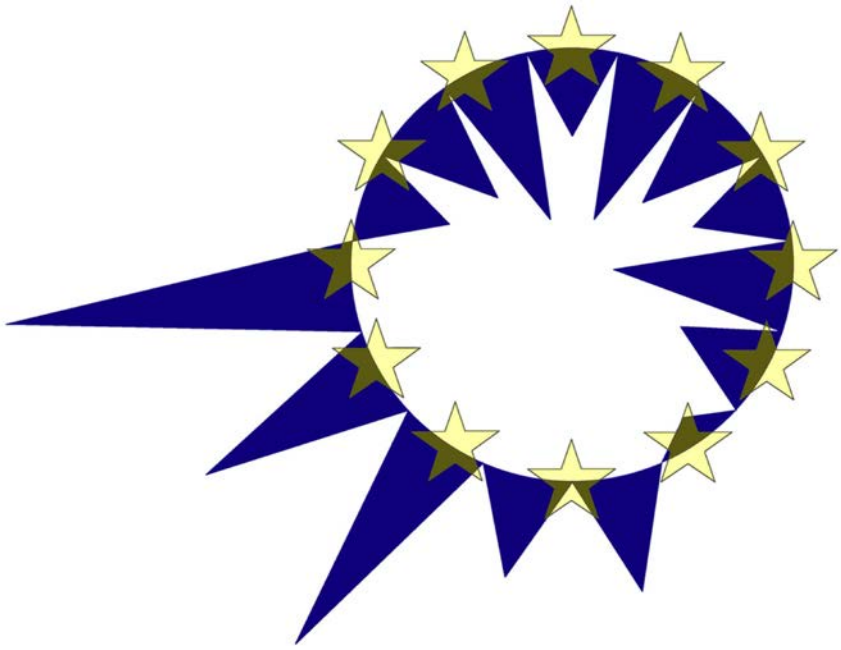
EUROMOD

WORKING PAPER SERIES



EUROMOD Working Paper No. EM 20/13

Integrating Indirect Taxation into EUROMOD
Documentation and Results for Germany

André Decoster
Richard Ochmann
Kevin Spiritus

December 2013

Integrating Indirect Taxation into EUROMOD[1] Documentation and Results for Germany

André Decoster[a]
Richard Ochmann[b]
Kevin Spiritus[a]

[a]Department of Economics, Katholieke Universiteit Leuven
[b]German Institute for Economic Research (DIW)

Abstract

This paper documents the integration of microsimulation tools for direct taxation, indirect taxation, and social benefits in the context of the European tax and benefit simulator, EUROMOD. Integration has been developed parallely for the two countries, Belgium and Germany. The paper at hand documents the process and presents simulation results for the case of Germany. An integrated data base underlying EUROMOD that contains household-level information on income and consumption is generated. Consumption micro data from the 2008 cross section of the household budget survey for Germany is used to impute information on spending for durable and non-durable commodities into EU-SILC data, applying regression-based imputation techniques. Engel curves are estimated at the household level for total non-durable spending, expenditures on durable goods, as well as non-durable expenditure share equations. Distributional plots evaluate the goodness of fit of the imputations. As a result, status quo tax legislation is simulated in EUROMOD on imputed household spending, and incidence analysis of baseline VAT is undertaken. Finally, several arbitrary policy reforms implementing VAT rate uniformity are analysed with respect to their distributional impact.

JEL Classification: D12, D31, H24, H31
Keywords: Budget survey, expenditure estimation, Engel curves, EUROMOD

Corresponding author:
Richard Ochmann
E-mail: rochmann@diw.de

[1] This paper benefited from valuable discussions with Peter Haan and audience of the EUROMOD project meeting 2012 in Bucharest. The paper uses EUROMOD F5.5. EUROMOD is continually being improved and updated and the results presented here represent the best available at the time of writing. Any remaining errors, results produced, interpretations or views presented are the authors' responsibility. The process of extending and updating EUROMOD is financially supported by the Directorate General for Employment, Social Affairs and Inclusion of the European Commission [Progress grant no. VS/2011/0445]. We make use of micro-data from the EU Statistics on Incomes and Living Conditions (EU-SILC) made available by Eurostat under contract EUSILC/ 2011/55 and contract EU-SILC/2011/32. The usual disclaimers apply.

Contents

1. Introduction

This paper documents the integration of microsimulation tools for direct taxation, indirect taxation, and social benefits in the context of the European tax and benefit simulator, EUROMOD. Integration has been developed in parallel for the two countries, Belgium and Germany. The paper at hand documents the process and presents simulation results for the case of Germany.

As simulation tools for direct taxation and social benefits already exist in the context of the European tax and benefit microsimulation model EUROMOD,[1] the exercise mainly consists of integrating indirect taxation into the existing environment of EUROMOD such that indirect tax policies are simultaneously available with direct tax policies and social benefits.

The major focus of this paper shall be on generating an integrated data base that contains household-level information on income and consumption, on which EUROMOD simulations can be run. Consumption micro data from household budget surveys (HBS) for Germany is used to impute information on spending for durable and non-durable commodities into the SILC data, which EUROMOD is based on. This is necessary because there is no information on household consumption expenditures in the EU-SILC data.

The general strategy for imputation involves regression-based imputation. Total non-durable spending, demand for durable goods, as well as non-durable expenditure share equations are estimated at the household level, in the context of Engel curves, using the 2008 cross section of the German household budget survey (EVS). Coefficient estimates are applied to impute this information into EUROMOD. Distributional plots will evaluate the imputations for each of the single commodity groups.

VAT legislation is integrated into EUROMOD in the form of a new policy. Status quo tax legislation is simulated on imputed household spending and incidence analysis of baseline VAT is undertaken. VAT simulations based on imputed spending reveal the typical incidence results in the baseline scenario of current VAT legislation for Germany. VAT looks regressive when plotted against the income distribution –tax burdens decrease in income in relative terms – while VAT is slightly progressive when plotted against the expenditure distribution – tax burdens increase in spending in relative terms.

Based on this integrated data base, we finally simulate several ad-hoc policy reforms that affect the three areas of direct taxation, social benefits, and indirect taxation simultaneously. The reforms generally build on uniformity with respect to reduced VAT rates, and they can be implemented such that revenue neutrality and at the same time distributional neutrality are largely guaranteed.

[1] For an introduction into EUROMOD, see Sutherland and Figari (2013).

2. Data

The consumption data for Germany applied in this analysis stems from the Income and Consumption Survey for Germany (*Einkommens- und Verbrauchsstichprobe*, EVS), i.e. the German HBS. The EVS is maintained by the German Federal Statistical Office (*Statistisches Bundesamt*, StaBu) in repeated cross-sections. Households are recruited voluntarily for reports every five years, according to stratified quota samples from Germany's current population census (*Mikrozensus*).

Households in the EVS data report detailed information on income, consumption, savings, and asset holdings at the household level. For savings, for example, it is observed which fraction of composite savings is saved in stocks, which in bonds, or which in owner-occupied housing, as it is observed for asset holdings, too. Also, income and consumption are reported in detail by single components. Expenditures are reported for about 150 different commodities. These 150 commodities are aggregated up to 15 commodity groups of non-durable expenditures, and one group for durable expenditures, for the purpose of this analysis. This aggregation follows the COICOP aggregation principles.[2] As a result, in addition to the category for durable spending, we consider 15 commodity groups of non-durable spending:

Commodity Groups of Non-durable Expenditures:

1. Food, non alcoholic beverages
2. Alcoholic beverages
3. Tobacco
4. Clothing and footwear
5. Home fuels and electricity
6. Rents (excluding imputed rents)
7. Household services
8. Health
9. Private transport

[2] Also see Decoster et al. (2007). In the EVS data, there are some commodities characterized as private consumption that are not assigned to any commodity group. They are effectively miscellaneous expenditures that are typically not subject to indirect taxation and that have thus been aggregated to a separate commodity group here, which is however not considered further in the entire analysis. The variable that collects these expenditures is called *expnondur_rest* in the do-files. Among these expenditures are various taxes (bequest taxes), wages kept back as a security, e.g. for a loan, and particular leasing rates for gardens and other property.

10. Public Transport
11. Communication
12. Recreation and culture
13. Education
14. Restaurants
15. Other goods and services

The definition of durable spending has been extended slightly.[3] Durable consumption goods have been treated separately by a user cost approach accounting for the fact that these goods provide a consumption stream that lasts over a longer period of time. Durable spending has been adjusted in sense that is more related to consumption of durable goods. Depreciation rates have been estimated and imputed for each household that holds stocks of particular durable goods, such as cars. Housing has been taken out of durable goods here, rents are considered explicitly under non-durables. For other minor durable goods, aggregate observed expenditures are redistributed among households that have these goods in stock. For more details, see Beznoska and Ochmann (2013).[4]

The total population covered by the EVS data is slightly restricted, as there are groups that are not covered: institutionalized people (i.e. military people in caserns, students in dormitories, elderly and disabled people in nursery homes or hospitals, nurses or migrant workers in residences, people in jails), homeless people, and households with monthly net household incomes greater than 18,000 euros. Nevertheless, the population covered by the EVS aggregates up to about 98% of the population of households in Germany. The scientific use files for the 2008 cross section used in this analysis contain 44,088 households.

Some observations have been dropped during the analysis. 1.0 percent of the sample (441 households) have been dropped because of outlying durable consumption during the three months observed, or outlying deviations in the total sums of the household's bookkeeping.[5]

[3] Spending on durable goods includes purchases of furniture, carpets, curtains, refrigerators, washing machines, dish washers, ironing machines, other big housework machines, electric housework devices, dishes (glass and porcelain), garden machinery, new cars, second-hand cars, motorbikes, bicycles, radios, TVs, TV-sets, photo cameras, video devices, computers, software, durable goods for sports and camping, jewellery, clocks, and watches.

[4] The EVS data also contain information on the stock of wealth at the household level. This information shall thus not be utilized here for the sake of applicability of the entire approach to other countries, where wealth is potentially absent from household budget surveys. Generally, the fit of the performed estimations does not change significantly when wealth is included among the explanatory variables.

[5] Observations have been dropped whenever durable consumption, or the statistical difference exceed 200 percent of current income. Deviations in the total sums of the household's bookkeeping can result from the fact that households' bookkeeping does not balance out perfectly in all cases due to non-reported incomes.

Another 0.1 percent (48 households) have been dropped because of zero or negative disposable household income. The analysis has been conducted on the remaining 43,599 households.

EUROMOD is based on the EU-SILC data. The EU-SILC survey for Germany consists of stratified random samples, which have fully replaced the formerly collected quota samples by the year 2008. The assessment unit is individuals aged 16 or older, living in private households in Germany. The target population is individuals living in private households in Germany, except for people in institutions, i.e. for example soldiers living in military caserns, or old people living in nursing homes. As a result, the sample consists of 28,904 individuals, living in 13,312 households.

The standard output from EUROMOD contains individual-level data. This has been aggregated up to household-level data for the purpose of this analysis, such that the micro data structure between the budget survey, which is on household level, and the EUROMOD output data are compatible. In EUROMOD, this leaves 13,281 households in the sample used for the analysis. For more details on the German implementation of EUROMOD and the German part of the EU-SILC data, see Ochmann and Fossen (2012) or Ochmann and Gallego Granados (2013).[6]

Current disposable household income has been defined such that it follows a concept that is consistent between the two surveys applied. It *ex*cludes imputed rents for owner occupiers. It is also after expenses for alimonies have been deducted for households that are observed paying them to other households. These are included in turn in the income of the households observed receiving them.

3. Model and Estimation

The model to be estimated at the household level involves the allocation of current disposable income to consumption in the current period, where several commodity groups shall be differentiated, and the residual to savings. Generally, the model is constructed at two stages. At the first stage, two equations are estimated separately: one for total non-durable expenditures and one for durable expenditures. The estimation techniques will vary across the two equations. At the second stage, the allocation of total *non*-durable consumption to 15 commodity groups is modelled, in terms of share equations.

[6] While Ochmann and Fossen (2012) document the model version that underlies the study at hand, Ochmann and Gallego Granados (2013) document an update of this model and an extension to later policy years.

Total Non-Durable Expenditures

The equation for total household expenditures on non-durable commodities, estimated on the one cross-section from consumption micro data, looks like this:

$$\ln(con_i^{nd}) \;=\; \alpha_0^{nd} \;+\; \gamma_1^{nd}\,\ln(y_i) \;+\; \gamma_2^{nd}\,(\ln(y_i))^2 \;+\; x_i'\,\beta^{nd} \;+\; \epsilon_i \tag{1}$$

for households $i = 1, \ldots, N$. The dependent variable $\ln(con_i^{nd})$ is the log of total expenditures for non-durable consumption at the household level, as observed on monthly average during the reporting period of three months. con_i^{nd} is strictly positive for all observations in the budget data so that Eq. (1) is defined for all households and the estimation can be conducted unconditionally for all observations. At the imputation, the prediction of $\ln(con_i^{nd})$ has been adjusted by the expected value of $exp(\epsilon_i)$.[7]

Among the explanatory variables, $\ln(y_i)$ denotes the log of current disposable household income and $(\ln(y_i))^2$ its square. The quadratic-log specification of income follows the almost ideal demand system approach in the QUAIDS version (Deaton and Muellbauer, 1980; Banks et al., 1997).[8] x_i denotes a $K \times 1$-vector of household-specific characteristics, such as the number of adults and children in the household, and the number of household members currently in work, as well as some demographic variables related to the household head, such as age (in groups of five years), education, gender, and employment status. Interactions of the income function with the number of household members are also included to allow for income effects to vary with the size of the household. The error term ϵ_i is assumed to be independent and identically distributed.

Durable Expenditures and Savings

The estimation of durable expenditures is also undertaken in two stages. At the first stage, we account for a large number of households reporting zero spending on durable goods during the reporting period of three months. A user-cost approach (see Section 2) has been applied.[9] At the second stage, demand for durable spending is estimated, conditionally on the outcome of the first stage.

[7] Assuming normality of the errors, a consistent estimate of the expected value of $\sigma^2 = exp(\epsilon_i)$ can be derived from the squared standard error of the regression: $s^2 = SSR/(n-k)$, where SSR is the sum of squared residuals and $(n-k)$ denotes the degrees of freedom. See Wooldridge (2003), pp. 207-210 and 276-280.

[8] For robustness checks, various specification tests for the income function have been applied, such as a log-linear quadratic functional form, a specification conditional on income percentiles, a linear spline function, as well as a cubic spline function. The differences between the fits across the specifications are not large.

[9] The user-cost approach reduces the number of observations with zero spending on durable goods significantly. However, there remain some 10% of the sample with zero durable consumption.

At the first stage, a probit model is estimated for the probability of positive demand for durable spending:

$$Pr(D_i^d = 1) \;=\; \Phi^d \left(\alpha_0^d \;+\; \gamma_0^d \, \ln(y_i) \;+\; \gamma_1^d \, (\ln(y_i))^2 \;+\; x_i' \, \beta_0^d \;+\; \xi_i \right) \tag{2}$$

where D_i^d denotes a dummy variable that is 1 for household i if demand for durable commodities is positive and zero otherwise. Covariates in the x vector are identical to Eq. (1).

