Incidence and Welfare Effects of Indirect Taxes*

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Abstract: The majority of microsimulation models are confined to ex ante evaluations of reforms in the personal income tax system or in social security contributions and benefits. This paper reports on an incorporation of indirect taxes, mainly VAT, excises and other consumption taxes, in the EUROMOD-microsimulation model. We sharpen the distributional picture of the overall tax and benefit system by bringing the indirect tax incidence for five European countries into the picture. We investigate explanations for the regressivity, and study the distributional effect of an integrated simulation of changes in social security contributions and indirect taxes as compensating channels of collecting government revenue.

I. INTRODUCTION

Indirect taxation forms part of a mix of different tax and revenue raising instruments including taxes on income, property and social security levies on employment income that households and other economic agents face. As table 1 and figure 1 illustrate for the OECD, indirect or consumption taxation is a substantial component in the tax system of most industrialized countries. Despite a decline in relative importance mainly taking place during the 70s, the total share of government revenue raised via consumption seems to have stabilized at around 30%, which still is substantially more than for instance the income tax. Note that this stabilization since 1980 hides two distinct evolutions partly offsetting one another: the implosion of taxes on special goods and services (say excise taxes[3]) from 1960

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3 It should be noted that also import duties belong to this category, suggesting that the promotion of free trade might be responsible for the decreasing influence of this revenue type. Detailed figures, e.g. also in

onwards and the rise of taxes on general consumption (mainly VAT and sales taxes) in the same period. Lacking an adequate political economy model of tax system formation, it is difficult to give a conclusive interpretation of these opposite evolutions. Theoretically there are (productive efficiency) arguments contra and (externality) arguments pro excise taxes (see Crawford et al., 2008 for an overview). In practice the growing unpopularity of these measures seems to be embedded in a much broader historical process starting at the beginning of the 19th century[4].

On the other hand, the growing popularity of general consumption taxes could be explained by the widespread point of view that taxing consumption has a less distortive effect on the labor market than taxing labor income (see e.g. Bosch and van den Noord, 1990), since taxing labor is equivalent to subsidizing leisure (making leisure relatively cheaper with respect to labor), decreasing labor supply. In the present times of rising unemployment as recession hits the world, reducing the tax wedge on employment is indeed high up the agenda (Organization for Economic Cooperation and Development - OECD, 2008a). Nevertheless, this view has not remained unopposed. In principle, a consumption tax with a constant uniform rate is equivalent to a constant proportional tax on labor and profit income and transfers. Although tax systems in the real world as a rule do not have this structure, the principle might indicate that shifting the tax burden from income to consumption will not result in a significant rise in labor supply (Crawford e.a., 2008). All this disregards matters about the evasion of taxes, which could legitimate implementing both kinds of taxes just to reduce the probability of succesfull evasion, as in Boadway e.a. (1994)[5].

In the discussion about the efficiency aspect, a distinction is made between the two most common forms of general consumption taxes, namely the sales tax and the Value Added Tax (VAT). The VAT is theoretically equivalent to a sales tax imposed on final goods, although each of them has distinct attractive features from the perspective of countering

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OECD (2008), show nevertheless that 1) the share of import duties is too small to provoke an effect of this magnitude and that 2) for the category of excise duties on itself the evolution is analogous.

[4] Cnossen (1977) argues that excises are "among the oldest forms of taxation in the world". Indeed, without a developed central administration, the simplicity of the tax base and of imposition played a decisive role here. Moreover, (import) excise duties provide for more flexibility to the sovereign in case of war, famine or in the bargaining with different professional groups (see e.g. Dowell, 1884, for an extensive overview for England). From the 19th century onwards, gradually the "small" excises (yielding little revenue) disappeared or were replaced by more general consumption taxes, leaving only the "big" ones, namely tobacco, alcohol, sugar and petroleum, in place. The apparent fact that excises are gradually abolished as soon as there suitable alternatives have been developed is an object of study on its own.

[5] For some canonical and some more recent theoretical contributions on the direct-indirect tax mix, see Atkinson and Stiglitz (1980) which, even after more than 25 years, is still the reference to start with when studying the topic, Ahmad and Stern (1984), Boadway and Pestieau (2003) and Auerbach (2006).

evasion. Indeed, the VAT is implemented as a sales tax on intermediate and final goods, where the tax on intermediate goods is refunded. This last property makes the VAT theoretically superior because of the productive efficiency theorem of Diamond and Mirrlees (1971). The focus in this paper will mainly lie on the VAT, since it is the dominant form of indirect taxation in the European Union, where all of the data were obtained.

A related issue concerns the differentiation of VAT rates. From an efficiency point of view, it is argued that higher taxes should be levied on goods with low own price elasticities[6] and goods complementary to leisure (which is essentially an extra tax on leisure). From an equity point of view, it makes sense to have a relatively lower tax on goods, consumed relatively more by poorer households. This point underlies the fact that a lot of goods deemed necessary, like food and household fuels, enjoy reduced or even zero tax rates in many countries. However, since Atkinson and Stiglitz (1976) it has become clear that, the more the government disposes of other redistributive instruments, like progressive personal income taxes, or social benefits, the less convincing the argument to use the differentiation in the indirect tax structure to pursue distributional objectives becomes.

Shifts in tax policy can be evaluated ex ante by applying the old and new tax rules on a representative sample of households and comparing the results. That is the general principle underlying so called "microsimulation models" (MSM's). Most MSM's thereby focus on a combination of income taxation and social insurance contributions and benefits[7], which will be referred to as direct taxation in what follows. This paper, however, assesses the effects of enriching a particular MSM[8], EUROMOD (for a description, see paragraph 2 and Immervoll et al., 1999), with household expenditure data and indirect tax systems, and use this combination of income, expenditure, direct and indirect tax information to simulate shifts between direct and indirect taxation.

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[6] This of course is a simplification of the optimal tax formulae obtained in the so-called Ramsey-formulation, where it is the compensated own àn cross price elasticities, which determine the optimal tax. Optimality is to be interpreted here in terms of minimisation of welfare losses as compared to a non distortionary, lump sum, tax.

[7] Although examples of consumption tax microsimulation can be found in Baker et al. (1990) and Decoster (2005). Also Sutherland et al. (2002) explore the possibility of validly imputing expenditure information into EUROMOD income datasets so as to simulate policy changes. Yet, they do not perform combined changes in direct and indirect taxation.

[8] However, the indirect tax routine is formulated in a more abstract way and could be used in combination with other direct tax MSM's. See Decoster et al. (2007, 2008, 2009, 2009a) for an extensive description of the routine.

The choice for microsimulation as a method stems from the need to provide alternative policy proposals with at least a first order approximation of their distributional consequences, which are often difficult to obtain in a closed formula. But the reliance on microdata also constitutes the main dangers of working with these models. First, data measurement error can evidently bias conclusions about incidence and progressivity of taxes. This becomes even more problematic with behavioral MSM's, which often use these same data to estimate models of household behavioral change (for instance demand systems or labor supply models). A second caveat concerns the fact that most household surveys do not contain all the information needed to implement the tax system in a strict sense (cf. whether one is the widow of a war victim in some countries). The level of detail in the underlying micro dataset thus creates an upper boundary to the accuracy of the MSM. Related to this is the fact that a significant part of benefits may not be taken up (e.g. due to stigmatization) and an equally significant part of taxes may be avoided. This is often overlooked in MSM's. Notwithstanding these potential flaws, we believe that proper use of MSM's can add valuable information to the evaluation of a policy proposal, being one of many elements considered and of course not as a standalone tool.

