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ABSTRACT

Consumption Patterns, Inflation, and Household Welfare: Demand-Based Equivalence Scales in Europe*

Equivalence scales are central to distributional analysis, adjusting household incomes for size and composition and shaping poverty and inequality measurement. Despite changes in consumption patterns, most applied work continues to rely on the modified OECD scale from the 1990s. We revisit equivalence scales for 23 EU countries using a linear expenditure demand system and harmonized Household Budget Survey data for 2010–2020. We estimate three demand-based scales: a minimum-needs scale anchored in subsistence, a utility-implicit scale based on welfare equivalence under common preferences, and a utility-explicit scale for sensitivity analysis. Our estimates imply larger economies of scale than the modified OECD scale, particularly for larger households. Scales decline with living standards and over time. Simulations of 2020–2024 price changes suggest that recent inflation is likely to further reduce equivalence scales, with stronger effects for households with children. While regional heterogeneity remains, poverty measures are more sensitive than inequality measures to the choice of scale. The results highlight the need to update equivalence scales and to report distributional statistics under alternative assumptions.

JEL Classification: D12, D31, E31, I32

Keywords: equivalence scales, demand system, linear expenditure system, household consumption patterns, income distribution measures

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1 Introduction

Equivalence scales are a central component of distributional analysis. By adjusting household incomes for differences in size and demographic composition, they make welfare comparisons across households empirically meaningful and normatively interpretable. Their specification directly influences the measurement of inequality and poverty and, through these metrics, the allocation and assessment of social benefits. Despite their central role, most empirical work continues to rely on the modified OECD scale, introduced in the mid-1990s, which assigns the weights of 1.0 for the first adult, 0.5 for each additional adult, and 0.3 for each child under 14. Its simplicity motivated its widespread adoption in research and official statistics on inequality and poverty, but the economic and demographic environment in which it was calibrated has since changed substantially.

Over the past three decades, households across Europe have experienced profound shifts in consumption patterns, price structures and living arrangements. Housing and services represent a growing share of household budgets today; durable goods have become cheaper; food and basic necessities have become less salient as incomes have risen; and household structures have diversified. These developments call into question whether a static, expert-based scale can adequately capture economies of scale or relative needs across contemporary household types. A growing body of research has raised concerns that the OECD modified scale may overstate households' needs, particularly for larger households (Bishop et al., 2014; Svavarsdottir et al., 2025). Bishop et al. (2014), for example, find that the first child is more costly than a third adult, with declining marginal costs for additional children. They argue that policymakers should consider these fixed costs in child support decisions while designing equivalence scales.

Other studies raised concerns that a 'one-size-fits-all' equivalence scale may mask a substantial cross-country heterogeneity in consumption, price levels, degree of economic development, cultural aspects, welfare regimes and across time (Bishop et al., 2014; Hagenaars et al., 1994; Kalbarczyk-Steclik et al., 2017; Mysíková & Želinský, 2019). Since children's relative costs vary widely across countries, both cultural differences and relative price structures significantly shape equivalence scales (Koulovatianos et al., 2005b; Rapp & Thévenon, 2025). Some evidence suggests that economies of scale are lower in less developed countries in Southern, Central and Eastern Europe than in Western Europe (Bishop et al., 2014; Mysíková & Želinský, 2019; Mysíková et al., 2022). This suggests that common scales might lead to misleading welfare comparisons and emphasises the importance of country-specific scales in certain contexts (Daley et al., 2020; Doorley et al., 2024; Sabates et al., 2001).

The evidence across time is also mixed. Some researchers found that scales change over time and that the economies of scale are larger than assumed by the 'square root of household size' scale on a worldwide sample of countries (Daley et al., 2020). Other researchers find less volatility and more regional similarities in Europe over time. Across European regions, Kalbarczyk-Steclik et al. (2017) documented a trend of convergence of economies of scale in Central and Eastern Europe towards the Western European countries. One mechanism through which scales may change over time is shifting relative prices. Ray (1981) shows that food and durable-goods prices exert sizeable but opposing effects on equivalence scales, with food price increases raising scales and durable-goods price increases lowering them. More recent evidence suggests these price effects are heterogeneous across the welfare distribution: using Indonesian data, de Ree et al. (2013) find that equivalence scales rise when food becomes more expensive relative to non-food items for poorer households, whereas more affluent households show little sensitivity to such relative price changes.

In light of these limitations, this paper revisits the measurement of equivalence scales for 23 European countries using harmonised Household Budget Survey (EU-HBS) microdata for 2010-2020 and a Linear Expenditure System (LES) framework grounded in consumer demand theory, following Creedy (1998), Sologon et al. (2024, 2025), and Temursho and Weitzel (2024). We estimate three complementary demand-based scales that reflect distinct welfare concepts: a minimum needs scale (MNS) anchored in subsistence consumption; a utility implicit scale (UIS) that recovers welfare equivalence by evaluating all household

types through a common preference structure, and a utility explicit scale (UES) evaluated at fixed utility levels provides additional sensitivity analysis. All expenditure data are expressed in 2020 real purchasing power parity (PPP) terms, ensuring both temporal and spatial comparability. We estimate equivalence scales at the EU and regional levels, capturing how actual consumption behaviour differs across household types. The analysis goes beyond static estimation and assesses how the recent cost-of-living crisis might have affected relative household needs, which static equivalence scales cannot capture.

Our contribution is threefold. *First*, we test the capacity of the widely-used expert-based equivalence scales - the modified OECD equivalence scale and the LIS equivalence scale - to capture real economies of scale within different types of households. By constructing three theoretically consistent demand-based alternatives, we provide a triangulation framework that identifies how welfare assumptions shape equivalence-scale magnitudes.

Second, we provide the first harmonised comparative analysis of demand-based equivalence scales and their implications for inequality and poverty indices for the majority of EU countries, examining both EU-wide and region-specific patterns (Northern, Western, Eastern, and Southern Europe). This extends the existing literature which tends to focus only on one country at a time or a subset of European countries (Table 1).

Third, we document how equivalence scales evolve over time and quantify the contribution of recent inflation to this evolution by applying 2024 relative price changes to 2020 consumption patterns. It allows us to uncover the potential impact of the recent cost-of-living crisis on European households and its implications for estimation of equivalence scales.

Our findings indicate stronger economies of scale than assumed in conventional practice, by the modified OECD scale. Scale magnitudes decline with living standards and have modestly fallen over time, consistent with strengthening economies of scale in consumption. Applying recent price changes further reduces scales, with stronger effects for households with children. Substantial regional heterogeneity persists, reflecting differences in prices, preferences and consumption structures. Recomputing inequality and poverty indicators shows that poverty measures are notably more sensitive than inequality measures to the choice of scale, and that the UIS typically yields the largest changes in poverty and inequality indicators relative to the mOECD benchmark.

These findings carry significant implications for poverty measurement, inequality assessment, and social policy design across Europe. Applying different equivalence scales meaningfully alters distributional summary measures and can significantly affect country rankings in poverty and inequality analysis. By comparing demand-based estimates with conventional expert scales, we quantify how different assumptions about household needs shape distributional assessments and demonstrate the value of consumption-grounded alternatives to static expert judgments. We further show that, in country-level distributional analysis, consumption-based equivalence scales, grounded in observed household behaviour rather than expert judgment, produce meaningfully different welfare assessments—particularly important given the substantial temporal shifts in consumption patterns and price structures we document.

