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Total expenditure elasticity of non-durable consumption of European households

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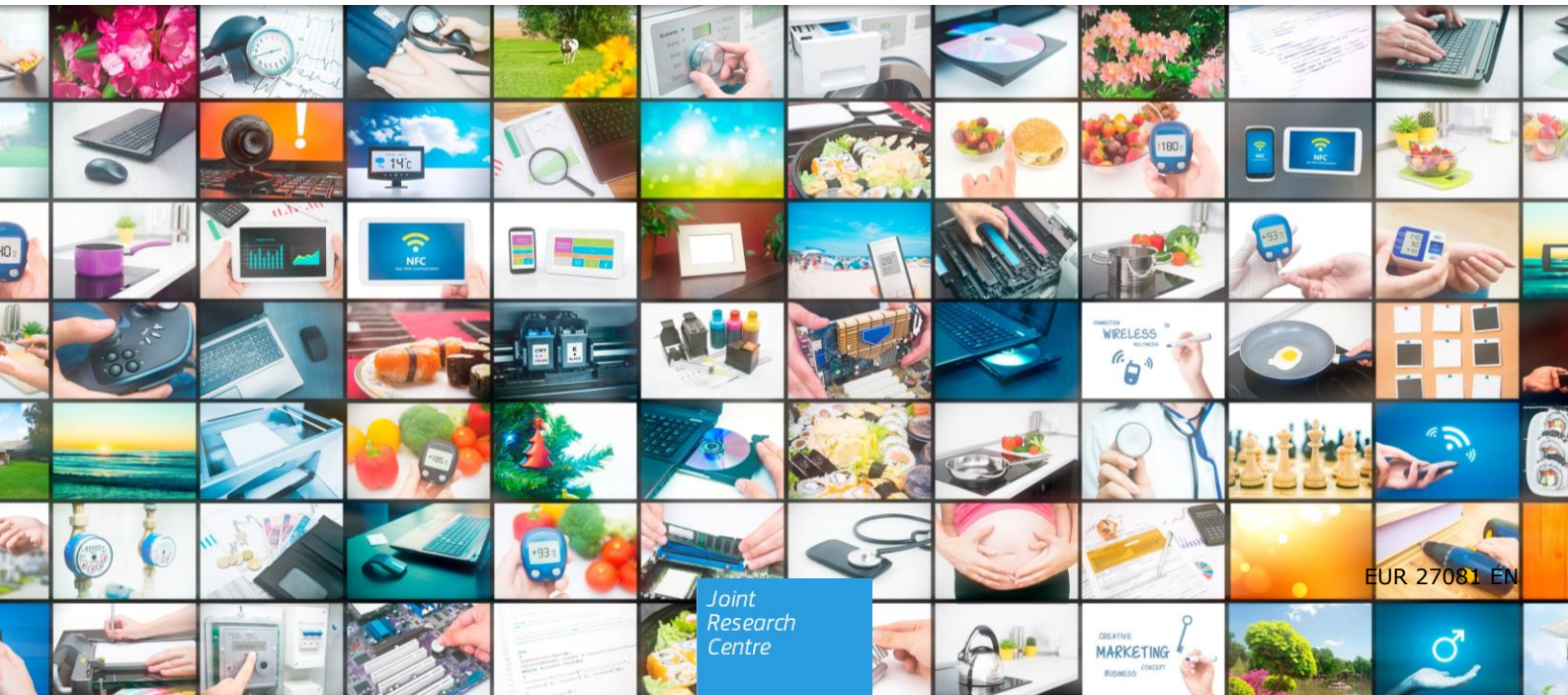

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Abstract

This document presents the results of an empirical analysis carried out in order to estimate total expenditure elasticities for the household consumption module of the FIDELIO model. The estimates are based on survey data for the following six European countries: Austria, France, Italy, Slovakia, Spain, and the UK. The analysis deals with twelve categories of non-durable consumption: four energy- and eight non-energy-related goods and services. Results appear to be in line with the comparable elasticity estimates of the existing literature. Socio-demographic controls related to both household characteristics and housing conditions offer interesting additional results that may be useful at a later stage of the analysis with the FIDELIO model.

1. Introduction

The work illustrated in this document has been carried out within the CARBON CAP project[1] which makes use of the FIDELIO model, an input-output demand-driven model (see Kratena et al. 2013 for more details on the first version of the model).[2] The latest version of it features a rich module for household consumption in need of several parameters to characterise the behaviour of European households. The present document illustrates the empirical analysis that has been done in order to produce the total expenditure elasticity (which is routinely interpreted as the income elasticity, see e.g. Browning and Crossley 2000) for the consumption of various non-durable goods and services for the purposes of the household consumption module of FIDELIO.

It has become standard to use general equilibrium model such as Computable General Equilibrium (CGE) and input-output models to carry out analyses on policy relevant issues such as international trade and environmental developments. General equilibrium models normally rely on microeconomic foundations specifying the behaviour of agents. Among the many parameters used in such models, price and expenditure/income elasticities for consumption are particularly important. The values of such parameters normally arise from econometric estimates using information on how the consumption of certain goods responds to both price and total expenditure changes.[3]

The goods and services which constitute the object of interest of the present analysis all pertain to the non-durables' domain and can be classified into energy and non-energy consumption. The four categories of energy-related goods and services are the following: electricity, heating fuel, fuel for private transport, and public transport services. The eight non-energy-related goods and services are the following: food, clothing, furniture and equipment [4], health, communication, recreation and accommodation, financial services, and other (the latter is a residual category). The FIDELIO model focuses on the European Union (EU) countries (some non-EU regions are included in the model, but with simplified structures and equations), therefore in principle data from all the EU countries should be used in order to estimate the elasticities needed. However, appropriate household-level (survey) data are only available for six countries, therefore the information extracted from those surveys has been extended to all the other EU countries featured in the model as explained in more details below.

The results of the analysis are the following. The estimated expenditure elasticities appear to be in line with those available in the literature. Although a full comparison is not feasible (since the existing articles and papers all focus on different countries and time periods, and make use of varying definitions of the variables at stake), numbers are mostly within the ranges of previously estimated coefficients. All the energy-related commodities appear to be necessities, i.e. normal goods with positive income elasticity smaller than one. Of the eight non-energy related commodities, food and communication appear to be necessities, while clothing, furniture, health, and recreation are all

[1] The idea behind this project is that growing consumption is an important driver behind rising greenhouse gas emissions and that the world economy is highly integrated. Thus, the project considers Consumption-based Accounting Policy (CAP) because it is thought to be able to complement existing policies (such as the Kyoto protocol) which are based on territorial emissions adopting a consumption oriented perspective.

[2] The acronym FIDELIO stands for Fully Interregional Dynamic Econometric Long-term Input-Output. The present document refers to the second version of the model.

[3] The present analysis only deals with the estimation of total expenditure elasticities, but not of price elasticities. Time series have been used to estimate the latter separately for FIDELIO-related purposes.

[4] Furniture and equipment are in fact durable goods, but within the context of the FIDELIO model non-durable goods are defined as goods that cannot constitute collateral for debt.

estimated to be superior goods (that is, normal goods with income elasticity above one). The estimates are unable to shed light on the nature of financial services and of the residual category ('other'). Finally, the use of a large number of socio-demographic controls related to both household characteristics and housing conditions yields additional results that could turn out to be useful at a later stage of the analysis with the FIDELIO model.

The remainder of the document is organised as follows. Section 2 contains a very brief review of the literature dealing with the estimation of income elasticities related to household consumption of both energy- and non-energy-related commodities. Section 3 illustrates the empirical models used in our analysis and presents an overview of the data. Section 4 shows the results, and section 5 briefly concludes.