The main objectives of this paper are then 1) to carry out a detailed household-level simulation and distributional analysis of a shift from direct to indirect taxation while keeping constant the government budget, this for four European countries, 2) a clear indication that the often mentioned regressivity of the indirect tax system in general and the Value Added Tax (VAT) system in particular critically depends on the welfare classifier one uses: disposable income versus total expenditure, and 3) an empirical illustration of the theoretical prediction (see e.g. Atkinson & Stiglitz, 1976; Mankiw et al., 2009) that a consumption tax – even allowing for differentiated tax rates – is a crude measure with respect to redistribution purposes and is indeed likely to be more regressive than other (direct) components of the tax system, regardless of which classifier is used.

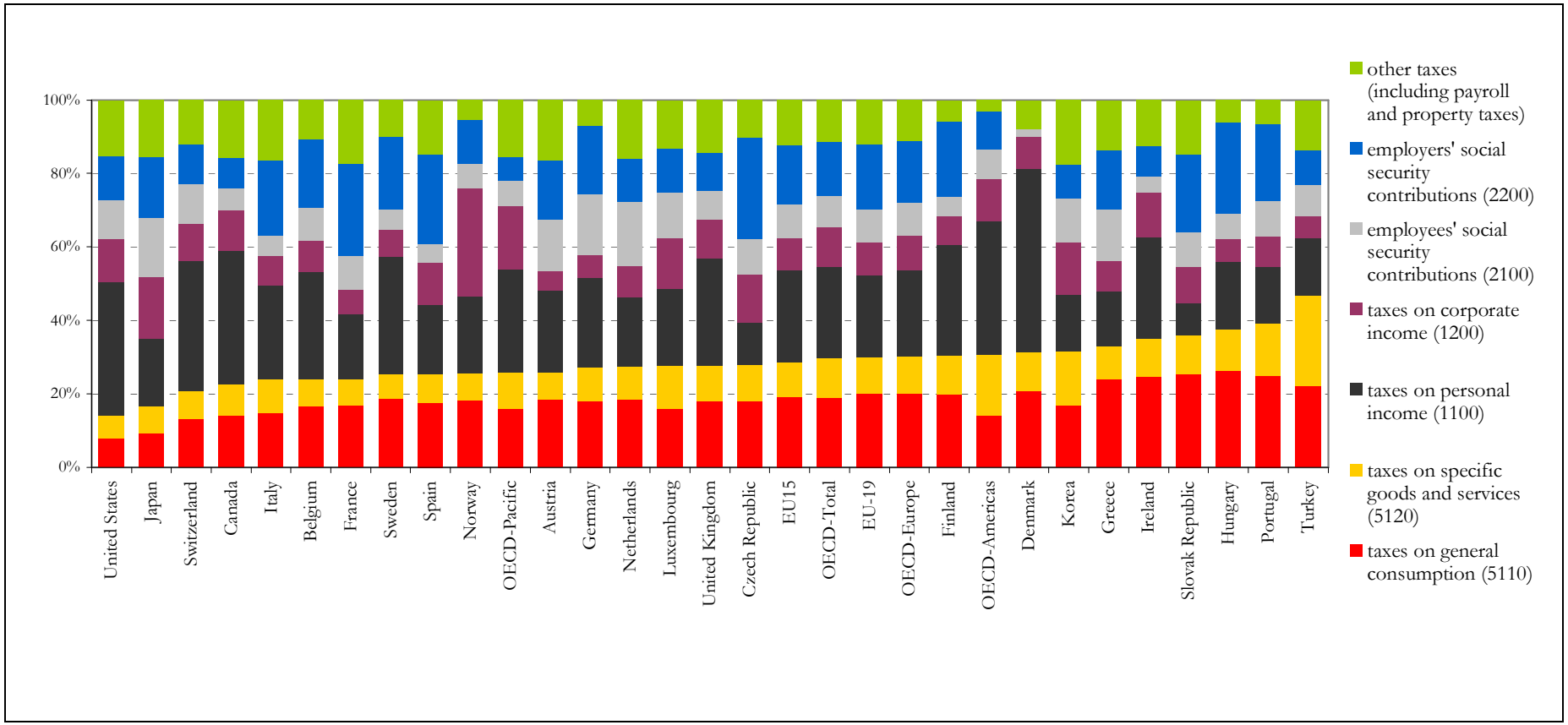
The structure of the paper is as follows: in section 2 we describe the datasets we have available and the methodologies used for the imputation. In section 3 we sketch the crude picture of the indirect tax incidence in the different countries under analysis, whereas in section 4 we describe the distributional pattern of indirect tax liabilities. Section 5 investigates three explanations for the observed regressive pattern: a differentiation between VAT and excise taxes, the interplay of Engel curves with a differentiated indirect tax structure, and the influence of savings by shifting the rate base from disposable income to total expenditures. Section 6 contains the method and results of the actual simulation.

TABLE 1: SHARE (%) OF DIFFERENT COMPONENTS OF GOVERNMENT REVENUE, OECD 1955-2005

	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
Taxes on personal income (1100)	25.5	25.6	26.2	28.0	30.0	31.3	29.7	29.6	27.0	26.1	24.6
Taxes on corporate income (1200)	11.4	10.6	8.8	8.7	7.6	7.6	7.9	8.0	8.0	10.1	10.3
Employees' social security contributions (2100)	4.1	5.0	5.7	6.1	6.9	7.1	7.4	7.8	8.3	8.4	8.7
Employers' social security contributions (2200)	5.4	6.5	9.8	10.9	13.8	14.0	13.3	13.1	14.2	14.6	14.8
Other taxes (including payroll and property taxes)	15.8	15.1	11.5	10.8	9.6	8.0	9.0	11.1	11.7	11.0	11.3
Taxes on specific goods and services (5120)	26.8	26.8	24.3	20.7	17.7	16.7	16.2	12.9	13.0	11.5	11.2
Taxes on general consumption (5110)	10.9	10.4	13.6	14.8	14.5	15.4	16.4	17.4	17.7	18.4	19.0
Indirect taxes (5110+5120)	37.8	37.1	37.9	35.4	32.2	32.1	32.6	30.3	30.7	29.9	30.2
Social security contributions (2100+2200)	9.5	11.5	15.6	17.0	20.7	21.0	20.7	20.9	22.5	22.9	23.5

Source: OECD (2008). The codes in brackets refer to the OECD classification of taxes. The category “other taxes” contains all other codes.

FIGURE 1: SHARE OF DIFFERENT COMPONENTS OF GOVERNMENT REVENUE - OECD 2005



Source: OECD (2008). The codes in brackets refer to the OECD classification of taxes. The category "other taxes" contains all other codes.

II. DATA AND IMPUTATION

As already stated briefly in the introduction, the quasi-absence of microsimulation of combined indirect and direct taxation changes can be mainly attributed to the lack of datasets containing detailed income, direct tax and social security data on the one hand and the consumption of households and indirect tax data on the other. Undoubtedly the most adequate way of tackling this problem consists in conducting more comprehensive socio-economic surveys where both types of information are registered for every household. Yet in the short run the only possibility that the individual analyst has, though conceptually much less satisfying and methodologically much harder, is to start from one dataset (in this case the EUROMOD income and direct tax dataset) and enrich it household per household with information from external sources (the country-specific expenditure dataset) according to some predefined algorithm (see below). Due to these strong data requirements, the following analysis will necessarily be restricted to four European countries[9]: Belgium (BE), Hungary (HU), Ireland (IE) and the United Kingdom (UK). Greece (GR) will be included to extend the distributional picture but we did not run a simulation. The respective income and expenditure datasets available to us are given in table 2.

