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*Gerlinde Verbist, Francesco Figari*

GINI Discussion Paper 88  
August 2013

**GROWING INEQUALITIES' IMPACTS**

August 2013  
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## **Bibliographic Information**

Verbist G., Figari F. (2013). The redistributive effect and progressivity of taxes revisited: An International Comparison across the European Union. AIAS, GINI Discussion Paper 88.

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## Abstract

Over the last decade income inequality has increased in most European countries. In this paper we investigate the redistributive role of direct taxes, with a focus on the EU-15 and the evolution over the period 1998-2008. Progressivity of taxes is one of the major determinants of the equalizing capacity of taxes. In most of these countries the top tariffs have been reduced, as well as the number of tax bands. Hence, it is commonly thought that the progressivity of these taxes has been reduced. However, the effects on overall progressivity (and hence on disposable income inequality) are less obvious than they may appear at first sight. First, the tax liability depends on exemptions, allowances deductions and credits, which may enhance or reduce progressivity. Moreover, changes in the underlying income distribution (due to socio-demographic and labour market changes) and fiscal drag may also play a role. Using EUROMOD, the EU-wide tax-benefit model, we document the wide variation in the EU-15 in the redistributive efforts through taxes on household income and their evolution between 1998 and 2008. Countries with a high pre-tax inequality level tend to redistribute rather less and there is a trade-off between progressivity and the average tax rate. If we concentrate on PIT progressivity, we find that broadly all tax exemptions and tax allowances enhance progressivity, as well as the rate structure. The evidence on tax deductions and tax credits is mixed.

**JEL Classification:** C81; D31; H23; H24

**Key words:** income redistribution; income taxes; social insurance contributions; microsimulation; European Union; EUROMOD

**Acknowledgement:** We use EUROMOD (version D25 and F6.36) which is financially supported by PROGRESS funding. We make use of microdata from the EU Statistics on Incomes and Living Conditions (EU-SILC) made available by Eurostat, the Italian, and Belgian versions of the SILC data made available by the respective statistical offices and the Family Resources Survey (FRS), made available by the UK Department of Work and Pensions (DWP) through the UK Data Archive. Additional datasets used are mentioned in the footnote 7. Material from the FRS is Crown Copyright and is used with permission. Data providers bear no responsibility for the analysis or interpretation of the data reported here.

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## **1 Introduction**

Over the last decade the income inequality has increased in many EU countries. In this paper we investigate the redistributive role played by taxation. Inequality reduction through taxes depends on the one hand on their departure from proportionality, i.e. the degree of progressivity, and on the other hand on the tax level. In the Western world many countries have gone through major or minor personal income tax reforms over the past years, which may also change their capacity to reduce inequality. A striking example is the strong reduction in top rates of the tariff structure in many countries. However, one needs to be careful when assessing the effects of such changes on overall progressivity, as progressivity is not only determined by the bands and rate structure, but also by provisions like tax exemptions, tax allowances, deductions and credits. The issue is further complicated by the fact that redistributive outcomes of the tax system are not only affected by changes in statutory rules, but also by changes in the underlying income distribution following from socio-demographic changes (e.g. ageing), labour market developments, and fiscal drag.

In this paper we use the microsimulation model EUROMOD to compare the redistributive effect of social security contributions and income taxes in the countries of the EU-15 (i.e. those countries that formed the European Union before 1<sup>st</sup> May 2004). The main contributions of this paper are threefold. First, we assess the extent to which direct taxes reduce income inequality, focussing on personal income taxes (PIT), social insurance contributions (SIC) and other direct taxes separately. Second, we decompose the progressivity effect of the personal income tax into the contribution of its different components. Third, we provide a comparison of the redistributive effects of taxation over the past decade (1998-2008) by revisiting an earlier study on this topic, namely Verbist (2004), which presented an international comparison of the redistributive effect of personal income taxes in the 15 countries of the EU in 1998.

International comparative studies that empirically investigate the redistributive effect of income taxes are still rather rare. Early examples include: Berglas (1971) who presents results for UK, France, US, West-Germany and Japan; Kakwani (1977a) who

compares Australia, Canada, UK and US, based on official data; Zandvakili (1994) who compares 8 LIS-countries by using the measures from the generalised entropy family; Atkinson et al. (1995) for a number of LIS-countries; Wagstaff and van Doorslaer provide more recent results, focussing on the financing of health care (2001, Wagstaff et al. 1999a, 1999b, van Doorslaer et al. 1999). Immervoll and Richardson (2011) is one of the few studies that investigates the redistributive impact of taxes and benefits over time, using data from LIS; they also give results for taxes separately but they do not focus on the role of the different components of the tax system.

The paper is structured as follows. In section 2 we present the main methodological aspects in measuring the redistributive effects of taxes. Special attention is given to the decomposition measures for progressivity over the different tax instruments. In section 3 we briefly explain EUROMOD, as well as the underlying data. Next, we present the empirical findings. We first look at the total of taxes, and then in section 5 we focus on personal income taxes. The last section brings the conclusions together.

## **2 *Measuring the redistributive effect of taxes***

Following common practice in the literature we use the term “redistributive effect of taxes” for the change in income inequality achieved through taxes. The redistributive effect of taxes depends on the one hand on the departure from proportionality, i.e. the degree of progressivity, and on the other hand on the tax level, measured by the average tax rate. A tax system is called progressive when the proportion of income that is collected as tax liability increases with income (i.e. the average tax rate increases with income). When measuring the redistributive effect of taxes, we (implicitly) compare the existing tax system with a proportional tax that yields the same revenue. This (hypothetical) proportional tax is distributionally neutral, as it preserves the relative pre-tax income differences.<sup>1</sup> The measurement of the redistributive effect and progressivity in the Lorenz curve framework was initiated by Musgrave et al. (1948) and Kakwani (1977a, 1977b). In this section we present the most important indicators used to measure the redistributive impact of tax instruments.<sup>2</sup>

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<sup>1</sup> This applies only within the framework of scale-invariant inequality measures, which are used here.

<sup>2</sup> Other measures for progressivity and redistributive effect have been proposed in the literature. For information on measures based on e.g. distances and relative concentration curves, see Lambert (2001).

## 2.1 Measurement of progressivity and redistributive effect of taxes

A very popular index of progressivity is the one proposed by Kakwani (1977a) which measures the departure from proportionality as the difference between the concentration coefficient of taxes and the Gini of pre-tax income<sup>3</sup>:

$$\Pi_T^K = C_T - G_X \quad (1)$$

For measuring the redistributive effect we make use of the Reynolds-Smolensky (1977) index, which equals the difference between the Gini coefficient of pre-tax income and the concentration coefficient of post-tax income:

$$\Pi^{RS} = G_X - C_{X-T} \quad (2)$$

There is a close link between the measures of progressivity and those of redistributive effect (Kakwani, 1977a). The redistributive effect appears to be a function of progressivity and of the tax level, i.e. total tax as a fraction of total net income  $t/(1-t)$ :

$$\Pi^{RS} = \frac{t}{1-t} \Pi_T^K \quad (3)$$

Up until now we have assumed that the tax system does not produce changes in the rank order of the income units, i.e. that it makes no difference whether income units are ranked in ascending order of their pre-tax or their post-tax income. But due to differences in tax treatment of income units it is possible that some of them swap positions in the income ranking. Reranking can be measured as the difference between the concentration coefficient of net income,  $C_N$ , and the Gini coefficient,  $G_N$  (Atkinson, 1980; Plotnick, 1981). The Reynolds-Smolensky index is then an indicator of vertical equity  $VE$ , i.e. it measures the total reduction of inequality that would occur if there were no reranking of income units.<sup>4</sup> The index  $D = G_N - C_N$  measures how much of this equalising effect is ‘undone’ by reranking. Thus, the total redistributive effect is the result of a vertical equity (VE) and a reranking effect (RR):

$$RE = G_X - G_N = VE - RR = \Pi^{RS} - D \quad (4)$$

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<sup>3</sup> For large samples the minimum value of the Kakwani index is  $-(1 + G_X)$  (i.e. when the poorest person pays all the tax,  $C_T = -1$ ), while its maximum value is  $1 - G_X$ , what corresponds with maximal progressivity. More details on the derivation of these formulae can be found in e.g. Lambert (2001) and Verbist (2004).

<sup>4</sup> Atkinson (1980) and Plotnick (1981) consider reranking as a measure of horizontal inequity of the tax system. Some authors also distinguish “pure horizontal inequity”, i.e. the unequal treatment of equals that does not automatically results in reranking (see e.g. Lambert et al., 1993). As the empirical implementation is problematic (e.g. how to define “equals”, see also Wagstaff et al, 1999a), we did not follow this approach



## 2.2 Decomposition of tax progressivity

As progressivity is one of the important determinants of the redistributive effect, we analyse it in more detail. Progressivity can be decomposed over the different factors that build up a tax system.

### 2.2.1 Decomposition of Progressivity of Total Taxes

In all countries we consider here there are different types of taxes. Progressivity of total taxes results from the progressivity characteristics of these different individual taxes. Kakwani (1977a) showed that progressivity of total taxes (T) can also be measured as the weighted sum of the Kakwani indices of these individual taxes (i):

$$\Pi_T^K = \sum_i \frac{t_i}{t} \Pi_{T_i}^K \quad (5)$$

### 2.2.2 Decomposition of Progressivity of Personal Income Taxes

The personal income tax schedule is a complex of various measures. Final tax liability is determined by different factors: the pre-tax income, tax exempt (categories of) income, tax deductions and tax allowances that can be applied on pre-tax income, the rate schedule and tax credits. The pre-tax income includes all income components before tax, and thus determines to a great extent tax liabilities.