The remainder of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature. Section 3 presents the methodology and data. Section 4 reports empirical findings on equivalence scales and their distributional implications. Section 5 concludes.

2 Theoretical Framework

Equivalence scales are an essential tool in economic and social policy analyses. They are used to convert the budgets of different household types to a needs-corrected basis (Muellbauer, 1980). While time and opportunity costs cannot be easily accounted for, consumption estimates and economies of scale linked to each additional household member, especially children, often form the focus of equivalence scale estimates. The aim is to answer the iso-welfare question on how much money a family with children needs to have in

order to be as well-off as a family without children (Browning, 1992).

There are three main approaches to estimation of equivalence scales (see Table 1): (i) expert (normative) scales, (ii) subjective (self-reported) scales, and (iii) econometric (objective) scales derived from consumption behaviour of households.

The most common example of expert-based scales is the OECD equivalence scale established in mid-1990s (de Vos & Zaidi, 1997; Hagenaars et al., 1994). To obtain such scales, experts specify minimum needs for various household types, historically grounded in nutritional requirements. Subjective equivalence scales are based on estimations from surveys about needs or welfare evaluations done by individuals whereas econometric scales are inferred from revealed consumption behaviour of households (Bellù & Liberati, 2005; Schulte, 2007).

Each of these approaches has certain advantages and disadvantages highlighting the challenges in accurately measuring household needs across different methodologies (Bishop et al., 2014; Doorley et al., 2024). Expert scales are simple to understand and implement, but face critiques of arbitrariness as they are grounded neither in theory nor in empirical data. They also do not reflect temporal shifts in consumption behaviour related to technological and societal changes. Subjective scales, based on respondents' own assessments, are subject to perceptions of well-being, making comparisons across households difficult; responses often vary with income, and underestimate the needs of larger households (Bellù & Liberati, 2005; de Vos & Zaidi, 1997). Demand system scales are grounded in economic theory and consumer behaviour, yet they suffer from identification problems (Pollak & Wales, 1979).

These identification problems are related to the fact that utility cannot be observed, only the shape and ranking of indifference curves (Lewbel, 2025). Whereas conditional preferences, or differences in the consumption patterns of households with different demographic profiles, are observed in consumption data, unconditional preferences, that are appropriate for welfare comparisons, are not directly observed and require more information and assumptions (Koulovatianos et al., 2005a; Pollak & Wales, 1979). Additionally, there is an econometric identification problem related to identifying parameters in a demographically modified demand system (Menon & Perali, 2010). To overcome the highlighted identification problems, Independence of Base (IB) and Equivalence Scale Exactness (ESE) concepts were developed. These concepts propose equivalence scales independent of utility, income or expenditure, but literature has proven that equivalence scales dependent on income can be useful for the analysis of low and high incomes as well as policy evaluation (Dudel et al., 2021a; Koulovatianos et al., 2005a).

Collective household models are a newer development that characterizes the household as a collection of individuals with well-defined objective functions who aim to maximize utility (Browning et al., 2013; Hsieh et al., 2024; Lewbel & Pendakur, 2008b). Chiappori (2016) highlights the importance of individual preferences and intra-household inequalities for the notion of equivalence scales in this context. This stream of literature proposes the use of indifference scales which would take into account the cost of an individual living alone needed to attain the same indifference curve that this individual attains as a member of a family of given composition. Considering computational complexity, the most recent approach of Hsieh et al. (2024) focused on simplification and is based on semi-parametric estimations through a system of linear equations which revealed, for Canadian data, lower economies of scale than initially presumed by policy design.

Araar and Verme (2019) emphasise that in the welfare analysis differences are minimal between different demand systems, as compared to changes in prices or budget shares. Dudel et al. (2021b) compared 10 different empirical approaches for the estimation of equivalence scales, covering parametric, semi-parametric, and fully non-parametric methods on German data and concluded that most plausible equivalence scales are close to the modified OECD scale, and to the square root scale for larger households. The choice among approaches depends on data richness, plausibility criteria, and preferences over restrictions versus flexible, but harder to estimate, models.

Table 1: Equivalence scale estimates from selected studies

Reference	Country (year)	Method	Single	Couple	Couple 1C	Couple 2C
Modified OECD scale	–	expert	1	1.5	1.8	2.1
Square root of HH size (LIS ES)	–	expert	1	1.41	1.73	2
Svavarsdottir et al. (2025)	Europe (2004-2020)	subjective[1]	1	1.18	1.28	1.35
Aaberge et al. (2024)	EU (2012) – needs adjusted	in-kind transfers	0.98-1.35	1.5-2.2	1.91-2.46	2.28-3.38
	EU (2012) – non-cash		0.77-6.02	1.53-11.56	3.43-8.63	4.67-15.08
Koch (2023)	South Africa (2014-2015)	subjective[2]	1	1.39	1.6	1.74
Mysíková et al. (2022)[3]	Eastern Europe (2019)	subjective	1	1.41	1.63	1.74
	Western Europe (2019)		1	1.3	1.51	1.64
Dudel et al. (2021b)	Germany (2003-2013)	QAIDS	1	1.58	1.76	2.11
		AIDS	1	1.2	1.25	1.31
		QES	1	1.9	2.03	1.97
		Semiparametric[4]	1	1.22	2.4	2.1
Mysíková et al. (2021)	Czechia (2016)	ELES	1	1.51	1.67	1.76
		subjective	1	1.31	1.41	1.55
Daley et al. (2020)	France (1999-2012)	Engel[5]	1	1.35	1.8	1.89
Kalbarczyk-Steclik et al. (2017)	EU (2005-2012)	subjective	1	1.36	1.76	1.89
Bishop et al. (2014)	Eurozone (2004-2007)	subjective	1	1.34	1.64	1.78
Menon and Perali (2010)	Italy (2002)	AIDS	1	1.25	1.5	1.7
Koulovatianos et al. (2005b)	France (2002)	subjective	1	1.5	1.75	1.97
	Cyprus (2000)		1	1.45	1.75	2.05
Deaton and Muellbauer (1986)	Sri Lanka (1969-1970)	Engel	-	1	1.41	1.77
		Rothbarth	-	1	1.12	1.21

Source: Authors' compilation based on cited studies.
Notes: C denotes child(ren); HH: household; LIS ES: Luxembourg Income Study Equivalence Scale; (Q)AIDS: (Quadratic) almost ideal demand system; QES: Quadratic expenditure system; ELES: Extended linear expenditure system

[1] EU fixed effects estimation
[2] Food adequacy - endogenous estimation
[3] From Table A.3 (without controls)
[4] Original loss estimation
[5] Food, housing, clothing and health estimation

Nelson (1993) argues that equivalence scales must be tied to a clear welfare concept, and that policy has historically understood welfare as the material living standard of all household members, not adults' subjective utility. She warns that much modern demand-system theory drifts toward adult-only or happiness-based welfare notions, which can misalign with policy goals—especially regarding children. At the same time, she stresses that policy does not require universally "true" or general scales: what matters is that scales are reasonable, well-informed, and fit for the specific application, so research should balance theory and pragmatism.

The demand-estimation framework we use, the linear expenditure system (LES), was introduced by Stone (1954). It models household demand with good-specific "subsistence" parameters and constant marginal budget shares: households are assumed to allocate income first to minimum required quantities of goods and then distribute any remaining income in fixed proportions. Although LES has faced criticism (Deaton & Muellbauer, 1980), it remains widely used in empirical and policy research (Cutillo et al., 2025; Mysíková et al., 2021; Rapp & Thévenon, 2025; Temursho & Weitzel, 2024).

