DISTRIBUTIONAL ASPECTS OF INDIRECT TAXATION IN GREECE: 1988-2002

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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	<u>1,758</u>	<u>48.3</u>	<u>11,421</u>	<u>57.5</u>
2. Traditional excises	<u>721</u>	<u>19.8</u>	<u>4,714</u>	<u>23.7</u>
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	<u>186</u>	<u>5.1</u>	<u>641</u>	<u>3.2</u>
4. Taxes on cars	<u>257</u>	<u>7.1</u>	<u>1,416</u>	<u>7.1</u>
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	<u>352</u>	<u>9.7</u>	<u>1,476</u>	<u>7.4</u>
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	<u>366</u>	<u>10.1</u>	<u>187</u>	<u>0.9</u>
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

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[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

□ (2002 taxes minus 1988 taxes) as a percent of expenditure
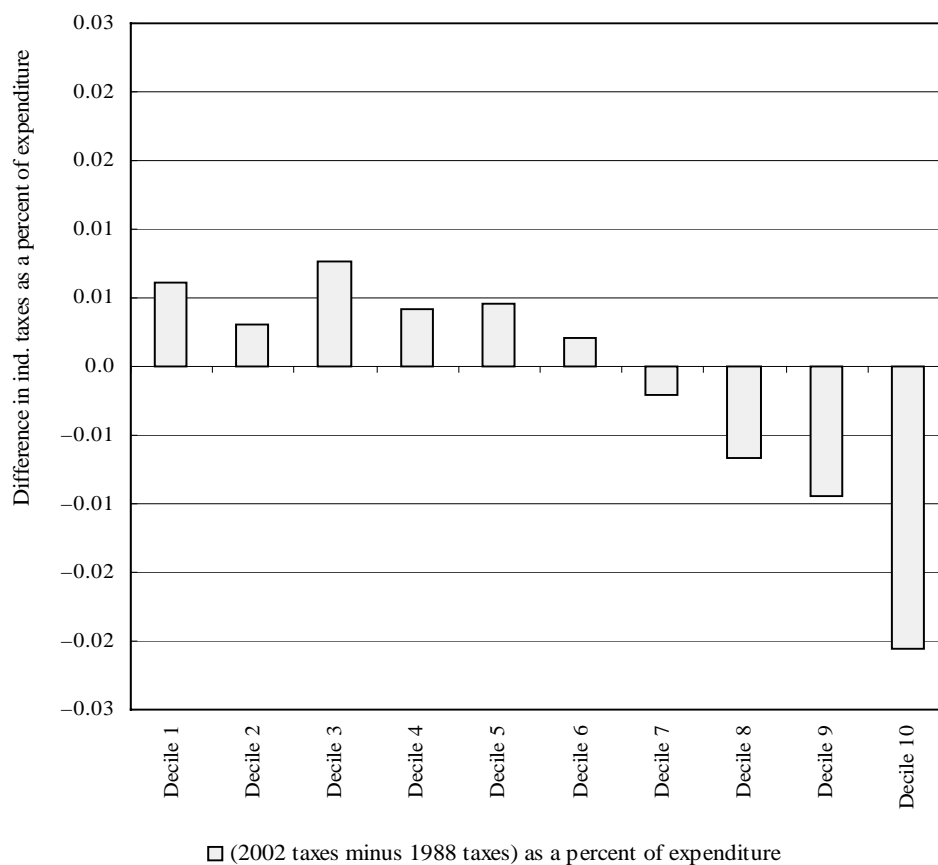
A comparative analysis of the degree of progressivity of the various components of an indirect tax system can be performed using Suits (1977) tax concentration curves. Although there has been some confusion over the definition of tax progressivity (for a discussion see Musgrave and Thin, 1948), the Suits 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)
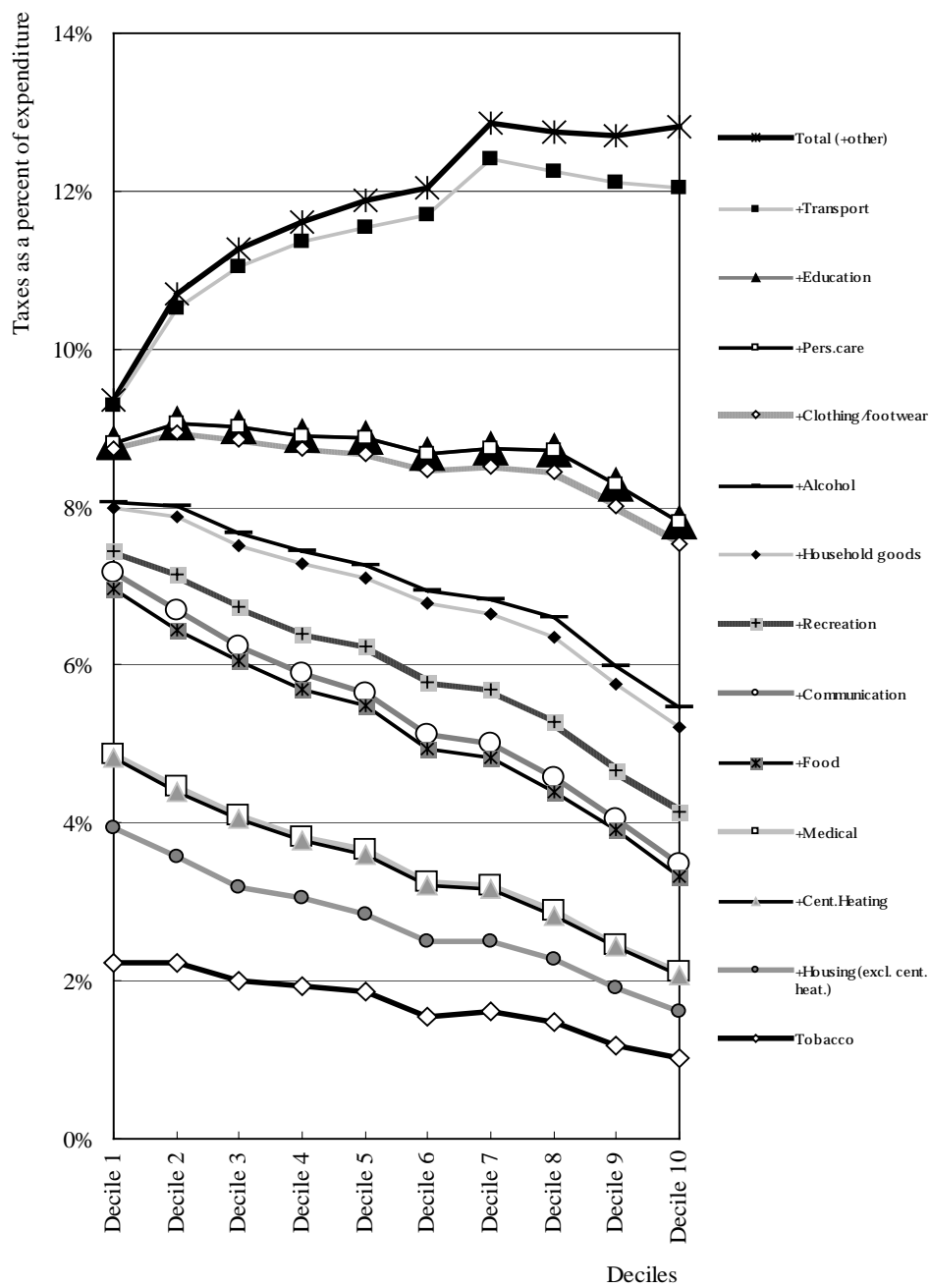
Figure 3