The imputation step itself can best be described by starting from the structure of both datasets used. A EUROMOD dataset contains socio-demographic background variables (age, sex, employment status, highest education level achieved etc.) and information about income and direct taxation, both on the household and individual level. Different income variables are constructed referring to the source of income: income from employment, self-employment, capital, real estate etc. A broad category of social benefit variables represents the social correction of primary income: state pensions[10], family, unemployment and illness benefits, and many other, often country-specific benefits. Deducted from these are a range of tax variables like income and property taxation, social contributions from employees and those from employers. Treating market incomes and socio-demographical characteristics as

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[9] Some preliminary and experimental calculations were carried out for a larger group of countries where only estimated Engel curve coefficients were made available by the owners of the expenditure surveys, rather than the microdata themselves. This larger group consists of Denmark, Finland, France, Italy, Luxemburg, the Netherlands, Portugal and Spain. Although a much more pragmatic matching strategy had to be adopted than in the AIM-AP-case, preliminary results – not reported in this paper - show that the results obtained in this paper are confirmed for this broader group of countries.

[10] Information about private pension schemes is often missing, a shortcoming likely to become more and more important in the traditional welfare states in Europe, where the public pension funds are under pressure from demographic evolutions.

given, EUROMOD then implements a number of policy modules (representing the existing or a reform to the tax-benefit system) in order to obtain disposable income, which is conceptualized as the sum of market income plus benefits minus taxes and contributions. Note that some variables cannot be simulated as the microdatasets do not contain enough information. The most classical example is the state pension, which in most countries depends on the income path of an individual during his or her life, whereas budget datasets often contain merely cross-sectional or insufficient longitudinal information. In these cases, the variables are taken directly from the dataset, and not simulated.

TABLE 2: EXPENDITURE DATASETS AND INCOME DATASETS FOR THE FIVE COUNTRIES

Country	budget survey	# of households	income survey	# of households	policy year indirect taxes
Belgium	Household Budget Survey 2003	3550	EU-SILC[11] 2004	5275	2003
Greece	Household Budget Survey 2005	6555			
Hungary	Household Budget Survey 2005	8710	EU-SILC 2005	6924	2005
Ireland	Household Budget Survey 1999	7644	Living In Ireland 2000	3644	2001
UK	Family Expenditures Survey 2003/2004	7048	Family Resources Survey 2003/2004	28768	2003

Expenditure surveys on the other hand contain socio-demographical information, disposable income, and a list of (very) detailed expenditure variables ("bread", "gasoline", "refrigerators" to give an idea). To simplify the analysis and allow for cross-country comparisons, the consumption data were aggregated according to a scheme close to the

[11] The European Union Statistics on Income and Living Conditions: this is a harmonization of country-level surveys on income, poverty, social exclusion and living conditions. Rather than being organized as a common survey, it consists of a common framework of harmonized variables, concepts (like income and household), classifications and procedures in order to ensure comparability across countries.

highest level of the Classification of Individual Consumption by Purpose (COICOP) - scheme[12] (e.g. "food", "private transport", "durables").

The actual imputation was carried out by using estimated Engel curves[13]. For each country a list of variables was identified that is common to both the EUROMOD and the expenditure datasets, and expenditures per aggregate category were estimated upon these common variables in the expenditure survey. Because disposable income belongs to the list of common variables, the estimations obtained are Engel curves. Then the estimated models were used for predicting expenditures in the EUROMOD dataset. Note that expenditures are often only registered on the household level, so the imputation was necessarily restricted to this level. One will appreciate that there are a lot of methodological issues involved in this step. For the interested reader, the three most important ones are discussed at the end of this paragraph.

The second part of the imputation involves the calculation of the indirect tax liabilities. Here we constructed a file containing the VAT rate and excise information for each of the detailed consumption variables in the expenditure dataset. From this a general indirect tax rate was constructed for every COICOP category by calculating a weighted average over all households and all items belonging to the respective category. More information can be found in Decoster et al. (2008). With these rates, we then calculated indirect taxes from the already imputed expenditure information in the EUROMOD dataset.

We now come back to the methodological issues during the imputation of expenditures. Three considerations are of major importance in this context. Firstly, since the regressors used in the Engel curve have to be selected from variables that are common to both datasets, this puts a limitation on model specification. It also required a phase of thorough comparison and harmonization of these common variables.

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[12] The COICOP is a legal obligation imposed by the EU on the national statistical agencies and specifies the aggregation of goods in calculating the Consumer Price Index. The aggregates involved are: Food and Non-alcoholic drinks, Alcoholic drinks, Tobacco, Clothing and Footwear, Home fuels and electricity, Rents, Household services, Health, Private transport, Public transport, Communication, Recreation and Culture, Education, Restaurants and hotels, Other goods and services, Durables and Home production (wherever applicable).

[13] In fact part of our work in the EU-funded project 'Accurate Income Measurement for the Assessment of Public Policies project (AIM-AP) consisted in identifying the most efficient and robust technique to impute expenditure data. The four techniques tested were parametric and non-parametric Engel curve estimation, and "copy-pasting" expenditure data by means of a distance function between observations or by grade correspondence. See Decoster et al. (2007).

Secondly, using disposable income in the estimation of expenditures per category was problematic for two reasons. Firstly, the income distributions in the expenditure dataset and the income dataset often differ, especially in the tails. If the latter distribution has the fatter tails, the imputation has the character of an extrapolation and is hence much less stable. This leads to some undesirable imputation properties, such as a large proportion of negative expenditures in each category and a large proportion of very high expenditures for some consumption categories. In the latter case, the implied savings rate becomes extremely negative in the income dataset. Secondly, disposable income is negative in a non-negligible number of cases. Note that this already makes the estimation of income shares very cumbersome. Moreover, it excludes the specification in terms of the logarithm of disposable income and its square, which is dominantly present in the literature. To deal with these problems we have split up the imputation in two steps. Since the relation between disposable income and total expenditures is smoother and hence more robust to problems of the kind described, we first estimated total expenditures, or equivalently the savings function[14], and durable expenditures on the basis of disposable income and a number of socio-demographic characteristics in the budget survey. This estimation was used to determine non durable expenditures in the income survey. [15] In the second step, we estimated nondurable budget shares on the basis of the logarithm of the total expenditures and its square and used these estimated relationships and the imputed non durable expenditures to impute the non durable expenditure shares in the income dataset. A priori, it cannot be excluded that this yields negative budget shares in the imputation. But since there are no observed negative values and because of the smoothening effect on extreme incomes in the first step, this happens much less often than in a one-step scenario. Any negative budget shares are set to zero and the shares are standardized to sum to one.

A third remark concerns the replication of zero expenditures in the target dataset. Estimating a regression on a consumption aggregate like tobacco, which is not consumed by a majority of households, and then imputing tobacco expenditures fails to reproduce a sufficient

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[14] In fact, for the estimation of total expenditures (and also durables), a specification was used including disposable income and disposable income squared as independent variables. Hence, the direct estimation of the savings function instead of total expenditures would yield exactly the same imputed values.

[15] Note however that the assumed relationship between disposable income and expenditure and thus the resulting savings rate is assumed to remain constant across time. As microsimulation datasets tend to be updated annually to reflect a new economic environment, it is important to play special attention to this linkage. For example some countries have seen substantially higher savings rates and thus lower taxation from consumption during the present economic crisis. Merely updating the income part of the dataset without the implicit savings rate may tend to seriously bias results.

number of exact zeroes. For distributional analyses, this might produce a significant bias in the target dataset. We therefore divided the population into subgroups according to whether or not households have expenditures on zero expenditures: smokers/non-smokers, renters/ home owners, users/non-users of public transport and users/non-users of education. We assumed that the 16 resulting subgroups have different preference structures, estimating separate subgroup Engel curves. We used a Tobit model based on group identification in the budget survey to simulate subgroups in the income survey. For each zero expenditure variable, we estimated an underlying propensity model in the budget survey and then predicted its probability for observations in the income dataset using a Monte Carlo method to determine the classification (smoker etc) of each observation. Finally we predicted the budget shares in the income dataset with the subgroup Engel curves to complete the imputation procedure. When the subgroups were too small to estimate a model we used the technique of subgroup-referencing (see Decoster et al., 2009), increasing the number of observations, and hence reducing the variation of the estimates, by adding observations of other subgroups. However, because of the different preference structures of the groups, this introduces estimation bias. To reduce this bias a weighting scheme and dummy variables for the different subgroups are introduced.