Within LES, equivalence scales can be derived in multiple ways. A common approach compares total subsistence expenditures across household types, yielding what we call the minimum needs scale (MNS). Several studies estimate LES-based scales by taking ratios of subsistence expenditures, producing income-independent measures (Dudel et al., 2021b). Extensions such as the extended LES (Kakwani, 1977) or quadratic expenditure systems (Pollak & Wales, 1978) allow needs to vary with income and demographics, at the cost of greater complexity. Beyond subsistence comparisons, LES also enables welfare-based scales that use the full parameter set. Our utility implicit scale (UIS) recovers welfare equivalence from indirect utility without imposing a common welfare reference, following the equivalent-expenditure/iso-welfare framework of Donaldson and Pendakur (2004) and Gerfin et al. (2009). The utility explicit scale (UES) evaluates equivalence at fixed utility benchmarks; in general, scales depend on the chosen utility level (Ferreira et al., 1998). Building on the constant-utility framework of van der Gaag and Smolensky (1982), who find this dependence to be empirically negligible in their application, we compute UES over a range of utility levels and use it as a welfare-benchmark sensitivity check. This design allows us to examine whether equivalence scales decrease with utility, as documented by de Ree et al. (2013), and hence whether economies of scale are lower at lower welfare levels.

3 Methodology and Data

Household consumption patterns, income and price elasticities, and equivalence scales are estimated using a demand model based on the Linear Expenditure System (LES) and Household Budget Survey (EU-HBS) data, following Creedy (1998) and Sologon et al. (2022, 2024, 2025). The approach estimates household expenditure patterns on groups of goods, income and price elasticities, and associated expenditure functions.

3.1 Data

We use the harmonised EU-HBS from Eurostat for EU members. The structure of the microdata is consistent across countries, and it includes detailed information on household expenditure by item. Expenditure data is available on item level, and aggregate levels consistent with Classification of Individual Consumption by Purpose (COICOP). There are 12 main category expenditures (COICOP divisions). EU-HBS also encompasses demographic data, which covers the composition of households, socio-economic attributes of household members, and the disposable incomes of households.[6] More information on EU-HBS data is available in User manuals for each wave, as provided by Eurostat (2025d).

We use repeated cross-sections from the 2010, 2015, and 2020 waves of the EU-HBS. The EU-HBS delivers

[6]Expenditure data include imputed rent within the housing category.

nationally representative weighted samples for each country–year. Because data availability varies across years, we restrict the analysis to countries observed in all three waves (a balanced country sample). The analysis covers: Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain. A caveat for 2020 wave data is that consumption patterns for some countries have been influenced by time of data collection, during the COVID-19 pandemic.[7] Additionally Cyprus, France, and Malta 2020 data have been produced by converting their 2015 waves using the respective harmonised index of consumer prices (HICP) coefficient. User manuals further note that values for expenditure and income are converted by Eurostat so that the data reflect the situation in the HBS reference year and so that values are in euro (Eurostat, 2025d).

To ensure temporal comparability, we convert all household expenditures from 2010 and 2015 to 2020 price levels using COICOP-consistent category-, country-, and year-specific harmonised annual average HICP (2015 = 100), (Eurostat, 2025b). For spatial comparability, we convert these 2020-price expenditures into a common purchasing power standard (PPS) by dividing by Eurostat purchasing power parities (PPP) with base EU27= 1 (2020), which adjust for differences in price levels across countries by reflecting the cost of a common basket of goods and services (COICOP-consistent), allowing for more accurate cross-country comparisons (Eurostat, 2025c). For category i expenditure in country c and year $t \in \{2010, 2015, 2020\}$,

$$x^{PPS}_{i,c,2020} = (x_{i,c,t} \times \frac{HICP_{i,c,2020}}{HICP_{i,c,t}})/PPP_{i,c,2020}. \tag{1}$$

This procedure removes within-country inflation (time effects) and between-country price-level differences (space effects), so cross-country comparisons reflect differences in quantities and expenditure composition rather than nominal prices or inflation. When yearly, cross-section, data only is used, expenditures were adjusted with the respective year's PPP.

To estimate equivalence scales, we classify households into ten types based on composition: (1) single adult (reference household); (2) single parent with children; (3) couple without children; (4) couple with one child; (5) couple with two children; (6) couple with three or more children; (7) three adults (without children); (8) four or more adults (without children); (9) extended family with children (three or more adults with children); and (10) other households. We define a child as aged 0–14 years (the age bracket available in the EU-HBS), which is a mild discrepancy relative to the modified OECD scale (children aged 0–13). The sample (2010-2020) consists of 762,442 households.

3.2 Demand System

The essential element for estimating equivalence scales is the expenditure (cost) function, $E(p, U, z)$, which gives the minimum expense for a consumer with characteristics z needed to obtain utility level U when facing prices $p = (p_1, \ldots, p_n)$ (Lewbel & Pendakur, 2008a). The expenditure function is derived by defining first the Stone-Geary direct utility function in the Linear Expenditure System (LES):

$$U = \prod_i (x_i - \gamma_i)^{\phi_i}, \tag{2}$$

where x_i is the consumption of good i, ϕ_i are the marginal budget shares for each good i, with $0 \leq \phi_i < 1, \sum_i \phi_i = 1$, and γ_i are the subsistence levels of consumption for each good i. Maximising utility subject

[7] Sampling designs and weight calibration differ across national surveys. Eurostat (2025d) reports that Czechia used quota sampling in 2010 and 2015 but probability sampling in 2020; correspondingly, the sum of Eurostat HA10 household weights in our data rises by about 134× in 2020 relative to earlier waves. We therefore exclude Czechia from the analysis. Conclusions are robust across alternative samples and specifications; with greater sensitivity of estimates for larger households.

to the budget constraint, $y = \sum p_i x_i$, we obtain the linear expenditure functions for each good i:

$$p_i x_i = p_i \gamma_i + \phi_i \left(y - \sum_{j=1}^{n} p_j \gamma_j \right). \tag{3}$$

Differentiating equation (3) with respect to y and multiplying by $y/p_i x_i$, we obtain the budget elasticities e_i, from which we obtain marginal budget shares (ϕ_i):

$$e_i = \frac{\phi_i y}{p_i x_i} \Rightarrow \phi_i = e_i w_i, \tag{4}$$

where w_i is the budget share of commodity group i.

To calculate the subsistence parameters γ_i, we require own-price elasticities e_{ii}. Applying the implicit function theorem to equation (3) and multiplying by p_i/x_i, we obtain:

$$e_{ii} = \frac{\gamma_i (1 - \phi_i)}{x_i} - 1 \Rightarrow \gamma_i = \frac{(e_{ii} + 1) x_i}{(1 - \phi_i)}. \tag{5}$$

Starting from equation (3), we derive the Marshallian demand functions, x_i, which are then substituted into the direct utility function U to obtain the indirect utility function V, expressed as:

$$V(p, y) = \frac{y - A}{B}, \text{ where } \quad A = \sum_i p_i \gamma_i, \quad B = \prod_i \left(\frac{p_i}{\phi_i} \right)^{\phi_i}. \tag{6}$$

The associated expenditure function, $E(p, U)$, which represents the minimum expenditure required to achieve utility level U at given prices p, is given by:

$$E(p, U) = A + BU. \tag{7}$$

3.3 Parameters Estimation

Following the approach of Sologon et al. (2024, 2025) and Creedy (1998) we first estimate LES parameters for each commodity group, i, using quadratic Engel functions:

$$w_i^h = \alpha_i + \beta_i \ln C^h + \varphi_i \left(\ln C^h \right)^2 + \delta_i z^h + \theta_{cy}, \tag{8}$$

where w_i^h is the household's h budget share of commodity group i in total household consumption C^h, and z^h is a set of characteristics of household h (number of children and adults in the household, similar to the approach of Svavarsdottir et al. (2025) and Doorley et al. (2024)), θ_{cy} are country×year fixed effects, and standard errors clustered at the country×year level.[8] The expenditure shares are estimated for commodity groups ($i = 1, \ldots, 12$). The specified Engel function diverges from the conventional Engel curve derived from the LES by incorporating quadratic terms in the logarithm of consumption and a vector of household characteristics. These modifications are introduced to enhance the model's empirical fit and to account for potential non-linearities and heterogeneity across different household types that the standard LES formulation may fail to capture (Banks et al., 1997).

