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Workpackage 3.5:
Imputation of expenditures into the income datasets of five European countries

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Abstract**:** **This workpackage contains the actual imputation of expenditure data into the EUROMOD income and taxation datasets for four countries: Belgium, Hungary, Ireland and the UK. The exact imputation method is described in section II. Two adaptations w.r.t. the methods described in workpackage 3.4 have been made: one to improve overall robustness and one to allow for the replication of zero expenditures. The third section discusses the results for the four countries.**

I. INTRODUCTION

This workpackage discusses the final imputation of expenditure data into the EUROMOD income and taxation datasets for four countries: Belgium, Hungary, Ireland and the UK. For the fifth country studied in project 3, Greece, no imputation is necessary since the original dataset, the Household Budget Survey of 2004/2005, already contains expenditure information. Hence, it suffices to perform a match by household identification number between the original and the EUROMOD dataset.

In workpackage 3.2, the variables that are common to both the expenditure and the EUROMOD data were identified for each country apart and wherever necessary harmonized. This harmonization took the form of deflating or inflating monetary variables to the same year and recoding qualitative variables so that they exhibit corresponding

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categories. In what follows, these common variables play the role of a similarity measure between observations on the basis of which the imputation will be carried out. Notice that some subgroups of society (e.g. regions, households with a male or a female household head, households with the head belonging to a certain age category) were over- or underrepresented in the EUROMOD dataset with respect to the budget datasets. Notwithstanding the fact that this can point to problems with representativeness of one or both of the datasets, it is not considered to be a problem for the matching procedure itself since this will occur conditional upon this characteristics. More problematic is the effect observed for most countries that the tails of the disposable income distributions tend to differ. This may affect values in the first and tenth (equivalent) disposable income deciles. However, since the number of observations in the "diverging tails" was observed to be very small (less than 1 per thousand in most cases), it is more likely that these values can be considered as outliers rather than as systematic measure differences and do not have a significant effect on the outcome.

The principal matching method used here is the parametric estimation of Engel curves on the expenditure data. The fitted model is then applied to predict values in the EUROMOD dataset. The selection procedure for the matching method was described in workpackage 3.4, where basically four different methods were tested on an artificially split Belgian dataset in order to evaluate the quality of the matching respectively obtained with them. The four methods were: parametric and kernel estimation of Engel curves, Mahalanobis distance matching and grade correspondence. The first method proved to be the most adequate and its matching result will be used in this and the remaining workpackages. However, the results of the other three methods will be presented here as well to provide a sensitivity analysis.

A well known problem with parametric estimation and imputation is that of zero expenditure. On some consumption categories, like tobacco, the majority of households spend nothing, not because they have a corner solution, but because they do not have the need to smoke. Nevertheless, their predicted values will always differ from zero because of the parametric linear specification. To tackle this problem, the estimation method was updated in comparison with workpackage 3.4. This update is described in the next section. The third section contains a per country description of the matching results, mainly in the form of a comparison between tax incidence in the expenditure and the imputed EUROMOD data. Section four concludes.

II. EXTENSION OF THE PARAMETRIC METHOD

Two adaptations were made with respect to workpackage 3.4. A minor change consists in adopting a two step-imputation, where in a first step total nondurable and durable expenditures are estimated and imputed, and in a second step nondurable budget shares. Making the method more adequate to the zero expenditures problem encompasses some more profound alterations.

The two-step imputation is a pragmatic solution to the fact that using disposable income in the estimation of absolute expenditures per category is problematic for two reasons. First, as stated before, the income distributions in the dataset used for estimation and the imputation 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 with respect to disposable income, so that the savings quotes for a considerable amount of observations become extremely negative. The relation between disposable income and total expenditures, on the contrary, is smoother and hence more robust to problems of this kind. Second, disposable income is negative in a non-negligible number of cases. Note that this already makes the estimation of income shares instead of budget shares very cumbersome. And since the preferred specification for budget shares estimation in the literature is in terms of the logarithm of disposable income or total expenditures, negative or zero values make the model unworkable.

The solution consists in first estimating both total nondurable and durable expenditures, thus avoiding largely the incidence of negative predicted total expenditures. Observations with predicted total nondurable expenditures smaller than zero are dropped. The number of observations dropped never exceeds ten, for datasets typically containing several thousands of households, so the robustness of the specification is thereby practically confirmed. In this way, nondurable budget shares can then be estimated and imputed using the logarithm of total nondurable expenditures and its square. With this specification, it is still possible, though in practice not very likely, that negative budget shares for the disaggregated commodities are predicted. To account for this, an extra standardisation step is introduced: the negative shares are set to zero, and each share is divided by the sum of all shares. Hence the nondurable expenditure shares sum to one. From this, all absolute expenditures can be derived by multiplying the shares with the already imputed absolute total nondurable expenditures.

More important is the problem of zero expenditures. Within the EUROMOD context, especially zeros on the aggregates tobacco, rents, public transport and education are often

not the result of the emergence of a corner solution, but simply because these items are irrelevant to the preferences of the households concerned. The strategy adopted here is to divide the population into sixteen subgroups, depending on whether or not they have expenses on the four aggregates. It is assumed that each of those groups has a different preference structure and hence that their budget shares on all the nondurable consumption aggregates should be estimated separately. It is worth noticing that instead of treating all zeros as corner solutions in the original model, here they are all a priori treated as not being corner solutions. This is due to the fact that most budget surveys do not contain information on the motivation of the household not to buy a certain product. Infrequent purchases in the four areas selected here is less of a problem, since the monitoring period is typically one month. Only the presence of school fees (education) and season tickets (public transport) might cause observations to be misallocated.

The first step is to replicate this division into subgroups in the EUROMOD dataset, immediately after the imputation of total nondurable expenditures. For this reason, a tobit specification was adopted. For the example of tobacco, the tobit model assumes that the discrete decision of using tobacco or not is the outcome of an underlying propensity-to-smoke variable. The higher one scores on this variable, the more likely one is to actually be a smoker. Then a probability distribution is attached to this variable, often the logit or normal distribution, so that for each observation a probability to be a smoker is obtained. The tobit model asks to specify a cut off value (typically 0.5), so that every observation above this value is considered to be a smoker, and a non-smoker otherwise. The model can be considered as a minimization of the number of “wrong guesses”.

In the EUROMOD context, the common variables and the total nondurable expenditures can be used to estimate this underlying variable in the budget survey. For the imputation however, a different approach was adopted in that no cut off value was used. Rather, for each observation a random number was drawn in the [0,1] interval. If this value was below the predicted probability to smoke, the observation was considered to be a smoker and a non-smoker otherwise. The reason for this change lies with the principle in microsimulation to imitate as well as possible the variation in the population. If the tobit model attributes a probability to smoke, given that it is not zero or one, this means that the explanatory variables are not sufficient to explain smoking behaviour in a deterministic way. Using a cut off value, however, introduces a certain amount of “deterministic faith” in the covariates. Using a probabilistic approach as the one described above corrects for this. The difference can be illustrated by the following points of view. Working with a cut off value is equivalent to saying: “Given your values on the covariates, you have 80% chance of being a smoker, so you are definitely a smoker.” On the contrary, the probabilistic view says: “You have 80% chance of being a smoker, so I draw a number between zero and one randomly and if it is

lower than 0.80, you are a smoker." In general, both methods have the same quality of prediction, but the latter method will also impute "exceptions", households that have a high probability of smoking given their covariates, but that do not and vice versa.

As mentioned in the introduction, the marginal distributions of the common variables are not necessarily the same across the estimation and imputation datasets. This results in possibly different proportions of e.g. smokers in both datasets. To correct for this, a standardisation of probabilities took place, where each predicted probability was divided by the ratio of the mean predicted probability and the desired mean probability, in casu the proportion of smokers in the expenditure dataset. Letting the law of large numbers work on these new probabilities ensures that the proportions of smokers are more or less the same across datasets. As mentioned earlier, this procedure was followed for tobacco, rents, public transport and education. In that way, sixteen subgroups in society can be identified.

The next step consists of estimating the budget shares for each constructed subgroup. The main problem here is that some subgroups are very small and hence, the variance of the estimated coefficients explodes and they are all insignificant. To tackle this, inspiration was found in Sabelhaus and Walker (2007) who use "subgroup differencing". It boils down to the following. In order to decrease the variation of the estimates, one can use observations of another group in the estimation. Because of the different preference structures of the groups however, one introduces estimation bias in this way. The problem thus reduces to a classical bias-variance trade off. Three extra provisions can be taken so as to reduce the bias.

First, it makes sense to only use subgroups that are "alike" to some degree in the estimation. The explanation is straightforward: the less the true population parameters differ, the less the bias in estimated parameters if both groups are mixed together. Identifying alike subgroups is of course easy when age is the concerned variable. Here a combination of intuitive and pragmatic considerations will be determinative (cf. infra). Second, one can apply a weighting scheme so that observations in the subgroup itself have the highest weight, while other subgroups get a lower weight corresponding to their level of similarity with the original group. Notice that the first provision is a special case of the second one, in that subgroups considered to be completely not alike get a weight of zero. Third, dummy variables can be used to draw off part of the bias. For instance, if one uses smokers to estimate the budget shares of a non-smoker, including a dummy for smoking will decrease the bias on other coefficient estimates. If there is no correlation between smoking and the other covariates, the bias will be zero. Note that this means that the tobit estimation step described above will perform weakly, in that it will basically randomly decide whether a household contains a smoker or not. Flexibility can be added by allowing for some interaction effects in the model. The extreme case of including all interaction effects with smoking of course coincides with the case of estimating every group strictly separated.

To describe the method in practice, let (*s, r, p, e*) denote the value of the group on the dummy variables for smoking, rents, public transport and education respectively. Within the EUROMOD context, a group with zero on a certain dummy typically has more observations than a group with one on the same dummy, ceteris paribus. So a subgroup that contains smokers has in general fewer elements than the subgroup that is the same on all other characteristics but contains non-smokers. In the case of the group (*0,0,0,0*), no other subgroups are even necessary to make the model as a whole and most of the coefficient estimates significant. For any group X, the following weighting scheme is adopted: all groups that have a one where X has a zero, get weight zero ("no smokers are used to estimate the preferences of non-smokers"), and all the other groups get weight one half to the power of the number of different dummy values. So for the estimation for group (*0,0,0,0*), all other groups get weight zero since they all have at least one value one where group (*0,0,0,0*) has a zero. For group (*1,0,0,0*) – the smokers that do not spend on rents, public transport and education – the observations in the group itself get weight one, whereas the observations in the group (*0,0,0,0*) – the non smokers with the same characteristics for the three other dummies – get weight one half. This is the only other group with a non-zero weight. For group (*1,1,0,0*), the groups with a non-zero weight are group (*0,0,0,0*), which gets weight one fourth, and groups (*1,0,0,0*) and (*0,1,0,0*), which get weight one half. This scheme tries to balance between two desired properties: primo, the more likely groups are, the higher the weight they should get in each others estimations procedure, and secundo, renters are not used to estimate preferences for non-renters, so the budget share for rent with non-renters is zero (and idem for the three other characteristics).

As a conclusion, the new estimation scheme is shortly summarized. First, nondurable and durable expenditures are estimated and imputed parametrically, using the common variables as covariates (also including age squared and disposable income squared).

$$nondurables = \alpha_n O + \beta_{n1} inc + \beta_{n2} inc^2$$
$$durables = \alpha_d O + \beta_{d1} inc + \beta_{d2} inc^2$$

In these expressions O represents a vector of socio-demographic variables other than disposable income (inc). Observations with negative imputed nondurable expenditures are dropped out of consideration, while negative imputed durables are set to zero. Then the subgroup of the observations in the EUROMOD dataset is determined by tobit estimation.

$$(s, r, p, e) = \alpha_s O + \beta_{s1} inc + \beta_{s2} inc^2$$

Finally, estimation of nondurable expenditure shares proceeds according to the subgroup differencing principle described above. So, for the expenditure share of COICOP aggregate i the expression becomes:

$$share_i = \alpha_i^{s,r,p,e} O + \beta_{i1}^{s,r,p,e} \log(nondurables) + \beta_{i2}^{s,r,p,e} \log^2(nondurables).$$

III. RESULTS FOR THE DIFFERENT COUNTRIES

In this section, we discuss the results of the matching procedure by country. The tables are numbered x.1, x.2 etc., where "x" refers to the country. Table x.1 shows the coefficient estimates of all nondurable expenditure aggregates for the group of observations that have zero expenditures on tobacco, rents, public transport and education. The effect of subgroup differencing is summarized in table x.2 by means of the coefficient estimates of the logarithm of total nondurable expenditures for each subgroup. Table x.3 describes the incidence of expenditures and indirect taxes paid per consumption aggregate in the expenditure and the EUROMOD dataset. This is followed by tables describing average indirect taxes per equivalent disposable income decile, household size and age group of the household head in both datasets (tables x.4, x.5 and x.6). Table x.7 shows a comparison of the savings and durables incidence across deciles between the datasets. Table x.8 compares indirect tax incidence and inequality measures across the four methods. The last tables, x.9 to x.12, compare the influence of indirect taxes to that of the other taxes in the EUROMOD baseline.

