Session 1

TAXATION AND THE LABOUR MARKET

LABOUR TAXATION IN THE EUROPEAN UNION. CONVERGENCE, COMPETITION, INSURANCE?

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Introduction

The EU total tax burden, which expresses total tax revenues in terms of GDP, recorded a level above 41 per cent in 2002 (see Figure 1).[1] This is, for instance, 13 percentage points higher than in the US (28 per cent). Moreover, such a figure for the EU at the beginning of the 21st Century sharply contrasts with that observed thirty years ago. In 1970, the total tax burden for the EU as whole was only slightly higher than 33 per cent, while the figure for the US was close to 27 per cent. Therefore, over the last three decades, total tax revenues in the EU have increased by 8 percentage points of GDP,[2] but by only 1 point in the US.

The differences between the EU and the US in terms of labour taxes are also striking. To understand the size of labour taxes in the EU and their evolution compared with our main economic partners, it is useful to follow the common distinction of classifying taxes into taxes on labour, capital and consumption.[3] Tax revenues obtained from labour income (social security contributions plus personal income taxes on labour income) in the EU represent 22 per cent of GDP. In the US they amount to only 14 per cent of GDP (15 per cent in Japan). Moreover, since labour tax revenues in the EU represented 16 per cent of GDP in 1970, ¾ of the 8 percentage points increase in the total tax burden over the last three decades has been financed by labour taxes. As a result, while the tax burden on labour income (labour tax revenues expressed in terms of gross wages – see section 2) in the EU amounted to 26 per cent in 1970, the figure was close 37 per cent in 2002, which contrasts with 23-24 per cent in the US and Japan (see section 2).

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This paper very much relies of two previous drafts by the author. The first one is a mimeo paper entitled *"Computing the Average Effective Tax Wedge on Labour"* which, in turn, is an update of Martinez-Mongay (2000). The second one is Huizinga and Martinez-Mongay (2001). I want to thank comments from participants at the Banca d'Italia Workshop. I particularly acknowledge fruitful discussions with and help by Lucio Pench. The findings, interpretation, and conclusions expressed in this paper are entirely those of the author and should not be attributed to the European Commission.

[1] The figures presented in this paper are based on Commission's Economic Forecasts of Spring 2003 (European Commission, 2003).

[2] Comparisons of the EU with Japan are also remarkable. Although the tax burden in the latter country has increased by 8 percentage points, at 19 per cent of GDP in 1970, the starting level was very low by EU standards and still remains low thirty years after (28 per cent in 2001).

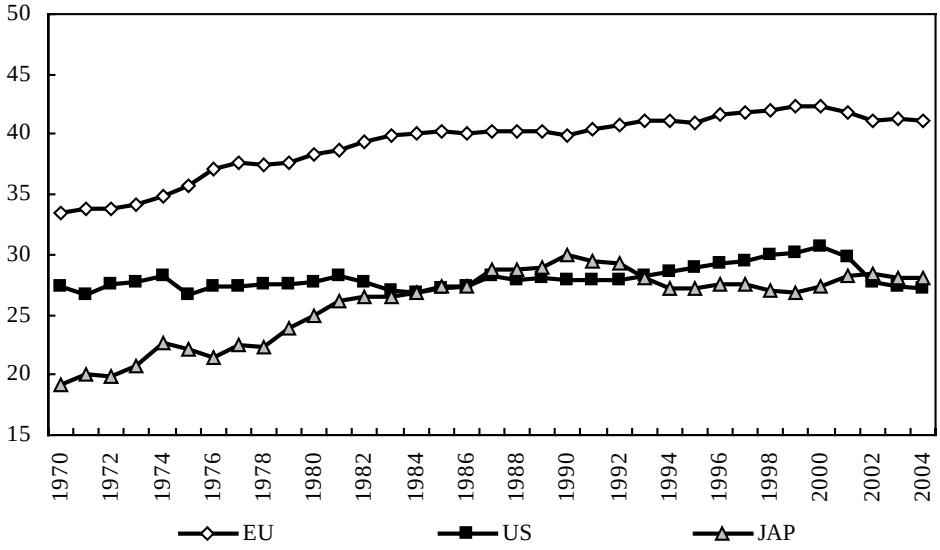
[3] Section 1 below, following Mendoza, Razin and Tesar (1994), Martinez-Mongay (2000) and European Commission (2000a), explains the criteria used to decompose total taxes into labour, capital and consumption taxes.

Figure 1

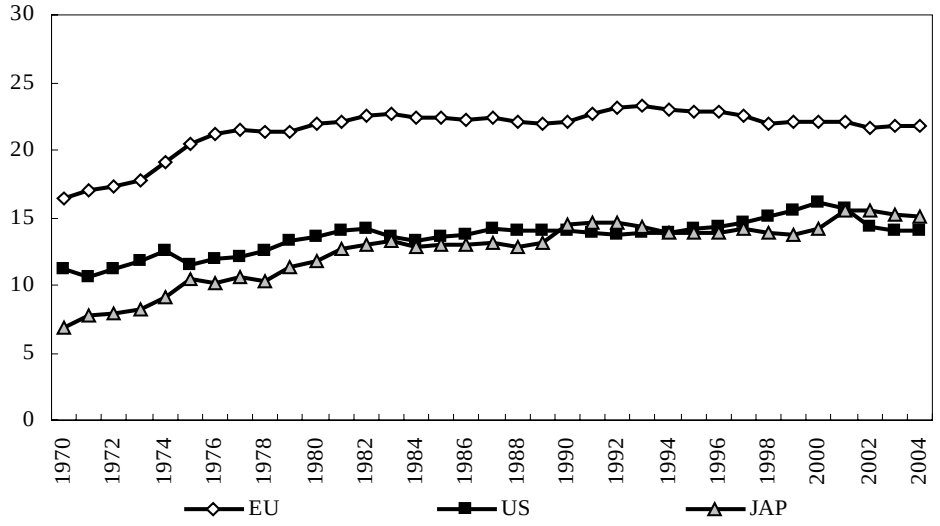
Total Tax Burdens and Labour Tax Revenues in the EU, the US and Japan, 1970-2004

(percent of GDP)

Panel I. Total Tax Burden



Panel II. Labour Tax Revenues



Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

The observed increase in the tax burden on labour sharply compares with the developments observed in capital and consumption taxes. In the EU, the tax burden on capital increased only by 3 percentage points (from 19 per cent to 22 per cent) between 1970 and 2002, while that on consumption remained practically unchanged at 20 per cent. In the other side of the Atlantic, the tax burden on labour also increased (by 6 percentage points – from 17 per cent to 23 per cent), but those on capital (from 27 per cent to 19 per cent) and consumption (from 13 per cent to 10 per cent) fell.

Against this background, the aim of the this paper is twofold: First to provide a dynamic picture of the structure of labour taxes in the EU and, second, to analyse the factors driving such dynamics. Concerning the latter, two apparently opposed factors should be weighed. On the one hand, the increase in labour taxes has coincided with larger public sectors. Empirical research, in turn, has linked larger public sectors to income, demography and trade openness.[4] On the other hand, there are forces of international competition and cooperation that generally shape tax structures and thus also labour taxes. Labour taxes, at least in the short run, are in part borne by capital. Therefore, they are affected by the international competition for capital. At the same time, there are several, though limited, forms of policy coordination in the area of EU labour taxes.

In the remainder of this paper, section 1 gives a complete view of the current labour tax wedge, its structure and long-run trends over the last three decades in the EU Member States, and compares them with those of the US and Japan. Section 2 analyses for comparison purposes the levels and developments in capital and consumption taxes and introduces the concept of effective labour tax rates. This section also presents some initial evidence on how labour tax changes are related to capital tax changes and on the interdependence of labour and other taxes in the EU. Section 3 attempts to work out the extent to which the observed labour tax trends in the EU can be attributed to international trends and to domestic forces. Section 4 concludes.

1. The structure and evolution of labour taxes in the EU

Following Layard, Nickell and Jackman (1991, page 209), the total wage wedge "is the gap between the real labour costs of the firm, on the one hand, and the real, post-tax consumption wage of the worker, on the other". Disregarding the effects of the real price of imports,[5] the tax wedge arises because labour income is first taxed through social security contributions; then, workers have to pay income taxes on the remaining income, which in turn, once direct taxes have been deducted,

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[4] See, for instance, Rodrick (1998), European Commission (2000a) and Martinez-Mongay (2001, 2002).

[5] Layard, Nickell and Jackman (1991) define the wedge as non-wage labour costs plus personal income taxes plus the difference between the consumer and the producer prices. This latter difference depends not only on consumption taxes but also on the real price of imports times the share of imports. We focus here on the tax components of the wedge and exclude external effects.

will be subject to indirect taxes when consumed. In other terms, the tax wedge on labour is the difference between the gross wage deflated by the producer's price (real producer wage $-w_p$) and the gross wage net of social security contributions and personal income taxes on labour income deflated by the consumer's price (the real consumer wage $-w_c$). Therefore, we can express the tax wedge on labour (TWL) as:

$$TWL = (w_p - w_c)/w_p = 1 - (w_c/w_p) \tag{1}$$

If P_p and P_c are respectively the producer price and the consumer price, and W_p and W_c are respectively the nominal gross wage and the nominal consumer wage, the tax wedge on labour can also be written as:

$$TWL = 1 - (W_c/W_p)(P_p/P_c) \tag{2}$$

The relationship between the nominal consumer and producer wages is determined by the ratio between social security contributions paid per unit of labour (*ssc*) and the nominal producer wage, the so-called "non-wage labour costs" ($nwlc=ssc/W_p$), and by the personal income tax rate (t_i) according to the expression:

$$W_c = W_p\,(1 - nwlc)(1 - t_i) \tag{3}$$

because workers first pay social security contributions on the producer wage and then pay personal income taxes on the rest.

The consumption tax rate is usually defined as the difference between the consumer price and the producer price expressed in terms of the latter:

$$T_c = (P_c/P_p) - 1 \tag{4}$$

so that:

$$P_p/P_c = 1/(1 + T_c) = 1 - t_c \tag{5}$$

where t_c would be an equivalent way of measuring the consumption tax rate: the difference between the consumer price and the producer price expressed in terms of the former.

$$t_c = 1 - (P_p/P_c) \tag{6}$$

Plugging (3) and (5) into (1) we obtain an expression of the tax wedge on labour income in function of non-wage labour costs, personal income taxes and consumption taxes:

$$wedge = 1 - (1 - nwlc)(1 - t_I)(1 - t_c) \tag{7}$$

The rates in (7) are unobservable at aggregate level and have to be estimated to obtain a quantitative indicator of the tax wedge in order to assess and compare the impact of tax reforms on the tax burden borne by labour across countries and its developments over time. The well-known work by Mendoza, Razin and Tesar

(1994) – MRT hereafter – proposed an operational solution to the problem of analysing the effects of the changes in tax laws, which consists of constructing synthetic tax indicators, the so-called (average) "effective" tax rates. According to this methodology, the average effective tax rates are defined as the ratio between the tax revenues from particular taxes (viz. indirect taxes) and the corresponding tax bases (viz. value of final consumption) obtained from national accounts.

The rest of this section and part of the next one is devoted to calculate and analyse such rates following Martinez-Mongay (2000), which applies a variant of the MRT method, suited to the information available within the framework of the Commission Spring and Autumn forecasts.

1.1 Non-wage labour costs

Properly speaking, non-wage labour costs include social security contributions (SSC)[6] and taxes on payroll and workforce, with the latter being actually non-existent or negligible in most countries, so that SSC can be considered as a good proxy to non-wage labour costs.[7] The non-wage labour costs effective rate (NWLC) can be calculated as the ratio of non-wage labour costs to total labour costs. This is a measure of the wedge between the nominal wage paid by the producer and the nominal wage received by the worker before paying personal income taxes.

AMECO directly provides the series on total social security contributions as ratios to each country's GDP (NWRV). On the other hand, the series for the total compensation of employees can also be obtained from AMECO in percentage of GDP (COEL).[8]

The problem with NWRV and COEL is that they refer to two different categories of labour. NWRV includes not only SSC paid by the employees and their employers, but also SSC paid by the self-employed, while COEL only reflects the total cost of the employees (including SSC paid by employees and employers). Therefore, in order to obtain an estimate of the tax base of NWRV we need to estimate the gross, or before taxes, labour income of the self-employed. We treat part of the total income of the self-employed as labour income and consider the rest as the income they receive as owners of capital. We estimate such a labour income of the self-employed in a way that is consistent with theoretical models of firm

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6 The appendix gives a detailed account of the statistical sources of the input series.

7 Taxes on payroll and workforce are zero in most Member States, as well as in the US and Japan. This is particularly true since the mid-Eighties, where the figure are only significant in Denmark, Ireland, Austria and Sweden (see OECD, 2002). Moreover, as shown in Martinez-Mongay (2000) disregarding or not TPRWF does not make a real difference in terms of within-country evolutions or across-country comparisons even for those countries (Ireland, Austria and Sweden) where taxes on payroll and workforce are sizeable. In consequence, from our point of view, the way such a tax item is treated to obtain the non-wage labour costs effective rate is not a relevant issue, while being able to calculate NWLC just on the basis of AMECO data is a clear advantage.

8 Note that COEL includes social security contributions paid by both the employers and the employees.

Box 1. Statistical Problems.
From ESA79 to ESA95 and the German Case

The changeover to ESA95 has affected AMECO series on public finances and, indeed, the components of the total tax burden. Where social security contributions are concerned, the ESA95 system considers three different items ("SSC received", "Actual SSC" and "Imputed SSC"), so that a choice has to be made. Analogously, the ESA95 system includes information on capital taxes, which are not available in ESA79. The problem with using ESA95 data is that, although all the series currently stop in 2001, the starting year varies from one country to another and there is no data before the Nineties for most of them. In addition, the ESA79 series, which start in 1970 for all the countries, stop in 1995 in most cases. Consequently, in order to obtain a set of series for all the countries over the period 1970-2001 it has been necessary to link the ESA95 series with their counterparts in the ESA79 system. Since the main purpose of the AMECO databank on effective taxation is to carry out early assessments of tax reforms (from 1999 onwards), we have kept the ESA95 original series for the available years and reconstructed them backwards on the basis of the observed growth rates in the corresponding ESA79 series. In the case of social security contributions, the choice of the ESA95 series, "Social security contributions received; general government" (AMECO code UTSG) has been determined by its unique counterpart in ESA79, "Social security contributions received; general government" (AMECO code UTSGF). The same applies to other series used in the calculations displayed in this paper (see appendix for a detailed description of the series used).

In the case of Germany the need to link ESA79 and ESA95 figures overlaps with the break imposed on the series by German Unification. Series for the unified Germany are only available for 1991 onwards, while those for the former West Germany only run until 1997/98. Unlike in the case of the changeover to ESA95, since the former and the unified Germany may be two very different economic entities, reconstructing the series for Germany backwards on the basis of the growth rates for West Germany may be controversial. Therefore, we have opted to link both types of series directly. As a result, a structural break usually appears in 1991 in the series in levels, which, indeed, does not affect within and across-country assessments in the 90's and 2000's.

behaviour. The opportunity cost of being self-employed is the wage that this category of workers would have earned had they been working as employees. Such an opportunity cost can be approximated by the average wage of employees. This hypothesis is of general use for estimating the labour share on the basis of the compensation of employees in macroeconomic and growth models, and has been adopted to calculate the effective tax rate of labour in, for instance, Gordon and Tchilinguirian (1998) and Carey and Tchilinguirian (2000).[9]

If *OCCP* is the occupied population or, in other words, total employment (National Accounts) and *EMPL* stands for employees (wage and salary earners), both measured in persons and available in AMECO, the labour share including the opportunity cost of the self-employed – *LETB*, which is coincidental with the labour effective tax base in percentage of GDP – can be calculated as:

$$LETB = COEL*OCCP/EMPL \quad (8)$$

Then, the effective average non-wage labour costs for total employment can be obtained as:

$$NWLC = NWRV/LETB \quad (9)$$

In short, the effective rate of non-wage labour costs (*NWLC*) is the ratio of total social security contributions (*NWRV*) to total labour costs (*LETB*). The rate includes the imputed wage of the self employed, as well as the social security contributions paid by this category of labour. At the macroeconomic level, such an imputed wage equals the average gross wage earned by employees (wage and salary earners). Therefore, the total cost of labour can be calculated as the total compensation of employees multiplied by the ratio of occupied population to wage and salary earners.[10]

Table 1 reports the evolution of *NWLC* (in percent) between 1970 and 2004 based on the European Commission Economic Forecasts of Spring 2003 (European Commission, 2003). The long-term trend has been unambiguously positive over the whole period, but it seems to have reversed after the late Nineties. The observed fall is related to efforts to reduce taxation on labour through cuts in SSC.

Despite this, however, the effective *NWLC* rate remains still much higher in the euro area (27 per cent in 2002) and the EU as a whole (24 per cent) than in the US (12 per cent) or Japan (17 per cent). The exceptions to this rule are the UK, Ireland and Denmark. At 11-12 per cent, non-wage labour costs in the two first countries are comparable to the US', while, in Denmark, the figure is below 5 per cent. In this latter case, as will be shown below, there is a clear compensation through very high personal income taxes on labour income. According to European

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[9] This solution had also been suggested in Martinez-Mongay (1998).

[10] Of course, the total operating surplus of the economy should be then reduced by an amount equal to the average gross wage times the number of the self-employed.

Table 1

Average Effective Non-Wage Labour Costs (*NWLC*)

Country	1970	1980	1990	2000	2001	2002	2003	2004	70-80	80-90	90-00	00-04
B	19.3	20.6	25.7	26.0	25.9	25.9	26.0	26.0	1.3	5.1	0.3	0.0
D	19.3	24.9	26.9	30.8	30.6	30.7	31.1	31.0	5.6	2.0	3.9	0.3
GR	11.3	14.8	17.5	24.0	24.3	24.8	24.9	25.4	3.5	2.7	6.5	1.4
E	11.3	18.4	20.6	22.1	22.7	22.8	22.9	23.1	7.1	2.1	1.5	1.0
F	22.6	28.8	33.9	31.7	31.4	31.4	31.8	31.7	6.2	5.1	–2.2	0.0
IRL	4.8	8.8	11.8	11.3	11.5	11.8	11.7	11.9	4.0	3.0	–0.5	0.6
I	18.9	20.7	22.5	22.9	22.7	22.8	22.9	23.0	1.7	1.9	0.4	0.0
L	16.2	19.7	21.0	21.5	21.9	22.0	22.2	22.0	3.5	1.3	0.4	0.5
NL	20.1	25.5	27.1	28.7	25.6	24.2	25.5	25.0	5.4	1.6	1.6	–3.7
A	14.9	19.5	22.6	26.5	26.8	26.7	26.8	26.9	4.6	3.1	3.9	0.3
P	7.8	10.4	15.1	17.6	17.7	18.1	18.2	18.3	2.5	4.7	2.5	0.7
FIN	8.7	17.0	20.3	22.4	22.5	22.2	21.8	21.8	8.3	3.3	2.1	–0.5
EU-12	**18.8**	**23.7**	**26.2**	**27.4**	**27.0**	**27.0**	**27.2**	**27.1**	**4.9**	**2.5**	**1.2**	**–0.2**
DK	3.7	2.8	3.8	5.7	5.5	4.6	4.5	4.4	–1.0	1.0	2.0	–1.3
S	13.6	22.2	24.1	25.5	25.6	25.6	25.2	25.1	8.6	1.9	1.5	–0.4
UK	9.6	11.6	11.4	12.2	11.9	11.9	12.5	12.8	2.0	–0.1	0.7	0.6
EU-15	**16.8**	**21.4**	**23.5**	**24.2**	**23.9**	**23.8**	**24.2**	**24.2**	**4.6**	**2.2**	**0.7**	**0.0**
US	6.9	9.3	11.2	11.5	11.5	11.6	11.4	11.4	2.4	2.0	0.3	0.0
JP	6.7	9.9	13.5	16.1	16.5	16.9	17.1	17.4	3.2	3.6	2.6	1.3

Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003) and own calculations.

Commission (2000b), the evolution of *NWLC* seems to be mainly driven by insurance principles, thus closely linked to the evolution of welfare spending. In the case of Denmark, however, such an insurance principle determines the personal income tax rather than non-wage labour costs.

1.2 The personal income effective tax rate

Once non-wage labour costs have been deducted from gross wages, workers pay personal income taxes on their remaining labour income. Analogously, once capital incomes have been adjusted for corporate income taxes and those on property and wealth, the remaining capital income received by households is also taxed through the same personal income tax. Therefore, to obtain the average effective total tax wedge on labour income it is necessary to split personal income taxes between the two production factors, labour and capital.

Such a distinction is not directly available either in AMECO or in the OECD Revenue Statistics (OECDRS). AMECO only provides the aggregate series on direct taxes on income and wealth (*DTRV*). These series actually include four categories of taxes: taxes on personal income from labour, taxes on personal income from capital, taxes on corporate income, and taxes on property and wealth. Taxes on corporate income are capital taxes, while property taxes could also reasonably be imputed to capital income, since they are taxes on the capital stock of the economy regardless of whether they are paid by individuals or by firms. Consequently, only the first component includes taxes on labour income.

Where the OECDRS databank is concerned, it provides a more detailed, but still insufficient, breakdown of direct taxes. OECDRS distinguishes between "Taxes on income, profits and capital gains of individuals" (item RS1100 – TRII hereafter), "Corporate taxes on income, profits and capital gains" (item RS1200-TRCI), and "Revenues from any kind of property taxes" (RS4000-PROP). *TRCI* and *PROP* are exclusively capital taxes, while *TRII* includes direct taxes on both labour and capital. Based on this breakdown of direct taxes, it is possible to decompose *DTRV* from AMECO into the same three categories of direct taxes. First, we calculate the following ratios from the OECDRS:

$$TRIIR = TRII/(TRII+TRCI+PROP) \tag{10}$$

$$TRCIR = TRCI/(TRII+TRCI+PROP) \tag{11}$$

$$PROPR = PROP/(TRII+TRCI+PROP) \tag{12}$$

Then we decompose *DTRV* from AMECO in the following way:

$$PIRV = DTRV*TRIIR \tag{13}$$

$$CORV = DTRV*TRCIR \tag{14}$$

$$PWRV = DTRV*PROPR \tag{15}$$

Since, at the time of writing, the series in OECDRS only provide coverage up to 2001, the values of the series on *PIRV*, *CIRV* and *PRIRV* for 2002-2004 can be obtained by assuming that the values of *TRIIR*, *TRCIR* and *PROPR* observed in 2001 hold in the 2002-2004 period.

Once *PIRV*, *CORV* and *PWRV* have been singled out, the problem is to split *PIRV* into household tax revenues from labour and capital income. In order to do that, we follow MRT and assume that any unit of a household income pays the same average tax rate regardless of the source of such income, whether labour or capital. Strictly speaking, we apply here a modified version of the MRT approach. As in Carey and Tchilinguirian (2000), we assume that only the net wage (take-home pay) is subject to personal income tax. However, we apply a rather broad definition of personal income from capital. Instead of using *OSPUE* (*less* the imputed wage income of the self-employed) plus *PEI*, we define the household income from capital as the net operating surplus of the economy (*NOS*), which is directly available in AMECO, minus the imputed labour income of the self-employed minus other direct taxes on capital, namely the corporate income tax and taxes on property and wealth. The personal income tax base is:

$$PITB = LETB - NWRV + NOS - (LETB - COEL) - CORV - PWRV \tag{16}$$

where *LETB* is defined in (8) and *CORV* and *PWRV* have been calculated in (14) and (21) respectively. A more condensed expression of (16) is:

$$PITB = COEL + NOS - NWRV - CORV - PWRV \tag{16a}$$

Then, the effective tax rate on personal income is:

$$PITR = PIRV/PITB \tag{17}$$

In sum, the total personal income effective tax rate is calculated as the ratio of tax revenues from income taxes paid by individuals to the total income received by them, a part of which is revenues from capital. Such personal income is the sum of total labour costs, including the imputed wages of the self-employed and excluding social security contributions and the net operating surplus of the economy, adjusted for the imputed wages of the self-employed and excluding taxes on corporate income and on property and wealth. Box 2 compares this proposal to calculate the personal income tax rate with other contributions in the literature.

The effective rate of personal income taxes (*PITR*) in the euro area is about 16 per cent in 2002 (slightly higher than in the EU-15, see Table 2). This is also

Table 2

Average Effective Personal Income Tax Rates (*PITR*)

Country	1970	1980	1990	2000	2001	2002 *	2003 *	2004 *	70-80	80-90	90-00	00-04 *
B	12.6	23.5	22.1	24.1	24.8	24.8	24.3	23.8	10.9	–1.4	1.9	–0.3
D	12.2	17.0	14.7	18.4	17.7	17.2	17.6	17.9	4.8	–2.2	3.6	–0.5
GR	2.0	4.1	4.8	8.3	10.5	10.2	10.1	9.7	2.1	0.7	3.6	1.3
E	1.9	6.4	10.5	10.0	10.5	11.0	10.7	10.7	4.5	4.1	–0.5	0.7
F	5.3	8.0	8.1	14.3	14.4	13.4	13.1	13.1	2.8	0.0	6.3	–1.2
IRL	5.2	12.6	14.5	12.7	11.9	10.8	10.6	10.3	7.4	1.9	–1.8	–2.5
I	3.6	9.9	16.3	18.1	18.7	17.6	16.9	16.7	6.3	6.4	1.8	–1.4
L	8.1	17.3	15.6	11.7	11.9	13.0	12.8	12.1	9.2	–1.6	–4.0	0.4
NL	14.6	19.5	18.8	11.8	11.8	11.8	11.3	11.0	4.9	–0.7	–7.0	–0.8
A	12.5	16.6	16.3	19.5	21.5	21.0	21.5	21.9	4.1	–0.3	3.2	2.4
P	6.0	7.2	7.7	10.5	9.8	9.9	9.9	9.8	1.2	0.5	2.8	–0.7
FIN	15.8	20.5	27.3	27.6	25.5	25.3	24.3	23.7	4.7	6.8	0.3	–3.9
EU-12	**8.1**	**12.8**	**13.8**	**16.2**	**16.2**	**15.6**	**15.5**	**15.4**	**4.7**	**0.9**	**2.5**	**–0.8**
DK	27.8	32.9	38.3	41.1	41.0	40.5	40.1	40.0	5.1	5.4	2.8	–1.1
S	25.8	31.5	35.6	31.6	35.4	31.0	31.7	31.5	5.6	4.2	–4.0	–0.1
UK	15.3	15.2	16.1	15.8	16.1	14.9	14.9	15.0	–0.1	0.9	–0.3	–0.8
EU-15	**10.5**	**14.3**	**15.4**	**17.1**	**17.3**	**16.4**	**16.3**	**16.3**	**3.8**	**1.1**	**1.8**	**–0.8**
US	10.9	12.9	12.3	16.0	15.2	12.9	12.7	12.5	2.0	–0.5	3.6	–3.4
JP	4.3	7.0	10.1	7.0	9.0	8.8	8.6	8.5	2.7	3.1	–3.1	1.5

* Projection on the basis of the OECD Revenue Statistics for the year 2002.

Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

Box 2. Alternatives To Calculate Personal Income Tax Rates

There are two major differences between the definition of the personal income tax rate in (17) and that of MRT (see also Carey and Tchilinguirian, 2002). Expression (17) is based on a rather rough approximation to the personal, taxable income. We include enterprises' (both corporate and incorporate, but especially the former[1]) net savings in the personal income tax base, thus wrongly assuming that profits are fully distributed.[2] This means that the tax base is overestimated if such net savings are positive and underestimated when they are negative. In addition, unlike MRT and Carey and Tchilinguirian (2000), we use a rather broad definition of property taxes, which covers the whole item RS4000 in OECDRS, while MRT only include RS4100 and RS4400.[3] The advantage in approximating personal income in this way is that we can use variables, such as the compensation of employees and the net operating surplus, which are updated and projected twice a year in the framework of Commission's Spring and Autumn Forecast, while the "operating surplus of unincorporated enterprises" and "property and entrepreneurial income" used by MRT are available with a or 4-year lag. Moreover, as a general rule, there is not a big quantitative difference between using RS4000 and RS4100+RS4400, while, in some cases, aggregate items in the OECDRS, such as RS4000, are more updated than their components.

Overall, one could argue that the criteria proposed here may be as good or as bad as any other applied in the relevant literature on effective taxation. The criteria applied by Mendoza, Razin and Tesar (1994) or Carey and Tchilinguirian (2000), as well as those in European Commission (1997b, 1999, 2000a), also lead to more or less rough approximations to the "true" personal income tax revenues from labour income.

Where the MRT method is concerned, one has to conclude that, in the end, the range of alternatives to define the personal income tax base is rather wide. For

instance, Carey and Tchilinguirian (2000) and, more recently, Carey and Rabesona (2002) have proposed a number of modifications to the MRT method. These include correcting the treatment of social security and private employers' contributions to pension funds, avoiding double taxation of dividends, considering the preferential tax treatment for pension funds and life insurance earnings, or assuming that households do not pay taxes on capital income. In most cases, such modifications require using costly information, which is only available with a certain lag and/or is totally absent in National Accounts. In addition, when comparing different alternatives, the conclusion seems to be that such modifications induce more or less large changes in levels and affect some countries more than others. However, their impacts in terms of within-country evolutions and across-country comparisons are fairly small in most cases or even negligible in some of them.

Therefore it seems that, from an empirical point of view, different methods either lead to fairly similar tax indicators or to totally different ones, but there are not clear *ex ante* arguments to make a choice. As shown in Martinez-Mongay (2000) and in de Hann, Suturm and Volkerink (2002) alternative approaches lead to sets of indicators with similar statistical properties. Given this, unless the detailed tables of the national accounts are published in time, and they can be included in the forecasts of the European Commission, the approximation proposed here appears to be, at least, a reasonable solution to compute medium-term forecasts of the personal income tax rates.

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1) Once the imputed wage of the self-employed is deducted from OSPUE, profits (and savings) of unincorporated enterprises are a rather small fraction of GDP.

2) AMECO includes series on net savings for both corporate enterprises and for households (including net savings from incorporated enterprises), which could be used to obtain a better proxy of the personal income tax base. However, the series of net saving of corporations are not available in some countries and they are very short in most of them, while the series of net savings from incorporated enterprises cannot be singled out from total household savings.

3) Carey and Rabesona (2002) also consider this broad definition of property taxes.

higher than in the US (13 per cent). Overall, the way the personal income is taxed varies across Member States. While in some Mediterranean countries, such as Spain, Portugal and Greece, the effective rate is below or close to 10-11 per cent, in the Nordic countries (Denmark, Finland and Sweden) as well as in Belgium, governments take more than 25 per cent of the personal income tax base in the form of taxes on households. High taxation in Denmark (more than 40 per cent) is, at least, partially explained by very low social security contributions, so that, as mentioned above, the welfare state there is mainly financed through general income taxes.

Over the whole period 1970-2000, the personal income effective tax rate increased by almost 100 per cent in the euro area. However, the bulk of the change took place during the Seventies, while in the Eighties and the Nineties such a positive trend slowed down. The reforms applied or planned in most Member States in the recent past seem to be reversing such a long-term path in the 2000s.

1.3 The effective tax rate on consumption

As mentioned in the introduction, the effective tax rate on consumption should be the ratio of tax revenues from consumption taxes to the pre-tax value of consumption. Consumption tax revenues can be accurately proxied by indirect taxes, which are available in AMECO. On the other hand, following MRT, the pre-tax value of consumption can be calculated as private final consumption (*PFC*), plus government final consumption (*GFC*), minus the compensation of employees of general government (*CEGG*), minus consumption tax revenues (*INVR*). *CEGG* is deducted from the tax base since governments pay indirect taxes on the purchases of

Box 3. The Tax Treatment of Government Wage Consumption Expenditures

Although the exclusion of CEGG from the tax base is proposed by many authors, the agreement as regards the treatment of such a series is far from total. For instance, in European Commission (1997b) this variable was not deducted from the base. Recently, Carey and Tchilinguirian (2000) (see also Carey and Rabesona, 2002) have proposed a variant of the MRT method, where they make the tax base more comprehensive by not excluding CEGG. They argue that the fact that government wage consumption expenditures are not subject to indirect tax is not a compelling reason for using a partial consumption tax base. In the end, many other elements of the consumption tax base are equally not subject to indirect taxes but remain in their base. However, they also conclude that the inclusion/exclusion of CEGG only changes the level of the rate without affecting very much comparisons across countries, as well as the major features of its evolution over time.

goods and non-factor services, while they are usually exempted from paying indirect taxes on goods and services provided by the public sector (see Box 3).

Calculated in this way, it can be shown straightforwardly that the effective tax rate on consumption is the difference between the consumer price (a post-tax price) and the producer price (a pre-tax price) expressed as a percentage of the latter. An equivalent definition of the effective tax rate on consumption is applied in European Commission (1997, 1999, 2000a) where the wedge is expressed in terms of consumer prices. As shown at the beginning of the section, this rate has the advantage of being explicitly included in the formulae of the tax wedge on labour. It is called the consumption implicit tax rate and its expression is:

$$t_c = (P_c - P_p)/P_c \tag{18}$$

In macroeconomic terms, the consumption implicit tax rate can be calculated as:

$$CITR = INRV/(PFC + GFC - CEGG) \tag{19}$$

One of the most distinguishing features of tax systems in the EU, as compared with the US or Japan, is the tax burden on consumption (Table 3).

Overall, at 20 per cent, indirect taxes in the EU, expressed in terms of the value of final consumption, are twice that of the US. Indirect taxes represent ¼ or more of the (inclusive of taxes) value of final consumption in France, Ireland, Luxembourg, Finland, Denmark, and Sweden. At the opposite extreme, in Germany, Spain, and the UK, the figure is clearly below the EU average, but always bigger than in the US or Japan.