Taxable income must be distinguished from pre-tax income. Some categories of income are part of pre-tax income, but are not included in the concept of taxable income; we refer to these income concepts as tax exemptions  $E$  (e.g. child benefits in most countries).

A further distinction between pre-tax and taxable income arises from the existence of tax allowances and deductions. Tax allowances  $A$  are a fixed amount subtracted from pre-tax income. Tax deductions  $D(X)$  also reduce taxable income. Contrary to tax allowances, they are not a fixed amount but their level is a function of pre-tax income. The effect of the different components can be measured by using decomposition formulae that make clear how the rate structure and the various tax advantages contribute to overall progressivity and redistribution. We use the analytical framework presented in Pfähler (1990) and Loizides (1988). Other decompositions are possible, but this one has the advantage that it follows the logic of the tax system. The transition from pre-tax income  $X$  to taxable income  $Y$  can be represented as:

$$Y = X - E - A - D(X)$$

The rate schedule  $r(\cdot)$  is then applied to taxable income, thus leading us to gross tax liability  $T_g = r(Y)$ . Finally, we find net (or final) tax liability  $T$  by reducing gross tax liability  $T_g$  with total tax credits  $K$ :

$$T_{pit} = T_g - K.$$

Net (or disposable) income is  $N = X - [r(X - E - A - D(X)) - K] = X - T_{pit}$

Progressivity of (net) personal income tax liabilities (or shortly ‘net progressivity’) results from the effect of gross tax liabilities minus that of tax credits, as  $T_{pit} = T_g - K$ . The average tax rate is  $t_{pit} = t_g - k$ , where  $t_g$  is the average rate of gross tax liabilities ( $T_g/X$ ) and  $k$  is the average rate of tax credits ( $k = K/X$ ). Thus, we find:

$$\Pi_{T_{pit}}^K = \frac{t_g}{t_{pit}} \Pi_{T_g}^K + \frac{k}{t_{pit}} \Pi_K^K \quad (6)$$

$\Pi_{T_g}^K$  is the Kakwani index of gross tax liabilities.  $\Pi_K^K$  shows the degree of disproportionality of tax credits  $K$  relative to the distribution of pre-tax income, or  $\Pi_K^K = G_X - C_K$ . A positive Kakwani index of tax credits indicates that the tax credit goes relatively more to the lower end of the income distribution, and is thus pro-poor.

Progressivity of gross tax liabilities (or ‘gross progressivity’) results on the one hand from the effect of the tax rate structure, which we call ‘direct progressivity’, and on the other hand from the effect of the tax base structure, which is ‘indirect progressivity’<sup>5</sup>:

$$\Pi_{T_g}^K = (C_{T_g} - C_Y) + (C_Y - G_X) \quad (7)$$

The first term of this formula measures *direct progressivity*, which follows from the progressive tax rate schedule applied on taxable income. We call this the pure rate effect, which is represented by the index<sup>6</sup>:

$$\Pi_R^K = C_{T_g} - C_Y \quad (8)$$

The second term looks at *indirect progressivity*, which is caused by taxable income falling short of pre-tax income and is measured by  $C_Y - G_X$ . Gross tax liability  $T_g = r(Y)$  is calculated on taxable income  $Y = X - E - A - D(X)$ , i.e. income after subtraction of exempt income  $E$ , tax allowances  $A$  and tax deductions  $D(X)$ . Analogously with (6) we can write:

$$C_Y - G_X = \frac{e}{1-e-a-d} \Pi_E^K + \frac{a}{1-e-a-d} \Pi_A^K + \frac{d}{1-e-a-d} \Pi_D^K \quad (9)$$

with :

- $e$  as the average rate of exempt income and  $\Pi_E^K = G_X - C_E$  measuring the disproportionality of exempt income;

<sup>5</sup> The terms ‘direct’ and ‘indirect’ progressivity come from Pfähler (1990), but the content is not exactly the same. Pfähler defines direct progressivity as  $C_T - C_Y$ , which means that it contains both the pure rate effect and the effect of tax credits, whereas we reserve the term for the pure rate effect  $C_{T_g} - C_Y$ . For indirect progressivity, Pfähler uses the expression  $C_{E+A+D} - G_X$ , i.e. progressivity of tax-free income w.r.t. pre-tax income.

<sup>6</sup> For some countries the rate effect we measure here includes also other elements. In some countries there exists the option to have individual or joint taxation (e.g. Ireland, Luxembourg, Spain; see also O’Donoghue et al. 1999); the effect of this distinction is measured in the rate effect. This is also the case for the “quotient familial” in France. These remarks have to be born in mind when interpreting the results.

- $a$  as the average rate of allowances and  $\Pi_A^K = G_X - C_A$  measuring the disproportionality of allowances;
- $d$  as the average rate of deductions, and  $\Pi_D^K = G_X - C_D$ , measuring the disproportionality of deductions.

Just as with tax credits, a positive value of  $\Pi_E^K$ ,  $\Pi_A^K$  and  $\Pi_D^K$  corresponds with exemptions, allowances and deductions benefiting relatively more to lower incomes, and thus enhancing overall progressivity, and consequently overall vertical equity.

The decomposition of gross tax liability progressivity thus takes the form:

$$\Pi_{T_g}^K = \Pi_R^K + \frac{e}{1-e-a-d} \Pi_E^K + \frac{a}{1-e-a-d} \Pi_A^K + \frac{d}{1-e-a-d} \Pi_D^K \quad (10)$$

The explanation above shows clearly that the measures of redistributive effect and progressivity are sensitive to the definition of the base income concept (i.e.  $X$ ). In order to guarantee cross-country comparability, in this paper we use a broad definition for the pre-tax income concept, namely gross income. But it is also possible to use market income (e.g. if one wants to investigate the redistributive effect of taxes and benefits jointly) or taxable income. Changing the income concept will lead to different results (see e.g. Verbist 2002 for a comparison of progressivity of taxes in Belgium with gross income and market income as the base income concept).

### **3 Data and methodology**

#### **3.1 EUROMOD**

This paper makes use of EUROMOD, the multi-country European wide tax-benefit model. Using the information available in the underlying datasets and on the basis of the tax-benefit rules in place, EUROMOD simulates cash benefit entitlements, direct tax, social insurance contribution. Instruments which are not simulated (due to data constraints), as well as market incomes, are taken directly from the input datasets. For further information on EUROMOD, see Sutherland 2007 and Sutherland and Figari (2013).

EUROMOD is a static model in the sense that the arithmetic simulation of taxes and benefits abstract from potential behavioural reactions of individuals. As such, EUROMOD is of value in terms of assessing the first order effects of tax-benefit policies and in providing detailed information on each component of the simulated tax-benefit systems usually not available in the underlying datasets. For example, EUROMOD provides a measure of tax exemptions, deductions, allowances, gross tax liability, tax credits and net tax liability at the individual level.

The tax-benefit systems simulated in this paper refer to 1998 and 2008. In the first case the simulations are performed on income data that come from 12 different

sources chosen by national experts and available at the time of implementing the 1998 policy systems in EUROMOD.<sup>7</sup> The simulations of 2008 policy systems are performed on EU-SILC data in all countries but the UK where the Family Resource Survey is used because more appropriate for microsimulation purposes. If the policy year does not match the income reference period, monetary values have been updated (e.g. from 2007 to 2008) according to the appropriate price and income indices.

Gross income components are taken directly from the dataset or, where necessary, are imputed from net income (see Immervoll and O'Donoghue, 2001). Gross income includes all gross cash benefit payments, gross income from work (salaries, wages, self-employment income), property income, other cash market income and occupational pension income. To arrive at disposable or net income ( $N$ ) we subtract personal income taxes ( $T_{PIT}$ ), other taxes ( $T_{OTH}$ ) and social insurance contributions ( $T_{SIC}$ )<sup>8</sup> from gross income ( $X$ ):

$$N = X - T_{PIT} - T_{OTH} - T_{SIC}$$

As discussed above, progressivity of taxes does not only depend on the design of the tax system but also on the distribution of pre-tax incomes. Table 1 gives the evolution pre-tax income inequality according to the EUROMOD data in 1998 and 2008. For countries like Austria, Belgium and Germany, changes are tiny. Larger increases are found in Finland and the Netherlands, while in about half of the countries a sizeable decrease has occurred (most notably in Ireland, Spain and Sweden). As most studies (e.g. OECD 2008 and 2011), present inequality of market income and of disposable income, but not of gross income, it is not easy to check these evolutions with other sources.

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<sup>7</sup> These are the European Community Household Panel (ECHP) User Data Base made available by Eurostat; the Austrian version of the ECHP made available by the Interdisciplinary Centre for Comparative Research in Social Sciences; the Panel Survey on Belgian Households (PSBH) made available by the University of Liège and the University of Antwerp; the Income Distribution Survey made available by Statistics Finland; the Enquête sur les Budgets Familiaux (EBF) made available by INSEE; the public use version of the German Socio Economic Panel Study (GSOEP) made available by the German Institute for Economic Research (DIW), Berlin; the Living in Ireland Survey made available by the Economic and Social Research Institute; the Survey of Household Income and Wealth (SHIW95) made available by the Bank of Italy; the Socio-Economic Panel for Luxembourg (PSELL-2) made available by CEPS/INSTEAD; the Socio-Economic Panel Survey (SEP) made available by Statistics Netherlands through the mediation of the Netherlands Organisation for Scientific Research - Scientific Statistical Agency; the Income Distribution Survey made available by Statistics Sweden; and the Family Expenditure Survey (FES) made available by the UK Office for National Statistics (ONS) through the Data Archive.