The coefficient estimates, $\widehat{\alpha}_0^d$, $\widehat{\gamma}_0^d$, $\widehat{\gamma}_1^d$, and $\widehat{\beta}_0^d$ are used to predict Eq. (2) into the SILC data, assuming the distributions of the explanatory variables are similar between the HBS and the SILC (which will be addressed in Table 1). Predicted probabilities are coded 0 and 1 if $\widehat{Pr}(con_i^d > 0)$ is below the sample mean probability, or above respectively. This provides a predicted distribution of the probability for positive spending on durable commodities ($\widehat{D}_i^d$) in the SILC data.

At the second stage, the demand equation for total household durable commodities is estimated, conditionally on the outcome of the first stage.

Specifically, for durable spending:

$$\ln(con_i^d) \;=\; \alpha^d \;+\; \gamma_2^d \, \ln(y_i) \;+\; \gamma_3^d \, (\ln(y_i))^2 \;+\; x_i' \, \beta^d \;+\; \varepsilon_i \quad \text{if } \widehat{D}_i^d = 1 \tag{3}$$

for households $i = 1, \ldots, N$. The dependent variable $\ln(con_i^d)$ is total expenditures for durable consumption in logs. It is defined for all households for which the condition $\widehat{D}_i^d = 1$ holds. All covariates in the x vector and the income function are identical to Eq. (1) as well as to Eq. (2) at the first stage. Again, at the imputation, the prediction of $\ln(con_i^d)$ is adjusted by the expected value of $exp(\varepsilon_i)$.[10]

Given estimates for Eqs. (1) and (3), savings are defined such that they follow residually from current income, total non-durable spending, and total durable expenditures:

$$\widehat{sav}_i \;=\; \mathrm{y}_i \;-\; \widehat{con}_i^d \;-\; \widehat{con}_i^{nd} \tag{4}$$

where, as in the HBS data, $\widehat{sav}_i$ is theoretically unbound in the open interval $]-\infty, +\infty[$, i.e. dissavings are explicitly allowed for.[11]

[10] As a specification test, a Tobit model has been estimated for durable expenditures, accounting for the fact that there is a significant number of zero observations. However, in the predictions into the EU-SILC data, the Tobit estimator produced distributions that were too smooth, effectively attaching a non-zero outcome to each observation, and at the same time heavily underestimated the upper tail of the distribution, which is why it has not been applied here.

[11] This degree of freedom allows households to have spending exceed their current income temporarily, i.e. either borrow against their future income or run down their assets. Negative savings are in fact observed for a significant number of households in the HBS (Table 3) and will also be predicted into the SILC data (Table 4).

Commodity Shares from Non-Durable Expenditures

Among the 15 non-durable commodity groups, estimation is conducted differently for two sub-groups. The first sub-group consists of commodities that are typically exposed to zero expenditure in the data, which are here tobacco, renting, public transport, and education. The second sub-group consists of the remaining 11 non-durable commodities.

The application of a different estimation strategy for these two groups is supposed to deal with the observation of many zero expenditures in the sample for the first-group commodities. Applying two-step estimation techniques can improve the goodness of fit when expenditures are imputed into the target data under these circumstances.[12]

The estimation strategy for the first group closely follows the approach for durable spending (see previous subsection). The estimation proceeds in two steps. In the first step, a Probit model is estimated for the probability of positive demand for the respective commodity:

$$Pr(D_{ik}^{nd} = 1) \;=\; \Phi_k^{nd}\left(\alpha_{0k}^{nd} \;+\; \gamma_{0k}^{nd}\,\ln(y_i) \;+\; \gamma_{1k}^{nd}\,(\ln(y_i))^2 \;+\; x_i'\,\beta_{0k}^{nd} \;+\; \nu_{ik}\right) \tag{5}$$

for households $i = 1, \ldots, N$, where D_{ik}^{nd} denotes a dummy variable that is 1 for household i if demand for non-durable commodity k is positive and zero otherwise. Covariates in the x vector are again identical to Eq. (1), α_{0k} denotes a commodity-specific constant, and ν_{ik} is assumed to be independent and identically distributed. Eq. (5) is estimated separately for each of the four non-durable commodities among the first sub-group.

Similarly to durable demand, the coefficient estimates, $\widehat{\alpha}_{0k}^{nd}$, $\widehat{\gamma}_{0k}^{nd}$, $\widehat{\gamma}_{1k}^{nd}$, and $\widehat{\beta}_{0k}^{nd}$ are used to predict Eq. (5) into the SILC data, for each of the $K = 4$ commodities, assuming similar distributions of the explanatory variables. Predicted probabilities are coded 0 and 1 if $\widehat{Pr}(con_{ik}^{nd} > 0)$ is below the mean probability for commodity k, or above respectively. This provides a predicted distribution of positive spending on the $K = 4$ commodities from the first sub-group ($\widehat{D}_{ik}^{nd}$) in the SILC data.

In the second step, share demand equations for each of the four non-durable commodities in the first sub-group are estimated, conditionally on the outcome from the first step. Specifically, demand is estimated for households for which demand is estimated to be positive ($\widehat{D}_{ik}^{nd} = 1$).

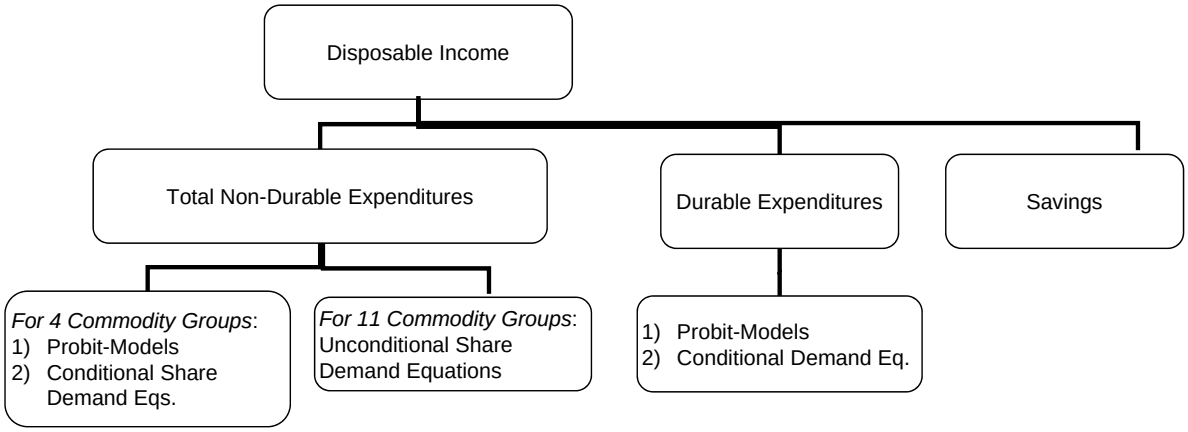
$$w_{ik} \;=\; \alpha_{0k} \;+\; \gamma_{1k}\,\ln(con_i^{nd}) \;+\; \gamma_2\,(\ln(con_i^{nd}))^2 \;+\; x_i'\,\beta_k \;+\; \eta_{ik} \quad \text{if } \widehat{D}_{ik}^{nd} = 1 \tag{6}$$

for households $i = 1, \ldots, N$ and commodities $k = 1, \ldots, K$. The dependent variable w_{ik} is the

[12] While this special treatment for the first-group commodities has been found to improve the imputations in the case of Germany, it turned out to make up only minor differences in the case of Belgium and has thus been omitted in the model application for Belgium.

share in percent of expenditures for non-durable consumption in commodity group k from total non-durable expenditures (con_i^{nd}). The latter appears on the right-hand side in a quadratic-log functional form. It is defined for all households for which the condition $\widehat{D}_{ik}^{nd} = 1$ holds. Eq. (6) has again the same demographic controls as the previous equations, α_{0k} is a commodity-specific constant, and the commodity-specific error term η_{ik} is assumed to be independent and identically distributed.

Figure 1: The Two-Stage Structure of the Model for Household Expenditures



The estimation strategy for the 11 remaining commodities in the second group is different from the first group. For these commodities, no special treatment of zero spending is necessary because the population of households with zero spending among each of these commodities is relatively small. Thus, the share demand equations for the second group are estimated unconditionally, for all households, in a single step:

$$w_{ij} \;=\; \alpha_{0j} \;+\; \gamma_{1j}\,\ln(con_i^{rnd}) \;+\; \gamma_2\,(\ln(con_i^{rnd}))^2 \;+\; x_i'\,\beta_j \;+\; \eta_{ij} \tag{7}$$

for households $i = 1, \ldots, N$ and commodities $j = 1, \ldots, J$. This time, the relevant total variable for the second sub-group (con_i^{rnd}) is not total non-durable spending, but the remaining non-durable spending, after spending on the four commodities from the first sub-group has been deducted:

$$con_i^{rnd} \;=\; con_i^{nd} \;-\; \sum_{k=1}^{K} w_{ik} * con_i^{nd} \tag{8}$$

Thus, the dependent variable w_{ij} in Eq. (6) is the share in percent of expenditures for non-durable consumption in commodity group j from the *remaining* non-durable expenditures

(con_i^{rnd}). The latter again appears on the right-hand side in a log-linear-quadratic functional form. It is defined for all households because for all households it is observed that $con_i^{rnd} > 0$. Eq. (7) has the same demographic controls as the previous estimation equations. α_{0j} is a commodity-specific constant. The commodity-specific error term η_{ij} is assumed to be independent and identically distributed.

The two-stage structure of the entire model is visualized in Figure 1. Each of the three single models at the two stages in Eq. (1)-(7) is estimated on a single cross section for 2008 from the German household budget survey data (EVS, see Section 2).

Table 1: Sample Descriptives – EUROMOD and Budget Survey (EVS)

	EUROMOD		Budget Survey	
	Mean	Median	Mean	Median
Income (Euros):				
disposable income	2,632	2,207	2,639	2,115
Age:				
Age of HH head	51.1	50	51.5	50
Demographics (Fraction):				
male head	0.61	1	0.60	1
education of head high	0.42	0	0.41	0
education of head medium	0.48	0	0.49	0
educ degree low or none	0.099	0	0.097	0
number of household members	2.06	2	2.05	2
Number of kids <18 in hh	0.47	0	0.35	0
Number of HH members working	0.89	1	0.88	1
civil servants	0.030	0	0.039	0
employee	0.40	0	0.33	0
selfemployed	0.050	0	0.061	0
worker	0.14	0	0.16	0
pensioner	0.30	0	0.30	0
Observations	13,310		43,619	

Notes: Income in Euros per month. Disposable income is defined in Chapter 2. Among social status, the group of non-employed has been omitted. Disposable incomes from EUROMOD simulated, switching off any benefit take-up correction. Data weighted by population weights.

Source: Own calculations using the EU-SILC data 2008 for Germany and EVS data (2008).

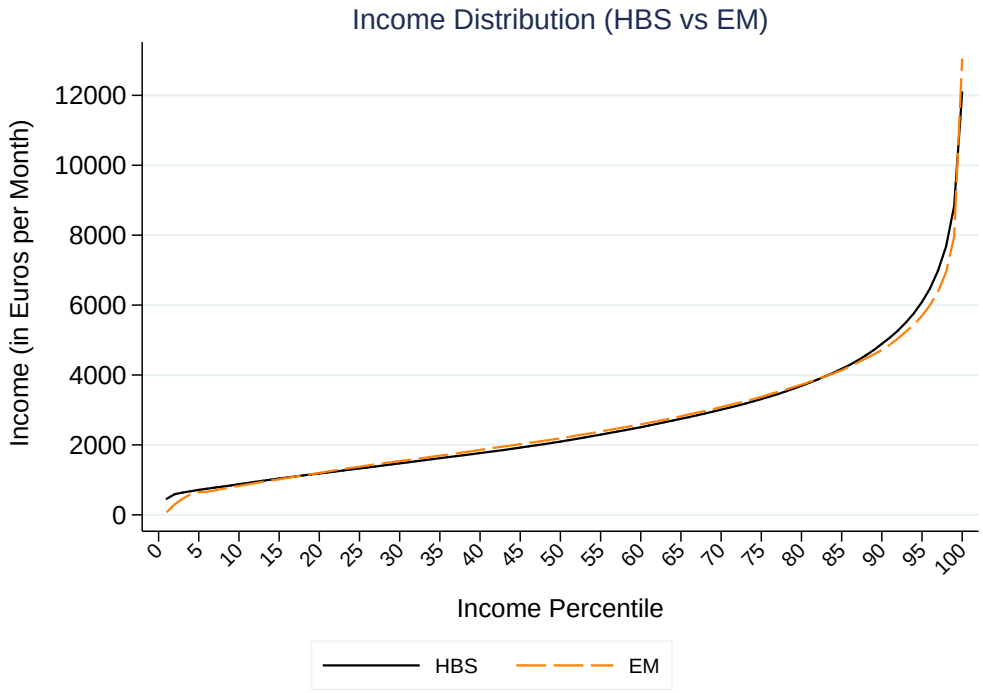
4. Sample Descriptives

To ensure that the imputations for expenditures are not biased it is important that the income variable and the demographic variables that have been applied as controls in the x_i vectors of the estimated demand equations are similarly distributed in the source data set (HBS) and in the target data set (EU-SILC data). Table 1 contains descriptive statistics on these

demographic variables and on the income variable from the two data sets. It becomes obvious that all applied demographic controls, as well as income, have mean and median values of largely the same size in the two data sets.

The median monthly disposable household income in the budget survey (EVS) amounts to 2,115 Euros. It is only slightly greater in EUROMOD (EM): 2,207 Euros. Mean incomes are of almost identical size in the EVS (2,639 Euros) and EM (2,632 Euros).[13] The distributions of household disposable income look very similar in the EVS and EM (Figure 2). Only at the very top (beyond the 90th percentile), as well as the very bottom (below the 5th percentile), there is a slight under-simulation of household incomes in EM compared to the reported EVS incomes.

Figure 2



Mean (51) and median (50) age of the household head is almost identical in both data sets. For the other demographic variables, only the mean can be interpreted meaningfully. Mean values are very similar in the EVS and EM for the three levels of highest education

[13] Note that disposable incomes from the EVS are reported values, whereas in EM they are simulated incomes. In the program version for 2008, the EM simulations for Germany apply a correction for non-take-up of social benefits, such as non-contributory unemployment benefits and basic social benefits, assuming that a non-negligible fraction of eligible households do not claim receipt of these benefits. For details, see Ochmann and Fossen (2012).

of the household head. Also the distribution of gender is comparable. The number of adult household members and the number of household members working are of almost identical size, on average, in both data sets. Only the number of children is slightly greater, on average over all households, in EUROMOD (0.47) than in the EVS (0.35). In both data sets, on average 0.9 household members are working. The distribution of the employment status of the household head is similar between the data sets, with employees slightly more present in EM, and self-employed slightly more present in the EVS.

5. Results for Imputations

Firstly, imputation results for expenditures on the single non-durable commodities and on durable goods will be compared to reported HBS spending in terms of fit along their distributions. Secondly, imputations will be evaluated across the distribution of household disposable income between the two data sets.