**Cumulative Indirect Taxes by Deciles of
Equivalent Non-Durable Expenditure, 2002**
(taxes are ranked by degree of regressivity)
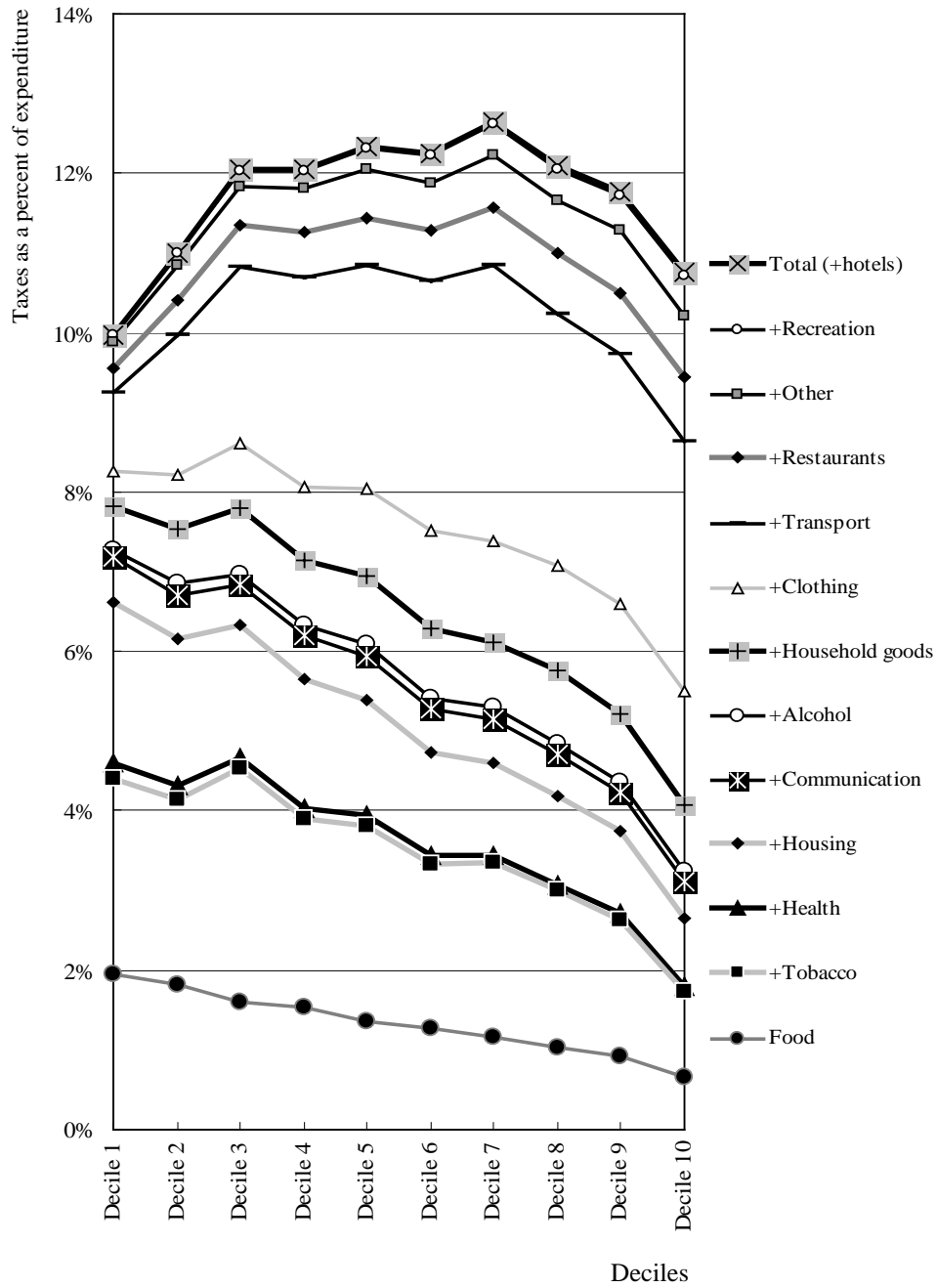
Figure 4