1. Belgium

For Belgium, the expenditure data of the Household Budget Survey of 2003 are matched to the observation of the EU-SILC 2004. Both surveys were taken in the year 2003. The 2003 direct and indirect tax systems are used.

Table 1.1 on the next page shows the regression coefficients for the first subgroup. Because this group contains only the households with no expenditures on tobacco, rents, public transport and education, these aggregates are not included in the list. Most of the coefficients are in line with intuition. To name some: people living in the Brussels capital region spend less on private transport, retired people spend relatively more on hotels and restaurants, self employed people spend relatively more on clothing and footwear and on hotels and restaurants, and larger households spend relatively more on clothing and footwear and on food, whereas they spend relatively less on hotels and restaurants. But perhaps the most interesting coefficients are the ones associated with total nondurable expenditures. For all aggregates except private transport, the coefficient of the logarithm of total expenditures has the opposite sign of the coefficient of the square. This means that no matter whether the

effect of total expenditures on budget share is positive or negative, the effect is decreasing. The categories food, alcoholic beverages, home fuels and electricity, other goods and services (personal care, social protection services, insurance and financial services) and, surprisingly, hotels and restaurants, are necessary goods, whereas the other categories like communication and recreation and culture, are luxury goods.

Table 1.2 gives the coefficient estimates of food for all the subgroups. The values range from -0,103 for households that spend money on tobacco, rent, education and public transport to -0,331 for households that only spend money on rent but not on the other three aggregates. So the decrease of the budget share on food for a percent increase in total nondurable expenditures is more than three times as large for the latter group. Of course, this mainly reflects the fact that households that spend on more categories of goods will have smaller budget shares per category, so that the space available for an increase or a decrease is smaller. However, the first two lines in the table give a situation where this is the other way around. This underlines the importance of including different preferences per subgroup.

Table 1.1: Regression coefficients for parametric match - Belgium

Category	ma	wa	br	se	em	ue	pe	he	se	ag	ag2	np	na	nc	lte	lte2	co
food, non-alcoh	-0.009	-0.007	-0.013	0.018	-0.017	-0.030	-0.036	0.000	0.005	0.007	0.000	0.069	-0.010	-0.040	-0.204	0.004	1.533
alcoh beverages	-0.005	0.003	0.009	0.008	0.006	0.000	0.004	0.005	0.002	0.001	0.000	0.005	-0.006	-0.006	-0.090	0.005	0.428
cloth, footwear	0.031	-0.015	-0.006	0.032	0.020	0.007	0.020	0.004	-0.002	-0.001	0.000	0.012	-0.001	-0.005	0.097	-0.004	-0.459
home fuel electr.	0.001	0.014	-0.010	0.026	0.008	0.017	0.010	-0.012	-0.014	-0.001	0.000	-0.001	0.005	0.002	-0.062	0.002	0.547
househ services	0.010	0.008	0.042	-0.007	0.004	0.005	0.016	-0.004	0.001	-0.001	0.000	-0.009	0.002	0.011	0.051	-0.002	-0.244
health	0.018	0.014	0.007	0.009	0.009	0.012	0.005	-0.016	0.002	-0.002	0.000	0.006	-0.007	0.000	0.055	-0.003	-0.201
private transport	-0.027	0.016	-0.019	-0.056	-0.018	-0.012	-0.026	-0.005	0.007	-0.003	0.000	-0.033	0.004	0.014	0.040	0.001	-0.186
communication	0.003	0.004	0.007	-0.013	-0.002	-0.005	-0.010	0.010	0.011	0.001	0.000	-0.001	0.001	-0.001	0.172	-0.010	-0.730
recreat., culture	-0.010	0.004	-0.006	-0.014	0.005	-0.021	0.001	0.018	-0.003	0.000	0.000	-0.014	-0.002	0.012	0.198	-0.011	-0.801
restaur., hotels	-0.022	-0.043	-0.006	0.030	0.002	0.015	0.028	0.009	0.000	-0.002	0.000	-0.027	0.007	0.008	-0.003	0.003	-0.008
other	0.012	0.003	-0.005	-0.034	-0.019	0.013	-0.012	-0.009	-0.010	0.002	0.000	-0.007	0.006	0.004	-0.252	0.015	1.122

ma is a dummy for male, wa for Wallonia, br for Brussels, se for self-employed, em for employed, ue for unemployed, pe for retired, he for higher education, se for secondary education, ag for age, ag2 for age squared; np is household size, na the number of active persons, nc the number of children, lte the log of total nondurable expenditures and lte2 the square; co is the constant term

Table 1.2: Coefficients for log(totexp) per subgroup - Belgium

Smoker	Renter	Use Public Transport	Use education	Coefficient
No	No	No	No	-0.204
			Yes	-0.259
		Yes	No	-0.260
			Yes	-0.174
	Yes	No	No	-0.331
			Yes	-0.318
		Yes	No	-0.246
			Yes	-0.148
Yes	No	No	No	-0.245
			Yes	-0.237
		Yes	No	-0.298
			Yes	-0.180
	Yes	No	No	-0.322
			Yes	-0.256
		Yes	No	-0.238
			Yes	-0.103

Table 1.3: Average expenditures, expenditure shares and indirect tax payments and rates in budget and EUROMOD dataset - Belgium

Commodity	expenditures in €		expend. shares in %		indirect taxes in €		indir. tax rates in %	
	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey
food, non-alcoholic beverages	4183	4050	18.9	17.9	315	305	8.1	8.1
alcoholic beverages	466	400	2.0	1.7	142	122	43.9	43.9
tobacco	275	279	1.3	1.3	170	173	162.9	162.9
clothing and footwear	1395	1284	5.2	5.0	240	221	20.8	20.8
home fuels and electricity	1321	1284	6.2	6.2	252	245	23.5	23.5
rents	1418	1560	7.4	8.6	0	0	0.0	0.0
household services	1268	1157	5.2	5.2	178	163	16.4	16.4
health	1608	1507	6.9	7.0	43	41	2.8	2.8
private transport	2660	2214	9.7	8.9	686	571	34.7	34.7
public transport	161	158	0.7	0.7	9	9	6.0	6.0
communi-cation	803	758	3.5	3.4	135	127	20.2	20.2
recreation and culture	2058	1752	8.1	7.4	220	187	11.9	11.9
education	207	141	0.6	0.4	4	2	1.8	1.8
restaurants and hotels	2344	1972	8.7	8.1	266	224	12.8	12.8
other goods and services	2491	2175	9.5	9.0	195	171	8.5	8.5
durables	2671	2372	6.1	9.2	464	412	21.0	21.0
all	25330	23062	100.0	100.0	3320	2972	15.1	14.8

Table 1.3 gives a comparison of expenditures, shares and indirect taxes in the original budget dataset and in the imputed EUROMOD dataset. Looking to the shares reveals that overall the correspondence is very good, except for the case of durables, accounting for 6% of total expenditures in the budget dataset and 9% in the imputed set. The aggregate indirect tax shares are the same since aggregate tax rates are kept constant across the datasets. The difference in overall indirect tax rate is a consequence of the difference in population and the resulting difference in consumption behaviour.

Tables 1.4 to 1.6 show indirect tax incidence for equivalent disposable income deciles, household size and age group of the household head in both datasets. Differences are minor. In table 1.4, indirect tax shares are regressive for both datasets with respect to disposable income (also indicated by comparing the Gini of disposable income with the concentration index of disposable income minus indirect taxes), but progressive with respect to total expenditures. This is caused by a higher savings rate for higher deciles, as is depicted in table 1.7. Table 1.7 also reveals a divergence in savings rate, especially for the three lowest deciles. This is caused by the fact that the matching procedure uses disposable income as observed in the income survey itself, while the table is constructed using the simulated EUROMOD income under the baseline. The result suggests that this simulation might be less accurate for the lowest three deciles in that the disposable income is underestimated.

Table 1.4: Indirect tax payments, in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per decile of equivalized disposable income - Belgium

Equival. disposable income deciles	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	1619	1492	14.56	18.46	11.95	11.30
2	1975	1768	12.61	13.86	11.97	11.80
3	2239	2027	12.49	12.83	12.32	11.87
4	2699	2347	12.45	12.50	12.75	12.25
5	2951	2674	11.89	12.10	12.83	12.59
6	3483	3029	12.04	11.59	13.23	12.78
7	3835	3406	11.47	11.33	13.25	13.06
8	4182	3790	10.74	10.87	13.37	13.26
9	4463	4306	9.95	10.42	13.31	13.48
10	5763	5553	8.43	9.25	14.09	13.87
Mean	3320	2972	10.86	11.26	13.11	12.89
Gini disp. inc.	0.322	0.341				
CI post-indirect-tax income	0.330	0.349				

Table 1.5: Indirect tax payments, in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per household size - Belgium

Household size	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	1909	1799	10.79	11.52	12.40	12.25
2	3174	2905	11.25	11.46	13.14	12.99
3	3953	3693	10.84	11.22	13.32	13.21
4	4648	4242	10.77	10.88	13.45	13.16
5	4524	4390	9.91	11.03	12.83	12.77
> 5	4923	4448	10.46	11.09	13.18	12.01
Mean	3320	2972	10.86	11.26	13.11	12.89

Table 1.6: Indirect tax payments, in € and in % to disposable income and total expenditures, in budget and EUROMOD dataset, per agegroup of household head - Belgium

Agegroup	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
< 35	3475	3039	10.87	11.25	13.40	13.07
35-55	3737	3567	10.49	11.12	13.18	13.10
> 55	2714	2384	11.58	11.50	12.82	12.37
Mean	3320	2972	10.86	11.26	13.11	12.89

Table 1.7: Savings rate per decile of equivalized disposable income - Belgium

Deciles (Equival. disposable income)	Savings rate in % of disposable income		Savings + durables rate in % of disposable income	
	Budget survey	**EUROMOD income survey**	**Budget survey**	**EUROMOD income survey**
1	-21.82	-63.36	-12.86	-52.33
2	-5.35	-17.53	1.76	-9.51
3	-1.37	-8.07	3.43	0.47
4	2.39	-2.11	11.76	6.86
5	7.26	3.85	16.74	13.09
6	9.03	9.33	18.34	18.71
7	13.45	13.28	22.71	22.55
8	19.66	18.04	29.78	27.11
9	25.23	22.69	33.81	31.66
10	40.17	33.32	48.63	42.18
Mean	17.11	12.65	25.85	21.70
Gini of disp. inc.	0.322	0.341	0.322	0.341
CI of inc. after saving.	0.223	0.240	0.205	0.225

Table 1.8 and figures 1.1 to 1.4 give a sensitivity analysis of the results with respect to the matching method used. The parametric imputation seems to replicate the budget shares of the expenditure data very well, as does the grade correspondence method. The same is true for the indirect tax rates, with one exception: if one depicts indirect tax rate in function of disposable income per equivalent total expenditure decile, the estimation methods yield a regressive structure, while the original data and the distance methods yield a progressive tax structure.