5.1. Distributions of Expenditures

In this section, results for the imputations of expenditures into EUROMOD are presented. Imputed expenditures shall be compared to the respective variables in the source data (EVS) in order to evaluate the accuracy of the imputation. Table 2 compares imputed expenditures from EUROMOD (columns 1 and 2) to reported expenditures in the EVS (columns 3 and 4). Firstly, only mean and median values are presented. Expenditures and probabilities for spending on commodities with significant zero fractions are reported according to the modeled categories from the estimated equations.

Total non-durable expenditures have very similar mean values in the EVS (1,800 euros) and when imputed into EM (1,797 euros). This also holds for durable spending (236 euros and 232 euros, respectively). This result was expected given the similar distributions of the determining variables in the two data sets (see the discussion in the previous section).

At the median these expenditure variables differ a little bit more between the two data sets, which is naturally related to the fact that expenditures have been imputed into the EM data based on regressions, by which a significant share of the variance is lost so that as a result the distribution tends to be smoother for the imputed variable compared to the observed variable.

The residual household savings rate differs somewhat between the two data sets, where the mean savings rate at the household level is presented, whereas median values are closer. The imputed probabilities for positive spending on the commodities imputed in two stages are fairly close to the observed probabilities in the budget survey. For example, the probability to be

Table 2: Spending Descriptives – EUROMOD (Imputed) and Budget Survey (EVS)

	EUROMOD		Budget Survey	
	Mean	Median	Mean	Median
Income (Euros):				
disposable income	2,632	2,207	2,639	2,115
Spending (Euros):				
Total non-durable expenditures	1,797	1,718	1,800	1,574
Durable expenditures	232	185	236	56
Savings (%):				
Household Savings Rate	5.7	14.8	11.7	16.7
Probability for Exp. on (%):				
Smoking	24.8	0.0	26.1	0.0
Renting a flat	55.0	100.0	54.8	100.0
Using public transport	67.3	100.0	66.7	100.0
In Education	20.6	0.0	19.2	0.0
Non-durab. Shares (%):				
Food, non-alcoh.	18.1	17.8	16.7	15.7
Alcoholic beverages	1.3	1.3	1.2	0.7
Tobacco	1.0	0.0	1.1	0.0
Clothing and footwear	5.3	5.4	5.4	4.4
Home fuels, electricity and water	8.7	8.6	8.3	6.8
Rents (excl. imputed rents)	16.1	21.6	15.8	14.4
Household services	4.5	4.6	4.8	1.7
Health	3.7	3.1	4.2	2.0
Private transport	9.8	10.3	10.3	9.0
Public Transport	2.0	2.5	2.1	0.6
Communication	4.3	4.1	4.0	3.5
Recreation and culture	8.2	8.2	8.2	7.1
Education	1.0	0.0	0.9	0.0
Restaurants and hotels	7.3	7.0	8.0	4.7
Other goods and services	8.8	8.6	9.1	7.6
Observations	13,310		43,619	

Notes: Income and expenditure variables in Euros per month. Data weighted by population weights.
Source: Own calculations using the EU-SILC data 2008 for Germany and EVS data (2008).

observed as a smoking household in the EVS is 26.1 percent and it is imputed to be 24.8 percent in EM. Differences are similarly small for the other three commodities.

Mean commodity shares for non-durable expenditures are also very similar between the EVS and EM, for all of the 15 commodities. For example, the observed share for rents is on average 15.8 percent in the EVS and it has been imputed to 16.1 percent in EM (note that this excludes imputed rents for owner occupiers, see Section 2). The observed share for home fuels and electricity is 8.3 percent, and the imputed share is 8.7 percent. There are some slight differences in average shares between the EVS and EM for some commodities. Imputed shares are significantly lower on average in EM than in the EVS for restaurants (0.7 percentage

Table 3: Spending Descriptives – Distribution in the Budget Survey (EVS)

	p1	p5	p10	p25	p50	p75	p90	p95	p99
Income (Euros):									
disposable income	557	732	894	1,341	2,115	3,345	4,979	6,263	9,738
Spending (Euros):									
Total non-durable expenditures	480	665	793	1,095	1,574	2,245	3,055	3,684	5,343
Durable expenditures	0.0	0.0	4	18	56	166	404	751	4,367
Savings (%):									
Household Savings Rate	-116.7	-44.5	-23.0	-1.0	16.7	35.2	50.6	59.0	73.2
Probability for Exp. on (%):									
Smoking	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0
Renting a flat	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0
Using public transport	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0
In Education	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0
Non-durab. Shares (%):									
Food, non-alcoh.	3.8	6.4	8.1	11.4	15.7	20.9	26.4	30.3	39.2
Alcoholic beverages	0.0	0.0	0.0	0.1	0.7	1.7	3.2	4.4	7.7
Tobacco	0.0	0.0	0.0	0.0	0.0	0.1	4.3	6.8	12.4
Clothing and footwear	0.0	0.0	0.6	2.0	4.4	7.6	11.4	14.2	20.9
Home fuels, electricity and water	0.0	1.5	2.4	4.2	6.8	10.3	15.3	20.5	36.6
Rents (excl. imputed rents)	0.0	0.0	0.0	0.0	14.4	29.3	38.8	44.3	54.5
Household services	0.0	0.0	0.0	0.0	1.7	7.0	13.4	18.8	32.7
Health	0.0	0.0	0.3	0.8	2.0	4.3	9.5	16.0	37.3
Private transport	0.0	0.0	0.0	3.3	9.0	15.1	21.9	26.6	37.9
Public Transport	0.0	0.0	0.0	0.0	0.6	2.7	5.9	9.0	18.2
Communication	0.2	1.2	1.6	2.4	3.5	5.0	7.0	8.6	12.4
Recreation and culture	0.3	1.8	2.7	4.5	7.1	10.6	14.8	18.0	25.3
Education	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.0	14.7
Restaurants and hotels	0.0	0.0	0.2	1.7	4.7	10.7	20.5	27.7	43.4
Other goods and services	0.6	1.8	2.7	4.6	7.6	11.6	16.9	21.3	32.8
Observations	43,619								

Notes: Income and expenditure variables in Euros per month. Data weighted by population weights.
Source: Own calculations using the EU-SILC data 2008 for Germany and EVS data (2008).

points), health (0.5) and private transport (0.5), whereas they are slightly higher for food (1.4 percentage points). These differences are related to the fact that the distributions of the control variables differ slightly between the two data sets (see previous section).

Tables 3 and 4 show the distributions of expenditures in more detail for the single commodities that have been imputed into EUROMOD, in order to point out which commodities are subject to over- or under-imputing in the tails of the distributions. Table 3 presents the distributions of the observed expenditures from the EVS data, and Table 4 the respective predicted expenditure distributions that have been imputed into EM.

At some commodities, negative predictions have been set to zero, for reasons of consistency. This was applied for less than 5% of all households. Negative imputed total expenditures for durable consumption goods have been censored at zero for less than 1 percent of all households. On the contrary, total non-durable expenditures and the sum of non-durable and durable expenditures are positive for all households in EM. Differences between the observed and the imputed non-durable spending shares are somewhat greater towards the upper end of the

Table 4: Spending Descriptives – Distribution in EUROMOD (Imputations)

	p1	p5	p10	p25	p50	p75	p90	p95	p99
Income (Euros):									
disposable income	187	662	849	1,396	2,207	3,412	4,791	5,842	8,729
Spending (Euros):									
Total non-durable expenditures	370	746	898	1,257	1,718	2,257	2,761	3,103	3,840
Durable expenditures	0.0	0.0	44	99	185	320	474	579	872
Savings (%):									
Household Savings Rate	-113.6	-27.4	-14.6	-0.1	14.8	26.1	34.5	39.4	48.9
Probability for Exp. on (%):									
Smoking	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0
Renting a flat	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0
Using public transport	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0
In Education	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0
Non-durab. Shares (%):									
Food, non-alcoh.	11.0	13.2	14.1	15.8	17.8	20.1	22.5	24.0	27.7
Alcoholic beverages	0.3	0.6	0.8	1.0	1.3	1.6	1.9	2.0	2.2
Tobacco	0.0	0.0	0.0	0.0	0.0	0.0	4.2	5.0	6.0
Clothing and footwear	0.4	2.4	3.0	4.0	5.4	6.7	7.8	8.4	9.3
Home fuels, electricity and water	4.9	5.9	6.4	7.4	8.6	9.8	11.0	11.9	14.2
Rents (excl. imputed rents)	0.0	0.0	0.0	0.0	21.6	29.0	34.2	37.3	44.6
Household services	0.9	1.8	2.4	3.5	4.6	5.5	6.2	6.7	7.7
Health	0.4	0.9	1.1	1.8	3.1	4.9	7.3	8.7	11.1
Private transport	0.0	2.1	3.9	7.1	10.3	12.9	15.0	16.1	17.8
Public Transport	0.0	0.0	0.0	0.0	2.5	3.2	3.8	4.1	4.7
Communication	2.1	2.8	3.0	3.5	4.1	5.0	5.8	6.4	7.5
Recreation and culture	1.6	4.8	5.7	6.8	8.2	9.9	11.0	11.5	12.5
Education	0.0	0.0	0.0	0.0	0.0	0.0	4.4	5.3	8.4
Restaurants and hotels	0.0	0.9	2.1	4.2	7.0	10.3	12.7	14.1	16.4
Other goods and services	1.7	4.4	5.5	7.0	8.6	11.1	11.9	12.4	13.2
Observations	13,310								

Notes: Income and expenditure variables in Euros per month. Data weighted by population weights.
Source: Own calculations using the EU-SILC data 2008 for Germany and EVS data (2008).

distributions, for most of the 15 commodity groups.

Taking a look at the distributions of the spending variables observed in the budget survey reveals that total non-durable expenditures and total durable expenditures are distributed completely differently. The distribution of total non-durable expenditures (Figure A.1 in Appendix A) increases largely in a linear form, with a convex shape at the higher end of the distribution. There are no zeros observed at total non-durable spending. They increase almost linearly until about the 80th percentile. At the top of the distribution, the curve increases significantly with a convex shape.

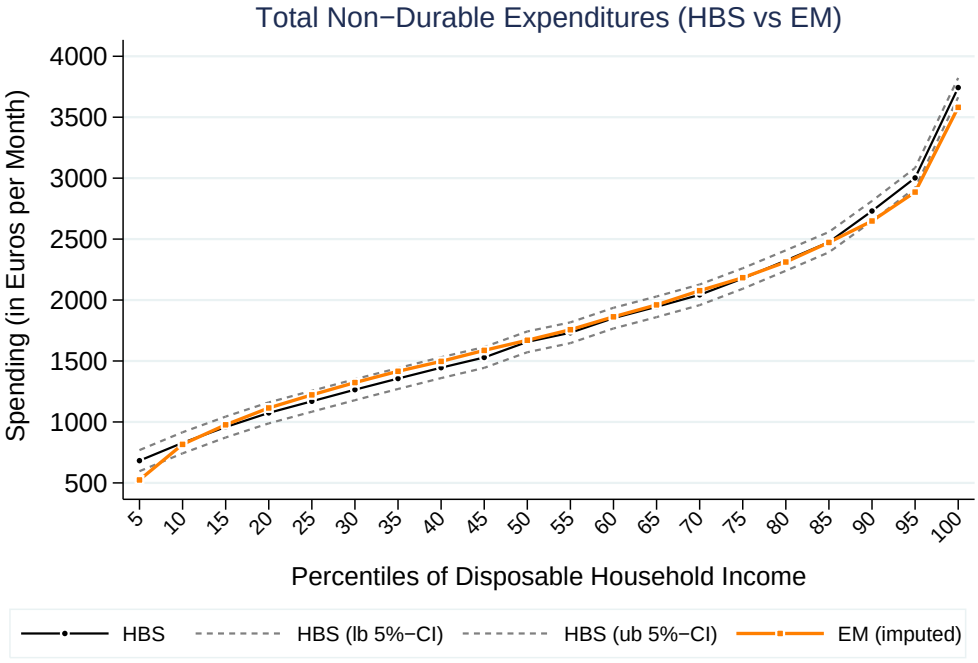
On the contrary, the distribution of total durable expenditures (Figure A.2 in Appendix A) looks totally different. It is almost flat across large parts of the distribution and spikes heavily at the very top of the upper tail. Spending for durable goods is a seldom event. In the relatively short interview period of three months, not everybody will be observed purchasing a durable good. However, due to the aggregation of various durable commodities under the group of durable goods here, as well as the user cost approach applied (see Section 2), the number of

households with zero durable consumption is significantly reduced. In fact, only about 7% of all households remain with zero durable consumption, after these corrections. Nevertheless, the majority of the households have a relatively low level of durable consumption. The distribution is almost flat until the 60th percentile, and it only increases marginally until about the 85th percentile. From then on, the increase is slightly greater, and it is followed by a heavy spike at the top end of the distribution. As a result, finding a good fit for the estimation of total durable consumption turns out to be more difficult than for non-durable consumption, due to its largely skewed distribution, even when conditioning on positive durable consumption.[14]

5.2. Spending across the Income Distribution

In this subsection, imputations for the single spending variables shall be evaluated across the distribution of disposable household income.

Figure 3

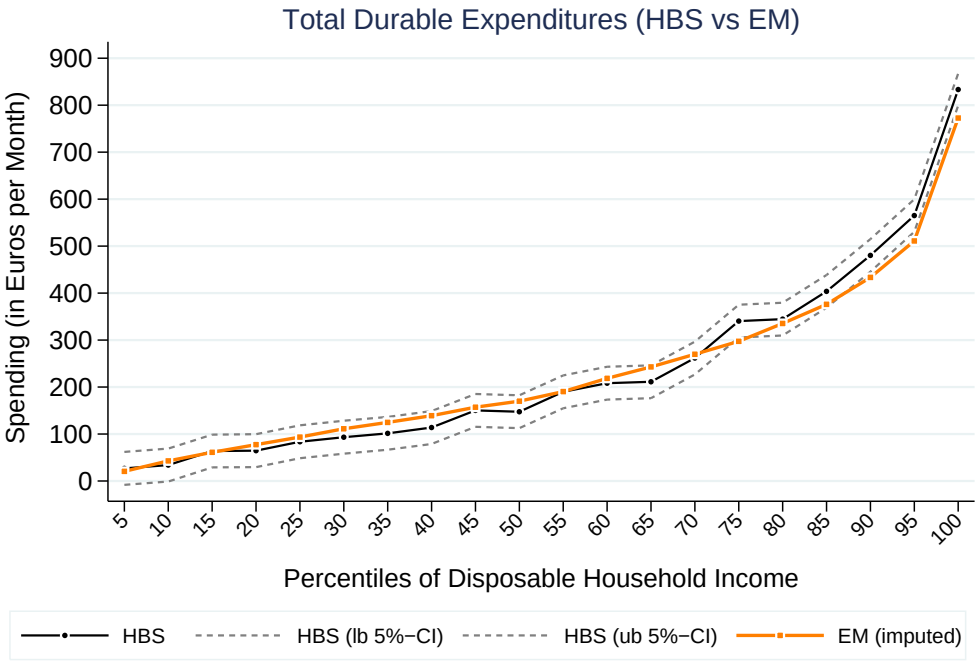


Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure 3 plots total non-durable spending, Figure 4 durable spending, and Figure 5 the resulting residual savings variable across the income distribution. Respective plots for the 15

[14] Confidence intervals in Figure A.1 and Figure A.2 denote 5% confidence intervals for the mean spending value at the respective percentile of the spending distribution.