Suits Tax Concentration Curves for All Types of Indirect Taxes
1988

- – □ – Food — Alcohol — ■ — Tobacco — △ Clothing
- — ◇ — Housing ···✗··· Heating oil — △ — Household goods — ✗ — Health
- — ○ — Personal care — ■ — Education – △ · Recreation — + — Transport
- ····✗···· Communication — ✳ — Other

2002

- ◆ Food — ■ Alcohol — ▲ Tobacco
- ✗ Clothing/Footwear ✳ Housing (incl. cent. heat.) ● HHgoods
- + Health — Transport — Communication
- ◆ Recreation □ Restaurants ▲ Hotels
- ● Other
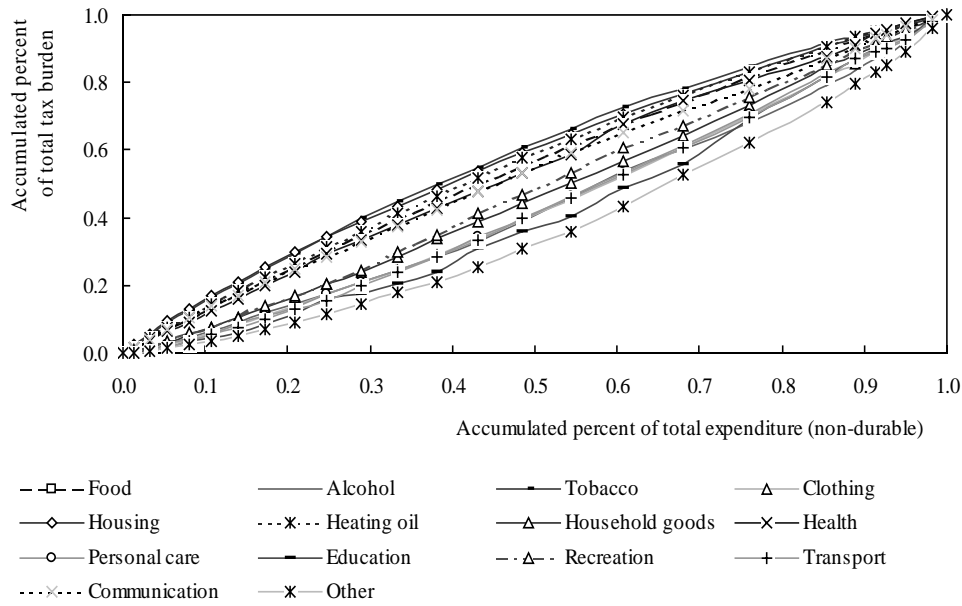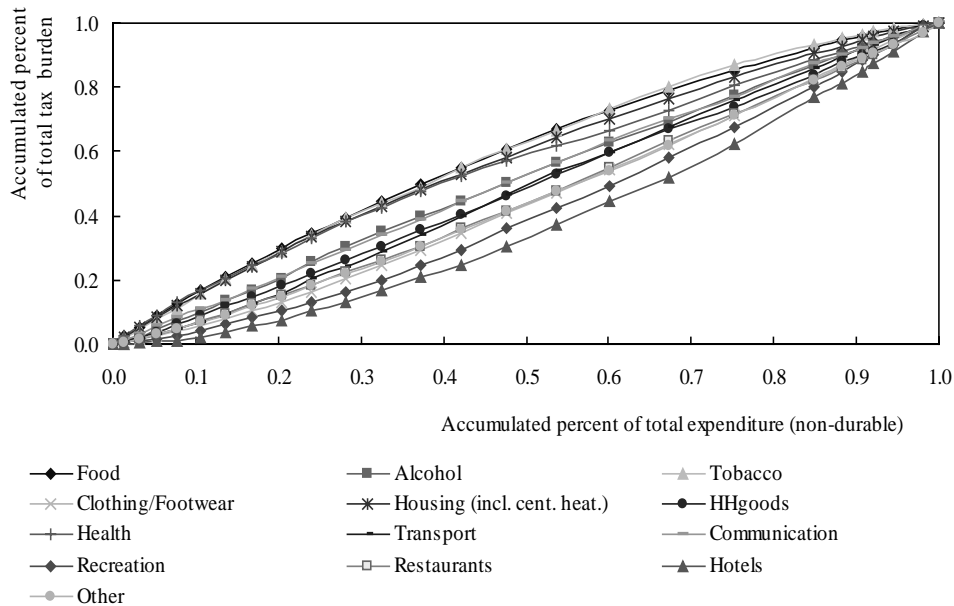
It becomes apparent that a group of taxes (*i.e.* those on food, tobacco, housing and heating oil, communication and health) are regressive, while the rest display various degrees of progressivity. An unambiguous ranking of indirect taxes is not possible, since in many cases the tax concentration curves 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

regressive taxes

progressive taxes

Figure 5 *(continued)*

2002

regressive taxes

FOOD   TOBACCO

↓   HEALTH   HOUSING (INCL.
                                          HEATING OIL)

