, 1–29, 2014.

Beramendi, P. and D. Rueda, "Social Democracy Constrained: Indirect Taxation in Industrialized Democracies," *British Journal of Political Science*, 37, 619–41, 2007.

Bozio, A., T. Breda, and M. Guillot, "Taxes and Technological Determinants of Wage Inequalities: France 1976–2010," PSE Working Paper 2016-05, 2016.

Bozio, A., B. Garbinti, J. Goupille-Lebret, M. Guillot, and T. Piketty, "Inequality and Redistribution in France, 1990–2018: Evidence from Post-Tax Distributional National Accounts (DINA)," WID.world Working Paper Series 2018/10, 2018.

Brady, D. and A. Bostic, "Paradoxes of Social Policy: Welfare Transfers, Relative Poverty, and Redistribution Preferences," *American Sociological Review*, 80, 268–98, 2015.

Caminada, K., J. Wang, K. Goudswaard, and C. Wang, "Income Inequality and Fiscal Redistribution in 47 LIS-Countries (1967–2014)," LIS Working Paper Series, 2017.

Ferreira, F. H. G., N. Lustig, and D. Teles, "Appraising Cross-National Income Inequality Databases: An Introduction," *Journal of Economic Inequality*, 13, 497–526, 2015.

Figari, F. and A. Paulus, "The Distributional Effects of Taxes and Transfers under Alternative Income Concepts: The Importance of Three 'I' s," *Public Finance Review*, 43, 347–72, 2015.

Fullerton, D. and G. E. Metcalf, "*Tax Incidence*," in A. Auerbach and M. Feldstein (eds), *Handbook of Public Economics*, vol. 4, 1787–872, Elsevier, Amsterdam, 2002.

Immervoll, H. and L. Richardson, "Redistribution Policy and Inequality Reduction in OECD Countries: What Has Changed in Two Decades?" Social, Employment and Migration Working Papers 122, OECD, Paris, 2011.

Immervoll, H., H. Levy, C. Lietz, D. Mantovani, C. O'Donoghue, H. Sutherland, and G. Verbist, "Household Incomes and Redistribution in the European Union: Quantifying the Equalizing Properties of Taxes and Benefits," in D. B. Papadimitriou (ed.), *The Distributional Effects of Government Spending and Taxation*, 135–65, Palgrave Macmillan, Basingstoke, 2006.

Jesuit, D. K. and V. A. Mahler, "Comparing Government Redistribution Across Countries: The Problem of Second-Order Effects," *Social Science Quarterly*, 91, 1390–404, 2010.

Joumard, I., M. Pisu, and D. Bloch, "Tackling Income Inequality: The Role of Taxes and Transfers," *OECD Journal: Economic Studies*, 2012, 1–37.

Kakwani, N. C., "Measurement of Tax Progressivity: An International Comparison," *Economic Journal*, 87, 71–80, 1977.

_____, "On the Measurement of Tax Progressivity and Redistributive Effect of Taxes with Applications to Horizontal and Vertical Equity," *Advances in Econometrics*, 3, 149–68, 1984.

Kato, J., *Regressive Taxation and the Welfare State: Path Dependence and Policy Diffusion*, Cambridge University Press, Cambridge, 2003.

Kenworthy, L., *Progress for the Poor*, Oxford University Press, Oxford, 2011.

Korpi, W., *The Democratic Class Struggle*, Routledge, London, 1983.

Korpi, W. and J. Palme, "The Paradox of Redistribution and Strategies of Equality: Welfare State Institutions, Inequality, and Poverty in the Western Countries," *American Sociological Review*, 63, 661–87, 1998.

Lindert, P. H., *Growing Public: Social Spending and Economic Growth since the Eighteenth Century*, vol. 1, Cambridge University Press, Cambridge, 2004.

Luxembourg Income Study (LIS) Database, 2018, http://www.lisdatacenter.org (multiple countries; accessed March to July 2018).