Figure 4



Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

non-durable commodity shares can be found in Appendix A.[15]

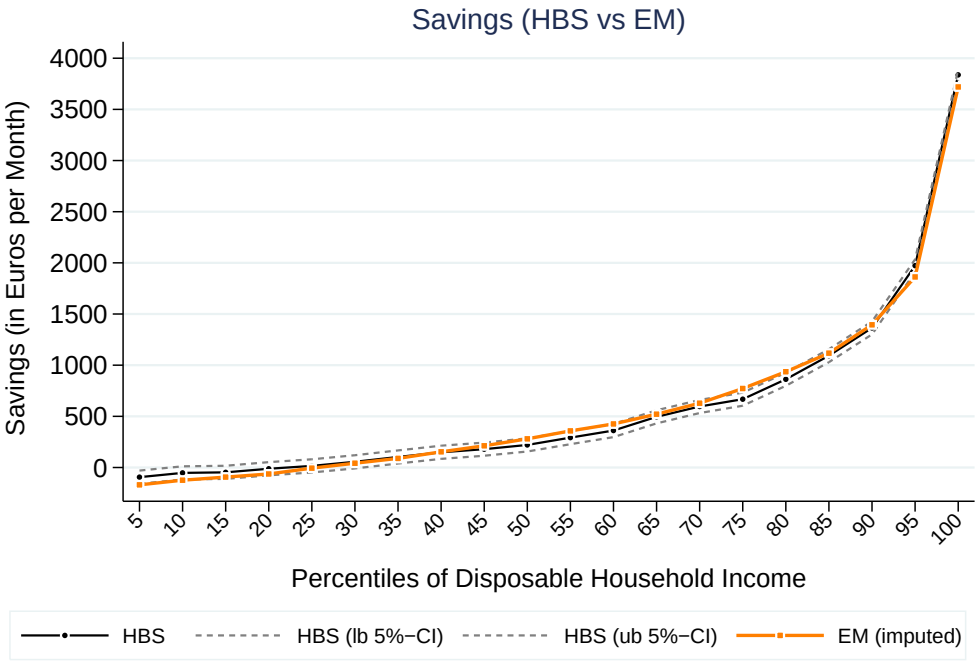
The plot for total non-durable spending (Figure 3) looks very similar to the respective plot across the spending distribution: spending increases almost linearly in income up to the 85th percentile, whereafter there is a slight convex increase. The fit of the imputations appears to be very good. Only in the lowest income percentiles, there is some underestimation of total non-durable spending.

The respective plot for durable spending (Figure 4) reveals an only slightly different evoluation across the income distribution. The distribution of durable spending is much less skewed than in the picture across the spending distribution, although there is also a significant convex increase at the top of the income distribution. The fit of the imputations is not so good as for non-durable spending, but it still appears to be acceptable. This is related to the fact that variation in durable spending in the HBS is somewhat greater than in non-durable spending, as the larger confidence intervals reveal.

As non-durable spending makes up the larger part of the two aggregate spending variables, in total the imputation of spending fits relatively well, so that residual savings also fit quite well across the income distribution (Figure 5).

[15] Confidence intervals in all figures for the income distribution are 5% confidence intervals for the mean respective spending value at the respective percentile of the income distribution.

Figure 5



Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

This also holds for imputations on most of the 15 non-durable commodity shares plotted in Appendix A. Naturally, variation at percentile means in the HBS is somewhat greater for many commodities, such as food, alcohol, energy, services, and education. Still, for most commodities, imputations into EM look relatively good across the income distribution when compared to the respective observed percentile means in the HBS. On the one hand, food is somewhat overestimated (Figure B.1), as is alcohol (Figure B.2), energy (Figure B.5), and communication (Figure B.11), and to a lesser degree recreation and culture (Figure B.12). On the other hand, shares are slightly under-imputed for tobacco (Figure B.3), health (Figure B.8), private transport (Figure B.9), restaurants (Figure B.14). The fit looks generally relatively bad only for services (Figure B.7). It looks pretty good for clothing (Figure B.4), rents (Figure B.6), and other goods and services (Figure B.15). Results are mixed for public transport (Figure B.10) and education (Figure B.13).

6. Results for VAT Simulations

Based on these ependiture imputations, simulations of VAT within EM can be conducted. Results for VAT simulations are presented firstly for the status quo tax legislation (the baseline).

Aggregate revenues and incidence analysis across the income distribution are provided. Secondly, results for several ad-hoc policy reforms are presented and effects on VAT incidence are discussed.

6.1. Status Quo VAT Legislation (Baseline)

This section addresses incidence analysis of the baseline VAT rate structure across households for Germany. The results are based on expenditure information that has been imputed from household budget survey data (HBS) into EUROMOD, as explained in the previous sections.

The baseline structure of VAT rates refers to the policy year 2010. In the baseline, the regular VAT rate in Germany is at 19 percent and the reduced rate is at 7 percent (see Table 5). Commodities that are VAT-exempt are taxed at a rate of 0 percent, while input tax deduction is not allowed for these goods. A true zero rate, i.e. a rate of 0 percent and allowing for input tax deductions, does not apply for any commodity in Germany.

Table 5: VAT Rates and Aggregate Revenues in the Baseline (EVS)

	Total	Exempt	Zero	Reduced	Regular
Expenditures, EXP (bn Euros):	950.8	271.5	0.0	207.8	471.6
VAT Rates (in %):	–	0.0	–	7.0	19.0
VAT Revenues (bn Euros):	88.9	0.0	0.0	13.6	75.3
VAT/(EXP-VAT) (in %):	10.3	0.0	0.0	7.0	19.0
Expenditure Share (in %):	100.0	28.6	0.0	21.9	49.6
VAT Share (in %):	100.0	0.0	0.0	15.3	84.7

Notes: Data weighted by population weights.
Source: Own calculations using the HBS for Germany, i.e. EVS data (2008).

Of a total of 951 bn euros, including VAT, households in Germany spend the greatest part of 472 bn euros (50%) on commodities that are taxed at the regular rate. The other half is spend on goods that are VAT-exempt (272 bn euros or 29%) and goods that are taxed at the reduced rate (208 bn euros or 22%). This information is derived from the HBS for Germany, i.e. the EVS data for 2008.

Overall, VAT revenues observed in the German HBS for private households sum up to 89 bn euros for the year 2008. 75 bn euros (85 percent) are related to commodities taxed at the regular rate and 14 bn euros refer to the reduced VAT rate. VAT revenues from national accounts for 2008 aggregate up to 176 bn Euros. As a result, about 51 percent of aggregate VAT revenues are simulated in EUROMOD. The major reason for this discrepency is the fact that several social groups that pay significant amounts of VAT are not covered in HBS. Among these groups are the government, business enterprises that are themselves exempt from VAT

but have to pay the input VAT from all previous production stages, and private households that are not covered by the HBS, such as people in dormitories, jails, or retirement homes.

Given the statutory VAT rates (Table 5), implicit or effective VAT rates can be calculated. The implicit tax rate relates the tax liability to net total spending, i.e. spending excluding tax liability. Implicit tax rate have been aggregated up from the lowest commiditiy level observed in the data to the 15 imputed groups. Thus, the implicit tax rates for the 15 commodity groups result as a weighted average of the rates for the underlying commodities (Table 6). The resulting implicit VAT rate in Germany, on average for all commodities, is 10.3 percent. It lies in between the implicit rate for goods taxed at the regular rate (19%) and the implicit rate for goods taxed at the reduced rate (7%), which are both identical to the respective statutory rates.

Table 6: Implicit Tax Rates in the Baseline (EUROMOD – Imputed)

	Expenditures incl. VAT (bn Euros)	VAT Revenue (bn Euros)	Implicit Tax Rate (Baseline)	Share in VAT Revenue (%)
Total	969.3	99.7	10.3	100.0
Food	155.3	24.8	8.1	24.9
Alcohol	10.3	1.6	19.0	1.6
Tobacco	21.9	3.3	19.0	3.3
Clothing	41.8	5.3	19.0	5.3
Electricity	71.4	1.1	19.0	1.1
Rents	154.0	11.6	0.4	11.6
HH Services	38.9	2.7	4.7	2.8
Health	24.4	3.9	7.6	3.9
Prv. Transport	80.5	3.6	14.7	3.6
Pub. Transport	18.7	1.4	10.3	1.4
Communication	34.5	4.4	17.9	4.4
Recreation	63.7	5.9	8.6	6.0
Education	26.9	2.1	1.6	2.1
Restaurants	48.7	3.2	11.4	3.2
Others	67.4	6.9	8.0	6.9
Durables	111.0	17.7	14.6	17.8

Notes: Data weighted by population weights.
Source: Own calculations using EUROMOD based on EU-SILC data 2008 for Germany and imputations based on EVS data (2008).

Table 6 breaks the implicit tax rate down by the single commodities and relates them to gross spending and absolute as well as relative VAT revenues. It is important to note that these figures are based on the imputations of expenditures into EUROMOD. This is why there is a difference between the figures on aggregate spending and VAT revenues imputed into EUROMOD in Table 6 and the respective figures in Table 5 that relate to observed values

from the HBS. Aggregate expenditures are about 2 percent higher and VAT revenues about 12 percent higher when imputed into EUROMOD. This relatively large discrepency in VAT revenues is related to deviations at the imputations of total non-durable spending (Figure A.1) and durable spending (Figure A.2) across the income distribution as well as the imputation deviations for the single commodity groups and their composition of goods with respect to the regular VAT rate, the reduced rate, and VAT-exemptions (see figures in Appendix B).

Aggregate VAT revenues for the population of private households, as simulated in EUROMOD, sum up to 99.7 bn euros for Germany in 2008 (the HBS year), and aggregate consumption expenditures for durable and non-durable goods sum up to 969 bn euros (Table 6). Related to aggregate VAT revenues from national accounts (176 bn euros), VAT revenues simulated in EUROMOD make up about 57 percent when summed up for the population covered in EUROMOD. This coverage is slightly higher than for the HBS (51%), for the same reasons mentioned in the previous paragraph. It is still significantly lower than 100 percent, which is due to the same reasons that apply to the HBS. Several groups that pay significant amounts of VAT are not covered in EUROMOD. Among these groups are the government, business enterprises that are themselves exempt from VAT but have to pay the input VAT from all previous production stages, and private households that are not covered by the underlying EU-SILC data, such as people in dormitories, jails, or retirement homes.

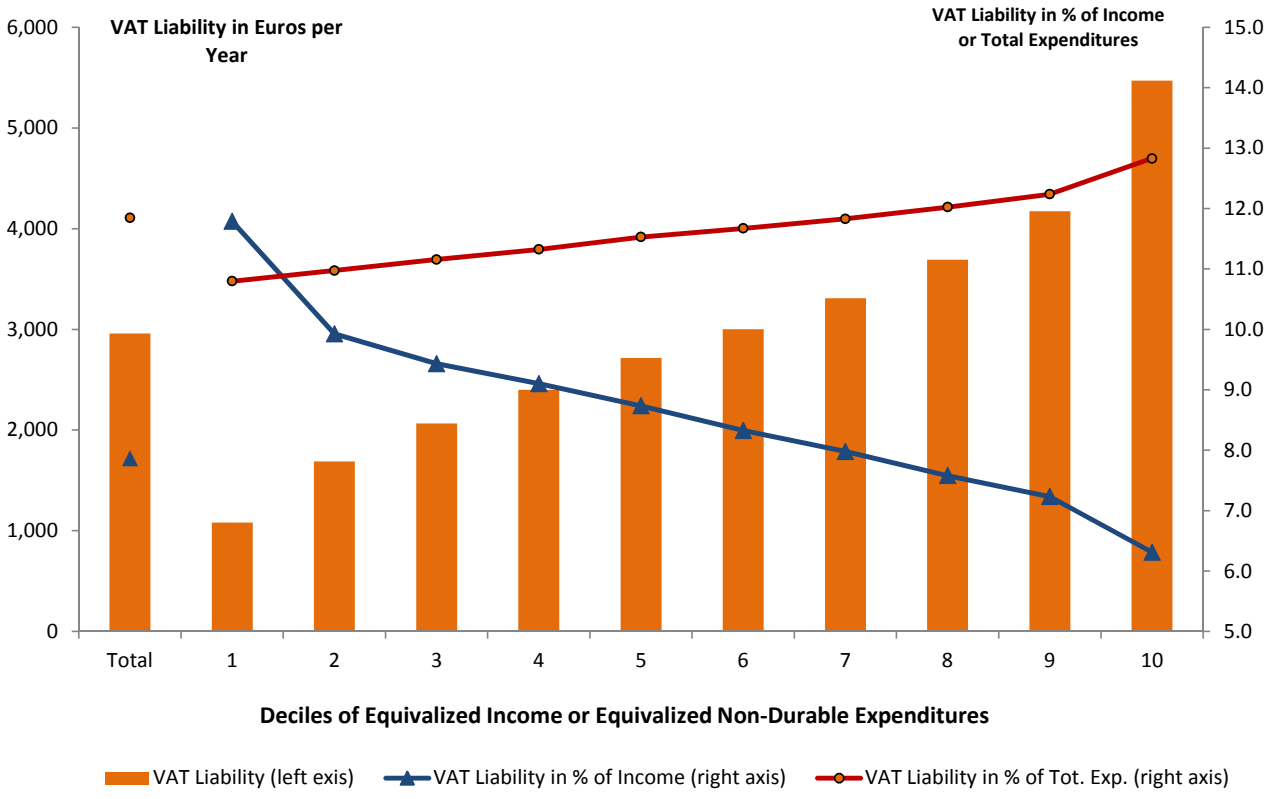
A large share of aggregate VAT revenues simulated in EUROMOD relate to food and non-alcoholic beverages (25%). This is followed by durable goods (18%) and rents (12%). All other commodity groups only account for less than 7 percent of overall revenues each.

Furtermore, implicit VAT rates are broken down by the single commodity groups in Table 6. While the average implicit VAT rate is 10.3 percent (as in the HBS), the implicit rate varies largely across the single commodity groups, according to their composition with respect to goods taxed at the regular VAT rate, the reduced rate, and VAT-exempt goods. Commodity groups that consist only of goods that are taxed at the regular rate, such as alcohol, tobacco, clothing, or electricity have an implicit VAT rate that matches the regular rate of 19 percent. Groups that consist of some goods that are taxed at the reduced rate or that are exempt have an implicit VAT rate that is lower than the regular rate, such as communication, private transport, or durables. Commodity groups that largely consist of goods with reduced rates have an implicit rate around 7 percent (food, health), and groups with mostly exemt goods have implicit rates near zero (education, rents).