III. THE INDIRECT TAX STRUCTURE IN FIVE COUNTRIES

In Table 3 we summarize the VAT-structure for the five countries and the rates and budget shares of the three most important excise good categories. We used the indirect tax legislation of the year of the expenditure survey. The main change in indirect tax legislation between the year of the survey and the current legislation has occurred in Hungary, where the standard rate has been lowered from 25 to 20% and the reduced rate from 15 to 5 %. This substantial change has to be kept in mind when interpreting the results. Also the temporary reduction of the VAT-rate from 17.5% to 15% in the UK as part of the macro-economic stimulus package, decided end 2008, is not included. Irish VAT rates have also changed during the period, falling to 20% from the reference year 21%, before rising back to 21% and 21.5% at the end of 2008.

Except for Hungary, the standard rates are quite similar. The variation across the countries mainly occurs in the reduced rate(s) and in the list of commodities subjected to the different rates, represented here by the average budget shares for the differently taxed commodities. In this respect, the basket of goods exempted from VAT varies widely between the countries, with Greece and Hungary with the lowest zero share, while in Belgium, Ireland and the UK, about 40% of expenditures are VAT exempt. Without a detailed incidence analysis, it is

difficult to see whether the smaller budget share of exempted goods in Greece and Hungary is compensated by lower standard and/or reduced rates in these countries.

The tax base for excise duties is more or less the same across the different countries: mineral oil products (private transport), alcoholic products and tobacco products. The Ad Valorem excise tax mostly concerns tobacco products. The level of excise duties however differs a lot across the countries. We present them in Table 3 as a percentage of the producer price. Alcohol and tobacco e.g. are most heavily taxed in the UK; Belgium has substantially lower excise taxation on tobacco products and also has the lowest excise taxation on private transport (probably due to the low excise on diesel).

IV. INDIRECT TAX INCIDENCE

Table 4 presents the distributional effect of indirect taxes, calculated on the income datasets in which we imputed expenditures and on which we appended our indirect tax calculation module. The table shows the indirect tax liability as a percentage of disposable income, by decile of equivalised disposable income. The picture is clear and confirms most of previous research (as summarized recently in Warren, 2008): in all countries the pattern of indirect taxes with respect to disposable income is clearly regressive, meaning that the tax rate is lower the higher one's income. Indeed, the tax rate is clearly monotonically decreasing across the equivalised income scale for every country, with the exception of the 5th decile in Ireland. In all countries the poorest ten percent pay at least twice as much indirect tax relative to their income as the richest ten percent.

The regressive effect is also confirmed at the bottom of the table, where we display the Suits-index, which measures the ratio between the cumulative proportion of tax and the cumulative proportion of income. Under the Suits Index a progressive tax means that the poorest households, who together earn q % of national income, will pay less then q % of taxes, and vice versa for a regressive tax. In table 4, the index is negative for all countries, indicating that lower incomes bear a share of the total indirect taxes collected which exceeds their share in disposable income. The rate regressivity is highest in Greece, followed by the UK. It is substantially lower in Belgium.

TABLE 3: VAT-STRUCTURE AND EXPENDITURE SHARES PER VAT-CATEGORY; EXCISE RATES AND SHARES FOR IMPORTANT EXCISE GOOD CATEGORIES

Country and policy year		VAT				Excise		
		standard rate 18-25%	not taxed or exempted	reduced rate 1 4-6%	reduced rate 2 8-15%	Alcohol	Tobacco	Private transport
Belgium-2005	Rates	21	0	6	12	43.9	162.9	34.7
	Shares	*41.9*	*37.9*	*19.8*	*0.4*	*1.7*	*1.3*	*8.9*
Greece-2004	Rates	18	0	4	8	24.8	278.6	40.6
	Shares	*46.5*	*16.4*	*0.5*	*36.7*	*1.7*	*3.2*	*7.5*
Hungary-2005	Rates	25	0	5	15	64.3	273.0	79.0
	Shares	*42.7*	*8.1*	*4.1*	*45.1*	*0.6*	*2.6*	*4.1*
Ireland-2001	Rates	20	0	-	12.5	26.6	300.0	75.4
	Shares	*36.2*	*42.0*	-	*21.8*	*4.5*	*3.4*	*5.3*
United Kingdom-2004	Rates	17.5	0	5	-	89.7	414.7	58.8
	shares	*57.7*	*36.3*	*6.1*	-	*1.9*	*2.2*	*8.0*

TABLE 4: INDIRECT TAX PAYMENTS AS % OF DISPOSABLE INCOME – BY DECILE

Decile	BE	GR	HU	IE	UK
1	23.8	28.6	25.7	24.8	20.6
2	13.6	22.6	19.3	19.5	14.8
3	13.3	19.2	17.6	16.6	13.5
4	12.8	18.8	16.7	15.2	12.5
5	12.4	17.7	15.8	15.5	11.8
6	11.8	16.2	15.4	14.2	10.9
7	11.6	15.8	15.1	13.1	10.8
8	11.0	14.9	14.7	12.4	10.1
9	10.8	14.2	14.4	11.0	9.3
10	9.6	11.9	12.8	7.8	7.5
Average	11.8	15.7	15.3	13.2	10.3
Suits index of indirect taxes	-0.079	-0.101	-0.086	-0.143	-0.120
Gini equivalent disposable income	0.319	0.324	0.318	0.331	0.368
Reynolds-Smolensky index	-0.011	-0.024	-0.016	-0.015	-0.015

The last row in table 4 gives a measure of redistributive effect: the Reynolds-Smolensky index. It is calculated as the difference in Gini before (second last row) and after tax. The redistributive effect is negative for every country, pointing out that inequality rises because of the taxation and so, again, that taxes are regressive. The reason why we include the redistributive effect in our analysis is that it is a combination of a progressivity measure (like the Suits), and the average tax rate. Indeed, taxing the richest person in a society 1 currency unit and all others 0 units, will turn out to be a very progressive tax. However, the resulting redistribution will be very very modest. Taking into account the average tax rate, and hence the importance of the tax in the composition of incomes, corrects for this[16]. Note for instance that the much lower budget share of the basket of VAT exempt commodities in Greece and Hungary in table 3 results in a much higher average tax rate in table 4: 18% and 15.3% respectively for Greece and Hungary, compared to 11.8% and 10.3% for Belgium and the UK. Together with the most pronounced regressivity, this produces the highest adverse distributional effects in Greece: inequality goes up by not less than 2.4 percentage points.

[16] See Yithzhaki (1994) and Lambert (2001) for a more extensive discussion.

But also in the other countries, the use of the indirect tax instrument is increasing inequality: in Hungary inequality goes up by 1.6 percentage points and in the UK and Ireland by 1.5 percentage points. The low rate regressivity in Belgium, combined with the lowest average indirect tax rate, bring the Belgian indirect tax system closest to distributional neutrality among the countries studied here.