<sup>8</sup> Whenever it is relevant the social insurance contributions are deducted from personal income tax.

**Table 1: Gini coefficients of Gross incomes, 1998-2008**

| $G_X$       | 1998   | 2008   | $\Delta$ | $\% \Delta$ |
|-------------|--------|--------|----------|-------------|
| Austria     | 0.3133 | 0.3100 | -0.0033  | -1.07%      |
| Belgium     | 0.3146 | 0.3150 | 0.0004   | 0.13%       |
| Denmark     | 0.3010 | 0.2781 | -0.0229  | -7.60%      |
| Finland     | 0.2893 | 0.3034 | 0.0141   | 4.86%       |
| France      | 0.3170 | 0.3075 | -0.0095  | -3.01%      |
| Germany     | 0.3331 | 0.3321 | -0.0010  | -0.30%      |
| Greece      | 0.3748 | 0.3618 | -0.0130  | -3.48%      |
| Ireland     | 0.3753 | 0.3328 | -0.0425  | -11.32%     |
| Italy       | 0.3779 | 0.3527 | -0.0252  | -6.66%      |
| Luxembourg  | 0.3183 | 0.2942 | -0.0241  | -7.56%      |
| Netherlands | 0.2955 | 0.3128 | 0.0173   | 5.84%       |
| Portugal    | 0.4044 | 0.3954 | -0.0090  | -2.23%      |
| Spain       | 0.3689 | 0.3263 | -0.0426  | -11.55%     |
| Sweden      | 0.2984 | 0.2698 | -0.0286  | -9.58%      |
| UK          | 0.3590 | 0.3638 | 0.0048   | 1.33%       |

Source: Authors' analysis based on EUROMOD

## 3.2 Policy scope of our analysis

Our analysis focusses on personal income taxes ( $T_{pit}$ ), social security contributions (paid by employee and self-employed -  $T_{sic}$ ) and other direct taxes on income ( $T_{oth}$ ). The content of these three types will be discussed in more detail in the following paragraphs. This means that an important part of the distributional process is not included, namely social benefits and transfers in kind. At the same time, we do take into account the effect of taxes paid on benefits. For an analysis of the joint effect of taxes and social benefits using EUROMOD, we refer to Immervoll et al. (2006). Publicly provided services, such as education and health care, are not taken into account, though they also have an important redistributive impact (see e.g. Paulus et al., 2010; OECD 2011; Verbist et al. 2012). In our analysis we consider the pre-tax income distribution as given without considering the impact of behavioural decisions or macro-economic aspects which can be affected by the tax-benefit system in place in each country. As our analysis is static, we do not adopt a life-cycle perspective although it is important to recognise that income taxes appear less progressive from a lifetime perspective (Bengtsson, Bertil and Waldenström, 2012). Nevertheless, it is interesting to look at the redistributive impact of taxes on income inequality at a given point in time, as these taxes affect disposable income of households, and thus their living standards.

### 3.2.1 Social insurance contributions

In all countries mandatory social insurance contributions (SIC) are levied on labour income from employees and self-employed as well as on some social benefits (Table

2). In Germany the self-employed pay voluntary contributions. In four countries SIC on labour income are the only contributions that are levied (Ireland, Italy, Portugal and UK). In all other countries recipients of either pensions or unemployment allowances or sickness and disability benefits also pay contributions, though in most cases the rate is lower than on income from work. In Denmark and Luxembourg, social assistance recipients pay contributions as well. France is the only country that levies social contributions on family benefits and capital income.

**Table 2: Basis for levying social insurance contributions in the EU-15, 2008.**

| SIC on      | Employee income | Self-employment income | Pensions | Unemployment allowances | Other income     |
|-------------|-----------------|------------------------|----------|-------------------------|------------------|
| Austria     | x               | x                      | x        |                         |                  |
| Belgium     | x               | x                      | x        |                         | x <sup>(2)</sup> |
| Denmark     | x               | x                      |          |                         |                  |
| Finland     | x               | x                      | x        | x                       |                  |
| France      | x               | x                      | x        | x                       | x <sup>(4)</sup> |
| Germany     | x               | x <sup>(1)</sup>       | x        |                         |                  |
| Greece      | x               | x                      | x        |                         |                  |
| Ireland     | x               | x                      |          |                         |                  |
| Italy       | x               | x                      |          |                         |                  |
| Luxembourg  | x               | x                      | x        | x                       | x <sup>(3)</sup> |
| Netherlands | x               | x                      | x        | x                       | x <sup>(5)</sup> |
| Portugal    | x               | x                      |          |                         |                  |
| Spain       | x               | x                      |          | x                       |                  |
| Sweden      | x               | x                      |          | x                       | x <sup>(2)</sup> |
| UK          | x               | x                      |          |                         |                  |

Notes: Only voluntary contributions; <sup>(2)</sup> on sickness & disability benefits; <sup>(3)</sup> On social assistance; <sup>(4)</sup> on family benefits, housing benefits and capital income; <sup>(5)</sup> social contributions (people's contributions) are calculated on the basis of taxable income, so all income components of taxable income are included. See Verbist (2004) for details on 1998 policy systems.

Source: EUROMOD Country Reports.

### 3.2.2 Personal Income Tax Systems

As already mentioned above, the personal income tax (PIT) schedule is a complex of different components, such as the rate structure and various tax advantages. In practice, it can be sometimes arbitrary to label an income component as either an exemption, a deduction or an allowance but we do follow a structured approach to guarantee cross-country comparability.

**Exemptions**<sup>9</sup> generally include child and family benefits. Greece is the only country in which these benefits are taxable. Also social assistance and minimum income

<sup>9</sup> In some countries we introduce the category of negative tax exemptions. This is done as some income components are part of taxable income, but not of gross income. The best example here is imputed

provisions are in most countries tax exempt. Study allowances and housing benefits are in general also excluded from taxable income. Many countries also exclude benefits for disability and invalidity from taxation, and sometimes (part of) unemployment benefits.

The majority of **deductions** are granted in relation to the acquisition of market income, such as a deduction of work-related expenditures, or provision to stimulate the acquisition of real estate (e.g. mortgage interest tax relief). In most countries social insurance contributions are deducted before taxes are calculated. In some countries maintenance payments are also deductible. In addition countries apply deductions for pensions or for childcare provisions.

**Allowances** are far less frequently used. The only three countries that have allowances of some substance are Ireland, the Netherlands and the UK and they use them mainly for old age and family policy. Many countries however have a zero rate band in the tax schedule (e.g. Greece, Sweden); even though this is not labelled in the tax law as an allowance, it can be considered as one. This illustrates again that it is not always evident to categorise the different tax measures.

**Tax credits** are frequently used in the framework of family policy and old age provisions. Some countries also use tax credits for the benefit of earners or as a mortgage interest relief. In some countries tax credits are refundable (or non-wastable), i.e. if the tax credit exceeds tax liability, the amount of the excess is paid to the taxpayer. This fits in a tendency in some countries to administer benefit payments through the tax system.

In table 3 we present the main characteristics of the **rate schedule** as it is simulated in EUROMOD for 1998 and 2008 policy system. Generally, these are only the rates that apply in the national personal income tax systems while the local taxes are simulated separately, using the (usually limited) information available in the underlying datasets. This explains the low values for the highest tariffs in the Scandinavian countries. As becomes apparent, some countries apply a zero tax band, whereas others do not. Here it becomes again apparent that it is not always easy to demarcate the various tax components in the PIT system: some countries grant tax credits that fulfil a similar role as the zero tax band (e.g. the basic tax credit in Belgium). Over time we see a general trend of reduction in number of income bands, and especially a reduction in the top income tax rates: on average the top rates have been reduced from 45.5% to 38.6%.

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values of real estate property (Belgium, Italy and the Netherlands). They are no part of standard disposable income, and hence not of gross income, but they are taxed

**Table 3: Overview of the rate structure in the personal income tax systems in the EU-15, 1998 and 2008.**

|                      | Number of bands |      | Lowest tariff |      | Highest tariff |      |
|----------------------|-----------------|------|---------------|------|----------------|------|
|                      | 1998            | 2008 | 1998          | 2008 | 1998           | 2008 |
| Austria              | 5               | 4    | 10            | 0    | 50             | 50   |
| Belgium              | 7               | 5    | 25            | 25   | 55             | 50   |
| Denmark <sup>1</sup> | 4               | 3    | 0             | 5.5  | 29             | 15   |
| Finland <sup>1</sup> | 7               | 4    | 0             | 6.5  | 38             | 31.5 |
| France               | 6               | 5    | 0             | 0    | 54             | 40   |
| Germany <sup>2</sup> | -               | -    | 19            | 14   | 53             | 45   |
| Greece               | 6               | 5    | 0             | 0    | 45             | 40   |
| Ireland              | 2               | 2    | 24            | 20   | 46             | 41   |
| Italy                | 5               | 5    | 18.5          | 23   | 45.5           | 43   |
| Luxembourg           | 18              | 17   | 0             | 0    | 46             | 38   |
| Netherlands          | 3               | 4    | 7.1           | 2.5  | 60             | 52   |
| Portuga <sup>1</sup> | 4               | 7    | 15            | 10.5 | 40             | 42   |
| Spain                | 9               | 10   | 0             | 24   | 56             | 43   |
| Sweden <sup>1</sup>  | 2               | 3    | 0             | 0    | 25             | 25   |
| UK                   | 3               | 2    | 20            | 20   | 40             | 40   |

Notes: <sup>1</sup> For the Scandinavian countries these tax rates do not include local or regional taxes. These local taxes are proportional, and the tax rate varies according to locality/region. In EUROMOD an average local tax rate is applied for Denmark (32.4% in 1998, 24.81% in 2008) and Finland (17.5% in 1998, 18.55% in 2008). In case of Sweden the distinct local tax rates are applied in 1998 and an average equal to 31.5% is used in 2008. In case of Italy and Spain the distinct regional tax rates are used in the simulations.<sup>2</sup> The tax schedule is not based on tax bands, but on a polynomial.