Now we turn to the analysis of the VAT incidence. The distribution of VAT liability for the baseline VAT legislation is presented in Figure 6 across the distribution of household income and spending respectively. Decile median VAT payments are plotted in Euros per year as well as related to income or total spending in percent. VAT payments are presented across

the distribution of equivalized net household income, respectively spending, where the income and spending distributions has been weighted by the number of persons in the household in terms of the modified OECD equivalence scale (size-weighted distribution of household income, respectively spending).

Figure 6: VAT Incidence in the Baseline



We can see from Figure 6 that VAT payments increase in income in absolute terms. On average across all deciles, households pay nearly 3,000 Euros per year for VAT. While households in the lowest decile only pay some 1,100 Euros, households in the 10th income decile pay about 5,500 Euros.

However, when we consider VAT payments in percent of household net income (right axis of Figure 6) the picture suggests that VAT is regressive. Tax liabilities decrease in income in relative terms. They amount to some 12% of income in the 1st income decile and decrease down to some 6% for the 10th decile. On average, households pay about 8.7% of their net income for VAT.

If on the contrary, VAT liabilities are related to total spending, instead of net income, the picture turns around (Figure 6). Now VAT is distributed slightly more progressively, in the

sense that tax liabilities increase in spending in relative terms. Households in the lowest expenditure decile spend 10.8% of their total expenditures on VAT, whereas households in the highest expenditure decile pay almost 13%. The variation is though not as great as it is when related to income and plotted across the income distribution. The average household pays some 11.8% of total spending for VAT.

The reason for the different pictures when VAT liabilities are plotted against the income distribution and the spending distribution lies in the distribution of savings, i.e. that part of current income that is not spent in the current period but saved for future consumption. It is not subject to VAT in the period under consideration. Because households with higher incomes tend to save a greater part of their income (see Figure 5), VAT liabilities make up a smaller fraction of income for rich households than for poor ones. Once the picture abstracts from savings and relates VAT liabilities to total spending only, we see a slight increase in tax liabilities for higher spending deciles. This increase is related to the fact that poor households tend to spend a larger part of their total expenditures on commodities that are VAT-exempt or subject to reduced VAT rates, such as food.[16]

6.2. Uniformity without Compensation (Reform A)

The first VAT reform that we simulate is uniformity in VAT rates with respect to the reduced rate. This implies substituting reduced rates by regular rates, while keeping zero rates (in case they are relevant, which is not the case for Germany) and exemptions (Reform A).

Table 7 displays the changes at the implicit tax rates resulting from this reform. The overall implicit VAT rate increases by 2.6 perecentage points to 12.9 percent. This implies an overall price increase by 2.3 percent. Broken down by commodity groups, we can see that uniformity implies price increases for groups that consist of goods that are taxed at reduced rates in the baseline tax legislation. Prices increase greater than on average for groups that have relatively great shares of these goods, such as health, public transport, or recreation, whereas increases are lower for groups that have only smaller fractions of reduced-rate goods, such as restaurants, communication, or private transport. Prices are not affected for commodity groups that do not contain any reduced-rate goods, such as alcohol, tobacco, clothing, or electricity, which only contain goods that are taxed at the regular VAT rate. There is also no price effect on groups that consist only of regular-rate goods and VAT-exempt goods, such as rents, household services, and durables.

[16] Similar pictures for VAT incidence in Germany are reported e.g. in Adam et al. (2011). Interestingly, however, Adam et al. (2011) also find that the slightly progressive effect of VAT when plotted against the spending distribution does not occur in all countries. In many countries, VAT is largely distributionally neutral when related to expenditures.

Table 7: Implicit Tax Rates in the Baseline and Under Uniformity

	Implicit Tax Rate (Baseline)	Implicit Tax Rate (Uniformity)	Implied Price Change (%)
Total	10.3	12.9	2.3
Food	8.1	19.0	10.1
Alcohol	19.0	19.0	0.0
Tobacco	19.0	19.0	0.0
Clothing	19.0	19.0	0.0
Electricity	19.0	19.0	0.0
Rents	0.4	0.4	0.0
HH Services	4.7	4.7	0.0
Health	7.6	15.3	7.1
Prv. Transport	14.7	15.3	0.5
Pub. Transport	10.3	16.6	5.7
Communication	17.9	19.0	0.9
Recreation	8.6	13.0	4.1
Education	1.6	4.0	2.4
Restaurants	11.4	13.2	1.6
Others	8.0	8.4	0.4
Durables	14.6	14.6	0.0

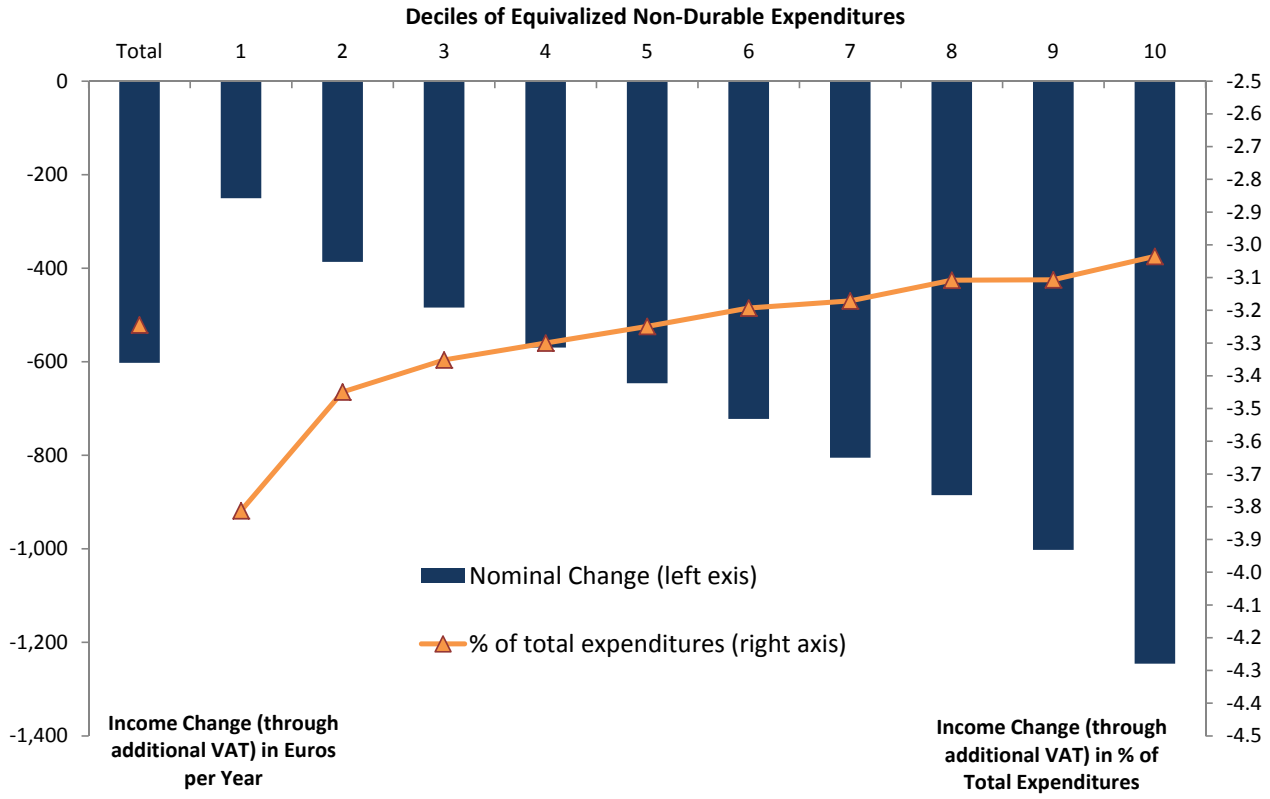
Notes: Data weighted by population weights.
Source: Own calculations using EUROMOD based on EU-SILC data 2008 for Germany and imputations based on EVS data (2008).

Implementing uniformity at VAT rates has huge effects on aggregate tax revenues. VAT revenues increase by 23.8 bn euros in the course of this reform if behavioral effects are assumed absent (i.e. assuming constant quantities). If we account for behavioral responses at the household spending structure (simulating responses implied by structures of estimated Engel curves), VAT revenues only increase by 22.9 bn euros. This implies that households alter their spending structure (in the current period) such that they move away from goods that show implied price increases towards goods that became relatively cheaper, in the sense that their VAT rates were unaffected by uniformity.

We now come to the distributional effects of this reform. The results of implementing uniformity, without any form of compensation, clearly show regressive effects (see Figure 7). On average, households bear an extra burden of about 600 Euros per year in terms of additional VAT liabilities. This burden in absolute terms increases across the spending distribution from some 250 euros in the lowest spending decile to over 1,200 euros in the 10th decile. However, in proportional terms, it decreases across the spending distribution. On average, it makes up 3.2% of total spending. For households in the lowest decile it is more than 3.8 percent, while the richest households only bear an additional tax liability of 3.0 percent of their total

expenditures.

Figure 7: Distributional Reform Effects (Uniformity at VAT Rates)



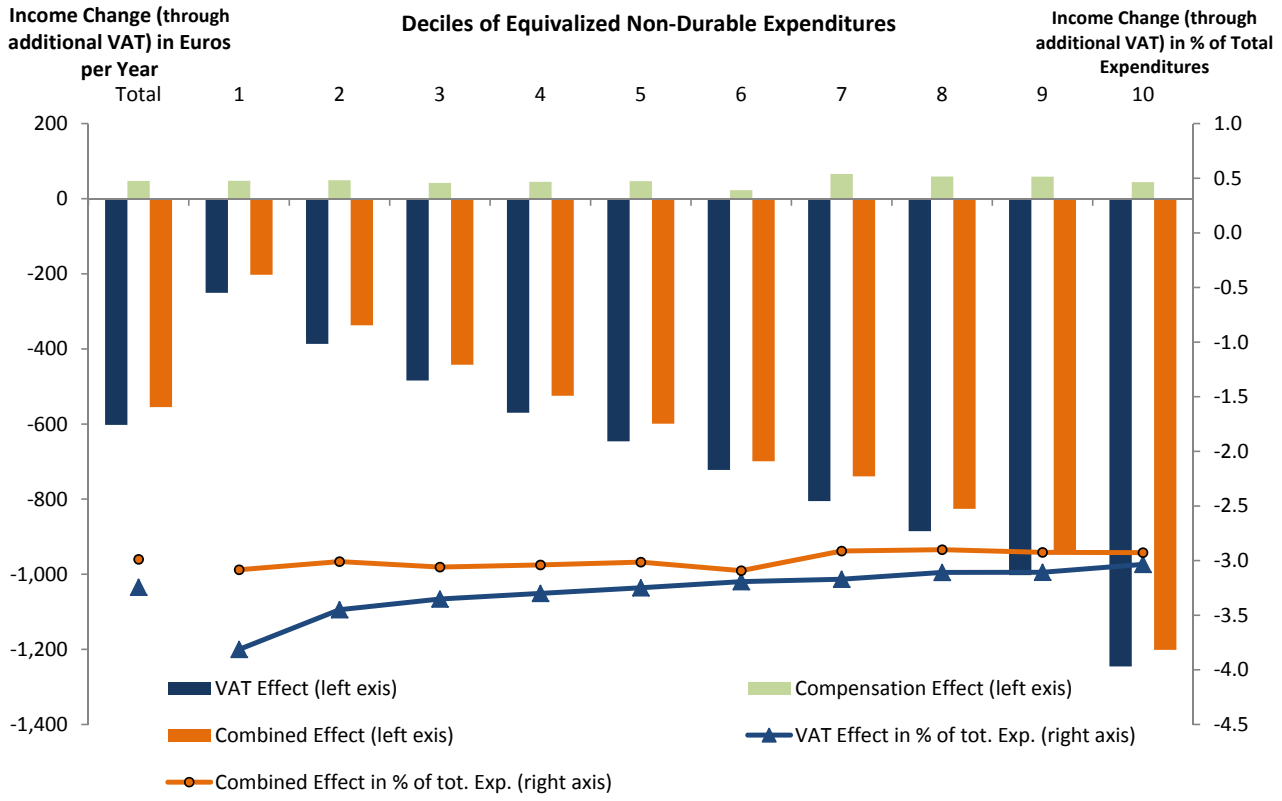
Concluding from the sole implementation of uniformity with respect to reduced VAT rates, we find that this reform implies regressive effects in the sense that it results in proportionally higher burdens for poor households than for rich ones, as long as households are not at the same time compensated for these burdens, which we will now turn to.

6.3. Uniformity with Compensation Through Social Benefits (Reform B)

Building on the results from the previous reform, we now implement uniformity indentically to Reform A, with the addition of compensating households for the additional tax burdens by increasing all social benefits by a fixed amount (Reform B). We have considered all relevant social benefits that are simulated in EUROMOD for Germany, which are contributory unemployment benefits, child benefits, non-contributory unemployment benefits, social assistance, and parental leave as well as maternity leave benefits. We raise the amounts paid of all these

benefits by the CPI increase implied by the implementation of uniformity (2.3%, see Table 7).

Figure 8: Distributional Reform Effects (Uniformity, Compensated at Social Benefits)



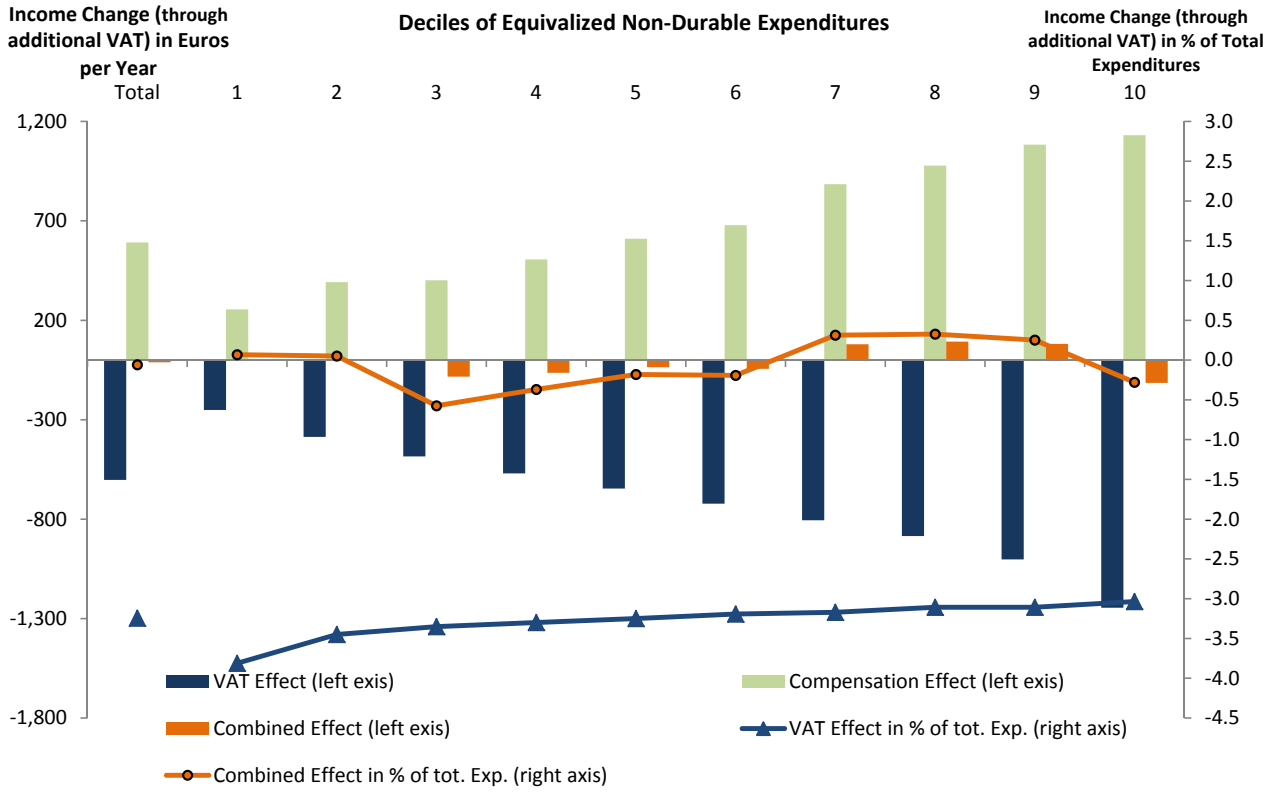
The fiscal costs of raising social benefits by 2.3% aggregate up to some 2 bn Euros per year. That is significantly less than the VAT increase of 22.9 bn euros resulting from uniformity alone, accounting for behavioral response. Thus, this increase in social benefits by the implied price change cannot fully compensate all households for additional VAT burdens, by construction. The intuitive reason is that not all households that are affected by implementing uniformity at VAT rates are eligible for social benefits, so that not all households get effectively compensated.