The estimation procedure addresses the issue of zero expenditures, which are common in household consumption data. For each commodity group i, we estimate equation (8) using pooled ordinary least squares at the household level, but restrict the estimation to households with positive expenditures on

[8] Our baseline includes country×year fixed effects to capture cross-country/time heterogeneity. While this reduces precision for some categories, the implied equivalence scales remain stable; estimation without fixed effects is presented as a robustness check in the Appendix.

commodity i (i.e., where $w_i^h > 0$).[9]

Based on the parameter estimates from the Engel functions in equation (8), we derive the budget elasticities as:

$$e_i = 1 + \frac{\beta_i + 2\varphi_i \ln C^h}{w_i}. \tag{9}$$

Budget elasticities are computed at the household type level, using the average total expenditure of the household type and budget shares. A 10×12 matrix of budget elasticity estimates is obtained (see Table 7 in the Appendix).

After obtaining budget elasticities, respective marginal budget shares ϕ_i are estimated:

$$\phi_i = e_i \times w_i. \tag{10}$$

For estimating price elasticities, we follow the approach of Creedy (2001), using the result established by Frisch (1959). The own and cross-price elasticities are formulated using the Frisch parameter, ξ:

$$e_{ij} = -e_i w_j \left(1 + \frac{e_i}{\xi}\right) + \frac{e_i \delta_{ij}}{\xi}, \tag{11}$$

where $\delta_{ij} = 1$ if $i = j$ and 0 otherwise, and ξ is the elasticity of marginal utility of expenditure with respect to total expenditure. Price elasticities are calculated at population and household type level.

The Frisch parameter is calculated as $\xi = \min(-1.3, -\exp(\phi - \alpha \times \ln(C_{total}/(12 \times N_{total}) + \theta)))$, where $\phi = 9.2$, $\alpha = 0.973$, $\theta = 7000$, C_{total} is the PPP-adjusted total expenditure, and N_{total} is the total weighted population.[10]

After obtaining budget and price elasticities, we derive the subsistence expenditure γ_i for each household type (k):

$$\gamma_i^k = \frac{\left(e_{ii}^k + 1\right) x_i^k}{\left(1 - \phi_i^k\right)}. \tag{12}$$

To ensure stability and reduce individual-level variation, the methodology aggregates and weights parameters at the household type level. In the analysis that follows we use the single point household type estimates for the derivation of the equivalence scales. We impose the following conditions: (i) budget elasticities are bounded between -2 and 1.8; (ii) where fewer than 5% of observations report positive expenditure on a particular commodity group, the corresponding budget elasticity is set to zero; (iii) marginal budget shares are constrained to sum to unity across all expenditure categories; and (iv) subsistence parameters are constrained to be non-negative. These conditions ensure economically plausible inputs for the subsequent analysis.

3.4 Estimation of Equivalence Scales

An equivalence scale is a function that determines the expenditure ratio between two household types achieving the same utility level under identical prices. It is derived as the ratio of expenditure (cost) function of household type k and a reference household type r (Lewbel & Pendakur, 2008a):

$$D(p, U, z) = C(p, U, z_k)/C(p, U, z_r). \tag{13}$$

[9] This conditional estimation approach ensures that the budget share regressions are estimated on the relevant population while avoiding bias from including zero expenditures directly in the dependent variable.

[10] Estimated Frisch parameter for main calculation is -1.612929.

Following the expenditure function in (7):

$$E\left(p, U, z_k\right) = C = A_k + B_k U, \text{ where } A_k = \sum_i p_i \gamma_i^k, \text{ and } B_k = \prod_i \left(\frac{p_i}{\phi_i^k}\right)^{\phi_i^k}. \tag{14}$$

The reference household type (r) is the single adult household. We conduct the analysis in 2020 PPS (EU27=1, see subsection 3.1). Throughout our analysis, we normalise prices to unity ($p_i = 1$) as a scaling convention (similar to Dudel et al., 2021b). Cross-country and temporal price differences are addressed through PPP/HICP adjustments to expenditures.

To assess the cost-of-living impact on equivalence scales, we perform a counterfactual exercise for 2024. We apply EU27-level HICP growth rates (by expenditure category; see Table 16 in Appendix) to the estimated EU scale to maintain the conceptual separation between spatial price differences and temporal price changes. In the baseline, prices are set to 1 ($p_i = 1$), for the 2024 scenario we apply the 2024/2020 HICP growth rate so that only relative price changes enter. Throughout this analysis, we hold the 2020 preference and needs parameters (γ_i, ϕ_i) fixed, so the analysis isolates the pure price-growth effect rather than changes in behaviour or price levels.

We derive equivalence scales using three complementary approaches within the LES framework, each reflecting distinct conceptual definitions of what it means for households to be "equally well-off." Although all three measure relative household needs, they differ in their underlying welfare benchmarks and behavioural assumptions: MNS compares subsistence requirements, UIS provides a common-preference welfare comparison, and UES evaluates living standards using household type specific preferences.

Minimum Needs Scale (Subsistence Approach)

The first approach is based on a comparison of the minimum (subsistence) expenditures by household type:

$$ES_{MNS} = \frac{A_k}{A_r} = \frac{\sum_i p_i \gamma_i^k}{\sum_i p_i \gamma_i^r}, \tag{15}$$

where γ_i^r is the reference household type's minimum expenditure on good i facing prices p for good i, and γ_i^k is the comparison household type's minimum expenditure on good i facing prices p for good i. Setting p_i equal to one, we obtain:

$$ES_{MNS} = A_k / A_r = \left(\sum_i \gamma_i^k\right) / \left(\sum_i \gamma_i^r\right). \tag{16}$$

The MNS represents the relative cost of meeting minimum consumption requirements across different household compositions. This approach captures the idea that different household types have different subsistence requirements, and the equivalence scale reflects how much more (or less) a household needs relative to a single adult to meet these basic consumption needs. It abstracts from preference heterogeneity beyond these minimum requirements.