2. Literature review

The studies on energy-related commodities differ significantly from those of other types of commodities. This is the reason why this literature review section is organised in two sub-sections, the first (2.1) dealing with energy consumption, and the second (2.2) on non-energy-related spending.

2.1 Energy consumption

The existing literature offers a number of studies dealing with the estimation of the price and income elasticity for the four categories of energy-related goods and services included in the FIDELIO model (electricity, heating fuel, fuel for private transport, and public transport services). The studies differ in terms of data used, country and time coverage, and econometric techniques employed. In fact, all those dimensions are interrelated, as the choice of the econometric technique depends on the characteristics of the available data (for example, household-level vs aggregate consumption data, and cross-sectional vs panel data). Thus, data availability plays a crucial role for identifying the empirical strategy capable of delivering the needed elasticity.

Consumption of electricity and heating fuel are often studied jointly, given that they can be considered, at least partially, as substitutes. Country-specific studies are very common, and examples dealing with EU countries include the following: Hondroyiannis (2004) on Greece; Tiezzi (2005) on Italy; Labanderia et al. (2006) using both cross-sectional and time series data for Spain; Rehdanz (2007) studying space heating expenditure in Germany; Druckman and Jackson (2008) and Meier and Rehdanz (2010) concentrating on the UK.[5] According to the literature, the income elasticity for electricity and heating fuel consumption ranges between -0.27 and 0.61, although most estimates lie in the [0.08, 0.27] range.[6]

Measuring the price and income elasticity of fuel/gasoline/diesel consumption has always proven to be a popular exercise in the economics literature due the relevance of the related policy implications. As for the case of electricity and heating fuel consumption, systems of equations have sometimes been used to account for the potential substitutability with public transport spending as well. The survey by Graham and Glaister (2002) on the elasticities related to automobile fuel is a reasonable starting point for a look at the literature. According to the evidence based on aggregate data for developed countries, the short-run income elasticity is above 0.15 and below 1.00, while the long-run elasticity is substantially higher but never above 2.00. Empirical studies employing micro-data suggest that numbers should be revised downwards, with an estimated elasticity between zero and 0.54. More recent studies (see, among others, Wadud et al. 2009, Dahl 2012) substantially confirm those findings.

The literature on public transport offers a significantly lower number of studies than that on automobile fuel. Also, the variable of interest in such studies is normally the number of public transport trips, rather than public transport expenditure. Since the data used in

[5] Other related articles include the early studies by Dubin and McFadden (1984) on the US, Baker et al. (1989) on the UK, as well as those by Filippini (1995) on Switzerland, García-Cerruti (2000) on California, Halvorsen and Larsen (2001) and Larsen and Nesbakken (2004) on Norway, Filippini and Pachauri (2004) on India, Holtendahl and Joutz (2004) on Taiwan, Kamerschen and Porter (2004) on the US, and Haas and Schipper (1998) on OECD countries.

[6] A positive income elasticity is associated with normal goods whose demand increases as income increases, as opposed to inferior goods. Values above one characterise superior/luxury goods (the increase in consumption is more than proportional to an increase in total expenditure), and values below one are associated with necessary goods instead (the increase is less than proportional in this case).

our empirical analysis only permit the estimation of an empirical model with the latter rather than the former as the dependent variable, the relationship with the literature's findings is less straight-forward than in the cases treated above. Most studies find negative income elasticity for public transport, and explain it with individuals turning to private transport as their income rise (see, e.g., Johansson-Stenman 2002, Paulley et al. 2006). On the other hand, FitzRoy and Smith (1998) claim that the income elasticity for public transport is positive (suggesting that public transport is not an inferior good), although their study applies to the specific case of the German city of Freiburg. As an anticipation of our results, we also find a positive income elasticity, possibly because public transport is not an inferior good, or maybe simply because of the type of variable that we use, i.e. spending, differs from what is routinely used in the literature on the topic.

A full review of the vast literature dealing with the estimation of the income elasticity for the energy-related commodities mentioned in this section is beyond the scope of the present document. All that should matter for the reader is the literature range of such elasticities in order to better frame the results arising from the empirical analysis carried out for the purposes of the FIDELIO model which is explained in the remainder of the present document.

2.2 Non-energy consumption

In the latest version of FIDELIO the consumption of the eight non-energy related non-durable goods and services mentioned in the introduction (food, clothing, furniture and equipment, health, communication, recreation and accommodation, financial services, and other) is modelled within a simplified version of an Almost Ideal Demand System (AIDS). Deaton and Muellbauer (1980) provide the seminal contribution for the demand system analysis with the AIDS which rapidly gained popularity and became a workhorse model (Buse 1994). There are numerous examples in the literature of analyses of non-durables' consumption using the AIDS, particularly for food products (see, among others, Abdulai 2002, and Tiffin and Arnoult 2010).

The AIDS is normally used to estimate own and cross price elasticities, as well as total consumption elasticity. Our analysis makes use of a simplified AIDS, without prices, due to the cross-sectional nature of the data used in our analysis. Basically, the expenditure shares of the eight non-durable commodities are regressed on total expenditure and on a number of socio-demographic controls. The total expenditure coefficient is then used to recover the elasticity to be interpreted as the one estimated in the other part of the analysis. Once again, a positive elasticity's value below one means that the expenditure share for that particular commodity shrinks as total expenditure increases (this happens in the case of necessary goods). On the other hand, elasticity values above one mean the opposite: the share of expenditure used to buy that commodity increases as total expenditure increases (this is the case for superior/luxury goods).

It is hard to find examples in the literature utilising the same commodities featured in our analysis, therefore it is difficult to compare our numerical results with existing ones. However, theoretical and practice-based priors suggest that food, communication, and health-related goods may be necessary goods (characterised by positive elasticity below 1.00); clothing, furniture and equipment, recreation and accommodation, and financial services may be superior goods (positive elasticity and above 1.00); the 'other' category is used as a residual and its construction makes it hard to state a clear prior.

3. The empirical model and the data

Sub-section 3.1 illustrates the empirical models used to estimate the total expenditure elasticity for the energy-related goods and services: electricity and heating fuel first, and private and public transportation consumption second. Sub-section 3.2 deals with the eight non-energy goods and services whose total expenditure elasticity is estimated with a simplified AIDS. The third sub-section (3.3) presents the survey data used in the analysis.

3.1 The energy consumption model

The total expenditure elasticity for electricity and heating fuel consumption is based on the estimation of the following model:

$$\log\left(elec_i\right) = \alpha_0^{elec} + \alpha_1^{elec}\log(total\_nondur_i) + \boldsymbol{\varphi}_{\mathbf{j}}^{\mathbf{elec}}\mathbf{V}_{\mathbf{j,i}} + \varepsilon_i^{elec} \qquad (1a)$$

$$\log\left(heatfuel_i\right) = \alpha_0^{heat} + \alpha_1^{heat}\log(total\_nondur_i) + \boldsymbol{\varphi}_{\mathbf{j}}^{\mathbf{heat}}\mathbf{V}_{\mathbf{j,i}} + \varepsilon_i^{heat}, \qquad (1b)$$

where *i* stands for households. The dependent variable is the logarithm of expenditure in either electricity (*elec*) or heating fuel (*heatfuel*). α_1^{elec} and α_1^{heat} are the parameters of interest and are to be interpreted as the total expenditure (*total_nondur*) elasticity, evaluating the % change in the dependent variable as total expenditure changes by 1%. The vector $\mathbf{V}_{\mathbf{j}}$ contains subsets[7] of *j* socio-demographic and economic controls that, according to the existing literature, have been found to be related to the dependent variable of model (1). ε^{elec} and ε^{heat} are standard error terms.