During the last thirty years, the effective tax rate on consumption has increased by 1 percentage point in the euro area, but has remained almost unchanged in the EU as a whole. The rate fell in most countries during the Seventies, probably due to a generalised fall in tariffs. In the Eighties, average rates in the euro area rose more than 1 percentage point. This is most likely due to the introduction of VAT regime in countries such as, for instance, Spain and Portugal in the Eighties. In addition, VAT harmonisation at the late Eighties, as well as the introduction of energy and environmental taxes could also have played a role. Such a trend continued and accelerated in Nineties, when budgetary consolidation strategies in many Member States consisted, at least in a first phase, of increasing taxation (see European Commission, 2000b).

1.4 The average effective total tax wedge on labour

Given (15), (24) and (26), the macroeconomic counterpart of (7), *i.e.* in terms of average effective tax rates, can be calculated as:

$$WEDGE = 1 - (1 - NWLC)(1 - PITR)(1 - CITR) \tag{20}$$

Table 3

Average Effective Tax Rates on Consumption (CITR)

Country	1970	1980	1990	2000	2001	2002	2003	2004	70-80	80-90	90-00	00-04
B	23.3	17.8	18.3	20.5	19.5	20.1	20.2	20.2	–5.4	0.5	2.2	–0.3
D	18.9	17.4	17.2	17.2	16.9	16.8	17.1	17.2	–1.5	–0.2	0.0	0.0
GR	17.1	14.5	17.8	20.7	20.5	20.3	20.5	20.5	–2.6	3.3	2.9	–0.2
E	11.4	9.0	15.4	17.7	17.4	17.9	18.1	18.3	–2.4	6.4	2.3	0.6
F	23.7	23.3	22.7	24.1	23.3	23.4	23.1	23.3	–0.4	–0.6	1.4	–0.8
IRL	20.9	18.3	22.2	24.6	22.6	23.6	24.0	24.0	–2.6	3.9	2.4	–0.6
I	14.9	13.1	16.4	22.0	21.3	21.4	21.1	21.1	–1.8	3.3	5.6	–0.9
L	11.7	14.1	19.6	29.2	26.9	26.3	25.3	24.8	2.3	5.5	9.6	–4.4
NL	16.0	15.9	16.6	19.4	20.1	19.4	19.8	19.5	–0.1	0.7	2.8	0.2
A	26.8	25.6	25.0	22.5	22.2	21.9	21.7	22.1	–1.2	–0.7	–2.4	–0.4
P	14.1	16.9	19.4	21.5	21.6	22.8	22.8	23.4	2.8	2.5	2.1	1.9
FIN	22.0	22.8	26.7	23.9	23.0	23.1	22.8	22.4	0.8	3.9	–2.9	–1.4
EU-12	**19.0**	**17.7**	**18.6**	**20.4**	**19.9**	**19.9**	**20.0**	**20.1**	**–1.3**	**1.0**	**1.7**	**–0.3**
DK	30.1	28.1	29.3	30.8	30.9	30.8	30.5	30.6	–2.0	1.2	1.5	–0.2
S	23.4	25.1	32.0	27.1	27.4	28.3	28.6	28.9	1.6	7.0	–5.0	1.8
UK	21.4	19.6	17.2	17.8	17.4	17.5	17.5	17.6	–1.8	–2.4	0.6	–0.3
EU-15	**19.9**	**18.5**	**19.2**	**20.4**	**19.9**	**20.0**	**20.1**	**20.2**	**–1.4**	**0.7**	**1.2**	**–0.2**
US	13.1	11.0	10.7	10.4	10.2	10.1	9.9	9.8	–2.1	–0.3	–0.3	–0.6
JP	12.8	11.6	13.2	12.8	12.7	12.4	12.4	12.4	–1.1	1.5	–0.4	–0.4

Source: AMECO (DG ECFIN Economic Forecasts of Spring 2003; see European Commission, 2003) and own calculations.

When a part of the income of the self-employed (the imputed wage) is considered as labour income, total taxes on labour, thus including the incidence of indirect taxes, represent half the gross wage in both the euro area and the EU in 2002 (Table 4). This strongly contrasts with the figures for our main trade partners, where the tax wedge on labour in 2002 was around 30 per cent. In no Member State the total burden on labour income is lower than in the US. In the UK, and, to a lesser extent, in Spain, Ireland, Portugal and Greece, the figure is well below the EU average. However, in Denmark, Finland and Sweden, the tax wedge represents more than 60 per cent of the gross wage bill. Relatively high taxes are also borne by labour in Belgium, Germany, France and Austria.

Indeed, the evolution of the tax wedge in the last three decades summarises that of its components. Overall, consumption taxes have contributed little, while the changes observed in the tax wedge have been driven by changes in non-wage labour costs and in personal income taxes. In the Seventies and the Nineties, both rates contributed by comparable amounts. However, the bulk of the increase recorded by the tax wedge was due to the surge in social security contributions.

2. The average effective tax rates on labour and capital

Section 1 provides the basic elements to calculate the so-called the average effective tax rate on labour income (*LERT*), as defined by MRT.

Basically, the *LERT* is a tax wedge on labour that does not take account of indirect taxes. By analogy and for comparison purposes, one can calculate the average effective tax rates on capital *KETR*, which includes direct taxes on capital plus the part of the personal income tax attributable to capital income.

2.1 The average effective tax rate on labour income

The average effective tax rate on labour income is the ratio of the sum of non-wage labour costs *plus* the personal income tax revenues attributable to labour income to the pre-tax labour income. In accordance with (8), the latter income is total gross wages, including gross wages imputed to the self-employed. The second component of the tax revenues can be estimated by multiplying *PITR* in (17) by the net wage, once non-wage labour costs have been discounted. Then the effective tax rate on labour income is:

$$LETR = (NWRV + PITR*(LETB - NWRV))/LETB \quad (21)$$

In short, the average effective tax rate on labour income (*LETR*) can be computed as the ratio of *NWLC* (*SSC* plus taxes on payroll and workforce) plus personal taxes on labour income to gross wages.

Table 4

Average Effective Total Tax Wedge on Labour (WEDGE)

Country	1970	1980	1990	2000	2001	2002 *	2003 *	2004 *	70-80	80-90	90-00	00-04 *
B	45.9	50.1	52.7	55.3	55.2	55.4	55.3	55.0	4.2	2.6	2.6	–0.3
D	42.5	48.6	48.4	53.2	52.6	52.3	53.0	53.1	6.0	–0.2	4.8	–0.1
GR	28.0	30.1	35.4	44.7	46.2	46.2	46.3	46.4	2.2	5.2	9.4	1.7
E	23.0	30.5	39.8	42.3	42.8	43.6	43.6	43.9	7.5	9.3	2.5	1.6
F	44.1	49.8	53.1	55.6	55.0	54.5	54.5	54.5	5.7	3.3	2.5	–1.1
IRL	28.6	34.9	41.3	41.6	39.7	39.9	40.0	39.9	6.3	6.4	0.3	–1.7
I	33.5	37.9	45.8	50.8	50.5	50.0	49.5	49.4	4.4	8.0	4.9	–1.4
L	32.0	43.0	46.5	50.9	49.7	50.0	49.3	48.4	10.9	3.5	4.5	–2.5
NL	42.7	49.6	50.6	49.3	47.6	46.1	47.0	46.3	6.9	1.0	–1.3	–3.0
A	45.5	50.1	51.4	54.2	55.3	54.8	55.0	55.5	4.6	1.3	2.8	1.4
P	25.6	30.9	36.8	42.1	41.8	43.0	43.1	43.6	5.3	6.0	5.3	1.4
FIN	40.0	49.1	57.5	57.2	55.5	55.3	54.3	53.7	9.0	8.5	–0.3	–3.5
EU-12	**39.4**	**45.1**	**48.2**	**51.5**	**51.0**	**50.6**	**50.7**	**50.7**	**5.6**	**3.1**	**3.3**	**–0.8**
DK	51.4	53.1	58.0	61.6	61.5	60.8	60.2	60.2	1.7	4.9	3.6	–1.3
S	50.9	60.1	66.8	62.9	65.1	63.2	63.6	63.5	9.1	6.7	–3.9	0.7
UK	39.8	39.7	38.5	39.2	39.0	38.1	38.6	38.9	–0.1	–1.3	0.8	–0.3
EU-15	**40.3**	**45.0**	**47.7**	**50.0**	**49.6**	**49.1**	**49.3**	**49.4**	**4.7**	**2.7**	**2.3**	**–0.6**
US	27.8	29.7	30.5	33.4	32.6	30.8	30.2	30.2	1.8	0.8	2.9	–3.2
JP	22.1	25.9	32.5	31.9	33.6	33.6	33.6	33.8	3.8	6.6	–0.6	1.9

* Projection on the basis of the OECD Revenue Statistics for the year 2002.

Source: AMECO (DG ECFIN Economic Forecasts of Spring 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

The effective tax burden on labour in the euro area was close to 40 per cent in 2002 (Table 5). It was 2 percentage points higher than in the EU-15, and 14-15 points higher than in the US and Japan. By comparing Table 5 with Tables 1 and 2, it becomes clear that such large differences between the EU and its two major trade partners are explained by the differentials in non-wage labour costs, rather than by the existing differences in taxes on household income. Where differences across Member States are concerned, the tax burden on labour is above 40 per cent in Belgium, Germany, France, Austria, Finland, Denmark and Sweden. In the latter country, the effective tax burden on labour income (total employment) represents more than 50 per cent of the gross wage bill. At the opposite extreme, the tax burden on labour is relatively low and comparable with that of the US in Ireland, the UK and, to a lesser extent in Portugal.

The effective tax rate of labour has not ceased to increase during the last thirty years both inside and outside the EU. The only clear exception is the UK, where the rate has remained fairly stable since 1970. As with non-wage labour costs and personal taxes, the largest change took place during the Seventies, while the trend slowed down in the Eighties and even more in the Nineties. Such trends are being reversed in most Member States in the 2000s.

2.2 The average effective tax rate on capital income

A proxy to tax revenues obtained by governments from capital income can be calculated in the following way. Total taxes on capital income should include taxes on personal income from capital, taxes on corporate income and property taxes. Property taxes being a tax on the capital (wealth) stock of the economy can be considered as taxes on capital income, regardless of whether they are paid by households or by business. Expressions (14) – *CORV* and (15) – *PWRV* respectively give the tax revenues from corporate and property taxes consistent with AMECO data and calculated on the basis of the OECDRS. The tax revenues from taxes on personal income from capital can be obtained on the basis of (16) by multiplying *PITR* in (17) by the capital income of households, which can be approximated by the net operating surplus of the economy after deducting taxes on corporate and property incomes and excluding the imputed wage income of the self-employed.

A second issue concerning the capital tax base is whether the capital income should include or exclude depreciation or, in other words, whether one should use the net or the gross operating surplus. MRT rightly argue that no capital taxes are levied on depreciation of fixed assets, so that the capital tax base should be calculated in net terms (excluding depreciation). However, Carey and Tchilinguirian (2000)[11] note that capital effective tax rates based on the net operating surplus depend on charges for depreciation, which vary a great deal from one country to

[11] See also Carey and Rabesona (2002).

Table 5

Average Effective Tax Rates on Labour (LETR)

Country	1970	1980	1990	2000	2001	2002 *	2003 *	2004 *	70-80	80-90	90-00	00-04 *
B	29.5	39.3	42.2	43.8	44.3	44.2	44.0	43.6	9.8	2.9	1.6	–0.2
D	29.1	37.7	37.7	43.5	42.9	42.6	43.3	43.4	8.6	0.0	5.8	–0.1
GR	13.1	18.3	21.4	30.3	32.3	32.5	32.5	32.6	5.2	3.1	8.9	2.3
E	13.1	23.6	28.9	29.9	30.8	31.2	31.2	31.4	10.6	5.3	1.0	1.5
F	26.7	34.5	39.3	41.5	41.3	40.6	40.8	40.6	7.9	4.8	2.2	–0.8
IRL	9.7	20.3	24.6	22.6	22.1	21.3	21.0	20.9	10.5	4.3	–2.0	–1.7
I	21.8	28.5	35.2	36.9	37.1	36.4	36.0	35.8	6.7	6.7	1.7	–1.0
L	23.0	33.6	33.4	30.7	31.2	32.1	32.1	31.4	10.6	–0.2	–2.7	0.7
NL	31.8	40.1	40.8	37.1	34.4	33.1	33.9	33.2	8.3	0.7	–3.7	–3.9
A	25.6	32.9	35.2	40.9	42.5	42.1	42.5	42.9	7.3	2.4	5.6	2.1
P	13.4	16.9	21.7	26.3	25.8	26.2	26.2	26.3	3.5	4.8	4.6	0.0
FIN	23.1	34.0	42.0	43.8	42.3	41.8	40.8	40.4	10.9	8.0	1.8	–3.4
EU-12	**25.4**	**33.5**	**36.4**	**39.1**	**38.8**	**38.3**	**38.4**	**38.3**	**8.1**	**3.0**	**2.7**	**–0.8**
DK	30.5	34.7	40.6	44.5	44.3	43.3	42.8	42.7	4.3	5.9	3.9	–1.8
S	35.9	46.7	51.1	49.1	51.9	48.7	48.9	48.7	10.8	4.4	–2.1	–0.4
UK	23.4	25.0	25.7	26.0	26.1	25.0	25.5	25.9	1.6	0.6	0.4	–0.2
EU-15	**25.7**	**32.7**	**35.5**	**37.2**	**37.1**	**36.4**	**36.7**	**36.7**	**7.0**	**2.8**	**1.8**	**–0.6**
US	17.0	21.0	22.2	25.6	24.9	23.1	22.6	22.5	4.0	1.2	3.4	–3.1
JP	10.7	16.2	22.3	21.9	24.0	24.1	24.2	24.4	5.5	6.1	–0.3	2.5

* Projection on the basis of the OECD Revenue Statistics for the year 2002.

Source: AMECO (DG ECFIN Economic Forecasts of Spring 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

another, mainly according to differences in the lives of capital assets assumed for tax purposes. In other words, if the net operating surplus is used, differences in capital taxation across countries may be due to differences in assumed services' lives of fixed assets rather than in any real difference in tax rates. On this basis, the gross operating surplus should be used as the tax base of capital. This seems particularly advisable when the labour income attributable to the self-employed has to be deducted from the operating surplus. If the net operating surplus is used, the resulting tax base becomes too small and the rates unrealistically high in some countries and years. Additionally, one should bear in mind that the net operating surplus exhibits more volatility over the cycle than the gross operating surplus, which may make it difficult to assess short to medium term changes in the rates.[12]

Finally, it is also worth noting that using the gross operating surplus seems to be coherent with the way the labour effective tax base (*LETR*) is defined in (21), where workers' expenditures to maintain, renovate and increase the stock of human capital is not deducted from the tax base. Yet, many (personal) tax laws do not foresee levying taxes on such expenditures. They usually establish (minimum) income thresholds and other deductible spending (viz. education, training), which are not taken into account to obtain the tax rates on labour income.

On this basis, the capital effective tax rate is:

$$KETR = (CORV + PWRV + PITR*(NOSA - CORV - PWRV))/GOSA \qquad (22)$$

where *GOSA* is the gross operating surplus adjusted for the imputed wage income of the self-employed – see (5):

$$GOSA = GOS - (LETB - COEL) \qquad (23)$$

and *NOSA* is the net operating surplus adjusted for the wage income of the self-employed:

$$NOSA = NOS - (LETB - COEL) \qquad (24)$$

At 19 per cent, the tax rate on capital income in the euro area in 2002 is lower than in the EU-15 and comparable to that in the US (18.5 per cent – see Table 6). Although it is still higher than in Japan (18 per cent), it is worth highlighting that the differences between European countries and their main trade partners are much smaller for capital taxes than for labour taxes. Where Member States are concerned, Luxembourg and the UK (31-34 per cent)[13] and, to a lesser extent, Belgium, France, Italy, Denmark and Sweden (22-27 per cent) set the highest tax burden on capital income. At the bottom end of the rate scale, in Germany, Spain, and Portugal, the capital effective tax rate is much lower than in the euro area.

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[12] See Martinez-Mongay (2000) for a detailed comparison of the capital effective tax rates calculated including and excluding depreciation from the tax base.

[13] Note that such a high effective tax rate of capital in Luxembourg does not take account of special fiscal treatment of capital income of non-residents.

Table 6

Average Effective Tax Rates on Capital (KETR)

Country	1970	1980	1990	2000	2001	2002 *	2003 *	2004 *	70-80	80-90	90-00	00-04 *
B	14.8	19.4	20.3	24.3	23.9	23.9	23.6	23.3	4.6	0.9	4.0	–1.0
D	17.1	17.6	15.0	16.6	12.6	12.3	12.7	12.9	0.4	–2.5	1.6	–3.7
GR	9.9	8.6	12.4	24.8	16.8	16.3	16.0	15.3	–1.3	3.8	12.4	–9.5
E	7.8	10.6	19.1	19.6	18.8	19.2	18.5	18.4	2.8	8.5	0.5	–1.2
F	15.9	18.8	18.9	23.5	24.5	23.0	22.7	22.6	2.9	0.2	4.6	–0.9
IRL	27.0	18.5	18.8	20.6	19.6	17.7	17.3	16.7	–8.6	0.4	1.8	–3.9
I	11.7	15.9	22.7	22.7	22.8	21.6	20.9	20.8	4.2	6.7	0.0	–1.9
L	15.6	30.3	31.3	32.4	34.5	37.6	36.3	34.2	14.7	1.0	1.1	1.8
NL	19.9	23.1	21.8	24.2	23.4	24.0	22.9	22.4	3.2	–1.3	2.5	–1.8
A	17.7	15.3	16.0	17.5	21.4	20.8	21.0	21.4	–2.4	0.7	1.5	3.9
P	6.4	4.6	14.3	23.5	22.1	22.4	21.5	20.7	–1.8	9.7	9.2	–2.7
FIN	14.8	13.2	15.2	28.9	26.0	25.9	25.0	24.7	–1.6	2.0	13.7	–4.3
EU-12	**15.0**	**17.0**	**18.4**	**20.8**	**19.6**	**19.0**	**18.7**	**18.7**	**2.0**	**1.4**	**2.3**	**–2.1**
DK	23.6	20.8	23.0	26.0	26.9	26.8	26.9	27.1	–2.9	2.2	3.0	1.1
S	20.1	18.1	22.7	27.9	25.6	22.4	22.7	23.6	–2.0	4.6	5.3	–4.4
UK	34.3	30.6	33.2	33.4	33.2	30.9	30.6	30.8	–3.7	2.5	0.2	–2.6
EU-15	**18.6**	**19.3**	**20.9**	**23.5**	**22.4**	**21.5**	**21.1**	**21.2**	**0.7**	**1.6**	**2.6**	**–2.3**
US	27.1	23.0	20.6	23.1	21.6	18.5	18.4	18.2	–4.1	–2.4	2.5	–4.9
JP	17.4	27.3	27.4	18.0	16.2	15.6	15.2	15.0	9.9	0.1	–9.4	–3.0

* Projection on the basis of the OECD Revenue Statistics for the year 2002.

Source: AMECO (DG ECFIN Economic Forecasts of Spring 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

Compared with the tax rates on labour, those on capital have remained fairly stable during the last thirty years. In the early 2000's, the fall in personal income taxes, as well as fiscal incentives for risk and venture capital, are inducing generalised cuts in capital taxes. Indeed, as mentioned in European Commission (2000b), a part of such reductions might be due to cyclical factors rather than to discretionary reforms. Anyway, on the basis of *KETR*, it is difficult to conclude that potential capital tax competition is lowering the tax burden on capital income. However, on the same grounds, it also seems evident that labour income, and not capital income, has been bearing the bulk of the additional tax burden generated since 1970. The two panels of Figure 2, which show the long-term developments of the average effective tax rates on labour, capital and consumption in the EU and the US between 1970 and 2003, provide a good illustration of this.

3. The shaping of tax systems: convergence, competition and insurance

It is worth noting that the increase in the effective tax rate on labour does not reflect the need for compensating eventual falls in the corresponding tax base, but rather the need for increasing labour tax revenues in order to finance a growing public sector. This is shown in Table 7, which compares the changes in the average effective tax rates and the changes in the labour tax base over the last thirty years, and in Figure 3, which depicts the developments in total revenues, total expenditures and transfer to households.

The effective labour income tax rate rose by 12 percentage points in the 1970-2000 period, while the average labour income tax base – as a share of GDP – fell by 4.9 per cent. It is interesting to look separately at the sub-periods 1970-1985 and 1986-2000. In the first sub-period, the average effective labour tax rate in the EU rose by 9.6 per cent, while the average labour tax base fell by 0.1 per cent. In the second sub-period, small tax rate increases more or less offset small labour tax base declines.

Higher effective labour taxes in the EU appear to have been driven by increased government revenue needs more than by anything else. Government expenditures grew on average by 9 percent of GDP over the last three decades (see Figure 3). The rise in social transfers accounts for more than half of this increase, with other welfare payments such as for health care and higher interest payments representing other major expense increases. Evidence in Martinez-Mongay and Fernandez (2001) suggests that the increased welfare spending has been the major factor behind the rise in labour taxes.

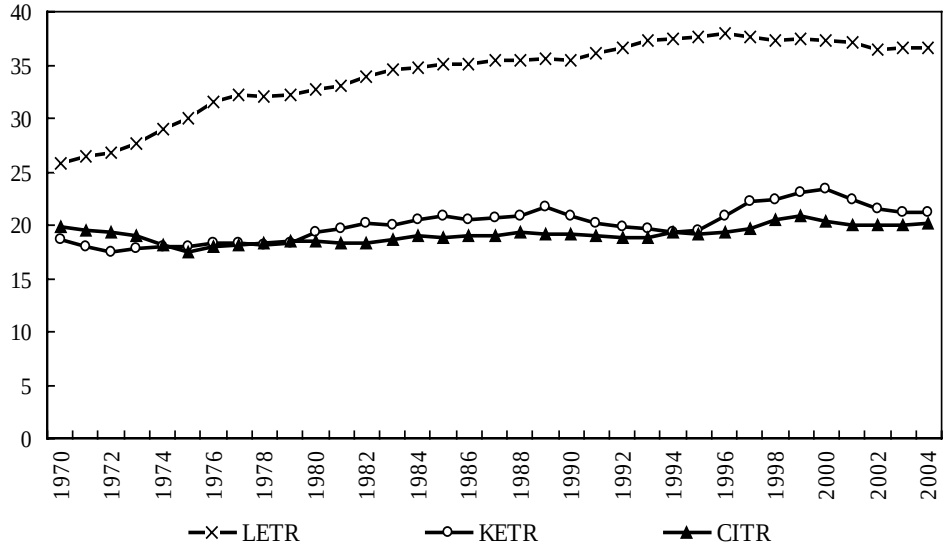
3.1 Tax convergence

Despite a larger tax burden gap between the EU and the US, there is some evidence that effective tax rates have converged somewhat among the EU augmented by the US and Japan. For these 17 countries, the coefficient of variation

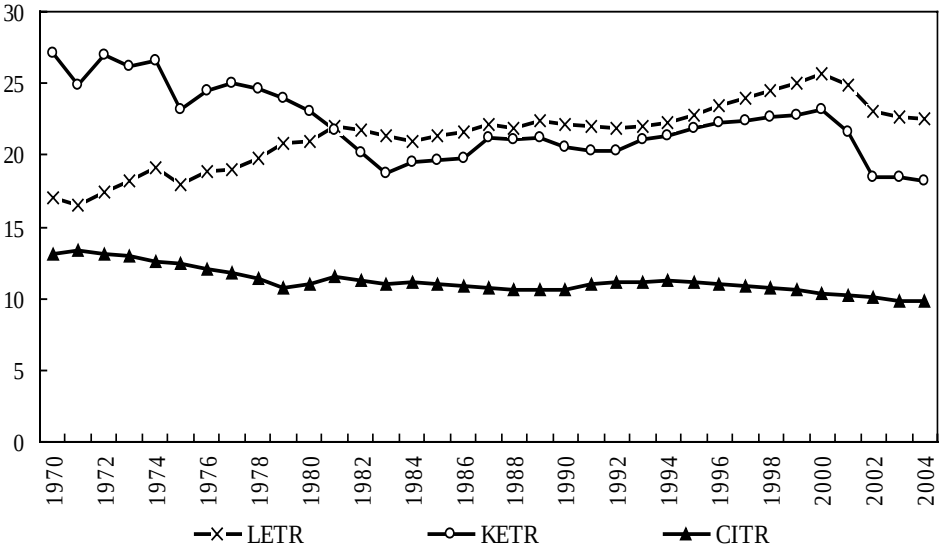
Figure 2

Effective Tax Rates on Labour (LETR), Capital (KETR) and Consumption (CITR) in the EU and the US, 1970-2004
(in percentage points of the corresponding tax bases)

Panel I. EU



Panel II. US



Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

Table 7

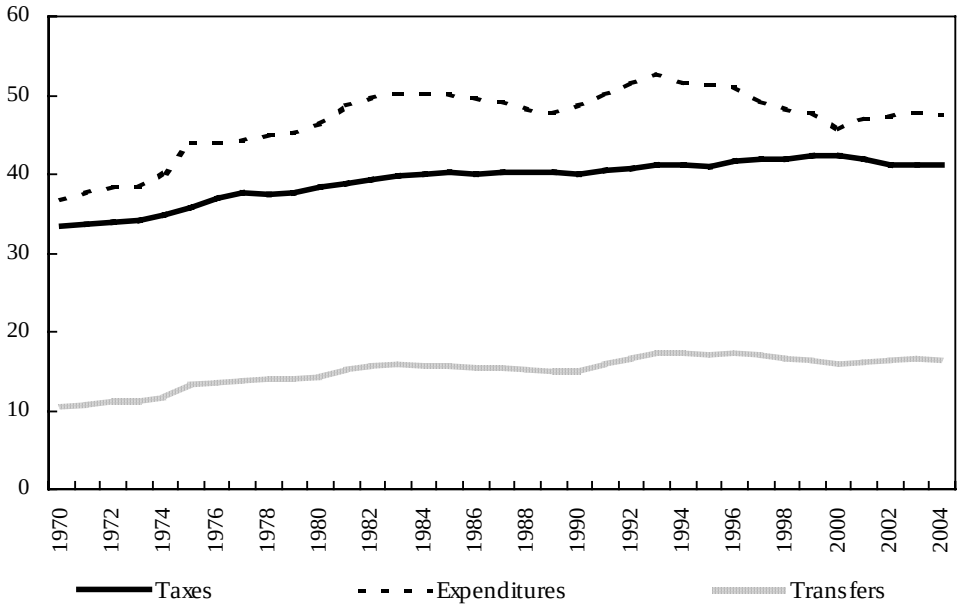
The Effective Labour Tax Rates and Bases over Time, 1970-2000

	Change (in percentage points) of tax rates between			Change (in percentage points) of tax bases between		
	1970 and 2000	1970 and 1985	1986 and 2000	1970 and 2000	1970 and 1985	1986 and 2000
Belgium	15.5	15.6	0.0	1.4	6.0	–4.4
Denmark	11.7	9.5	2.5	–6.8	–3.2	–3.1
Germany	14.6	10.4	4.7	–4.3	–0.6	–3.4
Greece	17.6	7.8	9.3	–9.6	1.0	–6.4
Spain	17.3	14.1	3.6	–6.0	–3.7	–0.5
France	15.0	11.4	3.9	–4.2	2.5	–5.0
Ireland	12.9	15.2	–3.4	–20.1	–4.5	–15.4
Italy	15.9	11.8	3.6	–9.4	1.7	–9.7
Luxembourg	8.5	12.2	–1.9	2.5	8.4	–4.7
Netherlands	7.0	9.8	–2.0	–8.1	–5.5	–3.4
Austria	14.9	10.4	4.6	–4.6	2.6	–7.7
Portugal	16.3	8.7	7.4	–12.1	–0.4	–7.6
Finland	21.3	14.8	5.0	–8.7	2.4	–11.2
Sweden	16.1	9.8	5.6	–2.2	–3.3	1.0
UK	2.7	2.8	–0.3	–1.7	–2.1	0.0
US	8.2	4.3	3.7	–5.2	–3.0	–2.3
Japan	10.5	8.1	2.1	0.2	4.0	–3.2
Euro area	14.3	11.1	3.3	–5.7	0.6	–5.3
EU	12.0	9.6	2.3	–4.9	–0.1	–4.1

Source: Huizinga and Martinez-Mongay (2001).

Figure 3

Total Tax Revenues, Total Public Expenditures and Transfers to Households in the EU, 1970-2004



Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

(the standard deviation divided by the mean expressed in percentage points) of the effective labour tax has declined from 37 to 25 per cent over the last three decades (see Figure 4, Panel A).

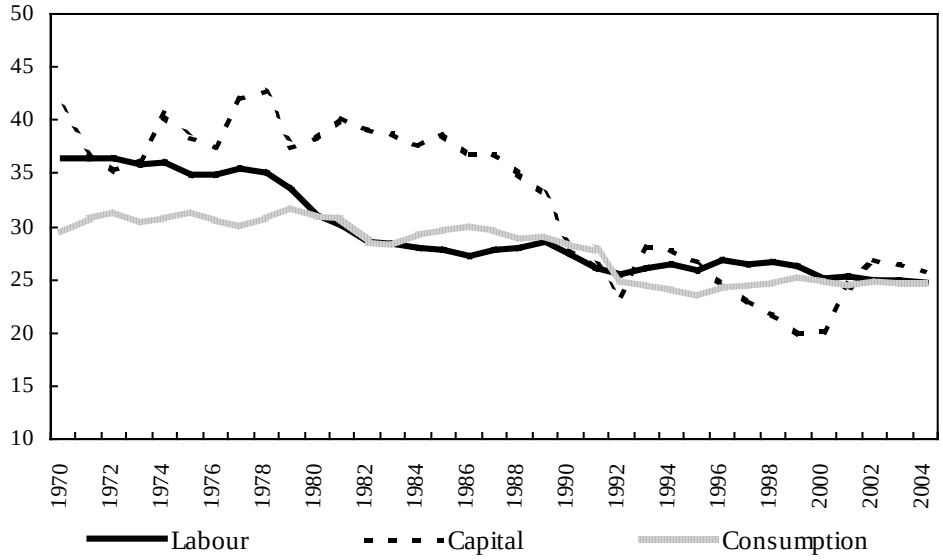
Convergence was particularly noteworthy till 1985 when this coefficient of variation stood at 28-27 per cent. Since then effective labour tax convergence has slowed or even stopped. A similar picture emerges if we look at the time trend of the coefficient of variation of the effective labour tax for the EU only (see Figure 4, Panel B). If anything, the degree of dispersion of the effective labour tax rates is lower in the EU than in samples including other industrial countries, as the coefficient of variation in the EU stands at a relatively low 22 per cent at the end of the sample period. This may reflect, as suggested by Figure 5, that government expenditures in the EU also appear to have lower dispersion than in other countries.

Effective capital income and consumption taxes also appear to have converged, but according to different patterns and speeds. Convergence in consumption taxes appears to be a genuine EU phenomenon. Due to early VAT harmonisation in the EU, there have been no significant changes in the coefficient of variation of the consumption tax rate in the EU since the late Eighties.

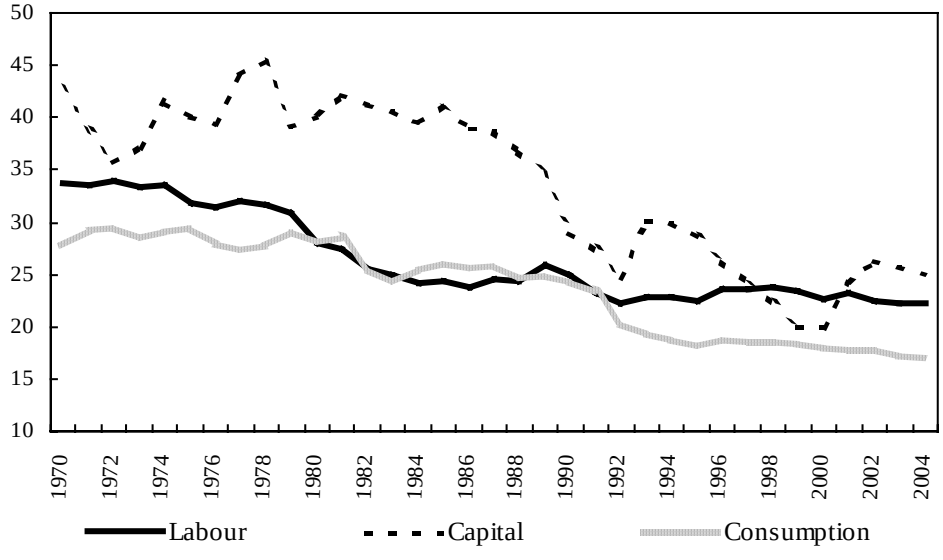
Figure 4

Convergence in Effective Tax Rates Across the OECD, 1970-2004(*)

Panel A. EU Member States, the US and Japan



Panel B. EU Member States

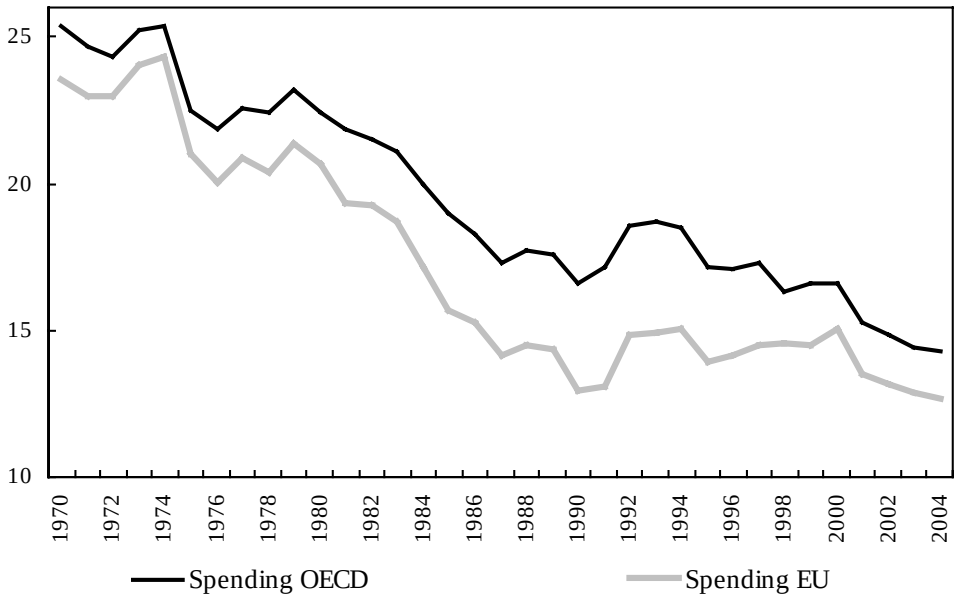


(*) The graphs show the evolution in time of the ratio between the standard deviation and the mean (coefficient of variation) expressed in percentage points.

Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

Figure 5

Convergence in Public Expenditures Across the OECD, 1970-2004(*)



(*) The graph shows the evolution in time of the ratio between the standard deviation and the mean (coefficient of variation) expressed in percentage points.

Source: AMECO (DG ECFIN Economic Forecasts 2003; see European Commission, 2003), OECD (Revenue Statistics) and own calculations.

Convergence of effective capital income taxes, as measured by the coefficient of variation, was somewhat slow and erratic in the early Seventies to accelerate later on. This is the case in the EU and in the larger set of 17 countries. In fact, the time trends of the coefficients of variation for these two groups of countries are very similar, suggesting that convergence in capital rates progressed similarly in the EU and in the larger set of countries including the EU and Japan. Moreover, convergence in capital tax rates has been stronger than in labour or consumption. While the coefficients of variation for labour and consumption tax rates were close to or below 35 per cent in the mid-Seventies, that of capital was higher than 45 per cent (Figure 4, panel A). However, 25 years later, the three coefficients of variation for the whole OECD were quite comparable.

Summing up, convergence in labour taxes has largely taken place in earlier days, and in particular during the first half of the Eighties and, to a lesser extent, during the early Nineties. Interestingly, labour tax rates are somewhat more alike in the EU than in the larger set of countries including the US and Japan. Convergence in consumption taxes is primarily an EU phenomenon as driven by VAT and excise

duties harmonisation in the EU and, to a lesser extent, by the dismantling of tariffs and common trends in environmental taxes. Finally, convergence in capital income taxes, instead, is a more significant phenomenon common to the EU as well as to the US and Japan. It is also worth keeping in mind that, leaving aside apparent cyclical fluctuations, convergence in capital has steadily taken place over the last 25 years, whereas the convergence processes in labour and consumption taxes seem much more irregular. In particular, the latter processes appear to be significant only in the early Eighties and the early Nineties, while in the rest of the period their time-profiles are rather flat.

3.2 Tax competition, tax interdependence and tax coordination

International tax competition – and by extension efforts to undue competition through coordination – are potentially important forces that shape tax burdens and structures. The question is to see the extent to which labour and capital taxation trends correspond to what one expects to result from increased international tax competition.

I will follow (and use results in) Huizinga and Martinez-Mongay (2001) to answer the question by looking at developments of labour taxes compared with that of capital taxes (have labour taxes risen relative to capital taxes?). I will discuss empirical evidence on the statistical relationship between changes in labour taxes and changes in capital taxes. Finally, I will also discuss empirical evidence on the reaction of various domestic tax rates to the corresponding rates and measures abroad.

Models of international tax competition tend to predict that capital income taxes will decline (or even fall to zero in the extreme). Indeed, this prediction has not materialised. In several countries, notably Ireland, the US, Japan and Germany, capital tax rates have fallen since 1970, but in others (Belgium, Greece, Spain, Italy, Luxembourg, Portugal, Finland) they actually have increased very significantly. For the EU as a whole, capital tax rates have in fact increased by almost 4 percentage points over the last three decades.

A second, weaker prediction of tax competition models would be that increases in welfare spending cannot be financed by increased taxes on capital. The evidence in Figures 1 to 3 largely supports this conjecture, as increased social spending was primarily met by increased taxation of labour income. To some extent, this reflects that workers were offered (and accepted) increased income insurance for which they had to pay themselves, but increased capital mobility – in part due to the liberalisation of international capital flows – may well have affected the financing of the expanding welfare state. A way to directly measure the increase, if any, in labour vs. capital taxes is to examine changes in the ratio of the effective labour and capital tax rates. This was done by Huizinga and Martinez-Mongay (2001), the results of which are reproduced in Table 8. It shows that during the last 30 years of the past century, labour tax rates grew at a higher speed than capital tax rates. This was particularly the case in the 1970-85 sub-period, during which welfare states in most

EU member states reached full maturity. In the subsequent 1986-2000 period, the earlier trend was in part reversed. Thus in the more recent period, the effective labour tax rate grew less (declined by more) than the effective capital tax rate.

Additional empirical evidence on co-movements in labour and capital taxes can be obtained by regressions that explain changes in effective labour tax rates on the basis of changes in effective capital income taxes. Regressions of this kind were ran by Huizinga and Martinez-Mongay (2001) and are presented in Table 9 for a number of sub-samples. These sub-samples consider either changes in the medium term (two consecutive five-year periods) or in the very long-run (changes between the late Nineties and the early Seventies. Five-year averages are considered in order to control for cyclical effects. Regression results are reported separately for the sample of EU countries and the larger sample including the US and Japan. In the table, none of the regressions have a significant slope parameter. Huizinga and Martinez-Mongay (2001) reported significant slope regressions for the differences between the period 2002-2000 and the period 1995-1999. Such results have not been included in the table, since new analyses have revealed that the regression results are very sensitive revisions in the late years of AMECO and Revenue Statistics series.

Overall, there thus appears to be little or no evidence at all of significant co-movements between labour and capital tax rates.

To shed additional light on international co-movements in tax rates, it is interesting to consider fiscal reaction functions – explaining changes in a particular tax in a country on the basis of the average change in this tax in other countries. Estimating fiscal reaction functions, Besley, Griffith and Klemm (2001) find evidence to support the idea that countries set their taxes interdependently. Moreover, they appear to do so in ways that are predicted by the theory. Specifically, Besley, Griffith and Klemm (2001) find that tax revenues from mobile tax bases (capital) are more reactive to tax revenues internationally than tax revenues from relatively immobile tax bases (labour and consumption). In addition, tax reactions are larger in countries where tax bases are more mobile.

While Besley, Griffith and Klemm (2001) estimate an annual panel data of tax revenues in percentage of GDP, Huizinga and Martinez-Mongay (2001) controlled for cyclical effects by using five-year averaged data. Moreover, in order to avoid spurious correlation effects, instead of working in levels, they took first differences across subsequent five-year periods. Additionally, since tax revenues are the result of multiplying tax rates and tax bases, they estimated fiscal reaction functions not only for tax revenues, but also for effective tax rates and tax bases. Another difference is that Huizinga and Martinez-Mongay focused on the three categories considered in this paper (labour, capital and consumption), while they also estimated reaction functions for the total tax burden, total expenditures and transfers to households.

Table 10 reproduces such results for the EU sample and the broader sample also including the US and Japan. The results of the tax revenue regression are very similar to those in Besley, Griffith and Klemm (2001). In particular, changes in tax

Table 8

The Relative Tax Burden on Labour over Time, 1970-2000(*)

	Changes between		
	1970 and 2000	1970 and 1985	1986 and 2000
Belgium	–1.9	25.0	–22.1
Denmark	19.9	27.2	8.9
Germany	98.7	55.6	40.2
Greece	–7.7	106.5	–94.6
Spain	–4.5	67.1	–64.2
France	5.8	22.5	–18.0
Ireland	78.8	101.0	–22.3
Italy	–13.2	–8.3	–4.6
Luxembourg	–70.4	–46.2	–30.4
Netherlands	–2.8	51.5	–38.4
Austria	88.4	79.8	2.9
Portugal	–26.6	112.0	–175.2
Finland	5.9	96.4	–96.7
Sweden	11.7	36.9	–6.2
UK	4.7	3.7	–4.2
US	47.7	48.9	–2.2
Japan	75.8	8.4	65.8
Euro area	25.3	35.3	–9.5
EU	21.2	28.1	–11.1

(*) Changes in the ratio between the effective tax rate of labor and that of capital (in percentage points).

Source: Huizinga and Martinez-Mongay (2001).

Table 9

Simple Regressions Between Changes in Labour Tax Rates and Changes in Capital Tax Rates(°)

Regression	Intercept	slope	Adj. R^2	LM Het(1)	T(2)
Within the OECD					
1970-1999(3)	2.19*	0.12	0.01	0.05	85
1990s-1970s(4)	10.3*	0.25	0.06	0.75	17
1974-1979(5)	4.20*	0.22	0.06	0.38	17
1979-1984(6)	3.13*	0.08	–0.0	2.24	17
1984-1989(7)	1.47*	0.30	0.04	0.86	17
1989-1994(8)	1.15*	0.12	–0.0	1.02	17
1994-1999(9)	0.61	0.14	–0.0	0.05	17
Within the EU					
1970-1999(3)	2.28*	0.10	0.00	0.00	75
1990s-1970s(4)	10.9*	0.18	–0.0	0.08	15
1974-1979(5)	4.52*	0.25	0.09	0.73	15
1979-1984(6)	3.21*	0.03	–0.0	1.53	15
1984-1989(7)	1.58*	0.27	–0.0	0.41	15
1989-1994(8)	1.08**	0.15	0.02	0.82	15
1994-1999(9)	0.65	0.11	–0.0	0.39	15

(°) The variables are differences in two consecutive five-year averages over 1970-99 (periods 1970-74, 1975-79, 1980-84, 1985-89, 1990-94, 1995-99). The regressor is changes in the capital effective tax rate.
* significant at 5%, ** significant at 10%.

(1) LM test for hoteroskedasticity. The null is accepted in all the cases.
(2) Sample size.
(3) Full sample.
(4) Differences between year averages for 1994-99 and 1970-74.
(5) Differences between 5-year averages for 1975-79 and 1970-74.
(6) Differences between 5-year averages for 1980-84 and 1975-79.
(7) Differences between 5-year averages for 1985-89 and 1980-84.
(8) Differences between 5-year averages for 1990-94 and 1985-89.
(9) Differences between 5-year averages for 1995-99 and 1990-94.

Source: Huizinga and Martinez-Mongay (2001).

Table 10

Fiscal Reaction Functions, 1970-1999(°)

Fiscal indicator	In the OECD		In the EU	
	Slope	R^2	Slope	R^2
Labour effective tax rate	0.83*	0.19	0.82*	0.21
Labour tax revenues	0.93*	0.40	0.92*	0.42
Labour tax base	0.93*	0.41	0.92*	0.42
Capital effective tax rate	–0.47	–0.0	–0.16	–0.0
Capital tax revenues	0.85*	0.23	0.88*	0.30
Capital tax base	0.17*	0.23	0.83*	0.21
Consumption effective tax rate	0.82*	0.19	0.81*	0.17
Consumption tax revenues	0.64**	0.07	0.61**	0.05
Consumption tax base	0.85*	0.21	0.84*	0.21
Total tax burden	0.76*	0.12	0.76*	0.13
Total expenditures	0.94*	0.47	0.94*	0.50
Transfers to households	0.90*	0.32	0.89*	0.33

(°) Regression results (estimates of the slope and the corresponding R^2) for the fiscal indicator at country level regressed on the arithmetic average for the sample (either the whole sample –1st block or the EU sub-ample –2nd block) excluding the country.
* Significant at 1%.
** Significant at 5%.

Source: Huizinga and Martinez-Mongay (2001).

revenues appear to be associated with similar changes in the "rest of the world". In addition, the estimated coefficients for the capital tax revenues are larger than for much less mobile tax categories such as consumption. Similar results are obtained with the EU sample and the larger sample of 17 countries.

Such co-movements are the results of co-movements in the tax bases and they are associated to co-movements in tax burdens, public expenditures and social transfers. Regressions of this kind fail to establish clear causality, and may suffer from simultaneity bias. Co-movements in tax revenues and tax rates may very well stem from common structural developments that force countries to become more similar in many areas including taxation. This would be consistent with the last two rows in Table 10 which show that total expenditures and transfers to households display international co-movements as well. Martinez-Mongay (2002) showed that these latter two fiscal variables seem to be driven by factors such as income, demography, trade, openness, and politics and by fiscal policy rules and other institutional factors. Commonality in fiscal variables such as these may be driven by common structural trends as well as by tax competition.

Interestingly, co-movements in capital tax rates are statistically insignificant. This is not surprising because, as shown in Figure 4, capital effective tax rates have converged towards an almost time-constant average, which actually implies very different across-country relationships between changes in countries' tax rates and changes in the rest-of-the-world's averages. Since the sample-average is only slightly increasing over time (see Figure 2), convergence implies that tax rates increase in some countries, decrease in others and remain constant in the rest. Therefore, small positive changes in the rest of the world would be associated to a wide range of changes at the country level, which would result in a very low correlation between changes in individual countries' tax rates and changes in the average tax rates for the rest of the world.

4. Conclusion

In the EU, effective labour tax rates have increased over the last three decades in absolute terms as well as relative to effective capital tax rates. Effective tax rates on labour and capital, and to some extent consumption, appear to have converged over this period. Little evidence exists that changes in effective labour tax rates are related to changes in effective capital tax rates, but there is some evidence of significant co-movements of effective tax rates (specifically labour and consumption tax rates) and of tax revenues across countries. All in all, the increased importance of labour taxes, and international co-movements of tax rates and tax revenues, can be explained by the existence of international tax competition, but they can equally result from common structural changes that underlie taxation choices.

APPENDIX

STATISTICAL SOURCES

Series from OECD (Revenue Statistics)[14]

PROP Taxes on property. National currency, current prices. OECD Classification: item 4000.

TRCI Corporate tax revenues from income, profits and capital gains. National currency, current prices. OECD Classification: item 1200.

TRII Tax revenues from income, profits and capital gains of individuals. National currency, current prices. OECD Classification: item 1100.

Input series from AMECO (DG ECFIN, European Commission)[15]

CEGG Compensation of employees; general government. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UWCG-ESA95/1 0 310 0 UWCGF-Old definition.

COEL Compensation of employees; total economy. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UWCD.

DTRV Taxes on income and wealth (Direct taxes); general government. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UTYG-ESA95/1 0 310 0 UTYGF-Old definition.

EMPL Employees, persons; total economy (National accounts). 1000 persons. AMECO Code: 1 0 0 0 NWTD.

GDPN Nominal Gross Domestic Product at market prices. Common currency, Mrd. current euro. AMECO Code: 1 0 92 0 UVGD. These series are used to obtain the weights to calculate the effective tax rates for the euro area (EU-12) and the EU (EU-15) as weighted averages of the tax rates of the corresponding Member States.

GFC Final consumption expenditure of general government at current prices. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UCTG.

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[14] In alphabetical order.

[15] In alphabetical order.

GOS Gross operating surplus; total economy. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UOGD.

INRV Taxes linked to imports and production (Indirect taxes); general government. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UTVG-ESA95/1 0 310 0 UTVGF-Old definition.

NOS Net operating surplus. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UOND.

NWRV Social contributions received; general government. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UTSG-ESA95/1 0 310 0 UTSGF-Old definition.

OCCP Employment, persons; total economy (National accounts). 1000 persons. AMECO Code: 1 0 0 0 NETD.

PFC Private final consumption expenditure at current prices. Percent of GDP (gross domestic product at market prices). AMECO Code: 1 0 310 0 UCPH.

REFERENCES

Besley T., R. Griffith and A. Klemm (2001), *Fiscal reaction functions*, mimeo, London School of Economics.

Carey, D. and H. Tchilinguirian (2000), *Average effective tax rates on capital, labour and consumption*, Paris, OECD.

Carey, D. and J. Rabesona (2002), "Average effective tax rates on capital, labour and consumption", paper presented at the CESifo Summer Institute Workshop on "Measuring the Tax Burden on Capital and Labour", Venice, 15-16 July.

De Haan, J., J.E. Sturm and B. Volkerink (2002), "How to measure the tax burden on labour?", paper presented at the CESifo Summer Institute, workshop on "Measuring the Tax Burden on Capital and Labour", Venice, 15-16 July.

European Commission (1997), *Structures of the Taxation Systems in the European Union. New version 1970-95*, Brussels.

——————— (1999), *Structures of the Taxation Systems in the European Union. 1970-96*, Luxembourg, EUROSTAT.

——————— (2000a), *Structures of the taxation systems in the European Union, 1970-97*, Luxembourg, EUROSTAT.

——————— (2000b), *Public finances in EMU – 2000*, European Economy Reports and Studies, No. 3.

——————— (2003), *Economic Forecasts, Spring 2003*, European Economy, No. 2.

Gordon, K. and H. Tchilinguirian (1998), "Effective average tax rates on capital, labour and consumption goods: Cross country estimates", OECD document DAFFE/CFA/WP2/RD(98)14, Paris, OECD.

Huizinga, H. and C. Martinez-Mongay (2001), "Labour taxation in the European Union", paper presented at the conference on "Tax Policy in the European Union" organised by the OCFEB of Erasmus University in The Hague, 17-19 October.

Layard, R., S. Nickell and R. Jackman (eds.) (1991), *Unemployment. Macroeconomic Performance and the Labour Market*, New York, OUP.

Martinez-Mongay, C. (1998), "On effective taxation", OECD document DAFFE/CFA/WP2/RD(98)17, Paris, OECD.

——————— (2000), "ECFIN's effective tax rates. Properties and comparisons with other tax indicators", Economic Paper No. 146, (October), Brussels, European Commission.

——————— (2001), "The long-run determinants of government receipts", in *Fiscal Sustainability*, (chapter 12), Roma, Banca d'Italia.

——————— (2002), "Fiscal policy and the size of governments", forthcoming in M. Buti, J. von Hagen and C. Martinez-Mongay (eds.), *The behavior of fiscal authorities. Stabilization, growth and institutions*, London, Palgrave.

Martinez-Mongay, C. and R. Fernandez (2001), "Effective taxation, spending and employment performance", in M. Buti, P. Sestito and H. Wijkander (eds.), *Taxation, Welfare and the Crisis of Unemployment in Europe*, Cheltenham (UK), Edward Elgar.

Mendoza, E.G., A. Razin and L. Tesar (1994), "Effective tax rates in macroeconomics. Cross-country estimates of tax rates on factor incomes and consumption", *Journal of Monetary Economics*, 34, pp. 297-33.

OECD (2002), *Revenue Statistics*, Paris, OECD.

Rodrick, D. (1998), "Why do open economies have bigger governments?", *Journal of Political Economy*, No. 106, pp. 997-1032.

DOES IT PAY TO WORK IN THE UNITED STATES?

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Introduction

Does it pay to work? That is a tough question to answer. In general, more work means a higher income and, therefore, higher taxes. A higher income usually also leads to fewer entitlement benefits (such as Food Stamps). Moreover, the effects of working today are not limited to today's higher taxes and today's loss of entitlement benefits. Income earned today also affects future taxes and future benefits. In particular, there are five important links between today's decisions and their future consequences:

- Earning more today typically leads to more saving and, therefore, more assets and more income from assets in the future; however, that higher future capital income will result in higher future capital income taxes.
- More assets and more income in the future will also mean fewer future benefits from entitlement programs that are linked to the assets and the income of the recipients (such as Medicaid).
- Earning more today will typically lead to more consumption in the future, because asset accumulation makes more consumption possible; however, that higher consumption will result in higher consumption taxes.
- Earning more income today will lead to higher Social Security benefits in the future.
- More non-Social Security income in the future, caused by higher earnings and more saving today, will increase the tax on future Social Security benefits.

1. Calculating the costs and benefits of working

As the above list indicates, understanding the full consequences of deciding to work requires taking into account all future taxes workers will pay plus all future transfer payments workers will lose from going to work. To illustrate this lifetime tax analysis we have chosen a representative, two-earner couple. The couple is assumed to rent in the early years and eventually buy a house. They have two children, who grow up and attend college. As a result, the couple has an opportunity

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to interact with the tax system in numerous ways, e.g., taking advantage of the mortgage interest deduction and the child tax credit, deciding whether to itemize deductions, paying FICA taxes, paying state income taxes, and using their after-tax earnings to pay sales taxes.

We assume that couples enter the labor market at a specific wage and that their income grows by 1 percent per year in real terms, and consider this couple at different income levels. For example, if they earn a low income they benefit from the Earned Income Tax Credit and the credit for retirement account contributions. If they earn a high income, they are penalized by the phase-out of itemized deductions and the alternative minimum tax. We approach entitlement benefits in a similar way. If they earn a low-income, the family qualifies for a host of "welfare" benefits – including cash assistance, Food Stamps, Medicaid, etc. If they earn a higher income or have assets, these benefits phase out.

Our approach is also probabilistic. In any given year, there is some chance one or both spouses will die. The death of a spouse triggers entitlement benefits for the remaining spouse and the children (such as survivors benefits under Social Security). These benefits are also affected by what the deceased spouse was earning. We calculate expected taxes and expected benefits for the couple. We do so by calculating the taxes and benefits for each possible lifetime. To get an expected result, we sum over all possible lifetimes, each weighted by its probability of occurring.

Our approach is also comprehensive. We include every major tax and transfer program. In the case of taxes, we include employer-paid taxes, whether they be corporate income taxes or employer-paid FICA taxes.

1.1 The complexity of the U.S. tax and transfer benefit programs

It is difficult to exaggerate the complexity of the taxes and transfer programs facing American workers. Mastering just the federal income tax represents a major challenge because it has so many special provisions. The list includes the inflation-indexation of tax brackets, the partial – but graduated – taxation of Social Security benefits above two non-inflation-indexed thresholds, the treatment of retirement account contributions and withdrawals, the phase-out of itemized deductions, the earned income tax credit, the child tax credit, the alternative minimum tax, and the recently legislated credit to low-income households for contributing to retirement accounts.

If the federal income tax weren't hard enough to follow, almost all states have income taxes with their own special provisions. For example, Massachusetts has a special exemption for the elderly, a child deduction, a rental deduction, and a deduction for employee-paid payroll taxes. Compared to these taxes, the Federal Insurance Contributions Act (FICA) payroll tax may seem straightforward.

Thanks to the growth of a variety of interrelated social welfare programs, the U.S. system of transfer benefits has become extremely complicated. It includes such

programs as Food Stamps, Medicaid, traditional "welfare" (now called Temporary Assistance for Needy Families), Supplemental Security Income (SSI), Housing Assistance Programs, the Low-Income Home Energy Assistance Program (LIHEAP), the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), etc.

1.2 Software program

Understanding the effective net tax on work requires an intertemporal model capable of carefully determining tax and transfer payments at each stage of a person's life cycle, based in part on economic choices in prior periods. This study uses *ESPlanner*, a financial planning software program developed by Economic Security Planning, Inc., to study the net tax levied on workers with different earnings capacities. *ESPlanner* smooths households' living standards subject to constraints on their capacities to borrow. In so doing, it makes highly detailed, year-by-year federal and state income tax and Social Security benefit calculations.

1.3 Reporting the results

In expressing the results of this study, we have chosen multiples of the minimum wage. A full-time worker earning the minimum wage of $5.15 an hours will earn $10,700 a year. When both spouses earn the minimum wage, their family income will be $21,400. If both spouses earn twice the minimum wage, (at $10.30 an hour), their joint annual income will be $42,800. And so forth.

2. Lifetime taxes and lifetime transfer benefits

In order to assess the consequences of going to work, we need to calculate over a lifetime the extra taxes paid and extra benefits received or sacrificed as a result of that decision. In what follows, all lifetime taxes and transfer benefits are reported as present values.

2.1 Lifetime taxes

Table 1 presents the couple's expected lifetime taxes and benefits, measured in current dollars. If we ignore the lowest income levels, the table shows:

- A couple earning twice the minimum wage can expect to pay more than $300,000 in taxes over the course of their lifetime – an amount equal to about seven times their initial annual income.
- A couple earning in the range of $100,000 can expect to pay close to a million dollars in lifetime taxes – an amount equal to almost ten times their initial annual earnings.

Table 1

Lifetime Taxes and Benefits by Income
(thousands of constant 2000 US Dollars)

Multiple of the Minimum Wage	Initial Annual Household Earnings	Lifetime Taxes	Lifetime Benefits	Lifetime Taxes as a Multiple of Annual Initial Earnings	Lifetime Benefits as a Multiple of Initial Annual Income	Lifetime Taxes as a Multiple of Lifetime Benefits	Average Net Tax Rate (Lifetime Net Taxes/Lifetime Earnings; percent)
0	**0.0**	0.0	489.0	n.a.	n.a.	n.a.	n.a.
1	**21.4**	101.5	268.6	4.7	12.6	0.38	–32.2
1.5	**32.1**	206.4	109.1	6.4	3.4	1.89	14.8
2	**42.8**	302.3	93.7	7.1	2.2	3.23	22.9
3	**64.3**	509.6	90.7	7.9	1.4	5.62	30.1
4	**85.7**	746.2	104.1	8.7	1.2	7.17	34.4
5	**107.1**	994.5	110.6	9.3	1.0	8.99	37.8
6	**128.5**	1271.0	116.8	9.9	0.9	10.88	41.0
7	**150.0**	1533.0	123.1	10.2	0.8	12.45	42.9
8	**171.4**	1785.4	127.7	10.4	0.7	13.98	44.2
9	**192.8**	2014.9	127.7	10.5	0.7	15.78	45.1
10	**214.2**	2242.0	127.7	10.5	0.6	17.56	45.7
15	**321.4**	3435.6	127.7	10.7	0.4	26.90	48.4
20	**428.5**	4601.4	127.7	10.7	0.3	36.03	49.6
30	**642.7**	6933.5	127.7	10.8	0.2	54.30	50.8
40	**857.0**	9265.7	127.7	10.8	0.1	72.56	51.4

Source: Authors' Calculations.

- At higher levels of income, expected lifetime taxes tend to be between ten and eleven times initial annual earnings, regardless of the amount earned.

On the tax side, then, the U.S. fiscal system is mildly progressive. As a percent of lifetime income, the tax burden tends to rise modestly as income rises, and then levels off once income gets much above $100,000.

2.2 The composition of lifetime taxes

One reason why the overall tax system is not more progressive is that people pay different types of taxes at different income levels. Although the rate structure of the federal income tax system is fairly progressive, payroll taxes tend to be proportional to income (although typically capped at a certain income level) and consumption taxes tend to be regressive – taking a larger portion of family income, the lower the income level. In general, the tax burden borne by lower income families tends to be weighted toward proportional and regressive taxes. As Table 2 shows:

- For a family earning $32,100 a year (1.5 times the minimum wage), half the taxes paid are payroll taxes and only 30 per cent are paid in the form of income taxes.
- By contrast, for a family earning $321,400 (15 times the minimum wage), three-fourths of all taxes are paid in the form of income taxes, and less than one in five tax dollars are paid in the form of payroll taxes.

2.3 Lifetime transfer benefits

Returning to Table 1, note that a couple in which both spouses initially earn the minimum wage and remain at the bottom of the income ladder throughout their work lives, can expect to pay more than $100,000 in taxes over their lifetime. However, they can expect to receive back almost $270,000 in benefits. Hence, a low-income household gets a very good return on its taxes. (Note however, that it is very difficult to work fulltime and earn only a minimum wage income for four to five decades). Going beyond the lowest income level, Table 1 shows that:

- A couple earning twice the minimum wage ($42,800) can expect to receive about $94,000 in lifetime entitlement benefits, measured in current dollars.
- At four times the minimum wage ($85,700) expected entitlement benefits rise to $104,000.
- After an income level of about $150,000, they reach about $127,000, where they remain, regardless of the size of the family's income.

Unlike taxes, which tend to be proportional to income once a certain income level is reached, transfer benefits tend to be constant once a certain income level is reached. This means that benefits as a percent of income tend to fall as income rises.

Table 2

Components of Lifetime Taxes as a Percent to Lifetime Earnings and Total Lifetime Taxes

		As A Percent of Lifetime Earnings			As A Percent of Total Lifetime Taxes		
Multiple of the Minimum Wage	**Initial Annual Household Earnings** *(thousands of constant 2002 US Dollars)*	**Payroll Taxes**	**Income Taxes (Personal plus Corporate)**	**Consumption Taxes**	**Payroll Taxes**	**Income Taxes (Personal plus Corporate)**	**Consumption Taxes**
1	**21.4**	13.9	0.1	6.4	68.1	0.5	31.4
1.5	**32.1**	13.9	8.3	5.6	50.0	29.9	20.1
2	**42.8**	13.9	11.3	5.2	45.7	37.2	17.1
3	**64.3**	13.9	15.6	4.8	40.5	45.5	14.0
4	**85.7**	13.9	19.3	4.4	37.0	51.3	11.7
5	**107.1**	13.9	22.0	4.2	34.7	54.9	10.5
6	**128.5**	13.9	24.9	4.0	32.5	58.2	9.3
7	**150.0**	13.9	26.5	3.8	31.4	60.0	8.6
8	**171.4**	13.6	27.7	3.8	30.2	61.4	8.4
9	**192.8**	12.4	29.3	3.7	27.3	64.5	8.1
10	**214.2**	11.5	30.6	3.7	25.1	66.8	8.1
15	**321.4**	8.7	35.2	3.6	18.3	74.1	7.6
20	**428.5**	7.3	37.2	3.6	15.2	77.3	7.5
30	**642.7**	5.8	39.4	3.6	11.9	80.7	7.4
40	**857.0**	5.0	40.4	3.5	10.2	82.6	7.2

Source: Authors' Calculations.

- At twice the minimum wage, couples can expect to get back about $1 in transfer benefits for every $3 they pay in taxes.
- At four times the minimum wage, couples can expect to get back less than one in seven dollars they pay in taxes.
- And at about $200,000 in income, they get back less than one in sixteen.

2.4 Composition of transfer benefits

The principle reason why transfer programs tend on the whole to be more progressive than the tax system is the existence of programs that are means tested. Although rich and poor alike participate in Medicare and Social Security, only low-income families have access to means-tested benefits, the most important of which is Medicaid. As Table 3 shows:

- About 70 per cent of all transfer benefits received by a couple earning the minimum wage over the course of their work life consists of Medicaid benefits; and only one in four dollars is in the form of Social Security and Medicare benefits.
- By contrast, a couple earning $150,000 (seven times the minimum wage) receives all of its transfer benefits in the form of Social Security (73 per cent) and Medicare (27 per cent).

2.5 Policy implications

From these observations, three conclusions with important public policy implications can be drawn. First, most Americans can expect to get back only a fraction of what they pay in taxes in the form of entitlement benefits (although they do receive other government services that are presumably worth paying for). Second, the system as a whole is quite progressive – with low- and moderate-income families doing much better in terms of their relationship with the state than higher income families. Third, most of the progressivity in the U.S. fiscal system comes on the benefit side rather than on the tax side of fiscal policy.

One way to appreciate the amount of overall progressivity in the system is to calculate an average lifetime net tax rate, defined as the ratio of lifetime taxes net of any transfer benefits received to lifetime income. The result of that calculation is shown in Figure 1. As in Table 1, Figure 1 shows that a couple in which both spouses earn the minimum wage over the whole of their work life can expect to receive far more in transfer benefits (including their EITC refund) than they will pay in taxes. (Yet, as noted above, it is very difficult to stay at the minimum wage over one's entire work life.) At 1.5 times the minimum wage, the couple experiences a positive net tax burden, however, and from that point on those who earn more pay more of their income (on net) to the state. Although progressive overall, it is only mildly so at higher income levels.

Table 3

The Distribution of Transfers by Type and Household Earnings

Multiple of the Minimum Wage	Initial Annual Household Earnings	Lifetime Benefits	Share of Lifetime Benefits *(percent)*			
	(thousands of constant 2000 Dollars)		Social Security	Medicare	Medicaid	Other
0	**0.0**	489.0	0.0	6.9	51.7	41.4
1	**21.4**	268.6	11.4	12.6	70.0	6.0
1.5	**32.1**	109.1	33.9	31.0	33.5	1.6
2	**42.8**	93.7	46.4	36.1	17.1	0.4
3	**64.3**	90.7	62.4	37.3	0.0	0.3
4	**85.7**	104.1	67.3	32.5	0.0	0.2
5	**107.1**	110.6	69.3	30.6	0.0	0.1
6	**128.5**	116.8	71.1	28.9	0.0	0.0
7	**150.0**	123.1	72.5	27.5	0.0	0.0
8	**171.4**	127.7	73.5	26.5	0.0	0.0
9	**192.8**	127.7	73.5	26.5	0.0	0.0
10	**214.2**	127.7	73.5	26.5	0.0	0.0
15	**321.4**	127.7	73.5	26.5	0.0	0.0
20	**428.5**	127.7	73.5	26.5	0.0	0.0
30	**642.7**	127.7	73.5	26.5	0.0	0.0
40	**857.0**	127.7	73.5	26.5	0.0	0.0

Source: Authors' calculations.

3. Lifetime marginal net tax rates

To those for whom progressivity is an important value, these results should be heartening. The disappointment is that this progressivity comes at a terrible price. Many entitlement benefits, it turns out, are available to people whether they work or not. And when they decide to work, the withdrawal of benefits plus the imposition of taxes creates very high marginal tax rates.