Source: EUROMOD Country Reports.

### 3.2.3 Other taxes

Other taxes are those direct taxes on household income that are not part of the national personal income tax system. Broadly, two groups of ‘other taxes’ can be distinguished: local taxes (Denmark, Finland, France, Sweden, UK) and taxes on income from real estate and financial assets (Austria, Belgium, Finland, France, Italy, Portugal, Sweden). Whenever local taxes cannot be simulated precisely in EUROMOD due to lack of data they are imputed or taken directly from the underlying surveys.

As we have already mentioned, local taxes are very important in the Scandinavian countries, whereas the weight of ‘other taxes’ in most countries is relatively small.



**Table 4: Other taxes on income in the EU-15, 1998 and 2008**

| <i>Country</i> | <i>1998</i>                                           | <i>2008</i>                                                                   |
|----------------|-------------------------------------------------------|-------------------------------------------------------------------------------|
| Austria        | Capital income tax, Church tax                        | Capital income tax                                                            |
| Belgium        | Property tax                                          | Property tax; Capital income tax                                              |
| Denmark        | Local tax                                             | Local tax, Church tax, Property tax, Health contributions                     |
| Finland        | Local tax, Wealth tax, Church tax, Capital income tax | Local tax, Church Tax, Capital income tax, Property tax, Health contributions |
| France         | Capital income taxes, Local and regional taxes        | Property tax, Capital income tax, Generalised Social Contributions            |
| Germany        | Solidarity surplus tax                                | Capital income tax, Property tax                                              |
| Greece         | -                                                     | Capital income tax, Tax on rental income                                      |
| Ireland        | -                                                     | Property tax                                                                  |
| Italy          | Capital income taxes                                  | Capital income taxes, Property tax                                            |
| Luxembourg     | -                                                     |                                                                               |
| Netherlands    | -                                                     |                                                                               |
| Portugal       | Capital income tax                                    | Capital income tax, Property tax                                              |
| Spain          | -                                                     | Capital income tax, Property tax                                              |
| Sweden         | Local taxes, Capital income taxes, Wealth tax         | Local taxes, Funeral tax, Capital income tax, Property tax                    |
| UK             | Local Council tax                                     | Local Council tax                                                             |

Source: EUROMOD Country Reports.

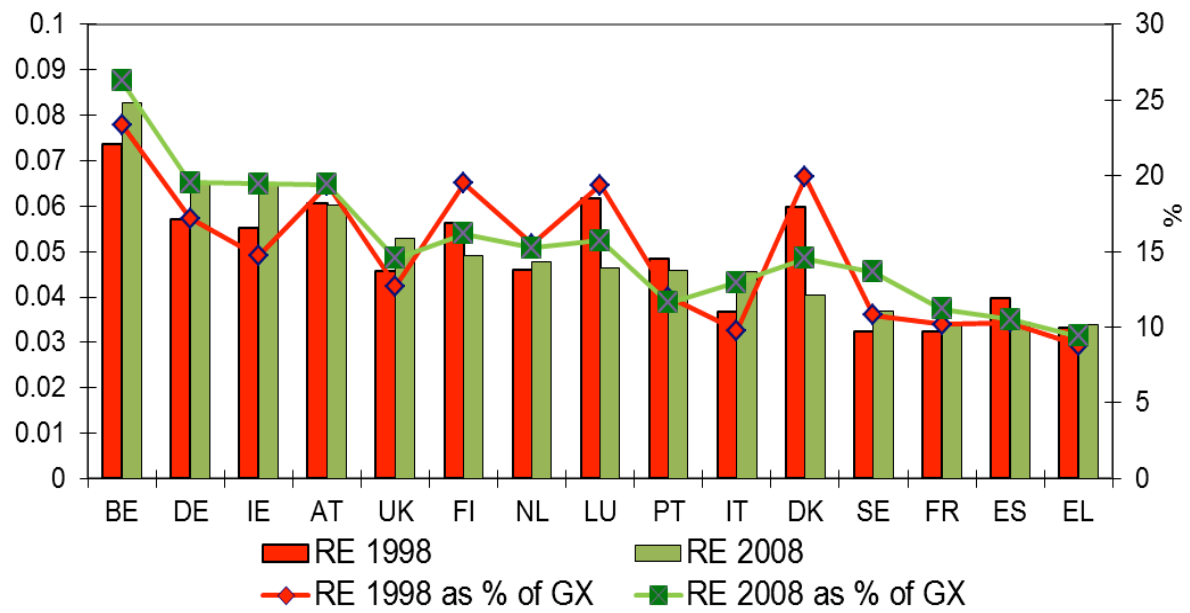
#### **4 The redistributive effect of taxes in the EU**

In order to analyse the effect of taxes on income inequality, we look at the transition from gross to net income by focussing on the different components of taxes in the EU. Income (components) have been equivalised using the modified OECD equivalence scale, which attributes a value 1 to the first adult, 0.5 to all other individuals older than 14 and 0.3 to individuals younger than 14.

##### **4.1 Redistributive effect of total taxes**

Using formulae (4) and (3) we can calculate for each country the redistributive effect of total taxes. Taxes reduce income inequality in all countries, though unsurprisingly not to the same extent (Table 6).

**Figure 1: Redistributive effect of total taxes in EU countries, 1998 and 2008.**



Notes: Redistributive Effect (RE) of total taxes in EU countries expressed in absolute terms (histograms, on left hand axis) and as a share of Gini of pre-tax income (markers, on right hand axis). Income are equivalised using the modified OECD equivalence scale. Countries are ranked according to RE 2008.

Source: Source: Authors' analysis based on EUROMOD

In 2008, highest redistributive effects are found in Belgium, Germany, Ireland and Austria, while it is low in France, Spain and Greece. The evolution across Europe has been very diverse. For instance in Belgium, where the RE was already high in 1998, it has further increased, while in other countries it has decreased, most notably in Luxembourg, and Denmark.

From Table 5 and 6 emerge that for most countries *RE* is broadly the same as vertical equity (*VE*); the main exception is Germany (and in 1998 Sweden) where inequality reduction is more strongly counteracted through reranking. Thus, as vertical equity is by far the most important factor, we will look more closely at the building stones of vertical equity, i.e. progressivity and tax level, measured respectively by the Kakwani index and the average tax rate.

**Table 5: Redistributive effects of total taxes in EU countries, 1998.**

|             | $G_X$  | $G_N$  | $RE$   | $RE$ as % of $G_X$ | $VE$   | $\pi_T^K$ | $t$    |
|-------------|--------|--------|--------|--------------------|--------|-----------|--------|
| Austria     | 0.3133 | 0.2526 | 0.0607 | 19.4               | 0.0639 | 0.1689    | 0.2745 |
| Belgium     | 0.3146 | 0.2408 | 0.0737 | 23.4               | 0.078  | 0.233     | 0.2509 |
| Denmark     | 0.301  | 0.2411 | 0.0599 | 19.9               | 0.0625 | 0.0985    | 0.3881 |
| Finland     | 0.2893 | 0.2329 | 0.0563 | 19.5               | 0.0597 | 0.1411    | 0.2972 |
| France      | 0.317  | 0.2847 | 0.0323 | 10.2               | 0.0345 | 0.132     | 0.2071 |
| Germany     | 0.3331 | 0.276  | 0.0571 | 17.2               | 0.0664 | 0.1684    | 0.2827 |
| Greece      | 0.3748 | 0.3417 | 0.0331 | 8.8                | 0.0353 | 0.1492    | 0.1913 |
| Ireland     | 0.3753 | 0.3202 | 0.0551 | 14.7               | 0.0568 | 0.2676    | 0.175  |
| Italy       | 0.3779 | 0.3411 | 0.0368 | 9.8                | 0.039  | 0.1219    | 0.2426 |
| Luxembourg  | 0.3183 | 0.2566 | 0.0617 | 19.4               | 0.063  | 0.2398    | 0.2081 |
| Netherlands | 0.2955 | 0.2496 | 0.0459 | 15.5               | 0.0484 | 0.1198    | 0.2877 |
| Portugal    | 0.4044 | 0.3561 | 0.0483 | 12                 | 0.0499 | 0.2098    | 0.192  |
| Spain       | 0.3689 | 0.3311 | 0.0398 | 10.3               | 0.0398 | 0.1792    | 0.1817 |
| Sweden      | 0.2984 | 0.2662 | 0.0323 | 10.8               | 0.0401 | 0.0891    | 0.3103 |
| UK          | 0.359  | 0.3133 | 0.0457 | 12.7               | 0.0474 | 0.1884    | 0.2009 |

Notes: Income are equivalised using the modified OECD equivalence scale. Source: Source: Authors' analysis based on EUROMOD

