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Income Redistribution in the European Union

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Abstract

The systems of direct taxes and cash benefits in the 27 Member States of the European Union (EU) vary considerably in size and structure. We explore their redistributive effects using EUROMOD, the tax-benefit microsimulation model for the EU. As well as describing redistributive effects in aggregate this allows us to assess and compare the effectiveness of individual types of policy in reducing income disparities. We consider the following categories of benefits and taxes: income taxes, tax allowances, tax credits, social contributions, cash benefits designed to target the poor or redistribute inter-personally (through means-testing) as well as cash benefits intended to redistribute intra-personally across the lifecycle (through social insurance or contingency-based entitlement). We derive results for the 27 members of the European Union using policies in effect in 2010 and present them for each country separately as well as for the EU as a whole.

Keywords:

Redistribution, European Union, Microsimulation, Tax-Benefit systems

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1 Introduction

The relationship between the tax-benefit system and the distribution of income has been the focus of longstanding scholarly work (Hicks and Swank, 1984; Myles, 1984). In particular, the welfare state literature has examined the link between welfare state characteristics and inequality and/or redistribution (Brady, 1995; Castles and Mitchell, 1992; Esping-Andersen, 1990; Korpi 1989; Korpi and Palme, 1998). This strand of research has primarily used broad macro-level indicators such as social expenditure as a share of GDP to characterize welfare states. More recently, studies using detailed micro-data have sought to go into more detail and quantify the redistributive effect of the various components of the tax-benefit systems. Along many national studies, several studies have taken on a comparative perspective making use primarily of the Luxembourg Income Study (Lambert et al, 2010; Mahler and Jesuit, 2006; Wang et al, 2012) or the EU-SILC (Fuest et al, 2010).

This paper describes the redistributive effects of the systems of direct taxes and cash benefits of the 27 member states of the European Union (EU). It is the first such analysis making use of the 27 country version of EUROMOD, the tax-benefit microsimulation model for the EU. International comparisons of redistribution that go beyond the use of model family analysis have tended to focus on particular parts of the tax-benefit system (e.g. Wagstaff and van Doorslaer, 2001) or, as described above, make use of data from the Luxembourg Income Study (see also Atkinson et al., 1995; OECD, 2011). The latter source is particularly useful if the focus is on long-term trends and not on the detailed workings of up-to-date policy systems. In this paper our focus is on very recent (2010) tax-benefit systems which are broken down into detailed components.

In carrying out our analyses, we rely on micro-simulation techniques to measure several of our income components. In particular, we micro-simulate taxes, social insurance contributions, means-tested benefits, as well as several non-means tested categories of payment[1]. Although the redistributive impact of taxes and benefits may be assessed directly, using the observed values of these income components, we believe micro-simulating them has a series of advantages. First, use of a comprehensive micro-simulation tool such as EUROMOD allows us to examine benefit transfers at a much more fine-grained level. Moreover, since EUROMOD simulates each individual policy, we are able to use our own classification of benefits. This allows us to be much more accurate in our analyses[2]. Second, the use of micro-simulation techniques allows us to disentangle three elements of the income tax system: schedule, allowances and credits. To our knowledge, there is no European comparative micro-data that can make this type of information available. Third, by using micro-simulation we potentially improve on the measurement of some types of transfers that are known

[1] More information about our simulations can be found in the Methods section.

[2] For example, EU-SILC mixes means-tested and non-means-tested benefits in several of its income variables (family benefits, unemployment benefits etc.).

to not be very well captured in surveys (such as for example means-tested benefits)[3]. Fourth, micro-simulation allows us to look at very recent policies, 2010, well in advance of micro-data becoming available. Previous analysis of redistributive effects using EUROMOD includes Immervoll et al (2006), covering the EU-15 and Paulus et al (2009), covering 19 countries. In common with those studies our analysis assesses tax liabilities and benefit payments in terms of their *direct* impact on household resources. This provides only a partial measure of how transfers between households and governments affect incomes (Boadway and Keen, 2000) and this needs to be kept in mind when interpreting results and comparing them across countries. On the one hand, taxes and benefits have an influence on pre tax-benefit market incomes (and economic welfare) which is not captured by looking at the amounts of taxes and benefits alone (Plotnick, 1984; Bergh, 2005). On the other hand, in-kind transfers (to individual households or provided collectively) represent a significant portion of the resources transferred from governments to households (Paulus et al., 2010; OECD, 2011; chapter 8).

Secondly, we measure incomes and inequality at a particular point in time. The analysis is therefore *static* and does not attempt to measure the distribution of lifetime incomes or separate the "intra-personal" and "inter-personal" components of cross-sectional inequality. This point is relevant because some of the tax-benefit instruments analysed here (pensions and other contingency- or insurance-based benefits as well as the taxes earmarked to finance them) are largely designed to redistribute across the life-cycle rather than across individuals. However, using EUROMOD we are able to distinguish these "life-cycle" components from those designed to redistribute from the current rich to the current poor.

In addition our analysis decomposes the effects of direct taxes not only into income tax and social insurance contributions, but also breaks down the redistributive effects of income taxes into those due to personal allowances, tax credits and the rate structure (or schedule). This is similar to previous work for a selection of countries using EUROMOD by Verbist (2004) which focussed on the implications of each component for the progressivity of income taxes.

The remainder of this paper is organised as follows. The following section describes the data, our simulation strategy as well as our measures of inequality and redistribution. Section three contains our main results. After examining the relative size of the tax-benefit systems as well as its components in the 27 countries, we turn to measures of redistribution. We find that public pensions together with tax schedules are the most important redistributive elements in all countries. Similarly

[3] It also has to be acknowledged that the use of micro-simulation techniques has its own problems. For example, we are not able to fully account for benefit non take-up. As such, our measures of redistribution should be taken as the intended rather than the actual effect of the tax-benefit system. Benefit non-take *is* explicitly modelled in a few countries where it is a widespread and important phenomenon. These include Belgium, UK, Estonia and Greece. Tax evasion corrections are modelled in Italy and Bulgaria.

to Fuest et al. (2010), we do not find that Central and European tax-benefit systems have peculiar features distinguishing them as a group from the other Member States.

2 Methods

2.1 EUROMOD

To evaluate the redistributive effect of national tax-benefit systems we make use of EUROMOD, the tax-benefit microsimulation model for the European Union. EUROMOD relies on micro-data representative of the household population of each EU member state to compute tax liabilities and benefit entitlements corresponding to each of the 27 tax-benefit systems existent in the EU. Based on a common framework – which applies the same methods and approaches both in the construction of its input databases and in the calculation of taxes and benefits of each country – EUROMOD is a unique tool for international comparative research on the effects of taxes and benefits, and their reforms, on the distribution and redistribution of income.

EUROMOD has been built and is maintained by a team of researchers at the University of Essex in collaboration with a group of national experts. Its data and policy rules are periodically updated and its results validated and documented.

Most of the EUROMOD input data is derived from the European Union Survey on Statistics on Income and Living Conditions (EU-SILC), provided by Eurostat. However, as some income variables in EU-SILC have been constructed in ways that are incompatible with the requirements of EUROMOD[4], in a number of countries national versions of the EU-SILC - provided by national statistics institutes – complement or substitute the Eurostat data (see Table 1).[5]

Where national versions of the SILC are not available, different adaptations are applied in order to make the information consistent and suitable for tax-benefit simulation. One adaptation of particular interest in the context of this analysis is the splitting of social benefits. EU-SILC provides data on benefits aggregated in one variable for each ESSPROSS function.[6] As such aggregation is not necessarily compatible with the tax treatment or interaction with simulated benefits; in EUROMOD such aggregated variables are decomposed as much as possible to reflect real benefit entitlements. Taking advantage of such decomposition in this analysis we are able to apply different social benefit classifications.[7]

[4] For a discussion on the difficulties of using the EU-SILC with EUROMOD, see Figari, Levy and Sutherland (2007), Iacovou, Kaminska and Levy (2012).
[5] In the case of the United Kingdom, the Family Resources Survey is used instead.
[6] For more details see Eurostat (2012)
[7] Social benefit classifications are explained in section 2.2.3.

Furthermore, while income data refers to the previous year, the EU-SILC reports demographic and labour market information at the current time when the data were collected. This mismatch in data reference periods is reconciled in the EUROMOD input data by adapting demographic and labour characteristics to the income information. Such adaptations involve changes and imputations in a number of variables as well as excluding individuals born after the income reference period.

EUROMOD simulates four types of policies, namely social insurance contributions, direct income taxes and their sub-components, means-tested benefits and some types of non-means-tested benefits. With some exceptions, pensions and other contributory benefits are not simulated due to absence of information on contribution histories in the input dataset. Instead, the values of these income variables are taken directly from the data.

Currently, EUROMOD contains tax-benefit simulations covering the period between 2005 and 2010[8]. In this paper we use the last available policy year, i.e. 2010. Simulations are carried out using data collected in the year 2008 with income information referring to the previous year - the only exceptions are France (data collected in 2007), Malta (data collected in 2009), and the UK (data collected in 2008/2009 and income refers to the previous month). The discrepancy between the data and simulation time periods is dealt with by adjusting monetary variables in the input dataset. All monetary variables are brought to price levels of the policy simulation year by applying uprating indices that reflect the average evolution of these variables between the income reference period and the year of simulation (in our case from 2007 to 2010).

2.2 Measurement

2.2.1 Measures of inequality, redistribution and progressivity

In order to measure the effects of taxes and benefits on the income distribution, we use a set of common inequality indicators. The inequality measures used are members of the so-called single parameter Gini (or S-Gini) family (Donaldson and Weymark, 1980; Yitzhaki, 1983). By choosing the value of an "ethical" parameter *v*, the S-Gini (*SG*) allows different weights *w* to be put on the contribution of lower versus higher income groups to total inequality:[9]

$$SG(v) = \int_0^1 w \cdot (p - L(p))dp \qquad (1a)$$

where

$$w = v \cdot (v-1) \cdot (1-p)^{v-2}, \qquad v > 1, \qquad (1b)$$

[8] The earlier years are not available for all of the 27 countries.

[9] See Duclos and Araar (2006). A discussion of alternative interpretations of Gini coefficients is provided by Yitzhaki (1998).

p is the rank of individuals in a population with individual observations ordered in ascending order of income whose inequality is to be measured and *L*(*p*) is the Lorenz curve, *i.e.*, the share of total income earned by the poorest *p*·100%. For *v* = 2, we have *w* = 2 and *SG*(*v*) is the standard Gini coefficient of inequality where departures from equality (*p* - *L*(*p*)) are weighted equally for all *p*, while *v* > 2 (<2) gives more weight to smaller (larger) *p*.

