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Fiscal Redistribution and Social Welfare

by David Coady, Devin D'Angelo, and Brooks Evans

I N T E R N A T I O N A L M O N E T A R Y F U N D

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Abstract

Fiscal policy is a key tool for achieving distributional objectives in advanced economies. This paper embeds the discussion of fiscal redistribution within the standard social welfare framework, which lends itself to a transparent and practical evaluation of the extent and determinants of fiscal redistribution. Differences in fiscal redistribution are decomposed into differences in the magnitude of transfers (*fiscal effort*) and in the progressivity of transfers (*fiscal progressivity*). Fiscal progressivity is further decomposed into differences in the distribution of transfers across income groups (*targeting performance*) and in the social welfare returns to targeting due to varying initial levels of income inequality (*targeting returns*). This decomposition provides a clear distinction between the concepts of progressivity and targeting, and clarifies the relationship between them. For illustrative purposes, the framework is applied to data for 28 EU countries to determine the factors explaining differences in their fiscal redistribution and to discuss patterns in fiscal redistribution highlighted in the literature.

JEL Classification Numbers: H22, H23

Keywords: Fiscal redistribution, progressivity, targeting, transfers, taxes

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I. INTRODUCTION

The empirical literature on the redistributive impact of fiscal policies in advanced economies has grown substantially over recent decades reflecting the increased availability of household survey data and microsimulation tools. For instance, the EUROMOD project has produced extensive work combining EU-SILC household survey data with a relatively standard microsimulation model adapted to member countries to evaluate the distributional impact of tax-benefit systems and reforms (Sutherland and Figari, 2013; Avram and others, 2014). Caminada and others (2017) have used Luxembourg Income Survey data for similar purposes, while the OECD also regularly produces estimates of fiscal redistribution based on in-house household survey data (Immervoll and Richardson, 2011; OECD, 2008, 2011).

A common finding of empirical studies of fiscal redistribution is that fiscal policy is a key tool for achieving distributional objectives in advanced economies, although the magnitude of fiscal redistribution has been found to vary substantially across countries. However, while there is much research on the contribution of different tax and transfer components to these trends, there is much less work on the contribution and determinants of different design parameters as captured by the level, targeting and progressivity of fiscal transfers.

This paper embeds the analysis of fiscal redistribution within the standard social welfare framework, which easily lends itself to a transparent and practical evaluation of the determinants of fiscal redistribution and of differences across countries and time. This framework is used to decompose fiscal redistribution into its various components. It starts by decomposing differences in fiscal redistribution into differences in *fiscal effort*, as reflected in the magnitude of redistributive transfers, and differences in *fiscal progressivity*, reflecting the distribution of transfers across different income groups. It then further decomposes fiscal progressivity into two components, one reflecting the share of transfers accruing to lower-income groups (*targeting performance*), the other reflecting the social returns to targeting due to differences in the initial inequality of income (*targeting returns*). This also provides a clear distinction between the concepts of progressivity and targeting, and clarifies the relationship between them.

The above decomposition further allows differences in fiscal redistribution to be separated into that due to differences in fiscal policies (fiscal effort and targeting performance) and that due to differences in targeting returns that reflect initial income inequality conditions. This highlights the possibility that countries with the exact same fiscal policies, as measured by the level and distribution of transfers across income groups, can have very different levels of measured fiscal redistribution simply because they have very different initial income distributions. To illustrate the importance of this distinction in practice, the framework is used to decompose fiscal redistribution in advanced European countries into their component parts, which are then used to discuss two patterns of fiscal redistribution often highlighted in the literature, i.e., whether more targeted programs end up achieving less fiscal redistribution, and whether high inequality countries do more or less fiscal redistribution.

II. CONCEPTUAL FRAMEWORK

Our analysis of fiscal redistribution is anchored in standard social welfare theory. We start by setting out a simple social welfare framework for evaluating the welfare impact of redistributive transfer policies financed by alternative tax financing regimes. We show how this framework lends itself to a transparent and practical decomposition of the welfare impact of fiscal redistribution into its various components reflecting fiscal effort, fiscal progressivity, targeting performance and targeting returns.

Social Welfare Impact of Fiscal Policy

Consider an economy with two groups; households and the government. Abstracting from behavioral responses, let y_0 be household market income (i.e., income before taxes and transfers) and y_1 be household disposable income (i.e., income after taxes and transfers) so that:

$$y_1 = y_0 + m - t \quad (1)$$

where m denotes transfers, t taxes, and $(m-t)$ net transfers.¹ Let social welfare be described by a standard Bergson-Samuelson function of household welfare:

$$W(\dots, V^h(\mathbf{p}, y^h), \dots) \quad (2)$$

where $V^h(\cdot)$ is the indirect utility function of household h and \mathbf{p} is a vector of commodity and factor prices facing the household (assumed fixed). The social welfare impact of a given transfer program with $dy^h = dm^h$ is:

$$dW = \sum_h \frac{\partial W}{\partial V^h} \frac{\partial V^h}{\partial m^h} dm^h = \sum \beta^h dm^h \quad (3)$$

where β^h is the social valuation of extra income to household h , the so-called social "welfare weight". Let the total transfer budget be $B = \sum_h dm^h$ so that (3) can be rewritten as:

$$dW = \frac{\sum_h \beta^h dm^h}{\sum_h dm^h} B = B \sum_h \beta^h \theta^h = \lambda B \quad (4)$$

¹ Most empirical papers on fiscal redistribution abstract from the important issue of behavioral responses arising from the taxes and transfers being analyzed. However, such responses could potentially be very important in deciding on the optimal level of fiscal redistribution since they generate an efficiency-equity trade-off (Picketty and Saez, 2013; Bargain, 2017). They also mean that the level and distribution of "original" incomes (i.e., incomes prior to the imposition of taxes and transfers) may be different from the level and distribution of "market" incomes (i.e., "disposable" incomes after taxes and transfers, minus taxes and transfers), the extent of these differences depending on the elasticity of income to net transfers and how this varies across income groups. While the conceptual framework used here applies regardless of whether original or market incomes are used in equation (1), the empirical results and their policy implications could, of course, be sensitive.

where θ^h is the share of the total budget received by household h and λ is the *distributional characteristic* capturing the social welfare impact of a unit transfer delivered through the program (Coady and Skoufias, 2004). Clearly λ can differ across transfer programs when welfare weights differ across households and the targeting of transfers differs across programs.² The greater the proportion of the budget ending up in the hands of lower-income households (i.e. those with relatively high β^h), the higher the distributional characteristic. Note also that the distributional characteristic is scale neutral in the sense that it does not change in response to a scaling up or down of transfer levels.

Any analysis of the redistributive impact of fiscal policies must take account not just of transfers but also their financing through taxation. Since taxes can be viewed as simply negative transfers, for a budget neutral tax and transfer system, (4) can be expanded to incorporate the tax side as follows:

$$dW = \frac{\sum_h \beta^h dm^h}{\sum_h dm^h} B - \frac{\sum_h \beta^h dt^h}{\sum_h dt^h} T = B \sum_h \beta^h (\theta^h - \phi^h) = B \sum_h \beta^h \psi^h \quad (5)$$

where t^h is the tax paid by household h , $T = \sum_h dt^h$ is the sum of taxes across households (which for a revenue-neutral transfer program equals B), ϕ^h is the share of household h in total tax payments, and ψ^h is the share of household h in *net* transfers (i.e., transfers minus taxes) and sums to zero across all households. If total taxes equal total transfers (i.e. $T=B$) then the welfare impact arises solely from the redistribution of income between lower-income and higher-income groups. Henceforth, we therefore use the terms welfare impact and fiscal redistribution interchangeably.³

Equation (5) can also be rewritten to bring out the separate redistributive roles of taxes and transfers, as:

² Note that differences in fiscal redistribution, and in its underlying components, will reflect both differences in policies (e.g., benefit eligibility and generosity) as well as differences in the environment in which policies are implemented (e.g., demographic structure). Therefore, care needs to be taken when translating the results from such decomposition analysis into policy insights and prescriptions. Such issues can be further analyzed by, for example, more detailed analysis of different transfer components, such as child benefits, social pensions and unemployment benefits. Bargain and Callan (2010) show how inequality measures of fiscal redistribution can also be decomposed into different component parts: *policy effects* (capturing the combined effect of targeting performance and fiscal effort) and *other factors* (capturing the combined effects of targeting returns and demographics).