Table 1.8: Average budget shares in source dataset and for 4 methods in target dataset - Belgium

Average Budget Shares	FOOD, NON-ALCOHOLIC BEVERAGES	ALCOHOLIC BEVERAGES	TOBACCO	CLOTHING AND FOOTWEAR	HOME FUELS AND ELECTRICITY	RENTS	HOUSEHOLD SERVICES	HEALTH
Source	16.5	1.8	1.1	5.5	5.2	5.6	5.0	6.3
Parametric	17.6	1.7	1.2	5.6	5.6	6.8	5.0	6.5
Kernel	19.0	2.1	0.3	5.6	6.0	1.4	5.8	7.1
Distance	16.3	1.7	1.2	5.4	5.9	6.5	4.8	6.6
Grade Corr.	16.0	1.9	1.1	5.3	5.3	6.9	5.3	6.2

Average Budget Shares	PRIVATE TRANSPORT	PUBLIC TRANSPORT	COMMUNI-CATION	RECREATION AND CULTURE	EDUCATION	RESTAURANTS AND HOTELS	OTHER GOODS AND SERVICES	DURABLES
Source	10.5	0.6	3.2	8.1	0.8	9.3	9.8	10.5
Parametric	9.6	0.7	3.3	7.6	0.6	8.6	9.4	10.3
Kernel	11.3	0.1	3.6	8.2	0.1	9.0	10.0	10.4
Distance	10.7	0.6	3.2	7.8	0.4	9.7	9.6	9.5
Grade Corr.	10.2	0.7	3.3	8.2	0.7	9.0	9.7	10.0

Figure 1.1: Indirect tax rate in function of disposable income, per equivalent disposable income decile - Belgium

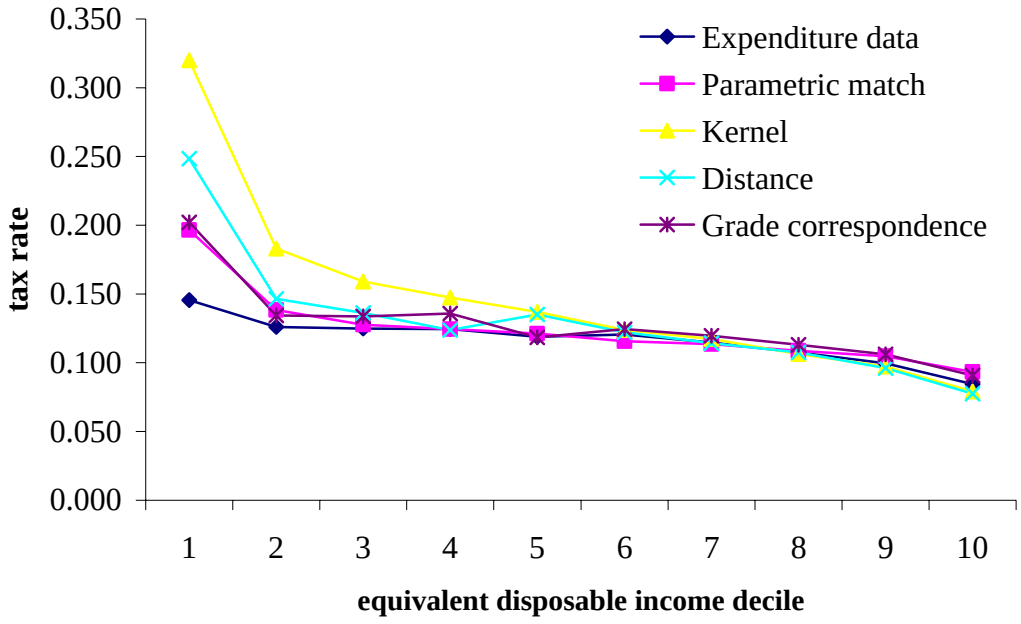


Figure 1.2: Indirect tax rate in function of total expenditure, per equivalent disposable income decile - Belgium

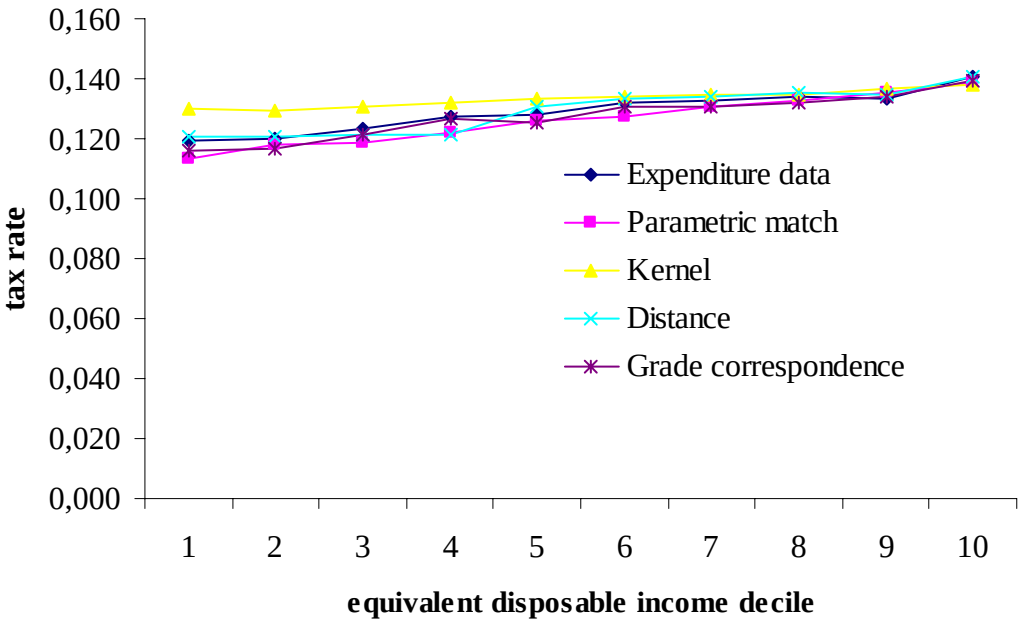


Figure 1.3: Indirect tax rate in function of disposable income, per equivalent total expenditure decile - Belgium

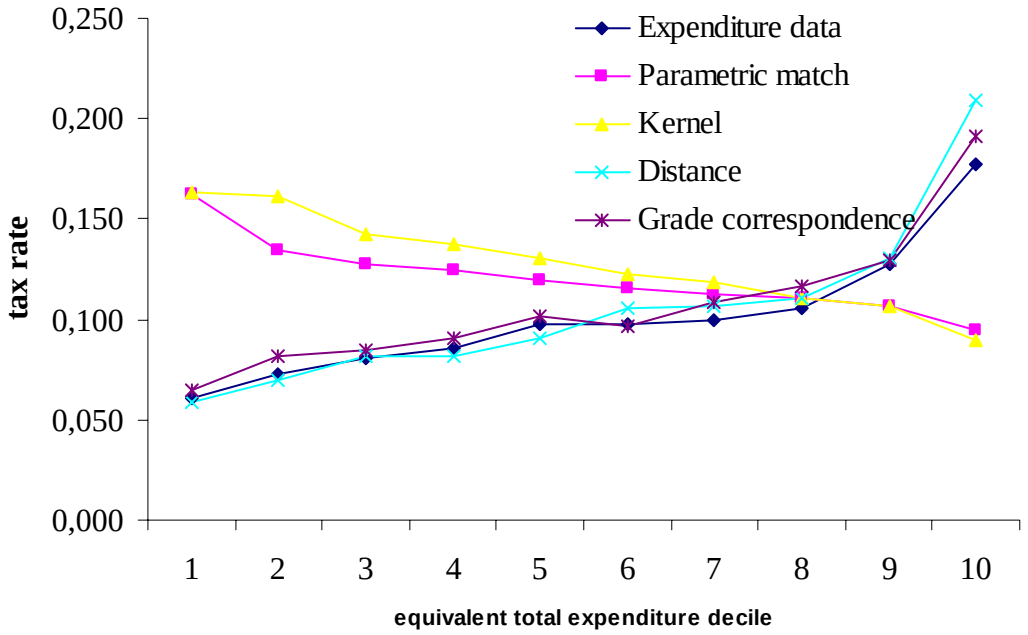


Figure 1.4: Indirect tax rate in function of total expenditure, per equivalent total expenditure decile - Belgium

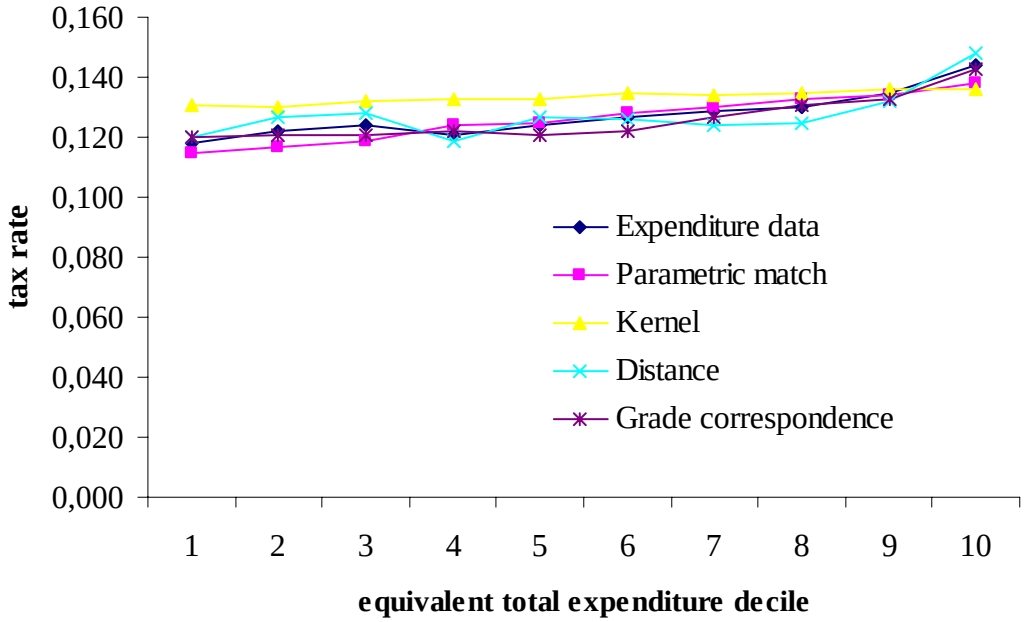


Table 1.9: Tax incidence per decile of equivalized disposable income - Belgium

Deciles (Equivalized disposable income)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	135	-7272	28	-7109	2033	-5076
2	503	-11101	524	-10074	1928	-8146
3	959	-12712	1206	-10547	2227	-8320
4	1805	-11836	2543	-7488	2583	-4905
5	2671	-11746	4371	-4703	2933	-1770
6	3605	-10631	6394	-632	3211	2579
7	4772	-8270	8743	5244	3618	8862
8	6152	-7552	12186	10786	3981	14767
9	7477	-6205	15773	17044	4504	21548
10	11565	-6356	28796	34006	5511	39516
Mean	3943	-9368	8002	2576	3246	5822
CI of income before tax	0.572	0.579	0.372	0.572	0.319	0.572
CI of income after tax.	0.578	0.329	0.315	0.280	0.329	0.290
RS Index	-0.005	0.250	0.057	0.292	-0.010	0.283

Tables 1.9 and 1.10 give a picture of the tax structure in EUROMOD. The importance of the indirect taxes is clear: the order of magnitude is the same as that of the social insurance contributions of the employees, but more pronounced in the lower deciles. Also noteworthy is the effect on inequality. In each column representing a tax, the concentration index of income before and after the tax is depicted, and the difference, the Reynold-Smolensky index, is a measure for the gain in progressivity. Columns 1, 2, 3 and 5 can be considered to show the effects of the consequent introduction of an extra tax. The CI of income after a tax is introduced and before and other tax is introduced differs in this table, because in each column, income before the tax is used as an ordering variable. The difference between the two CI's hence gives an idea of the amount of reordering due to the tax. Looking at equivalent disposable income deciles, indirect taxes decrease the progressivity of the total tax system by around 4% (0.01 on a total of 0.28). For equivalent total expenditure deciles, the effect on inequality is slightly negative.

Table 1.10: Tax incidence per decile of equivalized nondurable expenditures - Belgium

Deciles (Equivalized nondurable expenditures)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	396	-7660	541	-6723	1257	-5465
2	787	-10956	1145	-9024	1778	-7245
3	1528	-11771	2363	-7880	2253	-5627
4	2262	-12250	3871	-6117	2592	-3526
5	3355	-10245	5524	-1366	3058	1692
6	4133	-9150	7420	2403	3321	5724
7	4987	-8435	9486	6038	3702	9741
8	5668	-8068	11745	9344	4005	13349
9	6955	-7933	15149	14170	4383	18553
10	9846	-7104	23870	26613	6362	32975
Mean	3943	-9368	8002	2576	3246	5822
CI of income before tax	0.546	0.551	0.330	0.546	0.274	0.546
CI of income after tax.	0.550	0.288	0.264	0.222	0.271	0.218
RS Index	-0.004	0.263	0.066	0.324	0.002	0.328

Table 1.11: PIT and indirect taxes as percentage of gross taxable income - Belgium

Deciles (Equivalent disp. inc.)	PIT (% of gross taxable income)	Indirect tax (% of gross taxable income)	Total tax (% of gross taxable income)
1	0.3	23.5	23.8
2	3.6	13.2	16.7
3	6.7	12.4	19.0
4	11.3	11.5	22.7
5	15.5	10.4	26.0
6	19.1	9.6	28.7
7	21.8	9.0	30.8
8	25.2	8.2	33.4
9	27.5	7.9	35.3
10	33.4	6.4	39.8
Mean	22.5	9.1	31.6
Gini of income before tax	0.372	0.319	0.372
CI of tax	0.570	0.244	0.473
CI of income after tax	0.315	0.329	0.326
Kakwani	0.197	-0.075	0.100
RS Index	0.057	-0.010	0.046

Table 1.11 shows the personal income tax, the indirect taxes and total taxes as a percentage of gross taxable income. This clearly illustrates the fact that not only indirect taxes account for a large part of total taxes, but the effect is especially pronounced in the lower deciles. The regressive effect is shown by the negative values of the RS and the Kakwani indices. The conclusion is that indirect taxes play an important role both in the total tax structure and in the distributional consequences of the tax system. Finally, table 1.12 shows that the effect of indirect taxes on inequality is rather insensitive to the matching method used.