The difference between the S-Gini index of inequality of pre-tax/benefit income SG_g and the S-Gini concentration index of disposable income CI_n is a measure of vertical redistribution. It indicates to which extent disposable incomes are more equally distributed than market incomes and, for *v* = 2, corresponds to the Reynolds-Smolensky redistribution index *RS* (Reynolds and Smolensky, 1977).

$$RS = SG_g(2) - CI_n(2) = 2\left(\int_0^1 p - L_g(p)dp - \int_0^1 p - C_n(p)dp\right), \quad (2a)$$

where $L_g(p)$ and $C_n(p)$ are, respectively, the Lorenz and concentration curves of income before and after taxes and benefits. The degree of vertical redistribution is reduced by any changes in the ranking of individuals in the pre and after tax-benefit distribution, captured by a re-ranking term *d*. The equalising effect of the tax system, measured as the difference between the pre and post tax-benefit S-Gini indices, can then be expressed as

$$RE = SG_g(2) - SG_n(2) = RS - d \quad (2b)$$

The inequality reducing properties of the fiscal system depend on the size and inequality of the distribution of taxes and benefits. Formally, it can be shown that

$$RE = k\frac{r}{1-r} - d \quad (3a)$$

where

$$r = \frac{(\mu_g - \mu_n)}{\mu_g} \quad (3b)$$

$$k = 2\int_0^1 p - C_t(p)dp - SG_g(2) \quad (3c)$$

$$d = SG_n(2) - 2\int_0^1 p - C_n(p)dp \quad (3d)$$

r is the size of taxes and benefits expressed as the relative difference between mean income before and after taxes and benefits μ_g and μ_n, *k* is the Kakwani progressivity index (Kakwani, 1977), and *d* is the above-mentioned re-ranking term measuring by how much vertical redistribution is reduced as a result of differences in the ordering of market and disposable incomes (Atkinson, 1980; Plotnick, 1981). $C_t(p)$ and $C_n(p)$ are, respectively, the cumulative proportions of total taxes and benefits and disposable incomes at point *p* where individuals are ordered in terms of market incomes. Since the decomposition works analogously for $w \neq 2$, we can derive measures of redistribution (*RE*) and progressivity (*k*) using different "ethical" parameters *v*. In this paper, the following three values for v are used: 1.5, 2 and 3.

2.2.2 Inequality decomposition by source

In order to show the relative contribution of each source of income to overall income inequality, the Gini coefficient of disposable income can be also decomposed into the weighted sum of concentration coefficients of its various sources:

$$G = \sum_{k=1}^{k} r_k C_k \qquad (4)$$

r is the share of source k in disposable income, and C_k is the concentration coefficient with observations ranked in ascending order of disposable income. The concentration coefficient thus expresses how unequal the income component k is distributed across disposable income groups. The higher the concentration coefficient C_k or the share of the most unequally distributed (or "concentrated") components, the larger the Gini coefficient of disposable income will be.

The effect of a marginal increase in the income source k (M_k) on the Gini coefficient of disposable income can be measured as the difference between the contribution of k to inequality and its share of disposable income. Hence,

$$M_k = \frac{r_k C_k}{G} - r_k \qquad (5)$$

The sign of the effect depends on the sign of C_k since r is always positive. This means that if the concentration coefficient from source k with the distribution of disposable income is negative, the marginal effect will be negative. Otherwise, the sign will depend on the difference between the concentration coefficient of source k and the Gini coefficient. If the concentration coefficient of source k is larger than the Gini, the marginal effect will be negative; otherwise the effect will be positive.[10]

[10] Despite its simplicity and attractiveness, this approach is not free from problems. In the case of an income component k that is constant for all income units, its concentration coefficient will be zero. Therefore, contrary to the general view that that an addition of a constant to all incomes decreases total inequality, this approach

2.2.3 Income

In this analysis we assume that income is equally shared within the household, so that household disposable income can be used as an indicator of the economic well-being of each individual within the household ('within household' incidence is not considered).

Household disposable income is defined as market (original) income plus private transfers and social benefits minus taxes and social contributions, aggregated at the household level. Non-cash benefits are not included. Household disposable incomes are equivalised using the modified OECD equivalence scale.

In analyzing the redistributive effect of tax-benefit systems, we distinguish between the following income components:

- original market income: this includes labour income, unearned income such as income generates by assets (including private pensions), and inter-household transfers
- public pension income: this includes pension income from all public statutory pension schemes
- social insurance contributions: these include mandatory contributions paid by employees and self-employed to cover contingencies such as unemployment, sickness, old-age etc.
- means-tested benefits: we include here any benefit whose entitlement rules incorporate conditions referring to individual or household incomes (and assets where relevant and possible); fully refundable tax credits that depend on income/earnings are included in this income component.
- contributory benefits: these include any short-term benefit (i.e. not a pension) the awarding of which depends on previous contributions paid.
- non-contributory, non-means tested benefits: this is a residual category that includes cash transfers that do not meet one of the criteria above. To maintain consistency, fully refundable tax credits that do not depend on income/earnings are also included in this income concept.
- direct income taxes: this concept incorporates any type of taxes (excluding contributions) paid on any type of household income.

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would lead us to conclude that component k does not make any contribution to total inequality (Podder, 1993). The approach is nevertheless useful for understanding how different income components (in particular taxes and benefits) are distributed and contribute to total income inequality.

Since direct income taxes are often the result of complex taxation systems, we disaggregate them into three components not all of which are necessarily present in all countries: tax schedules, tax allowances, tax credits. Tax allowances and tax credits are so-called fiscal benefits and they may be an important channel through which the tax benefit system directs resources towards households. A tax allowance is any type of deduction from initial taxable income that would lower the effective tax base. This includes social insurance contributions whenever they are deductible from the tax base, as well as any tax bands where the tax rate is zero. A tax credit is any type of non-refundable deduction from the initial tax liability (gross tax). To effect the decomposition we take following approach. First, using EUROMOD, we estimate the gross tax (i.e. before any tax credits) payable in the baseline scenario. We then set any tax allowances in the system (including social insurance contributions when deductible, 0 rate bands etc.) to zero and recalculate the amount of gross tax payable. We evaluate tax schedules as the gross tax that would be payable in the absence of tax allowances. The size of this variable is driven by the tax schedule but also by the extent to which various types of incomes are subject to taxation. In the remainder of the paper we will refer to the tax schedule/ taxable base component of the income tax system as "taxes". The difference in the actual gross tax paid by households and the gross tax payable in the no allowances scenario is the net benefit that can be attributed to tax allowances. Finally, tax credits are the difference between gross and net taxes. Refundable tax credits are treated as benefits and thus included in the benefit concepts, not in tax credits, as explained above.

It should be made clear that although the decomposition of direct income taxes into different elements corresponding to schedules, allowances and credits goes a long way towards unpicking the workings on the income tax systems, this decomposition does not cover all the elements of income taxation. Features such as joint versus individual taxation, transferability of tax allowances and credits and progressivity adjustments, while included in the simulation are not directly addressed by our decomposition.

2.2.4 Confidence intervals

Standard errors and confidence intervals are computed for inequality and redistribution indices estimates using bootstrap[11]. Bootstrap is a technique based on re-sampling with replacement (Efron and Tibshirani, 1993). Given a random sample $Z = (z^1, z^2,\ldots, z^n)$, B bootstrap samples $Z^* = Z^{*1}, Z^{*2},\ldots, Z^{*B}$ are drawn so that each bootstrap sample $Z^* = (z^{1*}, z^{2*},\ldots, z^{n*})$ is an independent random sample of size n from the original distribution Z. Replicates of the analysed index (Π) are then calculated for each bootstrap sample $\Pi(Z^{*1}), \Pi(Z^{*2}),\ldots, \Pi(Z^{*B})$. The bootstrap estimate of the standard error is then computed as the standard deviation of the bootstrap replicates:

[11] For more on methods to compute standard errors on inequality indices see, among others, Yitzhaki (1991), Ogwang (2000) and Giles (2004).

$$\hat{se}_B = \left\{ \frac{1}{B-1} \sum_{b=1}^{B} \left[\Pi(Z^{*b}) - \sum_{b=1}^{B} \Pi(Z^{*b}) / B \right]^2 \right\}^{1/2} \qquad 2.2.4$$

Confidence intervals have been constructed to be significant at the 5% level: i.e.+/- 1.96 * estimated (se_B). One must remember that, in practice, there are other possible sources of error in the estimations besides sampling error. Therefore, confidence intervals should not be taken as definitive but as an indication of the accuracy of the estimates.

3 Results

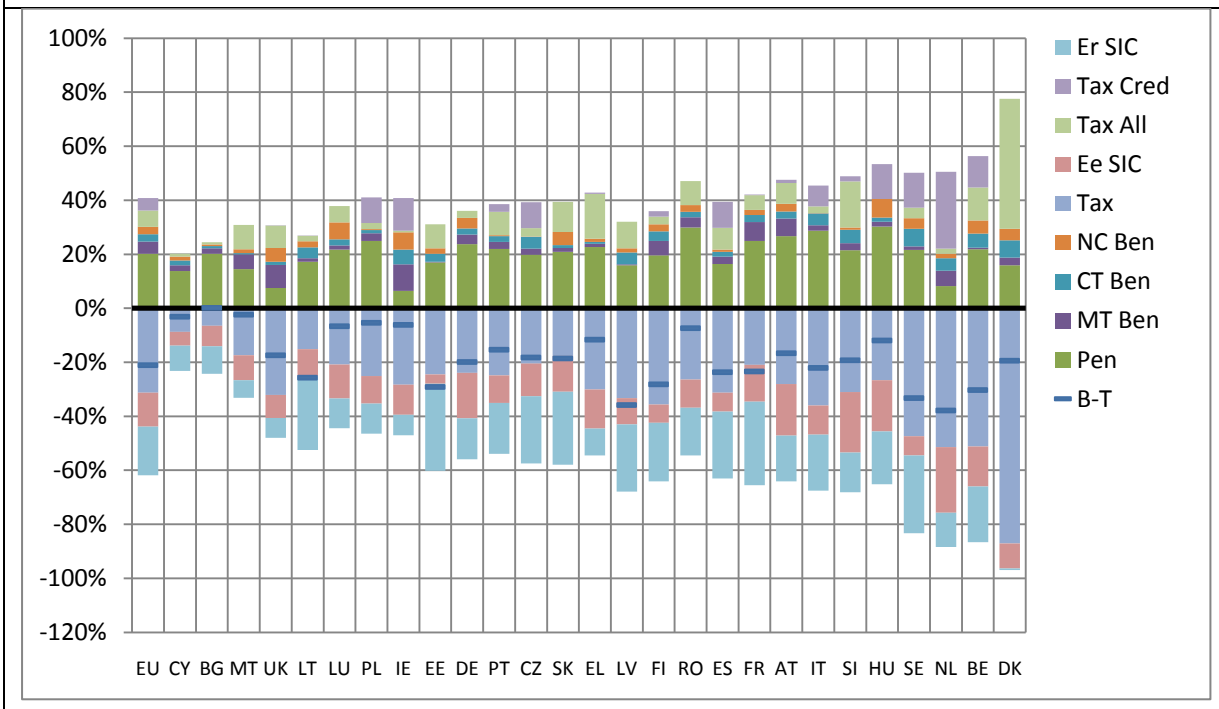
3.1 Relative size of tax-benefit systems

Before looking at the redistributive effects of taxes and benefits, we consider the relative size of the tax benefit system and its components. We define the size tax benefit system as the sum of all tax-benefit components, i.e. all pensions, benefits, taxes, tax allowances, tax credits, social insurance contributions, employer contributions taken as a share of household disposable income.[12] Similarly, the size of each tax and benefit income component is measured as a percentage of household disposable income. Using the aggregate sum of all tax and benefit components as an indicator of system size has both advantages and disadvantages. On the one hand, it can be roughly interpreted as system 'reach'. The larger the share of taxes and benefits, the lower the share of original market incomes and thus the higher the potential for redistribution. On the other hand, the measure incorporates some churning. For example, including the sum of the tax (schedule), tax allowances and tax credits elements will yield considerably larger values of system size compared to including net taxes only, at least in some countries.