The $\mathbf{V}_{\mathbf{j}}$ controls are the following: a) age group dummies for the household head (four, included the reference/omitted one, in all cases apart from Italy for which only three dummies are available in the survey data); b) one dummy taking the value 1 if the household head is retired (*retired*); c) one dummy taking the value 1 if the household head is unemployed (*unemployed*); d) one dummy taking the value 1 if the household head is the owner of the house he/she lives in (*owner*); e) the logarithm of the household size (*hhsize*); f) up to seven dummies indicating the age of the house (with significant differences in the exact definitions across the various surveys); g) the logarithm of the number of rooms of the house (*rooms*); h) dummies indicating the type of the house (detached, semi-detached, apartments...); i) one dummy taking the value 1 for rural households (rural); l) the population density of the area where the household lives (*pop_density*); m) regional dummies (mostly referred to the NUTS2 regions of the European Union). All the controls are meant to capture factors that can have non-negligible effects on the consumption of electricity and heating fuel in order to obtain an accurate estimate of the total expenditure elasticity, which is the objective of the analysis.

The model used to estimate the total expenditure elasticity for private and public transport spending is different from the previous one in terms of the included controls Rather than controlling for the housing stock, in this case it is more appropriate to

[7] In some cases it proved impossible to include some of the controls due to data availability issues, i.e. not all surveys contains all the controls that ideally should enter the model.

control for the vehicles' stock as this is what affects the demand for transportation services. The model is the following:

$$\log\left(fuel_i\right) = \beta_0^{fuel} + \beta_1^{fuel}\log(total\_nondur_i) + \mathbf{v_j^{fuel}N_{j,i}} + \xi_i^{fuel} \quad (2a)$$

$$\log\left(transport_i\right) = \beta_0^{transport} + \beta_1^{transport}\log(total\_nondur_i) + \mathbf{v_j^{transport}N_{j,i}} + \xi_i^{transport}, \quad (2b)$$

where again *i* stands for households, and ξ^{fuel} and $\xi^{transport}$ are error terms. As anticipated above, models (2a) and (2b) differ from models (1a) and (1b) in terms of their dependent variables (in the former it is either expenditure for fuel for private vehicles or for public transport, *fuel* and *transport* respectively) and for the vector of controls. Note that public transport stands for train, bus, and coach transportation only, and does not include expenditure for flights: the idea is to capture travels for which a private car could be a viable alternative. β_1^{fuel} and $\beta_1^{transport}$ are the parameters of interest, and their interpretation is analogous to that of α_1^{elec} and α_1^{heat} in models (1a) and (1b). The $\mathbf{N_j}$ vector contains the following *j* variables: a) age group dummies for the household head; b) one dummy taking the value 1 if the household head is retired (*retired*); c) one dummy taking the value 1 if the household head is unemployed (*unemployed*); d) one dummy taking the value 1 if the household head is the owner of the house he/she lives in (*owner*); e) the logarithm of the household size (*hhsize*); f) a dummy taking the value 1 when the household owns one car (*one car*); g) a dummy taking the value 1 if the household owns two or more cars (*more than one car*)[8]; h) one dummy taking the value 1 for rural households (*rural*); i) the population density of the area where the household lives (*pop_density*); l) the regional dummies introduced above.

3.2 The non-energy consumption model

The simplified AIDS that we use to estimate the total expenditure elasticity of the eight non-energy commodities is the following (and it is in fact very close to the Working-Leser model without prices - Working 1943, Leser 1963):

$$w_i^x = \mu_0^x + \mu_1^x\log(total\_nonenergy_i) + \mathbf{\theta_k^x M_{k,i}} + \vartheta_i, \quad (3)$$

where *i* stands for households and w^x is the expenditure share of the x^{th} commodity. μ_1^x is the parameter of interest, but cannot be interpreted directly as the expenditure elasticity like α_1 and β_1 in models (1) and (2) above. The total expenditure elasticity has to be calculated as follows (Leser 1963):

$$elasticity^x = 1 + \left(\frac{\mu_1^x}{\bar{w}^x}\right), \quad (4)$$

[8] Note that results are not affected when the number of vehicles is used instead: only a tiny minority of households own more than two vehicles.

where $\bar{w}^x$ is the sample average of the expenditure share of the x^{th} commodity. The $\mathbf{M_k}$ vector contains *k* variables: all those of vector $\mathbf{V_j}$ above - see equations (1a) and (1b) - plus those of the vector $\mathbf{N_j}$ - see equations (2a) and (2b) - not included in $\mathbf{V_j}$. ϑ is an error term.

3.3 The data

The data used in the analysis come from household-level surveys conducted in the 2004/2006 period. While the main objective of most of those surveys is to obtain data for the construction of the national Consumer Price Index (CPI) by the national statistical institutions, the information gathered in the process permits us to conduct our analysis using high-quality household-level datasets. Data for Austria, France, Italy, Slovakia, Spain, and the UK are used separately to estimate the required expenditure elasticities for the various commodities illustrated above. Then, a weighted average of those elasticities (with GDP per capita as a weighting factor) is chosen as the value to be utilised as a parameter in the FIDELIO model as explained in detail in sub-section 4.3 below.

Data for Austria are taken from the 2004/2005 Household Budget Survey produced by Statistics Austria (Statistik Austria). This survey provides information on the consumption expenditure of private households, and it contains information on household income, on key characteristics of the household members (such as age and occupation), as well as on the house the household lives in and the existing household equipment. The Household Budget Survey is currently carried out once every five years.

Data for French households are taken from the 2006 Household Budget Survey (BDF) produced by the National Institute of Statistics and Economic Studies (INSEE). The BDF puts together the entire household accounts: expenditure and resources of households in France (mainland and overseas departments). The study of expenditure is the traditional and central purpose of the survey: all household spending is recorded, and the amount and nature of these expenses is broken down into a classification of about 900 budgetary items compatible with the classification used in the national accounts. All expenses are covered, including those not associated with the consumption of goods and services (in the sense of the national accounts): taxes and contributions, insurance premiums, major home renovation expenditure, inter-household transfers, purchase of second-hand goods, loan repayments. This makes this survey the perfect instrument for our analysis, also because the survey collects information on household socio-demographic characteristics and equipment.

The Italian data come from the 2006 Household Budget Survey (Indagine sui Consumi delle Famiglie) produced by the Italian National Institute for Statistics (ISTAT). This survey contains data on household expenditures for consumption and on socio-demographic characteristics useful for our analysis. However, its monthly nature requires to be accounted for in the econometric specifications with month-specific dummies included in order to avoid seasonality issues. For example, and all else being equal, one household's heating fuel expenditure recorded in August will certainly differ from another household's expenditure for the same item recorded in January. The inclusion of monthly dummies controls for such differences due to the time of the year in which ISTAT carried out the interviews.

Slovak data are taken from the 2005 Household Budget Survey (HBS) which, like those above, contains information on household expenditure as well as on the household structure and on features of housing and other equipment. The Statistical Office of the Slovak Republic (Štatistický Úrad Slovenskej Republiky) is responsible for the publication of the HBS. In producing the 2005 wave of that survey, the Statistical Office has taken

on board the Eurostat methodological recommendations in order to facilitate the creation of a harmonised system of household-level datasets at the European Union level.