Table 1.12: Sensitivity of RS index to method - Belgium

Method	RS Indirect taxes	RS Total taxes
Parametric	-0.010	0.283
Kernel	-0.016	0.278
Distance	-0.011	0.283
Grade Corr.	-0.008	0.285

2. Hungary

For Hungary, the expenditure data of the Household Budget Survey of 2005 are matched to the observation of the EU-SILC 2005. Both surveys were taken in the year 2005. The 2005 direct and indirect tax systems are used.

Table 2.1 again shows the regression coefficients for the first subgroup. In comparison with the Belgian case, alcohol here is a luxury good while clothing becomes a necessary good. Food is a necessary good, and the decrease in the budget share becomes more pronounced with rising total nondurable expenditures.

Table 2.2 gives the coefficient estimates of food for all the subgroups. The values range from -0,065 for households that spend money on tobacco, rent, education and public transport to -0,174 for households that only spend money on tobacco but not on the other three aggregates. The conclusion is identical to the Belgian case.

Table 2.1: Regression coefficients for parametric match -Hungary

Category	ma	se	em	ue	pe	he	se	ag	ag2	np	na	nc	lte	lte2	co
food, non-alcoh	0.014	-0.015	0.016	-0.002	-0.007	-0.009	-0.007	0.001	0.000	0.021	-0.003	0.012	-0.080	-0.001	0.964
alcoh beverages	0.011	-0.007	-0.007	-0.005	-0.006	0.002	0.002	0.001	0.000	-0.005	0.002	0.004	0.010	0.000	-0.054
cloth, footwear	-0.004	0.000	0.003	-0.007	0.002	0.007	0.000	-0.002	0.000	0.002	0.004	0.003	-0.040	0.003	0.223
home fuel electr.	-0.011	0.009	0.001	0.020	0.009	-0.014	-0.006	0.002	0.000	0.009	0.003	-0.005	-0.088	0.001	0.798
househ services	-0.021	-0.026	-0.008	-0.001	-0.005	0.000	0.009	0.000	0.000	-0.011	-0.001	0.004	0.232	-0.013	-0.894
health	-0.007	-0.012	-0.008	-0.029	-0.006	-0.002	0.006	-0.002	0.000	0.012	-0.013	-0.015	0.000	0.000	0.091
private transport	0.033	0.016	0.000	0.003	-0.007	0.011	0.005	0.000	0.000	-0.013	0.010	-0.004	0.071	-0.001	-0.438
communication	-0.009	0.022	0.007	0.008	0.020	0.016	0.006	-0.001	0.000	-0.002	0.009	-0.003	0.191	-0.011	-0.725
recreat., culture	-0.005	0.000	-0.002	-0.001	-0.003	0.018	0.017	-0.001	0.000	-0.009	-0.003	0.010	0.022	0.000	-0.084
restaur., hotels	0.004	0.015	0.005	0.015	0.010	0.020	0.004	-0.001	0.000	-0.016	0.002	0.009	-0.297	0.020	1.164
other	-0.013	0.007	0.006	-0.001	-0.006	0.002	0.001	0.000	0.000	-0.005	-0.002	0.001	-0.091	0.008	0.311

ma is a dummy for male, se for self-employed, em for employed, ue for unemployed, pe for retired, he for higher education, se for secondary education, ag for age, ag2 for age squared; np is household size, na the number of active persons, nc the number of children, lte the log of total nondurable expenditures and lte2 the square; co is the constant term

Table 2.2: Coefficients for log(totexp) per subgroup - Hungary

Smoker	Renter	Use Public Transport	Use education	Coefficient
No	No	No	No	-0.080
			Yes	-0.146
		Yes	No	-0.153
			Yes	-0.111
	Yes	No	No	-0.082
			Yes	-0.151
		Yes	No	-0.110
			Yes	-0.077
Yes	No	No	No	-0.174
			Yes	-0.165
		Yes	No	-0.112
			Yes	-0.114
	Yes	No	No	-0.147
			Yes	-0.158
		Yes	No	-0.084
			Yes	-0.065

Table 2.3: Average expenditures, expenditure shares and indirect tax payments and rates in budget and EUROMOD dataset - Hungary

Commodity	expenditures in €		expend. shares in %		indirect taxes in €		indir. tax rates in %	
	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey
food, non-alcoholic beverages	1813	1675	26.0	24.9	244	225	15.5	15.5
alcoholic beverages	82	36	1.1	0.6	32	14	64.3	64.3
tobacco	191	170	2.8	2.6	140	124	273.0	273.0
clothing and footwear	442	380	5.4	5.0	88	76	25.0	25.0
home fuels and electricity	831	844	12.8	13.1	108	110	15.0	15.0
rents	59	62	0.8	1.0	0	0	0.0	0.0
household services	666	685	9.0	9.9	115	118	20.9	20.9
health	245	323	3.8	4.8	13	17	5.5	5.5
private transport	590	325	6.4	4.1	260	144	79.0	79.0
public transport	185	148	2.3	2.0	37	30	25.0	25.0
communi-cation	460	437	5.9	6.2	92	87	24.9	24.9
recreation and culture	390	384	4.7	5.2	42	41	11.9	11.9
education	76	76	0.8	0.9	0	0	0.0	0.0
restaurants and hotels	246	153	2.4	1.8	30	19	14.0	14.0
other goods and services	471	466	5.6	6.2	87	86	22.8	22.8
durables	656	658	6.5	8.0	128	128	24.1	24.1
home prod.	243	235	3.6	3.5	0	0	0.0	0.0
all	7645	7056	100.0	100.0	1415	1219	22.7	20.9

Table 2.3 comparing expenditures, shares and indirect taxes in the original budget dataset and in the imputed EUROMOD dataset shows that the matching results are reasonable, though there are some important deviations for durables (6.5 vs. 8%) and private transport (6.4 vs. 4.1%).

Indirect tax incidence for equivalent disposable income deciles, household size and age group of the household head in both datasets are synthesised in tables 2.4 to 2.6. The results underline again that the matching result is reasonable. Table 2.4 shows the same regressive indirect tax structure respective to disposable income in both datasets, as in the Belgian case, but with respect to total expenditures, a difference emerges: the budget survey exhibits a progressive structure, while the imputed values show more or less a proportional tax.

Table 2.4: Indirect tax payments, in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per decile of equivalized disposable income - Hungary

Eq. disposable income deciles	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	765	587	23.50	25.76	17.69	17.13
2	802	695	17.51	19.27	17.17	16.86
3	983	762	17.68	17.51	17.94	16.86
4	1035	821	16.22	16.49	17.50	16.75
5	1206	907	16.48	15.85	17.89	16.94
6	1376	1026	16.34	15.27	18.39	16.99
7	1542	1153	16.38	15.11	18.88	17.19
8	1683	1319	15.78	14.87	18.94	17.38
9	2017	1551	15.86	14.51	19.17	17.60
10	2751	2191	14.33	13.10	19.25	17.98
Mean	1415	1219	16.18	15.33	18.51	17.27
Gini disp. income	0.300	0.318				
CI post-indirect-tax income	0.310	0.334				

Table 2.5: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per household size - Hungary

Household size	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	603	681	16.78	18.01	16.80	17.33
2	1068	993	16.01	15.11	18.08	17.22
3	1468	1279	16.95	15.19	18.89	17.58
4	1660	1375	16.52	15.34	18.72	17.29
5	1803	1485	15.54	14.68	18.64	16.95
> 5	1682	1594	14.41	13.84	18.17	16.39
Mean	1415	1219	16.18	15.33	18.51	17.27

Table 2.6: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per agegroup of household head - Hungary

Agegroup	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
< 35	1377	1178	16.20	16.61	18.81	17.90
35-55	1636	1275	16.59	16.51	18.74	17.70
> 55	1062	898	15.19	14.11	17.76	16.61
Mean	1415	1219	16.18	15.33	18.51	17.27

Table 2.7: Savings rate per decile of equivalized disposable income - Hungary

Deciles (Equivalized disposable income)	Savings rate in % of disposable income		Savings + durables rate in % of disposable income	
	Budget survey	**EUROMOD income survey**	**Budget survey**	**EUROMOD income survey**
1	-32.849	-50.384	-26.448	-48.431
2	-2.030	-14.337	2.869	-10.515
3	1.403	-3.870	6.140	1.539
4	7.343	1.559	13.216	7.922
5	7.914	6.443	14.526	13.812
6	11.122	10.086	18.661	18.213
7	13.255	12.093	20.424	20.737
8	16.698	14.438	24.282	23.749
9	17.301	17.581	24.872	27.503
10	25.553	27.143	35.590	37.696
Mean	12.604	10.454	20.104	18.752
Gini of disp. inc.	0.300	0.318	0.300	0.318
CI of inc. after saving.	0.230	0.229	0.215	0.208

Table 2.8 and the figures 2.1 to 2.4 reveal, as in the Belgian case, that the estimated budget shares are generally insensitive to the matching method used and are overall successful in reproducing the distribution in the original expenditure data. The kernel method performs considerably weaker than the other methods. Private transport is the exception, where all methods other than the kernel method, perform badly. Home production is estimated badly by the grade correspondence method. Indirect tax rates are also reproduced rather accurately. The estimation methods again show a regressive structure when plotting tax shares in terms of disposable incomes against equivalent expenditure deciles, whereas the original data show a progressive structure. The effect is less pronounced than in the Belgian case.

Table 2.8: Average budget shares in source dataset and for 4 methods in target dataset - Hungary

Average Budget Shares	FOOD, NON-ALCOHOLIC BEVERAGES	ALCOHOLIC BEVERAGES	TOBACCO	CLOTHING AND FOOTWEAR	HOME FUELS AND ELECTRICITY	RENTS	HOUSEHOLD SERVICES	HEALTH
Source	23.7	1.1	2.5	5.8	10.9	0.8	8.7	3.2
Parametric	23.3	0.5	2.4	5.3	11.7	0.9	9.5	4.5
Kernel	24.6	0.8	0.3	4.9	13.0	0.1	9.8	5.3
Distance	24.2	1.0	3.4	6.3	11.9	0.5	8.9	5.0
Grade Corr.	22.2	1.0	2.1	5.6	11.0	1.1	9.6	3.9

Average Budget Shares	PRIVATE TRANSPORT	PUBLIC TRANSPORT	COMMUNI-CATION	RECREATION AND CULTURE	EDUCATION	RESTAURANTS AND HOTELS	OTHER GOODS AND SERVICES	DURABLES
Source	7.7	2.4	6.0	5.1	1.0	3.2	6.2	8.6
Parametric	4.5	2.1	6.1	5.3	1.1	2.1	6.5	9.2
Kernel	7.4	0.8	6.0	4.8	0.6	2.7	5.8	8.9
Distance	5.1	2.0	5.6	5.3	1.1	3.1	6.0	7.3
Grade Corr.	6.3	2.3	6.4	5.6	1.0	4.1	6.8	9.0

Average Budget Shares	HOME PRODUCTION
Source	3.2
Parametric	3.3
Kernel	4.2
Distance	3.4
Grade Corr.	1.9

Figure 2.1: Indirect tax rate in function of disposable income, per equivalent disposable income decile - Hungary

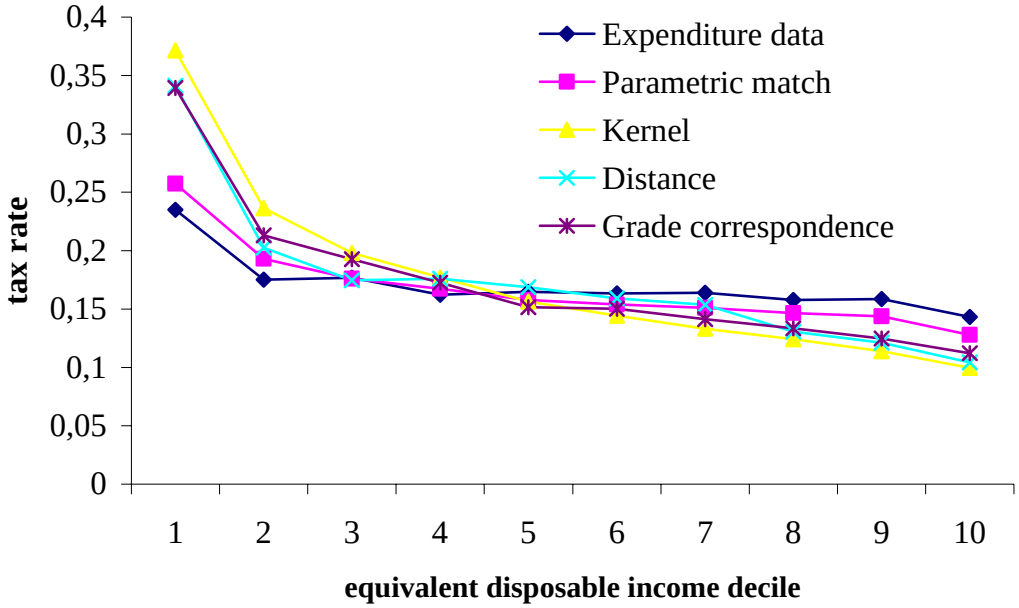


Figure 2.2: Indirect tax rate in function of total expenditure, per equivalent disposable income decile - Hungary