³ If taxes are proportional to income, then ϕ^h can be interpreted as the share of households in total income. Alternatively, if taxes are uniform in absolute terms across households, then ϕ^h can be interpreted as the share of each household in the total population, in which case the distributional characteristic simplifies to the difference between the weighted average of β^h 's (with transfer shares as weights) and the simple average of welfare weights. Additionally, when total taxes T differ from total transfers B (as is often the case in many empirical studies of fiscal redistribution) then, for $T=\alpha B$, ϕ^h in (5) needs to be multiplied by α . When taxes and transfers generate inefficient behavioral responses, so that "original" incomes are different than "market" incomes, this can be captured by an additional term capturing the ratio of market to original incomes.

$$dW = B \sum_h \beta^h (\theta^h - \phi^h) = B \left(\sum_h \beta^h \theta^h - \sum_h \beta^h \phi^h \right) = B(\lambda^M - \lambda^T) \quad (6)$$

where λ^M is the social value of a unit transfer and λ^T is the social cost associated with its financing, with the difference between the two giving the net social benefit from redistributive tax and transfer policies. The greater the share of transfers going to low-income groups the higher λ^M while the lower the share of taxes borne by low-income groups the lower λ^T (so tax progressivity decreases with λ^T). Trivially, if their respective share in taxes and transfers are the same then λ^T and λ^B are equal (i.e., social benefit equals social cost) and the tax and transfer scheme has zero fiscal distribution and zero social welfare impact. The ratio (λ^T/λ^M) can be interpreted as a cost-benefit ratio, or the percentage decrease in welfare due to the distribution of taxes used to finance redistributive transfers.⁴

Fiscal Redistribution and Social Welfare

To analyze the variation of fiscal redistribution across countries we can interpret the set of redistributive tax and transfers in a country as a transfer program. The total welfare impact of a transfer program in country j (dW_j) with budget B_j can then be written as:

$$dW_j = \lambda_j \cdot B_j \quad (7)$$

This can be rewritten in percentage terms as:

$$\frac{dW_j}{Y_j} = \lambda_j \cdot \frac{B_j}{Y_j} = \lambda_j \cdot \tau_j \quad (8)$$

where Y_j is total income and τ_j is the ratio of the transfer budget to total income.⁵ The percentage increase in welfare due to the tax-transfer program in country j can then be compared to the increase for another country. These differences will reflect differences in fiscal effort (τ) and differences in fiscal progressivity (λ). Differences in fiscal progressivity can be further decomposed into differences in targeting performance (ψ) and differences in targeting returns (β). Differences in targeting performance could also be broken down into the targeting performance of transfers (θ) and taxes (ϕ) and even further into their component parts.

⁴ In inequality-based analyses of fiscal redistribution, it is common to attribute total fiscal redistribution between transfers and taxes, with both typically having positive shares since the share of lower-income groups in transfers (taxes) is greater (smaller) than their share in income. Within the welfare-based framework presented here, this can be interpreted as implicitly comparing the distribution of actual taxes and transfers to that from proportional taxes and transfers; the latter would not change inequality or welfare. Where the share of lower-income groups in actual transfers (taxes) is higher (lower) than their share under proportional transfers and taxes, both taxes and transfers would contribute to higher fiscal redistribution compared to the proportional alternatives.

⁵ Dividing by initial income is strictly only equivalent to dividing by initial welfare for $\epsilon=1$ and when welfare weights are normalized to equal one for households with mean income. More generally, for this normalization, initial welfare is given by $\sum_h y^\epsilon y_h^{1-\epsilon}$.

Note that it is possible that countries with the same fiscal policy design (i.e., exact same level and distribution of net taxes) can have very different levels of fiscal redistribution solely because of differing initial income distributions.⁶ In such instances, a country with relatively high income inequality will have a relatively high level of fiscal redistribution because the social welfare return to targeting, captured in more unequally distributed social welfare weights, is higher. In other words, there is very little social benefit from redistributing income in countries where incomes vary little across households. When comparing the differing levels of fiscal redistribution across countries it is therefore useful to know how much of this reflects different fiscal policy design (i.e., levels and distribution of transfers) and how much reflects different initial income distributions. These decompositions are discussed further in Section III below.

Social Welfare Weights

The calculation of λ_j requires specifying social welfare weights. A very useful and common method for specifying these derives from Atkinson's (1970) constant elasticity social welfare function with the (relative) welfare weight of household h calculated as:

$$\beta^h = \left(\frac{y^k}{y^h} \right)^\epsilon$$

where k is a reference income level (e.g., mean income) and ϵ captures one's "aversion to inequality" with this aversion increasing in ϵ .⁷ For example, a value of $\epsilon=0$ implies no aversion to inequality (i.e. a dollar is a dollar no matter to whom it accrues) so that all welfare weights take on the value unity. A value of $\epsilon=1$ implies that if household h has twice (half) the income of household k then its welfare weight is 0.5 (2.0) as opposed to unity for k . A value of $\epsilon=2$ similarly implies a welfare weight of 0.25 (4.0) for h .

For small transfers, the (marginal) social welfare weights can be calculated using market incomes and assumed constant with respect to the level of net transfers. For large transfers, however, these weights will be a decreasing function of transfers and an increasing function of taxes. Therefore, for progressive net transfers, the welfare impact based on constant welfare weights will overestimate the social welfare impact of fiscal redistribution. Appendix I discusses how the constant household welfare weights can be easily adjusted to get to the "exact" welfare impact of large taxes and transfers. In the analysis presented below, the "exact" welfare weights were very well approximated by the average of marginal social welfare weights with and without net transfers.

More generally, social welfare weights can be derived from a broader set of social objectives. Within the narrower income perspective, these weights can be based on absolute rather than proportional differences in incomes, or some combination of both (Atkinson and Brandolini, 2010; Urban, 2017). But these weights can also be based on non-welfarist notions of social

⁶ For related discussions in the context of measures of tax progressivity, see Lambert and Pfahler (1992), Milanovic (1995) and Dardanoni and Lambert (2002).

⁷ This approach is well established in the literature; for examples, see Atkinson and Stiglitz (1980), Newbery and Stern (1987), and Ahmad and Stern (1991).

justice, e.g., based on such concepts as equality of opportunity or various concepts of fairness (Saez and Stantcheva, 2016). Consistent with most of the literature, in this paper we focus on welfare weights derived from constant elasticity social welfare functions, thus reflecting proportional differences in incomes. But note that the overall approach can incorporate welfare weights derived from a broader set of social objectives.

Fiscal Redistribution and Inequality

The literature on fiscal distribution has been traditionally anchored in the literature on income inequality. Typically, the Gini coefficient for income after taxes and transfers (i.e., disposable income) has been compared to that before taxes and transfers (i.e., market income) to determine the extent of fiscal redistribution. This latter approach can be motivated by the social welfare framework used above as follows (Deaton, 1997).

Let social welfare, W , be described by a function of individual incomes y_i as:

$$W = V(y_1, y_2, \dots, y_N)$$

where N is the number of individuals in the population, $V(\cdot)$ is Paretian so that it is increasing in individual incomes, and satisfies the principle of transfers which requires that:

$$\frac{dW}{dy_i} > \frac{dW}{dy_j} \quad \text{for } y_i < y_j$$

with social welfare weights decreasing with individual incomes. To relate this social welfare framework to the income inequality framework it is useful to choose a social welfare function that has social welfare measures in the same units as individual welfare (i.e., income) so that a proportional change in incomes leads to an equal proportional change in social welfare. This will be the case if $V(\cdot)$ is homogenous of degree one (or can be thus transformed by a monotone increasing transformation). In such a case, social welfare can be written as:

$$W = \mu V\left(\frac{y_1}{\mu}, \frac{y_2}{\mu}, \dots, \frac{y_N}{\mu}\right)$$

where μ is mean income in the population, and $V(1, 1, \dots, 1) = 1$ so that social welfare equals mean income when income is distributed equally with every individual having mean income. Since, by the principle of transfers, social welfare reaches a maximum equal to mean income, social welfare will be less than mean income when the income distribution is unequally distributed.