Graph 1 shows the relative sizes of nine types of tax and benefit. Countries are ranked by the scale of their tax-benefit system calculated as described above. The first thing to notice is that the size of the tax benefit system varies widely among the 27 countries. Thus, taxes and benefit instruments are four times larger in Denmark, the country with the biggest system, compared to Cyprus where taxes and benefits are smallest as a percentage of disposable income. Secondly, the incorporation of taxes and social insurance contributions (both worker and employers) in the calculation of the tax-benefit size yields very different results from looking at benefits only. For example, Latvia and Italy usually categorized as less developed welfare states (Ferrera, 1996; Noelke, 2008) rank relatively high using our measure.

[12] Employer contributions, also simulated by EUROMOD, are included in this calculation because the employee-employer share of total contributions varies widely across countries.

Graph 1. Taxes* and benefits as share of disposable income, 2010



* Including workers and employers social insurance contributions
Er SIC: employer contributions; Tax: gross tax payable in the no allowances scenarios (tax schedule); Tax Cred: tax credits; Tax All: net gain due to tax allowances; SIC: employee and self-employed insurance contributions; NC Ben: non contributory, non means-tested benefits; CT-contributory, non pension benefits; MT BEN: means-tested benefits; Pen: public pensions; B-T sum of benefits (including tax credits and net gain due to tax allowances) minus taxes (including social insurance contributions). All income components are equivalised.
Countries are ranked by size of their tax-benefit system.
Source: EUROMOD F5.42

Not surprisingly, among benefits, pensions are the largest component. They are particularly important in Poland, Romania, Hungary and Italy. They are least important in the UK, Ireland and the Netherlands where private and/ or occupational pension schemes (here included in original income) feature prominently. With the exception of a few countries -Denmark, Sweden, Netherlands, Belgium and Slovenia - contributory benefits (other than pensions) are a relatively small income component totalling less than 5% of equivalised disposable income. Similarly, non contributory non means-tested benefits account for between 1 and 7 percent of disposable income. They are most important in Hungary, Belgium and Luxembourg. In most countries, means-tested benefits amount to less than 5 % of disposable income. There are some exceptions such as the UK and Ireland where the prevalence of means-testing has been well documented. Other countries where means-tested benefits also play a more prominent role are France, Austria, the Netherlands, Malta and Finland.

Contrary to the literature on regime types (Esping-Andersen, 1990; Korpi and Palme, 1998;), there appears to be no systematic relationship between the various types of non-pension benefit instruments. The country-level correlation between the size of means-tested benefits and other non-pension benefits (as a percentage of disposable income) is low and actually positive (0.12). Correspondingly, there is no consistent pattern when analyzing the relationship between means-tested and contributory transfers.

By far the largest component of the tax-benefit system, taxes are also the most significant driver of overall system size variation. When including social insurance contributions, taxation ranges between 23% of disposable income in Cyprus to 97% in Denmark. Obviously, the high taxation levels shown in Graph 1 are also due to the separation of tax schedules, tax allowances and tax credits. Put differently, since the tax component is taken gross of any tax allowances and tax credits, it is much larger than tax measures considering only net tax payments. Part of the income tax liabilities shown in the blue bars above are returned via tax allowances and tax credits. In fact, there is a very close relationship between taxation levels and the use of tax allowance and tax credit instruments[13]. Broadly speaking, countries may be loosely categorised as having either simple and low tax rates systems (Cyprus, Bulgaria) or more complicated higher taxation ones (Denmark, Austria). Essentially, higher initial gross tax liabilities are reduced via tax allowances and tax credits, thus resulting in much lower average tax rates than what the tax schedule alone would suggest. Theoretically, the use of tax allowances and tax credits should provide extra flexibility to adjust the burden on particular groups.

Most countries do use tax allowance and tax credit instruments to fine tune their fiscal regimes. However, the extent to which these types of fiscal tools affect disposable income varies considerably. In some countries such as Denmark and the Netherlands, tax allowances and tax credits have a larger effect on disposable income than benefits. Other countries where tax allowances and tax credits play a particularly important role are Hungary, Belgium, Sweden, Spain and Greece. Their use is generally much less widespread in the New Member States. Generally, tax allowances are more important than tax credits.

Worker and employer social insurance contributions amount, on average, to about a third of disposable income. Countries with low contributions include Cyprus, Bulgaria, Malta, the UK and Denmark whereas the burden of contributions is highest in France, Slovakia and Hungary. Employer contributions generally exceed those paid by employees and self-employed although a few countries, notably Denmark, take exception from this pattern.

[13] The country-level correlation between the size of the tax schedule component (i.e. gross tax payable in the no tax allowance scenario) and the sum of tax credits and gains via tax allowances is 0.9 in the sample of 27 countries. To some extent the high correlation is partly mechanical; high tax allowances / tax credits can only be taken advantage of if taxation (i.e. tax schedules) is high enough,

By and large, countries that tax more are also the countries that make use of more substantial benefit transfers. The country-level correlation between net tax liabilities (incl. employer contributions) and the size of benefit outlays is a moderate 0.47.

Last but not least, Graph 1 illustrates the aggregate net effect of the tax benefit system. This effect is negative in all countries meaning that overall, taxes collected exceed benefit outlays. The difference may be thought of as "residual resources" the state may use on other types of spending (for example, in-kind benefits which are not captured by the tax benefit system). Obviously, in this sense 'resources' refer to what is extracted by the state via the tax benefit system and do not encompass all government revenue sources.

3.2 Distribution of income components

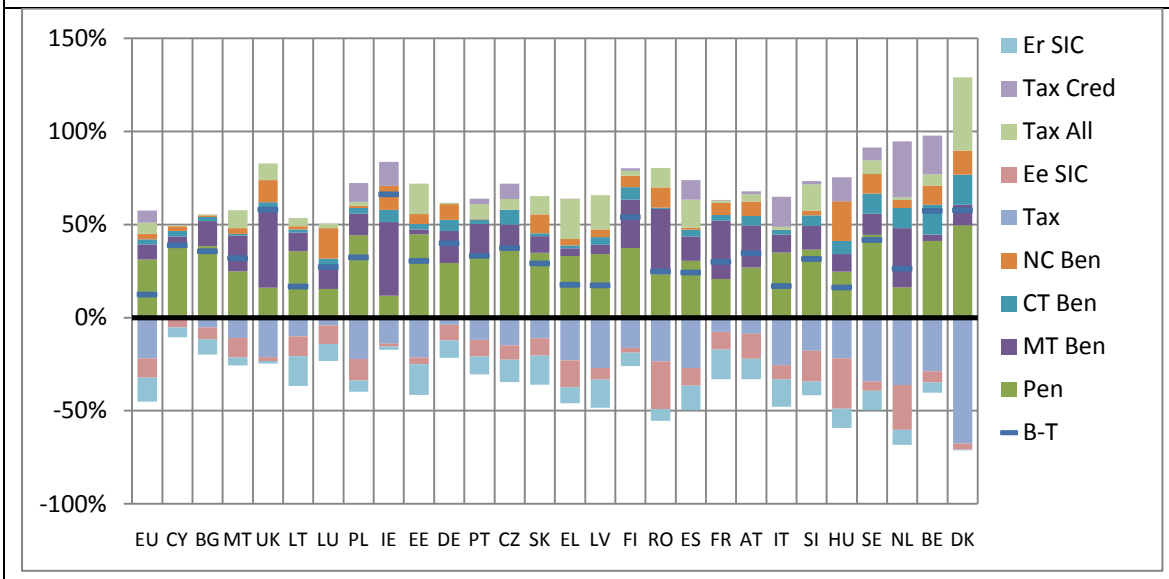
To gain a better understanding of how the various components of the tax benefit system affect households along the income distribution, we have repeated the analysis above separately for each quintile of disposable income. Graph 2 presents the relative size of different income components for the bottom quintile. Countries are again ranked by the size of their tax-benefit system, as in Graph 1.

In all countries the bottom quintile gains from the tax benefit system. This is illustrated in Graph 2 by the positive value of the B-T indicator. Not surprisingly, households in the bottom of the distribution receive more by way of benefits and tax concessions than they pay via direct taxes and social insurance liabilities. However, the magnitude of the gain differs from country to country. Thus, households in the bottom quintile are most advantaged by the tax benefit system in Belgium, Denmark, Finland, Ireland and the UK where their net receipts total around or just above 50% of their disposable income. Conversely, households in the bottom quintile benefit least from the tax benefit system in Lithuania, Italy, Latvia and Hungary. In these countries, the net gain of households in the bottom quintile is, on average, less than 20% of disposable income.

Among benefits, pensions rank high as an income source for the poorest quintile in all 27 countries. They are particularly important in Estonia, Poland, Sweden, Belgium and Denmark where they account for over 40% of disposable income. As expected, means-tested cash benefits are also an important income source for the bottom quintile especially in countries where means-testing plays a prominent role such as the UK and Ireland. France, the Netherlands, Romania and Finland also have relatively large means-tested income components.

Finally, non-pension and non-means-tested benefits appear to play a less important role for the bottom quintile. Particularly contributory benefits are unlikely to contribute much to incomes in the lowest quintile with a few notable exceptions-Denmark, Netherlands, Sweden and Belgium. There is more diversity in the relative size of non means-tested non-contributory benefits. They are clearly very important to households in the bottom quintile in Hungary but also in a few other countries such as Luxembourg, Slovakia, Sweden, Belgium, Ireland, Romania, Denmark or Netherlands.