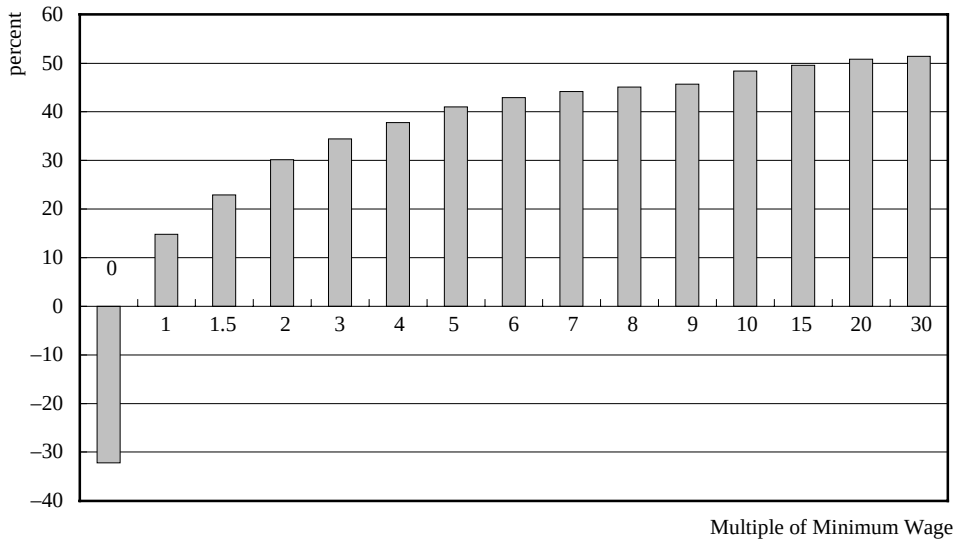
3.1 Working versus Not Working

To calculate marginal tax rates we ignore benefits that people are entitled to whether or not they work. Instead we want to identify any changes in taxes paid and benefits received as a result of the decision to work rather than not work. The additional taxes paid plus the net reduction in transfer benefits received divided by the income from working is called the marginal net tax rate. These are depicted in Table 4.

The first thing to note is that all full-time working households face marginal net work-tax rates in excess of 50 per cent! In going to work, all American households hand over half or more of every dollar they earn to state and federal government in taxes paid net of benefits received. Second, note that the lowest income households face the highest marginal net tax rates:

Figure 1

Average Net Tax Rate



Source: Authors' calculations.

Table 4

Marginal Net Tax Rates on Working Full- and Part-Time
(percent)

Multiple of the Minimum Wage	Full-Time Marginal Net Work/Tax Rate	Change in Taxes	Change in Benefits	Half-time Marginal Net Work/Tax rate	Marginal Net Tax Rate on Switching from Part- to Full-Time Work
1	66.5	20.2	44.4	36.4	96.8
1.5	80.6	27.5	51.1	55.0	106.3
2	72.2	30.1	39.9	66.5	77.9
3	63.0	34.0	26.9	80.6	45.5
4	59.1	37.3	19.5	72.2	46.0
5	57.5	39.8	15.3	67.1	48.0
6	57.5	42.5	12.5	63.0	51.9
7	57.0	44.0	10.6	60.7	53.3
8	56.6	44.8	9.1	59.1	54.0
9	56.1	45.1	8.1	58.1	54.1
10	55.7	45.4	7.4	57.5	53.8
15	55.2	47.1	5.0	56.8	53.5
20	54.7	47.6	3.7	55.7	53.6
30	54.2	48.2	2.6	55.2	53.2
40	54.0	48.3	1.8	54.7	53.3

Source: Authors' calculations.

- The marginal net tax rate of households earning 1.5 times the minimum wage is 81 per cent; *families at this income level get to keep less than one-fifth of the income they earn.*
- At two times the minimum wage the marginal net tax rate is 72 per cent; *these families get to keep less than 30 cents out of each dollar they earn.*

Third, marginal net tax rates actually decline as income rises. On the whole, marginal net tax rates tend to be regressive, imposing the highest burdens on those with the lowest earnings.

Perhaps the most striking feature of Table 4 is that the minimum wage household faces a 67 per cent net marginal tax on working full time. This family gets to keep only one in every three dollars it earns on net! The principal reason is that households who don't work receive very substantial transfer benefits. Many of these benefits are either lost entirely or substantially reduced when the household goes to work full time. In addition, the household must pay federal income, state income, and FICA taxes on its earnings. Offsetting these factors is the increase in Social Security benefits associated with working and the availability of the earned income tax credit.

Households earning 1.5 times the minimum wage also lose benefits when they go to work. But they lose essentially all of their earned income tax credits. In addition, their higher earnings limit the degree of progressivity of the Social Security benefit schedule.[1] This is the reason marginal net tax rates are higher for households earning 1.5 time the minimum wage than for those with higher incomes.

3.2 The composition of marginal net tax rates

Figure 2 also shows the composition of marginal net tax rates for couples at different income levels. Note that the loss of benefits is more important the lower the family's income. Conversely, direct taxes on income become more important the higher the family's income. For example:

- At $32,100 (1.5 times the minimum wage), two-thirds of the marginal net tax rate consists of the loss of transfer benefits, while a little more than one in five dollars is lost to income and payroll taxes.[2]
- At $64,300 (3 times the minimum wage) slightly more half of the marginal net tax rate consists of additional income and payroll taxes, while slightly less than half arises from lost benefits.

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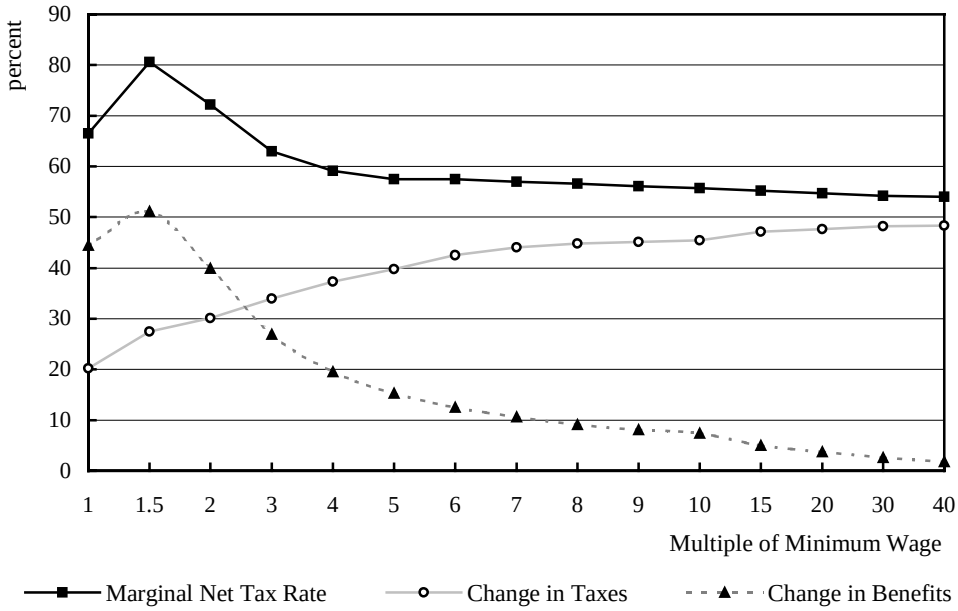
[1] The loss of benefits is, of course, experienced by higher earning couples when they go to work. But the higher the level of earnings, the small is this loss as a share of the increase in spending associated with working.

[2] Note: These are payroll taxes net of increases in Social Security benefits.

Figure 2

Decomposition of the Marginal Net Tax Rate



Source: Authors' calculations.

- At $321,400 (15 times the minimum wage), four in five dollars of the marginal net tax is lost to income and payroll taxes.

3.3 Working part-time

Table 4 also shows marginal net tax rates for those who go from no work to part-time work and from part-time to full-time work. As the table reveals, fiscal policy discourages full-time work more than half-time work for low and moderate income couples:

- At the minimum wage, the marginal net tax rate on going to work half-time is 36 versus 67 per cent for working full-time.
- At 1.5 times the minimum wage, the rate for half-time work is 55 versus 81 per cent for full-time work.
- At 2 times the minimum wage, the rate for half-time work is 67 versus 72 per cent for full-time work.

Fiscal policy, in other words, encourages families at the bottom of the income ladder to work half-time rather than full-time, if they work at all. However, at higher income levels, these incentives are reversed.

- A family earning 3 times the minimum wage faces a marginal net tax rate of 81 per cent for half-time work versus 63 per cent for full-time work.
- At 4 times the minimum wage, the rates are 72 per cent for half-time versus 59 per cent for full-time.

Another way of looking at this issue is to ask what happens to people who switch from working half-time to full-time. As the table shows:

- A minimum wage couple who switches from half-time to full-time work will lose 97 cents out of every extra dollar they earn.
- At 1.5 times the minimum wage, the couple will lose $1.06 for every $1.00 they earn; for this couple, *working more literally means having less.*

3.4 Marginal net tax rates at different ages

Table 5 shows marginal net tax rates for couples at different ages. Note that at higher income levels, marginal net tax rates are roughly the same regardless of the amount earned. However, at lower-income levels, there is a significant difference. Specifically:

- At 1.5 times the minimum wage, the marginal net tax rate is 60 and 61 per cent for couples ages 25 and 35 respectively.
- However, at ages 55 and 65, these rates drop to 14 and 22 per cent respectively.

The difference seems to stem from those tax and spending programs that relate to children and are means tested. These provisions steeply raise marginal net tax rates for young couples. Ironically, fiscal policies designed to help children are the ones most responsible for discouraging low and moderate-income families from working.

4. Conclusion

To understand lifetime average and marginal net tax burdens, we have included in fine detail every major tax and transfer program affecting American households. What emerges is a picture of a fiscal system with six characteristics:

- The U.S. fiscal system is highly progressive over the bottom half of the income distribution. Couples working full-time and earning the minimum wage get back 32 cents in benefits (net of taxes) for every dollar they earn; while couples earning $64,000 (or 3 times the minimum wage) pay 30 cents in taxes (net of benefits) per dollar earned. The system is only mildly progressive over the top half of the income distribution, however.

Table 5

Marginal Net Tax Rates on Working At Different Ages

Multiple of the Minumum Wage	Initial Annual Income *(thousands of constant 2002 US Dollars)*	Household's Age				
		25	35	45	55	65
1	**21.4**	9.7	23.8	16.6	12.6	24.5
1.5	**32.1**	59.6	61.1	16.5	14.1	21.6
2	**42.8**	52.8	52.9	9.4	10.3	17.6
3	**64.3**	47.9	48.2	14.8	31.7	35.2
4	**85.7**	47.1	46.7	15.2	37.9	40.7
5	**107.1**	46.7	45.5	16.0	40.3	40.6
6	**128.5**	48.4	46.2	17.7	43.4	44.9
7	**150.0**	48.3	45.2	19.6	45.3	46.5
8	**171.4**	47.9	44.9	20.6	45.5	46.7
9	**192.8**	47.6	43.2	20.2	44.6	48.3
10	**214.2**	47.4	42.3	19.5	45.6	48.2
15	**321.4**	47.9	41.6	25.8	45.2	45.3
20	**428.5**	45.0	40.8	32.2	44.3	43.8
30	**642.7**	44.3	33.6	44.7	44.6	43.6
40	**857.0**	44.1	27.1	43.8	43.3	42.1

Source: Authors' calculations.

- Most of the progressivity in the U.S. fiscal system comes from means tested spending programs, rather than taxes, and these are concentrated at the bottom of the income ladder.
- Workers at every income level face very steep lifetime marginal tax rates. In fact, virtually all full-time American workers lose more than half of their earnings in taxes and foregone transfer benefits.
- The very highest marginal net tax rates are imposed on the lowest-income earners, largely because of the withdrawal of means-tested tax and spending benefits. Indeed, working couples in the bottom half of the income distribution only get to keep a third or less of the income they earn, on net.
- If low-income households work at all, the U.S. fiscal system strongly encourages part-time work rather than full-time work. Couples earning 1.5 times the minimum wage will actually reduce their standard of living if they work full-time rather than half-time.
- The principal reason for very high marginal net tax rates for low-income households is the existence of means tested tax and welfare benefits tied to children. For example, a 25-year-old couple with children, earning 1.5 times the minimum wage, will give up 60 cents for every dollar earned. However, the marginal net tax rate on that same couple drops to 14 per cent at age 55, when they are well past the child-rearing years.

Overall, our system is very generous to those at the bottom of the income ladder. But the price of that generosity is an incentive structure that strongly discourages labor market participation among those with the lowest skills.

REFERENCES

Altig, D., A. Auerbach, K. Smetters and J. Walliser (2001), "Simulating Fundamental Tax Reform in the U.S.", forthcoming in *The American Economic Review*.

Boskin, M.J., L.J. Kotlikoff, D.J. Puffert and J.B. Shoven (1987), "Social Security: A Financial Appraisal Across and Within Generations," *National Tax Journal*, vol. 40, No. 1, March, pp. 19-34.

Bradford, D.F. (ed.) (1995), *Distributional Analysis of Tax Policy*, Washington, D.C., AEI Press.

Browning, E.K. (1995), "Tax Incidence Analysis for Policy Makers," in D. Bradford (ed.), *Distributional Analysis of Tax Policy*, Washington, D.C., The AEI Press.

Caldwell, S.B., M. Favreault, A. Gantman, J. Gokhale, T. Johnson and L.J. Kotlikoff (1999), "Social Security's Treatment of Postwar Americans," in J. Poterba (ed.), *Tax Policy and the Economy*, 13, pp. 109-48.

Fullerton, D. and D.L. Rogers (1995), "Distribution Effects on a Lifetime Basis," in D.F. Bradford (ed.), *Distributional Analysis of Tax Policy*, Washington, D.C., AEI Press, pp. 262-94.

———— (1993), *Who Bears the Lifetime Tax Burden?*, Washington, D.C., The Brookings Institution.

Gokhale, J. and L.J. Kotlikoff (2002), "Social Security's Treatment of Postwar Americans: How Bad Can It Get?" in M. Feldstein and J. Liebman (eds.), *The Distributional Aspects of Social Security and Social Security Reform*, Chicago, University of Chicago Press, pp. 207-62.

———— (2003), "Who Gets Paid to Save," forthcoming in J. Poterba (ed.), *Tax Policy and the Economy*, Cambridge, MA, MIT Press.

Hubbard, G.R., J. Skinner and S.P. Zeldes (1995), "Precautionary Saving and Social Insurance," *Journal of Political Economy*, Vol. 103, No. 2, April, pp. 360-99.

Hurd, M.D. and J.B. Shoven (1985), "The Distributional Impact of Social Security," in David Wise (ed.), *Pensions, Labor, and Individual Choice*, Chicago, IL, University of Chicago Press.

Myers, R.J. and B.D. Schobel (1993), "An Updated Money's-Worth Analysis of Social Security's Retirement Benefits," *Transactions*, Society of Actuaries, No. 44, pp. 247-75.

Pechman, J. (1985), "Who Paid the Taxes, 1966-1985," Washington, D.C., The Brookings Institution.

———— (1990), "The Future of the Income Tax," *American Economic Review*, March, pp. 1-20.

Poterba, J. (1989), "Lifetime Incidence and the Distributional Burden of Excise Taxes," *American Economic Review*, May, pp. 325-30.

ESTIMATING THE GAINS FROM WAGE AND CAPITAL INCOME TAX CUTS

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Introduction

In recent years, a significant number of industrialized countries have taken steps towards cutting wage income taxes. In the EU, for example, the largely unfinanced tax cuts implemented by a substantial majority of member states amount to 1-1.5 per cent of GDP on average.

Although there is a good deal of variation across countries, a key aim seems to have been the reduction of the tax burden at the low end of the income distribution, thus potentially enhancing participation incentives among these groups.

However, broadly aimed tax cuts also imply significant revenue costs that may exacerbate the pre-existing long-term fiscal sustainability problems confronted by most governments. As indicated by the results in Frederiksen (2003), the average EU member state would thus have to accelerate fiscal consolidation by 3-3.5 per cent of GDP to ensure fiscal sustainability.

Therefore, the question arises whether broad reductions in labor income taxation are likely to lead to supply side adjustments sufficiently strong to justify the fiscal cost. Accordingly, it seems relevant to examine whether, e.g., more narrowly aimed reductions in the marginal tax rate (*i.e.*, a reduction in the progressive elements of the tax code rather than more or less proportional income taxes) might be more cost effective.

Also, in a wider perspective, one may ask whether the key focus should in fact be on labor income taxes rather than the taxation of capital income, as the latter is fraught with a number of well known problems implying both intertemporal and inter-asset distortions which furthermore tend to rise with the rate of inflation.

The objective of this paper is to present a simple and operational approach to comparing the benefits from alternative tax policy options and specifically highlight the relative merits of wage versus capital income tax cuts. It aims at providing a rough first approximation of the relative benefits building on essentially the well-known concept of the marginal cost of public funds, or *MCPF* (see, e.g., Mayshar, 1991, and Dahlby, 1998). The basic idea is to measure in a simple, yet consistent way the potential welfare gains without having first to construct a full general equilibrium model embodying the key behavioral relationships.

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In the analysis, we exploit the key insight that the efficiency impact of a small tax change is equal to the change in government net revenue resulting from the behavioral response. Computing the "revenue recovery ratio" – *i.e.*, the fraction of the revenue loss that is offset by behavioral changes – is therefore identical to estimating the efficiency gain per marginal dollar of tax revenue sacrificed and therefore also provides a useful tool for comparing the relative attractiveness of alternative tax policy options, including the choice between wage and capital income tax cuts. The *MCPF*, in turn, is closely related to the revenue recovery ratio.

This approach is fairly straight forward as far as wage income taxes are concerned. In the next section we recapitulate some basic insights using the distortive labor taxation *MCPF*. Things are somewhat more complicated when reforms of capital income taxes are considered. First, capital income taxes may change not only household saving, but also portfolio composition. Hence, several margins of choice are affected, and we single out four key ones, namely total savings, business investment, residential housing investment and the allocation of household financial assets across institutional (*i.e.*, pension fund and life insurance reserves) and non-institutional investment.

Second, by the very nature of capital accumulation, the effects of tax changes are likely to come about only gradually. Therefore, we employ a simple adjustment to take this into account, thereby computing a revenue recovery ratio that expresses the effects of behavioral changes on fiscal sustainability.

The approximate nature of the results to be reported shortly is related to, first, the absence of general equilibrium effects. We thus ignore all general equilibrium repercussions and hence, e.g., the interactions between changing factor supplies and factor price determination. Second, potential interactions between the distortions under investigation are left unexplored. Third, the present analysis abstracts from issues related to transition – *i.e.*, the potentially important incentive and allocative effects arising from gradual changes in the tax treatment of capital income. An analysis of this issue clearly requires a full general equilibrium model.

1. Wage income taxes

To develop (or, rather, restate) the basic insights, we consider a three-good static model, where households select labor supply, and therefore leisure time, and consumption of goods. We cut through the complexities caused by general equilibrium considerations by assuming that the market wage rate, reflecting the marginal productivity of labor, is constant. Also, we consider an economy populated by (a large number of) identical households, thus allowing us to ignore distributive issues.

Below, our purpose is initially to show two alternative, and from a first glance very different, ways of deriving the well-known expression for the *MCPF* and explaining why they are in fact closely related. The first method involves the examination of how the marginal efficiency condition for public good provision, *i.e.*

the Samuelson rule, is changed when the provision of public goods necessitates the use of a distortionary labor income tax. We consider both a proportional and a progressive tax system.

In the second case we proceed by asking the extent to which the required tax change is affected by the endogenous response of private sector behavior. It turns out that the magnitude by which the change in the tax rate must be augmented is precisely the *MCPF*.

1.1 The traditional way of deriving the MCPF

The individual household chooses labor supply and the consumption of goods and services so as to maximize utility subject to a budget constraint, which states that consumption is equal to after-tax wage income, *i.e.*:

In selecting labor supply L as well as consumption C, the household takes:

$$\underset{\{C,L\}}{\text{Max}} U = U(\overset{(+)}{C}, \overset{(-)}{L}, \overset{(+)}{G}) \quad \text{s.t} \quad C = (1-t)wL \tag{1}$$

as given the amount of the public good, G, that is provided free of charge by the government, as well as the after-tax wage rate, $(1 - t)w$.

Carrying out the usual optimization produces the first order conditions:

$$U_C = \lambda; \quad -U_L = (1-t)w\lambda \;\Rightarrow\; -U_L = (1-t)wU_C \tag{2}$$

where λ is the Lagrange multiplier associated with the household budget constraint. The first-order conditions in (2) imply that labor is supplied up until the point, where the additional sacrifice of an hour of leisure is just compensated, in utility terms, by the increase in consumption that may be financed by incremental after-tax income.

We turn now to the optimization problem faced by the (benevolent) government. The government's job is to select the amount of the public good, G, to supply and hence, by way of the public sector budget constraint, the tax rate on labor income, t. The social welfare function is of the utilitarian type, and we may accordingly express the government's decision problem as:

$$\underset{\{G,t\}}{\text{Max}} W = NU(C,L,G) \quad \text{s.t} \quad pG = twLN \tag{3}$$

In order to identify the condition characterizing optimal provision of the public good, we totally differentiate the SWF and the two budget constraints. This yields:

$$dW = NU_C dC + NU_L dL + NU_G dG = 0 \tag{4}$$

$$pdG = twNdL + wLNdt \tag{5}$$

and

$$dC = (1-t)wdL - wLdt \tag{6}$$

Inserting first the household's first order condition from (2) in (4) gives:

$$dW = NU_C\{dC - (1-t)wdL\} + NU_G dG = 0 \tag{7}$$

By combining (5) and (6) we obtain:

$$dC = wdL - twdL - wLdt = wdL - \frac{twNdL + wLNdt}{N} = wdL - \frac{pdG}{N} \tag{8}$$

which may be used to replace *dC* in equation (7). Doing so, and re-arranging, produces:

$$U_G\, dG = U_C\left\{\frac{pdG}{N} - twdL\right\} \tag{9}$$

Equation (9) shows how the level of provision of the public good is determined. Optimality thus calls for the marginal benefit to the individual household, *i.e.* the left-hand side, to equate marginal cost. Marginal cost, in turn, is made up of the two components appearing on the right hand side. The first one is the direct resource cost equal to the share of total cost borne by each individual. The second component is the change in the deadweight loss due to the use of distortionary taxation. This is the induced change in the tax base, *wdL*, times the wedge capturing the discrepancy between private and social valuation of the marginal hour of labor time. The wedge, of course, is the marginal tax rate, *t*.

Thus, equation (9) indicates how the use of distortionary taxation acts to augment the cost associated with, and hence the required marginal benefits from, government spending programs. In order to arrive at an expression that lends itself directly to numerical application, we insert equation (5) into (9), thus obtaining

$$N\frac{U_G}{U_C} = \frac{wLdt}{wLdt + twdL}\,p = \frac{p}{1 + \frac{tw}{wL}\frac{dL}{dt}} = \frac{p}{1 + \frac{t}{L}\frac{dL}{dt}} \tag{10}$$

The final term in the denominator is the tax elasticity of labor supply, which may be more conventionally written using the wage elasticity of labor supply, ε_L, *i.e.*:

$$\varepsilon_L \equiv \frac{dL}{L}\Big/\frac{d[(1-t)w]}{(1-t)w} = \frac{dL}{L}\frac{(1-t)w}{d[(1-t)w]} = -\frac{dL}{L}\frac{(1-t)w}{wdt} - \frac{1-t}{L}\frac{dL}{dt} \Rightarrow \frac{dL}{dt} = -\frac{L}{1-t}\varepsilon_L \tag{11}$$

We then get the following condition characterizing the optimal provision of the public good *G*,

$$N\frac{U_G}{U_C} = \frac{1}{1-\frac{t}{1-t}\varepsilon_L}p \tag{12}$$

Equation (12) is the familiar Samuelson condition, modified to take into account the fact that we are using a distortionary, proportional tax to finance government spending instead of the standard textbook assumption of lump sum taxation. The intuitive content of (12) is that aggregate marginal willingness to pay, *i.e.* the summation over the marginal rates of substitution between private and public goods, should be equated to total marginal cost, which consists of the direct resource cost, *i.e.* *p*, augmented by the marginal increase in the deadweight loss.

We refer to the efficiency cost of collecting a unit of revenue as the "marginal cost of public funds", or *MCPF*. Hence,

$$MCPF \equiv \frac{1}{1-\frac{t}{1-t}\varepsilon_L} \tag{13}$$

1.2 Progressive taxation and non-wage income

When deriving equation (13), we assumed a simple proportional wage tax, and that wages is the only source of household income. Clearly, it is relevant to consider how the result changes when we allow for progressive taxation. Also, the presence of income taxable transfer payments or private pension benefits implies that part of the tax base is unresponsive to changes in the income tax rate.[1]

We can modify equation (13) to cover these cases by introducing a per capita income tax deduction, *D*, and an amount of exogenously given, taxable per capita income, *S*. The household budget constraint then reads:

$$C = (1-t)(wL+S)+Dt \;\Rightarrow\; dC = (1-t)wdL-(wL+S-D)dt \tag{14}$$

while the government's budget constraint becomes:

$$S+pG = t(wL+S-D)N \Rightarrow pdG = twNdL+(wL+S-D)Ndt \tag{15}$$

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[1] Of course, we could alternatively introduce a parameter capturing the elasticity of the *tax base* rather than the elasticity of *labor supply*. However, for easier interpre-tation and application, we derive below an expression for the *MCPF* that explicitly incorporates the part of the tax base, which is invariant to (labor) income taxation.

while equation (7) applies unchanged. Going through the same steps as above yields:

$$MCPF = \frac{1}{1 - \frac{wL}{wL+S-D}\frac{t}{1-t}\varepsilon_L} \tag{16}$$

Unsurprisingly, progressive taxation, *i.e.* $D > 0$, implies higher *MCPF*, because the revenue impact of a marginal tax increase is reduced, while the incremental efficiency loss is unchanged. Per unit of revenue, therefore, the cost of financing government spending goes up. Hence, the cost-benefit comparison necessitates a higher aggregate willingness to pay for the benefits enjoyed from the marginal unit of government spending, *G*.

Equivalently, for a given value of the labor supply elasticity, the presence of, for example, taxable transfers or deferred income tax pension assets acts to reduce the marginal cost of revenue through the lower responsiveness of the overall tax base.

1.3 An alternative derivation of the MCPF

Above, we derived an expression for the *MCPF* by asking how the Samuelsonian rule of optimal public good provision is modified by the need to resort to distortionary taxation. In this section we shall see that an identical expression emerges when we seek to determine the magnitude of the tax change that is required to raise a pre-specified amount of net revenue.

The change in tax revenue may be written:

$$dR = (wL + S - D)Ndt + twNdL = \left(1 - \frac{wL}{wL+S-D}\frac{t}{1-t}\varepsilon_L\right)(wL + S - D)Ndt \tag{17}$$

where again we have made use of equation (11). If required revenue is equal to, say, *pdG*, we obtain the following expression:

$$dR = pdG \quad \Rightarrow \quad dt = \frac{1}{1 - \frac{wL}{wL+S-D}\frac{t}{1-t}\varepsilon_L}\frac{pdG}{(wL + S - D)N} \tag{18}$$

Consider now the expression for the required change in the tax rate, *dt*. The last term is net revenue, *pdG*, divided by the ex ante tax base, *i.e.* $(wL + S - D)\,N$. This is the required change in the tax rate if behavior does not respond. The first term is equal to the *MCPF*.

Hence, the *MCPF* may be thought of as *either* the true cost in terms of private utility sacrificed in order to raise one unit of revenue *or*, alternatively, as the "mark-up" that must be applied in order to determine how much the tax rate must be raised in order to provide a given amount of tax revenue.

Unsurprisingly, the key component in the computation of the *MCPF* is the amount by which government revenue is diluted through the behavioral changes induced by taxation. From the perspective of the individual household, this essentially represents the operation of a "fiscal externality": When the individual household is induced to change hours of work, the marginal substitution of leisure time for consumption of goods and services *per se* leaves welfare unaffected, and the social cost derives entirely from the implied loss of government net tax receipts.

When examining a tax cut (rather than as above where, for illustrative purposes, we followed the analysis of the theoretical literature and therefore considered a tax increase) this implies that we may identify the marginal welfare gain by computing the "revenue recovery ratio", *i.e.* the share of the revenue loss which is clawed back as a result of the change in private sector behavior.

Obviously, such fiscal externalities are not confined to changes in labor income taxation. If, e.g., the taxation of capital income is altered, similar effects will be at work reflecting tax-induced differences between social and marginal rates of return prevailing at the outset.

Hence, in section 2 we adapt the *MCPF* approach to deal with capital income tax changes, but before doing so, we examine the fiscal externality effects at work when labor income taxes are reduced in order to provide a basis for comparison between this option and the effects of changes in capital income taxation to be examined shortly.

Table 1 below shows the revenue recovery ratios for the three income tax brackets in the Danish tax system, assuming that the wage elasticity of labor supply is equal to 0.1 throughout the income range. The welfare gain per dollar of direct revenue loss is equal to 0.2 for a cut in the lowest income bracket tax rate, while a cut in the top rate produces 88 per cent revenue recovery and hence is almost self-financing.

Of course, the results would be modified if, e.g., the wage responsiveness of labor supply varies throughout the income distribution; however, judged on purely efficiency grounds, a reduction in the low bracket (essentially proportional) tax rate would have to elicit a labor supply increase about five times larger than a cut in the top bracket rate for the former initiative to be cost-effective.

2. Capital income taxes

In the previous section, we saw how the efficiency impact from (small) tax changes takes the form of a fiscal externality, namely the change in government net revenue implied by the change in private sector behavior. Below we show how to quantify the size of the fiscal externalities generated by a (hypothetical) reform aimed at streamlining and lowering capital income taxes, taking the current Danish tax system as the benchmark situation.

Table 1

Wage Income Revenue Recovery Ratios

	Bracket income tax rate *(percent)*	Payroll tax rate *(percent)*	Effective indirect tax rate[1)] *(percent)*	Share of tax-payers[2)] *(percent)*	Average marginal tax rate *(percent)*	Wage base/tax base ratio *(share)*	Revenue recovery ratio[3)] *(share)*
Low bracket	38.8	8.0	32.5	49.6	61.7	1.04	0.17
Mid bracket	44.8	8.0	32.5	30.0	65.9	2.58	0.50
Top bracket	59.7	8.0	32.5	20.4	72.1	3.42	0.88

Notes: 1) VAT and excise duties net of subsidies. Expressed as a revenue-equivalent "augmented VAT" rate.
2) Percentage of tax payers with marginal tax rate in the respective income brackets.
3) The after-tax wage elasticity of labor supply is assumed to be 0.1 for taxpayers in all three marginal rate brackets.

The elements of the hypothetical tax reform as well as the direct revenue impacts are shown in Table 2. The reform involves imposing a uniform 25 per cent income tax rate on personal capital income (typically household net interest income plus certain components of the profits from privately held businesses) instead of the current progressive taxation of positive net capital income. The tax rates applicable to dividends and capital gains are reduced from 28 or 43 per cent to 20 per cent, while the corporate income tax rate is reduced from 30 to 25 per cent. As the table shows, the revenue loss at unchanged behavior equals about 0.5 per cent of GDP.

In the next four subsections we develop an analytical toolkit that may be used to assess – through the computation of an appropriate revenue recovery ratio directly comparable to the results in Table 1 – the attractiveness of launching a reform such as the one outlined above.

We illustrate how the effects on four dimensions of behavior can be evaluated. The first is household savings while the remaining three essentially relate to the composition of private sector asset holdings, namely business capital formation, residential housing investment and pension/life-insurance asset accumulation.

Throughout we assume that the real before tax market rate of return is 4 per cent, while the inflation rate is 2 per cent in our baseline scenario. When reporting the combined revenue recovery ratio, we examine further the consequences of

Table 2

Tax Rates on Capital Income Before and After Hypothetical Reform

	Pre-reform (2003) *(percent)*	Post-reform *(percent)*	Revenue impact at unchanged behavior *(percent of GDP)*
Negative net personal capital income	33.3	25	0.38
Positive net personal capital income	38.8-59.7	25	–0.31
Dividends and capital gains	28-43	20	–0.18
Corporate income	30	25	–0.37[1)]
Pension and life insurance asset returns	15	15	0.00
Total	**-**	**-**	**–0.48**

Notes: 1) After adjustment for shareholder level taxes assuming ownership shares of one-third each for domestic households, domestic pension funds and foreign investors.

changing the assumption regarding inflation in order to illustrate the quantitative significance of the interaction between nominal income taxation and inflation. Finally, we assume that the annual real wage growth rate (which is relevant for computing present values as well as the derivation of effective real tax rates on pension assets) is 1.5 per cent.

2.1 Household savings

As shown in Table 3, the hypothetical reform implies a reduction in the average tax rate applicable to household net capital income from 37.3 per cent (*i.e.*, a weighted average of the statutory rates shown in Table 2) to 25 per cent. Allowing for inflation, the real effective tax rate is cut from 56 to 38 per cent thus producing a 0.7 percentage point permanent increase in the after-tax rate of return.

Increased household savings imply that, as private sector assets are gradually built up, tax receipts increase. To facilitate comparison with the results concerning wage taxation, we need to compute the equivalent permanent revenue effect – *i.e.*, the impact of behavioral changes on fiscal sustainability. We thus need to track the dynamic evolution of private financial assets and convert the implied additional revenue into an annuity.

