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PROGRESSIVITY OF INCOME TAX SYSTEMS

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INTRODUCTION

The international integration of markets and the increase in factor mobility have substantially accentuated interest in relative levels of effective income taxation in different countries. While quite a number of recent studies have presented comparable estimates of effective corporate tax rates, similar estimates for the personal income tax are relatively rare, perhaps because tax legislation leads to substantial cross-country differences in the tax base.

The progressivity of the personal income tax, which is the main topic of this article, is important in relation to two different objectives of fiscal policy. A first objective is to distribute the tax burden fairly, in terms of ability to pay and the effect of taxation upon income inequality. A second objective is to avoid economic distortions and efficiency losses: progressivity is closely linked to the concepts of marginal and average tax rates which are generally regarded as determining incentive effects. These two objectives may conflict[1].

To facilitate international comparisons in the field of the personal income tax, the OECD has established a new data base, described in detail in a recent publication[2], which makes adjustments to the income concepts normally used in data from national fiscal authorities. The resulting statistics are not completely comparable across countries, in particular because they relate to incomes of persons in some countries and to family incomes in others. However, the data base covers seventeen countries and has unique advantages, notably for analysis by level of income of effective tax rates and the components of tax liability such as standard tax allowances, interest deductions from taxable income, and other non-standard allowances.

In this article, Part I looks at different measures of progressivity, the inequality measures upon which they are based and their welfare theoretical underpinnings. This part also discusses the different aspects of progressivity measured by each index and how they are related from a conceptual as well as from a mathematical point of view. Part II presents the new database in the form of the common methodology applied and the data collected. It also briefly summarises the many statistical as well as conceptual caveats which still complicate international comparisons using this type of data and which will be addressed in future work on the data base. Finally, Part III presents the estimated measures and some tentative conclusions are presented in the final section.

I. DEFINING AND MEASURING PROGRESSIVITY

A. Defining progressivity

Most people associate the concept of income tax progressivity with the noti of a rate schedule with an increasing rate. A more precise mathematical definiti is as follows: let T(Y) be the tax paid by an individual with income Y and let m be the marginal tax rate and t(Y) the average tax rate; the tax system in questi could then be defined as proportional when the elasticity of T with respect to Y is equal to one for all Y. The tax system is *progressive* when the elasticity exceeds one and regressive when the elasticity is less than one:

$$(dT/T)/(dY/Y) > 1 \iff m(Y)/t(Y) > 1 \iff m(Y) - t(Y) > 0 \qquad [1]$$

This definition of progressivity is thus equivalent to saying that a tax system is progressive, proportional or regressive when the marginal tax rate m(Y) which equals dT/dY is greater than, equal to or less than the average tax rate t(Y) which equals T(Y)/Y, respectively. This is also equivalent to saying that progressivity occurs when the average tax rate t(Y) is an increasing function of income:

$$\frac{dt(Y)}{dY} = \frac{d(T(Y)/Y)}{dY} = \frac{m(Y)-t(Y)}{Y} > 0 \qquad [2]$$

Also this expression shows that progressivity is determined by the relation between average and marginal tax rates which in turn are determined by the tax rate schedule as well as the structure of tax reliefs. It is, however, worth noting that the above relates to progression at a given point in the income scale and therefore does not give an unambiguous index of overall progressivity.

B. Types of progressivity measures

In recent economic literature there has been a proliferation of progressivity measures using a single index of the level of progressivity of a tax system. There is no universal agreement as to what constitutes the "correct" one, but following Kiefer (1984), existing measures may broadly be classified into two groups, "structural indices" and "distributional indices".

Point measures of progressivity can take many values depending upon the levels of income Y that are examined. To estimate a single summary of progressivity, specific income levels needs to be selected for examination. Measures are sometimes based upon the tax paid at fixed multiples of a single reference income level, which may be average income or a fixed real income level in a common currency. These belong to the group of "structural" indices, and differ from "distributional" indices which depend upon the entire distribution of income. Distributional indices may be subdivided according to the measure of inequality upon

which they are based. Two well-known measures are the concentration index (or Gini coefficient) and the "equally distributed equivalent" (EDE) measures defined by Atkinson (1970).

Measures of progressivity can also be divided between "tax-scale invariant" and "redistribution" indices. Tax-scale invariant measures are invariant when the tax paid changes by the same multiple at each income level: they depend upon the distribution of tax. Redistribution measures are invariant when the after-tax income changes by the same multiple at each income level, and depend upon the distribution of after-tax income. This article focuses on the concentration index-based *measures* (though EDE-measures are briefly dealt with in section C below), primarily because they are the most frequently used in applied research, but also because they are relatively simple and may easily be interpreted graphically.

C. Progressivity measures based on the concentration index[3]

As indicated above, progressivity is closely related to the concept of inequality: if the average tax elasticity is greater than one, post-tax income will be more equally distributed than pre-tax income. It follows that measures of progressivity must, either implicitly or explicitly, be based on some measure of inequality.

The inequality measure most often used is the concentration or the Gini index, which in turn is based on the well known concept of the Lorenz or concentration curve[4]. This curve is defined as the relationship between the cumulative proportion of income and the cumulative proportion of income-receiving units. The Gini coefficient may in turn be defined as one minus the ratio of the area under the Lorenz curve to the area under the diagonal or the egalitarian line. See Annex I for details of definition and estimation.

As mentioned above, a proliferation of suggested measures has recently developed in order to enable a description of global progressivity on the basis of one single number, and the measurement of progressivity has generated considerable controversy over the last decade. The different measures of progressivity do not always give consistent rankings. This is an argument for using, as many empirical studies do, more than one. This section describes the three measures used here, all of which are based upon concentration curves.

Musgrave and Thin (1948) presented a distributional tax progressivity index, which they called effective progression, based upon a comparison of the Gini coefficients before and after tax. It is defined as follows:

$$M = \frac{1 - G^a}{1 - G^b} \qquad [3]$$

where G^a is the Gini index of after-tax income and G^b is the Gini index of before-tax income. This is an indicator of the relative equality of the after-tax distribution compared with the before-tax distribution: values of M greater than 1 indicate a progressive tax. Other researchers have measured progressivity as the percentage

decrease in the Gini coefficient (Pechman and Okner, 1974) and the absolute change in the Gini coefficient (Reynolds and Smolensky, 1977).

Kakwani (1976) applied a progressivity index that is based on a comparison of G^b and G^t which is the concentration index or Gini coefficient of taxes (using pre-tax income as classifier). The measure is defined as follows:

$$K = G^t - G^b \qquad [4]$$

This measure judges a tax to be progressive if the tax concentration curve is more concave than the Lorenz curve, therefore: if K is greater than 0, the tax is progressive; if K equals 0, the tax is proportional; and if K is less than 0, the tax is regressive. The proportionate difference in inequality between taxes and pre-tax income, as indicated by these Gini coefficients, was used by Khetan and Podder (1976).