When looking at the distributional effects of Reform B, we do however see that the regressive effect that we saw at Reform A vanishes when we compensate households by raising social benefits (Figure 8). On average, households lose 555 Euros from uniformity coupled with compensation, which makes up 3.0% of their total spending. This proportional effect is largely constant across the spending distribution, i.e. this reform is distributionally neutral, when we consider the distribution of total expenditures in the current period.

6.4. Uniformity with Compensation Through Benefits and PIT (Reform C)

Now we build on Reform B and fulfill the additional target of being largely revenue-neutral so that households are fully compensated, on average, for implementing uniformity. We implement uniformity with respect to reduced VAT rates and compensate households by raising social benefits significantly and at the same time lowering effective personal income tax (PIT) burdens. We increase all relevant social benefits, this time by 10 percent. In addition, we raise the tax-exempt allowance at PIT by about 25%, from 8,004 euros to 10,000 euros (Reform C).

Figure 9: Distributional Reform Effects (Uniformity, Compensated at Social Benefits and Taxes)



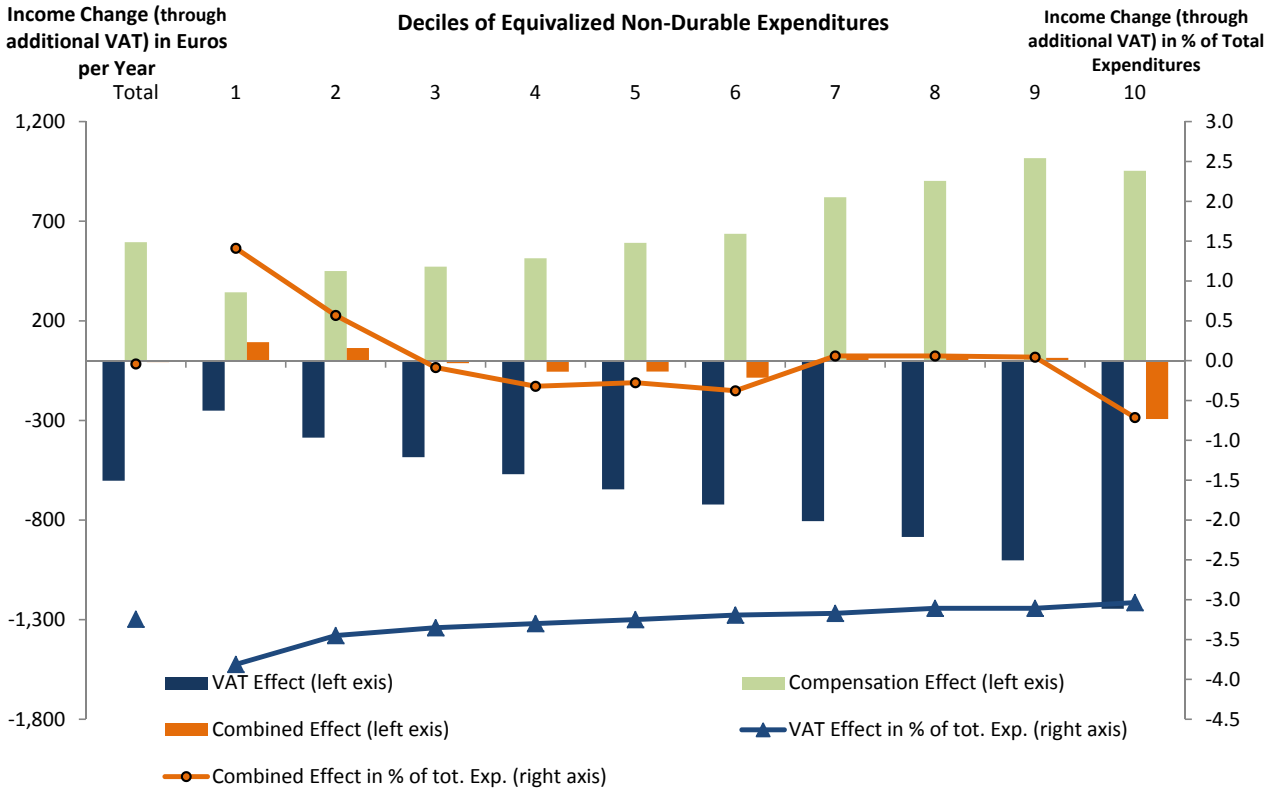
The aggregate costs of raising benefits by 10 percent and at the same time shifting the tax-exempt allowance of PIT up sum up to about 23 bn Euros per year. This implies that Reform C is almost revenue-neutral (under constant quantities) and leaves only a tiny loss for the average household. The average household loses 11 Euros per year, which makes up 0.1% of total spending. From the distributional plot we can see that there are some benefits for households in the 7th-9th spending deciles, while households in the 3rd-6th deciles bear some additional burdens, even after compensations at social benefits and PIT have been accounted

for (see Figure 9). This is related to the fact that in these mid and lower deciles, many households have too high incomes to be eligible for social benefits but at the same time to little income to pay taxes to a significant amount so that they benefit less that on average from the compensations.

6.5. Uniformity with Compensation Through Benefits and SSC (Reform D)

Finally, we want to check whether we can get rid of the additional liabilities for mid and lower income households if we lower social security contributions, instead of PIT burdens.

Figure 10: Distributional Reform Effects (Uniformity, Compensated at Social Benefits and SSC)



We implement uniformity, raise all relevant social benefits (see Reform B), this time by 15 percent, and reduce employee social security contributions (SSC) by 6 percent (Reform D).

This form of compensation has aggregate fiscal costs of about 23.5 bn Euros per year, i.e. it is also mostly revenue-neutral and leaves only a negligible loss for the average household of 7 Euros per year, which makes up less than 0.1% of total spending of the average household.

However, from the distributional plot we can see again that this result does not hold perfectly along the spending distribution (see Figure 10). There are some benefits for households in the lowest two deciles. This time they benefit from the generous increase in social benefits and some of them benefit from reduced SSC. But, in 3rd-6th spending deciles again households bear on average some additional burdens, even after compensations at social benefits and SSC have been accounted for. This also holds for households in the 10th decile. They are typically not affected by increases in social benefits and many of them do not benefit from reductions in SSC either because they have incomes that are above the contributions thresholds of the social security systems.

In conclusion, we can say that uniformity with respect to reduced VAT rates can be implemented such that it is largely revenue neutral and at the same time largely distributionally neutral, but we have not found a reform yet that guarantees perfect distributional neutrality.

7. Conclusion

We impute expenditure information at the household level into EUROMOD using micro data from the German household budget survey data. The goodness of fit seems to be acceptable to build on this integrated data base a microsimulation model that combines the simulation of direct taxation and social benefits with indirect taxation, in the context of EUROMOD.

VAT simulations based on imputed spending into the SILC data for Germany reveal the typical incidence results in the baseline scenario of current VAT legislation. VAT looks regressive when plotted against the income distribution – tax burdens decrease in income in relative terms – while VAT is progressive when plotted against the expenditure distribution – tax burdens increase in spending in relative terms.

Policy reforms that build on uniformity with respect to reduced VAT rates can be implemented such that revenue neutrality and at the same time distributional neutrality are largely guaranteed.

References

Adam, S., D. Phillips, S. Smith, L. Bettendorf, S. Boeters, H. Kox, B. Straathof, K. Stuut, M. Baldini, M. Ferrari, S. Giannini, P. Onofri, S. Tomasini, L. Vincenzi, L. Barbone, R. Bird, L. V. Caro, T. Valkonen, N. Määttänen, C. Breuer, A. Ebertz, C. Nam, J. Berger, L. Strohner, M. Myck, S. Bach, M. Beznoska, R. Ochmann, N. Badenes, O. Canto, J. Labeaga, A. Trannoy, N. Ruiz, V. Denis, A. Decoster, and D. Verwerft (2011): "A Retrospective Evaluation of Elements of the EU VAT System: Final Report," *Study on behalf of the European Commission (ed.), TAXUD/2010/DE/328, FWC No.TAXUD/2010/CC/104, Institute for Fiscal Studies (Project Leader).*

Banks, J., R. Blundell, and A. Lewbel (1997): "Quadratic Engel Curves and Consumer Demand," *The Review of Economics and Statistics*, 79, 527–539.

Beznoska, M. and R. Ochmann (2013): "The Interest Elasticity of Household Savings," *Empirical Economics*, 45 (1), 371–399.

Deaton, A. S. and J. Muellbauer (1980): *Economics and Consumer Behavior*, Cambridge University Press, New York.

Decoster, A., B. D. Rock, K. D. Swerdt, D. Flannery, J. Loughrey, C. O'Donoghue, and D. Verwerft (2007): "AIM-AP: Deliverable 3.3 Matching tax legislation and commodity aggregation," *Accurate Income Measurement for the Assessment of Public Policies (AIM-AP).*

Ochmann, R. and F. Fossen (2012): "EUROMOD Country Report Germany, EUROMOD Version F6.0. Project on behalf of the Directorate-General for Employment, social affairs and equal opportunities of the European Commission," *DIW Data Documentation*, 64.

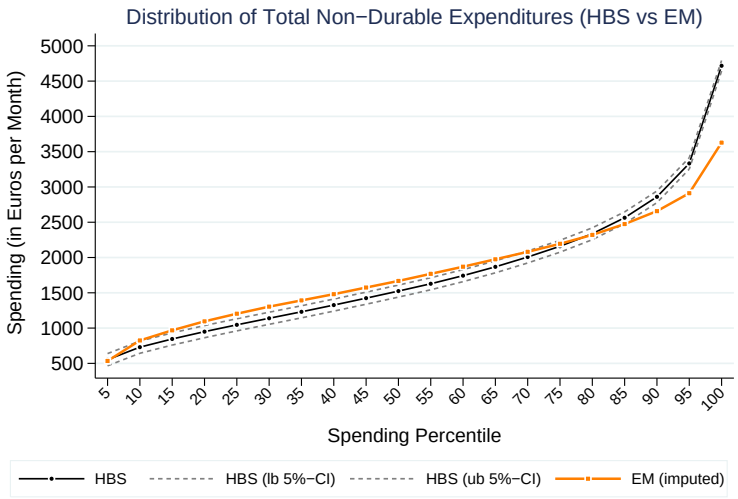
Ochmann, R. and P. Gallego Granados (2013): "EUROMOD Country Report Germany, EUROMOD Version F7.0. Project on behalf of the Directorate-General for Employment, social affairs and equal opportunities of the European Commission," *DIW Data Documentation*, 67.

Sutherland, H. and F. Figari (2013): "EUROMOD: the European Union tax-benefit microsimulation model," *International Journal of Microsimulation*, 6(1), 4–26.

Wooldridge, J. M. (2003): *Introductory Econometrics - A Modern Approach*, Thomson.

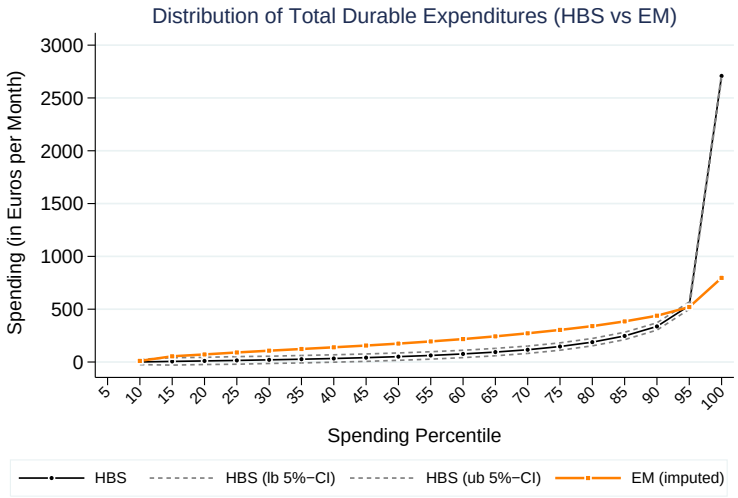
A. Appendix – Plots for Durable and Non-Durable Spending