Table 3

Effect on Private Savings

Pre-reform average statutory income tax rate on capital income *(percent)*	37.3
Post-reform average statutory income tax rate on capital income *(percent)*	25.0
Pre-reform effective real tax rate[1)] *(percent)*	56.0
Post-reform effective real tax rate[1)] *(percent)*	37.5
Change in effective real tax rate *(percentage points)*	–18.5
Implied increase in real return *(percentage points)*	0.74
Impact increase in savings[2)] *(percent of GDP)*	0.369
Effect on fiscal sustainability[3)] *(percent of GDP)*	**0.134**

Notes: 1) Denotes tax on interest income expressed in per cent of the pre-tax real rate of return. The nominal interest rate is assumed to be 6 per cent, while the rate of inflation is 2 per cent.
2) Based on the assumption that a 1 percentage point permanent increase in the after-tax rate of return yields a 0.5 per cent of GDP short-run increase in private savings.
3) Based on a marginal propensity to consume out of total wealth (*i.e.*, discounted disposable labour income plus net household financial assets) equal to 4 per cent. See Annex 1.

To do so, it is useful to parameterize the effects on household asset accumulation, using two key magnitudes, namely the impact increase in household saving, *dS*, and the marginal propensity to consume out of private assets, Δ. The implied gain in net tax receipts – that is, the fiscal externality and hence the contribution from private savings to the revenue recovery ratio – may then be expressed as:[2]

$$d\sigma = \frac{\tau i}{\tau i + \Delta} dS \tag{19}$$

where τ is the capital income tax rate, *i* is the nominal market interest rate, while $d\sigma$ denotes the permanent stream of incremental tax revenue that is equivalent in present value to the gradually increase in capital income tax revenue generated by the hypothesized rise in household savings.

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2 See Annex 1.

In other words, equation (19) shows how to compute the impact on fiscal sustainability arising from the behavioral response to lower taxes on household net capital income.

Table 3 reports results based on the assumption that a 1 percentage point sustained increase in the post-tax real return generates at short-run increase in private savings of 0.5 per cent of GDP. The marginal propensity to consume is set to 4 per cent, reflecting calibration of the key intertemporal parameters in an extended version of the Blanchard-Weil overlapping generations model, as shown in Annex 1.

As shown in Table 3, revenue recovery from this component of the reform is equivalent to a sustained increase in government net tax receipts of 0.13 per cent of GDP. Notice also that this amount in fact exceeds the direct (*i.e.*, ignoring behavioral changes) reduction of tax receipts shown in Table 1 (0.38 – 0.31 = 0.07 per cent of GDP). Hence, even with a fairly modest[3] impact on private savings, this part of the overall package is in fact more than self-financing.

2.2 Business investment

The hypothetical reform of capital income taxation affects business investment through the reduction in the taxation of household interest earnings (which tends to increase the hurdle rate that business investment must satisfy) as well as the lowering of the corporate tax rate and the tax rates applicable to household dividend income and capital gains.

The net effect of the tax system on business investment is summarized by the standard concept of the cost of capital *c*, *i.e.*:

$$c = \left\{ \frac{(1-t^c)}{(1-\theta)(1-\tau)} r + \frac{\tau + (1-\tau)\theta - t^c}{(1-\theta)(1-\tau)} \pi \right\} - \left(\frac{\tau}{1-\tau} \right) \left[\frac{\left(\frac{1-t^c}{1-\theta}\right)(r+\pi)}{\left(\frac{1-t^c}{1-\theta}\right)(r+\pi) + \tilde{\delta}} \right] \left(\tilde{\delta} + \pi - \delta \right) \qquad (20)$$

where we have assumed that the marginal investment project is financed through retained earnings, while θ is the tax rate on dividends and capital gains, t^c is the tax rate on interest income, τ is the corporation tax rate, while $\delta, \tilde{\delta}$ denote, respectively, the rates of physical and tax depreciation and π is the inflation rate.

The term in curly brackets is the cost of finance, and it exceeds the real pre-tax rate of interest *r* (and is furthermore increasing in the inflation rate) provided the combined taxation of equity returns at the corporate and investor levels exceeds the taxation of interest earnings.

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[3] An alternative perspective on the assumed behavioral effects may be obtained by computing the long-term increase in private sector financial assets implied by the assumptions concerning the path of incremental asset accumulation. This amounts to about 13 per cent of GDP for each 1 percentage point increase in the post-tax return. Given the 56 per cent real tax rate at the outset, the presence of capital income taxation thus depresses private asset holdings by about 30 per cent of GDP, or less than one-fifth of the household asset-to-GDP ratio reported in Table 6 below.

The second term on the right hand side in equation (20) is the contribution from tax depreciation. Specifically, if the tax depreciation rate exceeds the nominal rate of economic depreciation, tax write-offs will reduce the cost of capital and this effect is increasing in the inflation rate.

Table 4 shows the potential consequences of the hypothetical reform, when the elasticity of business investment with respect to the user cost of capital (*i.e.*, the cost of capital computed according to equation (20) augmented by the physical depreciation rate) is assumed to be –0.5.

Table 4

Effect on Business Investment

	Pre-reform	Post-reform
Business capital stock (buildings and equipment) *(percent of GDP)*	137.0	
Physical depreciation rate (avg. for buildings and equipment) *(percent)*	8.0	-
Personal capital income tax rate *(percent)*	37.3	25.0
Dividends and capital gains tax rate *(percent)*	35.5	20.0
Corporate income tax rate *(percent)*	30.0	25.0
Tax depreciation rate (avg. for buildings and equipment) *(percent)*	12.0	12.0
Cost of finance *(percent)*	6.33	5.50
Tax depreciation *(percent)*	–0.84	–0.64
Cost of capital (cost of finance + tax depreciation) *(percent)*	5.49	4.86
User cost (cost of capital + physical depreciation) *(percent)*	13.49	12.86
Change in user cost *(percent)*	-	–4.7
Long-run change in capital stock[1)] *(percent)*	-	2.3
Long-run change in capital stock *(percent of GDP)*	-	3.2
Long-run impact on government revenue *(percent of GDP)*	-	0.048
Effect on fiscal sustainability[2)] *(percent of GDP)*	**-**	**0.038**

Notes: 1) The elasticity of capital demand with respect to user cost is assumed to be –0.5.
2) Assuming that one-half of the remaining adjustment of the capital stock takes place each 3 years. See Annex 3.

The reform leads to a reduction in the cost of capital from 5.5 to 4.9 per cent, thus somewhat alleviating the distortion to investment decisions inherent in the current tax code – although the cost of capital remains above the real interest rate post-reform, thus indicating that socially profitable investment opportunities are left unexploited.

The fact that the cost of capital initially exceeds the real interest rate implies that the subsequent increase in business capital formation improves allocative efficiency. And the magnitude of the gain is equal to the fiscal externality associated with shifting the composition of the private sector asset portfolio towards business assets. In the long term, the government financial balance is thus improved by 0.05 per cent of GDP.

This comes about only gradually, however, as the accumulation of additional productive capital is likely to take time due to, e.g., cost of adjustment. Assuming that half of the remaining adjustment takes three years, the equivalent effect on fiscal sustainability[4] is equal to 0.04 per cent of GDP.

2.3 Residential housing investment

The reduction in the tax rates applicable to household net interest income implies a parallel reduction in the tax preference for owner-occupied housing. The housing cost of capital may be expressed as:

$$c = (1-t^C)i - \pi + t^P = (1-t^C)(r+\pi)i - \pi + t^P = (1-t^C)r - t^C\pi + t^P \qquad (21)$$

where t^P denotes the property value tax. Notice how – unless the property value tax rate is set equal to the capital income tax rate times the nominal interest rate – a higher tax rate on capital income t^c will lower the cost of residential capital.

Similarly, an increased inflation rate (keeping the real interest rate constant in pre-tax terms) also tends to reduce the cost of capital and hence stimulate residential construction.

If we assume that the elasticity of residential housing demand with respect to user cost equals –0.5, the hypothetical tax reform leads to an 8 per cent long run decline in the housing stock as shown in Table 5. This reduction reflects, of course, the drop in the income tax shield due to interest deductibility. As the cost of capital is initially below the real interest rate, the shift in the composition of private sector assets away from housing exerts a positive fiscal externality.

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4 The adjustment used is described in detail in Annex 3.

Table 5

Effect on Residential Housing Investment

Residential housing stock *(percent of GDP)*	105.0
Physical depreciation rate *(percent)*	2.0
Pre-reform interest tax shield *(percent)*	37.3
Post-reform interest tax shield *(percent)*	25.0
Property value tax rate *(percent)*	1.0
Pre-reform cost of capital *(percent)*	2.7
Post-reform cost of capital *(percent)*	3.4
Pre-reform user cost *(percent)*	4.7
Post-reform user cost *(percent)*	5.4
Change in user cost *(percent)*	15.8
Long-term change in housing stock[1)] *(percent)*	–7.9
Long-term change in housing stock *(percent of GDP)*	–8.3
Long-term impact on government revenue *(percent of GDP)*	0.111
Effect on fiscal sustainability[2)] *(percent of GDP)*	**0.061**

Notes: 1) The elasticity of housing demand with respect to user cost is assumed to be –0.5.
2) Assuming that one-half of the remaining adjustment of the capital stock takes place each 10 years. See Annex 3.

However, this effect is likely to come about only slowly, and if one-half of the remaining adjustment takes place every 10 years, the implied permanent net gain equals 0.06 per cent of GDP.

2.4 Pension assets

The tax and transfer system, and in particular the relative tax treatment of institutional (*i.e.*, pension and life insurance) and non-institutional assets, is likely to affect the location of private financial wealth.

The taxation of pension returns is typically quite complicated, reflecting in most countries deductibility of pension contributions combined with the taxation of pension distributions and possibly also means-testing of public old-age benefits.

Furthermore, the Danish tax system features a uniform accrual-based 15 per cent tax on the return on pension assets. The net influence of the tax system on financial asset location reflects the operation of these tax provisions, on the one hand, and the income taxes levied on household capital income on the other hand.

To the extent that the effective tax rate on pension returns is below the one applicable to non-institutional assets, an incentive is created to divert assets into pension and life-insurance reserves. Clearly, institutional and non-institutional assets are not perfect substitutes, as they possess different economic characteristics in terms of risk, insurance and liquidity. Accordingly, households will select the composition of asset portfolios such that the marginal after-tax benefit from the various assets are equated. This in turn implies that investment in the tax-preferred asset will be carried to the point where the marginal net tax benefit is just offset by the marginal net non-tax cost.

Using the approach outlined in Annex 2, the typical Danish household faces a 22 per cent effective real tax rate on pension asset returns, whereas the average real effective tax rate on non-institutional assets is equal to 56 per cent. Consistent with the tax-preference for pension assets, roughly three-quarters of household assets are held in this form as shown in Table 6.

The hypothetical tax reform outlined in Table 2 implies – through the reduction in the tax rate on household capital income – that the return differential is cut by roughly one-half. Assuming that households will react by reallocating assets to an extent corresponding to half of what is required to explain baseline portfolio composition, the long run reduction in pension assets amounts to 6 per cent of GDP.

The long-term effect on the government financial balance, reflecting the shift towards more heavily taxed non-institutional assets, amounts to slightly less than 0.1 per cent of GDP, or 0.06 per cent of GDP on a permanent basis if the portfolio shift kicks in gradually with a "half-life" of 5 years.

2.5 Overall effects of the hypothetical capital income tax reform

The reduction and streamlining of the taxation of capital income implied by the hypothetical tax cut leads to higher savings and a general shift away from currently tax-favored assets (residential property and pension assets) towards business capital as shown in Table 7 which summarizes the long term portfolio changes.

Table 8 indicates the revenue recovery ratio of the overall reform, *i.e.* the share of the 0.5 per cent of GDP direct revenue loss, which is recouped through the behavioral effects. Under the baseline assumption of a 2 per cent inflation rate, revenue recovery amounts to 68 per cent, thus implying that the reform of capital income taxation ought to be a more urgent priority than lower wage income taxes – except for reductions in the top bracket tax rate – at least when judged by a pure efficiency criterion.

Table 6

Effect on Pension and Life Insurance Asset Accumulation

	Pre-reform	Post-reform
Household net asset holdings[1] *(percent of GDP)*	160.2	-
of which: non-institutional (percent of GDP)	*43.4*	-
institutional[2] (percent of GDP)	*116.9*	-
Effective real tax rate on non-institutional asset returns[3] *(percent)*	56.0	37.5
Effective real tax rate on pension and life ins. asset returns[4] *(percent)*	21.6	21.6
Difference in effective real tax rates *(percentage points)*	34.3	15.9
Real return differential *(percentage points)*	1.37	0.64
Change in real return differential *(percentage points)*	-	–0.74
Long-run change in pension assets[5] *(percent of GDP)*	-	–6.2
Long-run change in net tax revenue *(percent of GDP)*	-	0.085
Impact on fiscal sustainability[6] *(percent of GDP)*	-	**0.060**

Notes: 1) Includes residential housing equity, bond and share holdings as well as pension and life insurance reserves.
2) Includes reserves held in the private pension and life insurance sector as well as fully funded government schemes.
3) Using the average income tax rate on household capital income shown in Table 3.
4) Includes the effects of the deferred income tax treatment op pension assets, means-testing of government old-age benefits as well as the income taxation of accrued pension returns. See Annex 2.
5) The composition of private asset holdings is assumed to respond to the after-tax return differential by an amount equal to one-half of the sensitivity that is required to explain the deviation between the pre-reform portfolio composition and equal portfolio shares.
6) Assuming that one-half of the remaining adjustment of pension asset holdings takes place each 5 years. See Annex 3.

Table 7

Change in Private Sector Asset Holdings
(percent of GDP)

Total household assets		**+10.0**
of which:	Business capital stock	+3.2
	Residential housing	–8.3
	Pension and life insurance assets	–6.2
	Household non-institutional assets	+21.1

Table 8

Capital Income Tax Revenue Recovery Ratio under Alternative Inflation Rates

	Inflation rate		
Contribution from:	0 percent	**2 percent**	4 percent
Household savings	0.14	**0.28**	0.45
Business investment	0.05	**0.09**	0.13
Residential investment	0.04	**0.16**	0.39
Pension and life ins. assets	0.10	**0.15**	0.20
Total	**0.33**	**0.68**	**1.17**

The table also shows that the attractiveness of capital income tax reform is very sensitive to even low levels of inflation. This reflects the fact that the taxation of nominal capital income becomes more distortive when the inflation rate rises because existing non-neutralities are magnified.

In particular, at a moderately high (although by no means extreme) inflation rate of 4 per cent, the efficiency gains in fact exceed the direct revenue loss; *i.e.* the reform is more than self-financing. The results of the analysis in this paper thus also underscore the critical importance of taking account of inflation when assessing the allocative distortions due to capital income taxation.

3. Concluding remarks

This paper outlines a simple methodology, building essentially on the insights from the literature on the marginal cost of public funds, that may be used to compare the attractiveness of various tax policy options, in particular the choice between wage and capital income tax cuts.

The results indicate that policy makers may be well advised to devote more attention to reforming the taxation of capital income rather than across-the-board cuts in broad-based labor income taxes, which seems to be a key trend in recent years.

Taking into account the various dimensions of private sector behavior, which are distorted by capital income taxes, and taking account also of the taxation-inflation interaction, lowering and streamlining the taxation of asset returns seems to promise significant gains in allocative efficiency. And it should be emphasized that the behavioral responses assumed above are quite modest as witnessed by the pattern of savings and asset relocation.

It should also be borne in mind that the argument in favor of capital income tax reform does not depend on considerations associated with international tax competition. The effects discussed in the previous section are solely related to changes in the behavior of domestic residents and firms. Of course, the temptation to attract internationally mobile investments (or individuals), or slow capital flight, may provide additional motivation for countries to, e.g., reduce the corporation tax rate (and, possibly, the progressive elements of labor income taxation).

Finally, while a range of inter-asset distortions have been addressed above, the analysis is by no means complete in this regard. Specifically, we have ignored the important intersectoral and inter-asset distortions arising inside the business sector. Explicit treatment of the efficiency losses associated with the differential tax treatment of long- and short-lived capital, or alternative sources of finance for business firms, is thus likely to raise further the potential gains from capital income tax reform.

ANNEX 1

CALIBRATION OF THE SAVINGS RESPONSE

The effect of additional private savings on the government financial balance reflects, in addition to the tax rate on the real return, the initial impact on savings as well as the propensity to consume out of additional financial wealth.

In this section we show how the latter parameter may be calibrated using a version of the familiar Blanchard-Yaari-Weil (BYW) model (see, e.g., Blanchard, 1985). In this model, aggregate private consumption spending *C* is determined by:

$$C_t = \Delta\left(H_t + A_t\right) = \Delta\left(\frac{Y_t}{p + r - (\gamma - \delta)} + A_t\right) \qquad \text{(A1.1)}$$

where *H* denotes the present value of disposable after-tax labor (*i.e.*, wage and transfer) income, *A* is household net financial assets while Δ is the marginal propensity to consume out of household net worth. The discount rate applicable to future labor income reflects the death probability (*i.e.*, the effective time horizon of households) *p*, the real rate of interest *r* as well as the aggregate productivity growth rate γ and the parameter δ describing the path of productivity-adjusted labor income over the lifecycle.

We exploit the simple relationship between financial assets *A* and consumer spending *C* in the BYW model in order to compute the path of additional private assets, and hence also the impact on the government financial balance, generated by a change in the after-tax real return. For this purpose, we need an estimate of the marginal propensity to consume out of financial assets, *i.e.* Δ.

After-tax labor and transfer income equals about 75 per cent of GDP. At a 4 per cent real interest rate, a death probability of 0.02 (that is, corresponding to an effective planning horizon of 50 years for the average household) and γ = 1.5 per cent, while δ = 0.5 per cent, the net present value of labor income equals 13.6 times GDP.

Using the estimate of private sector net financial assets of 1.6 times GDP reported in section 2 then produces total household wealth equal to approximately 15 times GDP. With private consumption at about 60 per cent of GDP, the implied marginal propensity to consume out of total household wealth is roughly 4 per cent.

The increase in private savings, in combination with the assumption concerning the impact on future consumption outlays captured by Δ, gives rise to a gradual increase in household financial assets and hence the capital income tax base. Incremental revenue in period *s*, dT_s, may then be written as:

$$dT_s = \tau i dA_s = \tau i \sum_{u=t}^{s} \left(\frac{1 + (1-\tau)i - \Delta}{1+g} \right)^{(u-t)} dS_t \qquad \text{(A1.2)}$$

where τ is the capital income tax rate, i is the nominal rate of return, while g denotes the aggregate nominal growth rate. Calculating the net present value of incremental tax revenue, and converting it into a stream of net tax receipts that remain constant as a percentage of GDP, finally produces equation (19) of the main text.

ANNEX 2

THE EFFECTIVE TAXATION OF PENSION ASSET RETURNS

The tax treatment of institutional savings typically implies that contributions are income tax deductible, while benefits are subject to income taxation as well as means testing of pension benefits from the government. In addition, in some countries – including Denmark – the return on pension fund assets is subject to taxation at accrual.

Obviously, the incentive to hold assets through pension accounts, rather than as "free" household savings, depends on the relative tax treatment of the two types of assets. A convenient way of comparing the attractiveness of institutional and non-institutional savings instruments is to calculate and compare the effective tax rates on the underlying real return. For pension assets, this requires taking into account the tax treatment of pension contributions and pension benefits as well as the taxation of accrued returns.

Below, we estimate the effective tax rate on pension assets by computing, first, the internal rate of return associated with the after-tax cash flow generated by the pension investment. Second, by comparing the internal rate of return to the real market rate of interest, we can compute the fraction of the underlying real return, which is absorbed by taxation. This fraction is the effective (income) tax rate on pension asset returns.

At retirement after T periods of contributions, total pension assets W are:

$$W_{T+1} = \sum_{u=1}^{T}\left(\frac{1+(1-t^P)i}{1+\gamma}\right)^u \bar{c} = \left(\rho^T - 1\right)\frac{\rho}{\rho-1}\bar{c} \quad \text{where } \rho \equiv \frac{1+(1-t^P)i}{1+\gamma} \tag{A2.1}$$

where $\bar{c}$ is the (wage-indexed) contribution paid into the pension fund, i is the nominal rate of return before tax, γ denotes the nominal wage growth rate (and hence the rate of growth of contributions), while t^P is the tax rate applicable to pension asset returns.

Assuming that (wage-indexed) pension benefits are paid out over a period of S years after retirement, thus exhausting the value of assets in the pension account at the end of period $T+S$, and denoting by $\bar{b}$ the pension benefit distributed in period $T+1$, this implies that:

$$\sum_{u=T+1}^{T+S}\left(\frac{1+\gamma}{1+(1-t^P)i}\right)^u \bar{b} = \left(1-\rho^{-S}\right)\frac{\rho}{\rho-1}\bar{b} = W_{T+1} \tag{A2.2}$$

Combining (A2.1) and (A2.2) we may now find the pension benefit parameter:

$$\bar{b} = \frac{\rho^T - 1}{1 - \rho^{-S}} \bar{c} \tag{A2.3}$$

Along with the duration of the contribution and benefit periods, equation (A2.3) then determines the pre-tax cash flow (negative during the first T periods, positive during the subsequent S periods) generated by the pension investment.

In order to compute the implied internal rate of return on the pension account we next calculate the net present value of the post-tax cash flow $\tilde{W}$, *i.e.*:

$$\begin{aligned} \tilde{W} &= \underbrace{(1-t^D)(1-m)\left(1-\tilde{\rho}^{-S}\right)\frac{\tilde{\rho}}{\tilde{\rho}-1}\left\{\frac{\rho^T-1}{1-\rho^{-S}}\bar{c}\right\}}_{\text{Present value of net-of-tax distributions}} - \underbrace{(1-t^C)\left(\tilde{\rho}^T-1\right)\frac{\tilde{\rho}}{\tilde{\rho}-1}\bar{c}}_{\text{Net-of-tax cost of pension assets at retirement}} \\ &= \left[(1-t^D)(1-m)\frac{\rho^T-1}{1-\rho^{-S}} - (1-t^C)\frac{\tilde{\rho}^T-1}{1-\tilde{\rho}^{-S}}\right]\left(1-\tilde{\rho}^{-S}\right)\frac{\tilde{\rho}}{\tilde{\rho}-1}\bar{c} \end{aligned} \tag{A2.4}$$

where $\tilde{\rho}$ is the growth-adjusted discount rate, t^C is the income tax rate applicable to pension contributions, t^D is the income tax rate on pension bene-fits, while m is the rate of means testing (thus indicating the fraction of pre-tax pension benefits which is offset by reduced public retirement benefits). The growth-adjusted internal rate of return is then the value of $\tilde{\rho}$, for which $\tilde{W}$ is equal to zero. It is impossible to derive from equation (A2.4) an analytical expression for $\tilde{\rho}$, but it is easily approximated numerically.

Finally, we recover the effective tax rate on pension returns, $\tilde{t}^R$, by observing that:

$$\tilde{\rho} \equiv \frac{1+(1-\tilde{t})i}{1+\gamma} \Rightarrow \tilde{t}^R \equiv \frac{\tilde{t}i}{r} = \frac{1+i-(1+\gamma)\tilde{\rho}}{r} \tag{A2.5}$$

Obviously, the effective tax rate on pension assets reflects, in addition the tax rates on contributions, benefits and accrued returns, the duration of the period in which contributions are made as well as the duration of the retirement period.

Assuming that contributions are paid over a period of 30 years followed by 20 years of benefits, combined with a 15 per cent tax rate on accrued returns, a 47.5 per cent tax rate on contributions (corresponding to the average of the middle and top bracket income tax rates), a 41.4 per cent tax rate on distributions (equal to the average of the low, middle and top bracket income tax rates) and a means testing rate of 10 per cent then produces the effective real tax rate of 21.6 per cent reported in Table 6.

ANNEX 3

ADJUSTMENT FOR THE TIME PATH OF REVENUE EFFECTS

In this section we show how to compute the annuity equivalent value, expressed as a constant percentage of GDP, of long-term revenue effects that occur gradually.

If the long-term (*i.e.*, steady state) effect on tax receipts is ΔR_∞, and the adjustment path may be approximated by an exponential speed of adjustment of λ, the NPV-equivalent permanent effect on the government financial balance is

$$\Delta\sigma_t = (i-\gamma)\int_{s=t}^{\infty}\left\{(1-e^{-\lambda(s-t)})\,\Delta R_\infty\right\}e^{-(i-\gamma)(s-t)}ds = \frac{\lambda}{i-\gamma+\lambda}\Delta R_\infty \qquad \text{(A3.1)}$$

where i denotes the nominal rate of interest and γ the growth rate of nominal GDP.

Replacing the adjustment speed by the "half-life" of the deviation between the short- and the long-term impact on the government financial balance, $T^{½}$, yields the expression used in section 2, *i.e.*:

$$\Delta\sigma_t = \frac{\lambda}{i-\gamma+\lambda}\Delta R_\infty = \frac{\ln 2/T^{½}}{i-\gamma+\ln 2/T^{½}}\Delta R_\infty = \frac{\ln 2}{(i-\gamma)T^{½}+\ln 2}\Delta R_\infty \qquad \text{(A3.2)}$$

REFERENCES

Blanchard, O.J. (1985), "Debt, Deficits and Finite Horizons", *Journal of Political Economy*, No. 93.

Dahlby, B. (1998), "Progressive Taxation and the Social Marginal Cost of Public Funds", *Journal of Public Economics, No.* 67.

Frederiksen, N.K. (2003), "Fiscal Sustainability in OECD Countries: December 2002", manuscript, Ministry of Finance, March.

Mayshar, J. (1991), "On Measuring the Marginal Cost of Funds Analytically", *American Economic Review*, No. 81.

DISTRIBUTIONAL ASPECTS OF INDIRECT TAXATION IN GREECE: 1988-2002

Georgia Kaplanoglou[*] *and David Michael Newbery*[**]

Introduction

Greece's accession to the European Union in the beginning of the 1980s had radical implications for its tax system in a twofold way. First, the need for fiscal consolidation imposed initially by the Maastricht Treaty and later by the Stability and Growth Pact was almost exclusively accommodated through rises in the levels of taxation whose share in GDP increased by more than 13 percentage points within a period of 15 years since 1988. Second, coordination of tax systems at a European Union level has been given prominence as a means of removing distortions affecting commodity and factor movements in order to bring about a more efficient allocation of resources within an integrated market (Kopits, 1992). The steps taken towards this direction substantially affected the tax structures of Member States.

Among the different components of the Greek tax system, indirect taxation occupies a central position in both dimensions mentioned above, since indirect taxes are both the main revenue-raising device in Greece, yielding around 60 per cent of total tax revenue, and the field of taxation where tax coordination at an EU level has mostly progressed. More precisely, although one would expect the importance of income taxes as a source of government revenue to grow at the expense of indirect taxes as the country reaches higher levels of economic development (see Tanzi, 1987), this indeed happened in Greece, but not to an extent comparable to other countries with similar level of economic development. The share of indirect taxes has fallen from 70 to 60 per cent since the beginning of the 1980s, but the indirect-direct tax balance in Greece is still exactly the opposite of that prevailing on average in the EU-15 or among OECD countries. Thus, the importance of indirect taxes in revenue terms survived, despite the radical changes in the tax structure mainly as a result of EU membership, namely the introduction of VAT, the abolition of numerous taxes (import taxes, general sales taxes of a cumulative nature, etc.), subsequent changes in the number and levels of VAT rates, changes in the basis and levels of traditional excises, etc.

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Two questions arise naturally from a distributional perspective. The first is who has borne the burden of fiscal consolidation, at least to the extent the latter was achieved through sustaining high levels of indirect taxation during the last fifteen years. The second is whether the indirect tax reforms introduced during this period directly or indirectly as a result of EU membership, had any distributional benefits for the population. The paper employs microsimulation modelling techniques based on Household Expenditure Survey data in order to explore the distribution of the indirect tax burden and its components at two points in time: in 1988, a year after VAT was introduced but still many hangovers from the past remained, and in 2002 when the major indirect tax reforms had been completed. Thus, we compare the distributional effects of the 1988 indirect tax system on the 1988 population and the effects of the 2002 system on the 2002 population.

The structure of the paper is as follows. Section 1 provides some summary information on the structure of indirect taxation in 1988 and 2002. Section 2 explores and compares the distribution of the indirect tax burden among Greek households in 1988 and 2002 on the basis of the raw Household Expenditure Survey data of the respective years (National Statistical Service of Greece, 1994 and 2001). We also attempt to rank the components of the indirect tax system and show the decisive role of taxes on cars and their use in shaping the distributional characteristics of the system. Section 3 assesses the effects of indirect taxes on welfare inequality. Section 4 concludes.

1. The structure of indirect taxation: 1988, 2002

Indirect taxes occupy a dominant position in the Greek tax system, since they yielded around 60 per cent of total tax revenue in 2002. Over the last decades, indirect taxation was designed primarily with cash targets in mind and this led to the accumulation of an uncommonly large number of taxes, most of which had very low yields. At the beginning of the 1980s, the Greek indirect tax system was composed of six general sales taxes, several excises and a large number of less significant taxes. Many of those taxes were cumulative, which made it hardly possible to rebate taxes for exported and investment goods and to impose taxes on imports on a comparable basis with domestic products. This encouraged vertical integration, impeded specialisation and eventually harmed productivity. Finally, the structure of the indirect tax system offered effective protection for domestic goods by severely discriminating against imports in several ways (Georgakopoulos, 1991).

The above structure was judged unacceptable within the European Union, one of the main objectives of which was the efficient allocation of resources within and between member states. This objective required the elimination of both the taxation of intermediate goods and the unequal tax treatment of domestic and imported products. As one of the EC requirements, a large number of taxes only or mainly applying to imports had to be eliminated in 1984, while VAT was introduced in

1987 replacing the two main general sales taxes[1] and several smaller ones, and several excises had to be reformed in terms of rates and coverage.

Table 1 presents the revenue structure of indirect taxes in 1988, a year after VAT was introduced and 14 years later in 2002, by the time the reforms initiated by EU membership had been largely completed. Immediately after its introduction, VAT emerged as the main source of indirect tax revenue and in the following years its share increased by almost 10 percentage points reaching 57.5 per cent in 2002. In 1988 VAT was levied at four rates: 3, 6, 16 and 36 per cent, with the very low rate covering books, newspapers, magazines and theatres, the low rate covering most food items, heating oil, medicines, transport services, etc, the high rate covering luxury items or products creating negative externalities, like spirits, tobacco, television sets, motor fuel, etc., and the standard rate applying to the remaining goods and services. Several items, like educational, medical and financial services, were and still are exempt from VAT. VAT rates and product classifications have changed several times. Since 1988, the two low and the standard VAT rates were increased to 4, 8 and 18 per cent respectively, while the top VAT rate was abolished.

Excises are levied on all traditional candidates for such taxation, namely tobacco, petroleum products, alcoholic beverages and beer, altogether now yielding around a quarter of total revenue from indirect taxes. As is apparent from Table 1, mainly due to the increase in the revenue from the tobacco tax, excises have gained importance in revenue terms during the last 15 years. The Council, in an attempt to coordinate excises, has set lower bounds for most of these products and Greece has adopted rates very close to these bounds for nearly all of them in an attempt to control inflation and comply with the relevant Maastricht criterion. Had this not been the case, the importance of excises in revenue terms would have been even more pronounced.

A variety of taxes are levied on car purchase and use (in addition to the car fuel tax) which yield another 7 per cent of total indirect tax revenue. Car purchase taxes differ according to engine power and car technology, while transport dues differ according to engine power only. In 1988 car purchase taxes were on the whole much more finely differentiated and therefore more progressive and on the whole higher. On the other hand, the share of population owing a car drastically increased during recent years. Thus, although the share of car taxes in total tax revenue has remained stable over the years, its composition has changed in favour of taxes on car use rather than car purchase.

Stamp duties, the main general sales tax before the introduction of VAT, still apply to a large number of transactions outside the VAT field of taxation, but their importance has diminished over time. Several other taxes, like the consolidated special consumption tax, entertainment and luxury taxes and other sales consumption taxes, yielding around 10 per cent of indirect tax revenue in 1988, were

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[1] Namely, stamp duties and the business turnover tax, which at the beginning of the 1980s yielded around 90 per cent of revenue from general sales taxes.

Table 1

The Revenues from Indirect Taxes Levied on Behalf of Central Government

Indirect Taxes	1988		2002	
	Mio Euro	% of total	Mio Euro	% of total
1. Value-added tax	1,758	48.3	11,421	57.5
2. Traditional excises	721	19.8	4,714	23.7
a) Fuel taxes	481	13.2	2,280	11.5
b) Tobacco tax	216	5.9	2,142	10.8
c) Alcoholic drinks and beer tax	24	0.7	292	1.5
3. Stamp duties	186	5.1	641	3.2
4. Taxes on cars	257	7.1	1,416	7.1
a) Registration tax and other car taxes	175	4.8	821	4.2
b) Transport dues	82	2.3	595	3.0
5. Other indirect taxes	352	9.7	1,476	7.4
a) Turnover tax	24	0.7	235	1.2
b) Special banking tax	153	4.2	0	0.0
c) Capital transfers tax	110	3.0	790	4.0
d) Other	65	1.8	451	2.3
6. Indirect taxes abolished	366	10.1	187	0.9
a) Revenue from Custom Offices	22	0.6	187	0.9
b) Consolidated special consumption taxes	80	2.2	-	-
c) Regulatory tax	141	3.9	-	-
d) Entertainment and luxury taxes	3	0.1	-	-
e) Other consumption taxes	120	3.3	-	-
TOTAL	**3,640**	**100.0**	**19,855**	**100.0**

Source: Ministry of Finance.

abolished as a result of EU membership. It is worth noting that most of these taxes applied at varying rates to a large number of commodities and their abolition greatly simplified the tax structure. Finally, there is a small number of indirect taxes which will not be analysed here either because they have the characteristics of an income tax (e.g. the capital transfer tax) or because their yield is too low to justify their analysis.