Data for Spanish household are contained in the 2004 Household Budget Continuous Survey (Encuesta Continua de Presupuestos Familiares) produced by the National Statistics Institute (INE). The survey includes many thousands of households in its sample and provides quarterly and annual information that is essential both for estimating the Spanish National Accounts household expenditure on consumption, and for updating the CPI weightings. The consumption expenditure that is recorded in the survey refers both to the monetary flow that the household pays for certain final consumption goods and services, and to the value of certain non-monetary household consumption. Household socio-demographic characteristics are recorded as well.

Finally, the 2004/2005 Expenditure and Food Survey (EFS, now called LCF) published by the Office for National Statistics is the source of the UK data. The EFS/LCF is primarily used to provide information for the Retail Prices Index (the British equivalent to CPI), National Accounts estimates of household expenditure, analysis of the effect of taxes and benefits, and trends in nutrition. The results are multi-purpose, however, providing a rich supply of economic and social data, and in fact the survey proves to be a good source of data for our analysis. The fact that the observations refer to two-weeks-long periods is a drawback that we try to minimise in the econometric estimates by including in the models appropriate period dummies (similarly to what we do for the Italian data).

4. Results

This section contains the results of the analysis and it is organised as follows: sub-section 4.1 reports the results arising from the energy consumption equations; sub-section 4.2 contains the results of the non-energy commodities' models. In all cases, only the households for which non-zero total non-durables' expenditure and non-zero values of the dependent variables have been used in the analysis (and the top 1.5% of the distribution of the latter has been excluded in order to avoid the presence of outliers in the sample). The sample is restricted to households whose head is between 20 and 85 years old, and survey weights have been used in all estimations. Sub-section 4.3 explains how the country-specific results are combined in order to produce the EU-level estimates of the expenditure elasticities used in the FIDELIO model.

4.1 Energy-consumption results

Table 1 contains the sample averages and the number of observations of the variables used in the energy-related goods and services of the analysis. Each column of the table refers to the data of each one of the six surveys used separately in the analysis. Since not all variables are recorded in all surveys, there are empty cells in the table. Note that the expenditure values are not directly comparable across countries due to the fact that Italian figures are monthly and UK figures are referred to periods of two weeks (and are expressed in pounds rather than in euros).

Tables 2 and 3 contain the results arising from the estimation of models (1a) and (1b) for electricity consumption and for heating fuel consumption, respectively. Results are mostly consistent across the various surveys. The estimated total expenditure elasticities are always significant and within the range of the existing literature estimates.[9] The expenditure elasticity for electricity consumption ranges from 0.05 (UK) to 0.33 (Spain), while the elasticity for heating fuel lies between 0.12 (France) and 0.47 (Spain). As a reminder, note that the existing literature point towards such elasticity to lie between 0.08 and 0.27, therefore it is compatible with our results.

Results for the controls are also mostly consistent across countries. Older households appear to spend more on both electricity and heating fuel than younger ones, and the larger the household size, the higher the expenditure for both commodities. Larger houses (in terms of number of rooms) call for higher electricity and heating fuel consumption. In the case of electricity consumption, the *rural* dummy and population density both offer consistent results, with households living in rural areas and less-densely populated consuming less than the others. The same does not hold for heating fuel consumption. As for the rest of the controls, in some cases results are not significant, and in others they are not consistent across countries, therefore it is harder to draw neat conclusions.

Tables 4 and 5 contain the estimates of models (2a) and (2b) for fuel for private transport and for public transport spending, respectively. Results are again reassuringly consistent across the various surveys. The estimated expenditure elasticities are always significant and within the range of the available literature estimates in the case of fuel for private transport. The expenditure elasticity of the latter ranges from 0.33 (UK) to 0.94 (Austria), which is again compatible with the available evidence of the literature. The expenditure elasticities for public transport consumption are not directly comparable to those of the literature (for the reasons explained in sub-section 2.1), and lie between 0.29 (UK) and 0.58 (Austria).

[9] Since both the dependent variable and the total expenditure variable are expressed in logarithmic form, those numbers are to be interpreted as elasticities directly.

Table 1: sample averages, energy consumption

		Austria		France		Italy		Slovakia		Spain		UK	
Variables:		**no. of obs**	**average**	**no. of obs**	**average**	**no. of obs**	**average**	**no. of obs**	**average**	**no. of obs**	**average**	**no. of obs**	**average**
Spending:	*elec*	7473	609.05	10240	1095.77	24853	37.67	4710	1041.49	8881	371.11	6762	2.94
	heatfuel	7473	843.82	10240	784.80	24853	74.20	4710	2050.13	8881	315.19	6765	3.27
	fuel	7473	2532.35	10240	1067.63	24853	127.32	4710	775.92	8881	841.61	6765	15.71
	transport	7473	231.67	10240	1201.61	24853	13.73	4710	405.38	8881	135.85	6765	2.09
Income:	*total_nondur*	7473	29803.73	10240	31774.29	24853	1801.94	4710	18546.11	8881	17358.21	6765	312.57
Household:	*agegroup_1*	7389	0.20	10078	0.20	24804	0.07	4686	0.20	8720	0.08	6783	0.18
	agegroup_2	7389	0.38	10078	0.31	24804	0.57	4686	0.33	8720	0.31	6783	0.30
	agegroup_3	7389	0.25	10078	0.27			4686	0.29	8720	0.31	6783	0.26
	agegroup_4	7389	0.18	10078	0.22	24804	0.37	4686	0.17	8720	0.30	6783	0.26
	retired	7473	0.28	10240	0.05			4710	0.25	8881	0.32	6798	0.39
	unempl	7473	0.04	10240	0.05			4710	0.03	8881	0.03	6798	0.02
	owner			10240	0.60			4710	0.87	8629	0.85		
	hhsize	7473	2.56	10240	2.48	24853	2.64	4710	2.93	8881	2.93	6798	2.39
Housing:	*agehouse_1*	7473	0.25	9435	0.19	24853	0.18	4703	0.03	7844	0.07		
	agehouse_2	7473	0.14	9435	0.12	24853	0.19	4703	0.11	7844	0.12		
	agehouse_3	7473	0.28	9435	0.19	24853	0.28	4703	0.47	7844	0.45		
	agehouse_4	7473	0.12	9435	0.15	24853	0.24	4703	0.30	7844	0.26		
	agehouse_5	7473	0.18	9435	0.13	24853	0.11	4703	0.10	7844	0.10		
	agehouse_6	7473	0.03	9435	0.12								
	agehouse_7			9435	0.11								
	rooms			10206	4.13	24853	4.34	4710	4.06	8629	5.15	6798	5.64
	housetype_1							4710	0.42	8635	0.15		
	housetype_2							4710	0.06	8635	0.21		
	housetype_3							4710	0.50	8635	0.64		
	housetype_4							4710	0.01	8635	0.00		
Vehicles:	*numcars_1*	7454	0.19	10240	0.15	24853	0.19	4710	0.50	8876	0.26	6798	0.29
	numcars_2	7454	0.53	10240	0.46	24853	0.45	4710	0.47	8876	0.52	6798	0.47
	numcars_3	7454	0.28	10240	0.39	24853	0.36	4710	0.03	8876	0.22	6798	0.24
Area:	*rural*			10240	0.25					8628	0.24		
	pop_dens	7473	2.04					4710	1.94	8881	2.18		

Source: authors´ calculations based on six different surveys.