Suits (1977) proposed a measure, which has been applied in several studies, based upon the Gini coefficient for a curve showing the cumulative share of tax liability on the vertical axis and the cumulative share of income on the horizontal axis (using pre-tax income as classifier). By this measure, a tax is progressive if the relative concentration curve of taxes with respect to income is concave (from above), thus, if the index called S is greater than 0, the tax is progressive; if S equals 0, the tax is proportional; and if S is less than 0, the tax is regressive.

Substantial efforts have been devoted to clarifying the conceptual and statistical relationships between the different types of progressivity measures outlined above. This has been accompanied by a heated discussion on what constitutes the most appropriate measure of progressivity which in turn is closely related to the questions being addressed. If the emphasis is on the impact of taxes on the income distribution (i.e., post-tax compared to pre-tax distributions), Musgrave-type measures are preferable. If, however, progressivity is seen as more a question of how the percentage distribution of taxes across deciles compares to the percentage distribution of (pre-tax) income (disregarding the size of the average tax rate), Kakwani and Suits-types of measures should be used. Dependent on which point of view is preferred, the ranking of countries may change.

Referring to the terms defined in section B above, the Musgrave and Thin index M is a redistribution index, since it takes the same value for all tax systems that give – for a given pre-tax distribution – an after-tax income distribution with the same level of equality. Both the Kakwani index K and the Suits index S are tax-scale invariant indices, since their value is unchanged if all tax liabilities increase by a constant multiple[5]. Kakwani (1976, 1977) shows that his index is related in a simple way to the Gini coefficients before and after tax:

$$G^a - G^b = \frac{tK}{(1-t)} \qquad [5]$$

where t is the average tax rate. For a given value of K, the change in inequality brought about by the tax system is an increasing function of t. If t is small, a tax

system may be judged highly progressive according to Kakwani's K, but at the same time be approximately proportional according to the group of redistributive measures. Depending on which aspects of progressivity they consider most important, different authors advocate different measures[6].

Using this relationship, other indices based upon G^a and G^b, including the Musgrave and Thin index M, can be expressed in terms of G^b, K and t. Bourguignon and Morrisson (1980) prove that K is the only conventional summary that allows the total impact of taxation upon inequality to be decomposed into terms expressing the progressivity (K) and average rate (t) of each tax.

The concentration curve-based measures discussed here have, however, been criticised. In his seminal article, Atkinson (1970) argued that underlying any summary statistic of inequality is some concept of social welfare, and that the analysis should explicitly focus on this aspect. Indices of inequality such as the Gini coefficient can be thought of as assigning weights to income transfers from richer to poorer individuals, and the Gini coefficient has been criticised on this account (Kiefer, 1984, and Atkinson, 1970). First, it attaches most weight to income transfers among individuals close to the mode of the income distribution, and secondly, it has the same symmetric weighting scheme regardless of how equal or unequal is the income distribution in question whereas a more satisfactory scheme probably would attach higher weights to transfers to the poor, the greater the inequality of the distribution[7].

Among other considerations that may be important are the sensitivity of the measures to zero and negative incomes, and their robustness in the face of various types of omissions in coverage[8].

II. CALCULATING PROGRESSIVITY

A. Defining the tax function

While different mathematical measures of progressivity have been widely discussed in the literature, progressivity measures also depend upon how the tax function T(Y) is measured.

One method, which was applied in OECD (1980), involves defining a "typical case", for example a married man with two children with all his income from wages and salaries and with his wife not working. On the assumption that this person benefits only from standard tax allowances, a function T(Y) showing his tax liability at each income level can be computed on the basis of the allowances and schedules that appear in tax legislation. This type of tax function is easy to use for the computation of the structural indices described in Section I. It would be difficult to use for computing summary measures of progressivity for the whole economy, because

the population contains a variety of income and household types. A particular criticism of this approach to definition of the tax-income relationship is that it may be misleading, because non-standard tax allowances may significantly reduce tax liabilities for persons or households with high incomes.

Another common but very different approach is based upon household income distribution statistics. Household survey data typically record gross income and tax payments for each household, and are frequently used to analyse progressivity in terms of summary statistics of inequality in the distributions of gross and net incomes (e.g., Sawyer, 1976, O'Higgins *et al.*, 1989, Rosenberg, 1989). A limitation of this approach is that the tax-income function derived from aggregate household income distribution data depends not only upon how tax varies with income, but also upon how tax varies by household type and any other household characteristics that may be correlated with income[9]. The second source of variation is normally regarded as affecting horizontal equity, rather than tax progressivity.

In the OECD data base described below, the tax-income function is based upon the actual tax liabilities of tax units, ordered by tax unit income and grouped into decile groups. As with household income distribution data, the tax-income function estimated from this type of data takes into account standard tax allowances (which in many cases depend upon family circumstances) as well as non-standard allowances (such as mortgage interest deductions).

B. The OECD data base

Methodology

The quality and amount of data required to make calculations of progressivity and related measures (such as effective tax rates at different income levels) – especially for the purpose of international comparisons – are demanding. Valid comparisons ideally require data for the same period, with the same coverage and using exactly the same units, classifications and definitions. The new OECD data base on the personal income tax base goes some way in satisfying these requirements and has thereby improved the possibilities of making international comparisons in this field of taxation. However, as shown below, a large number of problems still need to be resolved. For these reasons, the estimates provided in the following chapter must be seen as rough approximations rather than precise measures.

The data base contains detailed information on amounts of income, tax allowances, tax liabilities and tax credits within decile groups for seventeen countries. The data derives as a general rule from administrative tax files on individual taxpayers, though a few countries have supplemented with data from other sources.

The basic methodology applied in setting up the data base (for details, see OECD, 1990*b*) was influenced by three factors:

- All countries have data on taxable income, i.e., the income base to which schedule tax rates are applied;

- Data availability regarding broader definitions of income (e.g., income including allowances, exempt income, etc.) differs substantially between countries;
- The broader the income used, the better the comparability between countries (because, by definition, the broader the income concept, the less important are specific differences between country legislation).

This is why an "add-back" methodology was applied under which countries were first asked to supply data on taxable income, then to add to taxable income, all standard as well as non-standard tax allowances, then exempt types of income, etc. in order to arrive at the broadest possible income concept in each country. In practice nearly all countries are able to provide data on "income subject to tax" (see item 7 in Annex II), but very few on a wider income concept. Consequently, comparisons are generally made on the basis of income subject to tax. The process of adding-back gives in itself a good impression of the degree of comparability of the data, though a full picture requires additional information (see below).

The precise format of the data collected for the data base is given by a "standard classification" shown in Annex II and Annex III provides as an example the specific data for Spain. All information is provided in *decile groups* of tax units, i.e., data exist in the same distributional format for all 17 countries in the data base.