Graph 2. Taxes* and benefits as share of disposable income, 2010: bottom quintile

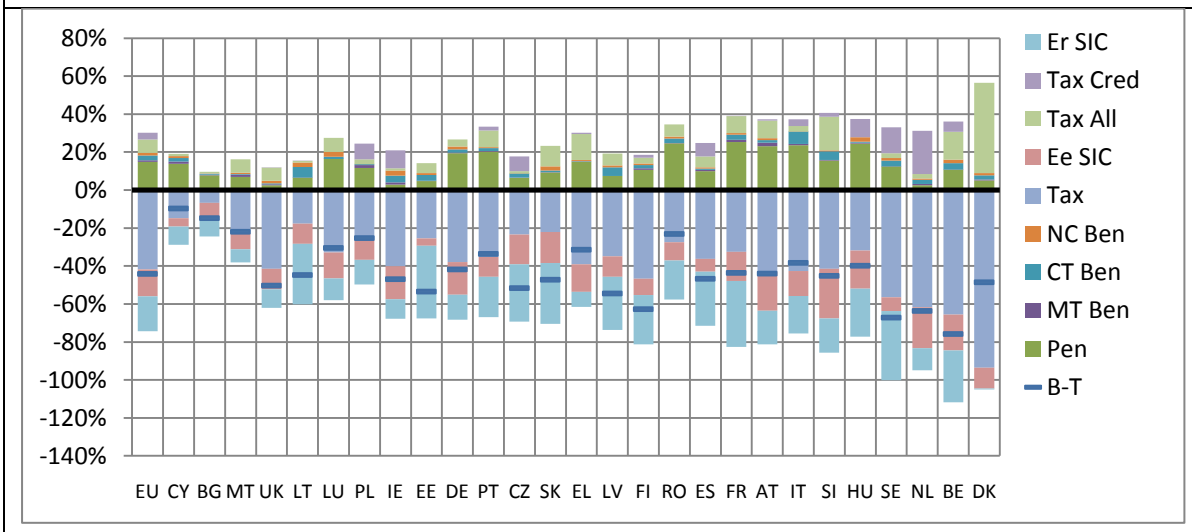


* Including workers and employers social insurance contributions
Er SIC: employer contributions; Tax: gross tax payable in the no allowances scenarios (tax schedule); Tax Cred: tax credits; Tax All: net gain due to tax allowances; SIC: employee and self-employed insurance contributions; NC Ben: non contributory, non means-tested benefits; CT-contributory, non pension benefits; MT BEN: means-tested benefits; Pen: public pensions; B-T sum of benefits (including tax credits and net gain due to tax allowances) minus taxes (including social insurance contributions). All income components are equivalised.
Countries are ranked by size of their tax-benefit system.
Source: EUROMOD F5.42

Taxes and social insurance contributions are obviously much lower in the bottom quintile compared to the population as a whole in all 27 countries. In some countries, most notably Cyprus but also Germany, Luxembourg and Bulgaria, households in the bottom quintile pay very little in the way of direct income taxes. Countries where taxation levels on the bottom quintile are higher such as Denmark, the Netherlands or Sweden also use tax allowances and tax credits to reduce the final tax liability. This is especially true for Denmark where tax allowances play a very important role even for the bottom quintile. This is a somewhat surprising finding considering that tax allowances can be taken advantage of only to the extent that there is enough taxable income. The importance of the tax allowances in the Danish system is largely due to the fact that many benefits are taxable. In turn, worker contributions are high, amounting to, on average more than 20% of disposable income in Netherlands, Romania and Hungary.

The same exercise of decomposing tax and benefit income components is repeated for the top quintile. Results are shown in Graph 3.

Graph 3. Taxes* and benefits as share of disposable income, 2010: top quintile



* Including workers and employers social insurance contributions
Er SIC: employer contributions; Tax: gross tax payable in the no allowances scenarios (tax schedule); Tax Cred: tax credits; Tax All: net gain due to tax allowances; SIC: employee and self-employed insurance contributions; NC Ben: non contributory, non means-tested benefits; CT-contributory, non pension benefits; MT BEN: means-tested benefits; Pen: public pensions; B-T sum of benefits (including tax credits and net gain due to tax allowances) minus taxes (including social insurance contributions). All income components are equivalised.
Countries are ranked by size of their tax-benefit system.
Source: EUROMOD F5.36

The most important instrument affecting incomes in the top quintile is clearly direct income taxation. However, the relative size of this instrument varies enormously among the 27 EU countries. It ranges from 7% in Bulgaria to 93% in Denmark. As in the case of the general population, higher taxation levels are generally offset by higher tax allowances and tax credits.

On the benefit side, clearly pensions are the most important transfer to the top quintile. Means-tested benefits are virtually unavailable to households in this section of the income distribution. Similarly, non means tested benefits, while clearly not zero, make up a very small proportion of disposable income at the top.

As with Graph 1 and 2, the B-T line indicates the overall net gain from the tax benefit system. This indicator is negative for households in the top quintile of the income distribution in every country indicating that richer households contribute more than they take out from the part of the system that we examine. Yet, the size of their contribution is country specific. Generally, countries where the tax benefit system strongly advantages the bottom quintile are also countries where the top loses relatively more. Examples include Finland, Sweden, the UK, Netherlands, and Belgium. The reverse is however not true. Countries where the bottom gains relatively less from the tax benefit system are not necessarily imposing a lower burden on the top. For example, in Latvia the difference

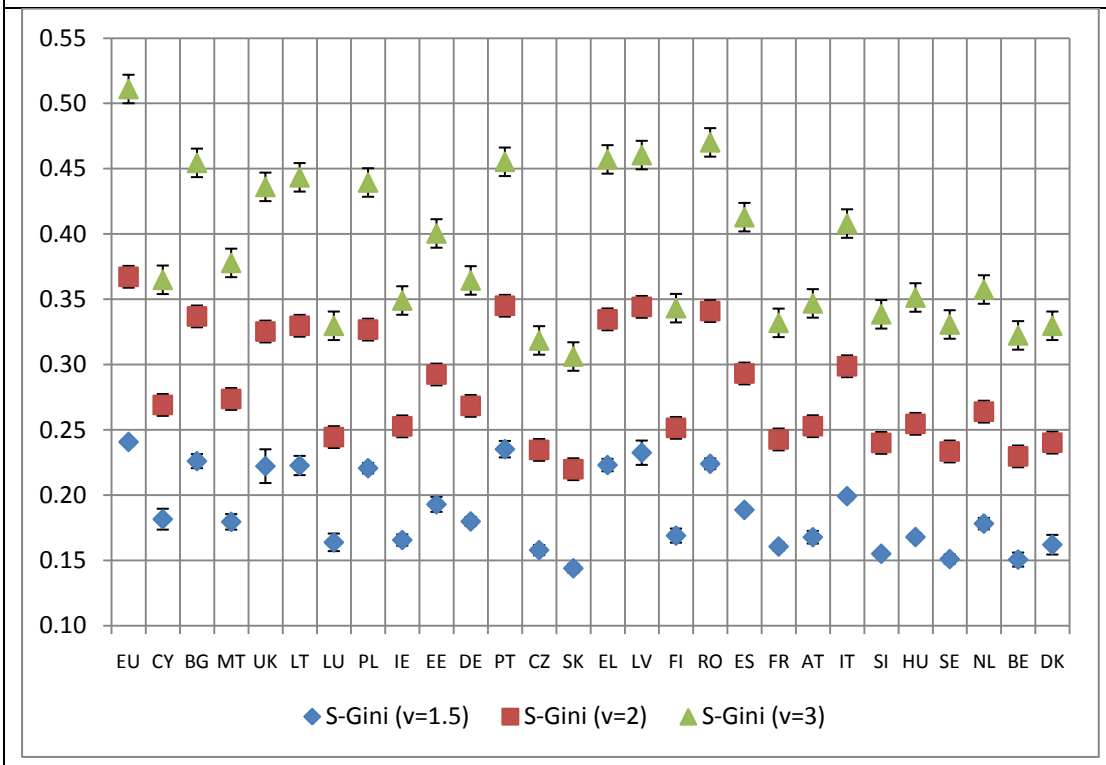
between benefits and taxes is 17 % of disposable income in the bottom quintile but reaches -54% at the top. Large reductions in income from the tax benefit system at the top are mainly due to direct income taxation suggesting that if richer households are to be made to contribute more to the system this will mostly be done via higher taxation.

3.3 Redistributive effect of taxes and benefits

We examine the redistributive effect of taxes and benefits by looking at a common and simple measure of inequality, namely the Gini coefficient. We first present measures of how income inequality changes when we exclude a given tax-benefit instrument from the construction of household disposable income. Our measures are based on the generalized Gini index measure (S-Gini), using three different sensitivity levels, i.e. 1.5, 2 and 3. We then decompose the standard Gini (S-Gini with a value of 2) index and calculate the contribution of each of our nine tax-benefit instruments to overall disposable income inequality. Finally, we show bootstrapped values of the Gini index, together with their corresponding standard errors.

An overall view of inequality of disposable income levels in the 27 countries as well as in the EU as a whole is given in Graph 4. Three S-Gini series are shown each using a different sensitivity parameter, namely 1.5 (Gini 1), 2(Gini2) and 3 (Gini 3). Higher values of the sensitivity parameters indicate the corresponding S-Gini measure places more weight on individuals at the bottom of the distribution. Countries are ranked by the size of their tax-benefit system. Although the last seven countries do have lower levels of inequality, there is not necessarily a straightforward relationship between the size of the tax-benefit system and inequality of disposable income.

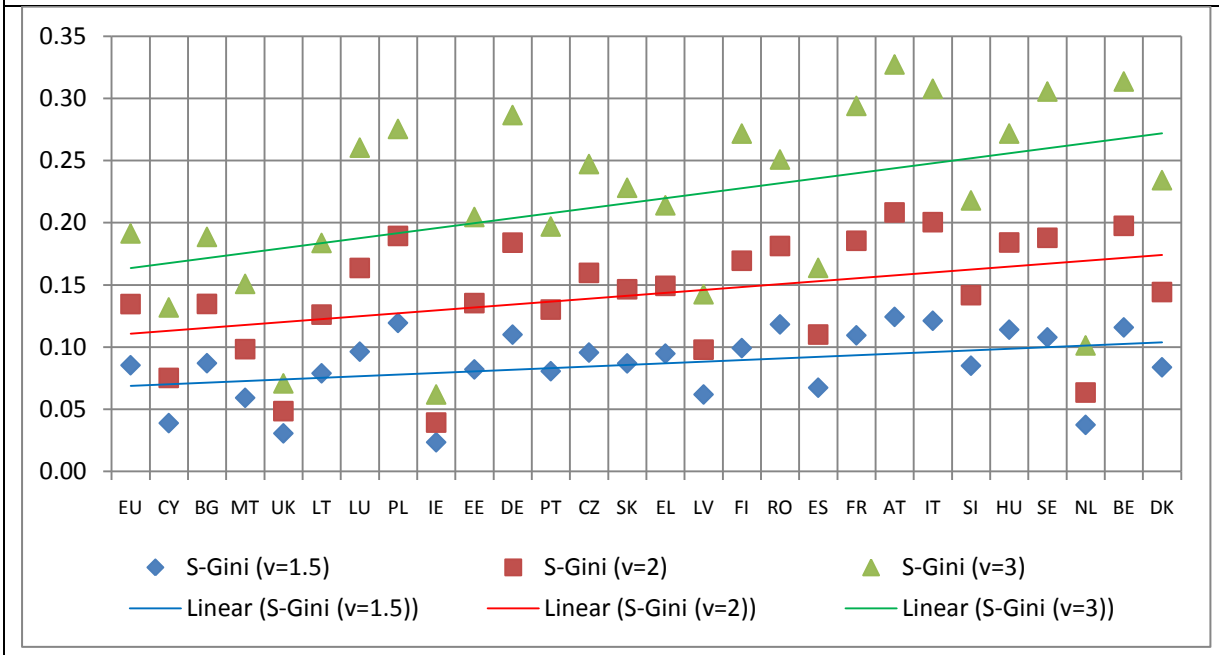
Graph 4. S Gini values of equivalised disposable income, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system.
Source: EUROMOD F5.42

Next, Graph 5 shows the changes in the three S-Gini indicators if pension income would be excluded from the calculations. The difference is a measure of the vertical redistributive effect of pension income. Public pensions clearly redistribute towards the bottom in all countries. Ireland and the UK where public pensions are a less important source of income in old-age are outliers, but even in their case the progressive nature of pensions is unambiguous. Interestingly, pension income is more redistributive in countries with larger tax benefit systems. The relationship is most striking when more emphasis is put on the poor when computing the level of inequality (S-Gini with v=3).