COMMUNICATION   ALCOHOL

TRANSPORT   HOUSEHOLD GOODS   CLOTHING

↓

RESTAURANTS   OTHER GOODS

RECREATION

HOTELS

progressive taxes
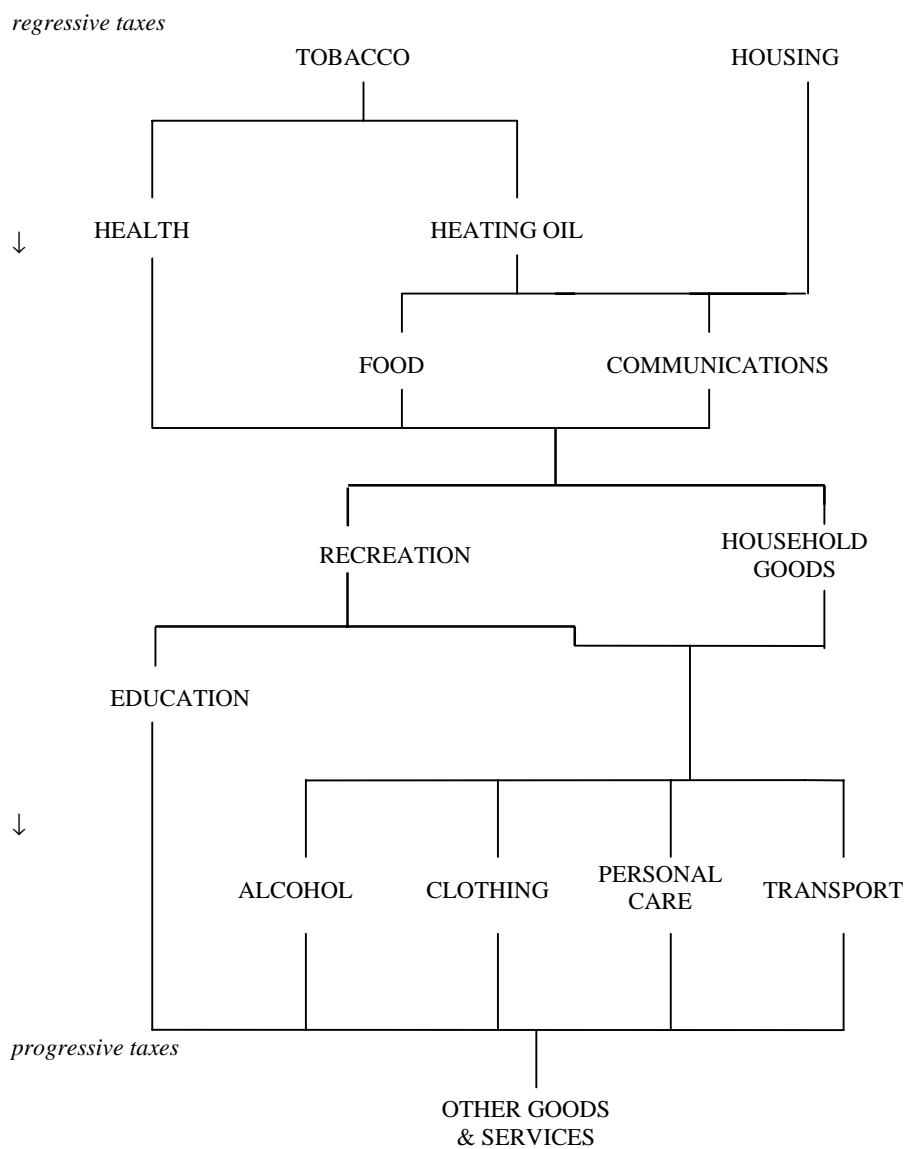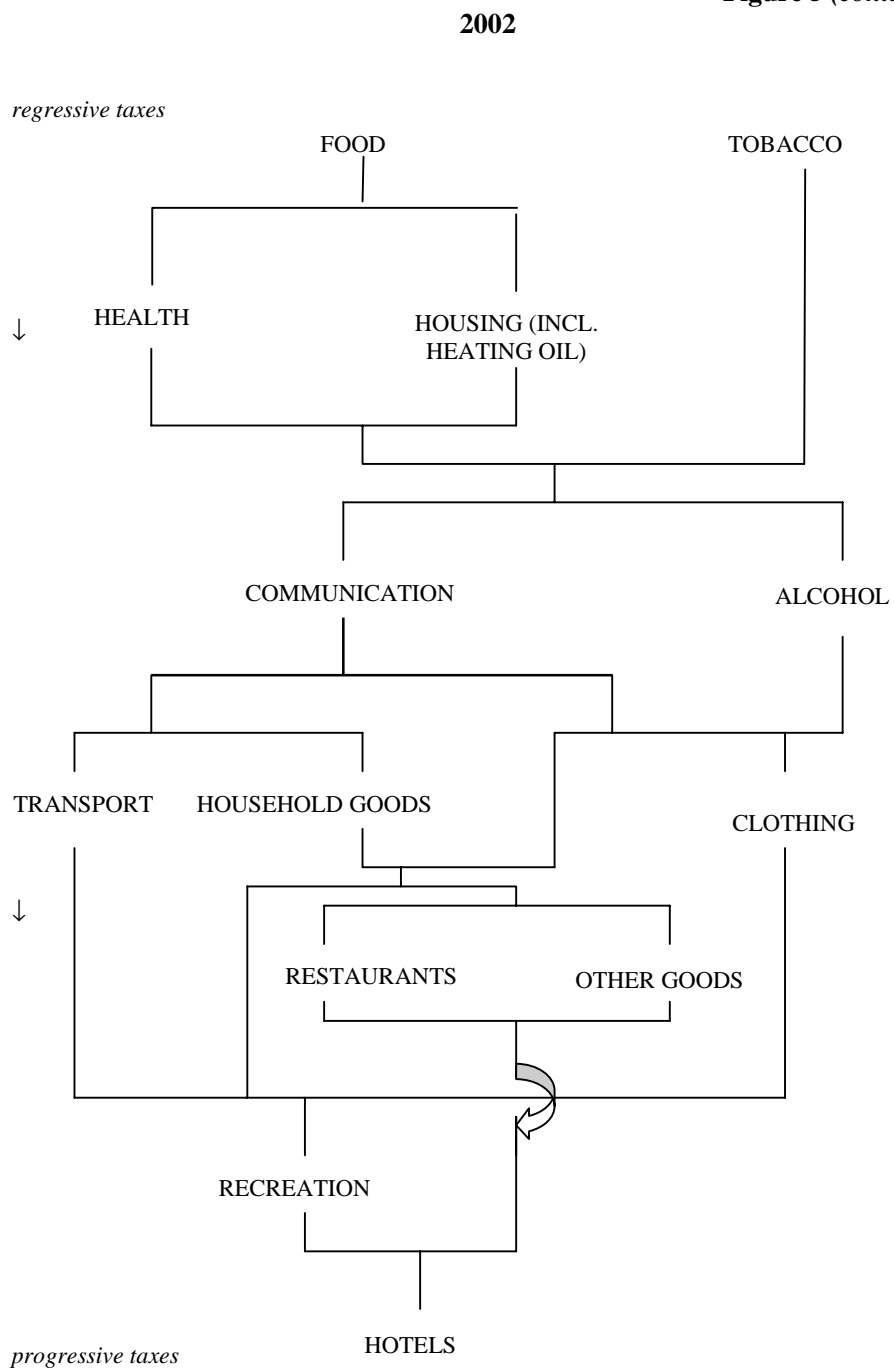