Caveats

A number of the remaining problems relating to data comparability are indicated in the summary table below, though these are not the only important limitations[10].

Table 1 clearly shows that the weight of income taxes differ substantially between countries, and so does the weight of income taxes relative to social security contributions which are not (for the time being) included in the scope of the data base (apart from those levied on an income tax base as in the Nordic countries). As the distribution of social security contributions within a country differs substantially from that of income taxes, the different tax structures among countries may have important implications for relative progressivity levels. This article focus thus only on the progressivity of income taxes, leaving aside the impact of other taxes[11]. The table also indicates a substantial variation in the weight of income taxes raised at subordinate levels of governments (which are within the scope of the data base), implying *inter alia* that governments have chosen different ways of financing lower levels of government – constituting another factor of potential importance for relative progressivity (and which may or may not be regarded as a caveat).

In addition to incomparabilities arising from structural differences, a number of more specific statistical problems reduce comparability. As can be seen from Table 1, the data refer to different years and – more important – the portion of the total adult population covered by the statistics differs as well. This poses a special

Table 1. **Aspects of tax systems and of data in data base**

Country	Income taxes and social security contributions as percentage of total taxes 1987			Statistical characteristics			
	Income tax		Social security contribution	Year	Coverage[a]	Tax unit	Classifier (income concept)[b]
	Central government	Subordinate government					
Australia	45.4	–	–	1985/86	93	Individual	Taxable
Austria	12.6	10.1	32.3	1982	71	Individual	Gross
Belgium	29.4	3.3	33.9	1987	83	Family	IST
Canada	24.2	14.5	13.3	1986	65	Individual	IST
Denmark	23.3	25.9	3.7	1987	104	Individual	IST
Finland	17.2	23.7	9.0	1985	105	Individual	Taxable
France	11.4	1.3	43.0	1985	..	Family	IST
Germany	11.6	17.4	37.3	1987	..	Joint	IST
Greece	12.3	..	32.6	1987	..	Individual	Taxable
Ireland	34.6	–	14.0	1985/86	43	Joint	IST
Italy	26.0	0.3	[illegible]	1985	..	Individual (joint is optional)	IST
Netherlands	19.7	–	42.7	1988	83	Individual	Taxable
Norway	5.5	16.3	23.7	1984	..	Joint (individual is optional)	IST
Spain	19.6	1.8	36.2	1987	..	Family	IST
Sweden	10.3	26.8	24.1	1987	..	Individual	IST
United Kingdom	26.6	–	18.1	1986/87	82	Joint (individual is optional)	IST
United States	29.8	6.4	28.8	1988	..	Joint	IST

a/ Per cent of total adult population covered.
b/ IST = Income subject to tax.
Source: "The personal income tax base: A comparative survey", OECD 1990.

problem for distributional analyses due to the fact that differences in coverage is mainly due to whether people with less than threshold income are included or not.

The tax unit differs among countries according to national tax legislation, as does the classifier (which is the income concept used to rank tax units in order to create decile groups) though as Table 1 shows in 12 out of the 17 countries it is income subject to tax. Although these are also factors with potentially important impact, in some empirical cases, examined below, the impact on progressivity estimates seems to be only moderate.

It is the general impression that whereas the factors mentioned are important in direct international comparisons especially of income distributions and income inequality, in this "second order" problem of comparing progressivity (i.e., *changes* in inequality), especially if the calculations are based on the Musgrave measure, these problems are more manageable, though still important.

III. RESULTS

A. Summary of measures[12]

The estimated progressivity measures are shown in Table 2 below. For brevity, the measures are called Musgrave, Kakwani and Suits, respectively. The table also shows estimated elasticities of tax with respect to income for each of the 17 countries[13].

Four general comments are worth making on these results, taking into consideration the comparability problems described above which imply that all results must be interpreted with considerable caution. First, all countries clearly have progressive income tax systems, whatever measure is applied.

Second, the different measures rank countries differently owing to the factors explained above. This is illustrated by United Kingdom and Sweden, the United Kingdom having substantially more "progressive" taxes than Sweden using the K and S measures which depend upon the percentage distribution of taxes across deciles, but the "less progressive" Swedish taxes having a greater impact on income distribution because taxes in Sweden on average are nearly twice as high as in the United Kingdom. It is thus important *a priori* to decide on the specific aspects of progressivity one wants to analyse.

Third, the results are in some cases extremely sensitive to how the tax system is "perceived" or "defined". In the case of Canada, for example, the existence of refundable tax credits (i.e., tax reliefs deducted from calculated tax liability and paid out to the taxpayer as a negative tax to the extent they exceed tax liability) makes the Canadian system by far the most progressive of the countries compared here. If the negative taxes resulting from these tax credits instead are defined as part of

Table 2. **Measures of progressivity**

Country	Musgrave		Kakwani		Suits		Estimated elasticity	
	Income subject to tax	Gross income	Income subject to tax	Gross income	Income subject to tax	Gross income	Income subject to tax	Gross income
Australia	1.08	1.08	0.28	0.30	0.45	0.47	2.00	2.04
Austria	1.04	1.04	0.23	0.23	0.39	0.39	2.15	2.19
Belgium	1.08	..	0.23	..	0.38	..	2.10	..
Canada[a]	1.15 (1.03)	1.09 (1.03)	-(0.37)	-(0.45)	0.82 (0.83)	0.84 (0.84)	1.98	3.35
Denmark	1.05	1.08	0.06	0.17	0.19	0.32	1.09	1.88
Finland	1.08	1.08	0.16	0.21	0.32	0.37	1.70	2.05
France	1.03	..	0.31	..	0.55	..	3.10	..
Germany	1.05	..	0.24	..	0.56	..	2.20	..
Greece	1.04	..	0.25	..	0.44	..	1.99	..
Ireland	1.08	..	0.30	..	0.53	..	2.74	..
Italy	1.03	..	0.09	..	0.21	..	1.09	..
Netherlands	(1.05)	..	(0.27)	..	0.51	..	2.70	..
Norway	1.07	..	0.15	..	0.27	..	1.63	..
Spain	1.04	..	0.26	..	0.43	..	2.46	..
Sweden	1.08	..	0.13	..	0.24	..	1.58	..
United Kingdom	1.06	..	0.39	..	0.72	..	3.05	..
United States	1.03	1.04	0.09	0.37	0.66	0.78	0.57	3.28

a/ Numbers in parentheses show the effect of reallocating refundable tax credits from negative taxes to income subject to tax and gross income.

Notes: The measures shown indicate the level of progressiveness as follows:

	Progressive	Proportional	Regressive
Musgrave	Higer than 1	1	Lower than 1
Kakwani	Positive	0	Negative
Suits	Positive	0	Negative

Source: "The personal income tax base: A comparative survey", OECD 1990.

income (and many of these credits are, in fact, given as social transfers in other countries), this effect would be taken out of the tax system, and progressivity (at least judged on the Musgrave measure) would fall back to a more "normal" level (see numbers in parentheses in Table 2).