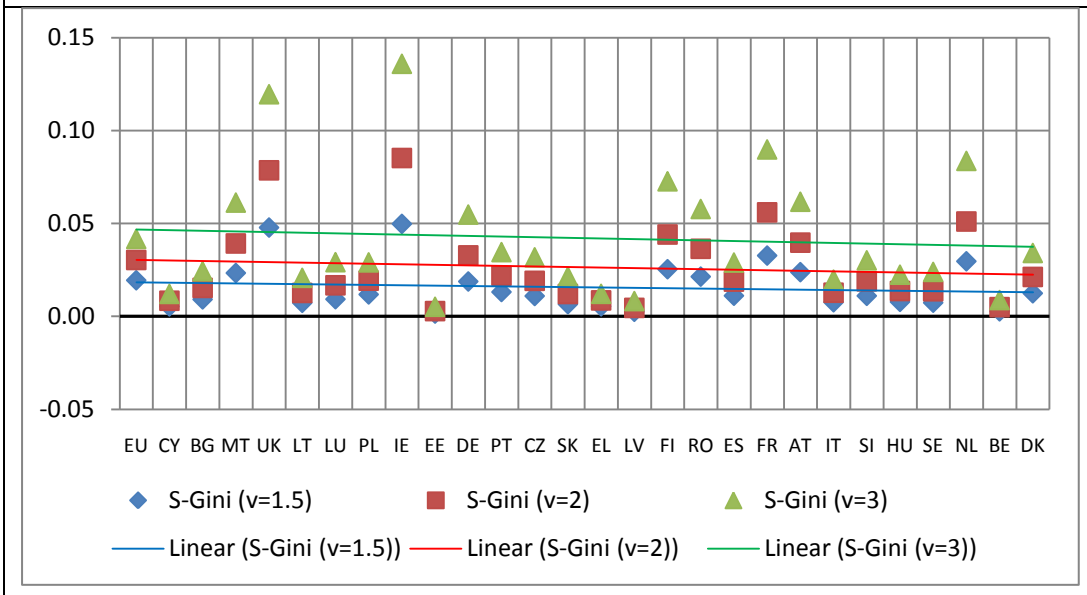
Graph 5. Changes to inequality indices due to exclusion of pension income, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component.
Source: EUROMOD F5.42

Changes in the S-Gini indexes when excluding means-tested benefits are presented in Graph 6. As expected, inequality measures increase across the board when means-tested benefits are excluded from disposable income. The three inequality measures are most affected in countries where means-tested benefits are relatively important such as the UK, Ireland, France and the Netherlands. There is however no association with the size of the tax benefit system as a whole. The lack of a relationship between the redistributive capacity of means-tested benefits and size of the overall tax-benefit system is partly attributable to the fact that a sizeable means-tested components (and thus a larger inequality reducing effect) may be found both in countries with smaller tax-benefit systems (UK, Ireland) as well as in countries with more extensive systems (France, Netherlands).

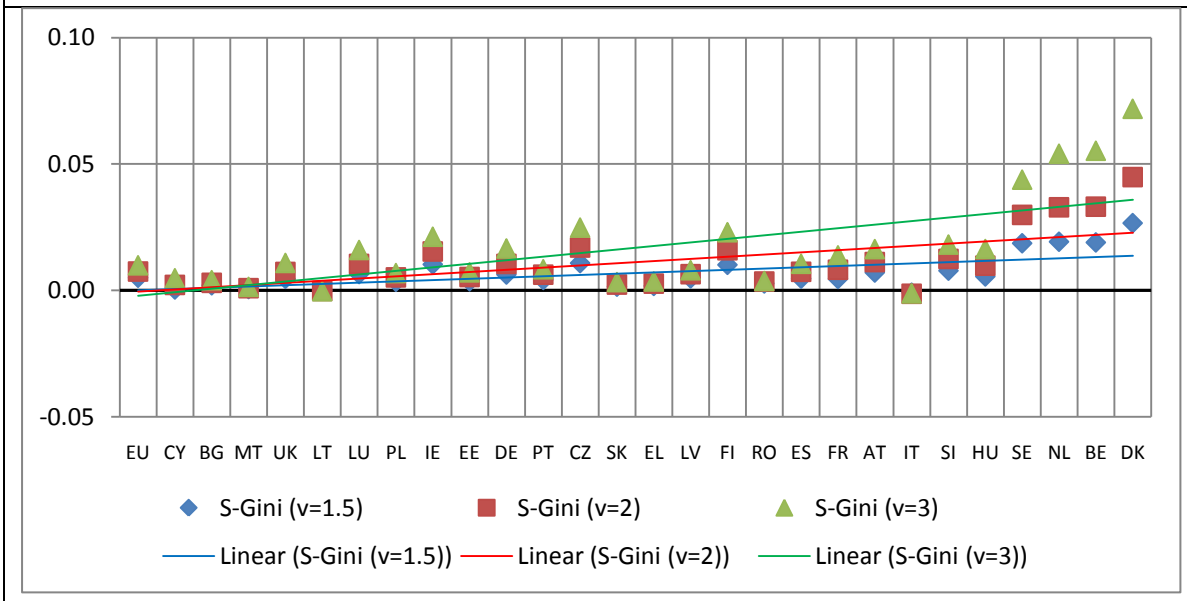
Graph 6. Changes to inequality indices due to exclusion of means-tested benefits, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component. Source: EUROMOD F5.42

We repeat the exercise and exclude contributory benefits. Results are displayed in Graph 7. Disregarding contributory benefits leads to small increases in the S-Gini indexes in most countries. This suggests that contributory benefits are unlikely to significantly alter the income distributions and thus their potential for vertical redistribution is limited. This is not surprising given that contributory benefits are generally aligned with earnings, the most important source of market income. Exceptions are Belgium, Denmark, Netherlands and Sweden where their impact is more significant. Note that all four countries have some of the largest tax-benefit systems.

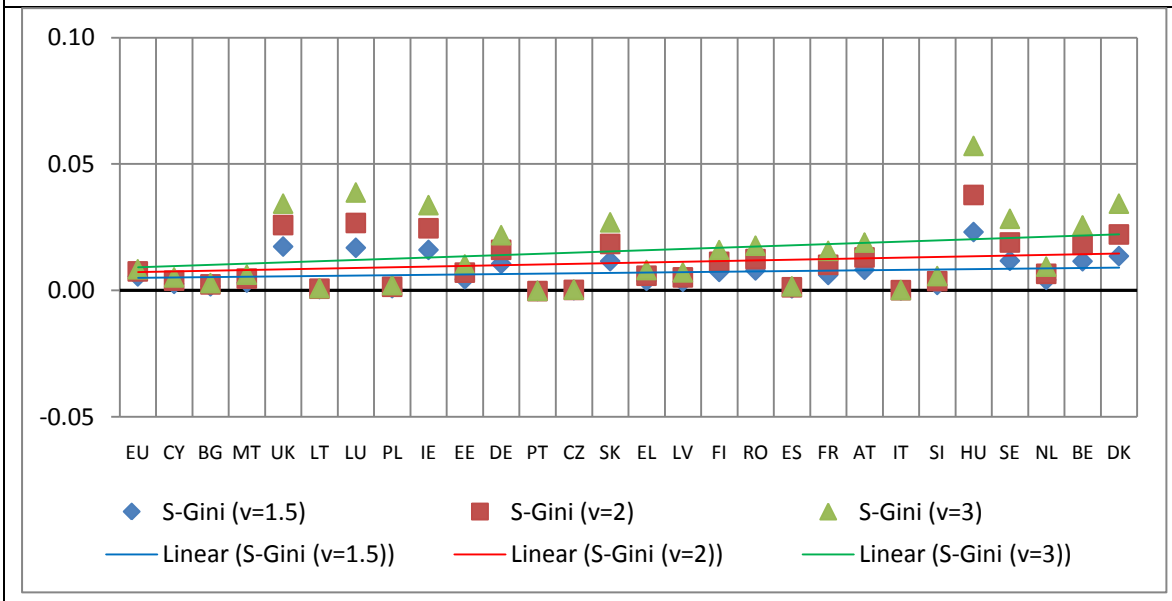
Graph 7. Changes to inequality indices due to exclusion of contributory benefits, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component.
Source: EUROMOD F5.42

Likewise, non contributory non means-tested benefits have a reduced redistributive effect. This can be clearly seen in Graph 8. The one exception is Hungary where all three S-Gini measures go up substantially when excluding non contributory benefits from disposable income. There is little indication that the vertical redistributive effect of non contributory benefits varies with the size of the tax benefit system.

Graph 8. Changes to inequality indices due to exclusion of non-contributory benefits, 2010

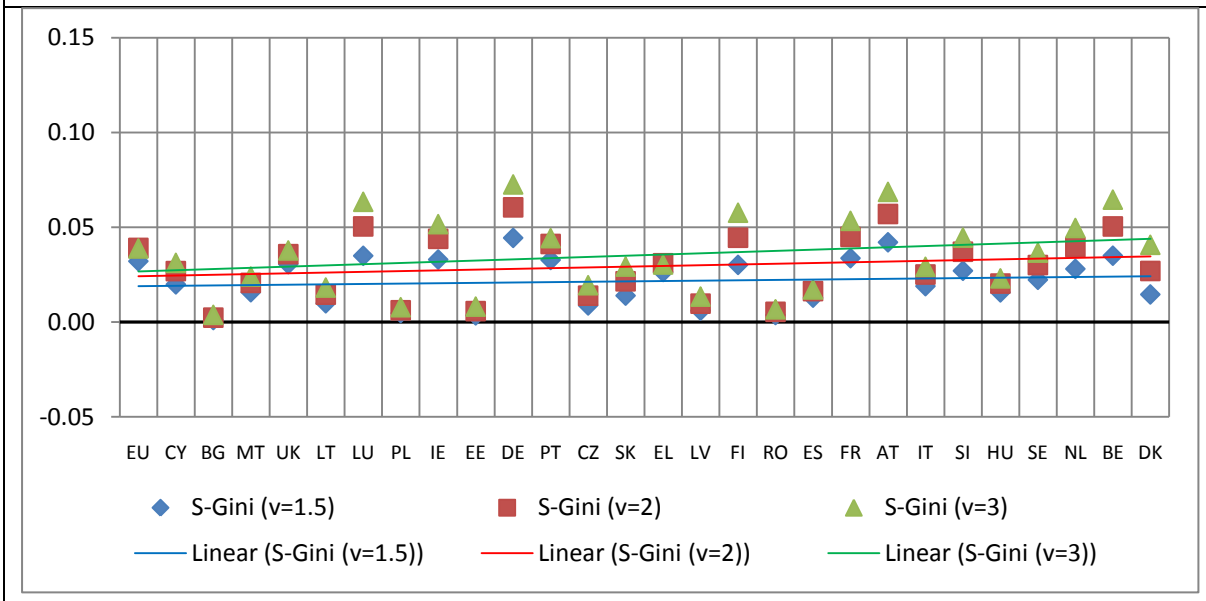


Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component.
Source: EUROMOD F5.42

In addition to pensions, taxes are the instrument most likely to affect the distribution of disposable income. Like pensions, they are generally progressive albeit their redistributive effect is relatively muted in the New Member States as well as South European countries. Taxes result in the strongest vertical redistribution in countries where the tax-benefit system is most developed. As expected, the redistributive effect of the schedule is low in countries with flat rate taxes such as Bulgaria, Estonia or Romania (Graph 9). While income tax is flat rate in Slovakia as well, the higher redistributive effect of the tax schedule stems from the fact that pensions and benefits which tend to be more important to lower income groups are not taxable. Likewise, the tax schedule has a notable redistributive effect in the Czech Republic despite the existence of a flat-rate regime, due to the inclusion of employer contributions into the tax base. The most extensive redistribution via the tax schedule is found in Austria and Germany, possibly due to the combination of a progressive tax schedule with the so-called 'progressivity adjustment'.[14]

[14] The adjustment entails the calculation of the applicable tax band including some types of incomes, such as certain benefits, that are not themselves taxable.