The above welfare function can then be rewritten as:

$$W = \mu (1 - I)$$

where $(1-I)$ is a scalar version of $V(\cdot)$, and I represents a measure of income inequality ranging from zero to unity (such as the Gini coefficient or Atkinson index)⁸. In this case, I can be interpreted as the social welfare cost of inequality, i.e., the loss in social welfare due to incomes being unequally distributed. Thus, any inequality index can be interpreted within a social welfare framework and, if it satisfies the principle of transfers, will be consistent with the framework set out above.

III. FISCAL REDISTRIBUTION IN EUROPEAN ECONOMIES

The analysis used below to illustrate the extent and component parts of fiscal redistribution is based on databases available on the EUROMOD website.⁹ These databases provide information on direct taxes and transfers for 28 EU countries broken down by income deciles (see Appendix II for an example of the data available)—in-kind transfers (e.g., education) and consumption taxes are therefore not included. Together with data on average decile per capita incomes, this information is sufficient to calculate the extent of fiscal distribution by country for each year available, i.e., from 2011 to 2016. It is also sufficient to decompose differences in fiscal distribution across countries and time into differences in their various design components as described above.

Table 1 provides a description of the salient features of the EUROMOD tax and transfer data used for our analysis, for the first (2011) and last (2016) years of available data. Benefits include social insurance (e.g., pensions) and social assistance cash transfers, while taxes include social contributions (or payroll taxes) and personal income taxes. The average ratios of benefits and taxes to income (B/Y and T/Y , respectively) vary substantially across countries, but are relatively constant over time. In 2016, for instance, at over 40 percent, Austria, Greece, Hungary and Luxembourg have the largest benefit ratios. At 25 percent or below, the lowest benefit ratios are in Malta, the Netherlands and the UK. The highest tax ratios, at over 40 percent, are in Denmark and Hungary, with the lowest at or below 20 percent in Bulgaria, Cyprus, Estonia, Spain and Malta. On average, tax ratios (0.31) are slightly below benefit ratios (0.33), but this varies substantially across countries.

The share of benefits (benefit share) and taxes (tax share) accruing to the bottom three income deciles, a good measure of how well targeted benefits and taxes are to the bottom of the income distribution, also vary little across time but more so across countries. In 2016, at over 35 percent, the highest benefit shares were in Denmark, Ireland, the Netherlands and the UK. The lowest, at 20 percent or less, were in Greece, Italy, and Romania. The highest tax shares at above 10 percent were in Hungary, Poland, and Slovakia; the lowest at below 5 percent were in Belgium, Estonia, Ireland, Lithuania, Latvia and Portugal. On average, 27 percent of benefits accrue to the bottom three deciles, who pay only 7 percent of taxes.

⁸ Note that, in the context of the iso-elastic social welfare function used by Atkinson (1970), this implies setting social welfare equal to the level of income which if equally distributed will give the same level of social welfare as the existing distribution of income, which he refers to as “equally distributed equivalent” (EDE) income.

⁹ These data can be accessed at: <https://www.euromod.ac.uk/using-euromod/statistics>.

The average of the social welfare weights across market income deciles (for $\varepsilon=1$, normalized at $\beta=1$ at mean income), provides a summary measure of the extent of market (or initial) income inequality in a country; the higher the average the lower the ratios of incomes at the bottom of the distribution to those at the top. Again, while average income inequality changes little over time (increasing slightly), it varies substantially across countries. In 2016, the highest levels, at above 3.0, were in Denmark, Ireland, and Latvia, while the lowest at below 1.7 were in Cyprus, Hungary, Luxembourg, and Slovakia.

Table 1. Description of EUROMOD Tax and Transfer Data, 2011 and 2016

	2011					2016				
	B/Y	T/Y	Benefit Share (Bottom 30%)	Tax Share (Bottom 30%)	Average Market Beta	B/Y	T/Y	Benefit Share (Bottom 30%)	Tax Share (Bottom 30%)	Average Market Beta
Austria (AT)	0.40	0.39	0.24	0.06	1.93	0.41	0.37	0.23	0.06	1.88
Belgium (BE)	0.33	0.40	0.30	0.04	2.80	0.34	0.39	0.30	0.03	2.71
Bulgaria (BG)	0.31	0.20	0.26	0.07	2.25	0.27	0.19	0.28	0.06	2.51
Cyprus (CY)	0.30	0.15	0.26	0.05	1.83	0.33	0.17	0.24	0.06	1.63
Czech Republic (CZ)	0.33	0.22	0.31	0.08	1.75	0.31	0.23	0.32	0.08	1.79
Germany (DK)	0.36	0.36	0.24	0.07	2.18	0.34	0.37	0.25	0.07	2.35
Denmark (DK)	0.29	0.46	0.36	0.09	2.84	0.29	0.49	0.36	0.10	4.55
Estonia (EE)	0.27	0.21	0.28	0.04	2.59	0.27	0.19	0.30	0.04	2.96
Greece (EL)	0.43	0.32	0.14	0.08	1.74	0.44	0.36	0.16	0.10	1.76
Spain (ES)	0.38	0.21	0.21	0.05	2.12	0.39	0.20	0.21	0.05	2.10
Finland (FI)	0.35	0.35	0.31	0.07	2.71	0.35	0.37	0.31	0.07	2.60
France (FR)	0.39	0.32	0.22	0.11	1.68	0.38	0.36	0.23	0.09	1.71
Croatia (HR)	0.37	0.28	0.23	0.06	2.57	0.37	0.27	0.23	0.06	2.61
Hungary (HU)	0.47	0.42	0.26	0.13	1.70	0.42	0.41	0.23	0.14	1.60
Ireland (IE)	0.32	0.28	0.36	0.02	3.16	0.29	0.30	0.37	0.03	3.48
Italy (IT)	0.42	0.35	0.16	0.06	1.84	0.43	0.36	0.17	0.06	1.85
Lithuania (LT)	0.33	0.23	0.24	0.05	2.38	0.29	0.22	0.24	0.04	2.71
Luxembourg (LU)	0.42	0.32	0.23	0.08	1.41	0.41	0.34	0.23	0.07	1.40
Latvia (LV)	0.31	0.31	0.22	0.05	2.43	0.24	0.29	0.26	0.03	3.42
Malta (MT)	0.23	0.19	0.31	0.07	1.82	0.22	0.19	0.32	0.07	1.87
Netherlands (NL)	0.20	0.36	0.41	0.11	1.91	0.19	0.35	0.44	0.10	1.94
Poland (PL)	0.35	0.33	0.22	0.13	1.64	0.38	0.34	0.24	0.13	1.72
Portugal (PT)	0.41	0.26	0.21	0.05	1.94	0.39	0.29	0.21	0.04	2.04
Romania (RO)	0.43	0.29	0.17	0.07	1.80	0.38	0.29	0.20	0.05	2.20
Sweden (SE)	0.33	0.36	0.31	0.10	2.14	0.34	0.37	0.29	0.10	2.12
Slovenia (SI)	0.35	0.33	0.24	0.07	1.97	0.35	0.32	0.26	0.07	2.10
Slovakia (SK)	0.31	0.23	0.29	0.10	1.60	0.30	0.26	0.27	0.12	1.53
United Kingdom (UK)	0.24	0.28	0.37	0.06	2.55	0.23	0.27	0.38	0.06	2.66
Average	0.34	0.30	0.26	0.07	2.12	0.33	0.31	0.27	0.07	2.28

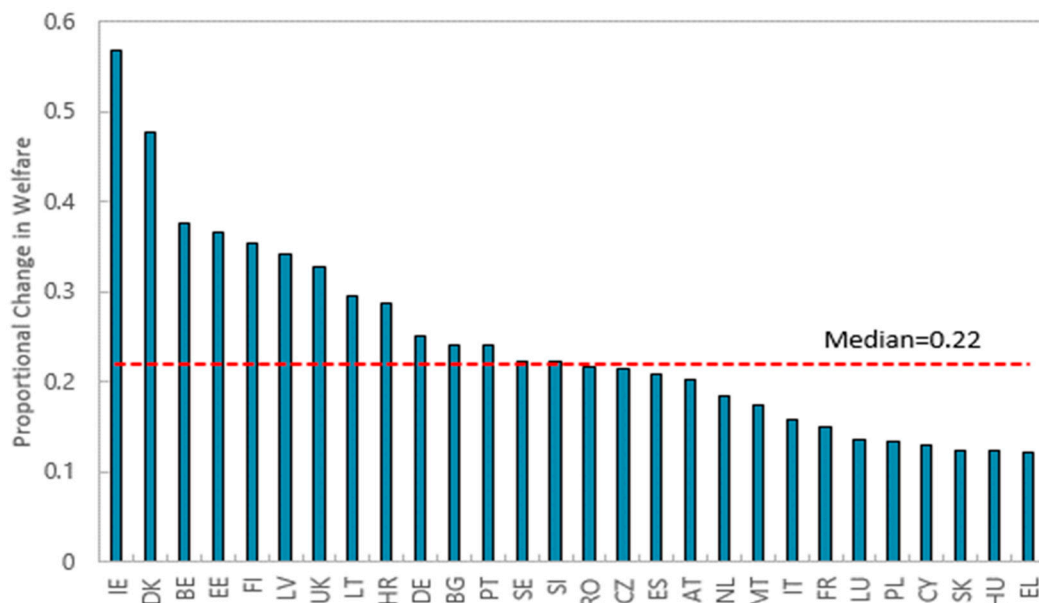
Note: See text for definition of column terms. Average market beta is the average of social welfare weights based on market income for $\varepsilon=1$.