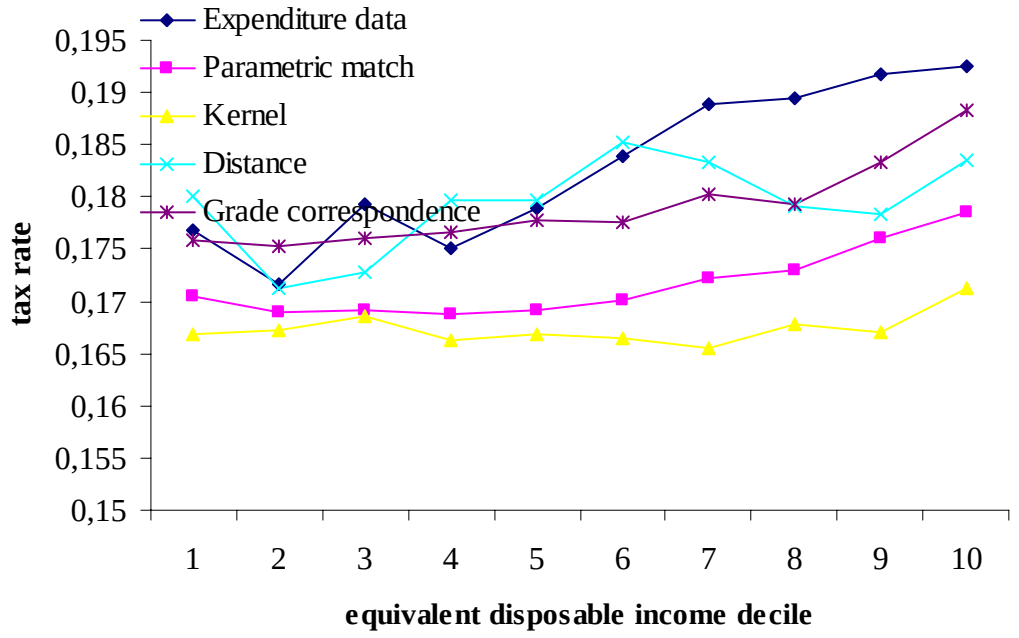


Figure 2.3: Indirect tax rate in function of disposable income, per equivalent total expenditure decile - Hungary

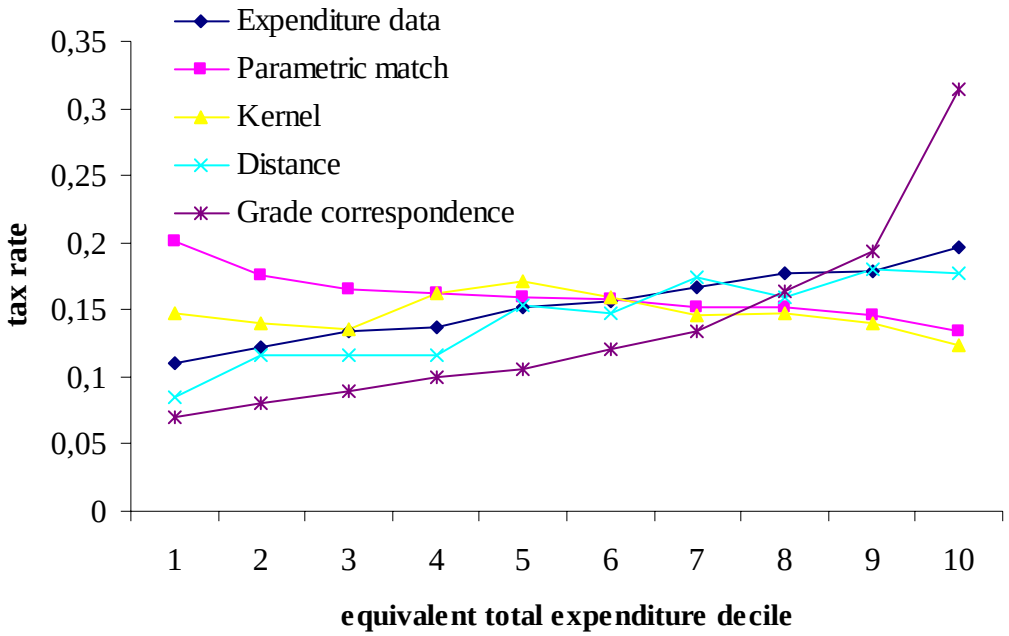
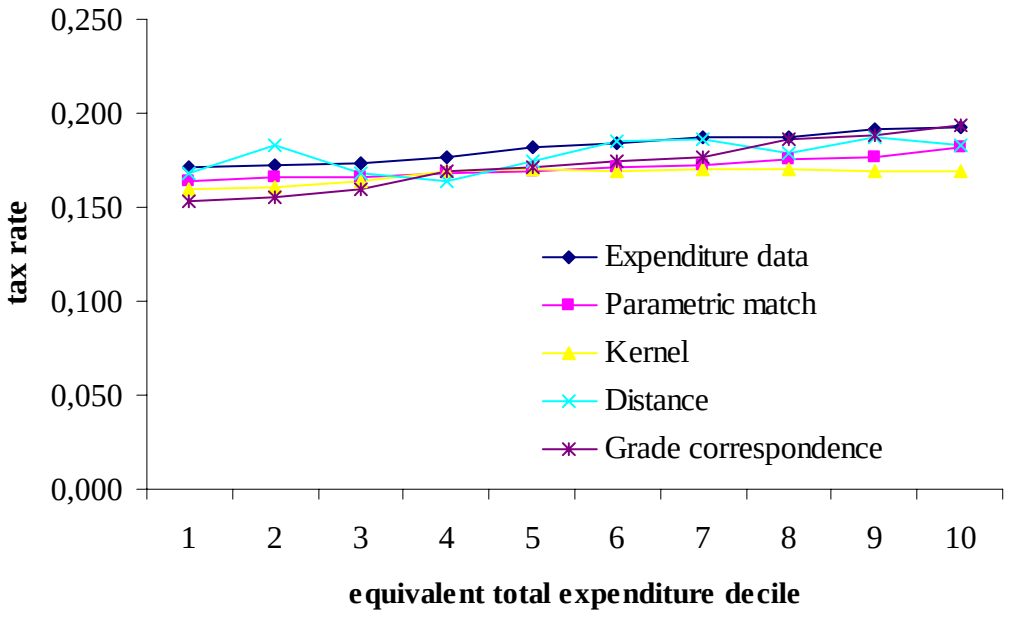


Figure 2.4: Indirect tax rate in function of total expenditure, per equivalent total expenditure decile - Hungary



Tables 2.9 to 2.11 show the EUROMOD baseline tax system extended with the indirect taxes. In the case of Hungary, the indirect tax system is of the same magnitude as the personal income tax. The effect is less regressive, however, than in the Belgian case for the equivalised disposable income deciles, so that the associated loss in progressivity due to indirect taxation amounts to about 3%. Relative to equivalised total expenditure deciles, the effect is again slightly progressive. Table 2.11 stresses the fact that indirect taxes are very important for the lowest deciles, whereas the personal income tax dominates in the higher deciles. The sensitivity table 2.12 supplies some evidence that the parametric method may underestimate the regressive effect of indirect taxation.

Table 2.9: Tax incidence per decile of equivalized disposable income - Hungary

Deciles (Equivalized disposable income)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	106	-1454	239	-1109	583	-526
2	230	-1830	159	-1441	699	-742
3	296	-2332	212	-1824	774	-1050
4	356	-2563	312	-1894	827	-1067
5	391	-3019	307	-2321	890	-1430
6	519	-3127	416	-2192	1003	-1189
7	662	-3113	739	-1712	1106	-606
8	900	-3304	1169	-1234	1281	47
9	1203	-3350	1838	-309	1494	1186
10	2307	-3732	6037	4612	2111	6723
Mean	691	-2754	1147	-916	1070	154
CI of income before tax	0.619	0.619	0.394	0.619	0.342	0.619
CI of income after tax.	0.619	0.342	0.338	0.272	0.358	0.280
RS Index	0.000	0.277	0.056	0.347	-0.015	0.339

Table 2.10: Tax incidence per decile of equivalized nondurable expenditures - Hungary

Deciles (Equivalized nondurable expenditures)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	100	-2055	145	-1810	512	-1298
2	166	-2605	104	-2335	647	-1688
3	225	-2869	135	-2508	732	-1777
4	334	-2837	250	-2253	839	-1414
5	421	-2665	341	-1903	914	-989
6	534	-2882	452	-1896	1012	-884
7	730	-2830	723	-1377	1171	-206
8	897	-2875	1091	-886	1285	399
9	1182	-2871	1942	253	1456	1709
10	2125	-3044	5663	4744	2009	6753
Mean	691	-2754	1147	-916	1070	154
CI of income before tax	0.633	0.636	0.331	0.633	0.257	0.633
CI of income after tax.	0.635	0.274	0.251	0.186	0.254	0.180
RS Index	-0.002	0.362	0.080	0.448	0.003	0.453

Table 2.11: PIT and indirect taxes as percentage of gross taxable income - Hungary

Deciles (Equivalent disp. inc.)	PIT (% of gross taxable income)	Indirect tax (% of gross taxable income)	Total tax (% of gross taxable income)
1	7.9	19.3	27.2
2	3.9	17.0	20.8
3	4.3	15.7	20.0
4	5.6	14.9	20.5
5	5.0	14.6	19.6
6	5.9	14.2	20.1
7	9.0	13.5	22.5
8	11.7	12.8	24.6
9	15.0	12.2	27.2
10	26.1	9.1	35.2
Mean	13.7	12.8	26.4
Gini of income before tax	0.394	0.342	0.394
CI of tax	0.746	0.253	0.509
CI of income after tax	0.338	0.358	0.353
Kakwani	0.351	-0.089	0.115
RS Index	0.056	-0.015	0.041

Table 2.12: Sensitivity of RS index to method - Hungary

Method	RS Indirect taxes	RS Total taxes
Parametric	-0.015	0.339
Kernel	-0.028	0.331
Distance	-0.022	0.334
Grade Corr.	-0.031	0.326

3. Ireland

For Ireland, the expenditure data of the Household Budget Survey of 1999/2000 are matched to the observation of the Living in Ireland survey 2000. The 2001 direct and indirect tax systems are used.

Table 3.1 again shows the regression coefficients for the first subgroup. The positive coefficient for food with respect to the log of consumption appears unusual. However the situation is reversed in the case for the log of consumption squared. This corresponds to the result from the UK data. Analysing by subgroup indicates the essential nature of food for most sub-groups. However that is not indicated by the coefficients for the age of household head and household size.

Table 3.2 gives the coefficient estimates of food for all the subgroups. The values range from -0,078 for households that spend money on education and not on smoking, renting or public transport to 0,090 for households that spend money on renting but not on the other three aggregates. This indicates that households of the latter type have little scope for reducing their budget share for food in their current circumstances. Households of the former type are more likely to reduce their budget share for food in response to rising total expenditure. The differing budget constraints faced by different households is likely to be crucial to this result.