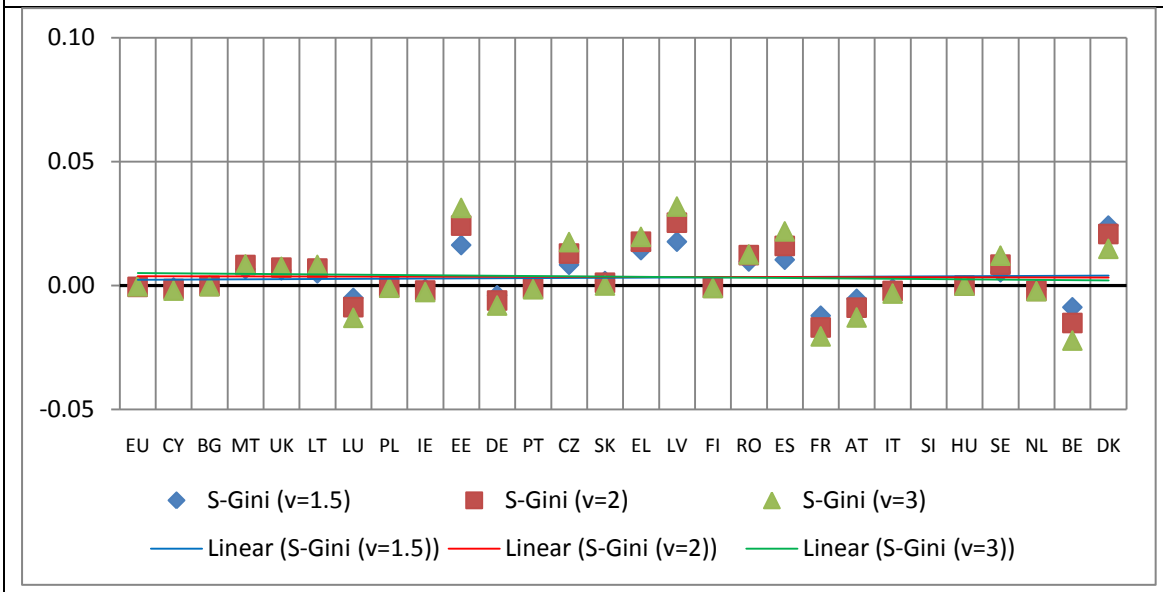
Graph 9. Changes to inequality indices due to exclusion of gross income tax before tax allowances, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component.
Source: EUROMOD F5.42

Neither tax allowances nor tax credits are particularly relevant for vertical redistribution (Graphs 10 & 11). In fact, tax allowances are generally slightly regressive, as the negative values of the change in the S-Gini indexes indicate. France, Belgium, Austria and Luxembourg are the countries where tax allowances do most to increase inequality. The close interlinking of tax allowances with the tax schedule is clearly visible. Tax allowances tend to be redistributive in a framework of flat-rate taxation (for example, Romania or Estonia). On the contrary, they tend to be regressive in a context of progressive taxation.

Graph 10. Changes to inequality indices due to exclusion of net gain attributable to tax allowances, 2010

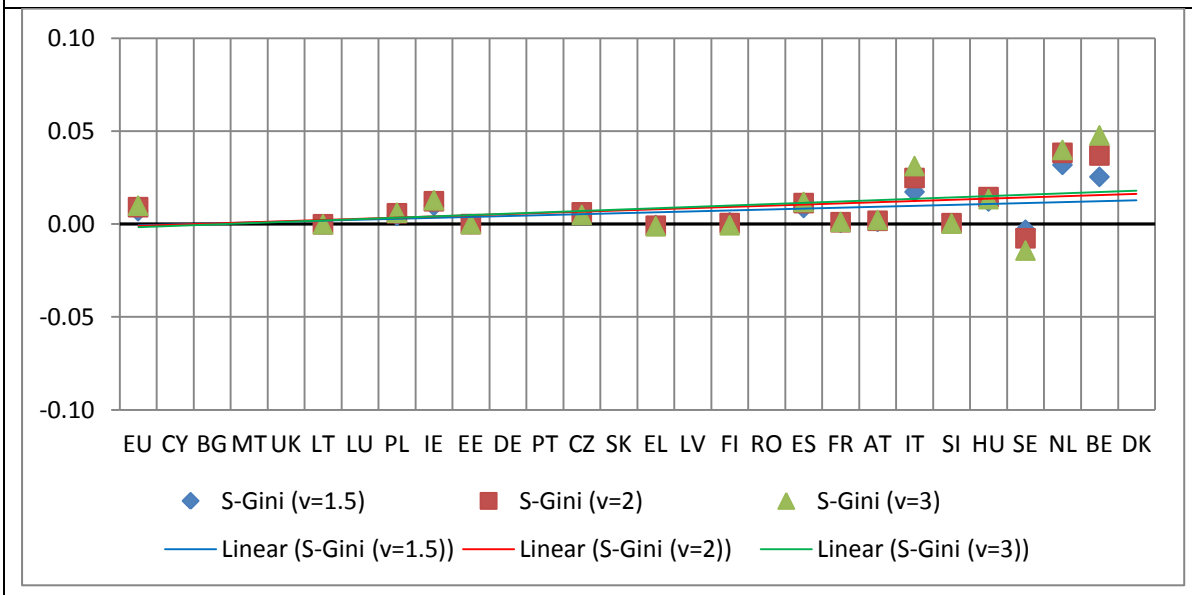


Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component. Countries without tax allowances have no markers
Source: EUROMOD F5.42

Tax credits on the other hand are slightly progressive with the exception of Sweden where their effect is to mildly increase inequality[15]. Yet, the redistribution they effect is virtually negligible. S-Gini coefficients computed when they are excluded from disposable income are very similar to baseline coefficients.

[15] The regressive effect of tax credits in Sweden is mostly likely due to the existence of a tax credit for interests paid on mortgages (negative capital income).

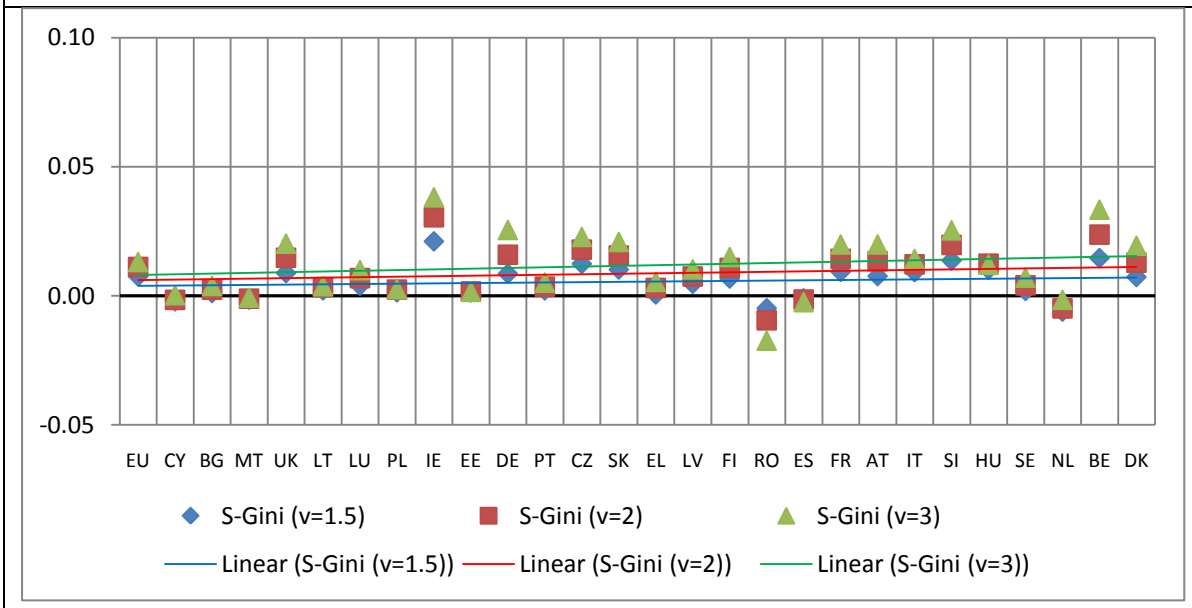
Graph 11. Changes to inequality indices due to exclusion of tax credits, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component. Countries without tax credits have no markers.
Source: EUROMOD F5.42

Lastly, social insurance contributions generally do contribute to redistribution albeit much less than pensions or the tax schedule (Graph 12). Although the changes in the S-Gini indexes when they are excluded are generally positive, substantively they are relatively small. Ireland and Belgium are the countries where social insurance contributions do most to vertically redistribute. There are also countries where their effect is to increase inequality, such as Romania or the Netherlands, possibly due to (low) caps on contributions. No relationship between the redistributive effect of social contributions and the size of the tax benefit system becomes apparent.

Graph 12. Changes to inequality indices due to exclusion of worker contributions, 2010



Note: v is the sensitivity coefficient controlling the weight placed on incomes at the bottom. Countries are ranked by the size of their tax benefit system. Lines show the association between the ranking in terms of tax-benefit size and changes in inequality when excluding one income component.
Source: EUROMOD F5.42

Next, we look at the drivers of disposable income inequality from a different perspective. To this end, we use a standard Gini decomposition to show the contribution of each type of income component to overall inequality. The contribution depends on the size of the income component (i.e. its share of disposable income), how unequally it is distributed and its correlation with final household disposable income. The effect of a marginal increase in a given income source on the Gini coefficient of disposable income offers an intuitive way of summarizing the contribution to overall inequality of each income component. The percent change in the Gini index of household disposable income associated with a 1 percent marginal increase in a given tax benefit income instrument is shown for the 27 countries and for the EU as a whole in Graph 13 below.

Overall, the strongest effect on disposable income inequality is exerted by pensions and taxes (i.e. tax schedules). Both tend to be redistributive. The prominence of pensions and taxes is not surprising given that they are the largest tax-benefit instruments affecting disposable income (see Graph 1). In the large majority of EU countries, public pensions are the most important income source in old-age. Since many pension systems do incorporate important redistributive elements such as minimum pensions or caps on benefits, public pensions tend to reduce inequality. Their effect is much lower in countries where private pensions are an important part of the income of the

elderly such as UK or Ireland but also in countries where their distribution is closely aligned with that of market income such as Romania, Portugal, Austria or France.