Table 2: electricity consumption estimates, model (1a)

Variables	Austria	France	Italy	Slovakia	Spain	UK
log(total_nondur)	0.18***	0.30***	0.18***	0.17***	0.33***	0.05***
age(35-49)	0.13***	0.03	0.10***	0.04**	0.03	0.04*
age(50-64)	0.23***	0.18***		0.06***	0.06**	0.10***
age(65+)	0.15***	0.18***	0.11***	-0.01	0.09**	0.03
retired	-0.03	-0.06		-0.02	-0.03*	0.01
unemployed	0.07*	0.01		0.04	-0.02	0.06
owner		-0.52***		0.03	0.04	
log(hhsize)	0.46***	0.19***	0.50***	0.28***	0.17***	0.33***
agehouse_2	0.08***	0.02	-0.03**	0.19**	-0.02	
agehouse_3	0.03	0.01	-0.05***	0.15*	-0.03	
agehouse_4	0.04	0.07**	-0.08***	0.12	0.03	
agehouse_5	0.06**	0.16***		0.11	0.06*	
agehouse_6	-0.02	0.24***				
agehouse_7		0.18***				
log(rooms)		0.21***	0.36***	0.32***	0.20***	0.17***
housetype_2				-0.21***	0.02	
housetype_3				-0.27***	0.01	
housetype_4				-0.34**	-0.08	
rural		-0.09***			-0.06***	
pop_dens	-0.08***			-0.08***	-0.02**	
Regional dummies	YES	YES	YES	NO	YES	YES
Constant	4.10***	3.30***	0.77***	4.48***	2.02***	0.96***
No. of obs.	6336	8977	24657	4058	7545	2844
R^2	0.32	0.17	0.27	0.31	0.33	0.20

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used in all cases. Period dummies are included in the Italian and the UK estimates due to the non-yearly frequency of the data. The age group dummies in the Italian data are different from the rest and the two categories for the older households are merged into one.

Table 3: heating fuel consumption estimates, model (1b)

Variables	Austria	France	Italy	Slovakia	Spain	UK
log(total_nondur)	0.33***	0.12***	0.33***	0.23***	0.47***	0.14***
age(35-49)	0.06*	0.06	0.11***	0.00	0.00	0.08*
age(50-64)	0.16**	0.11***		0.03	0.05	0.14***
age(65+)	0.22***	0.32***	0.26***	0.04	0.12**	0.18***
retired	0.02	-0.14**		0.02	0.02	0.02
unemployed	0.13***	-0.05		-0.02	0.05	-0.10
owner		0.15***		0.20***	0.09***	
log(hhsize)	0.31***	0.08***	0.12***	0.04	0.08**	0.08*
agehouse_2	0.05	0.09**	-0.02	0.25**	0.11**	
agehouse_3	0.07**	-0.11***	-0.04*	0.34***	0.14***	
agehouse_4	0.07*	-0.15***	0.05**	0.38***	0.17***	
agehouse_5	-0.03	-0.19***	0.05*	0.21**	0.29***	
agehouse_6	-0.04	-0.35***				
agehouse_7		-0.18***				
log(rooms)		0.76***	0.59***	0.67***	0.36***	0.68***
housetype_2				-0.12**	-0.03	
housetype_3				-0.02	-0.16***	
housetype_4				-0.15	0.01	
rural		0.20***			-0.06*	
pop_dens	-0.03			0.10***	-0.05***	
Regional dummies	YES	YES	YES	NO	YES	YES
Constant	3.05***	3.73***	0.89***	3.56***	-0.38**	-0.46***
No. of obs.	6272	6587	22752	3875	7075	2413
R^2	0.18	0.17	0.30	0.18	0.37	0.25

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used in all cases. Period dummies are included in the Italian and the UK estimates due to the non-yearly frequency of the data. The age group dummies in the Italian data are different from the rest and the two categories for the older households are merged into one.

Table 4: consumption of fuel for private transport estimates, model (2a)

Variables	Austria	France	Italy	Slovakia	Spain	UK
log(total_nondur)	0.94***	0.34***	0.47***	0.68***	0.83***	0.33***
age(35-49)	-0.02	-0.02	-0.04**	-0.15***	-0.08**	0.03
age(50-64)	-0.11**	-0.01		-0.23***	-0.07	0.02
age(65+)	-0.24***	-0.14***	-0.10***	-0.19**	-0.08	-0.11***
retired	-0.08	-0.08		-0.10*	-0.01	-0.10***
unemployed	0.12*	-0.15***		-0.14	-0.01	-0.07
log(hhsize)	-0.26***	-0.06*	-0.04**	-0.10*	0.02**	-0.01
one car	0.26***	0.49***	0.38***	0.40***	0.21***	0.14***
more than one car	0.59***	0.73***	0.54***	0.59***	0.29***	0.45***
rural		0.08***			0.12***	
pop_dens	-0.06***			0.02	-0.03*	
Regional dummies	YES	YES	YES	NO	YES	YES
Constant	-1.84***	3.21***	1.11***	0.22	-1.49***	0.85***
No. of obs.	6128	6250	17811	2157	5649	4091
R^2	0.26	0.20	0.27	0.25	0.29	0.26

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used in all cases. Period dummies are included in the Italian and the UK estimates due to the non-yearly frequency of the data. The age group dummies in the Italian data are different from the rest and the two categories for the older households are merged into one.

Table 5: public transport consumption estimates, model (2b)

Variables	Austria	France	Italy	Slovakia	Spain	UK
log(total_nondur)	0.58***	0.49***	0.50***	0.56***	0.45***	0.29***
age(35-49)	-0.18**	-0.22***	0.02	0.15**	-0.05	-0.19***
age(50-64)	0.03	-0.21***		0.12*	-0.07	-0.04
age(65+)	-0.11	-0.38***	-0.14*	-0.42***	-0.27**	-0.21***
retired	-0.17	-0.01		-0.48***	0.06	-0.12**
unemployed	0.15	-0.01		-0.17	-0.15	0.09
log(hhsize)	-0.37***	0.14***	0.10	0.43***	-0.00	0.11
one car	-0.35***	0.34***	-0.24***	-0.31***	-0.45***	-0.23***
more than one car	-0.55***	0.64***	-0.21***	-0.50***	-0.55***	-0.27***
rural		-0.14***			-0.14*	
pop_dens	0.17***			0.02	0.41***	
Regional dummies	YES	YES	YES	NO	YES	YES
Constant	-0.04	1.39***	-0.24	0.04	-0.33***	-0.11
No. of obs.	2854	9166	5990	2737	4852	1934
R^2	0.13	0.33	0.11	0.28	0.15	0.12

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used in all cases. Period dummies are included in the Italian and the UK estimates due to the non-yearly frequency of the data. The age group dummies in the Italian data are different from the rest and the two categories for the older households are merged into one.

Results for the controls are also mostly consistent across countries. For both types of expenditure, the households whose heads are older than 65 years old and/or are retired spend less than those whose heads are below 35 years old (which is the reference category in the econometric specification). Households owning one car obviously consume more fuel than those with no cars, and having more than one car also impacts positively on fuel consumption. The other side of this is reflected in the negative coefficients of the car dummies in the public transport model: owning one or more cars lowers the expenditure for public transport. Living in rural areas impacts positively on fuel consumption and negatively on public transport spending, possibly due to the fact that rural areas are poorly served by public transport services and rural households rely more on their private vehicles to move (the same result arises from the coefficients associated with population density). As for the rest of the controls, in some cases coefficients are not significant, and in others they are not consistent across surveys, therefore it is more problematic to draw neat conclusions.

4.2 Non-energy consumption results

Table 6 contains the sample averages and the number of observations available in each survey for the non-energy-related expenditure shares used as dependent variables in the simplified AIDS illustrated in Sub-section 3.2. Table 6 also reports the same information for total non-energy non-durables' expenditure, which is the main variable of interest and whose coefficient will constitute the basis for the calculations of the expenditure elasticities in this case.