Fourth, as expected, the ranking of countries according to estimated elasticities corresponds *in broad terms* to the ranking implied by the Kakwani measure. The main reasons why the correspondence is not perfect are that tax is not an exact constant-elasticity function of income, and that the regression procedure implies a system of weighting across deciles which differs from the inequality measures.

The Gini coefficients shown in Annex IV (see data for Denmark and the United States) seem to indicate that changes in other important "structural" factors such as the tax unit or the classifier used to define the decile distribution generally lead to changes in the pre-tax and post-tax Gini coefficients in the same direction, so that there is no clear indication of a systematic bias in the progressivity measures associated with differences in the tax units used by different countries.

B. Determinants of progressivity

The new data base presented above has a number of potential applications. The results presented below should be considered primarily as *examples of possible calculations* relevant to the question of income tax progressivity rather than precise estimates of the factors in question. The first example in this section focuses on the relative importance of the rate schedule compared with other factors, the second example concerns the impact on progressivity of interest expenditure deductibility.

The progressivity effects of allowances and the rate schedule

Generally, there are three main types of determinants of income tax progressivity:

i) The way taxable income is calculated by the deduction of tax allowances from broader income concepts;
ii) The progressive tax rate schedule applied to taxable income;
iii) The structure of tax credits, i.e., tax reliefs deducted, not from income, but from tax liability.

In principle, a certain progressivity effect may be obtained using any of these determinants. For example, an identical impact on progressivity may be obtained either by the use of a basic allowance or by a zero rated first bracket (similarly, a given result may be obtained by the substitution of an allowance with a tax credit). Comparisons between countries must, therefore, take into account all three determinants.

There are also important differences between the three types of progressivity determinants. A number of countries have, for example, substituted tax credits for

Table 3. **Determinants of progressivity**

Country	Split	
	Income subject to tax	Gross income
Australia	39	43
Austria	17	19
Belgium	66	..
Canada	70 (73)	77 (78)
Denmark	-20	54
Finland	42	56
France	13	..
Germany	23	..
Greece	14	..
Ireland	98	..
Italy	40	.
Netherlands	5	..
Norway	21	21
Spain	-1	..
Sweden	96	..
United Kingdom	84	..
United States	16	79

Source: "The personal income tax base: A comparative survey", OECD 1990.

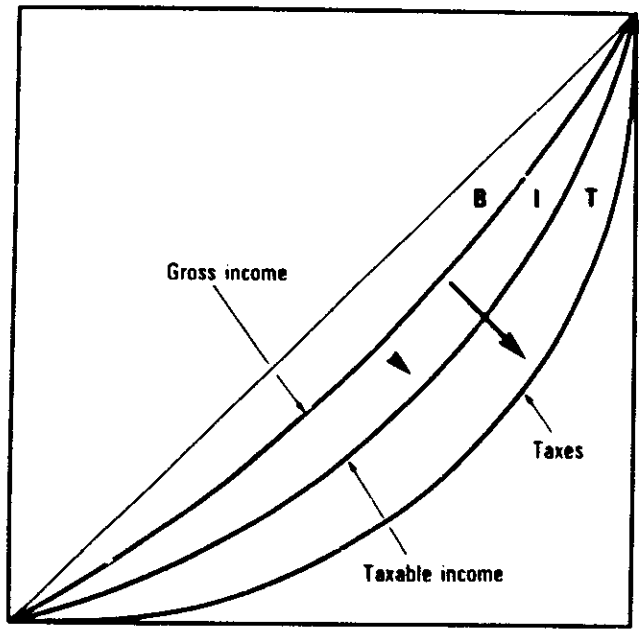
allowances in order to give tax reliefs of the same value to all taxpayers, independently of their income. It could be held that the progressive tax rate schedule is a more transparent component than the two others, and that it is an exogenous parameter for the individual taxpayer, whereas tax allowances and credits are to varying extents endogenously determined by the saving, investment and expenditure and marriage decisions of taxpayers.

Table 3 attempts to quantify the relative importance of the different determinants of progressivity mentioned above. As a simplifying assumption, tax credits have been treated as part of the rate schedule[14]. The method could, however, relatively easily be extended to cover all three determinants independently.

The table shows estimates of a measure called "SPLIT", which is explained in Chart A. Lorenz curve B describes the distribution of a "broad" measure of income such as gross income. Lorenz curve I illustrates the distribution of taxable income. Lorenz curve T illustrates the distribution of final net tax liabilities. The increase in the Gini coefficients from curve B to T may be interpreted as the total progressivity effect of the tax system. The percentage proportion of this total progressivity effect that can be ascribed to the way taxable income has been defined (i.e., the movement from B to I), is called SPLIT. The remaining part of the total progressivity effect (i.e., 100-SPLIT) may be attributed to the progressive rate scale, including the effect of tax credits. This measure therefore estimates the relative significance of the two

CHART A

THE MEASURE SPLIT



main sources of progressivity: the definition of taxable income through exemptions and allowances and the progressive rate schedule (including tax credits).

Table 3 indicates that countries have chosen very different ways of achieving progressivity in their tax systems. When income subject to tax is taken as the broad income concept, the portion of total progressivity attributable to the way taxable income is "defined" ranges from –20 per cent in Denmark (indicating that tax allowances are regressive) to almost 100 per cent in Ireland and Sweden (indicating that the tax rate schedule makes a negligible contribution to progressivity).

The impact of interest deductibility on progressivity

The calculations of SPLIT in Table 3 group together both standard and non-standard tax allowances. In almost all countries, standard allowances are progressive in the sense that the lower the income the greater the proportion they represent of it. Thus, it is of interest to examine separately the impact on progressivity of non-standard allowances, which are generally regressive. Table 4 shows standard and non-standard allowances as a percentage of income subject to tax for the five countries with the highest non-standard allowances. For the four countries with more detailed information, the deduction of interest expenditure from income is the most important non-standard allowance. Tax credits are only of major importance in Denmark, where they have a very clear progressive impact.

With the exception of Sweden, these four countries have relatively low values of SPLIT, i.e., a low proportion of total progressivity may be ascribed to tax allowances in general. Table 5 examines the degree to which the rather low progressivity of tax allowances may be attributed to interest deductibility.

Table 4. Allowances and tax credits as percentage of income subject to tax

Country	Standard allowances	Non-standard allowances	*Of which:* Interest expenditure	Tax credits	Split*
Denmark	1.8	21.6	15.7	10.8	-20
Germany	7.1	17.6	..	..	23
Norway	8.4	18.0	13.7	1.2	21
Sweden	13.3	12.4	7.5	0.3	96
United States	26.3	14.5	6.0	0.3	16

* Measured on income subject to tax.