Table 5 confirms and enriches this regressive picture for some selected groups: poor versus non-poor (with the poverty line at 60% of median equivalised income), households on income support, and households with more than 80% of disposable income originating from unemployment benefits, pensions. Certainly the divergence of the average indirect tax rate between the average population and households on income support is striking. The latter are paying more than a quarter of disposable income as indirect taxes in Hungary and the UK. Also the retired and the unemployed are hit more by indirect taxes, although this effect is less pronounced, due to their larger variation of disposable income.

TABLE 5: INDIRECT TAX PAYMENTS AS % OF DISPOSABLE INCOME – BY CATEGORY

Group	BE	GR	HU	IE	UK
income poor	21.1	20.5	23.0	20.9	16.7
income non-poor	11.3	15.1	14.8	15.5	9.3
on income support	36.0	14.1	25.8	17.5	26.1
retired	12.1	13.1	13.2	20.2	10.0
unemployed	12.2	17.6	16.1	18.9	13.6
average	11.8	15.7	15.3	13.2	10.3

The aim of matching of income and expenditure data is that we can now sketch a more comprehensive picture of the distributional effects for the complete transition from gross to net disposable income. A summary of the regressive character of the indirect tax instrument for the five countries is displayed in Table 6. We sharpen the picture by only looking at the erosion of the progressivity of the other instrument intended to generate general fiscal revenues (and hence not embedded in the insurance approach related to social risk): personal income taxes. The results are striking. In Ireland e.g. indirect taxes are about as regressive as

the personal income tax system is progressive.[17] The indirect tax system is the least regressive in Belgium and Hungary. The rightmost part of Table 6 shows the erosion of the redistributive effect of the system, measured again as the difference between the Gini coefficient before taxes, and the Gini after taxes. Indirect taxes nearly halve the redistributive effect of the progressive personal income tax system in Ireland. In Hungary and the UK the erosion of the redistributive effect is about a quarter. Belgium has the least erosive indirect tax system as far as the redistributive character of the general tax instruments is concerned.

TABLE 6: SUITS AND REYNOLDS-SMOLENSKY INDEX FOR PERSONAL INCOME AND INDIRECT TAXES

Country	π_S^{PIT}	π_S^{IND}	π_S^{TOT}	π_{RS}^{PIT}	π_{RS}^{IND}	π_{RS}^{TOT}
Belgium	0.219	-0.079	0.113	0.057	-0.010	0.046
Greece	0.492	-0.101	0.094	0.035	-0.024	0.01
Hungary	0.424	-0.086	0.144	0.056	-0.015	0.041
Ireland	0.140	-0.143	0.044	0.043	-0.019	0.024
UK	0.200	-0.120	0.092	0.038	-0.011	0.026

Note: π_S^Y denotes the Suits index for tax component Y, π_{RS}^Y the Reynolds-Smolensky index; the superscript PIT refers to Personal Income Taxes, IND to Indirect Taxation and TOT to Personal Income Taxes and Indirect taxation.

The result of the combined operation of all taxes and benefits is shown in Table 7. We express the payment of indirect and personal income taxes as a percentage of market income plus social benefits and minus social contributions. The result is a clearly U-shaped pattern of tax liabilities. For some countries the decreasing part of this tax liability curve across the income scale stretches well beyond the first decile. But the decline is particularly sharp between the first and the second decile. In the next section, we list and investigate some explanations for this regressive nature of indirect taxes.

[17] The disproportionality of the indirect and personal income taxes combined is the weighted average of the Suits-indices for both instruments, the weights being the shares in the combined tax revenues.

TABLE 7: TOTAL TAX PAYMENTS AS % OF PRIMARY INCOME MINUS SOCIAL SECURITY CONTRIBUTIONS PLUS SOCIAL BENEFITS

Decile	BE	GR	HU	IE	UK
1	23.8	29.5	27.2	28.6	30.1
2	16.7	21.5	20.8	27.1	22.7
3	19.0	20.7	20.0	30.9	21.6
4	22.7	28.0	20.5	27.5	21.0
5	26.0	23.5	19.6	33.6	21.3
6	28.7	22.6	20.1	33.6	22.4
7	30.8	25.4	22.5	34.8	23.5
8	33.4	23.9	24.6	36.4	24.7
9	35.3	23.3	27.2	36.6	26.2
10	39.8	28.9	35.2	35.7	31.3
average	31.6	24.7	26.4	34.4	26.3

V. EXPLANATIONS

In this section we discuss three factors that may explain the regressive pattern found above: the difference between VAT on the one hand and excises and ad valorem taxes on the other; the interplay between differences in expenditure patterns, differentiated tax rates and the position in the distribution; and finally the choice for disposable income (as opposed to expenditures) as the variable on the basis of which we construct the distributional picture.

V.1. Differences in VAT and excises

Sometimes it is hypothesized that the regressivity of the consumption taxation as a whole is solely due to the influence of excises and that the VAT system, considered separately, might be progressive. Excise taxes, with often high implicit rates, are levied on products like petrol, tobacco etc. which are relatively more important for low income households, but are often considered legitimate as a compensation for some externalities associated with the commodities, e.g. bad health, pollution etc. Table 8 divides indirect taxes into excise duties and VAT. It is clear that the hypothesis can be rejected: VAT is regressive with respect to disposable income in each country, and in Belgium the VAT system is even more regressive

than the excise system. Moreover, if one looks at the effects on redistribution (third last and last rows), the effect of the VAT system is more important than the excise system because of the larger average tax rate of the former.

V.2. Different expenditure patterns across deciles

From an efficiency point of view it makes sense to tax necessities more heavily. Indeed, although minimizing excess burdens (or welfare losses) hinges on compensated own price elasticities (taxing the price-inelastic commodities more heavily), the Slutsky equation also shows that one can reasonably expect that commodities with low compensated price elasticities are also the ones with low total expenditure elasticities. This simply unveils the traditional trade-off between equity and efficiency. From an equity point of view, one would argue that necessary goods should be taxed less than luxury goods. But efficiency points in the other direction.[18]

Table 9 shows the budget shares in Belgium for the goods of different VAT rates, and for excise duties. Clearly, the reduced rate products are consumed more, amongst lower deciles and the reverse is true for the standard rate products. For the excise goods, the picture is more complicated. The shares of alcohol and car fuel consumed do not depend monotonically on the decile. For tobacco the shares are clearly negatively correlated with equivalent income. Nevertheless, one can conclude that these results do not support the view that lower income deciles spend relatively more on more heavily taxed commodities.

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[18] The trade-off has been formalised extensively in optimal tax theory, with numerous examples of numerical calculations of optimal indirect tax rates.

TABLE 8: VAT AND EXCISE PAYMENTS AS % OF DISPOSABLE INCOME – BY DECILE

Decile	BE		HU		UK		GR		IR	
	VAT	Excise	VAT	Excise	VAT	Excise	VAT	Excise	VAT	Excise
1	21.1	2.7	22.0	3.7	13.9	6.7	24.9	4.7	31.7	9.6
2	11.8	1.8	16.8	2.5	10.1	4.7	18.1	3.6	14.2	5.5
3	11.5	1.8	15.3	2.3	9.3	4.2	16.4	3.6	12.0	4.6
4	11.0	1.8	14.6	2.1	8.6	3.9	15.6	3.3	10.4	4.1
5	10.7	1.7	13.8	2.0	8.1	3.6	15.6	3.3	10.9	4.6
6	10.1	1.7	13.5	1.9	7.6	3.3	14.3	3.0	10.2	4.6
7	9.9	1.7	13.2	1.9	7.6	3.2	13.3	2.9	9.3	4.1
8	9.3	1.7	12.8	1.9	7.0	3.0	13.1	2.8	8.7	3.9
9	9.2	1.7	12.5	1.9	6.6	2.7	11.8	2.5	7.8	3.3
10	8.1	1.5	11.1	1.7	5.5	2.0	10.4	2.1	5.9	2.5
Average	10.1	1.7	13.3	2.0	7.3	3.1	13.1	2.7	9.0	3.8
Suits index of indirect taxes	-0.083	-0.054	-0.084	-0.099	-0.108	-0.147	-0.101	-0.101	-0.171	-0.155
Gini equivalent disposable income	0.319	0.319	0.318	0.318	0.368	0.368	0.312	0.312	0.315	0.315
Reynolds-Smolensky index	-0.010	-0.001	-0.013	-0.002	-0.009	-0.005	-0.021	-0.004	-0.015	-0.005