It is interesting to note that the food expenditure share (*food*) is in all cases substantial, as well as the share devoted to recreation and accommodation (*recreation*). Additionally, the magnitude of the various shares across countries is somewhat comparable (with some exceptions, such as the extremely large *financial* share in France). Tables 7-12 present the estimates of equation (3) above (since the set of controls is the same for all commodity shares, organising the tables on a country-by-country basis seems the most sensible thing to do in this case). The first row contains the estimated coefficients associated with total expenditure, and the second row presents (in bold) the resulting elasticity obtained by applying equation (4) above.

The estimates offer interesting results, with the overwhelming majority of the expenditure elasticities being statistically significant and with a number of controls also associated with significant coefficients. An overall consistent picture emerges from the results contained in Tables 7-12: *food* and *communication* turn out to be necessary goods (with expenditure elasticities below one, apart from the case of *communication* in Austria). On the other hand, *clothing*, *furniture*, *health*, and *recreation* seem to be superior/luxury goods (the only exception being the elasticity below one for *health* with the Slovakian data). *financial* and *other* are the two only commodities for which our estimates do not permit to draw neat conclusions, and the latter case at least is understandable on the ground that *other* is a residual category containing a wide variety of expenditures that differ across the six surveys.

Table 6: sample averages, non-energy consumption

Variables:		**Austria**	**France**	**Italy**	**Slovakia**	**Spain**	**UK**
	food	30.89	23.89	36.94	44.94	30.64	24.43
Spending shares:	*clothing*	8.02	8.04	9.83	7.22	10.04	6.80
	furniture	8.51	8.94	7.23	8.02	14.75	26.58
	health	4.59	6.71	10.92	8.59	3.20	4.60
	communication	4.42	4.47	4.24	6.67	4.34	4.70
	recreation	27.10	15.07	12.86	13.64	19.50	28.66
	financial	*missing*	19.98	7.01	2.66	4.46	0.49
	other	16.47	12.89	10.98	8.26	13.08	3.72
Income:	*total_nonenergy*	19401.07	26601.17	1501.87	13939.40	15694.45	292.65
Number of obs.		7436	10240	24727	4686	8881	6556

Source: authors´ calculations based on six different surveys (see section 3.3 for details).

Table 7: consumption of non-energy related non-durables (simplified AIDS), model (3) - Austrian data

Variables	*food*	*clothing*	*furniture*	*health*	*communication*	*recreation*	*financial*	*other*
log(tot_nonenergy)	-15.9***	3.50***	4.10***	1.96***	0.47**	7.00***		-1.09***
income elasticity	**0.48**	**1.43**	**1.48**	**1.43**	**1.11**	**1.26**		**0.93**
age(35-49)	2.59***	-0.59	-1.06***	0.53**	-1.10***	-0.58		0.21
age(50-64)	4.69***	-0.90*	-0.62	0.60*	-1.68***	-2.72***		0.63
age(65+)	3.20***	0.0076	-0.40	2.81***	-2.16***	-6.96***		3.50***
retired	0.68	-0.16	-0.20	1.07**	0.29	-1.46		-0.22
unemployed	4.28***	0.054	0.95	-0.67**	1.27*	-4.78***		-1.11
log(hhsize)	16.1***	0.022	-1.28**	-1.33***	-1.30***	-12.0***		-0.22
agehouse_2	1.30**	0.54	-1.08*	-0.43	-0.43	-0.38		0.48
agehouse_3	2.14***	-1.16***	-0.58	0.50	-0.10	-0.43		-0.36
agehouse_4	1.05	-0.71	-1.07**	-0.47	0.56	-0.51		1.15
agehouse_5	2.37***	-1.07**	-0.64	-0.49	0.38	-0.66		0.10
agehouse_6	4.75***	0.87	-1.51**	-0.76	-0.053	-1.52		-1.78**
one car	-2.51***	-1.44***	-0.19	-0.52	-0.58*	1.38*		3.86***
more than one car	-3.67***	-2.34***	-0.99*	-0.99**	-0.34	2.27**		6.06***
pop_dens	-0.78***	0.32	-0.46*	-0.15	0.067	0.94***		0.063
Regional dummies	YES	YES	YES	YES	YES	YES		YES
Constant	166***	-23.9***	-27.0***	-13.1***	2.37	-26.4***		21.8***
No. of obs.	7333	7333	7333	7333	7333	7333		7333
R^2	0.41	0.06	0.06	0.06	0.02	0.16		0.05

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used. The expenditure elasticity is calculated according to equation (4) using the *log(tot_nonenergy)* coefficients and the sample averages are reported in Table 6.

Table 8: consumption of non-energy related non-durables (simplified AIDS), model (3) - French data

Variables	*food*	*clothing*	*furniture*	*health*	*communication*	*recreation*	*financial*	*other*
log(tot_nonenergy)	-7.99***	1.60***	3.59***	1.76***	-1.81***	3.96***	-3.61***	2.49***
income elasticity	**0.67**	**1.20**	**1.40**	**1.26**	**0.60**	**1.26**	**0.82**	**1.19**
age(35-49)	3.14***	-1.60***	-1.46***	-0.41	-1.04***	-0.26	0.28	1.35***
age(50-64)	6.54***	-2.21***	-1.59***	0.30	-1.21***	-0.25	-3.34***	1.77***
age(65+)	9.60***	-3.72***	-2.31***	2.48***	-2.11***	-0.36	-6.18***	2.60***
retired	-0.34	-0.21	-0.71	0.39	0.017	0.42	-0.94	1.37*
unemployed	-0.63	-0.042	-0.47	1.30***	0.22	-0.53	-0.56	0.71
owner	0.061	-1.54***	-0.44*	-0.0025	-0.71***	-0.30	8.22***	-5.28***
log(hhsize)	11.4***	1.99***	-3.72***	0.17	0.29	-5.69***	0.66	-5.05***
agehouse_2	0.93*	-0.28	-0.25	0.18	0.16	-0.80*	-0.15	0.21
agehouse_3	-0.30	-0.077	-0.12	-0.17	0.084	-0.89**	0.20	1.27***
agehouse_4	-1.11**	0.53*	-0.20	0.15	0.026	-0.83**	-1.05**	2.49***
agehouse_5	-0.18	0.14	-0.12	0.21	0.21	-0.23	-1.45***	1.42***
agehouse_6	-1.52***	-0.34	0.32	0.25	0.23	0.026	0.36	0.67
agehouse_7	-0.62	-0.27	-0.77*	0.49	0.33*	-0.49	1.24**	0.100
log_rooms	-0.50	0.56	-0.52	-1.25***	0.33	-1.19**	0.72	1.86***
one car	-1.58***	-1.16***	1.59***	-1.40***	-0.11	0.92**	5.89***	-4.15***
more than one car	-2.07***	-1.58***	2.21***	-1.74***	-0.0044	1.43***	6.92***	-5.17***
rural	0.71*	-0.61***	1.37***	0.013	-0.29**	-1.48***	0.69*	-0.40
Regional dummies	-1.60***	0.63	0.086	-0.44	-0.22	1.07**	0.58	-0.12
Constant	88.9***	-6.96***	-21.1***	-8.04***	23.1***	-17.0***	45.1***	-4.04
No. of obs.	9197	9197	9197	9197	9197	9197	9197	9197
R^2	0.24	0.09	0.08	0.03	0.12	0.08	0.15	0.09

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used. The expenditure elasticity is calculated according to equation (4) using the *log(tot_nonenergy)* coefficients and the sample averages are reported in Table 6.