Note: The percentage for allowances and tax credits cannot be directly compared as the former are deductions in income and the latter deductions in taxes.

Source: "The personal income tax base: A comparative survey", OECD 1990.

Table 5. Effects on progressivity of interest deductibility

Country	Musgrave		Kakwani		Suits		Split	
	With interest deductibility	Without interest deductibility	With interest deductibility	Without interest deductibility	With interest deductibility	Without interest deductibility	With interest deductibility	Without interest deductibility
Denmark								
Income subject to tax	1.05	1.10	0.06	0.19	0.19	0.50	-20	75
Gross income	1.08	1.10	0.17	0.29	0.32	0.57	54	84
Norway								
Income subject to tax	1.07	1.08	0.15	0.20	0.27	0.38	21	21
Gross income	..	..	..	..	..	..	..	..
Sweden								
Income subject to tax	1.08	1.08	0.13	0.13	0.24	0.26	96	95
Gross income	..	..	..	..	..	..	..	..
United States								
Income subject to tax	1.03	1.03	0.09	0.09	0.66	0.69	16	15
Gross income	1.04	1.04	0.37	0.37	0.78	0.78	79	78

Source: "The personal income tax base: A comparative survey", OECD 1990.

In calculating this effect it has been assumed that the broadening of the tax base is off-set by a revenue neutral and proportional reduction in tax rates across deciles in terms of percentage points of income.

Abolition of interest deductibility would, *ceteris paribus,* imply an increase in progressivity in Denmark according to all the measures shown (though the Musgrave measure for gross income shows only a modest increase) whereas the impact is more limited in Norway and almost non-existent in the other countries.

Qualifications are required, however. First, for reasons indicated above, all results from these data should be interpreted with caution. Second, the method of Table 5 does not take any behavioural reaction into account. The impact incidence calculated here will differ from the final incidence. Third, it could be held that abolition of interest deductibility is only one side of the coin and that a fully neutral treatment of capital income would also include abolition of capital income taxation. For example, some countries allowing interest deductibility have taxes on imputed rent and if these were abolished together with interest deductibility, this would almost certainly moderate the calculated impact on progressivity. This idea has, however, not been pursued further here[15].

C. Use of standard income distribution

Another important aspect of the progressivity measures presented here is their possible sensitivity to changes in pre-tax income inequality. This is examined in

Table 6. **Sensitivity of progressivity a to pre-tax income inequality**

Country	Musgrave		Kakwani		Suits	
	Actual income distribution	Standard income distribution	Actual income distribution	Standard income distribution	Actual income distribution	Standard income distribution
Denmark						
Income subject to tax	1.05	1.08	0.06	0.18	0.19	0.42
Gross income	1.08	1.08	0.17	0.26	0.32	0.49
Norway						
Income subject to tax	1.07	1.06	0.15	0.11	0.27	0.30
Gross income	..	..	..	..	..	..
Sweden						
Income subject to tax	1.08	1.07	0.13	0.10	0.24	0.27
Gross income	..	..	..	..	..	..
United States						
Income subject to tax	1.03	1.03	0.09	0.25	0.66	0.65
Gross income	1.04	1.04	0.37	0.29	0.78	0.61

Source: "The personal income tax base: A comparative survey", OECD 1990.

Table 6 which shows the impact on the different measures of "superimposing" each country's tax system on a standard pre-tax income distribution.

Columns with actual income distributions repeat the statistics of Table 2. Columns with standard income distributions have been computed by applying actual ratios of taxable income to income subject to tax within deciles to the German pre-tax distribution, resulting in calculated distributions of taxable income in the four countries. Similarly, the actual ratios of tax to taxable income were applied to the calculated taxable income within deciles. The calculation has been made at the level of broad aggregates and will certainly differ from a situation where the different tax systems are applied on a detailed individual basis.

However, the Table indicates that the measures all are to some extent affected by the structure of the pre-tax income distribution. The least affected seems to be the Musgrave index applied to gross income, though the limited size of the sample of countries does not allow strong conclusions to be drawn.

CONCLUSIONS

The OECD "Income Subject to Tax" data base opens up new possibilities for making international comparisons of effective personal tax rates at different income levels. Though a number of conceptual and statistical problems remain – some of which will be resolved in future work with the data base – the preliminary analyses on the basis of the information given here have revealed interesting similarities and differences in the ways governments have designed income tax systems, not only in terms of the level of global progressivity obtained, but also the ways in which this level is achieved.

NOTES

1. A substantial number of tax reforms have been implemented in OECD countries since the mid-eighties in which in almost all cases efficiency considerations have played a crucial role, sometimes at the expense of vertical equity considerations (for an overview of these reforms, see OECD, 1990*a*, and Hagemann *et al.*, 1988). The main strategy has been removal of distortions through broadening of the tax base combined with rate reductions. In a number of cases, these changes have had important impact on the progressivity of income tax systems though the combined effect of flattened tax rate schedules and more broad tax bases on the structure of effective tax rates may be difficult to assess (in the case of the impact of the US tax reform, see for example Koppelman, 1985, and Pechman, 1990).
2. "The Personal Income Tax Base: A Comparative Survey", OECD (1990).
3. Space limitations do not allow a full overview of all existing progressivity measures. For a summary, see for example Kiefer (1984).
4. Strictly speaking, the concentration curve is a more general concept of which the Lorenz curve is only a special case, see for example Kakwani (1977).
5. Kiefer (1984) provides a numerical example for the constant elasticity tax function T(Y) equal to bY^c that shows how redistribution indexes are affected by the value of b whereas tax-scale invariant measures are not.
6. Kakwani (1976), p. 72, for example, considers that a measure of tax progressivity should show the deviation of a tax system from proportionality (i.e., from unit elasticity). However, tax-scale invariant measures as a group have been criticised for their alleged lack of relevance to the policy objectives of taxation according "ability to pay" and equalisation of the distribution of income (Kiefer, 1984). Pfähler (1987) prefers a multidimensional concept of tax progressivity. In his view, single index numbers will not be sufficient to portray all relevant features, and a multidimensional approach (e.g., pragmatic comparisons between concentration curves with checks for crossings, the use of several measures of concentration) is indispensable.
7. Keifer (1984), p. 500, calls the weighting system implied by the Gini coefficient "ethically perverse". Atkinson (1970) argued for explicit parameterisation of the welfare aspects of inequality measures in terms of the "equally distributed equivalent" level of income Yede, defined as the level of mean income which, equally distributed, would provide the same level of social welfare as the actual mean income Y*:

$$I = 1 - \frac{Yede}{Y^*} \qquad [6]$$

   Assuming the social welfare function to be separable, symmetric, increasing, concave and characterised by constant inequality aversion, a single class of inequality measures emerges, and this has in a few cases been used as the basis for tax progressivity measures.
8. Many theoretically derived inequality measures are extremely sensitive to the distribution of very low incomes and indeed take infinite values in the presence of zero or negative incomes,

which are common in empirical data. The Gini coefficient is relatively robust, being defined even in the presence of negative incomes. The sensitivity of the measures to incomplete coverage of the population, which is documented in Table 1, is also a relevant consideration. The progressivity measures M and S are unaffected by the exclusion of tax units which have zero income and pay zero tax, but such omissions do affect the K measure.