Source: Authors' calculations based on EUROMOD data.

Fiscal Redistribution, Progressivity and Effort

Figure 1 shows the welfare impact of redistributive fiscal policy, i.e. the extent of fiscal redistribution, across countries.¹⁰ The results are based on an aversion to inequality of unity ($\epsilon=1$) so that decile welfare weights equal the inverse of the ratio of each deciles income per capita to mean per capita income.¹¹ Transfers are based on the transfers and taxes in the EUROMOD data, but with taxes scaled (both upwards and downwards) to equal benefits in each country. This ensures that the welfare impact arises solely from the redistribution of income from higher-income to lower-income groups (redistribution of the pie) rather than from changes in average income (the size of the pie). The extent of fiscal redistribution varies widely, being highest (above 35 percent) in Ireland, Denmark, Belgium, Estonia and Finland, and lowest (below 13 percent) in Greece, Hungary, Slovakia and Cyprus. Fiscal redistribution increases social welfare by over 22 percent in more than half of all countries.

Figure 1. Fiscal Redistribution in European Countries, 2016



Source: Authors' calculations based on EUROMOD data.

Figure 2 presents the breakdown of fiscal redistribution across countries into fiscal effort and fiscal progressivity. On average, countries with higher fiscal effort have lower fiscal progressivity. For instance, while Greece, Italy, Hungary and Lithuania have relatively high fiscal effort this is offset by their relatively low fiscal progressivity, resulting in relatively low overall fiscal redistribution. On the other hand, while Ireland, Denmark and Estonia and Latvia have relatively

¹⁰ For the most part, the paper focuses on decomposition of fiscal redistribution across countries since, as alluded to above, the extent of fiscal redistribution is relatively constant across time.

¹¹ Chetty (2006) shows that a value of unity is consistent with empirical labor supply behavior and hence a reasonable benchmark.

low fiscal effort, this is offset by relatively high fiscal progressivity resulting in relatively high overall fiscal redistribution.

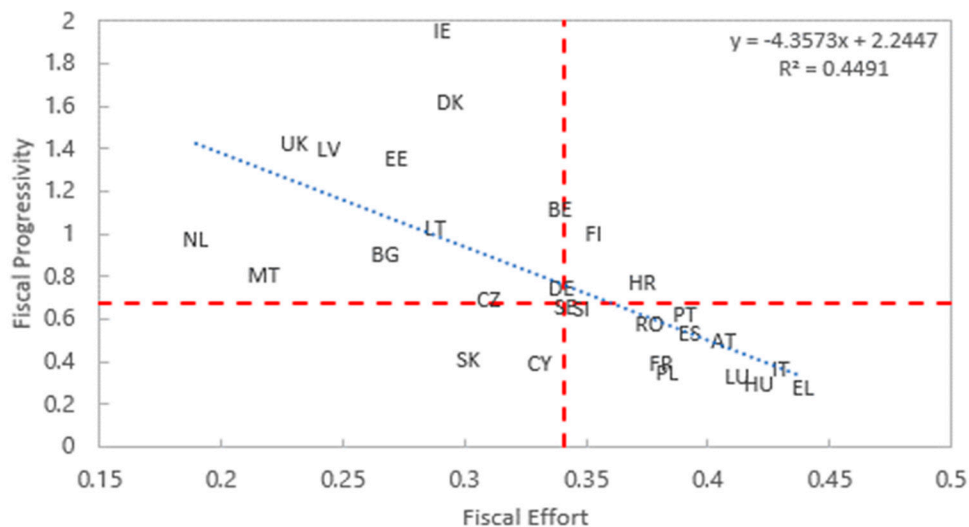
Decomposing Fiscal Redistribution

To decompose differences in fiscal redistribution into their component parts we use the decomposition technique developed in Shorrocks (2013), who provides a general framework for decomposing changes in indices into their component parts, with the sum across component contributions exactly equaling the total difference in the index. In the present context, let fiscal redistribution be written as a function of its various components: fiscal effort (B), targeting performance (ψ), and targeting returns (β):

$$FD = f(B, \psi, \beta)$$

The objective is to decompose differences in fiscal redistribution into the amount due to differences in B , ψ , and β .

Figure 2. Fiscal Progressivity and Fiscal Effort in European Countries, 2016



Source: Authors' calculations based on EUROMOD data.

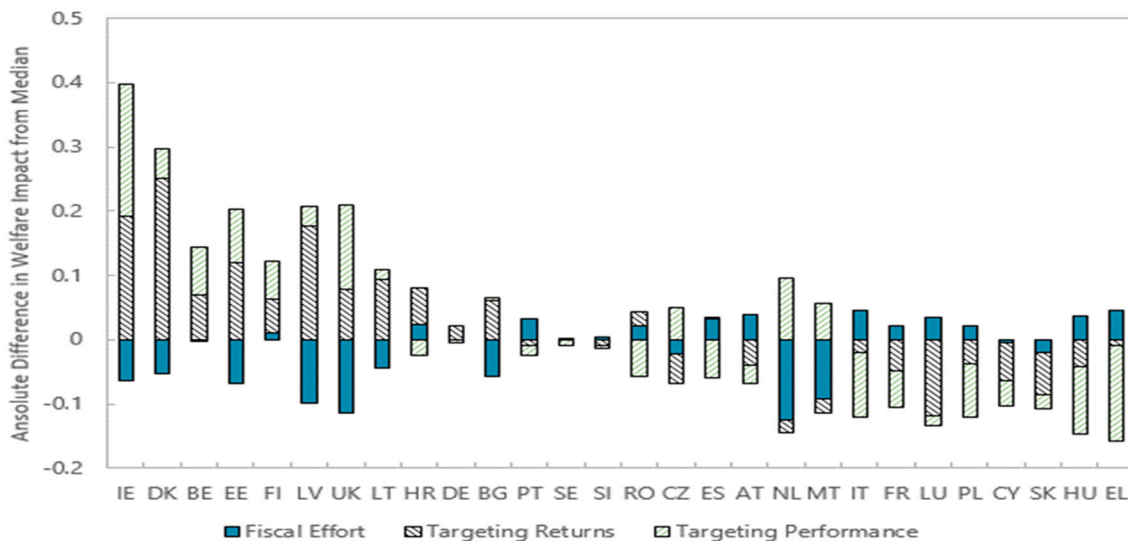
Let FD^0 be fiscal redistribution in country 0, and FD^1 be fiscal redistribution in country 1. Since fiscal redistribution is fully determined by B , ψ , and β , then the difference $FD^1 - FD^0$ can be exactly decomposed into the amount due to differences in B , ψ , and β . The approach is to first identify the marginal impact of each of the components when they are changed in sequence across all possible combinations of B , ψ , and β —in total there will be $3!$ (i.e., six) combinations for each component. The sum of all marginal contributions of each component separately can then be averaged to get the overall contribution of the component to the total difference in fiscal redistribution.¹² The analysis below starts by looking at the contributions of B , ψ , and β to differences in fiscal redistribution across countries. Specifically, it looks at the differences due to

¹² Alternatively, the decomposition can be applied to changes in fiscal distribution over time in a particular country, from period 0 to period 1.

differences in fiscal policies (i.e., fiscal effort and targeting performance) and differences in targeting returns, which reflect differences in the initial distribution of income that are in turn influenced by differences in other factors such as market structure, the distribution of skills (education), as well as by other non-fiscal policies (e.g., minimum wage policies).¹³

Figure 3 decomposes the variation in fiscal redistribution into that due to fiscal effort, targeting performance, and targeting returns (the sum of the latter two components giving fiscal progressivity). For presentational purposes, we compare fiscal redistribution in each country to that in a reference country assumed to have the median values of each of the key parameters B , ψ , and β . On average, 26 percent of the difference across countries is explained by differences in fiscal effort, 37 percent by differences in targeting performance, and 37 percent by differences in initial inequality. In other words, nearly two-thirds of the variation in fiscal redistribution across countries is explained by the amount countries spend on transfers and how these transfers are distributed across the income distribution (fiscal policy), while just over one-third is due to differences in initial income inequality. Overall, high levels of fiscal redistribution are driven predominantly by both targeting returns and targeting performance (i.e., high fiscal progressivity) and vice versa for low levels of fiscal redistribution. The high fiscal progressivity in Denmark, Latvia and Lithuania are driven particularly by relatively high targeting returns, i.e., their relatively high initial inequality. The low fiscal progressivity in Greece and Hungary is driven mainly by low targeting performance, i.e., lower shares of net benefits accruing to lower-income groups.