Table 9: consumption of non-energy related non-durables (simplified AIDS), model (3) - Italian data

Variables	*food*	*clothing*	*furniture*	*health*	*communication*	*recreation*	*financial*	*other*
log(tot_nonenergy)	-13.6***	3.26***	4.69***	2.55***	-2.13***	5.64***	-3.31***	2.92***
income elasticity	**0.63**	**1.33**	**1.67**	**1.23**	**0.50**	**1.44**	**0.53**	**1.27**
age(35-49)	2.31***	-0.94***	-0.59*	0.20	0.53***	-1.10***	-0.44**	0.025
age(50+)	6.14***	-3.16***	0.70**	3.53***	0.26**	-5.00***	-1.55***	-0.92**
log(hhsize)	13.8***	-1.97***	-2.83***	-1.15***	0.44***	-7.04***	-0.45***	-0.78**
agehouse_2	-0.17	0.20	0.24	-0.57**	-0.028	0.16	-0.21	0.37
agehouse_3	-0.34	0.26	0.38*	-0.22	0.040	-0.21	-0.17	0.27
agehouse_4	-0.39	0.40*	0.19	0.054	0.11	-0.19	-0.088	-0.082
agehouse_5	-1.95***	0.57*	0.93***	0.026	-0.057	0.31	0.19	-0.023
log_rooms	-1.35***	0.66*	0.049	-1.15***	0.66***	0.38	1.17***	-0.43
one car	-4.63***	0.038	-1.71***	-3.77***	0.11	1.80***	8.34***	-0.19
more than one car	-7.51***	0.68**	-2.60***	-4.59***	0.43***	2.02***	12.0***	-0.42
Regional dummies	0.37	-0.55*	0.017	-0.47	-0.18	1.10**	0.29	-0.57
Constant	119***	-10.2***	-22.6***	-2.12**	17.3***	-17.5***	22.8***	-6.28***
No. of obs.	24658	24658	24658	24658	24658	24658	24658	24658
R^2	0.45	0.09	0.09	0.07	0.13	0.19	0.33	0.05

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used. Period dummies are included due to the non-yearly frequency of the data. The expenditure elasticity is calculated according to equation (4) using the *log(tot_nonenergy)* coefficients and the sample averages are reported in Table 6.

Table 10: consumption of non-energy related non-durables (simplified AIDS), model (3) - Slovakian data

Variables	*food*	*clothing*	*furniture*	*health*	*communication*	*recreation*	*financial*	*other*
log(tot_nonenergy)	-14.8***	3.97***	6.95***	-0.54**	-1.11***	4.17***	1.07***	0.30
income elasticity	**0.67**	**1.55**	**1.87**	**0.94**	**0.83**	**1.31**	**1.40**	**1.00**
age(35-49)	1.58***	-1.04***	-0.50	-0.50*	-0.13	-0.12	-0.35	1.06***
age(50-64)	5.68***	-2.19***	-0.20	-0.56*	-0.70**	-2.28***	-0.22	0.47
age(65+)	7.73***	-2.44***	-0.097	1.00	-2.40***	-3.08***	-0.39	-0.32
retired	2.64***	-0.27	1.53**	1.50***	-0.65*	-3.83***	-0.35	-0.57
unemployed	2.14	-0.90	0.44	0.19	-1.37**	-3.62***	-0.052	3.16***
owner	0.36	-0.30	0.58	-0.37	-0.36	0.45	0.10	-0.46
log(hhsize)	15.4***	-1.84***	-6.28***	-1.50***	-0.49	-3.98***	-0.57*	-0.76
agehouse_2	-1.04	0.65	0.50	1.56*	0.56	-1.69	0.63	-1.17
agehouse_3	-0.96	1.33**	0.43	1.15*	0.59	-1.71	0.32	-1.16
agehouse_4	-2.04	1.29**	0.085	1.32**	0.93	-1.22	0.32	-0.67
agehouse_5	-3.82**	2.08***	0.98	1.35**	0.94	-1.11	0.19	-0.62
log_rooms	-0.44	-0.71	-0.42	0.019	0.91**	0.69	0.79**	-0.83
housetype_2	-0.93	-0.69	-1.48**	0.24	-0.16	1.10	-0.40	2.31***
housetype_3	-1.95***	-0.30	-1.11**	0.093	0.59**	0.55	-0.034	2.16***
housetype_4	-2.10	-0.072	-2.47	0.69	1.00	6.56***	-0.86*	-2.74**
one car	-1.83***	-0.31	-0.77**	0.053	0.66***	0.90**	1.74***	-0.44
more than one car	0.18	-1.48**	-2.71***	0.63	1.01**	0.61	1.71**	0.047
pop_dens	-1.41***	0.078	-1.50***	0.00093	0.28*	1.38***	0.18	0.99***
Regional dummies	NO	NO	NO	NO	NO	NO	NO	NO
Constant	166***	-25.7***	-45.3***	14.4***	15.6***	-21.3***	-9.10***	5.85
No. of obs.	4655	4655	4655	4655	4655	4655	4655	4655
R^2	0.38	0.11	0.11	0.06	0.05	0.14	0.06	0.06

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used. The expenditure elasticity is calculated according to equation (4) using the *log(tot_nonenergy)* coefficients and the sample averages are reported in Table 6 (in the *other* case it is set to 1.00 due to the not significant estimated coefficient).

Table 11: consumption of non-energy related non-durables (simplified AIDS), model (3) - Spanish data

Variables	*food*	*clothing*	*furniture*	*health*	*communication*	*recreation*	*financial*	*other*
log(tot_nonenergy)	-8.78***	0.78***	4.64***	0.45***	-1.52***	6.76***	-1.20***	-1.12***
income elasticity	**0.71**	**1.08**	**1.31**	**1.14**	**0.65**	**1.35**	**0.73**	**0.91**
age(35-49)	1.85***	0.061	0.14	0.46***	-0.82***	-1.48**	-0.21	0.0037
age(50-64)	4.25***	-0.56	0.038	0.88***	-0.90***	-3.28***	0.079	-0.52
age(65+)	7.36***	-0.77	0.81	0.49*	-1.29***	-6.53***	0.45	-0.54
retired	0.12	-0.58**	0.064	0.12	-0.23**	0.93**	-0.18	-0.25
unemployed	0.31	-0.84*	0.69	-0.27	0.090	-0.22	0.48	-0.23
owner	-0.87*	0.050	1.34***	0.021	-0.32**	-1.03**	0.047	0.77**
log(hhsize)	9.03***	-0.77**	-3.11***	-0.88***	0.011	-2.61***	-0.77***	-0.90**
agehouse_2	2.78***	0.63	0.39	-0.71**	-0.078	-2.82***	0.087	-0.27
agehouse_3	1.97**	0.043	0.89	-0.52	0.20	-2.31***	0.24	-0.50
agehouse_4	1.66**	-0.022	0.45	-0.47	0.25	-2.46***	0.70**	-0.10
agehouse_5	1.53*	0.56	0.53	-0.40	-0.0036	-3.09***	0.54*	0.33
log_rooms	-1.60*	0.29	-1.40*	0.12	0.48**	-1.96**	0.50*	3.56***
housetype_2	0.14	-0.20	-0.33	-0.057	0.10	0.71	-0.13	-0.23
housetype_3	-0.74	0.040	-2.32***	-0.088	0.31**	1.07**	-0.33	2.06***
housetype_4	-5.27	1.48	0.99	-1.60***	-0.021	1.23	-0.40	3.60
one car	-2.96***	-0.40	3.19***	-0.41**	0.11	0.076	1.80***	-1.41***
more than one car	-4.26***	-0.67**	2.95***	-0.32	0.29**	0.48	2.81***	-1.28***
rural	-0.61	-0.30	2.30***	-0.040	-0.090	0.55	-0.17	-1.64***
pop_dens	-0.75**	-0.50***	-0.32	-0.13	0.19***	0.28	0.31***	0.92***
Regional dummies	YES	YES	YES	YES	YES	YES	YES	YES
Constant	104***	5.62**	-25.0***	0.42	18.2***	-32.1***	13.3***	16.0***
No. of obs.	7658	7658	7658	7658	7658	7658	7658	7658
R^2	0.24	0.04	0.12	0.02	0.13	0.19	0.09	0.10

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used. The expenditure elasticity is calculated according to equation (4) using the *log(tot_nonenergy)* coefficients and the sample averages are reported in Table 6.