TABLE 9: BUDGET SHARES BY TAX CATEGORY - BELGIUM

Decile	0%	6%	12%	21%	Alcohol	Tobacco	Car fuel
1	28.1	25.2	0.5	46.2	1.6	2.3	2.2
2	27.5	24.6	0.7	47.2	1.7	1.8	2.7
3	24.9	24.2	0.4	50.6	1.8	1.2	3.7
4	22.6	23.2	0.4	53.8	1.8	1.2	3.4
5	23.2	22.8	0.4	53.6	2.1	1.0	3.5
6	22.5	21.8	0.3	55.5	1.6	1.2	3.6
7	24.2	21.3	0.3	54.2	1.8	0.9	3.8
8	22.6	21.4	0.3	55.7	1.9	1.0	3.4
9	21.4	20.0	0.2	58.4	2.0	0.8	3.1
10	21.5	17.6	0.3	60.7	1.9	0.7	2.7
income poor	28.7	24.9	0.5	45.9	1.5	2.1	2.3
income non-poor	22.8	21.2	0.3	55.6	1.9	1.0	3.3
average	23.3	21.5	0.3	54.9	1.8	1.1	3.2

Synthesizing the information in table 9 in order to present the picture for the four countries for which an imputation was performed, table 10 combines the total nondurable expenditure elasticities derived from the parametric imputation model with the implicit tax rates calculated per consumption aggregate. The story that emerges here is similar to table 9: lower expenditure elasticities correspond to lower indirect tax rates, pointing to a tax system more inspired by equity than by efficiency considerations.

As a crude measure, one can look at the correlation of elasticities with tax rates, weighted by the average budget shares. The value is between -1, indicating an efficiency based policy, and 1, indicating an equity-centred policy. The correlations are in the bottom row of the table. They are all close to zero, suggesting independence between tax rates and elasticities. But, if anything, the sign points to a slight preference for equity arguments in Belgium and Hungary, and the reverse concern for efficiency in the UK and Ireland.

TABLE 10: TOTAL EXPENDITURE ELASTICITIES AND AVERAGE TAX RATES (%)

Commodity aggregate	BE		HU		IE		UK	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Food, non alcoholic beverages	0.42	8.1	0.66	15.5	0.55	4.2	0.51	2.1
Alcoholic beverages	0.94	43.9	1.19	64.3	1.15	26.6	1.13	89.7
Tobacco	0.54	162.9	0.42	273.0	0.44	299.3	0.60	414.7
Clothing and footwear	1.25	20.8	1.25	25.0	2.14	16.3	1.58	14.1
Home fuels and electricity	0.53	23.5	0.44	15.0	0.33	12.4	0.21	5.0
Rents	0.34	0.0	0.46	0.0	0.43	0.0	0.35	0.0
Household services	1.25	16.4	1.19	20.9	1.27	16.3	1.03	12.2
Health	1.00	2.8	1.01	5.5	2.46	1.0	1.51	0.0
Private transport	1.72	34.7	2.25	79.0	1.24	75.4	1.11	58.8
Public Transport	0.30	6.0	0.35	25.0	0.42	0.0	0.34	0.0
Communication	0.68	20.2	1.06	24.9	0.67	19.1	0.51	16.5
Recreation and culture	1.08	11.9	1.30	11.9	1.04	12.4	1.12	13.6
Education	0.15	1.8	0.28	0.0	0.23	1.9	0.18	0.0
Restaurants	1.63	12.8	2.23	14.0	1.40	12.4	1.46	17.5
Other goods and services	1.48	8.5	1.59	22.8	1.62	3.1	1.26	8.5
Home production			0.64	0.0				
Durables	0.85		1.64		1.00		0.64	
Saving	1.77		0.98		1.10		1.78	
Correlation between (1) and (2)	0.041		0.0394		-0.0664		-0.0338	

Notes:
(1): total expenditure elasticity, except for savings and durables where elasticity is with respect to disposable income
(2) indirect tax rate

V.3. Disposable income or expenditures?

There is a longstanding debate on whether income or expenditures are the best indicator to measure household welfare and empirical evidence on the impact of this choice on the incidence calculations of commodity taxes. We will not discuss this issue here, nor review

the extensive literature.[19] The main reason for choosing expenditures instead of income is to flatten out short run volatilities in incomes, and/or to approximate some life-cycle income concept. Moreover, there is a conjecture that measurement error, although present in both variables, is less prominent in expenditures than in disposable income.

It is common knowledge that the savings rate is sharply increasing with income. This leads to a completely different picture of indirect tax incidence when using expenditures in the denominator as compared to income. We illustrate both aspects in Tables 11 and 12.

TABLE 11: SAVINGS AND DURABLES RATE PER DECILE

Deciles	BE	GR	HU	IE	UK
1	-52.3	-105.4	-48.4	-94.8	-15.8
2	-9.5	-50.8	-10.5	-54.5	18.3
3	0.5	-25.0	1.5	-25.3	26.1
4	6.9	-18.5	7.9	-13.0	31.9
5	13.1	-14.6	13.8	-9.9	36.7
6	18.7	-2.6	18.2	0.7	39.6
7	22.6	2.2	20.7	7.8	43.5
8	27.1	6.1	23.8	14.5	46.9
9	31.7	12.1	27.5	25.0	51.4
10	42.2	27.3	37.7	46.2	61.7
Mean	21.7	-16.9	18.8	8.0	45.2
Gini of disposable income	0.341	0.324	0.318	0.331	0.380
Concentration index of income after saving	0.225	0.202	0.208	0.180	0.255

[19] A reference contribution on the issue of choosing income or expenditures as a welfare standard is Blundell and Preston (1998). For a recent discussion of the sensitivity of poverty measurement and evolution in the UK with respect to the choice of income or expenditures as the measuring rod., see Brewer, Goodman and Leicester (2006). For the incidence of indirect taxes based on annual income, lifetime income or expenditures, see among others, Poterba (1989) Fullerton and Rogers (1991) or Caspersen and Metcalf (1994).

Notice that in both these tables, we have lumped durable expenditures together with savings, the latter being defined as the difference between disposable income and total expenditures. The reason behind this is that durable expenditure is of a clearly hybrid nature: the cost of buying a car captures some current consumption, but also a lot of future consumption. And in prefiguring this future consumption, part of durable expenditures therefore resemble savings. In the same spirit, a family who spends half as much on non durable goods as another, but who accidentally purchased a car in the month of the budget survey, might seem equally well-off when total expenditures is used as the welfare metric. Leaving durables out of the welfare identification process more or less corrects for these biases[20].

Table 11 illustrates the regressive nature of savings (including durables). For all countries, the savings rate is negative for the first decile. For some countries, like Greece, the amount of expenditures is double that of income. That de-saving is so high, that in reality it is difficult to believe, is perhaps due to the instability of income measurement mentioned before. Nevertheless, the higher equivalent income, the higher the savings rate.