Figure 3. Level Decomposition of Differences in Fiscal Redistribution



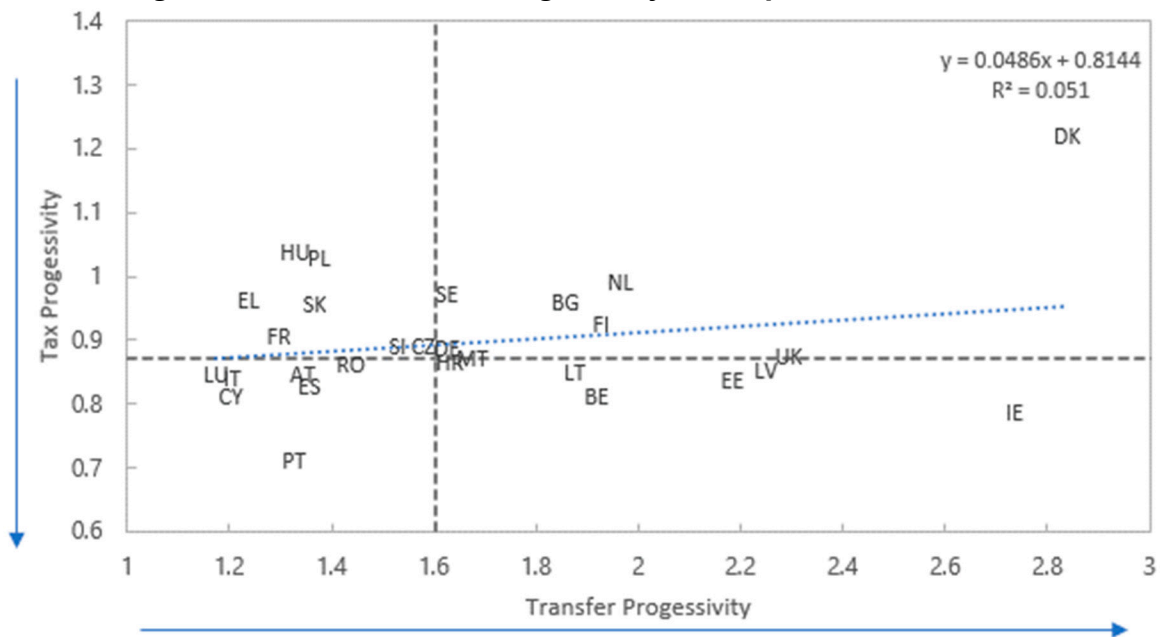
Note: Bars show the differences in fiscal redistribution compared to a fictitious program with median fiscal effort, targeting returns and targeting performance.

Source: Authors' calculations based on EUROMOD data.

¹³ The decompositions keep welfare weights fixed at the average of welfare weights before and after net transfers. Strictly speaking, welfare weights should be allowed to vary with the level of net transfers. However, this adjustment is likely to be of second-order importance.

Fiscal progressivity is affected by both the progressivity of taxes (lower λ^T) and transfers (higher λ^M). Fiscal redistribution requires that transfers are more progressive than taxes, i.e. the social cost of transfers needs to be less than the social benefit of transfers. Figure 4 shows the variation in tax and transfer progressivity across countries. While, on average, taxes reduce fiscal redistribution by around 56 percent (the ratio of the social cost of taxes, λ^T , to the social cost of transfers, λ^M), there is very little systematic relationship between the two. In some countries, such as Ireland and Belgium, high transfer progressivity is reinforced by high tax progressivity. In others, such as Hungary and Poland, low transfer progressivity is reinforced by low tax progressivity. In the Netherlands and Belgium, high transfer progressivity is offset by low tax progressivity, whereas in Portugal and Cyprus low transfer progressivity is offset by high tax progressivity.

Figure 4. Tax and Transfers Progressivity in European Economies, 2016



Note: Tax progressivity (λ^T) is higher when lower-income groups pay a lower share of the total tax burden. Transfer progressivity (λ^M) is higher when lower-income groups receive a higher share of total transfers. Source: Authors' calculations based on EUROMOD data.

IV. PATTERNS IN FISCAL REDISTRIBUTION

In this section we use the above analysis to analyze two patterns of fiscal redistribution often discussed in the literature. The first refers to the relationship between progressivity (or targeting) and fiscal redistribution. The second refers to the relationship between market income inequality and the extent of fiscal redistribution. In both cases we will discuss the relation with conditional

and unconditional fiscal redistribution, where the latter abstracts from differences arising from differences in targeting returns (i.e., from differences in initial market income inequalities).¹⁴

Conditional and Unconditional Fiscal Redistribution

The decomposition of a difference (or change) in fiscal redistribution into its various components allows us to distinguish between conditional and unconditional fiscal redistribution, where the former includes differences due to targeting returns (reflecting the initial inequality of income) and the latter abstracts from these differences and captures fiscal redistribution due to differences in fiscal policies (i.e., differences in targeting performance and fiscal effort). From our decomposition analysis, the difference in *conditional fiscal redistribution* between each pair of countries (i and j) can be written as the sum of the differences due to each component part:

$$\Delta FR_{ij}^c = \Delta FR_{ij}^b + \Delta FR_{ij}^g + \Delta FR_{ij}^p$$

Differences in *unconditional fiscal redistribution* can then be written as:

$$\Delta FR_{ij}^u = \Delta FR_{ij}^g + \Delta FR_{ij}^p$$

Analysis of the relationship between progressivity, inequality and fiscal redistribution can then be analyzed separately in terms of conditional and unconditional fiscal redistribution.

In the regression analysis below, when analyzing the relationship between unconditional fiscal redistribution, progressivity and inequality, we need to use a specific targeting index for each country to capture targeting performance. The results are based on a targeting index defined as the share of transfers accruing to the bottom 30 percent of the population; which in the context of unconditional fiscal redistribution is also the appropriate measure of progressivity. This is equivalent to using social welfare weights that are unity for this target group, otherwise zero (Coady and Skoufias, 2004), which corresponds to our notion of unconditional fiscal redistribution since it is independent of the extent of initial inequality. This also requires us to replace our measure of fiscal redistribution with one consistent with these welfare weights; based on (5) this becomes the share of total income being transferred to the bottom 30 percent.¹⁵

Progressivity and Fiscal Redistribution

It is often argued that countries that focus on designing taxes and transfers to have high progressivity end up having lower overall fiscal redistribution since narrow targeting of net transfers results in the loss of political and public support for fiscal redistribution (Korpi and

¹⁴ The term conditional is thus used to designate that the associated measure of fiscal redistribution is dependent on the inequality of market income.

¹⁵ The focus on the bottom 30 percent for our regression analysis is of course arbitrary, and one can test sensitivity of results to say using 10 or 20 percent. In contrast, the decomposition analysis does not require the specification of a single index since it uses the complete vector of net tax shares across income deciles.

Palme, 1998; Kenworthy, 2011; Marx and others, 2013).¹⁶ Within our framework, this requires that higher progressivity is more than offset by a decrease in fiscal effort, which was observed in Figure 2 above.