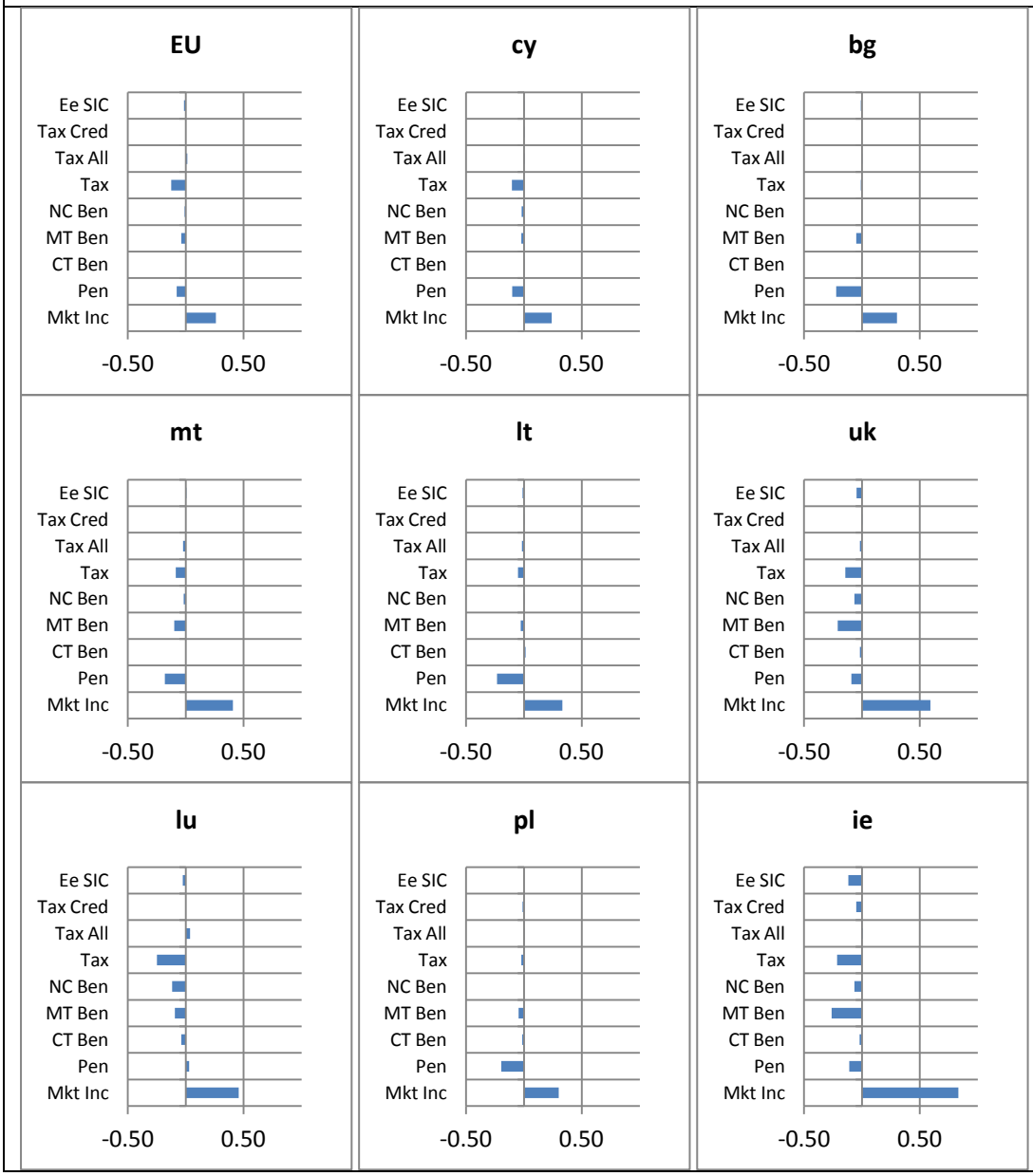
The other main element of the tax-benefit system affecting inequality is gross taxation before allowances (tax schedules). The effect of this is redistributive in all countries. Nonetheless, the scale of the redistribution varies. The strongest effects are found in Luxembourg, Ireland, Germany, Finland, France, Slovenia, Netherlands, Belgium and Austria. All are countries using progressive taxation regimes. Not all countries use tax credits in their fiscal regime but where they do, tax credits tend to have a mild redistributive effect. Sweden is something of an exception as its negative capital tax credit tends to be regressive. Similarly, tax allowances have a limited effect on overall inequality. The direction of their impact on inequality is ambiguous. In some cases they slightly increase it while in other they slightly decrease it.

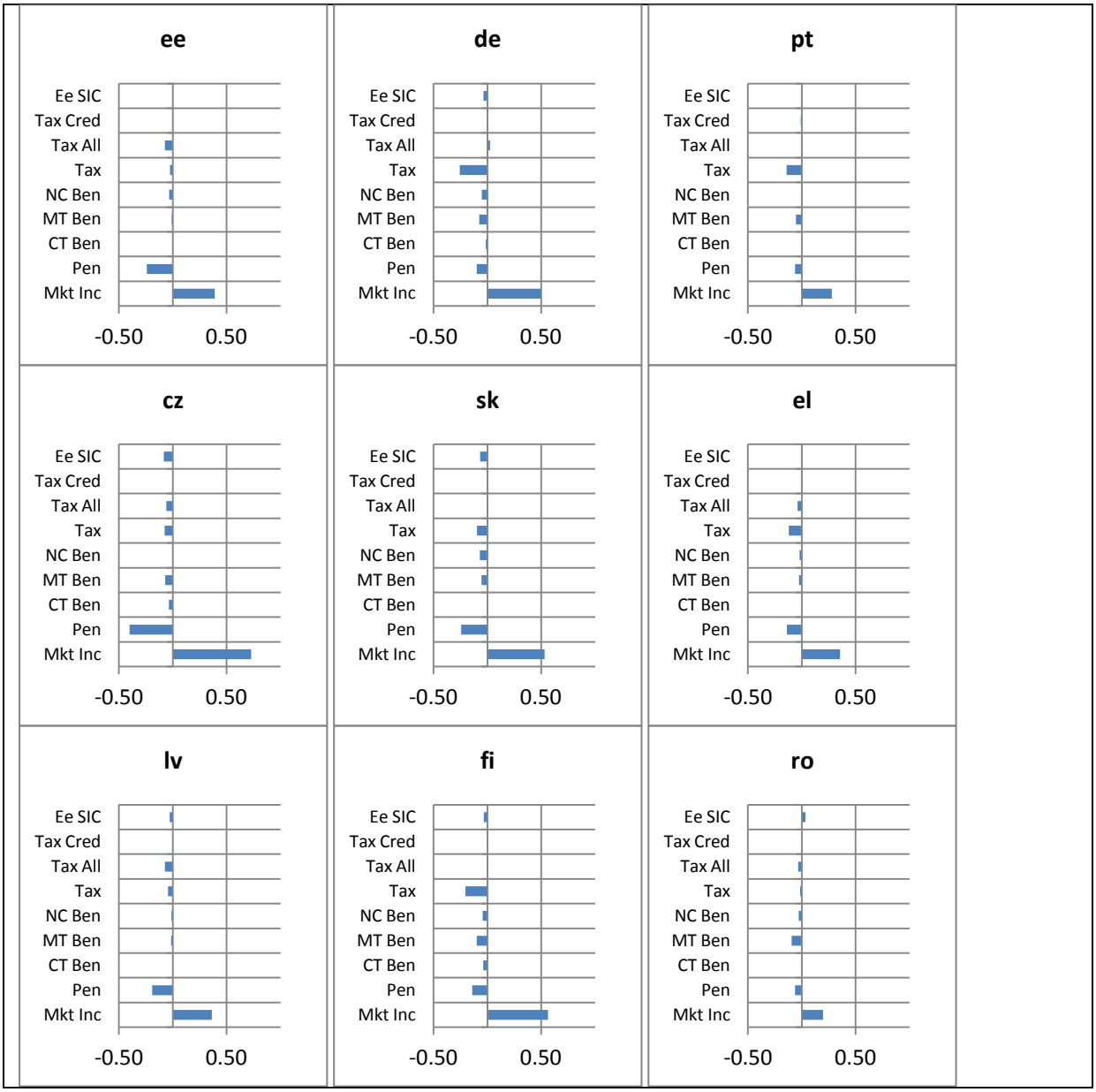
The other type of taxation that we consider in this exercise, namely worker insurance contributions, is much less redistributive. Their strongest equalizing impact is found in Ireland, Slovenia and Belgium. However, social insurance contributions are not always redistributive. In some cases, such as for example in Romania or the Netherlands, increasing contributions would actually increase inequality. This is most likely due to caps on contributions.

By design, means-tested benefits are negatively correlated with disposable income. As such, their effect is always to decrease inequality of market incomes. In most countries, their effect is relatively muted due to their small size. However, there are a few countries where their impact is notably larger. Ireland and UK stand out in particular but the pattern is visible also in Finland, Romania, France and Austria.

Non contributory, non means-tested benefits are generally redistributive but their contribution is small. They reduce inequality most in the UK, Ireland, Slovakia and Hungary. Finally, contributory benefits have the least potential to affect inequality. Their effect at the margin is closest to zero. This is perhaps not surprising given they generally replace market incomes in special contingencies.

Graph 13. Redistributive* effects of marginal increases in tax benefit income components, 2010