Table 3.1: Regression coefficients for parametric match - Ireland

Category	ma	se	em	ue	pe	he	se	ag	ag2	np	na	nc	lc	lc2	co
food, non-alcoh	-0.001	-0.007	-0.038	-0.015	-0.031	-0.041	-0.029	0.032	-0.003	0.059	-0.014	-0.026	0.030	-0.016	0.391
alcoh beverages	-0.034	-0.015	-0.006	-0.002	0.010	-0.006	0.000	-0.002	0.000	-0.009	0.006	0.002	0.026	-0.002	0.015
cloth, footwear	0.018	-0.003	0.005	0.019	-0.001	-0.028	-0.013	-0.020	0.002	0.003	-0.012	-0.002	-0.009	0.006	0.008
home fuel electr.	0.007	-0.004	-0.012	0.011	-0.013	-0.002	-0.007	0.001	0.000	0.002	0.000	-0.001	-0.138	0.008	0.565
househ services	0.011	-0.003	-0.001	0.006	-0.002	-0.020	-0.011	-0.023	0.002	-0.002	-0.010	0.000	0.018	0.000	0.066
health	-0.001	-0.007	-0.010	0.001	-0.005	-0.001	0.007	-0.012	0.002	-0.004	0.003	0.003	-0.001	0.003	-0.015
private transport	-0.010	0.000	0.008	-0.005	0.007	-0.005	0.000	0.016	-0.002	0.007	0.009	-0.010	0.151	-0.014	-0.382
communication	0.008	-0.002	-0.003	-0.003	-0.003	0.010	0.007	0.014	-0.002	0.006	-0.003	-0.008	-0.017	0.000	0.093
recreat., culture	-0.002	-0.007	-0.001	0.000	0.003	0.007	0.002	0.007	-0.001	0.000	-0.001	0.002	-0.012	0.001	0.078
restaur., hotels	-0.011	0.000	0.007	-0.007	0.007	0.014	0.004	-0.021	0.002	-0.012	0.008	0.003	0.078	-0.006	-0.122
other	0.016	0.048	0.050	-0.006	0.028	0.071	0.040	0.006	0.000	-0.049	0.013	0.037	-0.128	0.020	0.303

ma is a dummy for male, se for self-employed, em for employed, ue for unemployed, pe for retired, he for higher education, se for secondary education, ag for age, ag2 for age squared; np is household size, na the number of active persons, nc the number of children, lte the log of total nondurable expenditures and lte2 the square; co is the constant term

Table 3.2: Coefficients for log(totexp) per subgroup - Ireland

Smoker	Renter	Use Public Transport	Use education	Coefficient
No	No	No	No	0.030
			Yes	-0.014
		Yes	No	-0.041
			Yes	-0.078
	Yes	No	No	0.071
			Yes	-0.002
		Yes	No	-0.012
			Yes	-0.074
Yes	No	No	No	0.024
			Yes	-0.024
		Yes	No	-0.035
			Yes	-0.064
	Yes	No	No	0.090
			Yes	0.024
		Yes	No	0.018
			Yes	-0.028

Table 3.3: Average expenditures, expenditure shares and indirect tax payments and rates in budget and EUROMOD dataset - Ireland

Commodity	expenditures in €		expend. shares in %		indirect taxes in €		indir. tax rates in %	
	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey
food, non-alcoholic beverages	4620	8215	20.6	26.8	185	329	4.2	4.2
alcoholic beverages	1663	1513	5.4	4.5	349	318	26.6	26.6
tobacco	644	1098	2.9	3.4	483	823	300.0	300.0
clothing and footwear	1848	1493	5.2	4.3	259	209	16.3	16.3
home fuels and electricity	1128	1987	5.8	7.2	124	219	12.4	12.4
rents	681	913	3.0	3.0	0	0	0.0	0.0
household services	1230	1365	4.4	4.5	172	191	16.3	16.3
health	582	391	1.8	1.2	6	4	1.0	1.0
private transport	1394	1808	4.4	5.3	600	777	75.4	75.4
public transport	513	534	1.5	1.5	0	0	0.0	0.0
communi-cation	739	1223	3.0	4.0	118	196	19.0	19.0
recreation and culture	1931	2171	6.5	6.7	212	239	12.4	12.4
education	405	368	1.0	1.0	8	7	2.0	2.0
restaurants and hotels	1695	1652	5.1	4.8	186	182	12.4	12.4
other goods and services	4869	3917	14.8	12.2	146	117	3.1	3.1
durables	5306	3384	14.6	10.0	690	440	14.9	14.9
all	29248	32032	100.0	100.0	3539	4050	13.8	14.5

Table 3.3 gives a comparison of expenditures, shares and indirect taxes in the original budget dataset and in the imputed EUROMOD dataset. Looking to the shares reveals that overall the correspondence is good except for the case of food, accounting for 20.6% of total expenditures in the budget dataset and 26.8% in the imputed set. The aggregate indirect tax shares are the same since aggregate tax rates are kept constant across the datasets. The difference in overall indirect tax rate is a consequence of the difference in population and the resulting difference in consumption behaviour.

Tables 3.4 to 3.6 show indirect tax incidence for equivalent disposable income deciles, household size and age group of the household head in both datasets. Differences are minor with the exception of the bottom two deciles of the distribution. This could well be attributed to the calibration of state transfers to official statistics. This means that households in the bottom one fifth of the distribution appear even poorer in the case of the Euromod survey than is the case in the budget survey.

In table 3.4, indirect tax shares are regressive for both datasets with respect to disposable income (also indicated by comparing the Gini of disposable income with the concentration index of disposable income minus indirect taxes), but progressive with respect to total expenditures. This corresponds with Belgium and Hungary. The differing result between total expenditure and disposable income is primarily due to a higher savings rate for higher deciles, as is depicted in table 3.7. However it may also be true that house purchases and new goods not yet included in the household budget survey are responsible for skewing the distribution of savings rates. Average disposable income is higher in the case of the income survey and this leads one to be suspicious about the reliability of the disposable income variable in the budget survey. Savings rates are higher than depicted here if one assumes that the budget survey underestimates disposable income on average.

Table 3.4: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per decile of equivalized disposable income - Ireland

Eq. disposable income deciles	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	1351	1758	20.22	24.80	12.51	11.81
2	1510	2335	15.89	19.50	12.68	11.66
3	2309	2457	16.22	16.60	12.83	11.96
4	2864	2768	15.25	15.15	12.99	12.11
5	3346	3801	14.51	15.47	12.59	12.64
6	3921	4131	13.92	14.24	12.38	12.81
7	4288	4299	12.83	13.08	12.33	12.71
8	4724	4801	12.17	12.39	12.08	12.97
9	5311	4941	11.17	10.95	11.73	12.93
10	5768	5094	8.75	7.79	11.01	12.67
Mean	3539	4050	12.37	13.23	12.10	12.65
Gini disp. inc.	0.373	0.331				
CI post-indirect-tax income	0.385	0.351				

Table 3.5: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per household size - Ireland

Household size	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	1354	1246	10.83	11.84	11.44	11.74
2	2694	2377	11.67	11.62	12.07	11.89
3	3960	3551	12.50	12.34	12.27	12.33
4	4719	4408	12.45	13.01	11.98	12.78
5	4907	4939	12.60	13.27	11.94	12.77
> 5	5675	5933	13.91	14.29	12.78	12.92
Mean	3539	4050	12.37	13.23	12.10	12.65

Table 3.6: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per agegroup of household head - Ireland

Agegroup	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
< 30	4073	3851	11.95	13.59	11.25	12.81
30-50	5360	5410	12.49	13.19	12.07	12.62
> 50	3303	3214	12.15	11.97	12.26	12.24
Mean	4494	5142	12.37	13.23	12.1	12.65

Table 3.7: Savings rate per decile of equivalized disposable income - Ireland

Deciles (Equivalized disposable income)	Savings rate in % of disposable income		Savings + durables rate in % of disposable income	
	Budget survey	EUROMOD income survey	Budget survey	EUROMOD income survey
1	-61.61	-109.93	-38.98	-94.77
2	-25.36	-67.33	-7.88	-54.51
3	-26.44	-38.83	-6.77	-25.30
4	-17.44	-25.03	1.41	-12.98
5	-15.24	-22.33	5.53	-9.92
6	-12.43	-11.16	9.38	0.66
7	-4.07	-2.95	15.43	7.78
8	-0.74	4.50	18.74	14.47
9	4.77	15.36	22.31	24.98
10	20.55	38.48	36.04	46.15
Mean	-2.24	-2.55	16.30	7.98
Gini of disp. inc.	0.37	0.33	0.37	0.33
CI of inc. after saving.	0.31	0.18	0.30	0.18

Table 3.8 give a sensitivity analysis of the results with respect to the matching method used. The observed rather than the simulated disposable income was used to perform this analysis. The parametric imputation seems to replicate the budget shares of the expenditure data very well, as does the distance method.

Table 3.8: Average budget shares in source dataset and for 4 methods in target dataset - Ireland

Average Budget Shares	FOOD, NON-ALCOHOLIC BEVERAGES	ALCOHOLIC BEVERAGES	TOBACCO	CLOTHING AND FOOTWEAR	HOME FUELS AND ELECTRICITY	RENTS	HOUSEHOLD SERVICES	HEALTH
Source	15.8	5.7	2.2	6.3	3.9	2.3	4.2	2.0
Parametric	16.6	6.2	2.7	5.8	4.0	3.0	4.2	1.9
Kernel	19.5	3.8	0.5	4.9	5.3	0.3	5.0	2.7
Distance	17.3	7.1	3.0	6.1	4.5	5.1	4.0	3.0
Grade Corr.	12.8	6.9	2.4	5.6	2.9	3.4	3.9	1.6

Average Budget Shares	PRIVATE TRANSPORT	PUBLIC TRANSPORT	COMMUNI-CATION	RECREATION AND CULTURE	EDUCATION	RESTAURANTS AND HOTELS	OTHER GOODS AND SERVICES	DURABLES
Source	4.8	1.8	2.5	6.6	1.4	5.8	16.6	18.1
Parametric	5.4	1.9	2.8	6.5	1.0	6.3	15.0	16.8
Kernel	6.4	0.3	3.0	6.3	0.2	5.4	19.1	17.3
Distance	5.1	2.1	2.8	7.8	0.8	6.0	12.5	12.7
Grade Corr.	5.2	1.7	2.3	7.6	2.0	6.7	18.4	16.6

Table 3.9: Tax incidence per decile of equivalized disposable income - Ireland

Deciles (Equivalized disposable income)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	20	-6557	232	-6303	1995	-4308
2	217	-8078	1296	-6565	2820	-3744
3	552	-6463	3301	-2609	3190	580
4	568	-8016	3536	-3912	2719	-1195
5	1157	-4268	6822	3711	4031	7743
6	1581	-4417	9132	6295	4786	11081
7	2060	-3744	12992	11307	5399	16706
8	2608	-2806	16362	16164	5674	21838
9	3179	-2042	21259	22396	5633	28028
10	4067	-1465	32039	34641	5715	40356
Mean	1580	-4798	10612	7394	4144	11538
CI of income before tax	0.503	0.503	0.414	0.503	0.375	0.503
CI of income after tax.	0.503	0.408	0.371	0.362	0.393	0.380
RS Index	0.000	0.095	0.043	0.142	-0.019	0.123

Tables 3.9 and 3.10 give a picture of the tax structure in EUROMOD. Indirect taxation appears to be very important as it more than doubles the social insurance contributions for employees and the gap between both instruments is greatest in the bottom two deciles. The Reynold-Smolensky index shows that the indirect taxes decrease the progressivity of the total tax system by around 5% (0.019 on a total of 0.375) when deciles of disposable income are employed. The result appears greater in the case of total non-durable expenditures. Here the decline in progressivity is 11% (0.03 on a total of 0.28). Income taxes increase progressivity to an even greater degree regardless of whether one uses deciles of total expenditure or disposable income.

Table 3.10: Tax incidence per decile of equivalized nondurable expenditures - Ireland

Deciles (Equivalized nondurable expenditures)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	10	-7181	235	-6936	683	-6253
2	157	-6739	1174	-5407	1623	-3785
3	555	-5415	3438	-1422	2323	901
4	793	-5119	5135	809	3100	3909
5	1108	-3166	6720	4662	3290	7952
6	1573	-3246	9883	8211	3807	12018
7	1656	-1976	11279	10958	3902	14860
8	1742	-1748	12275	12269	4211	16480
9	2241	-1946	15015	15310	4776	20086
10	2751	-920	19361	21192	5321	26513
Mean	1244	-3779	8358	5823	3264	9087
CI of income before tax	0.409	0.406	0.327	0.409	0.280	0.409
CI of income after tax.	0.406	0.323	0.267	0.258	0.277	0.256
RS Index	0.003	0.083	0.061	0.151	0.003	0.153

Table 3.11: PIT and indirect taxes as percentage of gross taxable income - Ireland

Deciles (Equivalent disp. inc.)	PIT (% of gross taxable income)	Indirect tax (% of gross taxable income)	Total tax (% of gross taxable income)
1	3.0	25.7	28.6
2	8.5	18.6	27.1
3	15.7	15.2	30.9
4	15.6	12.0	27.5
5	21.1	12.5	33.6
6	22.1	11.6	33.6
7	24.6	10.2	34.8
8	27.0	9.4	36.4
9	28.9	7.7	36.6
10	30.3	5.4	35.7
Mean	24.7	9.7	34.4
Gini of income before tax	41.4	37.5	41.4
CI of tax	54.6	24.8	46.0
CI of income after tax	37.1	39.3	39.1
Kakwani	13.1	-12.7	4.6
RS Index	4.3	-1.9	2.4

Table 3.11 shows the personal income tax, the indirect taxes and total taxes as a percentage of gross taxable income. Income taxes account for more of total taxation than indirect taxation. The regressive effect of indirect taxation is shown by the negative values of the RS and the Kakwani indices. Income taxation appears to be highly progressive and outweighs the regressiveness of the indirect taxation. Finally, table 3.12 shows that the effect of indirect taxes on inequality is rather insensitive to the matching method used.