Table 1 shows that between 1988 and 2002 the indirect tax system became much more concentrated with VAT and excises now yielding over 80 per cent of total indirect tax revenue. At the same time, the tax structure was further simplified even after VAT had been introduced.

2. Who pays indirect taxes in Greece? 1988 and 2002

The evaluation of the distributional effects of indirect taxes in 1988 and 2002 is based on Household Expenditure Survey microdata (HES), collected by the National Statistical Service of Greece.[2] Such surveys provide data on a wide range of household and individual characteristics allowing information on the demographic structure, working patterns, income sources, spending patterns etc. of the population to be collected. The population sample consists of around 6,500 households and is representative of the population.[3] With regard to household expenditure, information is collected on around 300 goods and services in the 1988 HES and on over 400 goods and services in the 1999 HES. Information on the tax rates applying to each commodity group has been collected and tax payments have been calculated at a household level. In this process, we have assumed that indirect taxes are fully shifted to consumer prices and we have not taken into account the part of indirect taxes which falls on final consumption indirectly (i.e. through the shifting onto final products of indirect taxes which are not rebated during the production process). Regarding the chosen household welfare indicator, we have preferred consumption over income for both theoretical reasons based on the permanent income hypothesis and the theory of life-cycle consumption smoothing (Friedman, 1957; Modigliani and Brumberg, 1954) and practical reasons regarding the particularly poor quality of income data recorded in the HES. Durable expenditure has been subtracted due to its stochastic nature. Household non-durable expenditure has been deflated and adjusted for differences in household size and composition using the OECD equivalence scale.

The average proportion of total household expenditure absorbed by indirect taxes has remained remarkably stable at around 11.7 per cent during the period 1988-2002. Table 2 shows the distribution of the indirect tax burden across

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[2] For the analysis of the 1988 tax system, the 1988 HES has been used, while for the analysis of the 2002 tax system, we have used the data from the most recent HES, conducted in 1999.

[3] Various dimensions of the representativity of the HES sample have been checked against macro-variables from other sources and results are quite satisfactory, thus guaranteeing the quality of results, see Kaplanoglou (1999) and Kaplanoglou and Newbery (2002).

population deciles in 1988 and 2002, as well its difference, which is also plotted in Figure 1. It is apparent that the distribution of indirect tax payments has changed in favour of wealthier groups, with a higher proportion of household expenditure being taken up by indirect taxes in the lower half of the welfare distribution and richer deciles gaining increasing amounts in relevant terms.[4]

Looking at the distribution of indirect taxes at a commodity level shows that the pattern of tax payments by commodity group is remarkably similar. Figures 2 and 3 present the cumulative distribution of tax payments by commodity group in the years 1988 and 2002 respectively, where taxes have been ranked in order of regressivity. It becomes apparent that the largest part of indirect taxes is strongly regressive (*i.e.* taxes on food, tobacco, housing, health) and it is taxes on cars and their use which reverse the pattern of regressivity.

Table 2

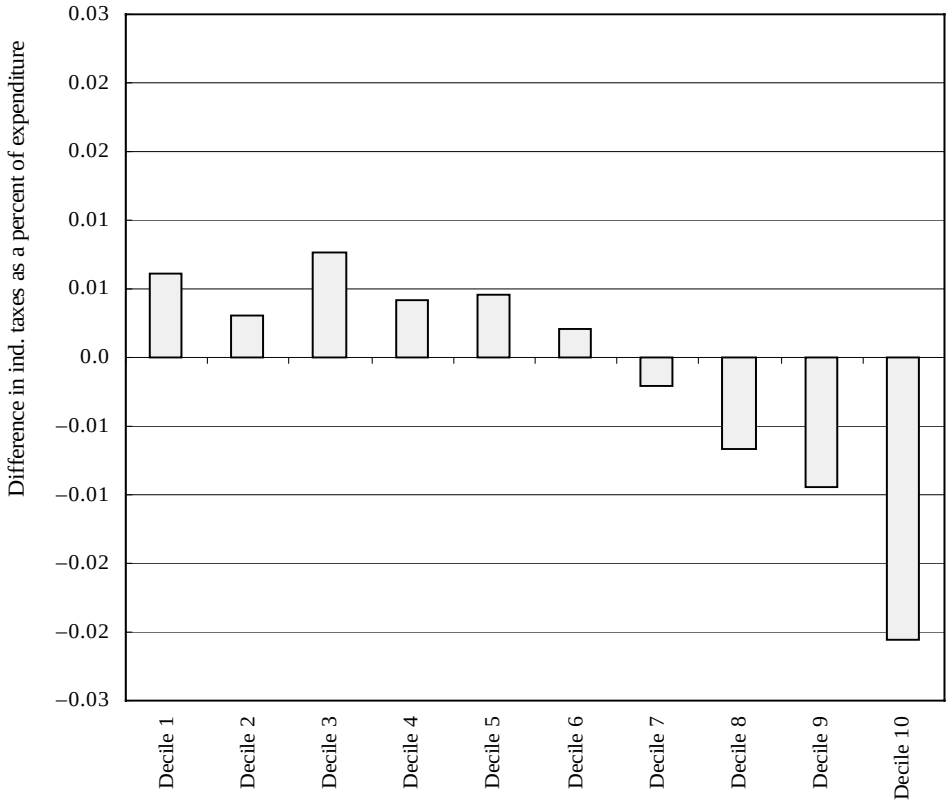
Indirect Tax Burden by Expenditure Group, 1988-2002

Households grouped by equivalent non-durable expenditure (OECD scale)	Average percentage of tax in total expenditure 1988	Average percentage of tax in total expenditure 2002	Difference
Poorest 10%	9.36	9.97	0.61
11%-20%	10.69	11.00	0.31
21%-30%	11.27	12.04	0.77
31%-40%	11.62	12.04	0.42
41%-50%	11.88	12.34	0.46
51%-60%	12.04	12.24	0.20
61%-70%	12.86	12.65	–0.21
71%-80%	12.75	12.09	–0.66
81%-90%	12.70	11.77	–0.93
Richest 10%	12.81	10.76	–2.05
All groups	11.80	11.70	–0.10

[4] For a detailed analysis of the distributional impact of the 1988 indirect tax system, see Kaplanoglou (2000).

Figure 1

Difference in the Indirect Tax Burden by Expenditure Group, 1988-2002



A comparative analysis of the degree of progressivity of the various components of an indirect tax system can be performed using Suits (1977) tax concentration curves. Although there has been some confusion over the definition of tax progressivity (for a discussion see Musgrave and Thin, 1948), the Suits tax concentration curves employed conform with the fundamental axioms of tax progressivity (as expressed in Kakwani, 1980) and are based on the difference between income and taxes across the income distribution, integrating this difference with respect to income.

Figure 4 presents the Suits tax concentration curves for a certain classification of goods and services in 1988 and also in 2002. Curves which lie above the 45-degree line indicate regressive taxes, while the curves below the 45-degree line indicate progressive taxes.

Figure 2

Cumulative Indirect Taxes by Deciles of Equivalent Non-Durable Expenditure, 1988
(taxes are ranked by degree of regressivity)

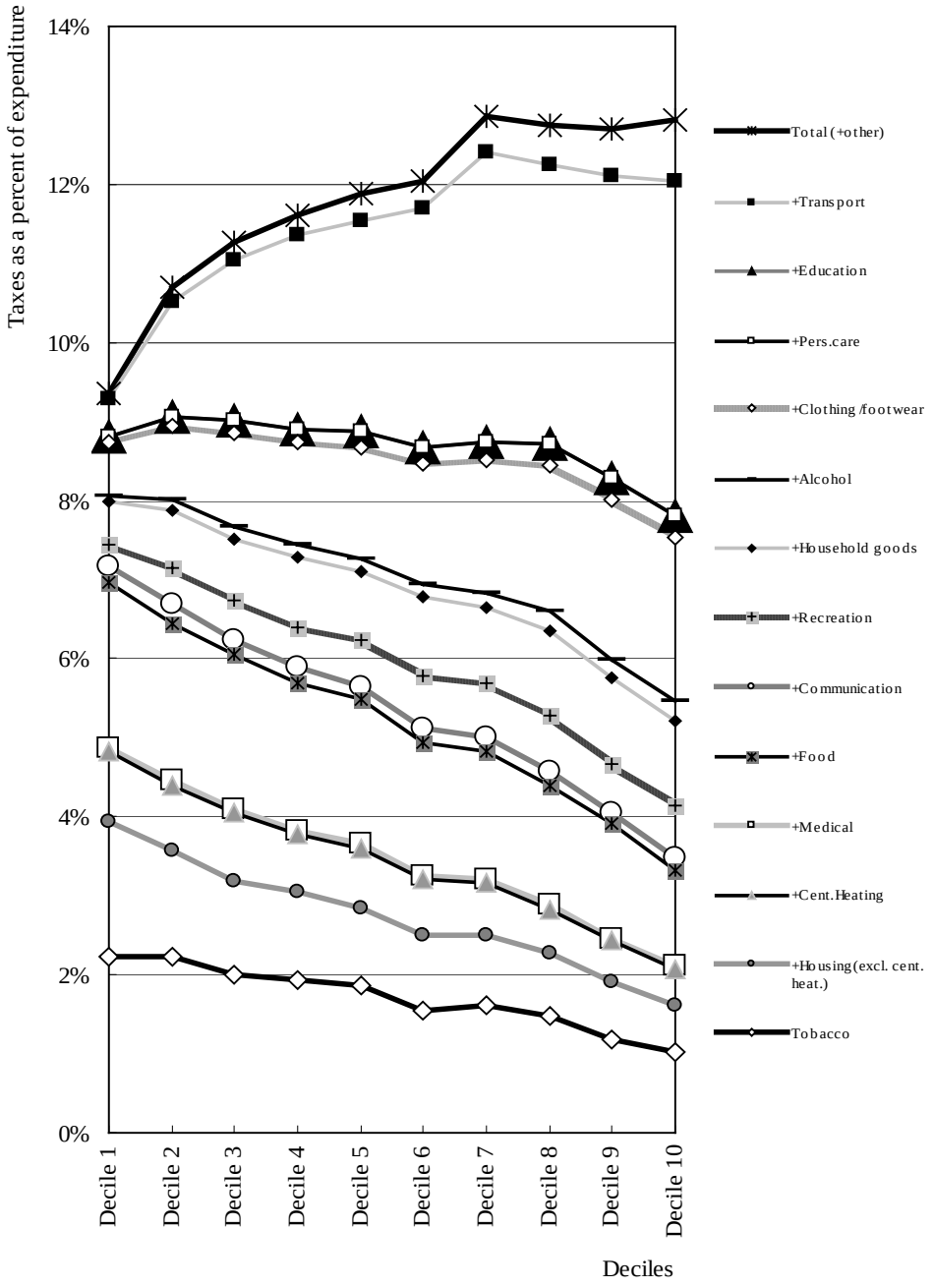


Figure 3

Cumulative Indirect Taxes by Deciles of Equivalent Non-Durable Expenditure, 2002
(taxes are ranked by degree of regressivity)

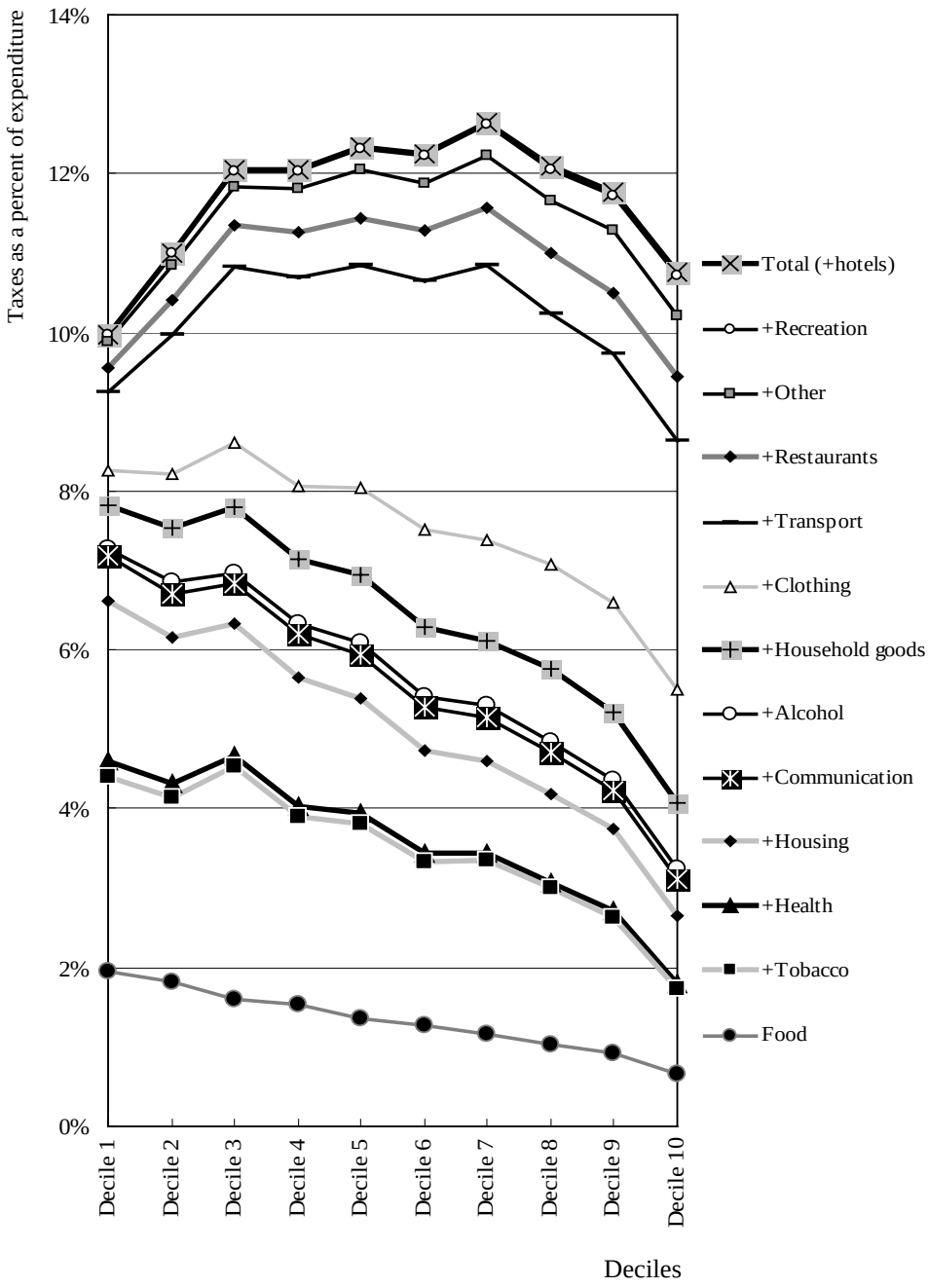
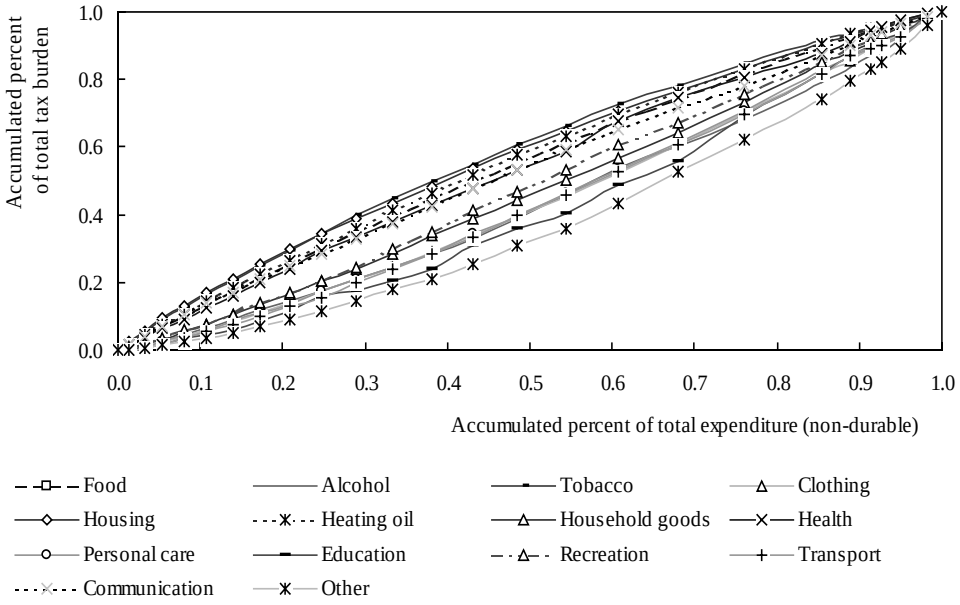


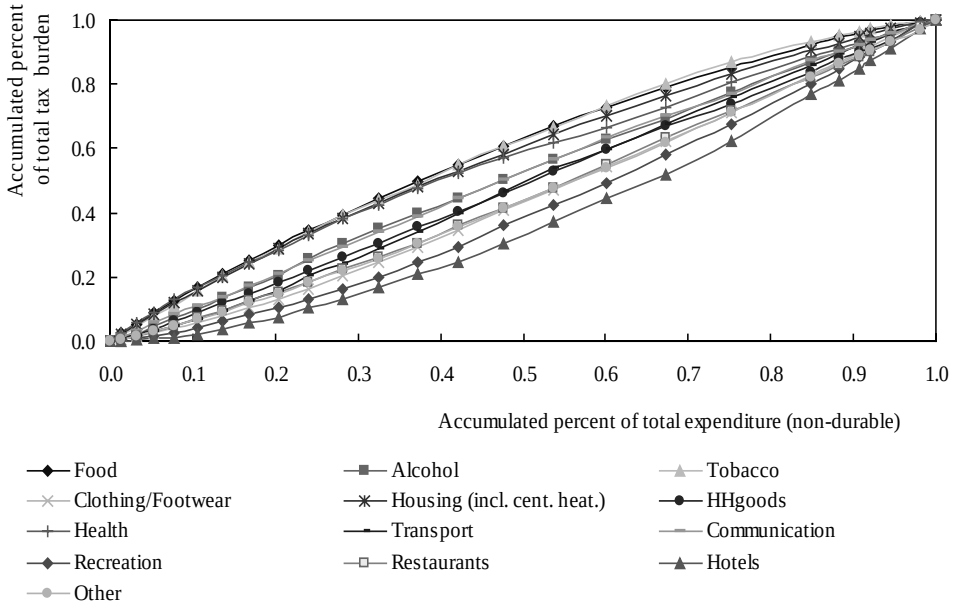
Figure 4

Suits Tax Concentration Curves for All Types of Indirect Taxes

1988



2002



It becomes apparent that a group of taxes (*i.e.* those on food, tobacco, housing and heating oil, communication and health) are regressive, while the rest display various degrees of progressivity. An unambiguous ranking of indirect taxes is not possible, since in many cases the tax concentration curves cross. One has to employ a single progressivity index in order to achieve complete ranking. Although such indices exist in the literature, they are not used here, simply because it is more sincere to admit that the data do not provide enough information to rank individual taxes in such a way.

A less ambitious, but more realistic approach is presented in Table 3. The share of taxes paid by the lowest decile of expenditure gives the initial rankings of the tax concentration curves, but the latter may subsequently cross. A + indicates that the tax concentration curve of the commodity group on the left stays everywhere above that of the commodity group on the horizontal axis; a ? indicates that the two curves cross and no ranking can be made. This partial ordering is summarised in Figure 5, which is a Hasse diagram. According to the latter, the taxes on commodity groups towards the top of the diagram are more regressive and where a line can be traced downwards from a commodity group A to a commodity group B then one can unambiguously say that the tax on A is more regressive than the tax on B.

Regarding 1988, there appears to be a clear grouping of regressive taxes – those on tobacco, housing and heating oil, health, food and communications – at the top. Almost identical is the group of regressive taxes in 2002. It is worth indicating that these taxes correspond to commodities representing over 60 per cent of the average household budget in both years. Taxes on other commodity groups are less regressive. In 1988, the most progressive taxes seem to be those on alcohol, clothing, personal care and transport. In 2002, the commodity ranking is not very dissimilar, especially taking into account the differences in the commodity classification, for example hotels were included in the "other goods and services" group in the 1988 HES.

We established earlier that the indirect tax system is characterised as broadly proportional or even slightly progressive on the sole basis of the progressivity of car taxes. However, there are two lines of argument which cast doubt on the justifiability of this assertion. The first one follows a recently growing literature (Walters, 1968, Dewees, 1979, Harrison *et al.*, 1986, Newbery 1988 and 1996, HMSO, 1993, Newbery and Santos, 1999) on road taxation and efficient road pricing. The argument is that some part of road taxes (*i.e.* car purchase taxes, annual transport dues, fuel taxes) should be viewed as road charges rather than pure taxes. Even though efficient and equitable road pricing would demand a much more careful planning of both the appropriate level and especially the structure of a system of input taxes, purchase taxes and licence fees, the relevant literature reveals a strong case for arguing that "the revenues associated with road pricing should be regarded as a charge rather than a tax" (House of Commons, 1995).

We consider three alternative approximations of road user charges in the Greek case. The first one is the sum of taxes on car ownership and use. The second

Table 3

Suits Tax Concentration Curves Comparisons
(taxes are ranked in order of regressivity)

1988	Heat.oil	Housing	Health	Food	Comm.	Recreation	Hhgood	Alcohol	Education	Clothing	P.care	Transport	Other
Tobacco	+	?	+	+	+	+	+	+	+	+	+	+	+
Heating oil		?	?	+	+	+	+	+	+	+	+	+	+
Housing			?	+	+	+	+	+	+	+	+	+	+
Health				?	?	+	+	+	+	+	+	+	+
Food					?	+	+	+	+	+	+	+	+
Communication						+	+	+	+	+	+	+	+
Recreation							?	+	+	+	+	+	+
Household goods and services								+	?	+	+	+	+
Alcohol									?	?	?	?	+
Education										?	?	?	+
Clothing/footwear											?	?	+
Personal care												?	+
Transport													+
Other goods and services													

2002	Tobacco	Health	Housing	Communication	Alcohol	Household goods	Transport	Clothing/footwear	Restaurants	Other goods	Recreation	Hotels
Food	?	+	+	+	+	+	+	+	+	+	+	+
Tobacco		?	?	+	+	+	+	+	+	+	+	+
Health			?	+	+	+	+	+	+	+	+	+
Housing (incl. Heating oil)				+	+	+	+	+	+	+	+	+
Communication					?	+	+	+	+	+	+	+
Alcohol						?	?	+	+	+	+	+
Household goods and services							?	?	+	+	+	+
Transport								?	?	?	+	+
Clothing/footwear									?	?	+	+
Restaurants										?	?	+
Other goods and services											?	+
Recreation												+
Hotels												

Figure 5

Ranking of Indirect Taxes (Hasse Diagram)

1988

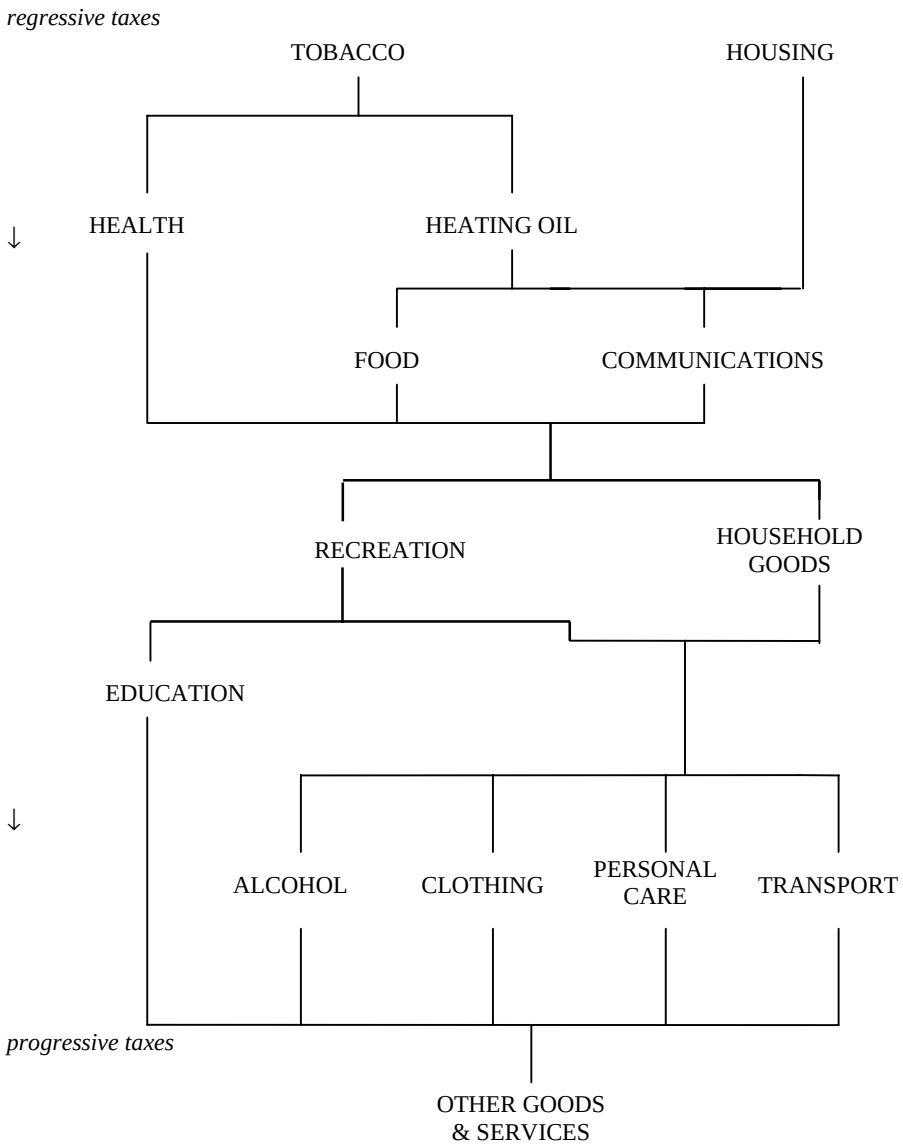
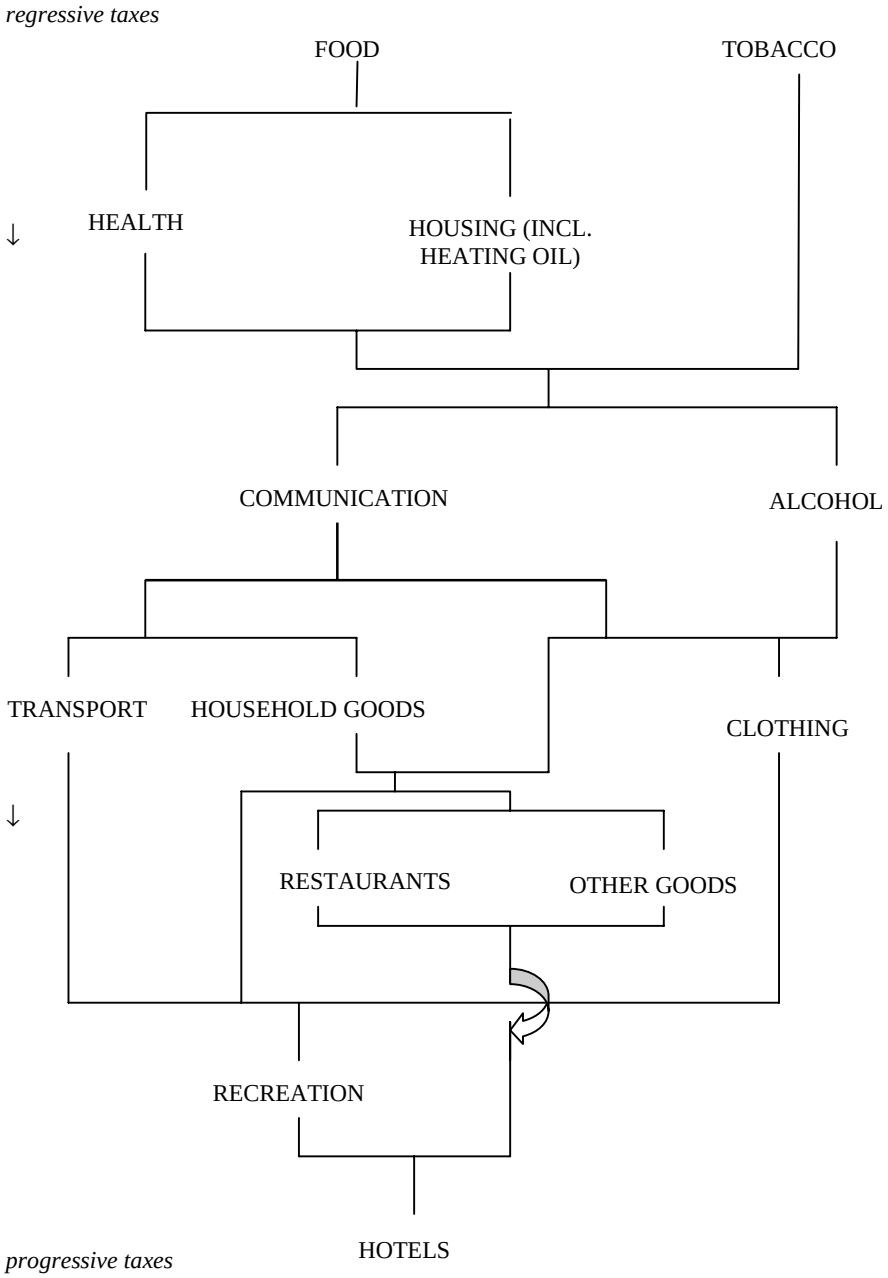


Figure 5 ***(continued)***

2002



is the car taxes that are not differentiated by engine size, mainly road fuel taxes. Implicit is the assumption that car taxes which are differentiated by engine size are used as a redistributive tool and therefore constitute a pure tax. In the third alternative, we assume that there is a constant road charge per car, equal to the minimum of the car purchase tax and the annual transport dues recorded in the HES, and the balance is the redistributive part. To the minimum of car purchase taxes and transport dues we add the proportional taxes on car use, mainly road fuel tax. What is assumed to constitute a road charge in each of the three cases is subtracted from the household tax burden. As Figure 6 reveals, once the approximation of road charges is taken out of the picture, the progressive shape in 1988 and the inverted U-shape in 2002 disappears and the indirect tax system becomes regressive.

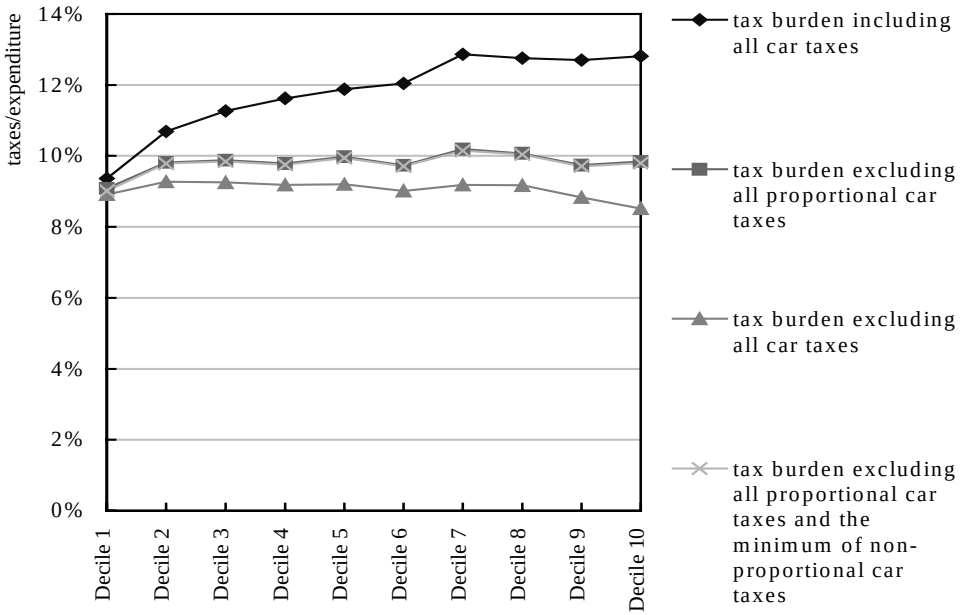
The other line of argument is related to the question whether car ownership is linked to the redistributive features of the Greek indirect tax system. Relevant statistics (Moutrouidis, 2001) reveal that the number of passenger cars per 1,000 inhabitants in Greece is by far the lowest among European Union countries (189 and 288 pass. cars/1,000 inhabitants in 1993 and 2000 respectively). Subsequently it is only a small proportion of the population, which is paying the high taxes on vehicles, their maintenance and circulation. Furthermore, car owners seem to be systematically wealthier than non-car owners; the null hypothesis that mean expenditure is higher for households with cars than for households without cars could not be rejected at the 0.01 significance level for several different expenditure measures both in 1988 and in 2002.

Figure 7 shows for the two years for each decile of the total household sample, the average proportion of expenditure absorbed by indirect taxes over all households belonging to the given decile (lines A1 and A2), over those households in the given decile which do not own a car (lines B1 and B2) and over the remaining households in the given decile which own a car (lines C1 and C2). Thus line A1(A2) are a weighted average of lines B1(B2) and C1(C2), the weights changing over deciles depending on share of car and no-car owners within each decile.

Regarding the shape of line A1(A2), there are two effects working in opposite directions both in 1988 and in 2002. On one hand, the relative number of households with car/s increases across deciles, and thus so will the weight of the higher indirect tax burden born by those households on the indirect tax burden of the whole sample along deciles. This means that line A1(A2), *i.e.* indirect tax burden of the whole sample, will be more and more dragged towards line C1(C2), *i.e.* the indirect tax burden of households which own a car and thus it will become upward sloping – since households with cars face higher tax rates – making the whole indirect tax system appear progressive. On the other hand, line C1(C2) is itself sharply downward sloping – among households with cars indirect taxes are regressive – and this regressivity will be becoming more apparent in the indirect tax burden of the whole sample as we move to the highest deciles, where more and more households own car/s. The shape of line A1(A2) can be explained in terms of these two effects. The former effect dominates in the first half of the income distribution, while the latter dominates towards the end of the income distribution.