Table 12 reproduces table 4, but now presenting indirect tax payments as a fraction of nondurable expenditures. The conclusion however is opposite. With the exception of Greece, the tax system follows a (slightly) progressive schedule, as is indicated by the positive Suits indices in the bottom row and thus confirming that regressivity of savings is the most important explanation for the regressivity of indirect taxes. One can split table 12 in VAT and excise rates as before, which does reveal a difference now: the VAT system is progressive for all countries, while excises are regressive for all countries except Belgium.

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[20] Better ways can be contrived of course, for instance using an imputed rent approach as in Wolff & Zacharias (2007). This, however, fell outside the scope of this paper.

TABLE 12: INDIRECT TAX PAYMENTS AS % OF NON DURABLE EXPENDITURES

Decile	BE	GR	HU	IE	UK
1	11.3	13.4	17.1	12.4	13.9
2	11.8	14.4	16.9	12.3	13.7
3	11.9	15.2	16.9	12.7	13.7
4	12.3	15.7	16.8	12.8	14.0
5	12.6	16.1	16.9	13.7	14.2
6	12.8	15.8	17.0	14.1	14.4
7	13.1	15.8	17.2	14.1	14.6
8	13.3	16.1	17.4	14.3	14.7
9	13.5	15.8	17.6	14.2	14.6
10	13.9	15.2	18.0	14.3	14.4
Average	12.9	15.4	17.3	13.5	14.3
Income poor	11.5	n/a	17.0	n/a	13.8
Income non-poor	13.0	n/a	17.3	n/a	14.4
Gini equivalent non durable expenditures	0.235	0.302	0.221	0.260	0.290
Concentration index post indirect tax	0.231	0.303	0.219	0.211	0.287
Suits	0.021	0.006	0.032	0.025	0.006

VI. SIMULATIONS OF INCREASED INDIRECT TAXES

Finally, we utilise the matched income and expenditure data to simulate changes in indirect taxation and evaluate the distributional consequences of these changes. We consider here a shift from labour income to consumption taxes, decreasing social security contributions of employees by 25% in EUROMOD. The disposable income before and after the reform are then used as input to our indirect tax routine. Assuming government budget neutrality, we calculate the rise in the standard VAT rate necessary to compensate fully for the loss the government runs because of the tax reduction. This is done as follows.

The rise in disposable income flows entirely into expenditures, so household savings are assumed constant. Since durables have a hybrid consumption-saving character (see above) we made the assumption that the quantity of durables is constant. Hence, the rise in

disposable income is translated in 1) paying the price rise in durable goods (due to an increase in VAT) at un unchanged quantity, and 2) a possible rise in nondurable consumption items. The rise of nondurable expenditures was allocated over the different expenditure aggregates according to the Engel curves estimated in the imputation step. The rise in total nondurable expenditures will indeed alter the predicted budget shares, and hence expenditures and quantities consumed of the non durable commodities.

In a second step the increase in the indirect tax rate, to compensate for the foregone revenues from social security contributions, is calculated by incrementally increasing the standard VAT rate with 1 or 0.5%. In each iteration step, the new aggregate tax rates (as a fraction of consumer prices) are calculated as a weighted average (cf. supra) and applied to the new expenditure levels in order to derive the total revenue from indirect taxation. This is then compared to the revenue loss of lowering the social insurance contributions. The iteration process stops whenever budget neutrality is obtained.

To evaluate the distributional implications of the tax reform, a measure of consumption based welfare gain (WG in the tables) was adopted. The complete derivation can be found in Capéau et al. (2009). For now, it suffices to say that WG represents the money cost of obtaining a certain welfare level by purchasing a basket of goods. This implies that two adverse forces act upon WG. On the one hand, the welfare level increases due to the rise of total non durable expenditures: at given prices households can buy more quantities. But on the other hand rising prices also decrease the affordable quantities of goods for a given budget. The price rise therefore exerts a downward pressure on WG.[21]

The results are summarized in the following three tables. Table 13 presents the changes in the government budget. The decrease of the social insurance contributions (SIC) of the employees by 25% leads to a substantial necessary increase in the standard VAT-rate: 4 to 5 percentage points in Belgium, Ireland and the UK. But up to 9 percentage points for Hungary. It is clear that the rise in standard VAT-rate is proportional to the relative importance of the social security contributions and the indirect tax system. Note that for some countries, like Belgium, part of the government's loss is recovered by an increase in taxable income and hence by a rise in personal income tax (PIT). Other countries do not

[21] Since the welfare gain WG is derived from the expenditure function of the consumer (which is the inverse of the indirect utility function), it also takes into account maximizing behavior and hence captures the fact that households can try to counteract (partially) the effect of price rises on their welfare level by altering their consumption baskets.

exclude social security contributions from the taxable base and hence their PIT revenue stays the same.

Table 14, 15 and 16 show the welfare consequences for different subgroups of the population. For each group and country, the average change in welfare WG is depicted, together with its two components: the change in nondurable expenditures and the price effect. In table 14 and 16 we give the absolute changes in Euros per year. In table 15 we also give the percentage changes by dividing the absolute change by total non durable expenditures. We first discuss table 14. The first component of the welfare change is everywhere positive, explained by the fact that disposable income can only increase by the tax reform and because savings are kept constant[22]. The second component represents the price effect, which captures the rise in price levels due to the VAT-increase. As no goods have their prices decreased, this effect is negative for every household. Taken together, one observes from table 14 that the price effect dominates the change in expenditures in the lower equivalized expenditure deciles, so that the welfare effect of the reform is negative for those groups (up to the fifth decile for Belgium and the UK, up to the sixth decile for Hungary). For the higher deciles, the situation is reversed and these groups become better off after the reform.

Table 15 shows the same figures but now expressed as a percentage of total expenditures. The relative change in total nondurable expenditures is clearly increasing over the deciles, indicating that the higher deciles benefit relatively more from the rise in disposable income and making the reform regressive. The percentage loss in welfare due to the relative price effect is mainly increasing over the deciles. For Belgium, the effect decreases from the 9th decile onwards, and for Ireland there seems to be no clear monotonic pattern. Yet the underlying trend for all countries is downwards, making this part of the reform a progressive move (the poor lose less). Overall however the regressivity of the increased total nondurable expenditures outweighs the progressivity of the price effect, resulting in a clearly regressive change in WG, as indicated by the fact that percentage changes in WG increase over the deciles.

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[22] There is a possibility, however, that the price rise of durables outweighs the increase in disposable income. E.g. a household that pays no social security contributions and therefore cannot enjoy the benefits of the tax reform will see its total nondurable expenditures diminished if it has strictly positive expenditures on durables. On the aggregated levels that are used here, this effect is not directly observable. In Belgium, this group of households constitutes 0.6% of the population, in Hungary 0.4% and in the UK 1.9%.

Above we found that indirect tax rates, and especially VAT, were progressive with respect to total expenditures. Raising the standard VAT-rate should then result in a more redistributive system rather than the regressive pattern of table 14 and 15. The reason for this can be found in the fact that for the population as a whole, the indirect tax system is less progressive than the system of social insurance contributions of the employees. This is of course mainly due to the fact that the non working population is disproportionately overrepresented in the lower deciles and does pay indirect taxes but no social contributions. Hence the gain in progressivity by raising indirect taxes is (more than) offset by the loss of progressivity by decreasing the social insurance contributions of employees. This is an important caveat for this kind of taxation shifts: if one wants to retain redistribution at the same level, there are only two possibilities. First, one could make the indirect tax system more progressive by equity driven rate differentiation. But as stated above, this is relatively ineffective. Secondly, one could increase the progressivity of what is left of the direct tax system, to restore the redistributive power of the entire tax-benefit system. If also this second option is barred, one has to accept the adverse distributional consequences of the tax shift.