Utility Implicit Scale (Common Preference Approach)

The second approach evaluates how much the reference household would need to spend to achieve the same utility level as household type k, using the reference household's preference structure. We derive

this by employing the indirect utility function (recall 6):

$$ES_{UIS} = \frac{C_r(p, V_k)}{C_r} \tag{17}$$

$$= \frac{A_r + B_r V_k(p, y)}{C_r} = \frac{A_r + B_r \frac{C_k - A_k}{B_k}}{C_r} \tag{18}$$

$$= \frac{\sum_i p_i \gamma_i^r + \prod_i (\frac{p_i}{\phi_i^r})^{\phi_i^r} \frac{C_k - \sum_i p_i \gamma_i^k}{\prod_i (\frac{p_i}{\phi_i^k})^{\phi_i^k}}}{C_r}, \tag{19}$$

where $V_k(p, y)$ is the indirect utility function of household type k, and C_r denotes the observed expenditure for the reference household. It asks: *If the single adult were to live at the same standard of living as a given family, how much would it need to spend?* In other words, UIS computes the expenditure that would make the reference household as well-off as that household type, and expresses this as a ratio of the reference household's actual expenditure. This yields a welfare comparison across household types using a common reference preference structure.

Utility Explicit Scale (Fixed Utility Approach)

The third approach compares the expenditure requirements for different household types to reach a common exogenously specified utility level:

$$ES_{UES} = \frac{E_k(p, U)}{E_r(p, U)} = \frac{A_k + B_k U}{A_r + B_r U} \tag{20}$$

$$= \frac{\sum_i p_i \gamma_i^k + \prod_i (\frac{p_i}{\phi_i^k})^{\phi_i^k} U}{\sum_i p_i \gamma_i^r + \prod_i (\frac{p_i}{\phi_i^r})^{\phi_i^r} U}, \tag{21}$$

where $E_k(p, U)$ and $E_r(p, U)$ are the expenditure functions at utility level U. The UES represents the relative cost for different household types to achieve the same utility level, using each household type's own preference structure. It asks: *At the same welfare level, how much more does a family (one household type) need to spend compared to the single adult (reference household), given their own consumption preferences?* Note that the numerical value of U has no intrinsic cardinal meaning; our benchmarks (subsistence, median, mean and high U) should be interpreted as different positions in the welfare distribution rather than meaningful "units" of utility.

The three defined scales represent a continuum from "needs-based" to "welfare-based" approaches: a MNS captures subsistence requirements; a UIS captures comparable welfare from a common reference point using a single preference structure; and a UES, which we treat primarily as a welfare-benchmark sensitivity check, uses fixed welfare benchmarks to compare the relative costs of achieving the same utility level under each household's own preferences. Their differences quantify how assumptions about welfare and preferences shape the perceived extent of household economies of scale and, consequently, the measurement of inequality and poverty.

4 Results

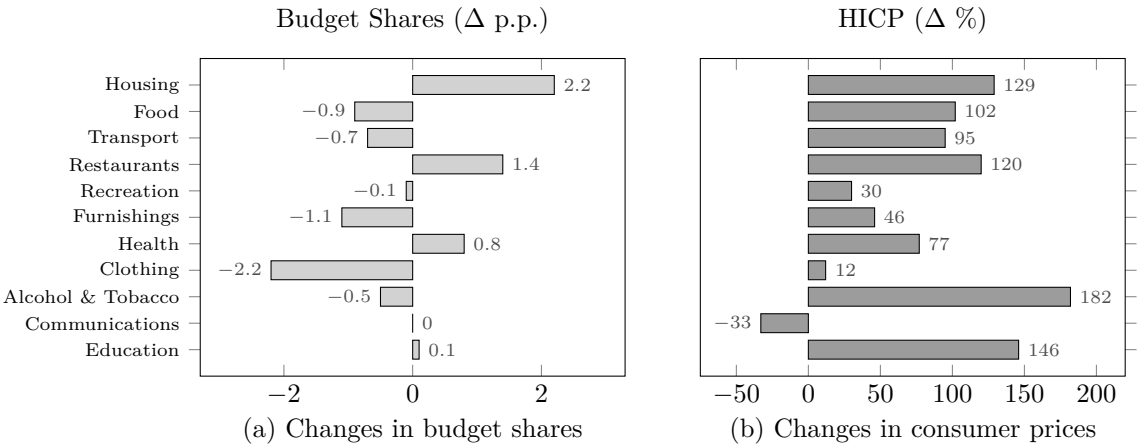
This section consists of four subsections. First, we document long-run shifts in consumption patterns and consumer prices since 1996, time close to the proposal of the modified OECD (mOECD) scale. We also summarise the analysed sample and budget shares by household type. Second, we estimate budget and own-price elasticities for twelve COICOP categories, and we present equivalence scale estimates from the three approaches for the pooled EU sample and by geographic groupings, and compare them with the mOECD scale and LIS scale (i.e., the square root of the number of household members). Third, we study

the changes in equivalence scales over time and the impact of prices growth. And, fourth, we discuss their implications for popular indices, such as the Gini inequality indices and at-risk-of-poverty rates.

4.1 Expenditure Patterns

Times have changed since the introduction of the mOECD scale. Consumption patterns have evolved influenced by shifts in technology, demography (such as ageing, migration, lower birth rates), urbanisation, climate and also influenced by the COVID pandemic measures. European households are not an exception, and their consumption patterns have undergone substantial structural change, reflecting both rising living standards and evolving price dynamics (Figure 1).

Comparing years 2023 and 1996, food expenditure share declined by 0.9 percentage points as incomes rose, while the share devoted to housing surged by 2.2 percentage points, the largest increase among all categories, driven by rapidly rising housing costs across Europe. The shift away from goods consumption is evident in the 2.2 percentage point decline in clothing expenditure, the largest decrease observed. Simultaneously, relative price changes have been highly heterogeneous: while alcohol and tobacco prices increased by 182% and education by 146%, communications experienced a decline due to technological advancement. These long-run budget-share and price shifts matter for equivalence-scale estimates because they change the relative cost structure facing household type



(a) Changes in budget shares (b) Changes in consumer prices

Figure 1: Changes in consumption patterns and prices in the EU-27: 2023 vs. 1996
Source: Authors' calculation based on data from Eurostat (2025a, 2025b)
Note: Consumption categories are ordered by their budget shares from highest to lowest; Δ denotes change.

Table 2 describes our sample. The repeated cross-section data of 762,442 households represents the population of 544 million households.[11] The most common household type is the single adult (31.4%), followed by couples (23.7%). Over 50% of the households are childless. Average household type expenditure, in general, increases with number of household members.

Figure 2 shows consumption patterns in terms of budget shares for each household type. The expenditure patterns reveal heterogeneity across household types, with housing representing the dominant expenditure category (32-44% of total expenditure) and exhibiting clear economies of scale as larger households allocate relatively smaller budget shares to housing costs. Food expenditure increases with household size from 15.3% for single adults to 21% for types with three or more members, consistent with household size effects in consumption theory. These findings provide empirical support for differentiated equivalence scales across household types, as the observed spending patterns reflect varying needs and economies of scale that justify different income requirements to achieve equivalent welfare levels.

The heterogeneity in expenditure patterns across household types, combined with the shifts in both

[11] Population estimate obtained as a sum of pooled sample weights of all three years.

Table 2: Descriptive Statistics

HH type	Share (%)	Adults	Children	HH Total Expenditure (ln, 2020 PPS)				
				Mean	SD	p50	Min	Max
Single	31.4	1	-	9.24	1.24	9.54	1.67	13.02
Single parent	2.1	1	1.42	9.52	1.17	9.79	2.29	12.66
Couple	23.7	2	-	9.76	1.19	10.08	2.28	13.69
Couple, 1 C	6.2	2	1	9.79	1.19	10.15	2.37	12.75
Couple, 2 C	6.2	2	2	9.92	1.18	10.30	2.33	12.48
Couple, 3+ C	1.7	2	3.23	9.85	1.26	10.24	2.73	12.68
Three adults	7.3	3	-	9.78	1.24	10.16	2.50	13.36
4+ adults	5.0	4.25	-	9.93	1.28	10.32	2.87	12.91
3+ adults w. C	6.7	3.52	1.43	9.52	1.38	9.89	2.34	13.31
Other	9.8	2.32	0.22	9.21	1.68	9.76	2.10	13.18
Total	100.0	1.98	0.39	9.55	1.31	9.86	1.67	13.69

Source: Authors' calculation.
Note: Sample of 762,442 households represents a population of 543,666,012 households. PPS denotes purchasing power standard. C denotes child(ren) (age 0-14). Descriptive statistics for each year available in the Appendix.