Table 3.12: Sensitivity of RS index to method - Ireland

Method	RS Indirect taxes	RS Total taxes
Parametric	-0.019	0.123
Kernel	-0.024	0.018
Distance	-0.035	0.004
Grade Corr.	-0.017	0.025

4. UK

The expenditure data for the UK are taken from the FES 2003/2004, while the EUROMOD dataset is the FRS 2003/2004. Direct and indirect systems of 2003 are used in the analysis.

The regression coefficients in table 4.1 reveal some interesting features. Home fuels and electricity and other goods and services are necessary goods, as for the other countries, but also communication and household services belong to this group. On the other hand, food and private transport are luxury goods. The increase with total expenditures falls sharper then was the case in the other countries though. Analysed per subgroup, food varies from being a necessary good (-0.017) to a luxury good (0.196). This is the only country studied so far where even the sign of the coefficient depends on the subgroup investigated.

Table 4.1: Regression coefficients for parametric match - UK

Category	ma	nor	mid	east	west	scot	nir	se	em	ue	pe	ag	np	na	nc	lte	lte2	co
food, non-alcoh	-0.009	-0.002	0.012	0.010	0.007	0.028	0.012	-0.008	-0.016	-0.042	-0.025	0.003	0.050	-0.010	-0.021	0.154	-0.013	-0.259
alcoh beverages	0.002	0.003	0.003	-0.002	0.000	0.001	-0.012	0.005	0.006	0.017	0.005	0.001	-0.002	0.000	0.000	0.064	-0.003	-0.311
cloth, footwear	-0.016	0.015	0.008	0.008	0.013	0.014	0.032	-0.003	-0.005	-0.007	-0.003	0.000	-0.003	-0.001	0.011	0.091	-0.003	-0.472
home fuel electr.	-0.001	0.009	0.006	0.005	0.008	0.016	0.022	0.012	0.003	0.018	0.004	0.000	0.001	0.003	0.004	-0.229	0.010	1.293
househ services	-0.015	-0.003	-0.010	0.007	0.010	-0.038	-0.043	-0.009	0.007	-0.005	-0.006	-0.002	-0.004	-0.009	0.004	-0.160	0.009	0.847
health	-0.003	0.000	-0.003	0.000	-0.001	-0.005	-0.002	0.003	0.003	-0.001	0.002	0.001	-0.001	-0.001	0.000	0.015	-0.001	-0.085
private transport	0.039	-0.008	-0.005	-0.007	-0.011	0.000	0.022	0.005	0.016	-0.012	0.007	0.000	0.005	0.001	-0.022	0.217	-0.011	-0.886
communication	-0.004	-0.008	-0.005	-0.005	-0.005	-0.002	-0.005	0.010	0.000	-0.009	0.001	0.000	0.003	0.000	-0.004	-0.141	0.006	0.816
recreat., culture	0.003	-0.008	-0.004	-0.003	0.009	0.003	-0.024	-0.030	-0.017	-0.032	0.005	0.003	-0.008	0.003	0.007	0.029	-0.001	-0.120
restaur., hotels	0.019	0.016	0.011	-0.005	-0.005	-0.003	0.014	0.011	-0.010	0.059	0.005	-0.003	-0.027	0.012	0.006	0.084	-0.001	-0.445
other	-0.016	-0.013	-0.013	-0.008	-0.024	-0.014	-0.016	0.004	0.013	0.013	0.006	-0.001	-0.015	0.002	0.015	-0.126	0.008	0.631

ma is a dummy for male, nor-nir regional variables, se for self-employed, em for employed, ue for unemployed, pe for retired, ag for age, ag2 for age squared; np is household size, na the number of active persons, nc the number of children, lte the log of total nondurable expenditures and lte2 the square; co is the constant term

Table 4.2: Coefficients for log(totexp) per subgroup - UK

Smoker	Renter	Use Public Transport	Use education	Coefficient
No	No	No	No	0.154
			Yes	0.191
		Yes	No	0.025
			Yes	0.105
	Yes	No	No	0.072
			Yes	0.142
		Yes	No	-0.016
			Yes	0.053
Yes	No	No	No	0.151
			Yes	0.196
		Yes	No	0.015
			Yes	0.081
	Yes	No	No	0.081
			Yes	0.139
		Yes	No	-0.017
			Yes	0.045

Table 4.3: Average expenditures, expenditure shares and indirect tax payments and rates in budget and EUROMOD dataset - UK

Commodity	expenditures in €		expend. shares in %		indirect taxes in €		indir. tax rates in %	
	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey	Budget Survey	EURO-MOD income survey
food, non-alcoholic beverages	2617	2121	17.5	15.1	53	43	2.1	2.1
alcoholic beverages	325	296	1.9	1.9	154	140	89.7	89.7
tobacco	280	321	2.1	2.2	225	258	414.7	414.7
clothing and footwear	1183	916	5.5	5.2	146	113	14.1	14.1
home fuels and electricity	623	590	4.9	4.7	30	28	5.0	5.0
rents	691	543	4.5	4.1	0	0	0.0	0.0
household services	999	818	6.2	5.7	109	89	12.2	12.2
health	174	144	0.9	0.9	0	0	0.0	0.0
private transport	1814	1413	9.1	8.0	672	523	58.8	58.8
public transport	292	242	1.7	1.5	0	0	0.0	0.0
communi-cation	551	457	3.6	3.2	78	65	16.5	16.5
recreation and culture	1760	1472	9.6	9.0	210	176	13.6	13.6
education	529	248	1.2	1.1	0	0	0.0	0.0
restaurants and hotels	2105	1746	10.5	10.0	314	260	17.5	17.5
other goods and services	1408	1210	7.7	7.6	111	95	8.5	8.5
durables	3405	3212	12.9	19.8	494	466	17.0	17.0
all	18754	15748	100.0	100.0	2595	2257	16.1	16.7

Tables 4.3 to 4.7 show the same pattern as for the other countries: budget shares are reproduced fairly accurate with the notable exception of durables, where a difference of 7 percent point is rather elevated. Indirect taxes relative to disposable income exhibit a regressive structure, but relative to total expenditures a proportional (original expenditure data) to a progressive (EUROMOD imputation) tax schedule. Savings are too high throughout all deciles, possibly because simulated disposable income is too high with respect to the observed income (cf. supra).

Table 4.4: Indirect tax payments, in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per decile of equivalized disposable income - UK

Eq. disposable income deciles	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	1124	1096	22.42	19.09	13.43	13.92
2	1157	1252	13.53	13.44	13.10	13.67
3	1681	1408	14.04	12.31	13.78	13.73
4	1933	1637	12.58	11.73	13.73	14.01
5	2423	1859	12.94	11.17	13.97	14.20
6	2709	2210	12.01	10.91	14.24	14.40
7	2867	2531	10.91	10.46	14.11	14.64
8	3482	2876	11.14	9.91	14.38	14.69
9	3793	3269	10.06	9.09	13.87	14.61
10	4783	4439	7.47	7.13	13.36	14.37
Mean	2595	2257	10.75	9.87	13.84	14.33
Gini disp. income	0.394	0.380				
CI post-indirect-tax income	0.406	0.391				

Table 4.5: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per household size - UK

Household size	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
1	1291	1254	10.52	9.53	13.40	13.70
2	2641	2631	10.69	9.69	14.17	14.43
3	3227	3687	10.46	10.88	14.06	14.74
4	3815	4776	11.23	11.47	13.49	14.96
5	3880	5360	10.50	11.23	13.60	14.31
> 5	4223	6113	12.58	11.22	13.51	13.89
Mean	2595	2257	10.75	9.87	13.84	14.33

Table 4.6: Indirect tax payments in € and in % of disposable income and total expenditures, in budget and EUROMOD dataset, per agegroup of household head - UK

Agegroup	indirect taxes paid in €		Ratio of indirect taxes over disposable income in %		Ratio of indirect taxes over total expenditures in %	
	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey	Budget Survey	EUROMOD income survey
< 35	2703	2318	10.91	10.13	13.73	14.63
35-55	3263	2745	10.78	9.58	13.93	14.69
> 55	1848	1764	10.60	10.17	13.74	13.67
Mean	2595	2257	10.75	9.87	13.84	14.33

Table 4.7: Savings rate per decile of equivalized disposable income - UK

Deciles (Equivalized disposable income)	Savings rate in % of disposable income		Savings + durables rate in % of disposable income	
	Budget survey	EUROMOD income survey	Budget survey	EUROMOD income survey
1	-67.00	-37.11	-45.59	-15.83
2	-3.24	1.66	8.34	18.32
3	-1.89	10.37	12.33	26.10
4	8.34	16.29	23.45	31.89
5	7.35	21.34	24.63	36.68
6	15.61	24.21	30.97	39.55
7	22.64	28.57	35.66	43.53
8	22.52	32.52	38.59	46.86
9	27.45	37.80	41.07	51.41
10	44.07	50.40	56.06	61.72
Mean	22.28	31.13	36.39	45.18
Gini of disp. inc.	0.394	0.380	0.394	0.380
CI of inc. after saving.	0.288	0.267	0.273	0.255

Table 4.8 and figures 4.1 to 4.4 also show the same tendencies as with the other countries: budget shares are replicated very well and more or less insensitive to the method used. The same applies for the indirect tax rates, except for the ratio of indirect taxes and disposable income, viewed per equivalent total expenditure deciles. Here, the original data show a progressive tax structure, whereas the estimation methods yield a rather regressive structure.

Table 4.8: Average budget shares in source dataset and for 4 methods in target dataset - UK

Average Budget Shares	FOOD, NON-ALCOHOLIC BEVERAGES	ALCOHOLIC BEVERAGES	TOBACCO	CLOTHING AND FOOTWEAR	HOME FUELS AND ELECTRICITY	RENTS	HOUSEHOLD SERVICES	HEALTH
Source	14.0	1.7	1.5	6.3	3.3	3.7	5.3	0.9
Parametric	13.1	1.9	2.0	5.8	3.5	3.7	5.4	0.9
Kernel	17.7	1.6	0.6	5.2	5.2	0.8	6.2	0.8
Distance	14.2	1.7	1.3	6.1	3.4	3.5	5.3	1.1
Grade Corr.	14.0	1.7	1.5	6.5	3.4	3.2	5.3	1.0

Average Budget Shares	PRIVATE TRANSPORT	PUBLIC TRANSPORT	COMMUNI-CATION	RECREATION AND CULTURE	EDUCATION	RESTAURANTS AND HOTELS	OTHER GOODS AND SERVICES	DURABLES
Source	9.7	1.6	2.9	9.4	2.8	11.2	7.5	18.2
Parametric	9.1	1.7	2.9	9.3	1.7	11.3	7.6	20.1
Kernel	11.1	0.5	3.5	9.6	0.3	9.1	7.9	19.8
Distance	9.5	1.5	2.8	9.4	3.3	11.3	7.7	17.8
Grade Corr.	9.6	1.5	2.9	9.3	3.0	11.2	7.5	18.5

Figure 4.1: Indirect tax rate in function of disposable income, per equivalent disposable income decile - UK

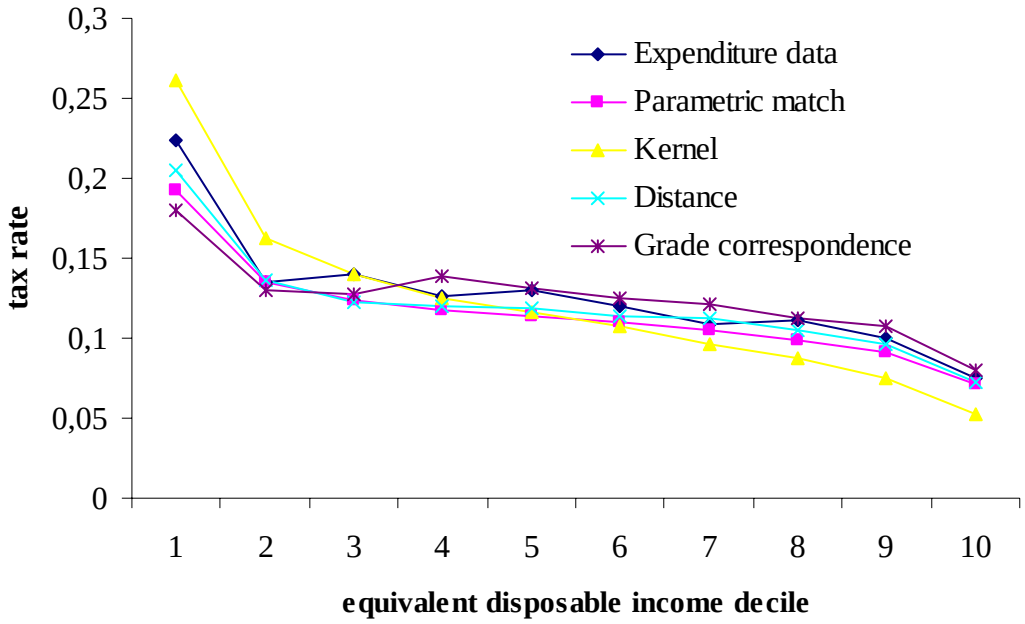


Figure 4.2: Indirect tax rate in function of total expenditure, per equivalent disposable income decile - UK