**Table 6: Redistributive effects of total taxes in EU countries, 2008.**

|             | $G_X$  | $G_N$  | $RE$   | $RE$ as % of $G_X$ | $VE$   | $\pi_T^K$ | $t$    |
|-------------|--------|--------|--------|--------------------|--------|-----------|--------|
| Austria     | 0.3100 | 0.2497 | 0.0602 | 19.4               | 0.0631 | 0.1634    | 0.2787 |
| Belgium     | 0.3150 | 0.2322 | 0.0828 | 26.3               | 0.0870 | 0.2082    | 0.2947 |
| Denmark     | 0.2781 | 0.2377 | 0.0405 | 14.5               | 0.0433 | 0.0816    | 0.3464 |
| Finland     | 0.3034 | 0.2543 | 0.0491 | 16.2               | 0.0510 | 0.1328    | 0.2774 |
| France      | 0.3075 | 0.2731 | 0.0344 | 11.2               | 0.0366 | 0.1450    | 0.2018 |
| Germany     | 0.3321 | 0.2671 | 0.0650 | 19.6               | 0.0747 | 0.1727    | 0.3019 |
| Greece      | 0.3618 | 0.3278 | 0.0340 | 9.4                | 0.0364 | 0.1552    | 0.1901 |
| Ireland     | 0.3328 | 0.2680 | 0.0648 | 19.5               | 0.0665 | 0.3205    | 0.1719 |
| Italy       | 0.3527 | 0.3071 | 0.0457 | 12.9               | 0.0476 | 0.1388    | 0.2552 |
| Luxembourg  | 0.2942 | 0.2480 | 0.0463 | 15.7               | 0.0485 | 0.1797    | 0.2125 |
| Netherlands | 0.3128 | 0.2651 | 0.0476 | 15.2               | 0.0509 | 0.1142    | 0.3081 |
| Portugal    | 0.3954 | 0.3494 | 0.0459 | 11.6               | 0.0477 | 0.2122    | 0.1836 |
| Spain       | 0.3263 | 0.2919 | 0.0344 | 10.5               | 0.0359 | 0.2025    | 0.1507 |
| Sweden      | 0.2698 | 0.2330 | 0.0368 | 13.7               | 0.0398 | 0.0976    | 0.2898 |
| UK          | 0.3638 | 0.3109 | 0.0529 | 14.5               | 0.0555 | 0.1780    | 0.2378 |

Notes: Income are equivalised using the modified OECD equivalence scale. Source: Source: Authors' analysis based on EUROMOD

## 4.2 Average tax rates

The average rate of total taxes results of course from the total of the three tax types (see Table 7). The average tax rate is very high in Scandinavia, Germany and the Netherlands. In the Scandinavian countries this follows from the high level of local taxes. In Germany, the high tax level is due to mainly PIT (54% of total taxes) and SIC (45%), whereas in the Netherlands SIC are more predominant (55%). The average tax rate is also high in Austria, Belgium and Italy, following largely from PIT, thus scoring in fact the highest average PIT rates.

**Table 7: Taxes as a % of gross income, and proportion of the three tax types in total taxes in the EU-15 countries 1998-2008.**

|             | <i>Total taxes</i>    |             | <i>Personal Income Taxes</i> |             | <i>Social Insurance Contributions</i> |             | <i>Other taxes</i> |             |
|-------------|-----------------------|-------------|------------------------------|-------------|---------------------------------------|-------------|--------------------|-------------|
|             | <i>average rate t</i> |             | <i>as % of t</i>             |             | <i>as % of t</i>                      |             | <i>as % of t</i>   |             |
|             | <i>1998</i>           | <i>2008</i> | <i>1998</i>                  | <i>2008</i> | <i>1998</i>                           | <i>2008</i> | <i>1998</i>        | <i>2008</i> |
| Austria     | 0.2745                | 0.2787      | 54.3                         | 54.7        | 45.4                                  | 45.3        | 0.3                | -           |
| Belgium     | 0.2509                | 0.2947      | 66.8                         | 62.6        | 33.1                                  | 34.9        | 0.1                | 2.5         |
| Denmark     | 0.3881                | 0.3464      | 20.8                         | 19.0        | 21.7                                  | 18.1        | 57.4               | 62.9        |
| Finland     | 0.2972                | 0.2774      | 27.5                         | 22.5        | 20.3                                  | 15.9        | 52.2               | 61.6        |
| France      | 0.2071                | 0.2018      | 17.3                         | 21.2        | 71.1                                  | 74.8        | 11.6               | 4.0         |
| Germany     | 0.2827                | 0.3019      | 51.4                         | 53.6        | 45.8                                  | 45.2        | 2.8                | 1.3         |
| Greece      | 0.1913                | 0.1901      | 57.3                         | 40.4        | 42.7                                  | 59.2        | -                  | 0.4         |
| Ireland     | 0.1750                | 0.1719      | 82.0                         | 74.3        | 18                                    | 25.7        | -                  | -           |
| Italy       | 0.2426                | 0.2552      | 65.6                         | 64.2        | 27.2                                  | 28.2        | 7.2                | 7.6         |
| Luxembourg  | 0.2081                | 0.2125      | 61.0                         | 53.9        | 39                                    | 46.1        | -                  | -           |
| Netherlands | 0.2877                | 0.3081      | 39.3                         | 45.3        | 60.7                                  | 54.7        | -                  | -           |
| Portugal    | 0.1920                | 0.1836      | 54.7                         | 52.9        | 42.3                                  | 44.0        | 3.0                | 3.1         |
| Spain       | 0.1817                | 0.1507      | 76.8                         | 60.1        | 23.2                                  | 38.2        | -                  | 1.8         |
| Sweden      | 0.3103                | 0.2898      | 7.9                          | 73.3        | 13.9                                  | 17.6        | 78.2               | 9.0         |
| UK          | 0.2009                | 0.2378      | 66.5                         | 60.7        | 22.5                                  | 26.7        | 11.0               | 12.6        |

Notes: Income are equalised using the modified OECD equivalence scale. For Sweden, results related to Personal Income Taxes and Other taxes in 2008 are inverted. Source: Authors' analysis based on EUROMOD

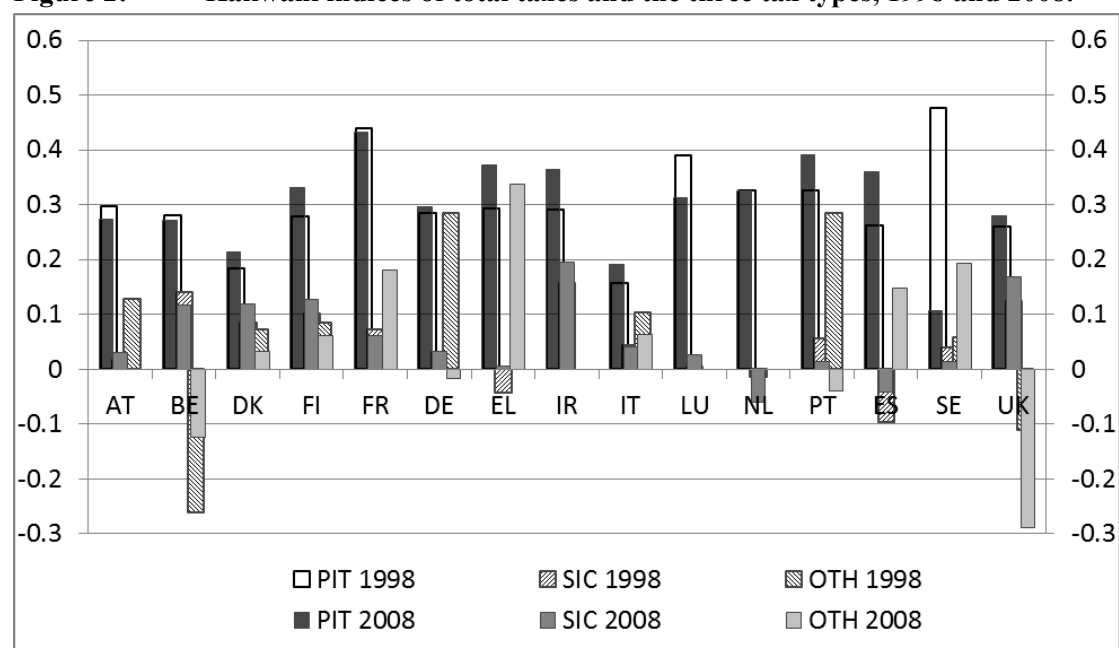
The highest SIC-rates are found in Austria, France, Germany and the Netherlands, ranging from 12.6% to 16.9% of gross income. Ireland, Spain and Sweden have the lowest SIC-rates (between 4.4% and 5.8% of gross income), though these entails an increase compared to 1998.

For most countries, personal income taxes are the most important tax type, though not for the Scandinavian countries and for France and the Netherlands. For these last two countries, social insurance contributions have the biggest weight (resp. 75% and 55% of total taxes), whereas for other countries this proportion varies between 16% (Finland) and 46% (Germany). In Denmark, Finland and Sweden other taxes, which are mainly local taxes, are the most important tax type (ranging from 62% to 78% of total taxes). In the UK and Italy, 'other taxes' have some weight (more than 5% of total taxes), but in all other countries these taxes are relatively small or non-existent.

### 4.3 Progressivity of the three tax categories

The tax types do not only differ in weight, but there is also quite some diversity in structure. In this section we compare progressivity of the three tax types over the EU-15. The Kakwani indices of total taxes range from 0.0891 in Sweden to 0.2676 in Ireland. This general figure results from the progressivity characteristics of the three different tax types, which can be disentangled with formula (5).