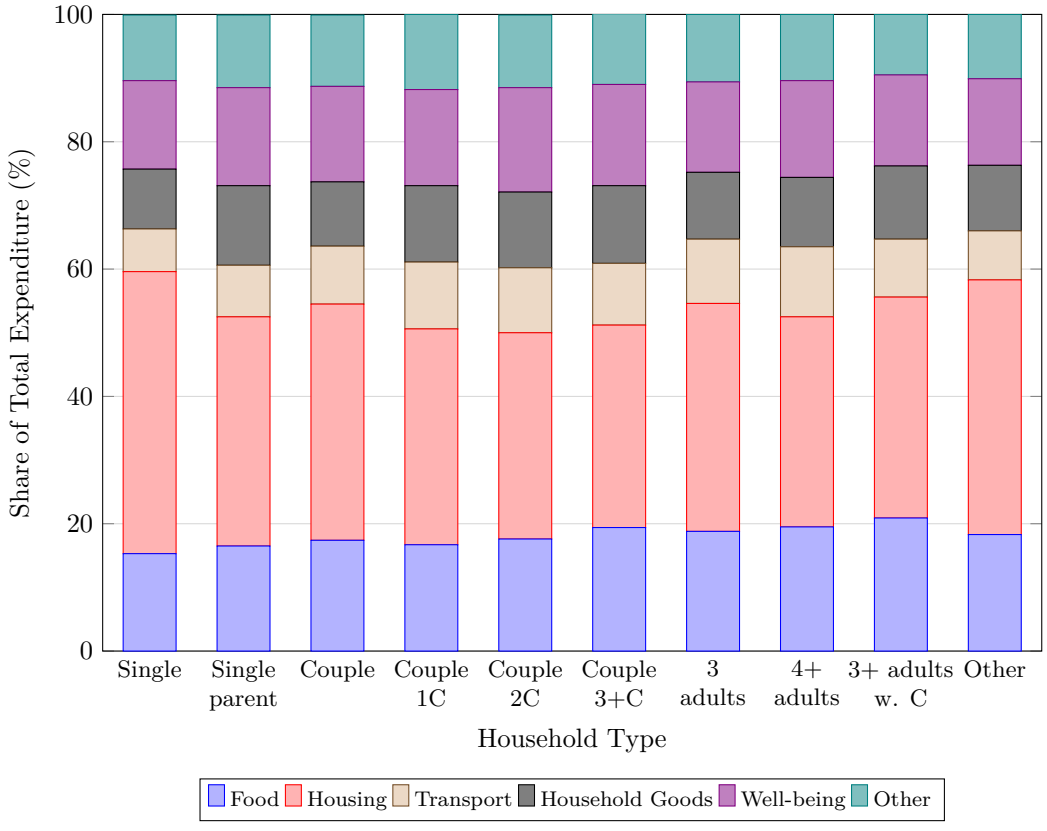


Figure 2: Expenditure Patterns by Household Type

Source: Authors' calculation.
Note: Household goods consists of clothing, furnishings, and communication; Well-being consists of health, recreation, education, and restaurants; Other is miscellaneous, and alcohol and tobacco. C denotes child(ren). Average budget shares for each year available in the Appendix.

consumption patterns and relative prices observed at the EU level, highlights that the cost of achieving equivalent living standards varies across household compositions. This motivates our demand-based approach to equivalence scale estimation, which accounts for these consumption differences and price dynamics.

4.2 Equivalence Scales Estimation

Following the estimation procedure outlined in Section 3, we derive budget (expenditure) and own-price elasticities for all consumption categories, with regression coefficients reported in the Appendix (Table 6). Robustness checks across alternative specifications and sample sizes yield elasticity estimates that remain broadly consistent with the range documented in the European consumption literature.[12] Figure 3 presents the estimated elasticities for the pooled EU countries. The estimated elasticities are consistent with previous studies (Clements et al., 2020; Selvanathan et al., 2024; Temursho & Weitzel, 2024). While our estimates may differ slightly from country-specific studies, they represent a pooled sample of 23 EU members across three years that smooths out national heterogeneities in consumption patterns. These estimates are crucial for equivalence scale estimation as they determine how subsistence requirements and discretionary consumption respond differently to income and price changes across household types.

The budget elasticities reveal a clear distinction between necessities and luxuries: food (0.56) and housing (0.66) exhibit elasticities below unity, indicating that households allocate proportionally less of incremental income to these basic consumption categories. In contrast, transport, furnishings, recreation, restaurants show elasticities exceeding one, classifying them as goods whose expenditure shares rise with income. The own-price elasticities are uniformly negative, as expected from the demand theory, with magnitudes ranging from -0.15 (alcohol and tobacco) to -0.94 (transport). Food (-0.40) exhibits relatively low price sensitivity, consistent with its status as a necessity, and housing moderate elasticity (-0.53). Cross-price elasticities are small and negative, suggesting limited substitution across commodity groups.

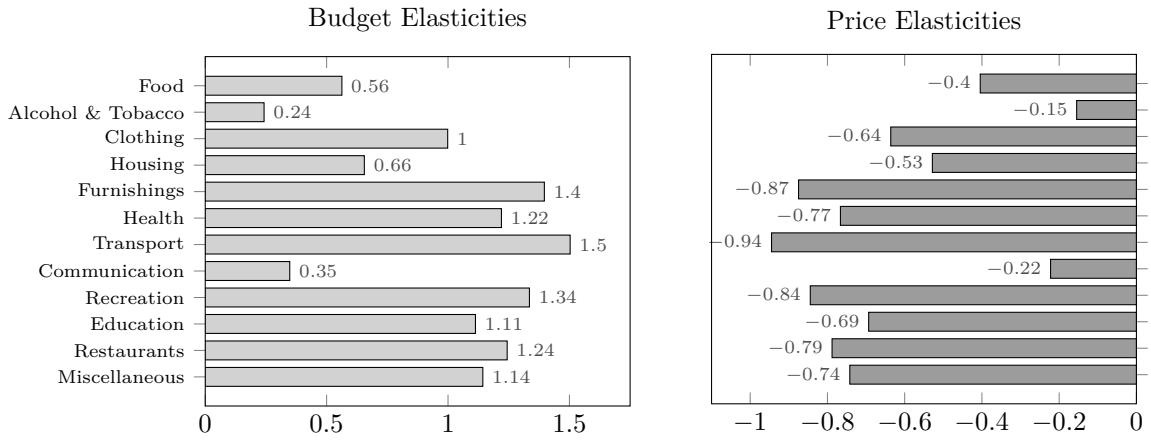


Figure 3: Elasticities of consumption categories

Source: Authors' calculation.
Note: Elasticities estimations are reported at population level.