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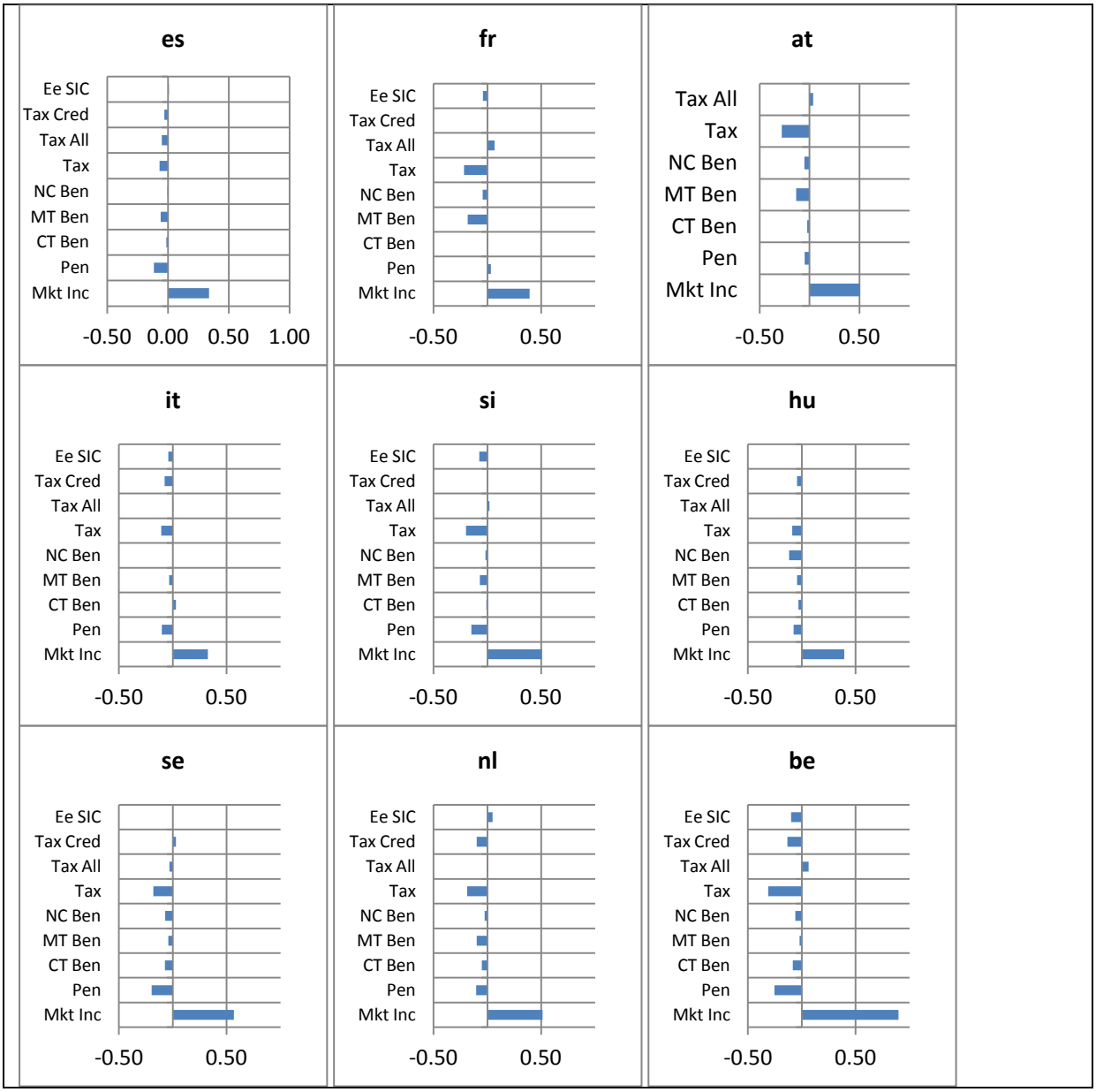
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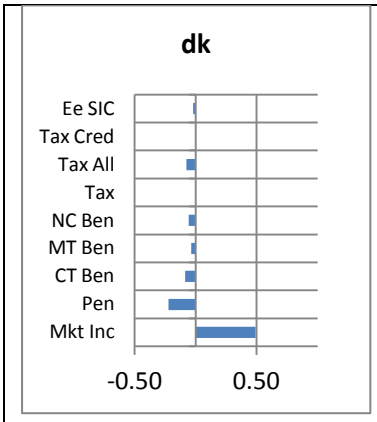
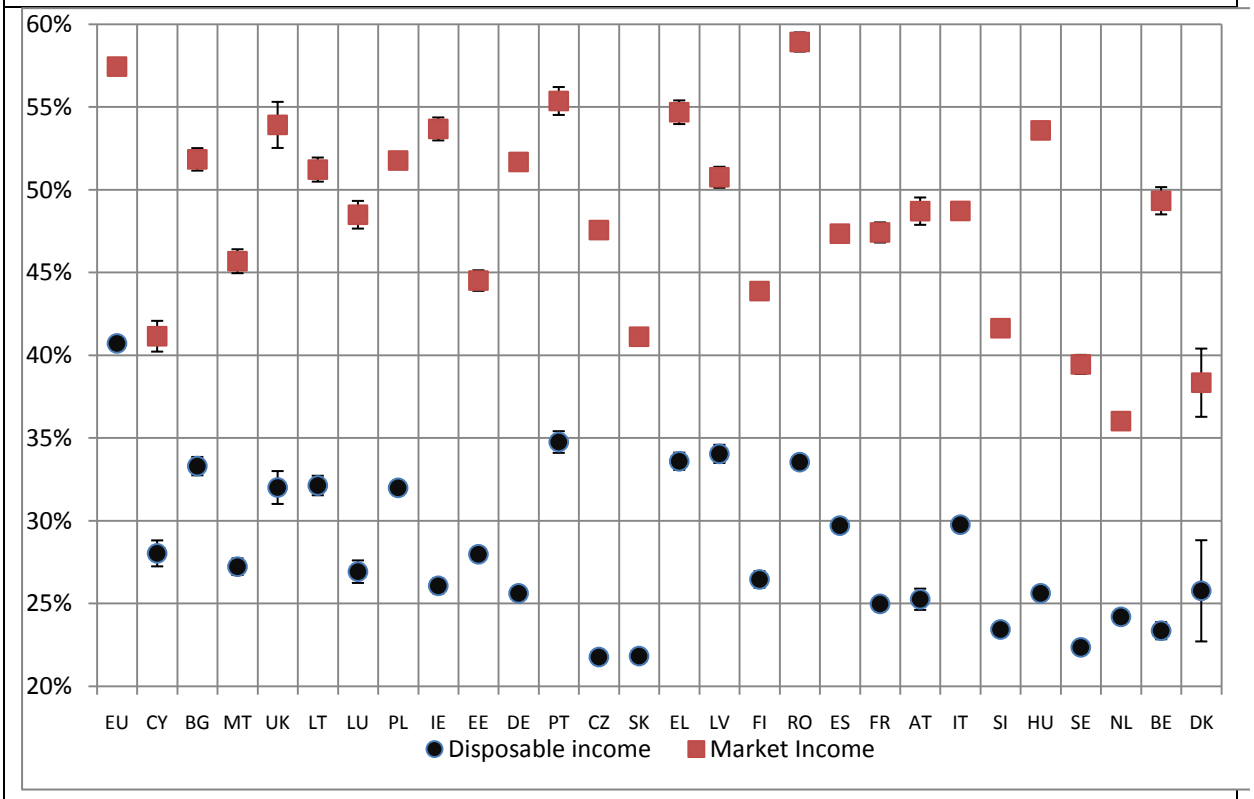


*Percent change in the Gini coefficient of disposable income after a 1 percent increase in the respective income components. Er SIC: employer contributions; Tax: gross tax payable in the no allowances scenarios (tax schedule); Tax Cred: tax credits; Tax All: net gain due to tax allowances; SIC: employee and self-employed insurance contributions; NC Ben: non contributory, non means-tested benefits; CT-contributory, non pension benefits; MT BEN: means-tested benefits; Pen: public pensions; B-T sum of benefits (including tax credits and net gain due to tax allowances) minus taxes (including social insurance contributions). Value of change in Gini after a marginal increase in the tax schedule component in Austria is -0.56.
Source: EUROMOD F5.42

An overall impression of the redistributive impact of the entire tax benefit system may be gained by looking at the difference in the Gini coefficient of market incomes and that of disposable income. This information is shown in Graph 14 along with bootstrapped standard errors based on 500 replications. The first thing to note is that tax benefit systems constitute effective redistributive mechanisms in all the 27 member states of the EU. While market income inequality levels, as measured by the Gini index, range between 0.35 and 0.60, they are considerably reduced after the intervention of tax-benefit instruments to levels between 0.20 and 0.35. Although the countries with the largest tax-benefit systems tend to experience lower levels of disposable income inequality, there appears to be no clear-cut relationship between size of the tax benefit system and redistribution.

The inequality measures for the EU as a whole are calculated based on incomes in Euro (converted using current market exchange rates where relevant) and not adjusted for differences in purchasing power. They therefore incorporate both within and between country inequalities, including these differences. Measured in this way the Gini for market income across the EU is larger than in any country except for Romania and for disposable income is much larger than for any single country.

Graph 14. Gini coefficients and bootstrapped SEs for disposable income and market income, 2010



Source: EUROMOD F5.42

4 Summary

In this paper, we analyze the redistributive effects of taxes and benefits in the 27 countries that form the European Union. We rely on various Gini class measures to assess the redistributive effect, as well as the contribution to overall inequality of eight different tax-benefit instruments, i.e. public pensions, means-tested benefits, contributory benefits, non-contributory non means-tested benefits, direct taxes, tax allowances, tax credits and worker insurance contributions. We find that, overall, tax benefit systems do succeed in redistributing significant portions of market income and in doing so they reduce inequality considerably.

The main instruments through which most of the tax-benefit systems considered in our analysis effect their equalizing action are public pensions and direct taxes. The strong redistributive effects of public pensions and the income tax schedule are mainly attributable to their sizeable share in final disposable income. Both pensions and taxes redistribute more in countries where the tax-benefit

system is more extensive (as measured by the relative size of taxes and benefits as a percentage of disposable income).

By and large, countries with higher levels of redistribution also are the countries where direct taxation is higher. However, the reverse is not necessarily true. An increased taxation level does not necessarily equate with more extensive redistribution. The level of taxation also appears to be linked to its complexity. Thus, direct tax regimes in the EU tend to place themselves on a continuum with simple lower level schedules at one end and more complex higher schedules at the other. In effect, more complex elements such as tax credits or tax allowances are drawn upon to reduce final net tax liabilities. New Member States do not appear to form a distinct cluster either in terms of the tax-benefit size or in terms of redistribution. The only peculiarity that is common to them but also to Southern European countries is that their direct tax policies and tax schedules in particular, tend to be comparatively less redistributive. One possible explanation is the comparatively widespread use of flat-rate taxation in the Eastern European region.

The influence of non-pension contributory benefits in disposable income inequality is largely muted. This is due both to their relatively small share of disposable income as well as to their general alignment with market incomes. Nordic countries and the Netherlands are clear exceptions to this pattern. Their contributory benefits are significantly more progressive than those in other EU member states.

While non contributory benefits do generally advantage poorer households, their share in disposable income is too small for them to have a large effect on inequality.

The disaggregation of direct taxation into schedules, tax credits and a part attributable to tax allowances showed that redistribution is effected mainly via the schedules. Neither tax allowances nor tax credits influence inequality levels to any great extent. However, it should be kept in mind that the effect of tax allowances and tax credits are critically linked to the design of tax schedules. In particular, tax allowances and tax credits cannot, by design, have a significant impact in the context of low taxation levels. Tax allowances are progressive in a context of flat rate taxation but regressive in a progressive regime. Both tax allowances and tax credits affect inequality much less than means-tested and even non-contributory benefits. This reinforces the idea that the inequality-reducing capacity of fiscal benefits is limited.

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Table 1. Euromod databases

Country		Input data
Belgium	BE	EU-SILC version 2008-2
Bulgaria	BG	EU-SILC version 2008-2 (+ additional national variables)
Czech Republic	CZ	EU-SILC version 2008-2 (+ additional national variables)
Denmark	DK	EU-SILC version 2008-1
Germany	DE	EU-SILC version 2008-2
Estonia	EE	EU-SILC version 2008-2
Ireland	IE	EU-SILC version 2008-2
Greece	EL	National SILC 2008
Spain	ES	National SILC 2008
France	FR	EU-SILC version 2007-3
Italy	IT	National SILC 2008
Cyprus	CY	EU-SILC version 2008-2
Latvia	LV	EU-SILC version 2008-3
Lithuania	LT	EU-SILC version 2008-2 (+ additional national variables)
Luxembourg	LU	EU SILC 2008-2 (+ additional national variables
Hungary	HU	EU-SILC version 2008-2
Malta	MT	EU-SILC version 2009-1
Netherlands	NL	EU-SILC version 2008-2
Austria	AT	National SILC 2008
Poland	PL	EU-SILC version 2008-2 (+ additional national variables)
Portugal	PT	EU-SILC version 2008-2
Romania	RO	EU-SILC version 2008-2
Slovenia	SL	EU-SILC version 2008-2
Slovakia	SK	National SILC 2008
Finland	FI	EU-SILC version 2008-2
Sweden	SE	EU-SILC version 2008-2
United Kingdom	UK	Family Resources Survey 2008/9

Note: Detailed information about how the EUROMOD input datasets have been constructed from the original sources of micro-data may be found in the corresponding Country Reports https://www.iser.essex.ac.uk/euromod/resources-for-euromod-users/country-reports