Figure A.1



Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

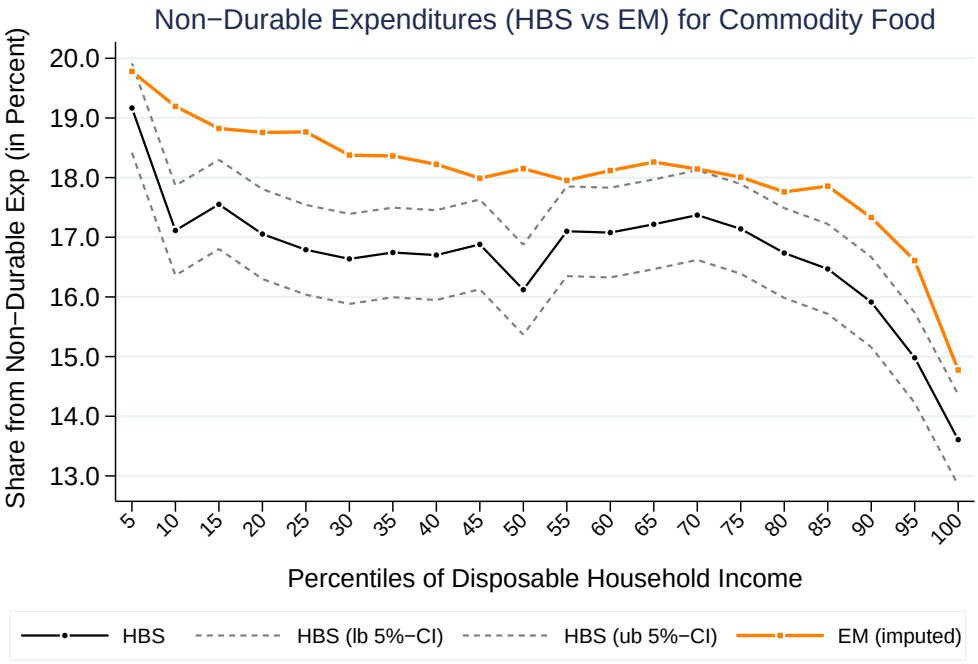
Figure A.2



Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

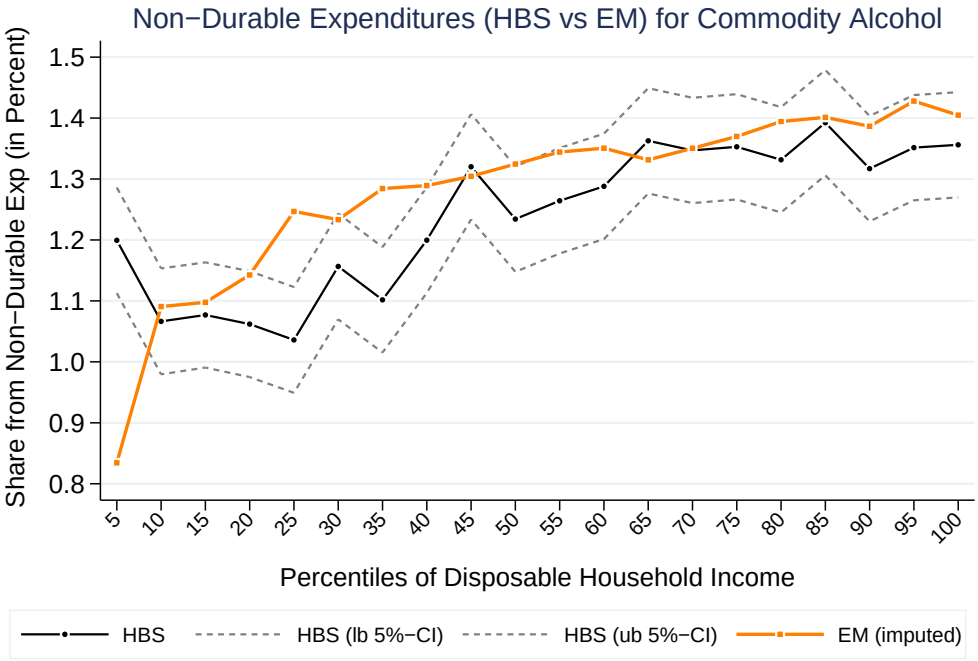
B. Appendix – Plots for Non-Durable Commodity Shares

Figure B.1



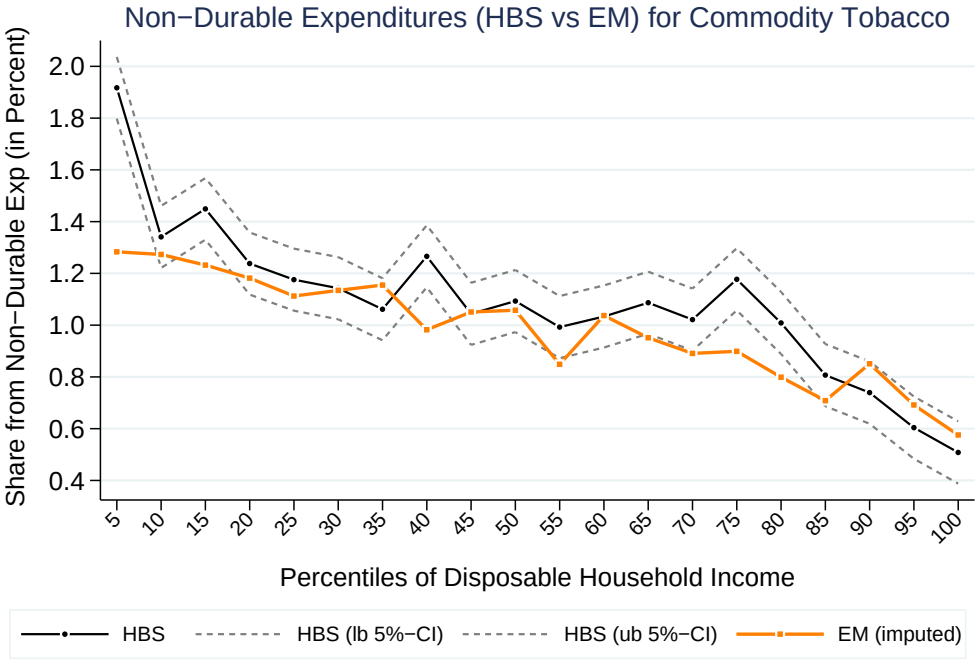
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.2



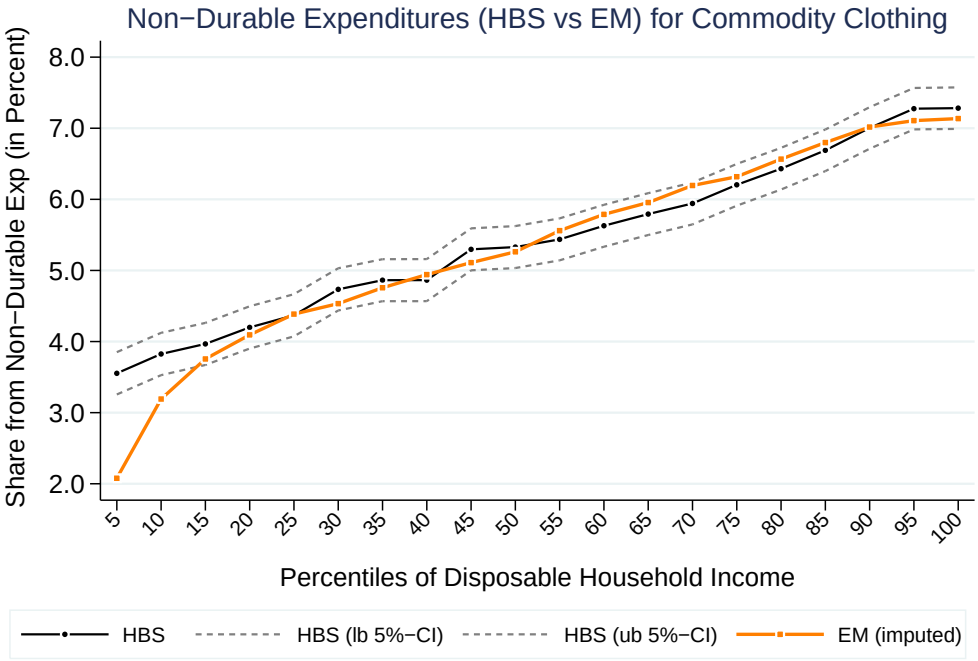
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.3



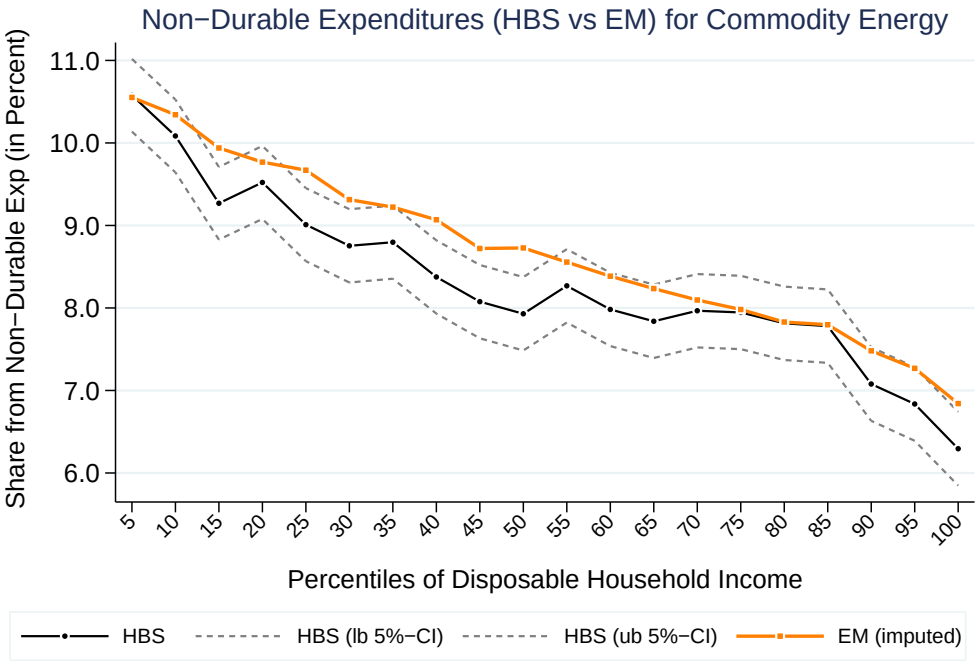
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.4



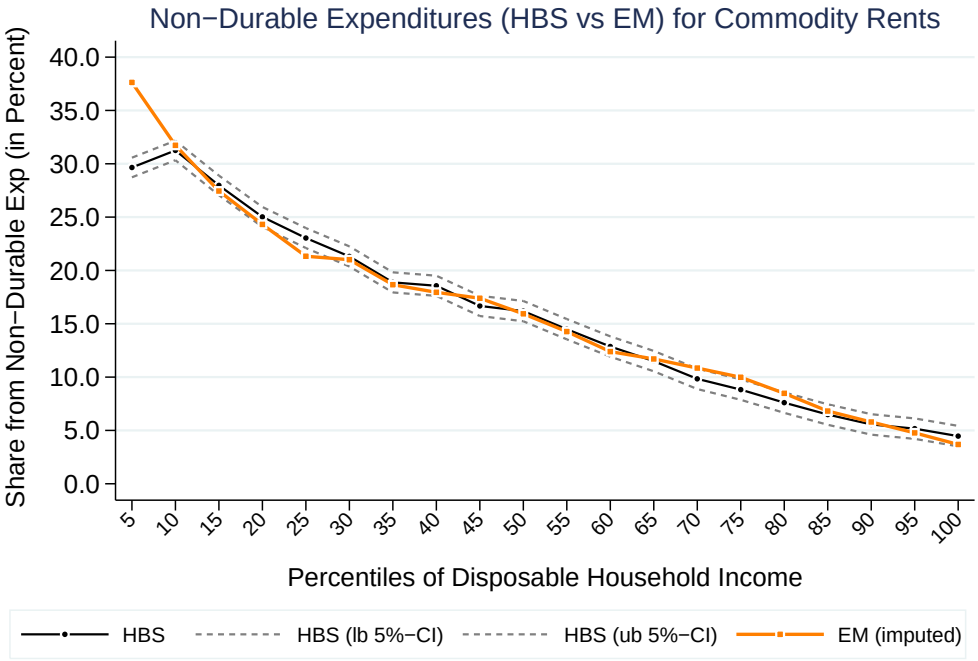
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.5



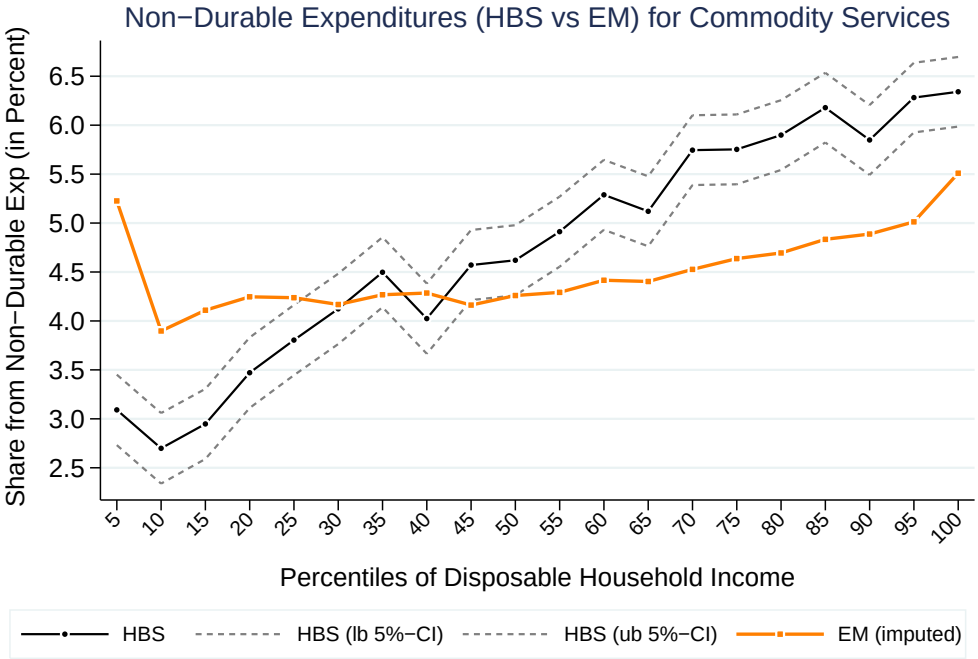
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.6



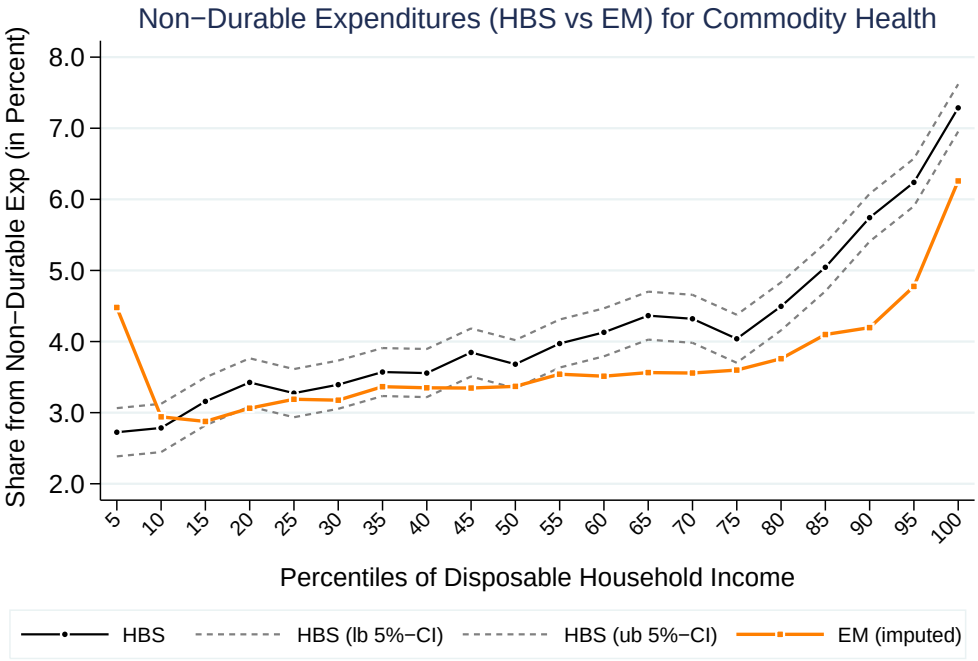
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.7