Figure 4 is the comparison of estimated equivalence scales with the widely-used mOECD scale and LIS (square root) scale. The results reveal substantial differences across methodological approaches and the five equivalence scales exhibit differences in magnitude and household size sensitivity. The mOECD scale generates the highest values across household types, while the UIS produces the lowest estimates; similar to recent research (see Table 1).

The UES, calibrated to the median utility level (278) representing the typical European household, falls between the MNS and UIS, providing a demand-based benchmark that accounts for actual consumption patterns while maintaining policy relevance for welfare comparisons. Across approaches, marginal equivalence falls with household size; the utility-based scales show the strongest sharing economies, especially for couples with children.

In terms of external validity, our estimates lie above the very low subjective scales reported by Svavarsdottir

[12] Education elasticities exhibit greater sensitivity to specification choices due to a small expenditure share in the sample, while alcohol and tobacco estimates also show higher variability.

et al. (2025), and often below the expert mOECD scale. Quantitatively, MNS is broadly comparable in magnitude to mOECD for common household types, but varies systematically by composition: implying a slightly higher scale for couples and lower scales for larger households, especially those with children. UIS lies at the lower end of the subjective literature, particularly for households with children (e.g., Svavarsdottir et al., 2025), and is closer to mid-range subjective estimates for adult-only households (e.g., Bishop et al., 2014). MNS is typically closer to mid-range estimates in Daley et al. (2020), Kalbarczyk-Steclik et al. (2017), and Koulovatianos et al. (2005b). Contrary to some subjective approaches (Bishop et al., 2014) that imply the first child is more costly than an additional adult, our demand-based estimates imply the opposite ranking. This is consistent with the LES framework, which infers needs from observed expenditure patterns.

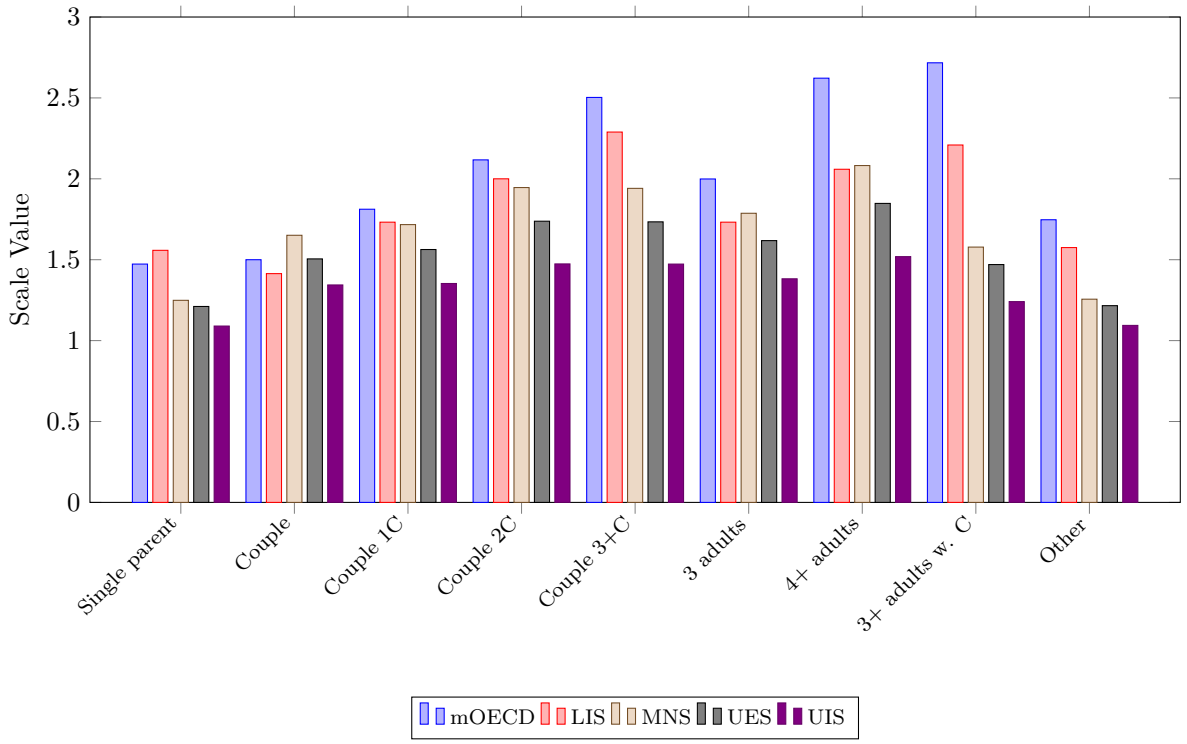


Figure 4: Comparison of Equivalence Scales by Household Type

Source: Authors' calculation.

Note: UES estimated at median utility level of weighted sample. Single adult household type as reference (scale value 1). C denotes child(ren).

Equivalence values decline monotonically as the reference utility level rises (Figure 5). Across all household types the scale falls monotonically as the reference utility level rises, converging toward unity at very high utility, signalling stronger economies of scale when welfare is evaluated at higher living standards. This finding contradicts the equivalence scale exactness (ESE)/independence of base (IB) assumption embedded in traditional parametric scales but aligns with patterns for income, expenditure and utility dependent scales (Conniffe, 1992; de Ree et al., 2013; Donaldson & Pendakur, 2004; Dudel et al., 2021a; Koulovatianos et al., 2005a).

For couples, the equivalence scale ranges from 1.65 at minimal utility (subsistence) to 1.10 at very high utility levels (10,000). Similarly, a couple with two children requires 1.95 times a single person's budget at low utility but only 1.16 times at high utility (a 41% reduction). The convergence reflects that at higher welfare levels, discretionary consumption dominates and exhibits stronger economies of scale than necessities. The steepest decline occurs between the 25th percentile (25) and mean utility (729). This suggests that equivalence adjustments are sensitive to welfare definitions for households in the middle-income range, where complex interactions of targeted social benefits and tax allowances can undermine policy goals. At the population median utility, our UES values for couples (1.51) and

couples with two children (1.74) lie between the MNS and the more compressed high-utility values, with median-calibrated scales modestly higher than mean-calibrated ones and converging toward 1 at very high utility levels—indicating that at affluent living standards, household size has little impact on relative resource needs. The ordering of household types is stable across all utility levels.

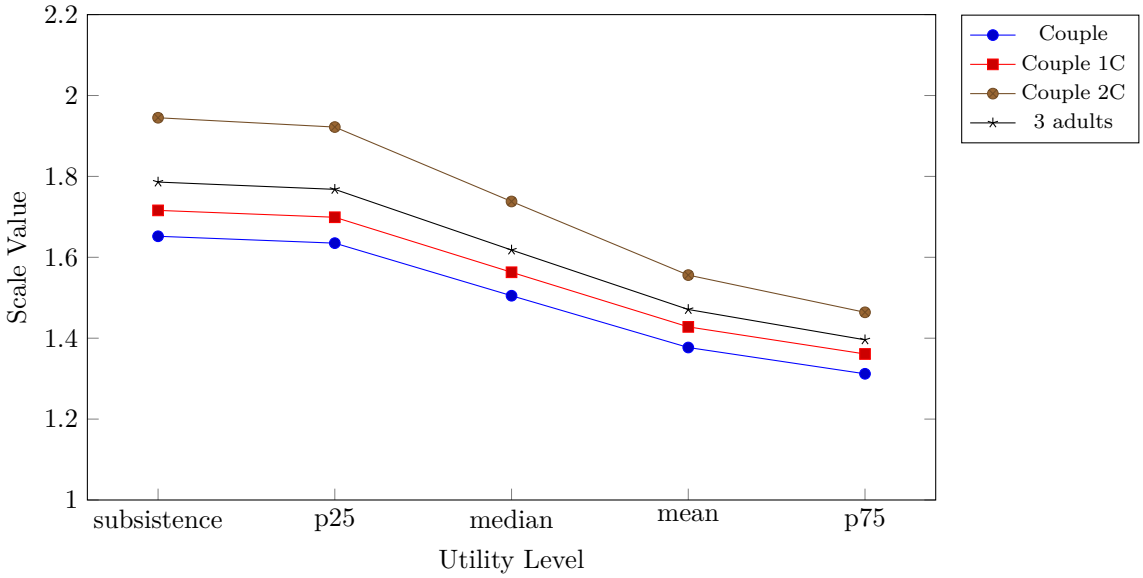


Figure 5: UES by Utility Level

Source: Authors' calculation.