McCarty, N. and H. J. Pontusson, "The Political Economy of Inequality and Redistribution," in B. Nolan, W. Salverda, and T. M. Smeeding (eds), *The Oxford Handbook of Economic Inequality*, 665–92, Oxford University Press, Oxford, 2011.
Mahler, V. A. and D. K. Jesuit, "Fiscal Redistribution in the Developed Countries: New Insights from the Luxembourg Income Study," *Socio-Economic Review*, 4, 483–511, 2006.
Marx, I., L. Salanauskaite, and G. Verbist, "The Paradox of Redistribution Revisited: And That It May Rest in Peace?" IZA Discussion Paper No. 7414, 2013.
_____, "For the Poor, but Not Only the Poor: On Optimal Pro-Poorness in Redistributive Policies," *Social Forces*, 95, 1–24, 2016.
Melguizo, A. and J. M. González-Páramo, "Who Bears Labour Taxes and Social Contributions? A Meta-Analysis Approach," *SERIEs*, 4, 247–71, 2013.
Meyer, B. D. and N. Mittag, "Using Linked Survey and Administrative Data to Better Measure Income: Implications for Poverty, Program Effectiveness and Holes in the Safety Net," *American Economic Journal: Applied Economics*, https://www.aeaweb.org/articles?id=10.1257/app.20170478&&from=f, Forthcoming.
Moene, K. O. and M. Wallerstein, "Inequality, Social Insurance, and Redistribution," *American Political Science Review*, 95, 859–74, 2001.
Nieuwenhuis, R., T. Munzi, and J. C. Gornick, "Comparative Research with Net and Gross Income Data: An Evaluation of Two Netting Down Procedures for the LIS Database," *Review of Income and Wealth*, 63, 564–73, 2017.
Nolan, B. and T. M. Smeeding, "Ireland's Income Distribution in Comparative Perspective," *Review of Income and Wealth*, 51, 537–60, 2005.
Piketty, T., E. Saez, and G. Zucman, "Distributional National Accounts: Methods and Estimates for the United States," *Quarterly Journal of Economics*, 133, 553–609, 2018.
Prasad, M. and Y. Deng, "Taxation and the Worlds of Welfare," *Socio-Economic Review*, 7, 431–57, 2009.
Reynolds, M. and E. Smolensky, *Public Expenditures, Taxes, and the Distribution of Income: The United States, 1950, 1961, 1970*, Academic Press, New York, 1977.
Salverda, W. and D. Checchi, "Labor Market Institutions and the Dispersion of Wage Earnings," in A. B. Atkinson and F. Bourguignon (eds), *Handbook of Income Distribution*, vol. 2B, North-Holland, Amsterdam, 1535–728, 2015.
Smeeding, T. M. and D. H. Weinberg, "Toward a Uniform Definition of Household Income," *Review of Income and Wealth*, 47, 1–24, 2001.
Sutherland, H. and F. Figari, "EUROMOD: The European Union Tax-Benefit Microsimulation Model," *International Journal of Microsimulation*, 6, 4–26, 2013.
Sutherland, H. and P. Tsakgloglou, "Accounting for the Distributional Effects of Non-Cash Public Benefits," in D. J. Besharov and K. A. Couch (eds), *Counting the Poor: New Thinking About European Poverty Measures and Lessons for the United States*, Oxford University Press, Oxford, 95, 2012.
Swenson, P., *Capitalists Against Markets: The Making of Labor Markets and Welfare States in the United States and Sweden*, Oxford University Press, Oxford, 2002.
Urban, I., "Kakwani Decomposition of Redistributive Effect: Origins, Critics and Upgrades," Working Paper 148, Society for the Study of Economic Inequality, New York, 2009.
_____, "Contributions of Taxes and Benefits to Vertical and Horizontal Effects," *Social Choice and Welfare*, 42, 619–45, 2014.
Verbist, G. and F. Figari, "The Redistributive Effect and Progressivity of Taxes Revisited: An International Comparison Across the European Union," *FinanzArchiv: Public Finance Analysis*, 70, 405–29, 2014.
Wang, C., K. Caminada, and K. Goudswaard, "The Redistributive Effect of Social Transfer Programmes and Taxes: A Decomposition Across Countries," *International Social Security Review*, 65, 27–48, 2012.
_____, "Income Redistribution in 20 Countries over Time," *International Journal of Social Welfare*, 23, 262–75, 2014.
Warren, N., "A Review of Studies on the Distributional Impact of Consumption Taxes in OECD Countries," Social, Employment and Migration Working Paper No. 64, OECD, Paris, 2008.
Zemmour, M., "Economie politique du financement progressif de la protection sociale," LIEPP Working Paper, Laboratory for Interdisciplinary Evaluation of Public Policies, Paris, 2015.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix

1. The Impact of Imputed Tax in the LIS Dataset

Figure A.1: Tax Coverage Before and After the Imputation of Employer Social-Security Contributions

Figure A.2: The Impact of Tax Imputations on Tax Rates and Progressivity

Figure A.3: The Tax and Transfer Contributions to Inequality Reduction Before and After Tax Imputation

2. Pensions

Figure A.4: The Inequality Reduction from Pensions: Average Rates and Targeting

3. Figures Repeated for the Working-Age Subsample

Figure A.5: Tax and Transfer Contributions to Inequality Reduction: Working-Age Households

Figure A.6: High Average Tax Rates Are Incompatible with Progressivity: Working-Age Households