We evaluate this hypothesis by regressing fiscal redistribution on fiscal progressivity. Table 2 presents the relevant relationships for $\epsilon=1$, log values for variables (to reduce the impact of outliers), and for both conditional and unconditional measures of fiscal redistribution. Appendix III shows results for $\epsilon=0.5$ and $\epsilon=2$, and for levels. Focusing first on conditional fiscal redistribution, on average greater progressivity is positively and significantly correlated with fiscal redistribution (column 1). The positive relationship holds across all years and in the pooled sample. It also holds in the pooled sample when we estimate the relationship with fixed effects to focus on the within-country relationship over time.¹⁷ When we regress fiscal progressivity on fiscal effort, consistent with Figure 2, we find a strong negative relationship, i.e., high fiscal progressivity is associated with low fiscal effort, but this relationship is clearly not strong enough to result in a negative relationship between fiscal redistribution and fiscal progressivity.

In principle, the positive relationship between fiscal redistribution and progressivity could reflect the role played by targeting returns. For example, if fiscal effort is significantly negatively correlated with targeting performance, then the share of total income being transferred to lower income groups (and thus the poverty impact) could also decrease with better targeting performance. However, if targeting returns are high due to high inequality, then conditional fiscal redistribution could in principle actually increase. To abstract from the initial distribution of income, we do the above analysis for unconditional fiscal redistribution using the targeting index discussed above (i.e., the share of transfers accruing to the bottom 30 percent of the population) in place of progressivity and also the corresponding measure of fiscal redistribution (the share of total income transferred to the bottom 30 percent). However, this does not overturn our findings based on conditional fiscal redistribution (Table 2, final two columns). Targeting and redistribution are significantly positively related, even though fiscal progressivity and fiscal effort are significantly negatively related. Therefore, neither set of results (focusing on conditional or

¹⁶ Korpi and Palme (1998) argued that “the more we target benefits at the poor, the less likely we are to reduce poverty and inequality”. In their analysis of a subset of countries, they “find that by providing high-income earners with earnings-related benefits, encompassing social insurance institutions can reduce inequality and poverty more efficiently than can flat-rate or targeted benefits” (p681). Glennerster (2014, p9) quotes Titmuss as saying that “separate discriminatory services for poor people have always tended to be poor services”. Stigma attached to claiming means-tested benefits may also result in low-take up and thus lower redistributive impact than otherwise (Beveridge, 1942; Townsend, 1979). In a study of fiscal distribution over time in four EU countries (France, Italy, Sweden and UK), McKnight (2015) finds a negative relationship between the concentration of net transfers and fiscal redistribution within countries. Others have argued to the contrary (Goodin and LeGrand, 1987; Castles and Mitchell, 1992).

¹⁷ The results are consistent with those of Marx and others (2013, p2) who find that “the relationship between the extent of targeting and redistributive impact over a broad range of empirical specifications, country selections and data sources has in fact become a very weak one....(T)argeting tends to be associated with higher levels of redistribution, especially when overall effort in terms of spending is high.” They also find that progressivity (targeting for them) is positively correlated with effort (generosity for them). Mantovani (2018) confirms these findings using an extended Kakwani index. Note that most of the quoted studies tend to focus only on the transfer side of fiscal policies, whereas the analysis in this paper focuses on fully tax-financed fiscal redistribution.

unconditional fiscal redistribution) support the view that “programs for the poor are poor programs.”

Table 2. Fiscal Redistribution (FR), Progressivity and Targeting

Year	Conditional Fiscal Redistribution		Unconditional Fiscal Redistribution	
	FR & Progressivity	Progressivity & Effort	FR & Progressivity	Progressivity & Effort
2016	0.724***	-1.746***	0.597***	-1.591***
2015	0.736***	-1.827***	0.648***	-1.768***
2014	0.730***	-1.836***	0.636***	-1.759***
2013	0.737***	-1.849***	0.667***	-1.845***
2012	0.746***	-1.792***	0.722***	-1.933***
2011	0.734***	-1.627***	0.710***	-1.727***
All	0.735***	-1.788***	0.668***	-1.770***
All (FE)	0.824***	-1.920***	0.887***	-0.965***

* p<0.1 ** p<0.05 *** p<0.01

Note: FR is fiscal redistribution; progressivity is fiscal progressivity; and effort is fiscal effort. All results are for inequality aversion parameter $\epsilon=1$.

Source: Authors' calculations based on EUROMOD data.

Inequality and Fiscal Redistribution

Early studies of the pattern of fiscal redistribution across countries found that countries with higher market income inequality (or “greater need for redistribution”) surprisingly did less fiscal redistribution, the so-called “Robin Hood Paradox” (Lindert, 2004) or the “paradox of redistribution.”¹⁸ However, more recent studies have found that countries with higher market income inequality on average do more fiscal redistribution (Padavano and others, 2016; Tanninen, Tuomala and Tuominen, 2018), often interpreted as higher inequality making it more likely that the median-voter will vote for more fiscal redistribution (Meltzer and Richard, 1981 and 1983).¹⁹

Table 3 presents regression results that explore the relationship between fiscal redistribution and market income inequality as measured by the Gini coefficient. These confirm the recent findings that countries with high initial inequality on average do greater fiscal redistribution. This relationship holds for all years and in both levels and logs, and when all years are pooled. It also

¹⁸ Note that this is not so surprising if one sees high market income inequality as a signal of lower aversion to income inequality, resulting in higher market income inequality *and* less fiscal redistribution.

¹⁹ Persson and Tabellini (2002) and McCarty and Pontusson (2009) provide a review of political economy theories related to the role of the median-voter and income inequality. In contrast to Meltzer and Richard (1981, 1983), Moene and Wallerstein (2001, 2003) argue that rising income inequality results in the median-voter having a lower preference for redistributive spending. Empirical studies that find a positive relationship between market income inequality and fiscal redistribution include Kenworthy and Pontusson (2005), Milanovic (2000), and Olivera (2012). Studies that find a negative relationship include Iversen and Soskice (2006, 2009), Finseraas (2009); McCarty and Pontusson (2009), Lupu and Pontusson (2011), Toth, Horn and Medgyesi (2013).

holds when we control for fixed effects in the pooled regression, indicating that the relationship also holds within countries over time. Fiscal redistribution therefore results in a convergence of income inequality across countries and has also acted as a constraint on inequality increases across time within countries.

Table 3. Fiscal Redistribution and Market Inequality

Year	$\epsilon=0.5$	$\epsilon=1$	$\epsilon=2$	Targeting	$\epsilon=0.5$	$\epsilon=1$	$\epsilon=2$	Targeting
	Levels	Levels	Levels	Levels	Logs	Logs	Logs	Logs
2016	0.577***	1.996***	21.0***	0.152**	2.491***	3.306***	5.997***	1.000*
2015	0.591***	1.989***	19.56***	0.189**	2.667***	3.520***	6.304***	1.357**
2014	0.578***	1.854***	15.51***	0.184**	2.636***	3.383***	5.815***	1.288**
2013	0.582***	1.807***	13.73***	0.188**	2.629***	3.290***	5.421***	1.295*
2012	0.603***	1.836***	13.51***	0.200**	2.643***	3.237***	5.176***	1.381
2011	0.301***	1.827***	13.59***	0.194**	2.524***	3.044***	4.771***	1.278
All	0.589***	1.893***	16.46***	0.184***	2.606***	3.315***	5.635***	1.273***
All (FE)	0.730***	2.633***	39.20***	0.449***	4.069***	5.494***	10.18***	4.052***

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Note: Market income inequality is measured by the Gini coefficient. The parameter ϵ captures increasing aversion to inequality.

Source: Authors' calculations based on EUROMOD data.