is the car taxes that are not differentiated by engine size, mainly road fuel taxes. Implicit is the assumption that car taxes which are differentiated by engine size are used as a redistributive tool and therefore constitute a pure tax. In the third alternative, we assume that there is a constant road 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
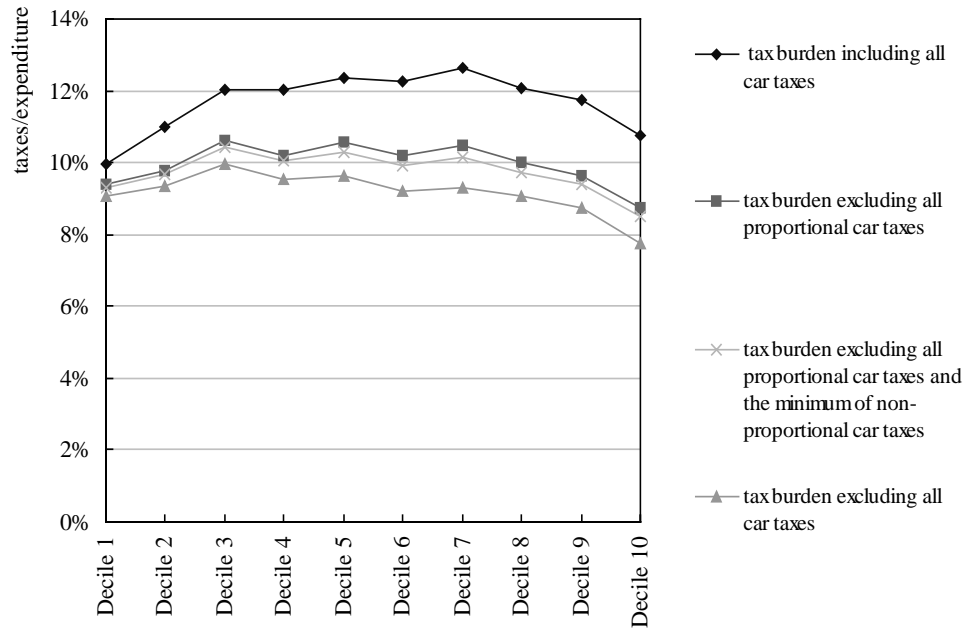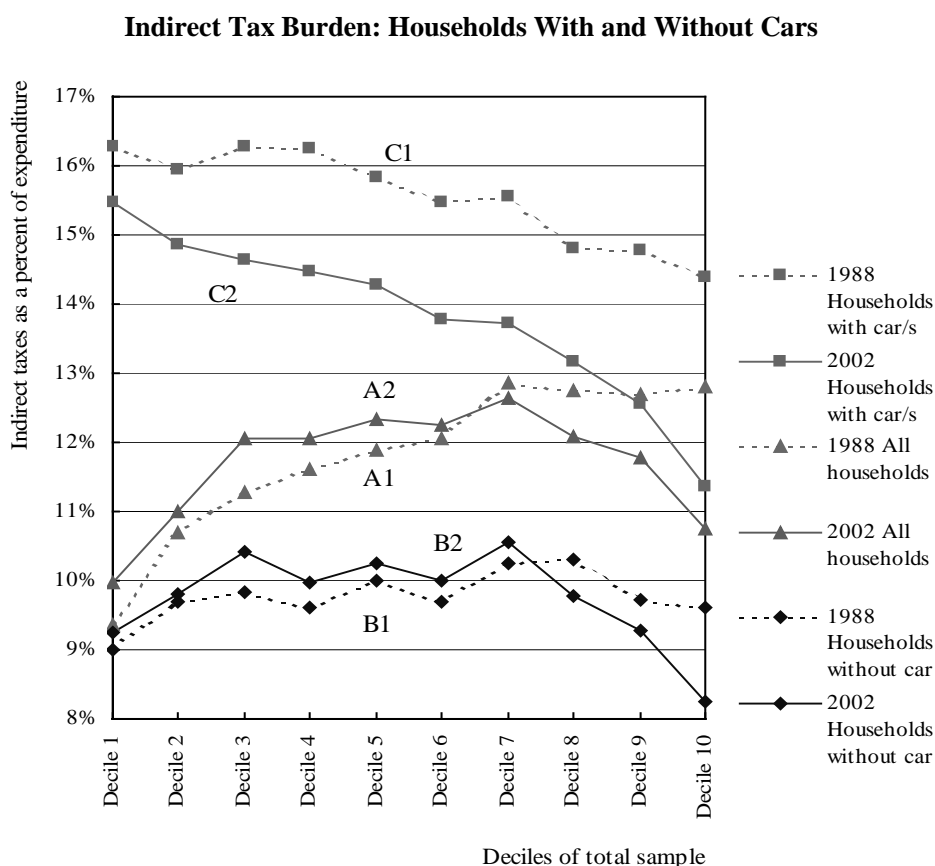**1988**