9. In the household income distribution approach a tax system where the average tax rate rises uniformly with income for all household types may be judged regressive. This could occur if married couples typically have both higher incomes and higher personal tax allowances than single persons, and the average tax rates on high-income households (which are mainly married couples) are lower than on low-income households (which are mainly single persons).

10. For a more systematic exploration of limitations to comparability, see OECD (1990*b*), Chapter 2, which as important additional problems of comparability mentions differences in the way specific income concepts are defined and measured in each country, differences in the treatment of negative income, differences in the way countries provide the basic tax relief and differences in the degree of tax evasion among countries.

11. Employee social security contributions are frequently analysed together with personal income taxes (as in the annual OECD publication, *The Tax/Benefit Position of Production Workers*). Studies of tax progressivity based upon income distribution data may also consider employer payroll taxes, sales taxes and corporation taxes. This involves explicit assumptions about the incidence of these taxes on households with different income levels. Bourguignon and Morrison (1980) estimate for Canada, France, the United Kingdom and the United States that in terms of the impact on the income distribution, the impact of social security contributions is smaller than that of the income tax. However, sales and property taxes have a large regressive effect. They also estimate that government spending (on social security, education, roads, health and housing) has a much greater redistributional impact than taxation does.

12. The estimated Gini coefficients which form the basis of the progressivity measures reported in this section are shown in Annex IV together with two alternative inequality indexes.

13. Estimated on the basis of a simple constant elasticity function for all 17 countries. The functional form is:

$$T(Y_i) = bY_i^c \quad \text{for } i = 1, 2, 3, \ldots, 10 \qquad [7]$$

where T is tax per tax unit in each decile, Y is average income in each decile and b and c are parameters where c is the tax elasticity.

14. The treatment of tax credits as part of the rate schedule is clearly an approximation, since not all taxpayers with the same taxable income get the same amount of tax credits. However, in the majority of countries which have provided data, tax credits are of a relatively modest size (i.e., around 1 per cent or less of income subject to tax). The four countries with more substantial amounts of tax credits are Belgium (3.3 per cent), Denmark (10.8 per cent), Italy (3.8 per cent) and Spain (5.9 per cent). Also important in this context, tax credits have a systematic progressive effect, and in this sense they tend to reinforce the effect of the progressive tax schedule.

15. OECD (1990*b*), Chapter 6, describes the distribution of capital income across decile groups in the 17 countries covered by the report.

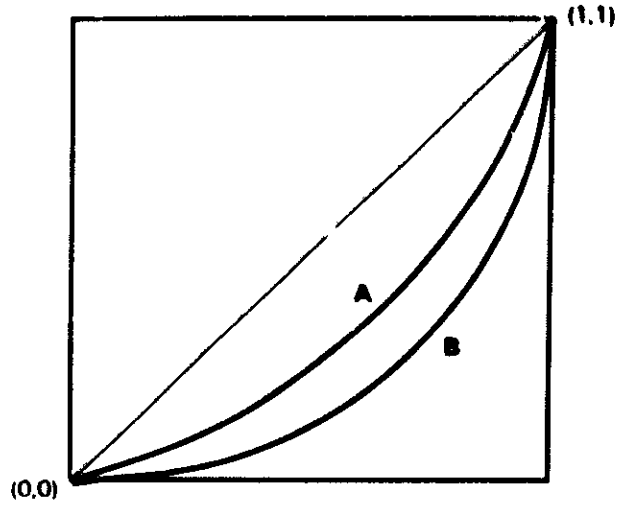
Annex I

THE LORENZ CURVE, THE GINI COEFFICIENT AND ITS ESTIMATION

Let U(y) represent the proportion of units that receive an income lower than or equal to y and I(y) represent the proportion of total income received by the same units. The Lorenz curve is then the graphical representation of the parametric relationship between I and U. The graph of the curve may be represented in a unit square, see Charts below which illustrates two different income distributions, A and B. The straight line joining the points (0,0) and (1,1) is called the egalitarian line, because along this line U equals I, which means that each unit receives the same income. The Lorenz curve falls below the egalitarian line.

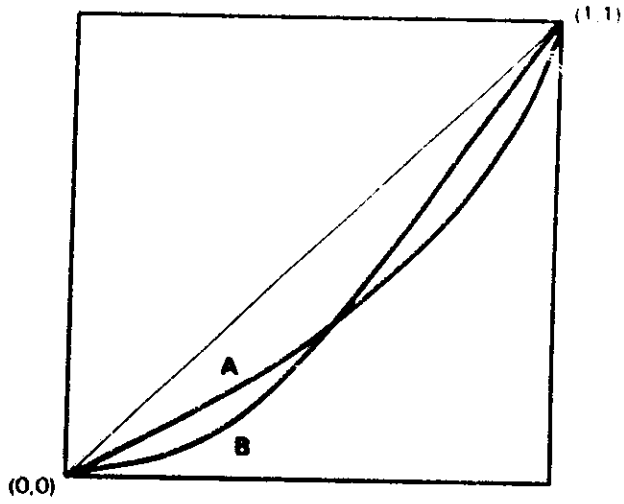
In the case of the two curves which have been drawn in Chart A.1.1, it is reasonably safe to say that income distribution represented by Lorenz curve A is "less unequal" than that represented by curve B since the lowest x per cent of households has a higher share of income under regime A than under regime B, for all values of x (between 0 and 100).

CHART A.1.1



Problems occur when the Lorenz curves of two distributions intersect, as in Chart A.1.2, where in A both the poorest and the richest have a lower share of total income than in B. A particular measure of inequality will give an answer to the question of whether A or B has the less-unequal distribution, but the measure must weight the shares in income of the households in a particular way. If the shares accruing to the poorest were stressed, the B income distribution would be seen as less unequal, whereas if the shares of the richest were stressed it would be the A income distribution. This is essentially a value judgement.

CHART A.1.2



Atkinson (1970) showed that the ranking of income distributions according to the Lorenz curve is identical with the ranking implied by aggregate economic welfare, regardless of the form of the individual welfare function (except that it must be increasing and concave), provided the Lorenz curves do not intersect. However, if the Lorenz curves do intersect, two functions that will rank the distributions differently can always be found.

Because of this, many studies make use of more than one measure (see Sawyer, 1976, and OECD, 1990*b*, for details of different measures). The mathematics of the Gini coefficient, its relation to other inequality measures and its estimation is dealt with in Berrebi and Silber (1987) who *inter alia* show that the Gini index belongs to the family of relative mean deviations. Most measures satisfy the so-called "Pigou-Dalton" condition that a transfer of income from the relatively rich to the relatively poor must cause a decrease in inequality.