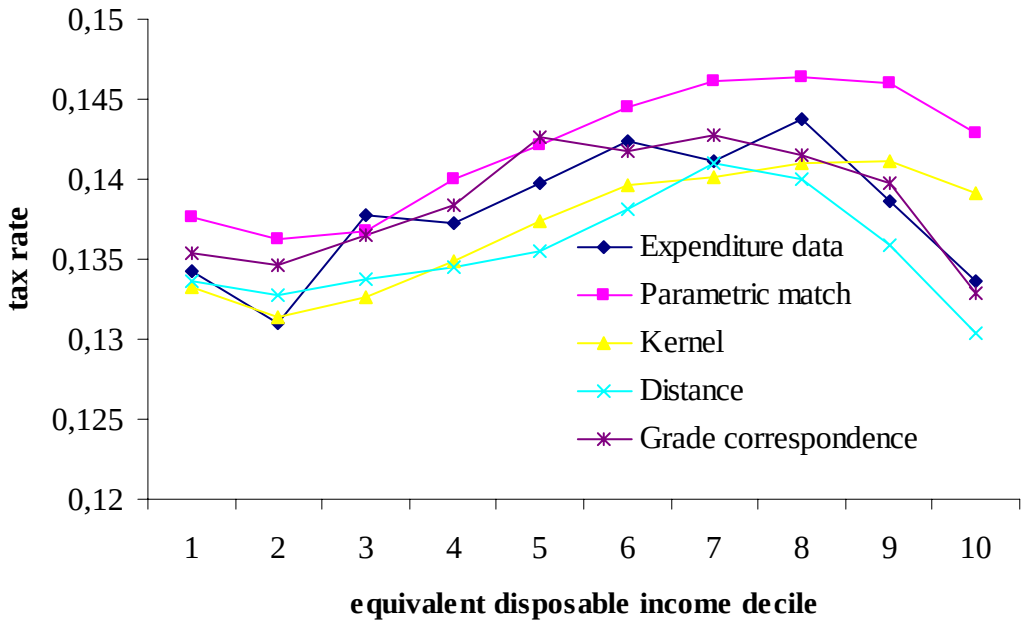


Figure 4.3: Indirect tax rate in function of disposable income, per equivalent total expenditure decile - UK

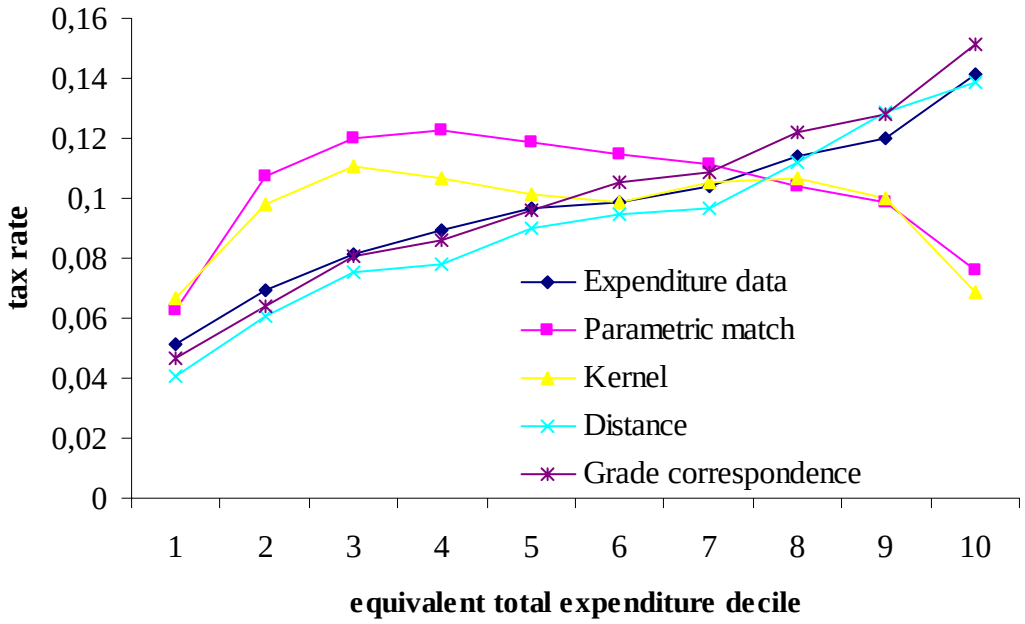


Figure 4.4: Indirect tax rate in function of total expenditure, per equivalent total expenditure decile - UK

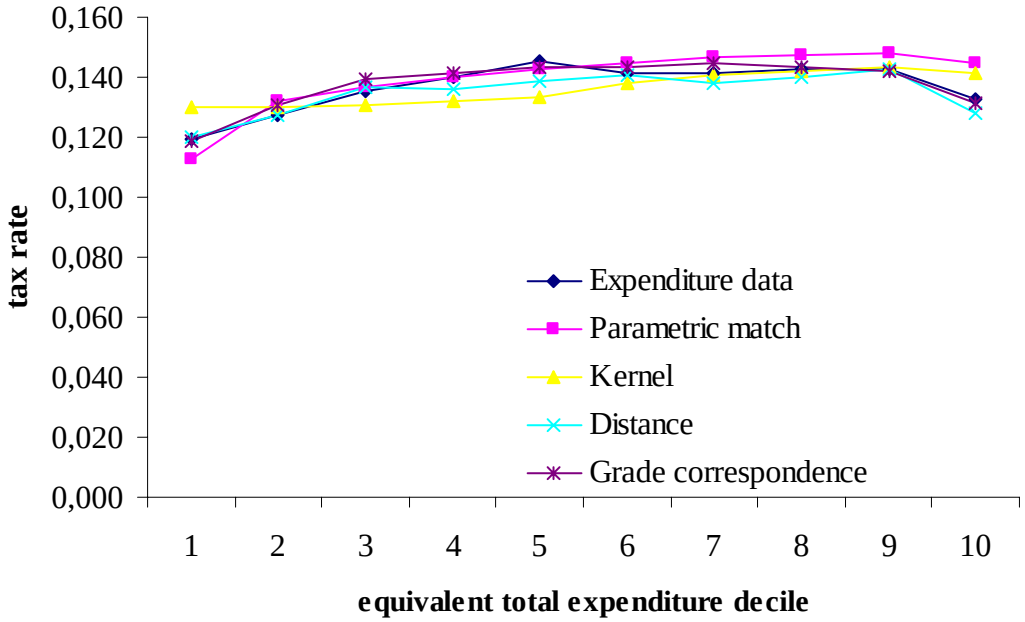


Table 4.9: Tax incidence per decile of equivalized disposable income - UK

Deciles (Equivalized disposable income)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	6	-5664	758	-4900	1193	-3707
2	73	-7374	906	-6395	1337	-5057
3	159	-7772	1127	-6486	1460	-5025
4	299	-7887	1468	-6120	1585	-4535
5	536	-7450	2002	-4911	1731	-3181
6	889	-6271	2812	-2570	1915	-655
7	1339	-5168	3829	-1	2236	2235
8	1941	-3776	5328	3493	2555	6048
9	2713	-2573	7847	7987	3022	11010
10	3673	-1874	19552	21352	4048	25399
Mean	1300	-5379	5069	990	2206	3196
CI of income before tax	0.565	0.564	0.397	0.565	0.361	0.565
CI of income after tax.	0.564	0.381	0.359	0.337	0.372	0.346
RS Index	0.001	0.184	0.038	0.228	-0.011	0.218

Tables 4.9 to 4.11 stress the importance of indirect taxes. They amount to more than the social security contributions of the employees, and to about one half of the personal income tax revenues. The indirect tax system is slightly progressive seen per equivalent expenditure decile, but decreases the overall progressivity of the tax system by about 5% considered per equivalent disposable income decile. Table 4.2 shows that this result is largely insensitive to the matching method used.

Table 4.10: Tax incidence per decile of equivalized nondurable expenditures - UK

Deciles (Equivalized nondurable expenditures)	SIC	Social Benefits	PIT	SIC + SB+ PIT	INDIRECT TAX	TOTAL
1	18	-9056	873	-8165	499	-7665
2	96	-8936	1014	-7826	934	-6892
3	272	-8283	1420	-6590	1248	-5343
4	501	-7398	2116	-4781	1542	-3239
5	771	-5926	2610	-2544	1826	-718
6	1116	-4653	3476	-60	2109	2049
7	1503	-3507	4427	2424	2435	4859
8	2034	-2724	5999	5309	2822	8131
9	2712	-2062	8271	8921	3328	12249
10	3554	-2041	18478	19991	4893	24884
Mean	1300	-5379	5069	990	2206	3196
CI of income before tax	0.627	0.633	0.374	0.627	0.322	0.627
CI of income after tax.	0.632	0.360	0.317	0.295	0.319	0.293
RS Index	-0.006	0.273	0.057	0.331	0.003	0.334

Table 4.11: PIT and indirect taxes as percentage of gross taxable income - UK

Deciles (Equivalent disp. inc.)	PIT (% of gross taxable income)	Indirect tax (% of gross taxable income)	Total tax (% of gross taxable income)
1	11.7	18.4	30.1
2	9.2	13.5	22.7
3	9.4	12.2	21.6
4	10.1	10.9	21.0
5	11.4	9.9	21.3
6	13.3	9.1	22.4
7	14.8	8.7	23.5
8	16.7	8.0	24.7
9	18.9	7.3	26.2
10	26.0	5.4	31.3
Mean	18.3	8.0	26.3
Gini of income before tax	0.397	0.361	0.397
CI of tax	0.565	0.254	0.471
CI of income after tax	0.359	0.372	0.371
Kakwani	0.168	-0.106	0.074
RS Index	0.038	-0.011	0.026

Table 4.12: Sensitivity of RS index to method - UK

Method	RS Indirect taxes	RS Total taxes
Parametric	-0.011	0.218
Kernel	-0.019	0.203
Distance	-0.014	0.216
Grade Corr.	-0.015	0.214

IV. CONCLUSION

This workpackage contains the actual imputation of expenditure data in the EUROMOD datasets. A two step parametric Engel curve estimation was used where total durable and nondurable expenditures are imputed first, followed by the nondurable budget shares. To solve the zero expenditures problem, subgroup referencing was used, estimating different Engel curves (and hence assuming differences in preferences) for different types of households. This division in subgroups was shown to be very important by a comparison of their respective value of the logarithm of total expenditures coefficient in the food equation.

In general, the imputed budget shares and indirect tax rates are a close approximation of the ones observed in the original expenditure data. The exception in most countries is the share of expenditures on durables, which tends to be overestimated. Durables are underestimated in the Irish case. Moreover, the tables containing the savings rates show that the imputed total expenditures are too high relative to disposable income. The most likely reason for this is that the match is performed using observed disposable income in both datasets, since these variables are operationalised in the most similar way (except for countries like Ireland where the observed disposable income from the EUROMOD dataset was not available). On the contrary, the tables are constructed with the disposable income calculated by EUROMOD. To avoid this maladjustment, in the next workpackage the results of the match will be used, but total expenditures will be rescaled by a factor representing the ratio between EUROMOD simulated and observed disposable income for each observation.

The matching results are shown to be rather insensitive to the matching method used.

Finally, a comparison with the EUROMOD tax system reveals that indirect taxation is an important factor in total taxation. Moreover, there seems to be a negative effect on the progressivity of this tax system: this effect amounts to between 3 and 5%.

V. REFERENCES

Sabelhaus, J. and Walker, L. (2007) *Economic flexibility in Microsimulation: an age-centered regression approach.* Congressional Budget Office, Washington, D.C. http://www.cbo.gov/ftpdocs/77xx/doc7735/2007-02.pdf