2002

Figure 7

Indirect Tax Burden: Households With and Without Cars


Deciles of total sample
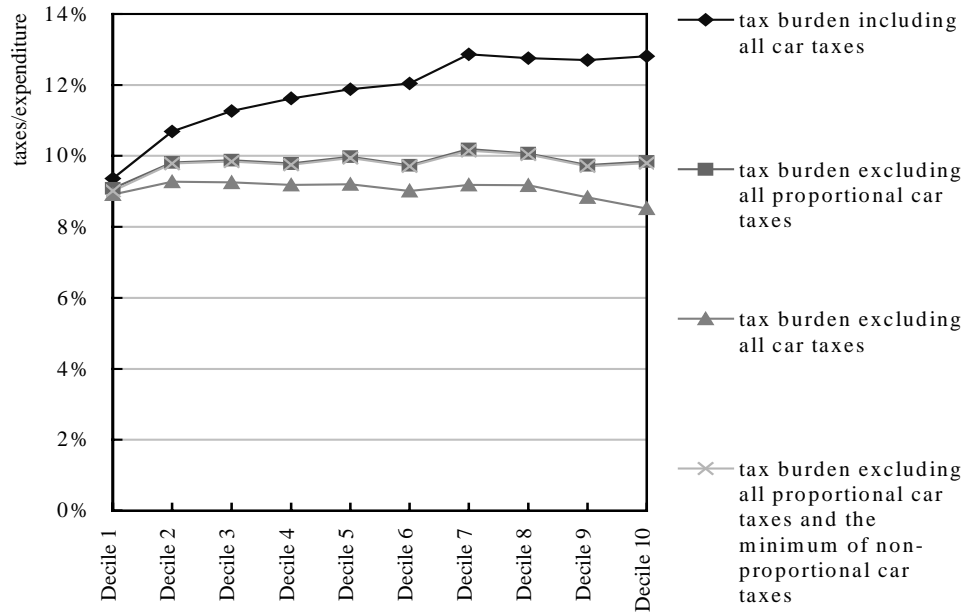
The difference between 1988 and 2002 is that indirect taxes among car owners are now both considerably lower and more regressive,[5] while among non-car owners they are about at the same levels and slightly more regressive. At the same time the number of car owners has almost doubled. The above differences 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
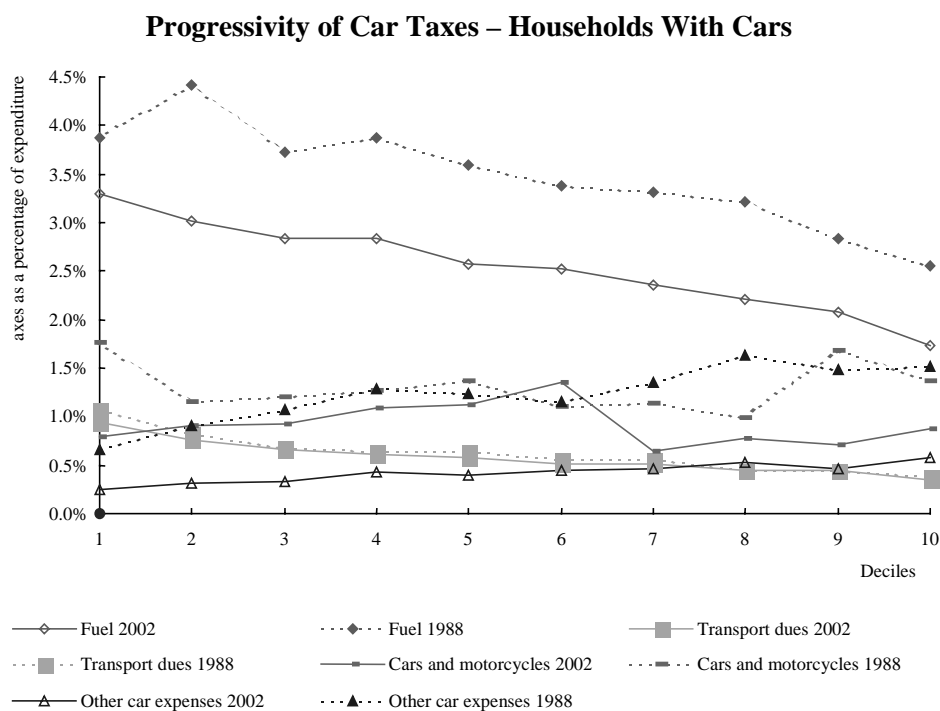
3. The impact of the indirect tax system on welfare inequality: 1988 and 2002

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

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

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

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[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).

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