One definition of the Gini coefficient is 1 minus the ratio of the area under the Lorenz curve to the area under the egalitarian line. A formula is:

$$G = \frac{1}{2N^2\bar{x}} \sum_{i=1}^{N} \sum_{j=1}^{N} |y_i - y_j| \qquad [8]$$

where N is the number of households, x the arithmetic mean of household income, and y_k the income of the kth household. An alternative formulation is:

$$\frac{1}{N} \sum_{i=1}^{N} [N - 2_i + 1]s_i \qquad [9]$$

where s_k is the share in total income of the kth household, with s_1 bigger than s_2 bigger than s_3 bigger than s_N. These definitions of the Gini coefficient indicates that stress is placed on the absolute differences in income between households, rather than the proportionate differences, and that a transfer of income from one household to another (all other things remaining the same) will change the Gini coefficient by (j–k) times 2/N times the share of income transferred from household j to household k. It can also be seen that the Gini coefficient will increase, indicating an increase in inequality, if j is larger than k, which arises when the share s_j is less than the share s_k. Finally, a transfer of a given amount of income from the very richest equally to everyone else would have the same impact as a transfer of an equal amount from everyone to the poorest, even though the change in income will add proportionately much more to the poor than it subtracts from the rich.

Estimation of the Gini coefficient using data grouped into deciles requires the use of an interpolation or "curve-fitting" procedure. Kakwani and Podder (1973, further developed in 1976) found that the following functional form gives a good fit to many empirical Lorenz curves.

$$I(x) = U(x)e^{-b(1-U(x))} \quad \text{for } b > 0 \qquad [10]$$

where U(x) represents the proportion of units that receive income up to x and I(x) represents the proportion of total income received by the same units whereas b is a parameter. Assuming this functional form for the Lorenz curve, the Gini coefficient (or concentration ratio) is:

$$G = 1 - 2\frac{(b-1)}{b^2} - \frac{2e^{-b}}{b^2} \qquad [11]$$

The parameter b can be estimated from the linear relation:

$$\log\frac{q(x)}{p(x)} = -b(1-p(x)) + w \qquad [12]$$

where q and p are the empirical representations of the functions I and U respectively and w is assumed to be a random disturbance term. Under this assumption, the least squares estimator of b is asymptotically unbiased and consistent. This estimator for the Gini coefficient is used in the OECD report (1990*b*).

The problem of *negative incomes* in relation to estimation of Gini coefficients has also been dealt with in the literature, see Chen (1982). This problem arises when using the Kakwani-Podder formula and has been dealt with here by merging the negative and positive incomes in the first decile. It should be emphasised that the use of these "curve-fitting" techniques entail a certain level of imprecision in the estimated Gini coefficients. One reason is the relative modest number of observations. Another is the fact that the use of linear regression implies that "extreme" observations carry a relatively high weight and thus influence the results more heavily than observations around the average.

Annex II

INCOME SUBJECT TO TAX UNDER THE PERSONAL INCOME TAX STANDARD CLASSIFICATION

Amounts in national currency within each decile group

1. Length of income classes
2. Number of tax units in classes
3. Amount of taxable income
4. Standard allowances
   - 4.1 Non-income related standard allowances
     - 4.1.1 Basic allowances
     - 4.1.2 Work related expenses
     - 4.1.3 Family and age related allowance
     - 4.1.4 Social security contributions
     - 4.1.5 Other standard allowances
   - 4.2 Income related standard allowances
     - 4.2.1 Basic allowances
     - 4.2.2 Work related expenses
     - 4.2.3 Family and age related allowances
     - 4.2.4 Social security contributions
     - 4.2.5 Other standard allowances
5. Taxable income plus standard allowances
6. Non standard allowances
   - 6.1 Transport and other work related expenses
   - 6.2 Social security contributions
   - 6.3 Insurance expenditures
   - 6.4 Mortgage interest expenditures
   - 6.5 Other interest expenditures
   - 6.6 Partly exempt income
   - 6.7 Other non-standard allowances
7. Income subject to tax (5+6) divided into:
   - 7.1 Employment income
   - 7.2 Fringe benefits
   - 7.3 Business income
   - 7.4 Interest income
   - 7.5 Dividend income
   - 7.6 Other investment income
   - 7.7 Rent income
   - 7.8 Imputed rent
   - 7.9 Public pensions
   - 7.10 Private pensions, annuities and life assurance
   - 7.11 Social transfers
   - 7.12 Alimony and maintenance receipts
   - 7.13 Capital gains
   - 7.14 Other income sources
8. Exempt income
   - 8.1 Interest income
   - 8.2 Social transfer
   - 8.3 Fringe benefits
   - 8.4 Capital gains
   - 8.5 Other exempt types of income
9. Gross income (7+8)
10. Other income items
    - 10.1 Illegally non-reported income
    - 10.2 Other income items
      - 10.1.1 Positive income items
      - 10.2.2 Negative income items
11. Total income (9+10)
12. Total amount of taxes
    - 12.1 Central government taxes
    - 12.2 State/Regional government taxes
    - 12.3 Local government taxes
13. Amount of tax credits
    - 13.1 Standard tax credits
      - 13.1.1 Income related
      - 13.1.2 Non-income related
    - 13.2 Non-standard tax credits
      - 13.2.1 Income related
      - 13.2.2 Non-income related
14. Final net tax liabilities (12-13)
    - 14.1 Central government taxes
    - 14.2 State/Regional taxes
    - 14.3 Local government taxes

Source: "The personal income tax base: A comparative survey", OECD 1990.