**Figure 2: Kakwani indices of total taxes and the three tax types, 1998 and 2008.**



Notes: Income are equivalised using the modified OECD equivalence scale. Source: Authors' analysis based on EUROMOD

We find a wide variety in Kakwani indices for tax types and countries. One fact is clear: PIT is in all countries the most progressive tax type. PIT is very progressive in Sweden, France and Luxembourg. Progressivity of PIT is rather low in Italy and Denmark. In section 5 we will analyse these results in more detail.

Social insurance contributions are in most countries proportional. Exceptions are Ireland and the UK. Most countries levy social contributions as a fixed percentage of income. Ireland and the UK apply lower and upper boundaries for these contributions; apparently the effect of the lower boundary is strongest as contributions in those countries tend rather towards progressivity. There is an additional SIC rate for high incomes in Finland, whereas in Belgium the lowest pensions do not pay SIC; these factors probably explain why SIC in both these countries also incline towards progressivity. Spain also applies lower and upper bounds for the calculation SIC, but contrary to the Anglo-Saxon countries the effect of the upper bound appears to be stronger, as SIC in Spain incline towards regressivity. Remarkably, progressivity of SIC has increased over the decade 1998-2008 in especially Finland and Denmark.

Other taxes are progressive in France, Greece and Spain in 2008, while in most other countries these taxes are close to proportionality. Other taxes are regressive in Belgium (regional tax on property) and UK (local council tax).

#### **4.4 Contribution to total tax progressivity**

Using formula (5) we can also calculate the contribution of each tax type to overall progressivity. The contribution to overall progressivity depends on the features of the individual instruments. For personal income taxes we will discuss the effect of the various income tax components into more detail in section 6. The effect of social insurance contributions will depend on the structure of the system (e.g. the existence of lower and upper bounds), but also on the structure of the underlying income distribution (e.g. the weight of low- and high-income groups). We expect that a lower bound will make social insurance contributions more progressive, whereas a ceiling will probably lead to regressivity. In countries where there is both a ceiling and a floor, the final effect will depend on the level of the SIC boundaries and on the weight of high and low income groups<sup>10</sup>. As the base income concept here is gross income, the degree of progressivity of social insurance contributions also depends on the weight of the income components on which SIC are levied. For the interpretation of the results we also have to bear in mind that there is a considerable difference in logic between personal income taxes and social insurance contributions. In general, personal income taxes are levied to fulfil the government revenue requirements for a specific time period (mostly a year, and can thus be considered as redistributive in a specific period), whereas social insurance contributions are part of a social insurance system, and thus redistribute over the life-cycle rather than between income groups in any given period.

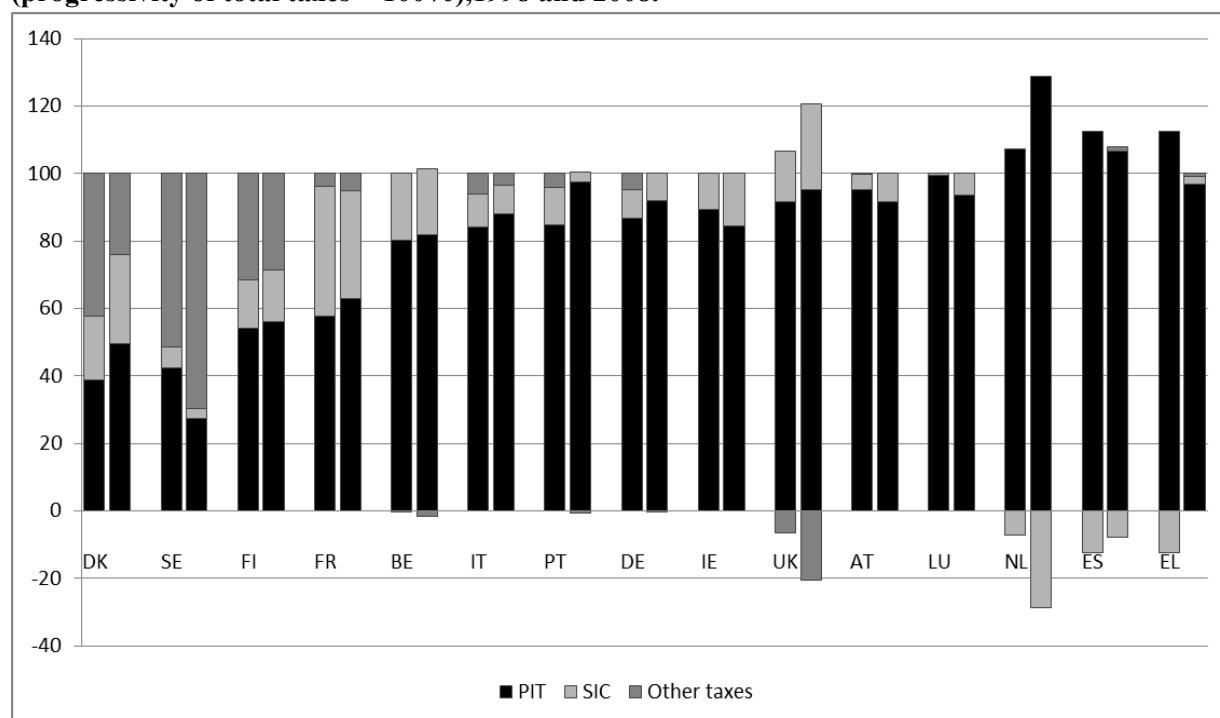
Personal income taxes deliver in each country a positive contribution. The fact that in all countries PIT have the highest Kakwani, combined with the fact that in many countries their average tax rate is the highest of the three types leads to PIT delivering the highest contribution to overall progressivity of total taxes (more than 80% in 11 countries, even more than 100% in Greece, Spain and the Netherlands). The notable exceptions are the Scandinavian countries and France.

For the Scandinavian countries, local taxes deliver a very important contribution to overall progressivity, which follows mainly from their high average other tax rate, not so much from their progressivity as they all have a relatively low Kakwani for their local taxes.

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<sup>10</sup> It also important to note here that the degree of progressivity also depends on the measure used. We work here within the standard Gini framework. Using for instance inequality measures with other inequality preferences, will lead to different results (see Immervoll, 2005).

**Figure 3: Decomposition of progressivity of total taxes over the three tax types: (progressivity of total taxes = 100%), 1998 and 2008.**



Notes: Income are equivalised using the modified OECD equivalence scale. Source: Authors' analysis based on EUROMOD

SIC are very important in France (mainly due to the high tax rate). But also in Belgium and Denmark they give an important positive contribution to inequality reduction. In Greece, Spain and the Netherlands the impact is negative, following from the negative Kakwani index; this means that total progressivity, and thus the redistributive effect, would be bigger if there were no social insurance contributions.

As we have already mentioned local taxes are important in the Scandinavian countries, and this is also reflected in the large share of 'other taxes'. In other countries this tax type has only a small impact. In the UK, however, we find an important anti-equalising effect. This last result is remarkable; despite the council tax benefit, which is designed to provide relief for the lowest income groups, the local council tax in the UK is regressive.

#### 4.5 Is there a trade-off between tax progressivity and tax level?

In this section we will deal with two issues. On the one hand we want to know if there is a relationship between initial inequality and redistributive efforts. On the other hand, we will test here on the basis of the EUROMOD-data the trade-off hypothesis formulated in section 2. It would not be illogical to have a correlation between pre-tax income inequality and the redistributive effect of taxes. This correlation can be positive: countries with a high pre-tax income inequality may tend to put more effort in redistribution. If market forces lead to relatively big inequalities, this may be a

reason for the government to interfere more strongly and correct this distribution. But also the opposite stand can be defended: an initially unequal distribution and the social choice to redistribute rather little can be based on the same underlying factors, such as a strong emphasis on individual responsibility and a big confidence in the market. We find that the sign of the correlation coefficient favours the second supposition, namely that countries with a high level of pre-tax inequality redistribute rather less. However, also this correlation is not significant. There is also no significant correlation between  $G_X$  and  $\pi_T^K$ . But there is quite a strong correlation between initial inequality and the average tax rate. This can be seen as an indication in favour of the second supposition.

The hypothesis of a trade-off between progressivity and tax level seems to rest on firmer ground. We find a significantly negative correlation between these two variables. This negative correlation applies both for total taxes as for personal income taxes. However, the classification of countries according to the trade-off hypothesis is not the same. For total taxes we can broadly identify a group of “low progressivity – high tax rate” countries (with the Nordic countries, the Netherlands and Italy), and a group of “high progressivity – low tax rate” countries (with Ireland, Portugal, the UK and Spain). Austria and Germany occupy a position in between and Belgium again combines a high degree of progressivity with a moderate tax rate. Greece and France have a combination of low progressivity with a low tax level.

**Table 8: Correlation between inequality, redistributive effect, progressivity and tax level, 1998 and 2008.**

| Variables               | Pearson rank correlation coefficient 1998 | Pearson rank correlation coefficient 2008 |
|-------------------------|-------------------------------------------|-------------------------------------------|
| $G_X - RE$              | -0.3058                                   | 0.0660                                    |
| $G_X - t$               | -0.7294*                                  | -0.5216*                                  |
| $G_X - \pi_T^K$         | 0.4198                                    | 0.4583                                    |
| $t - \pi_T^K$           | -0.6486*                                  | -0.6445*                                  |
| $t_{PIT} - \pi_{PIT}^K$ | -0.6255*                                  | -0.6797*                                  |
| $t_{SIC} - \pi_{SIC}^K$ | -0.2315                                   | -0.4877                                   |

Notes: \* Significant at the 0.05 level. Income are equivalised using the modified OECD equivalence scale. Source: Authors’ analysis based on EUROMOD

For personal income taxes solely the correlation coefficient is –0.6255 in 1998 and -0.6797 in 2008 and significantly different from zero at the 0.01 level. The “low-progressivity – high tax rate” group for PIT include Italy, Belgium and Germany, whereas Sweden, France, Portugal, Greece and Ireland belong to the “high progressivity – low tax rate” countries. Denmark has a low score on both variables, while the other countries take up a position somewhere in the middle. The trade-off



hypothesis does not hold for social insurance contributions: there is no systematic relation between the average SIC rate and SIC progressivity.