Figure 6

The Effects of Car Taxes on the Progressivity of the Greek Indirect Tax System
1988



2002

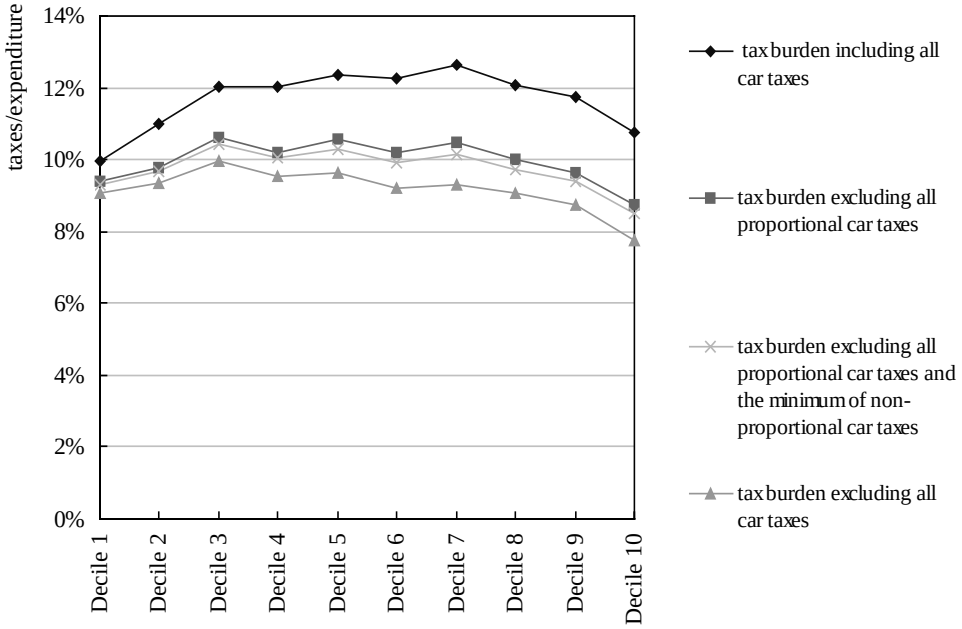
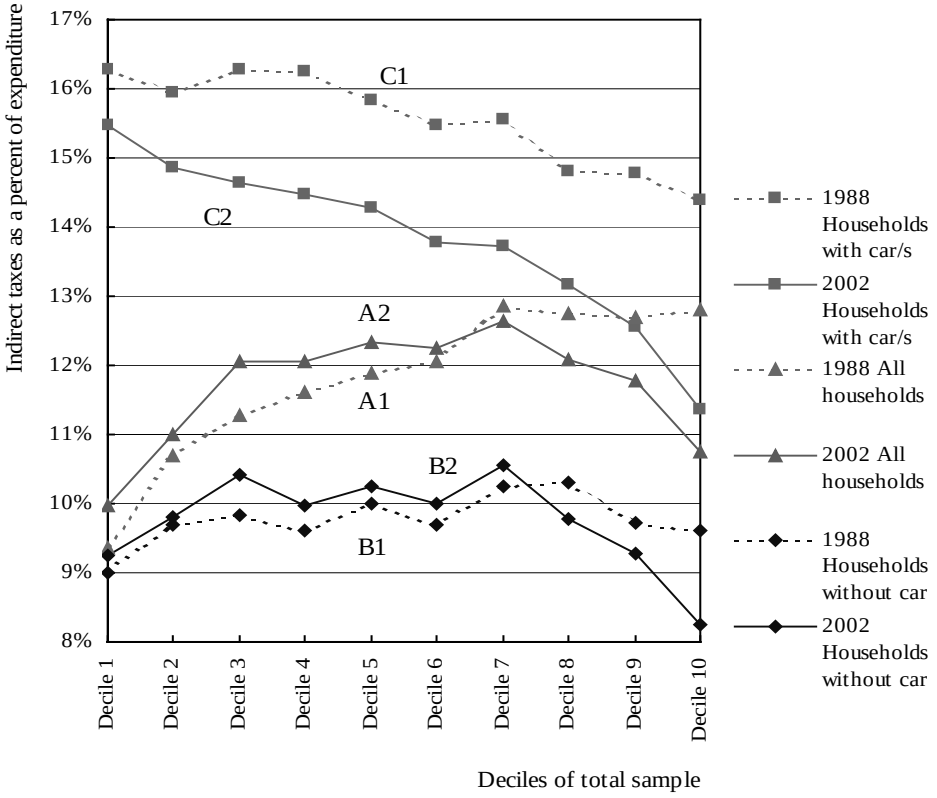


Figure 7

Indirect Tax Burden: Households With and Without Cars



The difference between 1988 and 2002 is that indirect taxes among car owners are now both considerably lower and more regressive,[5] while among non-car owners they are about at the same levels and slightly more regressive. At the same time the number of car owners has almost doubled. The above differences explain both why the indirect tax burden of the total population in 2002 increases faster in the lower deciles and why it decreases faster among wealthier deciles.

Finally, a breakdown of car taxes into finer categories among car owners (see Figure 8) proves interesting. The fuel tax and transport dues are clearly regressive in both 1988 and 2002, while car purchase taxes seem to be broadly proportional. Thus, it appears that the group of taxes which shapes the progressivity elements of the whole indirect tax system has actually strong regressivity characteristics when we isolate the part of the population this group of taxes applies to.

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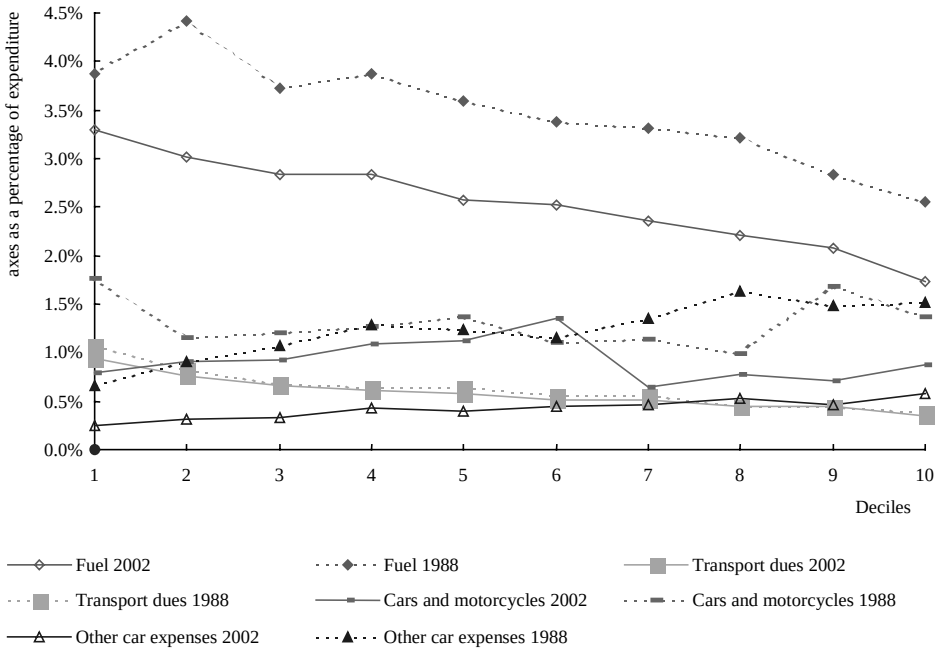
[5] This is due to the fact that between 1988 and 2002, car purchase taxes and transport dues significantly decreased and were made less progressive and the tax rate on motor fuel slightly decreased.

Figure 8

Progressivity of Car Taxes – Households With Cars



3. The impact of the indirect tax system on welfare inequality: 1988 and 2002

In order to more formally assess the distributional effects of indirect taxes in 1988 and 2002, we compare the distribution of welfare under the 1988 tax system, the 2002 tax system and a system of uniform equal-yield tax applying to all goods and services.[6] We employ several inequality measures, that is the well-known Gini index (Gini, 1912), the Atkinson indices for values of inequality aversion ε of 0.5, 1 and 2 (Atkinson, 1970), and the two Theil indices, T and N (Theil, 1967, also Shorrocks, 1980).

Table 4 presents the definitions of these indices. Giving some intuition behind them, it is worth noting that the Gini index measures twice the ratio of the area

[6] In the case of the uniform equal-yield tax and in the absence of detailed information on price elasticities, we implicitly assume own price elasticities equal to (–1) for all commodities and zero cross-price effects. In this way, the household budget constraint is not violated.

Table 4

Definition and Calculation of Inequality Measures

Name	Definition
Gini coefficient	$G = \frac{2}{n^2 \bar{y}} \sum_{i=1}^{n} i y_i - 1 - \frac{1}{n}$
Atkinson	$A_\varepsilon = 1 - \left[\frac{1}{n} \sum_{i=1}^{n} \left[\frac{y_i}{\bar{y}} \right]^{1-\varepsilon} \right]^{1/(1-\varepsilon)}$
Theil (*N*)	$N = \frac{1}{n} \sum_{i=1}^{n} \log\left(\frac{\bar{y}}{y_i} \right)$
Theil (*T*)	$T = \frac{1}{n} \sum_{i=1}^{n} \frac{y_i}{\bar{y}} \log\left(\frac{y_i}{\bar{y}} \right)$

Notes: y_i is income of individual i (i=1,...,n), $\bar{y}$ is mean income and ε is the inequality aversion parameter.

between the Lorenz curve and the diagonal to that of the whole box in which they lie. The Atkinson index measures the fraction of average income that could be thrown away if the remaining total income were equally distributed and yielded the same level of social welfare, using an isoelastic utility function with an inequality aversion parameter of ε. It should be noted that all these indices respect the desirable principles of anonymity, income scale dependence, population and the weak principle of transfers (see Kakwani, 1980 and Cowell, 1995).[7] The employment of a wide range of inequality indices is necessary given that each one implicitly or explicitly implies certain value judgements about the welfare of people at different parts of the distribution. The Gini index is more sensitive to changes in the middle of the distribution, the first Theil index (*T*) to changes at the top of the distribution, the second Theil index (*N*) focuses on the lower tail of the distribution. The weighting scheme is made explicit in the Atkinson indices with $\varepsilon \to \infty$ approaching the Rawlsian case, Atkinson (1970).

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[7] For details of the calculation of summary statistics and a review of the voluminous literature on the comparison and ranking of different distributions,see Cowell (1995).

Table 5 presents several inequality measures corresponding to the welfare distribution under the 1988 tax system, the 2002 tax system and the uniform tax.[8] The 1988 indirect tax system appears to have distributional benefits over the uniform tax, if the latter is applied to all commodities (see the top part of Table 5). The decline in inequality is rather small (2-4 per cent), but is indicated by all inequality measures employed. On the other hand, the 2002 indirect tax system seems to have overall a negative redistributive effect, since it leads to a more unequal distribution of welfare compared to a distributionally neutral system (*i.e.* the uniform equal-yield tax). Nevertheless, the increase in inequality is very small and not supported by all inequality indices. In fact, if one plotted the relevant Lorenz curves, they would cross, so that no dominance relationship could be traced between the two distributions. If we applied the uniform tax on non-durable commodities only and ignored taxes on durables (see the lower part of Table 5), results would be much more unfavourable for the indirect tax systems of both years.

It is worth noting that the underlying welfare distribution (before taxes)[9] was significantly more unequal in 2002 than in 1988 (by 3.5-7 per cent). The fact that the 2002 indirect tax system is more regressive than the 1988 one, means that the gap in inequality measures is further broadened between 1988 and 2002 if we consider the *after-tax* welfare distributions. Depending on the inequality measure used, the after-tax inequality has increased by 6-11 per cent between 1988 and 2002.

Finally, a tax mobility matrix has been employed to reveal the degree of "mobility" induced by the tax system (Atkinson, 1980). Such a matrix is constructed in the following way: suppose individuals are ranked by their pre-tax income (denote this ranking i) and also by their after-tax income (denote this ranking j). One can then write $j=iP$, where P is a permutation matrix. If no reranking occurs, P is the identity matrix. If one applies the same principle grouping the population in deciles, one can construct a transition matrix A, each element of which (a_{ij}) denotes the proportion of those in pre-tax group i entering the post-tax group j. This matrix is bistochastic (each row and each column add to 1) and the extent of mobility depends on the off-diagonal elements. Such a matrix indicates the degree of horizontal equality introduced by a certain tax system since it shows where households of similar initial welfare level end up when the tax system is imposed.

In Table 6, matrix A shows how households moved across deciles as a result of the indirect tax system, while matrix B gives the same information for 2002. What one is comparing is the relative position of households and not absolute

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[8] To be consistent with the previous analysis, the distribution of expenditure is derived by assigning the value of expenditure per equivalent adult (using the OECD scale) to each equivalent adult in the household.

[9] For all mean-independent inequality measures, such as the ones employed here, welfare distributions corresponding to no indirect taxes or to uniform indirect taxes are equivalent, if one makes the additional assumption that households will spend the same amount on commodities under prices corresponding to different tax regimes and will only adjust the quantity bought (this corresponds to own-price elasticities of demand equal to –1).

Table 5

1988 and 2002 Systems of Indirect Taxes Versus a Uniform Tax: A Comparison of Inequality Measures

Inequality measure	Uniform indirect tax 1988	Actual ind.tax system 1988	Percentage change in inequality	Uniform indirect tax 2002	Actual ind.tax system 2002	Percentage change in inequality
All commodites						
Gini coefficient (G)	0.326	0.320	–1.8%	0.337	0.338	0.3%
Atkinson (ε=.5) $A_{0.5}$	0.086	0.083	–3.5%	0.092	0.092	0.0%
Atkinson (ε=1)A_1	0.162	0.156	–3.7%	0.171	0.172	0.6%
Atkinson (ε=2)A_2	0.300	0.290	–3.3%	0.311	0.310	–0.3%
Theil index (T)	0.183	0.176	–3.8%	0.196	0.198	1.0%
Theil index (N)	0.179	0.172	–3.9%	0.190	0.190	0.3%
Non-durable commodities						
Gini coefficient (G)	0.310	0.308	–0.6%	0.320	0.325	1.6%
Atkinson (ε=.5) $A_{0.5}$	0.078	0.077	–1.3%	0.083	0.085	2.4%
Atkinson (ε=1)A_1	0.147	0.145	–1.4%	0.155	0.159	2.6%
Atkinson (ε=2)A_2	0.276	0.271	–1.8%	0.284	0.287	1.1%
Theil index (T)	0.164	0.163	–0.6%	0.177	0.183	3.6%
Theil index (N)	0.161	0.159	–1.2%	0.170	0.175	2.5%

welfare levels before and after indirect taxes are paid.[10] Inspection of the two matrices suggests that although the diagonal elements are dominant, some off-diagonal elements are quite large. Both in 1988 and in 2002, variability in tax rates tends to shift people, but in most cases not further than one decile. In both years, the mobility is concentrated in the more crowded middle of the distribution, where most rank reversals are likely to happen.

Matrix A is approximately tridiagonal, with people having moved one decile being in the order of 5-15 per cent and those having moved more than one decile

[10] This will depend on what ones assumes the alternative scenario to be, e.g. no taxes, uniform equal-yield taxes, etc.

Table 6

Matrix A: Tax Mobility Matrix 1988

Uniform-tax deciles in order of increasing equivalent expenditure	Actual-tax deciles in order of increasing equivalent expenditure *(percent)*									
	1	2	3	4	5	6	7	8	9	10
1	94.9	5.1								
2	5.1	85.7	9.2							
3		9.1	79.8	11.1						
4		0.1	10.5	74.4	15					
5			0.5	13.7	71.0	14.8				
6				0.8	13.3	70.4	15.5			
7					0.6	13.6	73.0	12.8		
8					0.1	1.1	11.0	77.6	10.2	
9						0.1	0.5	9.1	83.8	6.5
10								0.5	6	93.5

Matrix B: Tax Mobility Matrix 2002

Uniform-tax deciles in order of increasing equivalent expenditure	Actual-tax deciles in order of increasing equivalent expenditure *(percent)*									
	1	2	3	4	5	6	7	8	9	10
1	93.1	6.9								
2	6.9	83.4	9.7							
3		9.7	79.1	11.2						
4			11.0	76.8	12.2					
5			0.2	12.0	76.0	11.8				
6					11.8	76.2	12.0			
7						12.0	77.0	11.0		
8							11.0	80.0	9.0	
9								8.9	86.3	4.8
10									4.8	95.2

being less than 1 per cent. Matrix B, on the other hand, shows that in 2002 the indirect tax system introduced higher horizontal inequality than in 1988 towards the lower end of the income distribution, while the opposite is true for the middle and especially the upper end of the distribution. This might be another manifestation that the distribution of welfare itself was more skewed in 2002.

4. Conclusions

Exploring the distributional impact of the reforms of the Greek indirect tax system during the last 15 years allows several interesting conclusions to be drawn. The share of household expenditure absorbed by indirect taxes has remained remarkably stable, but the change in the distribution of the indirect tax burden among households over this period seems to have benefited wealthier groups. Poorer households now pay a higher proportion of their total expenditure in indirect taxes than 15 years ago, while richer households have gained in relative terms during the same period.

Analysing the distribution of indirect tax payments at a commodity level using tax concentration curves shows that there is a clear grouping of regressive taxes on food, tobacco, housing (including heating oil) and health. These commodities represent over 60 per cent of the average household budget. Taxes on cars and their use outbalance the regressive effect of these taxes in both years, so that their treatment proves decisive for the distribution of the total indirect tax burden.

Concentrating on measures of aggregate change in inequality shows that between 1988 and 2002 the overall inequality of the after-tax welfare distribution has increased by 6-11 per cent depending on the inequality measure employed. Changes in the indirect tax system seem to explain less than half of this increase in inequality, while the rest is explained by the increase in the inequality of the underlying (before-tax) distribution of welfare. In terms of horizontal inequality, that is how the indirect tax system treats households of similar welfare level, in 2002 the indirect tax system compared to 1988 introduced higher inequality at the bottom of the welfare distribution and less inequality among higher deciles.

Despite their rather negative overall distributional impact, one should not underestimate the fact that the indirect tax reforms introduced since 1988 substantially simplified the indirect tax structure, thus reducing the administrative and compliance cost of the tax system, which in Greece is perceived to be especially high (see Rapanos, 1997; TRC, 2002).[11] Considering that the "price" in terms of distributional fairness as suggested in the present paper might not have been especially large, these reforms could even be judged favourably.

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[11] Another dimension along which we could judge the indirect tax system is efficiency. This aspect is explored in Kaplanoglou and Newbery (2003).

REFERENCES

Atkinson, A.B. (1970), "On the Measurement of Inequality", *Journal of Economic Theory*, Vol. 2, pp. 244-63.

———————— (1980), "Horizontal Equity and the Distribution of the Tax Burden", in H. Aaron and M.J. Boskin (eds.), *The Economics of Taxation*, Washington, D.C., Brookings Institute.

Cowell, F.A. (1995), *Measuring Inequality*, 2nd edition, LSE Handbooks in Economics, UK, Prentice Hall/Harvester Wheatsheaf.

Dewees, D.N. (1979), "Estimating the Time Costs of Highway Congestion", *Econometrica*, Vol. 47, No. 6, pp. 1499-512.

Friedman, M. (1957), *A Theory of the Consumption Function*, Princeton N.J., Princeton University Press.

Georgakopoulos, T.A. (1991), *Indirect Tax Harmonisation in Greece and the Value Added Tax: Effects on the Greek Economy*, Piraeous, Stamoulis (in Greek).

Gini, C. (1912), *Variabilità e Mutabilità*, Bologna.

Harrison, W.J., C. Pell, P.M. Jones and H. Ashton (1986), "Some Advances in Model Design Developed for the Practical Assessment of Road Pricing in Hong-Kong", *Transportation Research*, Vol. 20A, pp. 135-44.

HMSO (1993), *Paying for Better Motorways*, London, CM 2200.

House of Commons (1995), *Urban Road Pricing*, Third Report of the Transport Committee, Session 1994-95, Cm 104-1, London, HMSO.

Kakwani, N.C. (1980), *Income Inequality and Poverty: Methods of Estimation and Policy Applications*, New York, Oxford University Press.

Kaplanoglou, G. (1999), "Distributional and Efficiency Aspects of the Greek Indirect Tax System: a Microsimulation Analysis", University of Cambridge, unpublished Ph.D. thesis.

———————— (2000), "A Microsimulation Analysis of the Distribution of the Indirect Tax Burden among Greek Households", in L. Mitton, H. Sutherland and M. Weeks (eds.), *Microsimulation Modelling for Policy Analysis: Challenges and Innovations*, Cambridge, Cambridge University Press.

Kaplanoglou, G. and D.M. Newbery (2002), "The Distributional Impact of the Proposed Tax Reform on Greek Households", Final Report to the Centre of Planning and Economic Research, Athens.

———————— (2003), "Indirect Taxation in Greece: Evaluation and Possible Reform", *International Tax and Public Finance*, forthcoming.

Kopits, G. (1992), "Tax Harmonisation in the European Community: Policy Issues and Analysis", IMF Occasional Paper, No. 94.

Modigliani, F. and R. Brumberg (1954), "Utility Analysis and the Consumption Function: an Interpretation of Cross-section Data", in K. Kurihara (ed.), *Post-Keynesian Economics*, New Brunswick, Rutgers University Press.

Mountrouidis, S. (2001), *The Car Market*, Athens, Foundation for Economic and Industrial Research, Sectoral Study No. 179 (in Greek).

Musgrave, R.A. and T. Thin (1948), "Income-tax Progression 1929-1948", *Journal of Political Economy*, Vol. 56, pp. 498-514.

National Statistical Service of Greece (1994), *Household Expenditure* Survey 1987/88, Athens, Hellenic Republic.

——————— (2001), *Household Expenditure Survey 1998/1999*, Athens, Hellenic Republic.

Newbery, D.M. (1988), "Charging for Roads", *Research Observer*, Vol. 3, pp. 119-38.

——————— (1996), "Pricing and Congestion: Economic Principles Relevant to Pricing Roads", in T. Jenkinson (ed.), *Readings in Microeconomics*, UK, Oxford University Press.

Newbery, D.M. and G. Santos (1999), "Road Taxes, Road User Charges and Earmarking", *Fiscal Studies*, Vol. 20, pp. 103-32.

Rapanos, V. (1997), "Tax Reform and Tax Administration", in G. Provopoulos and V. Rapanos (eds.), *Functions of the Public Sector: Problems and Prospects*, Athens, Foundation for Economic and Industrial Research (in Greek).

Shorrocks, A.F. (1980), "The Class of Additively Decomposable Inequality Measures", *Econometrica*, Vol. 48, pp. 613-25.

Suits, D.B. (1977), "Measurement of Tax Progressivity", *American Economic Review*, Vol. 67, No. 4, pp. 747-52.

Tanzi, V. (1987), "Quantitative Characteristics of Tax Systems of Developing Countries", in D.M. Newbery and N. Stern (eds.), *The Theory of Taxation for Developing Countries*, New York, Oxford University Press.

Tax Reform Committee (2002), "Report on Reforming the Greek Tax System: a Scientific Proposal", Athens.

Theil, H. (1967), *Economics and Information Theory*, Amsterdam, North Holland.

Walters, A.A. (1968), *The Economics and Road User Charges*, Baltimore, MD, Johns Hopkins University Press.

THE DISTRIBUTIONAL CONSEQUENCES OF PROGRESSIVE TAXATION, WHEN COMPLEMENTARITY BETWEEN SKILLS IS IMPORTANT

Ulrik Nødgaard[*]

Introduction

The countries of the European Union are all characterised by having a progressive tax system that redistributes income from persons with high incomes to persons with lower incomes. As earnings are closely related to educational qualifications the progressive tax systems do *de facto* redistribute from the highly skilled to the low skilled persons with little formal education.

The analysis of the distributional consequences of changes in the progression of taxation of wage income is normally done through so-called distributional tables that – based on a sample of the population – show the changes in after-tax income in a given year assuming no change in labour or relative wages. In essence, these calculations ignore that the burden of progressive taxes might not be borne entirely by the highly-skilled.

However, such static calculations are at odds with the vast empirical literature that shows that the labour supply of high wage earners does respond to changes in marginal tax rates. For instance, Blomquist and West finds that the Swedish tax reform in 1991, which led to a significant drop in the marginal tax rates of high wage earners led to an increase of 7 per cent in the labour supply of that group.

Furthermore, the assumption of unchanged relative wages is problematic, as several empirical studies have shown that the relative wages of different types of education is quite sensitive to the relative supply, see for instance Katz and Murphy (1992).

In section 1 of this paper we construct a simple model that will allow us to take into account these effects and calculate the distributional consequences when such dynamic responses are taking into account. In section 2 we use the model to illustrate the quantitative importance of taking into account the effects on relative wages. Finally, the implications for economic policy are presented in section 3.

1. A simple model

In this section a simple model is presented, which will be used to illustrate how potentially misleading simple static calculations can be.

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We look at an economy in which there are two types of households: N_L households that supply unskilled labour, L, and N_H households that supply highly educated labour, H.

Redistribution takes place through a proportional income tax t on the highly skilled persons. The revenue on this tax is then used to provide an income transfer, T, to the unskilled. Hence, the budget constraint says that: $N_L \cdot T = t \cdot w_H \cdot H \cdot N_H$, where w_H is the wage of the highly skilled persons.

The utility of the highly skilled persons is a function of consumption and leisure, U(1–H, C_H), where H is the labour supply of the skilled persons, while C_H is consumption. The level of consumption is determined by the after-tax income. Utility maximization gives rise to the following labour supply function:

$$\tilde{H} = \varepsilon(\tilde{w}_H - \tilde{t}) \tag{1}$$

where a variable with a tilde represents the percentage change (except for t where $\tilde{t} = dt/(1-t)$), and ε is the (uncompensated) labour supply elasticity.

The labour supply of the unskilled is, due to the need for simplicity, assumed constant.[1] Hence, the utility of the low skilled persons can be measured by the income including transfers.

Firms use low-skilled and highly-skilled labour in the production: $Y = F(N_L \cdot L, N_H \cdot H)$. Profitmaximization give rise to the following (inverted) demand curves for the two types of labour:

$$\tilde{w}_H = \frac{-(1-S_H)}{\sigma}\tilde{H} \tag{2a}$$

$$\tilde{w}_L = \frac{S_H}{\sigma}\tilde{H} \tag{2b}$$

where S_H is the income share of the highly-skilled and σ is the elasticity of substitution between the two types of labour. Furthermore, the number of households of each type is assumed constant, *i.e.* we ignore potential effects on the level of education coming from a change in tax progression.

Inserting (1) into (2) we get the labour supply and the wage of the highly-skilled as a function of (change in) the taxation of the highly-skilled:

$$\tilde{w}_H = \frac{1}{1+\sigma/((1-S_H)\varepsilon}\tilde{t} \tag{3a}$$

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[1] This assumption is only acceptable in the context of the specific policy experiment that we consider in this paper, *i.e.* an increase in the tax on the highly skilled persons.

$$\tilde{H} = \frac{-1}{(1-S_H)/\sigma + 1/\varepsilon}\tilde{t} \tag{3b}$$

The real wage of the low-skilled follows by inserting (3b) into (2b):

$$\tilde{w}_L = \frac{-S_H/\sigma}{(1-S_H)/\sigma + 1/\varepsilon}\tilde{t} \tag{4}$$

Taking a log-linear approximation to the government budget constraint, we find that the change in the income transfer to the low skilled is determined by change in the tax rate and changes in the endogenous tax base:

$$\tilde{T} = \frac{1-t}{t}\tilde{t} + \tilde{w}_H + \tilde{H} \tag{5}$$

As the low-skilled by assumption has an inelastic labour supply the change in welfare for this group is simply a weighted average of the (change in) the real wage and the (change in) the income transfers:

$$\Delta welfare = \alpha_w \tilde{w}_L + (1-\alpha_w)\tilde{T} \tag{6}$$

where α_w is the share of wage income in total income. Inserting the solutions from equation (3), (4) and (5) into (6), we can write the change in welfare of the low skilled persons, as a function of the parameters of the model:

$$\begin{aligned}\Delta welfare = &\left\{\left[\alpha_w \frac{-S_H/\sigma}{(1-S_H)/\sigma + 1/\varepsilon}\right] + \right. \\ &\left. + (1-\alpha_w)\left[\frac{1-t}{t} + \frac{1}{1+\sigma/(1-S_H)\varepsilon} + \frac{-1}{(1-S_H)/\sigma + 1/\varepsilon}\right]\right\}\tilde{t}\end{aligned} \tag{7}$$

Using this equation, we are now able to decompose the change in the welfare of low skilled persons when the tax on the highly-skilled is raised.

The first effect (corresponding to the first square bracket) is that the reduction of the labour supply of the highly-skilled will reduce the demand for low-skilled labour and hence depress the wage of the low-skilled. In what follows this will be called the "complementarity" effect. This effect is strong when the labour supply of the highly-skilled is very elastic or when the degree of substitution between the two types of labour is limited.

The second effect (corresponding to the second square bracket) reflects the effects of the income transfers. In general, the sign of this effect is indeterminate as

the reduction in the tax base could be sufficiently so strong, that it more that outweighs the effect of the increase in the tax rate. However, the likelihood of such a Laffer effect is dampened by the fact that the wage of the highly-skilled will increase as their labour supply is reduced, hence partly counteracting the negative effects on the tax base.

A few special cases can illuminate the intuition behind equation (7). If the labour supply of the highly-skilled is completely inelastic ($\varepsilon \rightarrow 0$) we get the ordinary "static" effect on the welfare of the low-skilled:

$$\Delta welfare = (1-\alpha_w)\frac{1-t}{t}\tilde{t}$$

This is the effect that normally is being calculated by the economic ministries and serves as a basis for the debate of the distributional consequences of raising the progressive taxes.

Another special case arises when the two types of labour are perfect substitutes ($\sigma \rightarrow \infty$). In this case, the relative wages will be unaffected by the higher tax and hence the change in welfare will amount to:

$$\Delta welfare = (1-\alpha_w)\left[\frac{1-t}{t} - \varepsilon\right]\tilde{t}$$

On the other hand, if the technology is of the Leontief form ($\sigma \rightarrow 0$) where the two types of labour is being used in the same proportions no matter what the relative wage is, we get:

$$\Delta welfare = \left[\alpha_w \frac{-S_H}{1-S_H} + (1-\alpha_w)\frac{1-t}{t}\right]\tilde{t}$$

In this case it is actually quite possible that the low skilled persons will experience a reduction in welfare when redistribution is increased. The "complementarity" effect and the tax base effect can dominate the initial positive effect.

2. Quantitative results

In this section we use the simple model presented in the previous section to quantify how different the distributional consequences can be when changes in relative wages are taken into account. More precisely, we ask: How misleading are the conventional static calculations for reasonable assumptions regarding the elasticity of labour supply and the degree of substitution between low-skilled and highly-skilled labour?

Specifically, we will look at the distributional effects of raising the tax on the highly skilled persons under two sets of assumptions:

1) No effect on labour supply and relative wages

2) Elastic labour supply and endogenous determination of relative wages.

Assume that initially the tax rate on the highly-skilled is 50 per cent and that it is raised to 60 per cent, so that $\tilde{t} = 0.2$. It immediately follows from the public budget constraint that this will – in the absence of endogenous changes in the tax base – increase the income transfer to the low-skilled by 20 per cent, cf. equation (5). Assuming that the income transfers initially are approximately 20 per cent of the total income of the low-skilled (*i.e.* we assume that α_w = 0.8), the total income or welfare of the low skilled persons will increase by 4 per cent (see Table 1).

In order to calculate the distributional consequences taking into account the effects on labour supply and relative wages, we need to make specific assumptions regarding the elasticity of labour supply and the degree of substitution between the two types of labour.

The most recent Danish study indicates that the average (uncompensated) elasticity of labour supply in the range of 0.1, c.f. Frederiksen *et al.* (2001). Hence, we will use an elasticity of 0.1 in our "conservative" baseline. However, the survey made by Fuchs *et al.* (1998) indicates that economists in general believe the elasticity of labour supply to be 0.2. Hence, we also include a "incentive" scenario where the elasticity is assumed to be 0.2.

Table 1

Effects on an Increase in the Tax Rate from 50 to 60 per cent

Percentage change	(I) Conventional static calculation	(II) "Conservative" baseline	(II) "Incentive" scenario
t	20.0	20.0	20.0
T	20.0	18.3	16.9
H	0	–2.0	–3.8
w_H	0	0.3	0.8
w_L	0	–1.1	–3.1
Welfare	4.0	2.7	0.9
Change in welfare as a percentage of change in welfare in the static calculation		68	23

Regarding the degree of substitution between low-skilled and highly-skilled labour this will depend upon where the line is drawn between these two types of labour. When looking at college and non-college workers it has been quite normal to assume an elasticity of substitution of 1.4 based on the time series study in Katz and Murphy (1992). However, as noted by Hamermesh (1994): "The strength of substitution between highly educated and raw labor is unclear". Hence, in the so-called incentive scenario we assume an elasticity of substitution equal to 1 corresponding to a Cobb-Douglas technology.

Taking into account the dynamic responses has tremendous effect on the distributional consequences, see again Table 1. The welfare gain for the low-skilled from the increase in redistribution is lowered from 4 to only 2,7 per cent under the "conservative" assumptions, and the gain drops to only 0,9 per cent in the equally realistic "incentive" scenario.