This analysis of gainers and losers can be carried out for other subgroups of the population as well. The upper rows of the table 16 show the effects along the division poor – non poor, where poverty is defined as having equivalized expenditures lower than 60% of the median equivalized expenditures. As can be expected from tables 14 and 15, the reform is beneficiary to the group of non poor as a whole, but the group of poor is affected very badly. The same conclusion can be drawn for socio-economic divisions as in the lower part of the third table: people in more vulnerable positions, like the unemployed (except for Hungary, where they are almost unaffected), retired people and people receiving income support, lose by the reform, while employed workers gain by it.

TABLE 13: REVENUE EFFECTS OF THE SIMULATION

	BE		HU		IE		UK	
	baseline	simulation	Baseline	simulation	Baseline	simulation	baseline	Simulation
SIC employee	17,490	-3,900	2,777	-693	168,875	-33,902	42,283	-9,713
PIT	35,500	+1,763	4,608	+0	1136,416	+0	164,813	+0
Indirect tax	14,400	+2,309	4,300	+731	443,139	34,791	71,717	+10,655
VAT rate	21%	26%	25%	34%	20%	23.5%	17.5%	21.5%

TABLE 14: DECOMPOSITION OF WELFARE CHANGE INTO INCOME EFFECT AND PRICE CHANGE – BY DECILE IN €'S PER YEAR

Decile equiv. non durable expend.	BE			HU			IE			UK		
	Change nondur. exp.	Price effect	WG	Change nondur. exp.	Price effect	WG	Change nondur. exp.	Price effect	WG	Change nondur. exp.	Price effect	WG
1	43	-193	-150	22	-70	-47	0	-59	-58	9	-50	-42
2	79	-262	-183	34	-90	-56	38	-152	-114	39	-99	-60
3	159	-308	-149	57	-105	-48	108	-202	-94	90	-134	-44
4	237	-366	-129	82	-124	-41	213	-277	-64	134	-168	-34
5	389	-417	-28	112	-139	-27	321	-313	8	196	-200	-4
6	482	-455	26	141	-157	-16	364	-328	36	278	-233	45
7	614	-509	105	192	-183	9	390	-338	52	360	-269	91
8	735	-557	178	231	-205	26	483	-403	80	473	-316	158
9	837	-607	230	310	-237	73	523	-399	124	620	-376	245
10	1162	-858	305	527	-339	188	722	-531	191	764	-570	194
Mean	473	-453	20	171	-165	6	316	-300	16	296	-241	55

TABLE 15: DECOMPOSITION OF WELFARE CHANGE INTO INCOME EFFECT AND PRICE CHANGE – BY DECILE IN % OF NON DURABLE EXPENDITURES

Decile equiv. non durable expend.	BE			HU			IE			UK		
	Change nondur. exp. (%)	Price effect (%)	WG (%)	Change nondur. exp. (%)	Price effect (%)	WG (%)	Change nondur. exp. (%)	Price effect (%)	WG (%)	Change nondur. exp. (%)	Price effect (%)	WG (%)
1	0.37	-1.67	-1.30	0.71	-2.22	-1.51	0.01	-0.83	-0.82	0.20	-1.17	-0.96
2	0.51	-1.70	-1.19	0.87	-2.29	-1.41	0.23	-0.90	-0.68	0.55	-1.39	-0.85
3	0.89	-1.72	-0.83	1.28	-2.36	-1.08	0.47	-0.88	-0.41	0.97	-1.45	-0.48
4	1.12	-1.74	-0.61	1.63	-2.45	-0.82	0.67	-0.87	-0.20	1.19	-1.49	-0.30
5	1.63	-1.75	-0.12	2.03	-2.52	-0.49	0.89	-0.87	0.02	1.49	-1.51	-0.03
6	1.88	-1.78	0.10	2.34	-2.61	-0.27	0.99	-0.89	0.10	1.84	-1.54	0.30
7	2.18	-1.81	0.37	2.81	-2.67	0.14	1.01	-0.88	0.13	2.11	-1.58	0.53
8	2.45	-1.86	0.59	3.14	-2.78	0.36	1.13	-0.94	0.19	2.40	-1.60	0.80
9	2.54	-1.84	0.70	3.73	-2.85	0.88	1.18	-0.90	0.28	2.67	-1.62	1.05
10	2.43	-1.79	0.64	4.83	-3.10	1.72	1.30	-0.96	0.35	2.17	-1.62	0.55
Mean	1.86	-1.78	0.08	2.78	-2.68	0.10	0.95	-0.90	0.05	1.91	-1.55	0.35

TABLE 16: DECOMPOSITION OF WELFARE CHANGE INTO INCOME EFFECT AND PRICE CHANGE – BY GROUP IN €'S PER YEAR

Decile equiv. non durable expend.	BE			HU			IE			UK		
	Change nondur. exp.	Price effect	WG	Change nondur. exp.	Price effect	WG	Change nondur. exp.	Price effect	WG	Change nondur. exp.	Price effect	WG
poor	55	-367	-312	30	-90	-60	4	-22	-18	17	-177	-160
non poor	554	-470	84	197	-178	18	329	305	24	362	-257	106
on income support	848	-571	277	333	-226	106	0	-24	-24	518	-286	232
retired	112	-289	-177	117	-120	-3	22	-46	24	35	-164	-130
unem ployed	54	-323	-269	35	-107	-72	2	-7	-5	16	-148	-133
Mean	473	-453	20	171	-165	6	316	-300	16	296	-241	55

VII. CONCLUSION

In this paper, we have presented the results of imputing expenditure information into income and tax datasets within the context of the EUROMOD microsimulation environment. With respect to disposable income deciles, the indirect tax system is regressive for all countries, and, because of its relative importance in the government budget, also significantly influences the progressivity of the tax system as a whole. Because indirect taxes are often overlooked in microsimulation modelling, the results are a clear case for integration of expenditure data into models like EUROMOD.

We then looked for reasons behind this regressivity. First, it was shown that there is no considerable difference in regressivity between the VAT and excise systems in the countries investigated. The regressivity therefore is not due to excise taxes alone. Moreover, differences in expenditure patterns across deciles cannot account for the degree in regressivity. For the UK, a slight preference for efficient taxation can be discerned, but for Belgium and Hungary, low elasticity (necessary) commodities tend to have lower aggregate tax rates. Finally, the regressivity of savings seems to be the major determinant of the patterns discerned: because the higher deciles save so much more, they spend relatively less of their income on indirect taxation.

The change from disposable income to total nondurable expenditures as a welfare concept and for analytic purposes can be justified by the conjecture that income measurement may be more vulnerable to errors, but most importantly that from a life cycle point of view disposable income can be considered too volatile to measure someone's welfare level. The question is whether progressivity should be defined as only considering the current income of households or the income earned over the entire lifetime. This discussion can be taken further by making a distinction between characteristics that households are respectively responsible and not responsible for. "True progressive taxes" would then decrease inequality between households of different endowments which they are not responsible for, but not affect other differences that can be described as "tastes". Of course this provokes the normative debate about how far the responsibility of people reaches.

Finally, we used the EUROMOD model to simulate a possible contemporaneous tax reform: an increase of social security contributions, followed by an increase in standard VAT rate to maintain neutrality of the government budget. The results show that the weaker groups in society are adversely affected by this measure, while richer households benefit from it. This was true even while keeping savings constant. The underlying reason is that although the

indirect taxes are progressive with respect to total expenditures, they are less progressive than the systems of social insurance contributions of employees. This is an important caveat for possible policy change plans in this direction: if one wants to keep redistribution levels untouched, the shift to direct taxes has to be accompanied by an increase in progressivity of the direct tax system.

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