## **5 Progressivity of personal income taxes in the EU**

Personal income taxes are in most countries the most important contributor to the redistributive effect of taxes in the EU-15. Therefore, we will go into more depth how this comes about. We have already pointed out that the PIT system is a complex of various measures (exemptions, allowances etc.). In this sections we apply the decomposition explained in section 2 and study how these various components contribute to PIT progressivity. As we have seen, there is a wide variety among countries in the composition of the tax base, in the kind of tax advantages that are granted (allowances, deductions and credits) and the structure of the rate schedule. So progressivity in the EU will result from different instruments.

### **5.1 Proportion of the components in gross income**

Taxable income (i.e. the income on which the rate structure is applied) is between 62% (France) and 87% (Denmark) of gross income (in 1998 this was between 54% (France) and 92% (Spain)). The gap between taxable and gross income follows in general mainly from deductions. The only exceptions are Italy, where exemptions are more important, and Ireland, the Netherlands and the UK that use allowances of some substance. Deductions are very important (+20%) in France, Portugal and Spain; and important (+10%) in Austria, Belgium, Finland, Germany, Greece, Luxembourg and Sweden. Most of these deductions are earnings-related or are social insurance contributions. Only in Germany, deductions are mainly related to old age and pensions, whereas in the Netherlands the mortgage interest deductions have most weight. Exemptions are important in Italy, Luxembourg and UK. Credits have some weight in Belgium, Ireland and Spain, but are small in other countries.

**Table 9: Average rate of the tax components as a proportion of gross income , 1998 and 2008.**

|             | 1998              |                   |                   |                       |                | 2008              |                   |                   |                       |                |
|-------------|-------------------|-------------------|-------------------|-----------------------|----------------|-------------------|-------------------|-------------------|-----------------------|----------------|
|             | Exemptions<br>(e) | Deductions<br>(d) | Allowances<br>(a) | Taxable<br>income (y) | Credits<br>(k) | Exemptions<br>(e) | Deductions<br>(d) | Allowances<br>(a) | Taxable<br>income (y) | Credits<br>(k) |
| Austria     | 0.0619            | 0.2293            | 0.0003            | 0.7085                | 0.0429         | 0.0609            | 0.1262            | 0.0051            | 0.8078                | 0.0108         |
| Belgium     | 0.0745            | 0.188             | -                 | 0.7375                | 0.0803         | 0.0606            | 0.1865            | -                 | 0.7529                | 0.0922         |
| Denmark     | 0.0413            | 0.1337            | -                 | 0.825                 | -              | 0.0443            | 0.0831            | -                 | 0.8726                | -              |
| Finland     | 0.1285            | 0.0796            | -                 | 0.7919                | 0.0054         | 0.0921            | 0.1240            | -                 | 0.7838                | 0.0116         |
| France      | 0.1381            | 0.3262            | -                 | 0.5357                | 0.0201         | 0.0727            | 0.3043            | -                 | 0.6231                | 0.0165         |
| Germany     | 0.0382            | 0.2313            | 0.0074            | 0.7231                | -              | 0.0477            | 0.1496            | -                 | 0.8027                | -              |
| Greece      | -0.0016           | 0.1386            | -                 | 0.863                 | 0.0083         | 0.0932            | 0.1189            | -                 | 0.7879                | 0.0029         |
| Ireland     | 0.1034            | 0.0182            | 0.2452            | 0.6332                | 0.0043         | 0.0995            | 0.0155            | 0.1035            | 0.7815                | 0.1101         |
| Italy       | 0.1612            | 0.0756            | -                 | 0.7632                | 0.0401         | 0.1044            | 0.0835            | -                 | 0.8121                | 0.0605         |
| Luxembourg  | 0.0559            | 0.2227            | -                 | 0.7214                | 0.0083         | 0.1051            | 0.1716            | -                 | 0.7234                | -0.0028        |
| Netherlands | -0.0098           | 0.133             | 0.2091            | 0.6677                | -              | 0.0085            | 0.0766            | 0.0735            | 0.8414                | 0.0077         |
| Portugal    | 0.069             | 0.3402            | -                 | 0.5908                | 0.0186         | 0.0535            | 0.3190            | -                 | 0.6275                | 0.0239         |
| Spain       | 0.0014            | 0.0836            | -                 | 0.915                 | 0.0217         | 0.0328            | 0.2317            | -                 | 0.7355                | 0.0912         |
| Sweden      | 0.1504            | 0.127             | -                 | 0.7226                | 0              | 0.0786            | 0.1019            | -                 | 0.8195                | 0.0801         |
| UK          | 0.1161            | 0.0147            | 0.2622            | 0.607                 | 0.0114         | 0.1305            | 0.0236            | 0.2854            | 0.5606                | 0.0001         |

Notes: Income are equivalised using the modified OECD equivalence scale. Source: Authors' analysis based on EUROMOD

## 5.2 Progressivity structure of the PIT components: Kakwani indices

There is again a wide variety among countries when we look at the structure of the tax components: some are pro-poor, whereas others are regressive or rather proportional. In most countries exemptions are pro-poor. Some countries even have a very high value of the Kakwani index for exemptions. In Austria, Belgium, Germany and Luxembourg exemptions consist mainly of family related benefits, more specifically child benefits. The highest Kakwani indices are found in those countries where exemptions include mainly benefits for unemployment or minimum income support, as is the case in Ireland and the UK. Exemptions are most progressive in Spain, which is not surprising as it consists of a means-tested benefit. The more benefits are concentrated among the lower income groups, the more pro-poor their exemption of taxation is. The negative values of the Kakwani indices of exemptions come from the so-called negative exemptions (i.e. the imputed taxable income components). This is the case in Greece, the Netherlands and in Italy. The most striking result here is the score of -1.80 for the Netherlands. This means that imputed rent is situated relatively more at the lower end of the income distribution and that adding its value to taxable income has a negative effect on progressivity.

**Table 10: Kakwani indices of PIT components (Exemptions E, Deductions D, Allowances A, Rate schedule R, Credits K, Personal Income Taxes T), 1998 and 2008.**

|             | 1998      |           |           |           |           | 2008      |           |           |           |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|             | $\pi_E^K$ | $\pi_D^K$ | $\pi_A^K$ | $\pi_R^K$ | $\pi_K^K$ | $\pi_E^K$ | $\pi_D^K$ | $\pi_A^K$ | $\pi_R^K$ | $\pi_K^K$ |
| Austria     | 0.4417    | 0.0034    | 0.3088    | 0.1088    | 0.3630    | 0.4640    | -0.0298   | 0.1732    | 0.2058    | 0.2790    |
| Belgium     | 0.3019    | -0.0002   | -         | 0.0665    | 0.2847    | 0.2008    | -0.0484   | .         | 0.0784    | 0.2969    |
| Denmark     | 0.5751    | -0.0619   | -         | 0.1644    | -         | -0.0597   | -0.1287   | .         | 0.2283    | .         |
| Finland     | 0.0587    | 0.0381    | -         | 0.2497    | -0.0307   | 0.0253    | 0.3298    | .         | 0.2276    | -0.0193   |
| France      | 0.159     | -0.0276   | -         | 0.3389    | -0.2258   | 0.6340    | 0.0723    | .         | 0.3064    | -0.3744   |
| Germany     | 0.5478    | 0.2681    | 0.1252    | 0.1703    | -         | 0.7712    | 0.2436    | .         | 0.2052    | .         |
| Greece      | -0.2456   | 0.0977    | -         | 0.2437    | 0.1778    | 0.0823    | -0.0105   | .         | 0.3575    | -0.1811   |
| Ireland     | 0.5992    | -0.2485   | 0.2281    | 0.1096    | -0.1861   | 0.5188    | -0.2145   | -0.1070   | 0.0986    | 0.1060    |
| Italy       | -0.0586   | -0.0235   | -         | 0.0709    | 0.3404    | 0.0095    | -0.0218   | .         | 0.0520    | 0.3271    |
| Luxembourg  | 0.4138    | 0.1392    | -         | 0.2728    | 0.3062    | 0.1204    | 0.0559    | .         | 0.2809    | -0.3116   |
| Netherlands | -1.8009   | -0.0745   | 0.262     | 0.233     | -         | 2.8565    | -0.1462   | 0.2706    | 0.2558    | 0.2472    |
| Portugal    | 0.2204    | 0.2174    | -         | 0.0905    | 0.2312    | 0.3674    | 0.2408    | .         | 0.1309    | 0.1506    |
| Spain       | 1.1462    | 0.0717    | -         | 0.2078    | 0.0808    | 0.0649    | 0.2553    | .         | 0.0479    | 0.0950    |
| Sweden      | 0.0991    | 0.1864    | -         | 0.424     | -0.2783   | 0.1847    | 0.1910    | .         | 0.0405    | -0.0177   |
| UK          | 0.6876    | -0.2378   | 0.17      | 0.0343    | 0.0704    | 0.6654    | -0.1841   | 0.3018    | -0.0212   | -0.0640   |

Notes: Income are equivalised using the modified OECD equivalence scale. Source: Authors' analysis based on EUROMOD

Deductions are pro-poor in Finland, Germany, Portugal, Spain and Sweden. In Germany, deductions are aimed at pensioners, who situated relatively more in the lower part of the distribution. In the other countries, deductions are mainly earnings related or social insurance contributions. Deductions are pro-rich in Denmark, Ireland, the Netherlands and the UK. In Ireland and the UK these are (private) pension contributions, which are clearly concentrated at the upper end of the distribution. In the Netherlands, this is mainly the mortgage interest tax relief.