Table 12: consumption of non-energy related non-durables (simplified AIDS), model (3) - UK data

Variables	*food*	*clothing*	*furniture*	*health*	*communication*	*recreation*	*financial*	*other*
log(tot_nonenergy)	-9.96***	1.26***	8.42***	0.10	-2.61***	2.66***	0.22***	-0.10
income elasticity	**0.59**	**1.19**	**1.32**	**1.02**	**0.45**	**1.09**	**1.45**	**1.00**
age(35-49)	2.25***	-0.75**	-0.26	-0.42**	-0.26	0.14	-0.34***	-0.37
age(50-64)	5.62***	-1.13***	-2.47***	0.23	-0.57***	-1.03*	-0.59***	-0.06
age(65+)	6.96***	-1.68***	-0.52	1.30***	-1.16***	-2.10***	-0.15	-2.66***
retired	-0.81*	0.28	2.54***	-0.18	-0.28	-2.28***	-0.03	0.76**
unemployed	3.13**	-0.28	-2.60*	-1.12***	-1.64***	0.50	-0.29**	2.30**
log(hhsize)	9.86***	3.27***	-11.82***	0.16	1.48***	-4.36***	0.29***	1.11***
one car	-0.37	-0.43	-0.88	0.22	-0.04	2.79***	-0.17**	-1.12***
more than one car	-1.08**	-1.01***	-1.14	0.19	0.24	4.09***	-0.16	-1.13***
Regional dummies	(3.33)	(3.13)	(4.03)	(5.88)	(1.09)	(2.02)	(0.27)	(2.24)
Constant	64.98***	-0.46	-3.66	0.48	16.74***	19.63***	-0.61**	2.91**
No. of obs.	6541	6541	6541	6541	6541	6541	6541	6541
R^2	0.32	0.06	0.11	0.02	0.18	0.06	0.02	0.03

Note: standard errors in parenthesis. ***, **, * indicate significance at 1, 5, and 10% respectively. Survey weights are used. Period dummies are included due to the non-yearly frequency of the data. The expenditure elasticity is calculated according to equation (4) using the *log(tot_nonenergy)* coefficients and the sample averages are reported in Table 6 (in the *health* and *other* cases it is set to 1.00 due to the not significant estimated coefficient).

4.3 EU-level expenditure elasticities

The ideal way to proceed for the estimation of the expenditure elasticities to be used for all the EU27 countries featured in the FIDELIO model would have been to use country-specific household-level panel data. Such a procedure would have also permitted the contemporary estimation of the price elasticities with a unique model. Unfortunately, such dataset simply does not exist, therefore cross-sectional data have to be used. This implies that the expenditure elasticities need to be estimated separately from the price elasticities (for which macro-aggregate time series data are in fact used and whose illustration is beyond the scope of the present document). An additional complication stems from the fact that cross-sectional data on non-durables' consumption of households are not available for all the EU27 countries. Thus, we used the existing data, only available for six of those countries, to produce credible estimates of the expenditure elasticities for the 27 European countries of the latest version of the FIDELIO model as explained below.

In all cases but two, i.e. *financial* and *other*, results are consistent across countries, although magnitudes vary as reported above. In principle, using the simple average of the elasticities arising from the six surveys for all the European countries in FIDELIO would be a viable way to proceed. However, we decided to use a weighted average based on GDP per capita in order to have values as representative as possible of the EU countries in terms of their incomes. Table 13 shows that the differences between the simple averages and the weighted averages of the elasticities are far from being dramatic. As for *financial* and *other*, we simply set the elasticity equal to one in order to define them as normal goods without taking a stand on whether they should be considered necessary or superior goods.

Table 13: EU-level total expenditure elasticities for the four energy-related non-durables and for the eight non-energy related non-durables

Energy income elasticities	**Austria**	**France**	**Italy**	**Slovakia**	**Spain**	**UK**	**Simple average**	**Weighted average**
elec	0.18	0.30	0.18	0.17	0.33	0.05	0.20	0.20
heatfuel	0.33	0.12	0.33	0.23	0.47	0.14	0.27	0.26
fuel	0.94	0.34	0.47	0.68	0.83	0.33	0.60	0.58
transport	0.58	0.49	0.50	0.56	0.45	0.29	0.48	0.47
Non-energy income elasticities	**Austria**	**France**	**Italy**	**Slovakia**	**Spain**	**UK**	**Simple average**	**Weighted average**
food	0.48	0.67	0.63	0.67	0.71	0.59	0.63	0.61
clothing	1.44	1.20	1.33	1.55	1.08	1.19	1.30	1.27
furniture	1.48	1.40	1.67	1.87	1.31	1.32	1.51	1.46
health	1.43	1.26	1.23	0.94	1.14	1.00	1.17	1.20
communication	1.11	0.60	0.50	0.83	0.65	0.45	0.69	0.68
recreation	1.26	1.26	1.44	1.31	1.35	1.09	1.29	1.27
financial	*missing*	0.82	0.53	1.40	0.73	1.45	1.00	1.00
other	0.93	1.19	1.27	1.00	0.91	1.00	1.00	1.00

Note: the *financial* and the *other* income elasticities are set to 1.00 due to the inconsistent results across the various surveys.

5. Conclusions

This document presents the estimates of the total expenditure elasticity for four energy-related and eight non-energy-related non-durable goods and services used in the latest version of the FIDELIO model. The estimates are based on survey data for the following six European countries: Austria, France, Italy, Slovakia, Spain, and the UK. The document illustrates the empirical analysis carried out in order to obtain the required results, and demonstrates that results are comparable to those of the existing literature, when available. The energy commodities appear to be necessary goods, with positive elasticities smaller than one; of the eight non-energy related commodities, two appear to be necessary goods as well (food and communication), four appear to be superior goods (clothing, furniture, recreation, and health), and two are set to be normal goods with an expenditure elasticity equal to one due to the lack of significant econometric results.

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List of abbreviations and definitions

AIDS: Almost Ideal Demand System.
BDF: Household Budget Survey (France).
CARBON CAP: carbon Consumption-based Accounting Policy.
CGE: Computable General Equilibrium.
CPI: Consumer Price Index.
EFS: Expenditure and Food Survey (UK).
EU: European Union.
FIDELIO: Fully Interregional Dynamic Econometric Long-term Input-Output.
GDP: Gross Domestic Product.
HBS: Household Budget Survey (Slovakia).
INE: National Statistics Institute (Spain).
INSEE: National Institute of Statistics and Economic Studies (France).
ISTAT: National Institute for Statistics (Italy).
NUTS: Nomenclature of Territorial Units for Statistics.
OECD: Organisation for Economic Cooperation and Development.

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