As earlier, this positive relationship between initial market income inequality and the extent of conditional fiscal redistribution could be driven by the high return to targeting in high inequality countries. Therefore, it is possible that the relationship between unconditional fiscal redistribution and inequality is still negative, i.e. countries with high inequality transfer a smaller share of national income to lower income groups. However, the results in columns 4 and 8 suggest otherwise with unconditional fiscal distribution being strongly positively related to market income inequality. This holds in both levels and logs, although in the log specification, while coefficients are always positive, their significance is much weaker for some years.²⁰

V. SUMMARY AND CONCLUDING REMARKS

This paper discusses the analysis of fiscal redistribution within the standard social welfare framework, which provides a transparent and practical approach to analyzing the determinants of fiscal redistribution across countries and time. Differences in fiscal redistribution are decomposed into differences in the magnitude of transfers (*fiscal effort*) and differences in the progressivity of transfers (*fiscal progressivity*). Fiscal progressivity is further decomposed into that due to differences in the distribution of transfers across income groups (*targeting performance*) and differences in the social welfare returns to targeting due to different initial levels of income inequality (*targeting returns*). This allows differences in fiscal redistribution to be separated into that due to differences in fiscal policy (fiscal effort and targeting performance) and that due to

²⁰ We also observe large variation in the magnitude and sign of the pairwise slope estimates across all years (see Appendix IV) suggesting that the results may be sensitive to the sample of countries and years used, as well as the estimation methodology.

difference in initial inequality (targeting returns). It also provides a clear distinction between the concepts of progressivity and targeting and helps clarify the relationship between them.

Analysis of fiscal redistribution patterns for 28 EU countries from 2011 to 2016 finds that the extent of fiscal redistribution has remained very stable over time. However, there is significant variation across countries. On average, in 2016, differences in fiscal progressivity (i.e., targeting performance and targeting returns) explains three-quarters of the variation across countries, with differences in fiscal effort accounting for the remaining one-quarter. Differences in targeting returns accounts for around one-third of differences in fiscal redistribution.

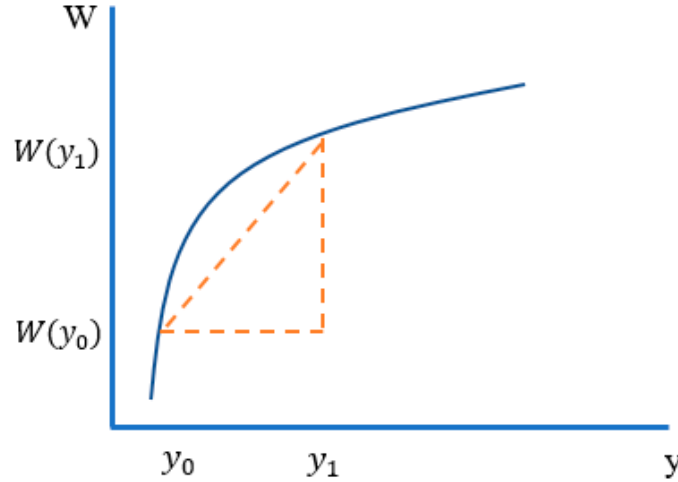
These decompositions are used to discuss two patterns in fiscal redistribution discussed in the literature. The first relates to the notion that “programs for the poor are poor programs,” which argues that fiscal redistribution is negatively correlated with fiscal progressivity (or targeting). Our analysis finds to the contrary, i.e., fiscal redistribution is on average higher in countries with greater fiscal progressivity (or targeting). While fiscal effort is lower in countries with high fiscal progressivity, this negative relationship is not strong enough to lead to a negative relationship between fiscal redistribution and fiscal progressivity. The second relates to the so-called Robin Hood Paradox of redistribution, which argues that countries with high market income inequality (and thus a greater “need” for redistribution) actually do less redistribution. Our results again suggest otherwise, with a very strong positive relationship between fiscal redistribution and initial inequality, and this still holds when we abstract from differences in initial income inequality (and thus in targeting returns) across countries, although the positive relationship is statistically weaker in some years.

The social welfare framework presented in this paper can be usefully extended in various directions. First, it can be applied to a more detailed disaggregation of taxes (e.g., social security contributions and income taxes) and transfers (e.g., pensions, child benefits, and means-tested benefits). Second, the framework can be easily adapted to incorporate indirect taxes or even in-kind transfers. Finally, different social objectives, such as different measures of inequality based on absolute (not relative) differences in income or notions of social justice, can be incorporated through the appropriate specification of social welfare weights.

Appendix I. Social Welfare and Large Transfers

The analysis of fiscal redistribution in the text implicitly assumes that social welfare weights are constant, which is strictly only a good approximation for small transfers. For positive transfers and welfare weights decreasing with income, this will overestimate the welfare impact. This can be seen from the figure below where W is social welfare, y_0 is original (pre-transfer) income, y_1 is final (post-transfer) income, and $t = (y_1 - y_0)$ is the transfer (Appendix Figure 1).

Appendix Figure 1. Social Welfare Weights for Small and Large Transfers



The marginal approximation of the welfare impact of t is $dW = \beta t$ where β is the slope of W at y_0 . The exact welfare impact is $dW^* = \beta^* t$ where $\beta^* = [W(y_1) - W(y_0)]/t$ and can be interpreted as an average of social welfare weights over the interval of the transfer, which can be calculated for any specific social welfare function. The exact welfare impact can then be calculated as in the text by scaling up β by a factor (β^*/β) . Note, however, that in general the directional relationship β^* and the simple average of β_0 and β_1 is unclear.

The welfare weights discussed in the text were based on an iso-elastic social welfare function of the form:

$$W(y) = \sum_h \frac{y_h^{1-\varepsilon}}{1-\varepsilon} \text{ for } \varepsilon \neq 1$$

and

$$W(y) = \sum_h \ln(y_h) \text{ for } \varepsilon = 1$$

The welfare impact of transfer t can then be written as:

$$F(t, y) = \frac{W(y+t)}{W(y)}$$

$$F(t, y) = \frac{\sum_h (t_h + y_h)^{1-\varepsilon}}{\sum_h y_h^{1-\varepsilon}} \text{ for } \varepsilon \neq 1$$

$$F(t, y) = \frac{\sum_h \ln(t_h + y_h)}{\sum_h \ln(y_h)} \text{ for } \varepsilon = 1$$

If $t_h = \theta_h B$ and $y_h = \gamma_h Y$ where θ_h and γ_h are the shares of household h in total transfers and total income respectively, then inserting in the above and dividing through by Y , and setting $b=(B/Y)$ gives:

$$F(\theta, \gamma, b) = \frac{\sum_h (\theta_h b + \gamma_h)^{1-\varepsilon}}{\sum_h \gamma_h^{1-\varepsilon}} \text{ for } \varepsilon \neq 1$$

$$F(\theta, \gamma, b) = \frac{\sum_h \ln(\theta_h b + \gamma_h)}{\sum_h \ln(\gamma_h)} \text{ for } \varepsilon = 1$$

Note that the results presented in the paper are based on an average of welfare weights before and after net transfers, which were found to be very close approximations to the exact welfare weights.

Appendix II. EUROMOD: Ireland Distribution of Income, Taxes, and Transfers

Decile Group	Disposable Income	Original Income	Means-Tested Benefits	Non-Means-Tested Benefits	Public Pensions	All Taxes	Social Insurance Contrib. (SICs) (2)	Simulated Benefits, of All Benefits (%)	Simulated Taxes, of All Taxes (%)
1	1,099.8	255.6	657.8	236.2	44.4	64.1	30.2	92.2	100.0
2	1,586.3	354.9	951.8	265.1	84.5	58.1	12.0	92.5	100.0
3	1,930.4	689.5	922.9	275.1	155.9	70.7	42.4	90.4	100.0
4	2,289.1	1,268.5	706.5	355.1	177.7	136.5	82.2	87.6	100.0
5	2,738.9	2,014.4	413.0	341.7	360.0	253.1	137.1	88.3	100.0
6	3,208.0	2,960.4	173.5	376.7	356.5	462.8	196.2	89.7	100.0
7	3,697.3	3,708.7	112.1	428.4	376.0	667.9	260.0	89.1	100.0
8	4,125.0	4,652.5	64.3	333.2	405.0	998.4	331.7	91.5	100.0
9	5,076.7	6,445.4	22.3	348.5	268.3	1,525.7	482.1	90.5	100.0
10	6,993.0	10,726.6	14.7	243.1	148.0	3,345.3	794.0	88.1	100.0
All	3,264.8	3,304.1	409.1	318.1	233.7	763.4	236.8	90.1	100.0
Poor (3)	1,283.2	270.2	790.2	249.9	53.6	58.5	22.1	92.7	100.0