Allowances are pro-poor in all countries where they are used, except in Ireland.

The rate schedule is everywhere progressive. Here we have some interesting results. One might assume that a large number of tax bands would lead to a more progressive tax system: the more tax bands, the more the tax rate increases with income. But apparently there is no relationship between the number of tax bands and rate progressivity: countries with the largest number of tax bands are not necessarily the most progressive in their rate structure, and vice versa (cf. Table 3; e.g. Belgium, which has 5 tax bands and an low value for rate progressivity, whereas Sweden has only 3 tax bands but the highest value of  $\pi_R^K$ ). Something similar applies for the upper tariff: Austria, Belgium and the Netherlands have the highest top rates, but their  $\pi_R^K$  are not that high compared to other countries. Here the role of pre-tax income inequality, the composition of taxable income and the role of joint or individual taxation become apparent. This also shows how important the characteristics of underlying income distribution are. The rate schedule is most progressive in France and Sweden; in France this also includes the effect of the application of the 'quotient familial'.

Credits are pro-poor in Austria, Belgium, Ireland, Italy, the Netherlands and Portugal. These credits are mainly family policy related and lump sum. Credits are pro-rich in France, Greece and Luxembourg. In Ireland the tax credit is mainly granted for mortgage interest relief.

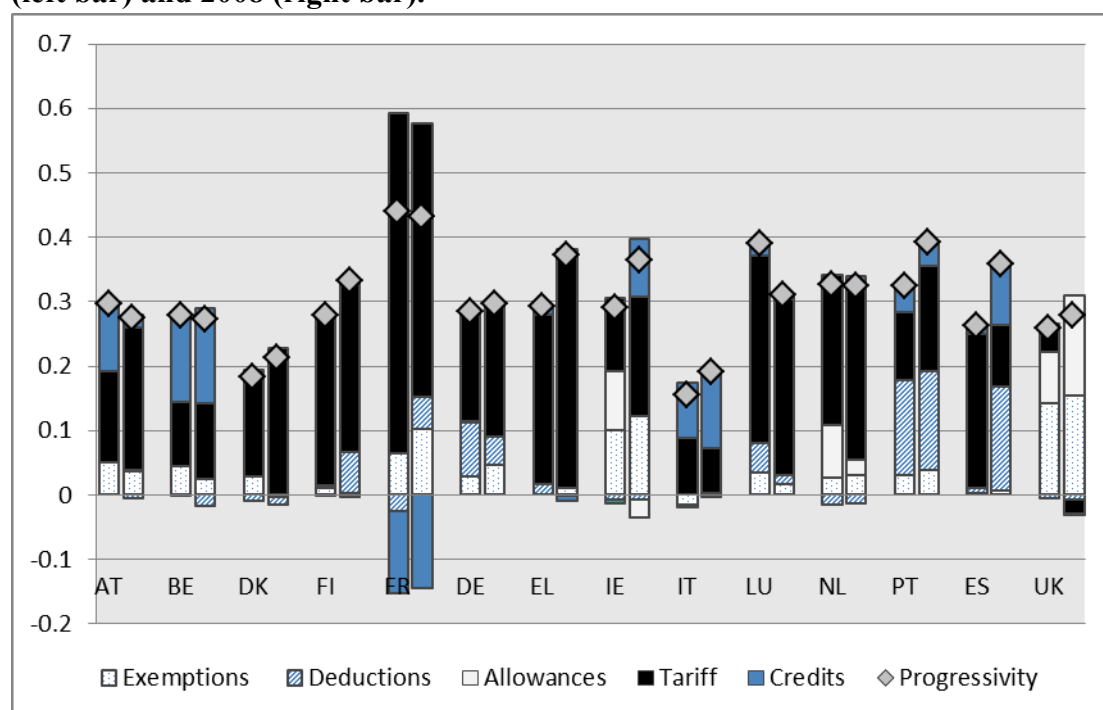
### 5.3 Contribution to progressivity of the PIT components

The structure and weight of the different PIT components are brought together in Figure 4, where we show the contribution of each component to total PIT progressivity. What strikes immediately is that the rate structure is the most important factor in most countries. Furthermore, there is a strong effect from exemptions and allowances in France, Ireland and the UK, from deductions in Portugal and Spain, and from credits in Belgium, France, Ireland, Italy and Spain, as well as in France but then in a negative way. In 10 of the 15 countries the rate schedule accounts for the majority of total progressivity. In Denmark, Finland, France, Greece, Spain and Sweden more than 85% of progressivity comes from the rate structure. These are in general the countries with the highest  $\pi_R^K$ . In Luxembourg, which also has a high  $\pi_R^K$ , the rate schedule accounts for 74%. In the Netherlands, Germany and Italy the rate structure is the most important determinant, but also other components have a considerable effect (allowances in the Netherlands, deductions in Germany and credits in Italy). In 3 countries progressivity results mainly from the composition of the tax base (i.e. the joint effect of exemptions, deductions and allowances): this is the case for Ireland, the UK and Portugal. In Belgium and Austria, we find a mixture of the rate structure, credits and exemptions.

We can thus distinguish three groups of countries:

- 1) rate structure countries: Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Spain and Sweden;
- 2) tax base composition countries: Ireland, Portugal and UK;
- 3) mixed structure countries: Austria and Belgium.

**Figure 4: Contribution of the various PIT components to PIT progressivity, 1998 (left bar) and 2008 (right bar).**



Notes: Income are equivalised using the modified OECD equivalence scale. Source: Authors' analysis based on EUROMOD

Compared to 1998, this grouping of countries has not changed. We can compare this with the typology in Wagstaff and van Doorslaer (2001), though we have to be careful: the databases are not the same, and the income concept is also quite different. In Wagstaff and van Doorslaer, taxable income is used and not gross income; exemptions E are not taken into account (as the data were not available in the administrative OECD dataset). Their analysis refers to the mid-late 1980s and most countries have embarked on rather substantial tax reforms towards the end of the eighties. However, bearing these caveats in mind, we try to draw some conclusions about the evolution of the PIT systems. A first conclusion is that most countries are still in the same group. According to Loizides (1988) in Greece the rate structure was the main determinant of progressivity, and this turns out to be still the case. A second observation is that Finland, Germany and Sweden have shifted from the mixed structure group to the rate structure category. For Finland and Sweden we have to qualify this observation: in our calculations local taxes are a separate category, and thus not included in the analysis of personal income taxes, whereas they are included in Wagstaff and van Doorslaer. A last observation is that the tax reform in Denmark has also led this country into the rate structure group. We cannot say anything about the evolution of Austria, Luxembourg and Portugal, as they were not in the Wagstaff and van Doorslaer study. As a broad pattern we see that the rate structure was already the major source for progressivity in the mid-eighties, and apparently this pattern has been reinforced in the countries of the EU-15 in the mid-late 1990s.

## **6 Conclusions**

Summarising, the following observations and conclusions can be drawn on the basis of our EUROMOD-research on the redistributive effect of taxes in the EU-15.

1. As expected, there is a wide variation in the EU-15 in the redistributive efforts through taxes on household income. France, Greece, Italy, Portugal and Spain have a low degree of inequality reduction through taxes (about 10% of pre-tax income inequality), whereas Austria, Belgium, Germany and Ireland have a redistributive effect that is relatively high (around 20% of pre-tax inequality). Countries with a high degree of pre-tax income inequality do not redistribute systematically more through their taxes. The results suggest rather the opposite: countries with a high pre-tax inequality level tend to redistribute rather less. We deduce this from the finding that the correlation between inequality before taxes and the average tax rate is negative and significantly different from zero. This supports the supposition that an initially unequal distribution and the social choice to redistribute rather little is probably based on the same underlying factors, such as a strong emphasis on individual responsibility and a big confidence in the market. A mixture of personal income taxes (PIT), social insurance contributions (SIC) and other taxes is used to achieve tax progressivity. However, PIT are the most important source of progressivity and hence income inequality reduction. The only exceptions are Denmark and Sweden, where progressivity arises from a mixture of the three tax types, with a preponderance of local taxes.
2. All PIT systems exhibit a progressive structure. This broadly applies also for SIC and other taxes, but there are some exceptions. SIC are regressive in Greece, the Netherlands and Spain, whereas other taxes are pro-rich in Belgium and the UK.
3. There is a trade-off between progressivity and the average tax rate, and this is true for total taxes as well as for personal income taxes. Apparently, a government puts more burden on the broadest shoulders, if the tax weight is rather mild. But when the tax level is high, it appears to be more difficult to avoid that everybody pays its share of taxes, such that the tax rate increase less with income level.
4. If we concentrate on PIT progressivity, we find that broadly all tax exemptions and tax allowances enhance progressivity. The evidence on tax deductions and tax credits is mixed.
5. The rate structure always contributes positively to the progressivity of the PIT system, so there is a wide variety among countries in the importance of this instrument. For some countries (e.g. Greece, Luxembourg and the Nordics) it is almost the sole source of progressivity, whereas in other countries its relative contribution to overall progressivity amounts only to less than one third.

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