Annex III

INCOME SUBJECT TO TAX BASIC DATA

SPAIN 1987

	1. Decile -Income	1. Decile +Income	2. Dec.	3. Dec.	4. Dec.	5. Dec.	6. Dec.	7. Dec.	8. Dec.	9. Dec.	10. Dec.	Total
Length of income classes		483559	297827	188147	171990	206925	238810	310453	478573	944851		3321135
Number of tax units	29000	773595	802595	802595	802595	802595	802595	802595	802595	802595	802595	8025950
Amount of taxable income	-12331	210267	491861	667032	783856	924612	1086224	1277318	1581765	2007539	4199631	13217774
Standard allowances, total	82	5766	19521	35133	44833	55289	69112	85094	104457	125306	183404	727977
Non-income related:												
Basic allowances												
Work related expenses												
Family and age related												
Social security contribution												
Other standard allowances												
Income related:												
Basic allowances												
Work related expenses	16	1492	5912	10738	13466	16235	19741	23669	29166	35807	57553	213795
Family and age related												
Social security contribution	46	4274	13609	24395	31367	39054	49371	61425	75291	89499	125581	514182
Other standard allowances												
Taxable income and standard allowances	-12269	216033	511382	702165	828689	979901	1155336	1362412	1686222	2132845	4383035	13945751
Non-standard allowances, total	1193	3422	5446	9559	12042	15622	21592	30242	39499	50517	112892	302026
Transport and other work rel.												
Social security contribution												
Insurance expenditures												
Mortgage interest	0	1675	4942	8567	11212	14243	19791	25383	34592	45086	83230	248721
Other interest												
Partly exempt income												
Other non-standard allowances	1193	1747	504	992	830	1379	1801	4859	4907	5431	29662	53305
Income subject to tax, total	-11075	219455	516828	711723	840731	995524	1176928	1392653	1725721	2183363	4495929	14247780
Employment income	804	76074	299892	541277	677491	815659	989346	1186759	1462413	1793877	2885706	10729298
Fringe benefits												
Net business income	-35132	88606	162339	116133	105546	110410	111335	115223	142587	208516	740149	1865712
Interest income	399	23483	33605	31937	34035	40956	44611	52211	67080	94459	400503	823259
Dividend income												
Other investment income												
Rent income	17	9401	19035	20348	21473	24724	28124	32154	43131	63647	190497	452551
Imputed rent												

Public pensions												
Private pensions, annuities and life assurances												
Social transfers												
Alim. and maint. receipts												
Capital gains	22 878	21 849	1 462	1 616	1 582	3 121	2 853	5 408	8 689	19 610	251 219	340 287
Other income sources	-41	62	495	412	604	854	859	898	1 821	3 254	27 855	36 873
Exempt income, total												
Interest income												
Social transfers												
Fringe benefits												
Capital gains												
Other exemp income												
Gross income	-11 076	219 455	516 827	711 724	840 731	995 523	1 176 928	1 392 654	1 725 721	2 183 364	4 495 928	14 247 779
Other income items, total												
Illegally non-rep. incomes												
Other items, positive												
Other items, negative												
Total income	-11 076	219 455	516 827	711 724	840 731	995 523	1 176 928	1 392 654	1 725 721	2 183 364	4 495 928	14 247 779
Total amount of taxes	0	14 269	47 165	83 177	113 536	156 135	200 135	245 637	320 018	434 407	1 291 845	2 906 324
Central government	0	14 269	47 165	83 177	113 536	156 135	200 135	245 637	320 018	434 407	1 291 845	2 906 324
State/regional												
Local government												
Tax credits, total	0	13 594	39 908	57 425	64 617	70 537	75 591	81 383	93 090	113 192	232 010	841 347
Standard, incomes related	0	0	3	74	212	314	504	1 082	2 866	8 384	41 152	54 591
Standard, non-incomes related	0	13 510	39 019	54 590	59 625	62 402	64 558	66 848	70 420	75 901	83 928	590 801
Non-standard, incomes related	0	9	90	222	233	370	513	734	1 373	2 110	18 115	23 769
Non-standard, non-incomes related	0	75	796	2 539	4 547	7 451	10 016	12 719	18 431	26 797	88 815	172 186
Total net taxes	0	675	7 257	25 572	48 919	85 598	124 543	164 254	226 928	321 215	1 059 834	2 064 975
Central government	0	675	7 257	25 572	48 919	85 598	124 543	164 254	226 928	321 215	1 059 834	2 064 975
State/regional												
Local government												

Source: "The personal income tax base: A comparative survey", OECD 1990.

Annex IV

ESTIMATED GINI COEFFICIENTS FOR VARIOUS INCOME CONCEPTS AND ALTERNATIVE INEQUALITY MEASURES

Country	Gini coefficients						Theil			Variance of logs		
	Taxable income	Income subject to tax	Gross income	Income minus taxes [1]	Income minus taxes [2]	Net taxes	Taxable income	Income subject to tax	Gross income to tax	Taxable income	Income subject	Gross income
Australia	0.48	0.37	0.35	0.32	0.30	0.65	0.27	0.20	0.18	1.38	0.71	0.69
Austria	0.44	0.40	0.39	0.38	0.37	0.63	0.25	0.22	0.21	0.96	0.71	0.69
Belgium	0.54	0.39	..	0.34	..	0.61	0.32	0.23	..	2.64	0.67	..
Canada[3]	0.80	0.46(0.53)	0.57(0.45)	0.51(0.51)	0.42(0.42)	– (0.88)	0.59	0.38(0.37)	0.32(0.31)	29.15	2.67(1.86)	1.06(0.74)
Denmark[4] *a)*	0.56	0.58	0.47	0.55	0.43	0.64	0.27	0.31	0.28	30.96	3.39	1.19
b)	0.43	0.45	0.41	0.42	0.37	0.56	0.24	0.29	0.27	0.90	1.00	0.74
c)	0.53	0.53	0.51	0.49	0.48	0.67	0.26	0.30	0.30	2.40	2.03	1.78
Finland	0.53	0.46	0.41	0.42	0.37	0.63	0.39	0.27	0.24	1.67	1.13	0.77
France	0.46	0.42	..	0.40	..	0.73	0.34	0.30	..	1.00	0.76	..
Germany	0.60	0.55	..	0.52	..	0.79	0.44	0.37	..	3.41	2.16	..
Greece	0.44	0.41	..	..	..	0.65	0.33	0.25	..	0.93	0.75	..
Ireland	0.73	0.43	..	0.39	..	0.73	0.49	0.25	..	11.47	0.88	..
Italy	0.52	0.48	..	0.47	..	0.58	0.27	0.27	..	2.26	1.51	..
Netherlands	0.46	0.44	..	0.42	..	0.72	0.27	0.27	..	1.06	0.93	..
Norway	0.48	0.45	..	0.42	..	0.60	0.29	0.28	..	1.33	1.10	..
Spain	0.40	0.40	..	0.37	..	0.66	0.28	0.28	.	0.70	0.70	..
Sweden	0.59	0.47	..	0.42	..	0.59	0.31	0.24	..	3.31	1.24	..
United Kingdom	0.78	0.45	..	0.42	..	0.84	0.56	0.30	..	27.12	0.96	..
United States[4] *a)*	0.80	0.79	0.51	0.78	0.49	0.88	0.82	0.64	0.46	18.14	16.59	1.35
b)	0.70	0.82	0.45	0.82	0.43	0.86	0.56	0.59	0.35	6.88	16.23	0.95
c)	0.61	0.72	0.50	0.72	0.49	0.63	0.59	0.47	0.37	2.73	16.16	1.44

1. Income subject to tax minus taxes.
2. Gross income minus taxes.
3. Numbers in parentheses show the effect of reallocating refundable tax credits from negative taxes to income subject to tax and gross income.
4. The three sets of s correspond to *a)* basic data, *b)* tax unit changed to family, *c)* classifier changed to gross income.

Source: "The personal income tax base: A comparative survey", OECD 1990.

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