Definitions

original income (sim.)	employment income + investment income + income of children under 16 + private pension + income from property + private transfers received + self-employment income + pension from other employment + pension taxes (sim.)
taxes (data)	property tax
employee SICs (sim.)	employee PRSI + superannuation + public sector pension related deduction
self-empl. SICs (sim.)	self-employed PRSI + self-employed investment and rental income SIC
benefits (sim.)	maternity benefit + state pension (non-contributory) + one parent family payment + widows non-contributory pension + disability allowance + illness benefit + supplementary welfare allowance + family income supplement + jobseekers benefit + jobseekers allowance + injury benefit + child benefit + state pension
benefits (data)	rent and mortgage supplements + fuel allowance + minor social assistance benefits + residual family allowances + grants/education (training) allowances + education grant (from FÁS) + household benefit package

Source: EUROMOD data available at: <https://www.euromod.ac.uk/using-euromod/statistics>

Appendix III. Fiscal Redistribution, Progressivity, Targeting and Fiscal Effort

Redistribution & Progressivity								
	$\epsilon=0.5$	$\epsilon=1$	$\epsilon=2$	Targeting	$\epsilon=0.5$	$\epsilon=1$	$\epsilon=2$	Targeting
	Levels	Levels	Levels	Levels	Logs	Logs	Logs	Logs
2016	0.204***	0.237***	0.285***	0.178***	0.625***	0.724***	0.871***	0.597***
2015	0.211***	0.242***	0.288***	0.192***	0.646***	0.736***	0.871***	0.648***
2014	0.215***	0.244***	0.287***	0.197***	0.646***	0.730***	0.862***	0.636***
2013	0.223***	0.250***	0.294***	0.203***	0.660***	0.737***	0.862***	0.667***
2012	0.235***	0.262***	0.305***	0.216***	0.673***	0.746***	0.867***	0.722***
2011	0.230***	0.257***	0.301***	0.213***	0.659***	0.734***	0.860***	0.710***
All	0.219***	0.247***	0.289***	0.200***	0.652***	0.735***	0.866***	0.668***
All (FE)	0.210***	0.237***	0.288***	0.281***	0.770***	0.824***	0.921***	0.887***

Progressivity & Effort								
	$\epsilon=0.5$	$\epsilon=1$	$\epsilon=2$	Targeting	$\epsilon=0.5$	$\epsilon=1$	$\epsilon=2$	Targeting
	Levels	Levels	Levels	Levels	Logs	Logs	Logs	Logs
2016	-1.412***	-4.357***	-36.27**	-0.956***	-1.442***	-1.746***	-2.561***	-1.591***
2015	-1.347***	-4.046***	-31.03**	-0.947***	-1.516***	-1.827***	-2.673***	-1.768***
2014	-1.298***	-3.750***	-24.27***	-0.922***	-1.548***	-1.836***	-2.606***	-1.759***
2013	-1.290***	-3.655***	-21.26***	-0.956***	-1.569***	-1.849***	-2.591***	-1.845***
2012	-1.227***	-3.445***	-19.28**	-0.943***	-1.520***	-1.792***	-2.507***	-1.933***
2011	-1.186***	-3.369***	-19.91**	-0.901***	-1.391***	-1.627***	-2.241***	-1.727***
All	-1.298***	-3.793***	-25.80***	-0.938***	-1.503***	-1.788***	-2.549***	-1.770***
All (FE)	-1.165***	-4.059***	-37.46**	-0.451***	-1.461***	-1.920***	-3.301***	-0.965***

* p<0.1 ** p<0.05 *** p<0.01

Source: Authors' calculations based on EUROMOD data.

Appendix IV. Pairwise Regression Analysis

We also analyze the relationships between market income inequality and conditional and unconditional fiscal redistribution based on pairwise country comparisons of these variables. From our decomposition analysis, the difference in fiscal redistribution between each pair of countries (i and j) can be written as the sum of the difference due to each component part:

$$\Delta FR_{ij} = \Delta FR_{ij}^{\beta} + \Delta FR_{ij}^{\theta} + \Delta FR_{ij}^B$$

For each pair of countries, we also know their market income inequalities (I) and so can calculate ΔI . Therefore, we can calculate $\Delta FR/\Delta I$ for the overall difference in FR and separately for each of the component parts or alternative combinations, with the sum of the component relationships equaling the overall relationship.²¹ This in turn allows us to break out the relationship between overall fiscal redistribution and market income inequality into that due separately to differences in fiscal policy (i.e., θ and B) and to targeting returns (β) capturing differences in market income inequality.

Appendix Figure 2 presents information on the distribution of the pairwise relationships between income inequality and fiscal redistribution, and the latter's component parts for the pooled country-year sample over 2011 to 2016. The large variation in magnitudes and signs of the different pairwise coefficients suggests that the observed relationship between conditional and unconditional fiscal redistribution and market income inequality may be sensitive to the sample of countries or years under investigation, and also the estimator used (Appendix Table 2).

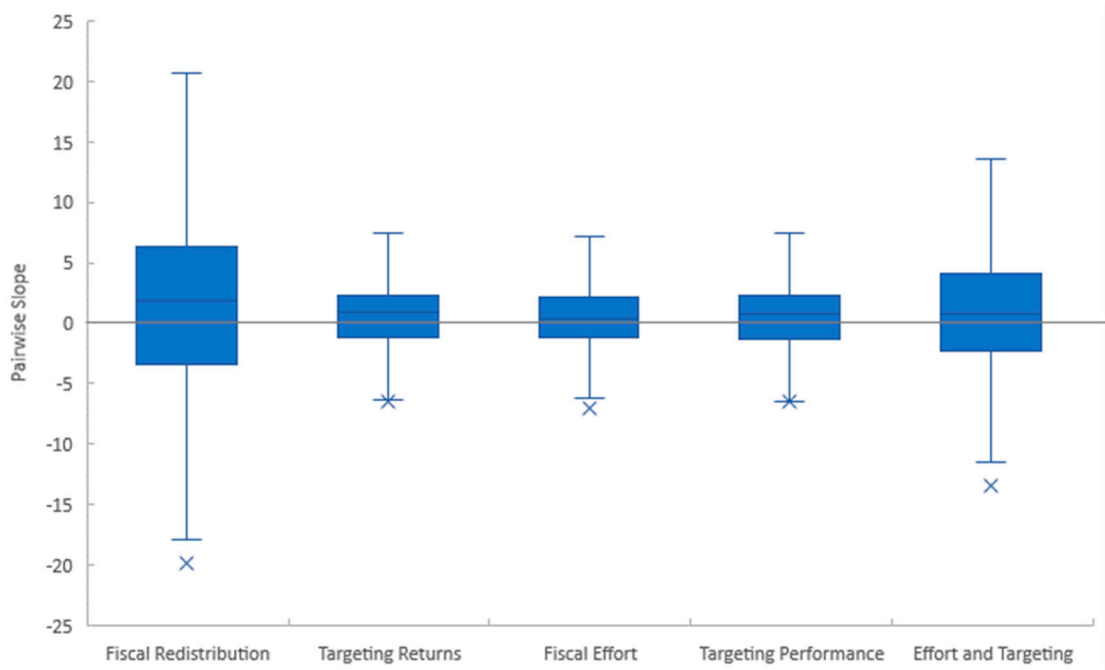
Appendix Table 1. Relationship Between Inequality and Fiscal Redistribution

	FR_C	Effort	Performance	Returns	FR_U
Mean	1.028	-0.581	1.166	0.442	0.586
Weighted Mean	0.322	0.14	-0.006	0.188	0.133

Note: Coefficients show average relationship between column variables and inequality based on pairwise comparisons across countries. Columns are conditional and unconditional fiscal redistribution (FR_C and FR_U), fiscal effort, and targeting performance and returns. Weights are based on the squared difference in income inequality across countries. Income inequality is measured by the Gini coefficient.

Source: Authors' calculations based on EUROMOD data.

²¹ The median of these relationships across all pairwise country comparisons provides an alternative non-parametric estimate to the OLS estimate discussed in the paper. This technique is often referred to as the Theil-Sen estimator (Dietz, 1989). Since it is insensitive to outliers, this estimator can be significantly more accurate than non-robust simple linear regression for skewed and heteroskedastic data. It is an unbiased estimator of the true slope in simple linear regression. The least-squares estimator is a weighted average of pairwise slopes, with the squared differences in the independent x-variable used as weights.

Appendix Figure 2. Relationship Between Inequality and Fiscal Redistribution

Note: Figure shows the distribution of the relationship between inequality and fiscal redistribution, and the latter's component parts, based on country pairwise regressions.
Source: Authors' calculations based on EUROMOD data.

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