As the results appear to be sensitive to the assumptions made regarding main parameters it might be advisable to do sensitivity analysis. In Figure 1 below the relationship between the elasticity of labour supply and the welfare gain to the low skilled persons is shown.

The degree of substitution between the two types of labour is also critical, see Figure 2.

Figure 1

The Elasticity of Labour Supply and the Welfare Gain for the Unskilled

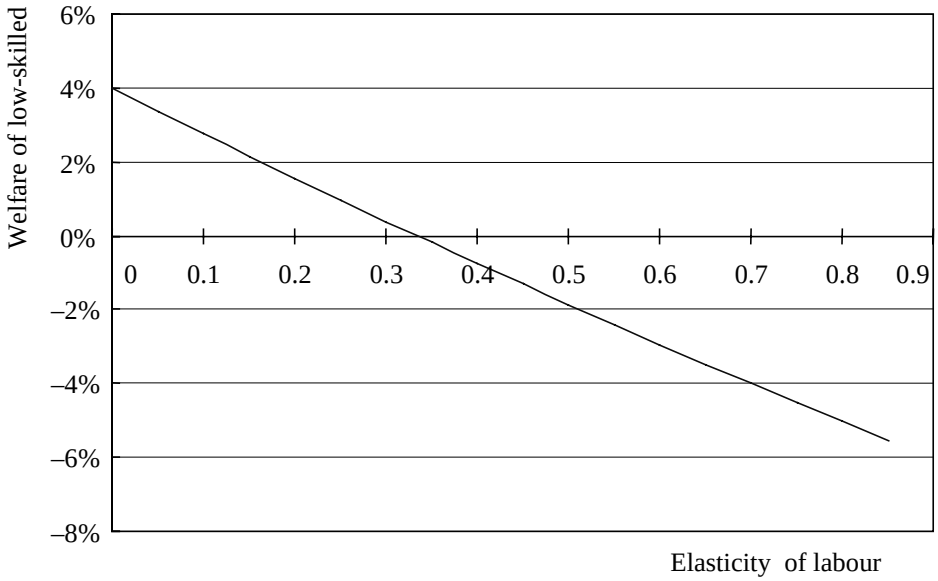
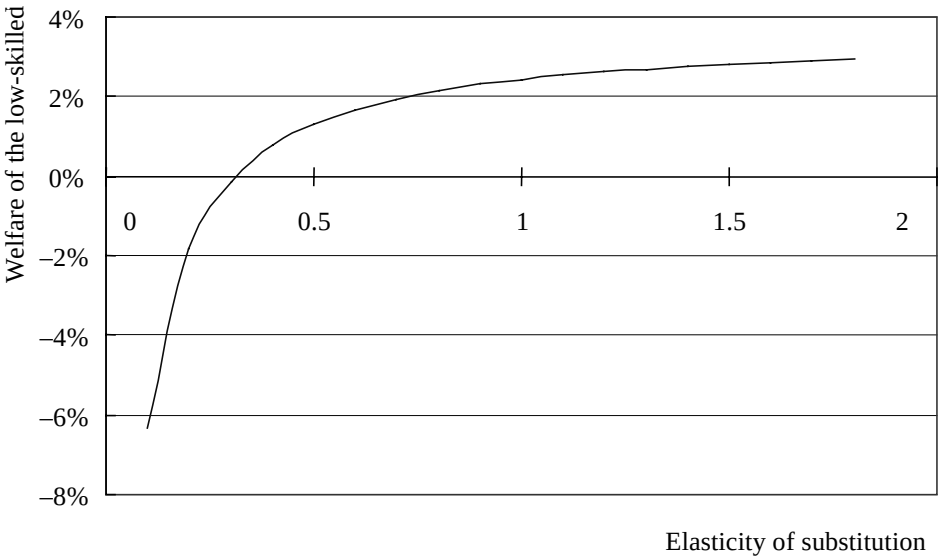


Figure 2

The Elasticity of Substitution and the Welfare Gain for the Low-Skilled



When substitution is very difficult, it is possible that the increased redistribution might actually leave the low-skilled worse off. They are carrying a large part of the burden of the increased taxation of the highly-skilled.

3. Implications for economic policy

The analysis has one central message: One should be cautious in the use of distributional calculations made under the assumption of no change in behaviour and relative prices. This was also the conclusion made by Hubbard (1999), who discussed the incidence of consumption and capital taxes.

This paper extends the analysis to study the incidence of progressive taxes on labour income. In particular, the analysis shows that the distributional consequences of progressive taxation can be significantly overestimated, if one ignores the effects on the relative wages coming from a reduction in the labour supply of the highly-skilled. Under realistic assumptions regarding the key parameters, the "true" distributional effects (*i.e.* the welfare gain for the low-skilled) is only 25-65 percent of the welfare gain to the low-skilled calculated under the assumption of no behavioural responses and unchanged relative wages.

Hence, we should make sure that we do not overestimate the redistributive powers of progressive taxes. Clearly, this point becomes even more important if the international mobility of the highly skilled persons increase in the coming years.

REFERENCES

Blomquist, S. and M. Eklöf (2001), "Tax Reform and Labour Supply in Sweden: Were Low and High Skill Individuals Affected Differently?", in M. Buti, H. Wijkander and P. Sestito (eds.), *Taxation, Welfare and the Crisis of Unemployment in Europe*.

Fuchs, V. *et al.* (1998), "Economists' View About Parameters, Values and Policies: Survey Results in Labor and Public Economics", *Journal of Economic Literature.*

Frederiksen, A. *et al.* (2001), "Overtime work, Dual Job Holding and Taxation", Working Paper, University of Århus, Denmark.

Hamermesh, D. (1994), *Labour Demand*, Princeton University Press.

Hubbard, G. (1999), "On the Use of Distributional Tables in the Tax Policy Process", in J. Slemrod (ed.), *Tax Policy in the Real World.*

Katz, L. and K.M. Murphy (1992), "Changes in Relative Wages 1963-87: Supply and Demand Factors", *Quarterly Journal of Economics*.

COMMENTS ON SESSION I: TAXATION AND THE LABOUR MARKET

Geert Langenus[*]

I would like to start this discussion by congratulating the contributors to this session for their excellent papers and presentations. At the same time, I need to apologise to them: the papers are quite heterogeneous and the specific format of this workshop probably does not allow me to provide a detailed analysis of each individual paper, which implies that I cannot give them the attention they deserve. What I would like to do instead is to float a few general observations concerning the issues dealt with in the papers.

When I read these papers it struck me again that a tax is really very much a multi-purpose device. First, it obviously serves to raise revenue (in order to finance government spending). Second, it seeks to redistribute welfare from the rich to the poor. Finally, it also affects people's behaviour and it is sometimes used for that very purpose (environmental taxes being a case in point). Taking into account that taxes are set by politicians, one should probably still add a number of political economy objectives to that list.

One of the messages that I took from these papers, is that these objectives are often conflicting. We all know that the best environmental tax is the one that yields exactly zero, but the authors provide a number of other examples. Nødgaard shows, for instance, that a large part of the intended redistribution of a tax hike can leak away through behavioural changes. Frederiksen, on the other hand, demonstrates how the net revenue impact of a tax change is eroded by the same mechanism.

Hence, it seems crucially important that the people who are responsible for designing the tax system and for setting the tax rates are fully aware of all the consequences of their decisions and, obviously, papers like the ones presented in this session significantly contribute to this understanding.

The authors look at taxation from different angles. Martinez-Mongay provides a detailed overview of the trends in European tax systems over the last decades. Gokhale and Kaplanoglou and Newbery are concerned with the redistributive features of individual tax systems although, interestingly, their approach is completely different. Nødgaard and Frederiksen, finally, try to capture the impact of tax-induced behavioural changes in stylised theoretical models and in some cases arrive at slightly unsettling conclusions.

Zooming in on the Martinez-Mongay paper, I think one can hardly overstate the enormous task involved in estimating internationally comparable tax rates. Even

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if one overcomes all the accounting difficulties – and the paper does a really great job in this respect – one should still refrain from drawing hasty conclusions. Let me give just one example: Martinez-Mongay confirms that EU tax rates are significantly higher than the US ones. I believe he is right not to overemphasise this conclusion, however, because what does this really mean? One of the reasons for the lower US tax wedge, for instance, is that the health care system, except for the very poor and the elderly, is mainly outside the government sector. This only means, in my view, that there is no formal legal obligation to buy appropriate health insurance. However, considering that health care is a basic need and that those who can afford it, buy some form of private health insurance, it is safe to say that the absence of such a legal obligation does not make health insurance less necessary. I wonder whether one can draw very robust conclusions about the optimal size of government in this respect. It quickly boils down to a discussion where you basically have to weigh the share of people without any health insurance in the US (which I understand to be some 15 p.c.) against the alleged benefits in terms of allocative efficiency.

I found Martinez-Mongay's results on the tax mix much more interesting. Ideally, countries should make their tax systems more employment-friendly by reducing taxes on labour. The scope to do so is however often claimed to be limited as any attempt to offset the budgetary cost by increasing the tax rate on capital would be ill-fated because of the high volatility of capital tax bases. In this respect, Martinez-Mongay's findings are particularly interesting. On the one hand, he shows that tax rates on labour have been gradually lowered recently in the EU but remain significantly higher than the tax rates on capital which have stayed roughly constant. On the other hand, however, he finds that, in the US, labour is taxed at the same effective rate as capital. In addition, he demonstrates that changes in taxation in the EU have occurred in what should be neutrally described as an apparent co-movement. So the obvious question is: taking the roughly equal taxation of both factors of production in the US as an example, can a coordinated European strategy to shift taxes from labour to capital – with a view to boosting the employment rate – be successful?

Frederiksen provides a theoretical framework to assess the relative merits of different tax policy options: taking into account behavioural reactions, what is the ex post budgetary impact of tax changes? His findings corroborate the claims regarding the large volatility of capital tax bases (even without taking into account international capital movements) and, in addition, point to large feedback effects for labour taxes on high incomes. I cannot help being surprised by the large impact of the behavioural changes reported by Frederiksen. In particular, the nearly self-financing nature of tax cuts for high-wage earners and the Laffer features of the capital income tax reform at moderate inflation rates seem "too good to be true". When reading the preliminary draft of the paper, it was not always fully clear to me which specific features of the model account for these strong results.

Nødgaard also provides results which somewhat qualify "conventional wisdom": increasing the tax rate for high incomes, *i.e.* making the tax system more

progressive, could have only a limited impact on after-tax equality due to behavioural changes. Even though I fully agree with the basic message – behavioural changes have to be taken into account in order to assess the equity of a tax reform –, I was again surprised at the size of their impact, which might be related to the actual set-up of the model. In this respect, I wonder whether the technical assumption of a fixed labour supply of low-wage earners is as "innocuous" as the author claims. It seems worthwhile to check whether the model wouldn't give more standard results if this assumption were relaxed or, more realistically, if involuntary unemployment for the low-skilled were introduced.

More generally, cuts in labour taxes on low incomes – such as implemented in a number of European countries – can be criticised on the basis of both Frederiksen's and Nødgaard's paper: they are relatively costly (Frederiksen) and their positive impact on income distribution could be very limited (Nødgaard). However, in actual practice, these tax cuts mainly aim at increasing the employment rate for the low-skilled and, specifically, at eradicating unemployment traps and this issue is not explicitly dealt with in the papers.

Finally, let me turn to the two remaining papers in this session, which both analyse the redistributive features of individual tax systems even if their approach is very different. Kaplanoglou and Newbery work with micro consumption data to assess the Greek VAT system whereas Gokhale puts the whole US tax and transfer system in a dynamic computer model and gets a very interesting helicopter view. Curiously enough, both papers have convinced me that their approach is the appropriate one!

Gokhale shows that, if you only look at the progressiveness of taxes, you might be missing the point; in the US, for instance, most of the progressiveness is accounted for by government transfers. Hence, *all* financial relations with the government need to be taken into account in a lifecycle model as proposed by Gokhale. Incidentally, one could even extend the analysis to non-transfer government spending. Are the benefits of these expenditure categories shared equally by different income groups? For a number of European countries, studies have shown that some government spending (e.g. on education or culture) might exhibit regressive features; although I can imagine that the situation might be different in the US.

Kaplanoglou and Newbery prove a different point. The regressive character of VAT is often only attributed to the fact that the consumption share is dropping with income. The authors demonstrate, however, that this is not the end of the story: as consumption patterns differ across income groups and different rates apply to different goods and services, the indirect tax burden can be distributed unequally even among households with the same consumption share. On the basis of detailed household data, the authors show that the Greek indirect tax system has become more regressive in recent years mainly due to the significant reduction in taxes on cars and their use. I might add that similar studies conducted for the Belgian indirect tax system point to steep Belgian car taxes as making the system actually more progressive. Two more technical questions arose when I read the paper by

Kaplanoglou and Newbery. First, can the authors be sure that their results are not biased by the exclusion of durable consumption? One could indeed argue that the share of durable consumption increases with income. Second, do the household data adequately reflect reality (in the case of tax fraud, for instance)?

Taken together, the papers by Gokhale and Kaplanoglou and Newbery prove that any assessment of progressiveness which does not take into account the whole tax and transfer system and the actual incidence of individual taxes and transfers, runs the risk of being either incomplete or biased.

Summing up, the five papers presented in this session adequately reflect the wide variety of empirical research on taxation. What they have in common, is their authors' conviction that an issue as complex as taxation requires a detailed assessment which goes beyond "common understanding" and "conventional wisdom".

COMMENTS ON SESSION I:
TAXATION AND THE LABOUR MARKET

Lucio R. Pench[*]

These papers approach the issue of taxation and the labour market from different angles. The paper by Martinez-Mongay and the paper by Gokhale and Kotlikoff elaborate indicators of the fiscal burden on labour, based, respectively, on a macroeconomic, "backward looking" approach and a microeconomic, "forward-looking" one. The paper by Nødgaard and the paper by Frederiksen focus on the efficiency effects of tax options, respectively, an increase in taxation on high-earners and tax cuts on wage and capital income.

Applying a well established methodology to national accounts figures integrating OECD and European Commission sources, Martinez-Mongay breaks down total taxes into labour, capital and consumption taxes. The breakdown highlights: the steady increase in the overall taxation of labour in the industrial world, particularly in the countries of the European Union and during the 1980s; the relative stability in the overall taxation of (income from) capital and its convergence across industrial countries; the stability in the overall taxation of consumption and its convergence across EU countries.

The story told by the figures collected by Martinez-Mongay is that of the increasing revenue requirement entailed by the "maturation" of the welfare state in Europe. The same figures suggest that the increase in the need for revenues has been met, by and large, by the increase in the tax burden on labour. At the same time the non-decline in both the overall tax rate and the tax revenue associated with capital seems to suggest that the increase in the mobility of the tax base has not been such as to make the taxation of capital much more inefficient than it used to be.

I find the story on the whole persuasive, including the tentative conclusion that news of the death of the taxation of capital at the hands of tax competition have been greatly exaggerated.

Looking at the trends highlighted by this very informative paper two rather speculative questions occurred to me, for which I have no ready answer.

The first concerns the eventual place of segniorage revenue in the framework for analysing the structure and evolution of taxation, which as applied so far takes only into account explicit tax revenue. This question might appear hardly relevant in today's low inflation environment, even if one found a satisfactory answer to the question that it presupposes, namely, the allocation of segniorage to an appropriate

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The views expressed are those of the author and do not necessarily correspond to those of the European Commission.

tax base (should seigniorage be seen as a form of taxation of (income from) capital?). Within the time frame of the study, however, segniorage has been an important source of government revenue, at least for some countries: for example, estimates for segniorage in Italy during the 1980s come close to 1 per cent of GDP per year on average (Pench, 1993).

The second question is prompted by the observation of the relative stability of the effective tax rate on consumption since the early 1970s in contrast with the relentless rise in the effective tax rate on labour at least until the late 1990s. In the light of the theoretical equivalence between a uniform sales tax and a linear income tax with a suitably chosen exemption level and marginal tax rate, one might have expected less diverging trends between the two tax rates. The question then becomes whether a misguided preoccupation with redistribution might have contributed to an excessive weight of labour taxation in the overall tax package.

How redistribution concerns might be misguided or, more precisely, how costly might be to disregard the efficiency effects of taxation is a theme that runs through the paper by Nødgaard and also the paper by Frederiksen. Both papers highlight, based on simple but not unrealistic assumptions, how the revenue impact of tax reform at unchanged behaviour might be a poor indicator of its true effects.

Specifically, Nødgaard highlights an often neglected but potentially important effect of redistributive taxation, that is, the effect on productivity and hence (pre-tax) income of the changes in the relative supply of factors induced by the tax itself. The size of this effect depends on how it is difficult to substitute one factor for another, that is, the (inverse of the) elasticity of substitution between them . In this respect the paper reminds one of Allen's (1982) revision of the standard Mirrlees model of optimal income taxation, which is explicitly based on the relaxation of the assumption of fixed productivities and hence fixed relative pre-tax wages.

Modelling the economy as a CES production function with two factors – typified by low-skilled and high-skilled workers – and concentrating on the revenue effects due to the behavioural response of the high-skilled, Nødgaard reaches the conclusion that such effects might reduce the revenue that would obtain if behaviour did not respond by at least one third and possibly by as much as three quarters, depending on the assumptions about the elasticity of supply of high-skilled labour and the elasticity of substitution between the two types of labour.

No matter how strongly held are one's subjective preferences for equalising utility, Nødgaard's simulations are a neat illustration of the need to take into account objective (although admittedly imprecise) estimates of factor elasticities in devising tax policy.

In the same vein, the paper by Frederiksen shows that for a high-tax economy such as Denmark and plausible values of supply elasticities, the behavioural responses of top wage earners and savers can be expected to largely offset or, in the case of the latter, even dominate the direct revenue effect (*i.e.*, ignoring tax-induced behavioural changes) of tax reform. The relative weight of such direct and indirect

effects is neatly encapsulated in the "revenue recovery ratio", which Frederiksen calculates for different tax reform options.

Although explicitly based on a partial-equilibrium approach that takes (pre-tax) factor remunerations as given, I find the approach proposed very attractive from the policy-making viewpoint, especially on account of its relative simplicity compared with that of computable general equilibrium models. Its application would represent a considerable step forward compared to the prevailing crude practice of assessing tax policy options under unchanged behaviour assumptions.

The joint reading of the two papers prompts me to make few additional remarks.

Both papers assume full employment of factors at market-clearing prices – prices that respond to relative supplies in Nødgaard's analysis (limited to a two-factor economy) while they are fixed in Frederiksen's. One might speculate on the implications of releasing the market-clearing assumption. For example, if low-skilled workers in Nødgaard's model were entitled to a minimum (pre-tax) wage, the fall in their productivity resulting from the tax-induced reduction in the supply of high-skilled labour would show up in higher involuntary unemployment rather than lower wages. This would presumably reinforce the caveat on the unintended consequences of distributional policies that is at the core of the paper. At the same time, the transfer element in the tax package, which is unconditional in both Nødgaard's and Frederiksen's simple models, could take the form of an employment subsidy, thereby offsetting, to some extent, the wage/employment implications of higher taxes.

It is also tempting to combine the insights offered by Nødgaard and Frederiksen, on the importance of elasticities of substitution and capital supply distortions, respectively. Frederiksen's analysis suggests that lowering and rationalising the taxation of capital would result in increases in the quantity and the productivity of the capital stock such as to make the reform more than self-financing. In turn, if capital and high-skilled labour are complementary, as it is usually assumed, the improved supply of capital would result, applying the main insight of Nødgaard's paper, in higher productivity and remuneration of high-skilled workers and, to a lesser extent, of low-skilled workers as well. Even at given tax rates for labour, revenue would increase. The policy conclusion would be that, streamlining the taxation of capital may be the most effective policy to make the low-skilled better off, in absolute if not relative terms.

A final conclusion is that these two papers, especially Frederiksen's, bring home forcefully is that tax reform could offer the opportunity for substantial "free lunches". The question then arises why this opportunity is not seized by policy makers. I guess that the most persuasive answer can be found in the political economy of special interests.

While the papers by Nødgaard and Frederiksen aim at providing rough estimates of the efficiency effect of tax reform options, the Gokhale and Kotlikoff's analysis of the costs and benefits of working skirts explicit social welfare

considerations. Its tone, if anything, appears to reflect the traditional policy makers' concern for maximising labour supply regardless of its social welfare cost.

The importance of the paper lies in the attempt to quantify, in the context of the US system, the lifetime tax and transfers implications of the decision to work at different points of the earning (and age) scale, in contrast with the standard approach focusing exclusively on the immediate changes in the tax/benefit position associated with the transition from non-work to work (for a review of such standard indicators see for example Carone and Salomäki, 2001).

It is generally acknowledged, for example, that the impact on labour supply of a payroll tax will depend on the degree to which workers value the benefits linked to the payment of the tax. However, the standard approach to calculating the marginal effective tax rate associated with the move from non-employment to employment typically disregards the benefits that the worker buys when paying the tax. By contrast, such benefits are incorporated in the marginal net tax rates on working calculated by Gokhale and Kotlikoff, which are based on actuarial present value of lifetime net tax payments. Their analysis however does not capture an effect of current work decision on future income, namely, the prospect of higher future wages arising from a continuous work history, and this probably represents a limitation of the approach.

The results presented are interesting, although I do not feel able, even for the US, to draw a proper comparison between the two types of indicators – those of the standard approach, which one might call 'instantaneous' and those proposed by Gokhale and Kotlikoff, which might be called the 'intertemporal' (*inter alia* because the standard indicators are typically calculated for cases that differentiate between the situation of the two earners in the household, while the data presented by Gokhale and Kotlikoff appear to assume that the same situation for the two spouses). However, a cursory look at the figures confirms a stylised fact and suggests a hypothesis.

The stylised fact confirmed by Gokhale and Kotlikoff's calculations is that it does not pay to take up part-time employment when the household is recipient of social assistance. The hypothesis concerns the extent of the work incentive problem identified by Gokhale and Kotlikoff in other industrial countries. Bearing in mind that, especially after the introduction of the Earned Income Tax Credit, the work incentive situation for the low paid appears to be more favourable in the US than in most other countries according to the 'instantaneous' indicators, one might venture that the work incentive problem highlighted by Gokhale and Kotlikoff 'intertemporal' indicators for the US is even more acute in other countries. It would be therefore interesting to see the approach implemented on a cross-country basis.

REFERENCES

Allen, F. (1982), "Optimal Linear Income Taxation with General Equilibrium Effects on Wages", *Journal of Public Economics* , Vol. 17, pp. 135-44.

Carone, G. and Sälomaki, A. (2001), "Reforms in Tax-Benefit Systems in Order to Increase Employment Incentives in the EU", European Commission, Directorate-General for Economic and Financial Affairs, Economic Paper, No. 160.

Pench, L.R. (1993), "Debts, Deficits and Fiscal Adjustment", European Economy, Reports and Studies, No. 1, pp. 71-111.

COMMENTS ON SESSION I: TAXATION AND THE LABOUR MARKET

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I will start off with the last paper by Ulrik Nødgaard on the distributional consequences of progressive taxation. The paper presents a nice and simple model, where a distinction is made between unskilled and highly skilled labour. The two key parameters of the model are the elasticity of the supply of labour by the highly skilled workers and the elasticity of substitution in the production function between the two types of labour. For the low-skilled the labour supply is fixed, *i.e.* the supply elasticity is zero by assumption. A further important assumption, although not emphasised in the paper, is that wages are fully flexible, as a result of which the labour market always clears.

The policy point of the paper is to challenge the general perception, according to which progressive taxes redistribute income from high-income to low-income workers. The underlying behind this perception is that labour supply and relative wages remain intact when the tax progressivity increases. This assumption is not justified.

The policy experiment done in the paper contains an increase of taxes on highly skilled workers and the use of the tax receipts to raise transfers to unskilled workers. According to the general perception the welfare of the low-skilled workers should increase as a result. Nødgaard's model shows that this is not necessarily the case, or in any case the increase in the welfare of low-skilled is much smaller than what one would obtain by assuming no changes in the behaviour. The reason for this is that higher taxes reduce the supply of highly skilled labour, which through the complementarity effect reduces the demand for low-skilled workers and depresses their wages. The wages of the highly skilled will actually increase as a reaction to reduced supply, which offsets in part the negative effect of higher taxes on net income. If the two types of labour were fully complementary, an increase of taxes on high-skilled labour would in fact make the low-skilled workers worse off. The results are policy relevant. References to empirical studies would further strengthen their relevance.

I have two questions in mind. First, what would happen if one relaxes the assumption of full wage flexibility? I do not see any major difficulty to modify the model in order to address this issue. Assume, for instance, that the wages of the low-skilled labour do not decline when the tax on highly skilled workers is increased due to, say, real wage rigidity, trade union power or minimum wage legislation. The outcome would no doubt be lower employment for the low-skilled workers and higher wage for the highly skilled, who also would choose to work less hours. This should be a policy-relevant issue for the European countries at least.

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Secondly, how does globalisation have any effect on the distributional effects of progressive taxation. One is tempted to assume that globalisation will increase the supply elasticity of especially the high-skilled labour. If this is the case, an attempt to further redistribute income from high-skilled to low-wage earners by raising the tax progressivity would be offset even more by lower wages or lower employment of the low-skilled workers.

Tax cuts are supposed to bring important supply-side benefits in the form of higher growth and employment growth. It is, however, difficult to estimate these dynamic benefits compared to the calculation of direct revenue losses to the government necessarily associated with tax cuts. In his paper Niels Kleis Frederiksen calculates the revenue/recovery ratio first for the wage income tax and secondly for a hypothetical reform of capital and corporate income taxation. The model used for the calculations is based on the concept of the marginal cost of public funding, which concept is related to the revenue/recovery ratio.

The calculation of the revenue/recovery ratio for wage income taxes is in principle straightforward. Simulation with the Danish parameters shows that the ratio is relatively small for low wages and increases with the wage. The differences arise from tax progressivity. A critical parameter again is the supply elasticity of labour supply. In the numerical example it is assumed to be the same for all wage brackets. A sensitivity analysis by changing the assumptions on the supply elasticities in different wages brackets might be informative. It would also be interesting to see similar results based on the parameters from other countries.

A reform of capital and corporate income taxation affects the behaviour in a number of fronts. Household saving, business investment and residential investment at least can be expected to change. As a result the asset allocation will change as will the rates of return, which in turn affects the accumulation of pension and life insurance assets.

In the hypothetical reform of capital and corporate income taxation, the tax rates are lowered (to a uniform level of 25 per cent) and the tax system is streamlined. Assuming no change in the behaviour this reform would lead to sizable revenue losses. The revenue loss will be much smaller once the savings and investment behaviour are assumed to change. The simulation shows that inflation matters a lot. With the same tax reform the revenue/recovery ratio would be comparatively modest when inflation is zero, while with an inflation of 4 per cent an identical reform would be entirely self-financing.

While these results are interesting and policy relevant it is not obvious to me that they carry far enough to justify the conclusion that the reform of capital and corporate income taxation to be preferred to tax cuts on labour income. Lowering capital and corporate taxes and streamlining the tax system may in itself be desirable, and in some cases unavoidable due to tax competition. But these two forms of taxes are not alternatives. I have some doubts of whether the labour supply elasticity alone is sufficient to capture the channels through which the dynamic effects are felt in the economy.

The reform in capital taxation affects the asset allocation, although it may take some time before a new allocation is obtained through investment flows. In principle, the asset prices could change before assets are reallocated by new investment. Would it affect the results in any way?

The only empirical content of the paper is the fact that the parameters chosen for simulations are close to those the present Danish tax system. However, there has been a number of important tax reforms in the developed world in recent years. It would be interesting to study whether the estimated affects of those reforms conform to Frederiksen's analysis. I think they would. I have in mind our own experience. Finland implemented a rather comprehensive reform in early 1990s. Tax rates were lowered to 25 per cent uniformly across the board. Many tax allowances were eliminated, and the double taxation of dividends was abolished. In retrospect, it appears that the revenue/recovery rate turned out to be very high, although it is difficult to distinguish between the effects of different elements of the reform.

The paper on taxation in the US by Jagadeesh Gokhale is also very interesting. The problem I have with the paper is the fact that it is not very transparent. To fully comprehend it would require huge institutional knowledge on the American system. However, what becomes clear is that the American tax system is very complicated. The fact that one does not know the financial planning software program *ESPlanner* and the underlying model does not help to read the results.

The paper presents rates of taxation which are calculated on the basis of lifetime incomes and lifetime taxes and transfers of stylized American families. I find the idea of stylized families attractive, but my problem with them is the fact that there does not seem to be any tax/income dynamics in the lifetime of these families. One stylized family earns minimum wage over the whole lifetime, while another family earns 40 times the minimum wage throughout its lifetime. Although there may be such families, this does not exactly correspond to my perception of stylized families in America. I have been in the belief that most families have rising incomes over their lifetime and that in the US workers who start at the minimum wage can expect to get much higher earnings in the not-too-distant future. It would be interesting to see similar results calculated for a representative middle class family, which faces a representative income and tax profile over the future lifetime. It would also be interesting to see similar calculations made for the European countries.

Nevertheless, the results are interesting. For example, they show that in the US the effective lifetime progressivity of taxes seems to be high for low-income families. It is also interesting for an European to note that despite the relatively low tax burden in the United States the US tax system contains a lot of distortions. I also find interesting one conclusion presented in the paper according to which all American workers lose more than half of their lifetime earnings in taxes. What do they actually lose? Apparently, these calculations are not made on the welfare basis.

The first part of the paper by Carlos Martinez-Mongay is largely descriptive. It uses national incomes data in order to calculate effective tax rates on labour, capital and consumption. An important merit of the paper is in its wide geographical

(OECD plus USA and Japan) and historical (1970 onwards) coverage. One could dig out much more interesting comparative information from this data than what is done in the paper.

The effective tax rates based on the flow-based national accounts may in some occasions be misleading. This is because of the treatment of taxes on capital gains and realized stock options. These two items played a very significant role in Finland during and immediately after the ICT boom. During a few years the tax revenue from stock options was very significant indeed. The gains from realized stock options are taxed as labour income, but they are not recorded as such, neither should they be recorded as such. In other words, the taxes and tax bases do not match. There is another reason why the flow-based national income data may occasionally give a distorted picture on effective tax rates. This is because of the year when taxes are collected may differ from the year they accrue.

These kind of distortions may be disturbing if cross-country comparisons are made on an annual basis, but they are likely to be less harmful when one uses five-year averages as in fact is done in the latter part of the paper to estimate the the so called fiscal reaction functions. These estimates illustrate the interdependence between various tax measures as well as public expenditure and transfers to households in the sample of EU countries as well as the EU plus the US and Japan. Table 5 shows that the relationship is indeed tight in all cases except for the effective capital tax rate. Admittedly the close relationship does not tell anything about the causality. The author is tempted to interpret the relationship reflecting the simultaneous build-up of the welfare states in most countries, which explains the fact that tax rates and tax revenues as well as public spending and transfers have been increasing practically everywhere.

While this may be part of the story, it most likely is not the whole story. Figure 1 depicts the cumulative increase in the total tax rate in Europe and in the US since 1970. The difference between the two panels is striking.[1] It reveals that unemployment and its relationship to the tax burden and transfers should be taken into account in order to tell a full story.

Indirect taxes are generally regarded as regressive, because low-income earners pay more indirect taxes in relation to their incomes than do high-income earners. This is simply due to the fact that the latter have a higher propensity to save. This regressivity element drops out if consumption expenditure rather than income is used as the welfare indicator. This is the choice done in the paper by Georgia Kaplanoglou and David M. Newbery on the distributional aspects of the indirect taxation system in Greece.

Indirect taxes have distributional effects if the tax rates differ between the commodity groups and if the distribution of consumption across different goods

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[1] It suggests also that the distinction between the two samples, EU15 and EU15 plus the US and Japan is not very interesting given that the data is unweighted. The most important differences are visible to the eye.

Figure 1

Cumulative Increase in the Tax Rate and the Rate of Uemployment in EU-15 and the US since 1970

Source: Secretariat of the Economic Council, *Structural Rigidities in Europe*, Helsinki, Prime Minister's Office, Publications 2002/7, p. 65.

differ between income groups. Kaplanoglou and Newbery use the microdata on Greek households in order to examine the effects of the tax reforms made between 1988 and 2002 on the distribution of welfare. The empyrical analysis is carefully done. According to the results the indirect tax system in 1988 reduced the welfare inequality compared to the hypothetical situation of an uniform indirect tax on all goods. In 2002 the redistributive effect was in other direction: the prevailing tax system increased welfare inequality compered to the case of a hypothetical uniform tax rate. This implies that changes made to the indirect tax system between 1988 and 2002 have increased inequality.

It is difficult to argue against these conclusions. But the question is: is the measured increase in inequality or the implied reduction in welfare large or small? Some kind of a yardstick would be helpful in order to assess the significance of the results. The authors tend to conclude that the reforms in indirect taxation probably have not had an important adverse impact on the distribution of purchasing power. In any case the system of indirect taxation in 1988 was complicated and costly to manage. Streamlining and modernizing the tax system probably have reduced these costs. If, in addition, they have led to better allocation of resources and higher growth, households in all income groups might have benefited. This potential effect need to be taken into account before a final conclusion on welfare effects can be done.

The paper demonstrates that taxes on cars and the use of cars (including fuels) plays a very important role in indirect taxation. Even the conclusion may change

depending on whether car-related expenditure is taken into account or not. The empirical analysis of the paper is based on the assumption that indirect taxes are fully passed on to the consumer prices and that they have no effects on producer prices. In theory, both prices could change. It would be interesting to see, how the results might change if the effects of taxes on prices are significant. Again cars are an interesting example. It is widely understood that pricing-to-market is a common practice in the car market. It implies that import prices of cars are lower in countries where taxes on new cars are high. A reduction of the tax will then lead to higher import prices.