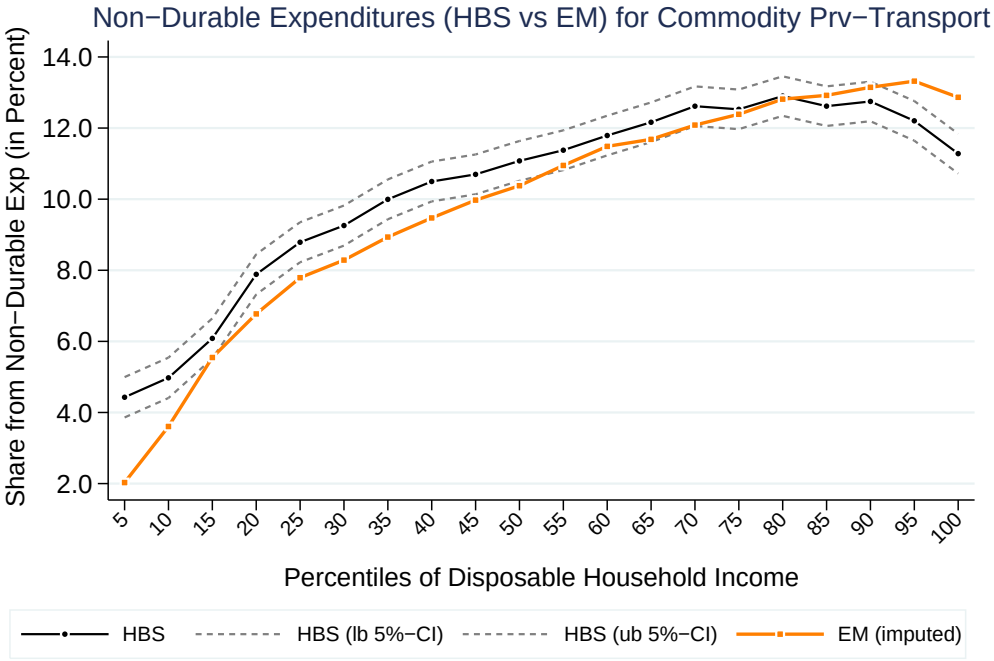
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.8



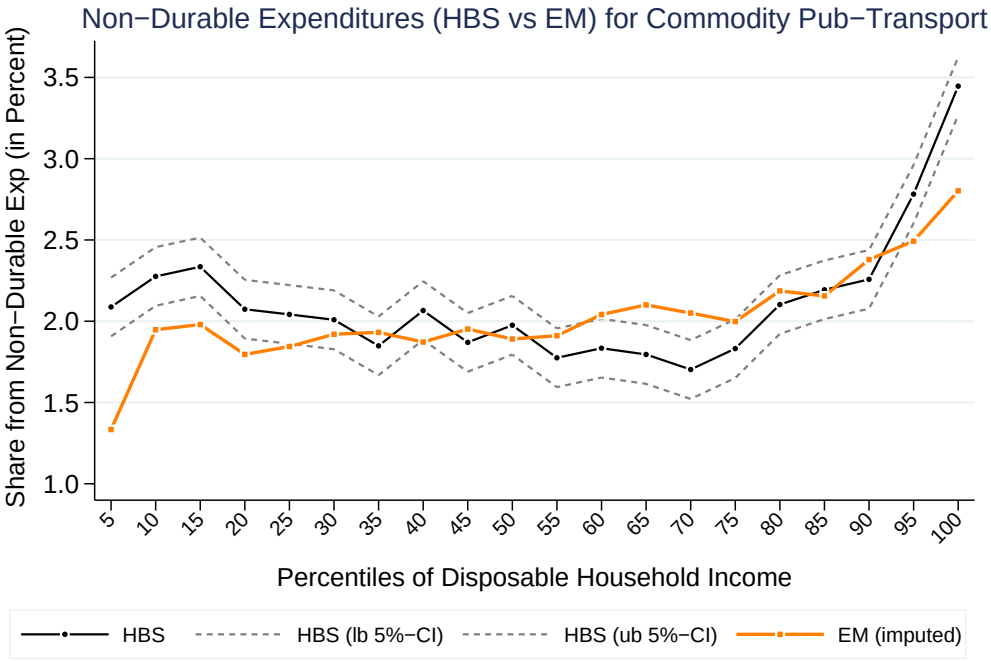
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.9



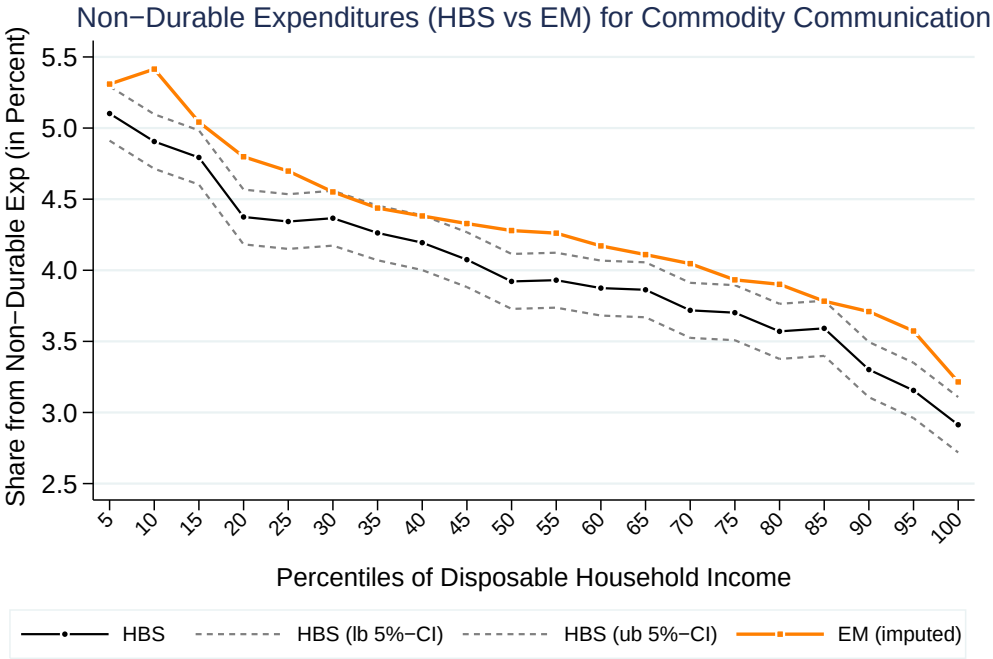
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.10



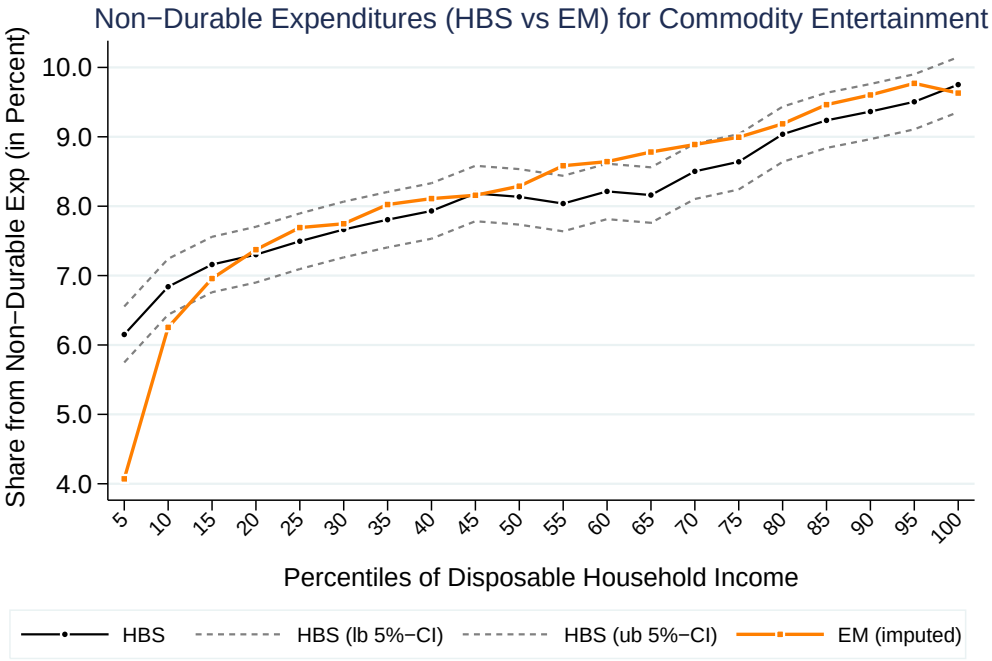
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.11



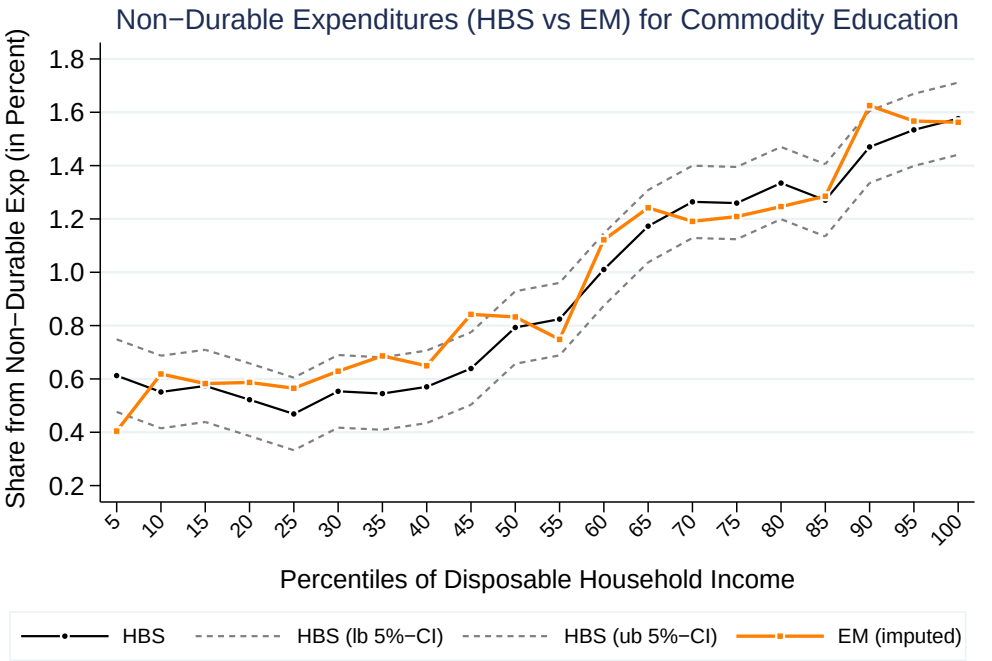
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.12



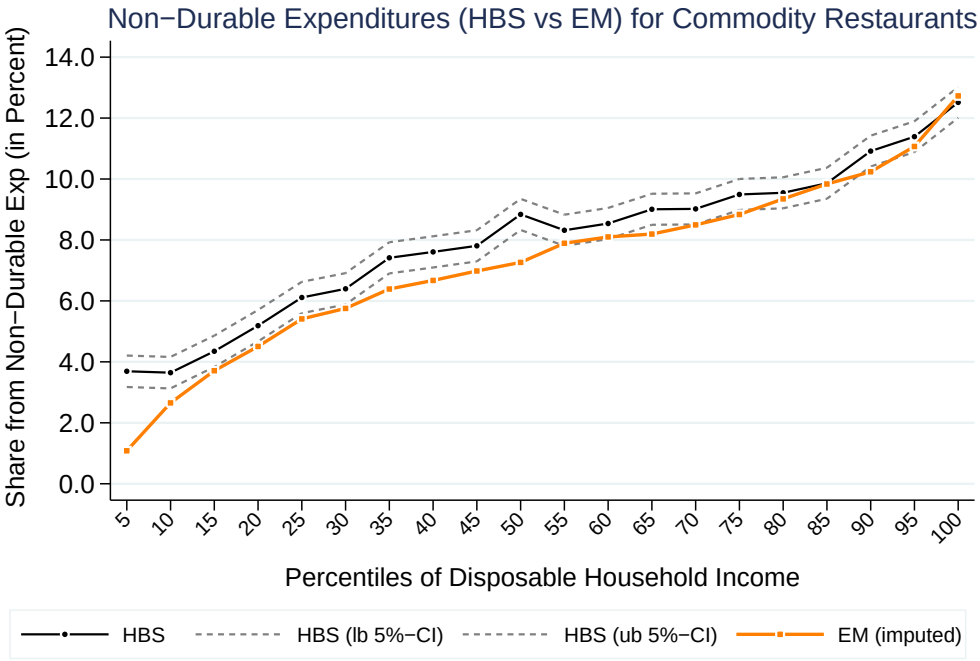
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.13



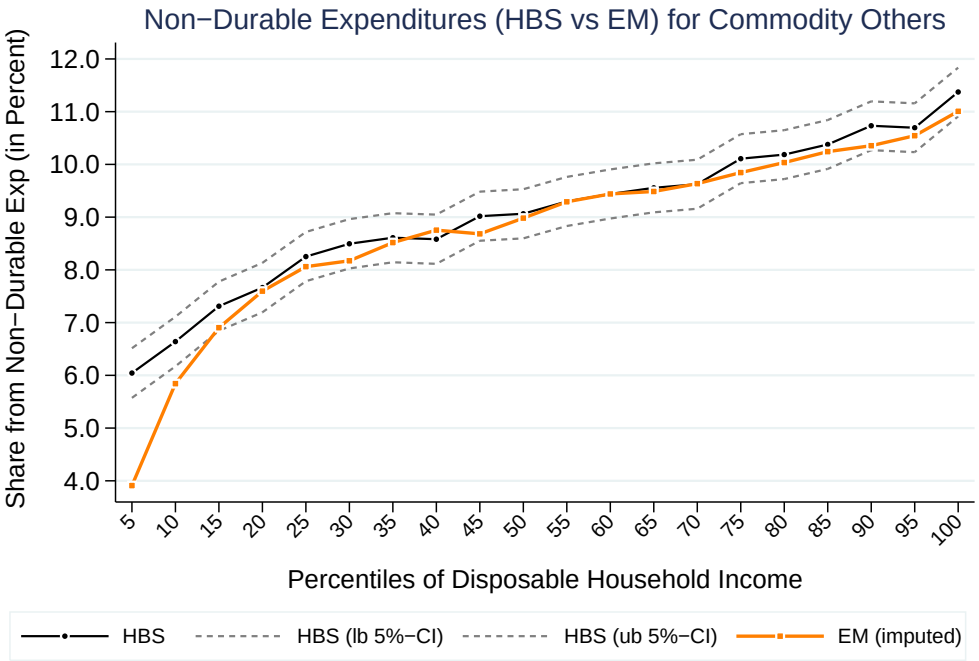
Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.14



Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).

Figure B.15



Notes: Weighted by population weights. EVS data (2008) and EU−SILC data (2008).