Note: C denotes child(ren). The chart focuses on simple household types (with exact number of members by type adult/child), as these are the most relevant for the analysis. Other household types are omitted for clarity (available in the Appendix). The x-axis represents utility levels: subsistence, 25th percentile (utility = 25), median (278), mean (729), and 75th percentile (1.124). Single adult household is the reference household type (scale value = 1).

These results demonstrate that the choice of equivalence scale has substantial policy implications: the utility based scales suggest that expert approaches may systematically overestimate the income compensation required for larger households, particularly at higher welfare levels where economies of scale are strongest.

Despite the EU's common market and strong convergence of newer member states, equivalence scales exhibit regional variation reflecting underlying differences in prices, consumption patterns, and household economies of scale. Table 3 presents equivalence scales estimated separately for Northern (Denmark, Finland, Estonia, Ireland, Lithuania, Latvia), Western (Belgium, Germany, France, Luxembourg), Eastern (Bulgaria, Hungary, Poland, Romania, Slovakia), and Southern (Greece, Spain, Croatia, Italy, Malta, Portugal, Slovenia, Cyprus) Europe using the United Nations' geoscheme classification. A broad pattern emerges: scales tend to be higher in Northern/Western Europe and lower in Eastern/Southern Europe, with some household-type exceptions. For couples, the MNS ranges from 1.83 in Northern Europe to 1.40 in Southern Europe (a 31% difference). The regional hierarchy becomes more pronounced for larger households, for example, couples with two children show scales of 2.38 (Northern) versus 1.69 (Southern).

These differences are consistent with regional variation in price levels (notably housing and food), tenure and housing consumption, and differences in household formation and expenditure composition. Our finding of lower demand-based scales in Eastern Europe compared to Western Europe differs in direction from some subjective evidence (e.g., Mysíková et al., 2022). This likely reflects both differences in what the methods measure (perceived needs versus expenditure-based requirements under the LES) and differences in regional grouping conventions across studies; Mysíková and Želinský (2019) further emphasise substantial heterogeneity within Eastern Europe at the country level. Svavarsdottir et al. (2025) find that subjective equivalence scales vary across European regions (modestly for couples, more apparent for larger households), but that cross-country variation within regions is substantially larger. Taken together, this reinforces that regional and country heterogeneity is significant enough that a single uniform scale can

Table 3: Equivalence Scales Across Geographic Regions: Northern (N), Western (W), Eastern (E), and Southern (S) Europe

Household Type	MNS				UES				UIS			
	N	W	E	S	N	W	E	S	N	W	E	S
Single parent	1.26	1.17	1.28	1.23	1.23	1.14	1.31	1.21	1.07	1.09	1.04	1.09
Couple	1.83	1.74	1.54	1.40	1.64	1.58	1.39	1.34	1.45	1.50	1.17	1.22
Couple 1C	2.09	1.92	1.81	1.57	1.83	1.72	1.65	1.50	1.57	1.63	1.18	1.28
Couple 2C	2.38	2.18	1.97	1.69	2.05	1.93	1.76	1.60	1.71	1.74	1.23	1.35
Couple 3+C	2.68	2.18	1.87	1.72	2.27	1.93	1.71	1.63	1.90	1.73	1.19	1.37
3 adults	2.12	2.15	1.79	1.63	1.87	1.91	1.59	1.55	1.55	1.78	1.20	1.32
4+ adults	2.78	2.57	2.04	1.88	2.37	2.24	1.78	1.75	1.86	2.00	1.25	1.46
3+ adults w. C	2.35	2.33	1.96	1.68	2.05	2.06	1.73	1.60	1.65	1.77	1.23	1.33
Other	1.21	1.51	1.33	1.28	1.20	1.41	1.32	1.26	1.05	1.30	1.04	1.11

Source: Authors' calculation.
Notes: Countries grouped by United Nation's geoscheme (Cyprus included in Southern Europe). UES estimated at median utility of pooled sample of all countries. Single adult household is the reference household type (scale value = 1).

misrepresent country and region-specific needs.

4.3 Temporal Evolution of Equivalence Scales

Figure 6 shows the evolution of equivalence scales over time. In contrast to the baseline analysis (which converts all years to 2020 real PPP terms using both spatial PPP adjustments and temporal HICP adjustments), we here estimate separate equivalence scales for each year using that year's PPP-adjusted consumption data without temporal price adjustments. This approach allows the scales to reflect period-specific consumption patterns and price environments. We find that equivalence scales generally decline over time for all types of households and estimation methods, indicating the strengthening of consumption economies of scale. The MNS exhibits the steepest decline: couples with two children fall from 2.08 to 1.77 (-14.8%). The UIS shows the most pronounced convergence, with couples with two children declining from 1.58 to 1.35 (-14.4%). The UES (at median utility) displays modest declines, though couples exhibit a slight increase from 2015 to 2020 (1.47 to 1.51). Households with children experience larger reductions than adult-only households: couples with two children see 14% declines in UIS values versus 11% for three-adult households. This differential suggests increasingly efficient consumption sharing for children.

While cross-country heterogeneity has been extensively documented, some studies demonstrate that scales decline over time across diverse contexts and methodologies. Daley et al. (2020) documented non-linear declines in Engel scales across Canada, France, and Poland (capturing the period around the Great Financial Crisis). Kalbarczyk-Steclik et al. (2017) found subjective equivalence scales remained constant in Eurozone countries (2004-2012) but declined in Central and Eastern Europe during the same period. Country-specific analyses using both LES and subjective methods for Czechia confirm declining trends (Mysíková et al., 2021), while Doorley et al. (2024) demonstrate for Ireland that country- and time-specific scales improve income distribution measurement. Our contribution extends this evidence into the 2020s by exploring the potential effects of cost-of-living crisis on equivalence scales, demonstrating that declining trends persist across multiple household types and estimation approaches. However, the 2020 estimates (and by extension the 2024 counterfactual analysis) require cautious interpretation: EU-HBS 2020 data were collected during COVID-19 disruption, and several countries employ 2015 data adjusted to 2020 price levels, introducing potential estimation errors.

To gauge whether observed time trends reflect changing consumption preferences or inflation, we conduct a price-only counterfactual analysis holding consumption patterns fixed. Table 4 applies EU27 category-specific CPI changes between 2020 and 2024 to 2020 expenditure patterns. The implied scale reductions are modest (about 0.1–0.9%) but systematic, and are larger for households with children. This reflects the

differential inflation experienced across household types, driven by heterogeneous consumption patterns and varying exposure to price increases across expenditure categories (Gürer & Weichenrieder, 2020; Hobijn & Lagakos, 2005).

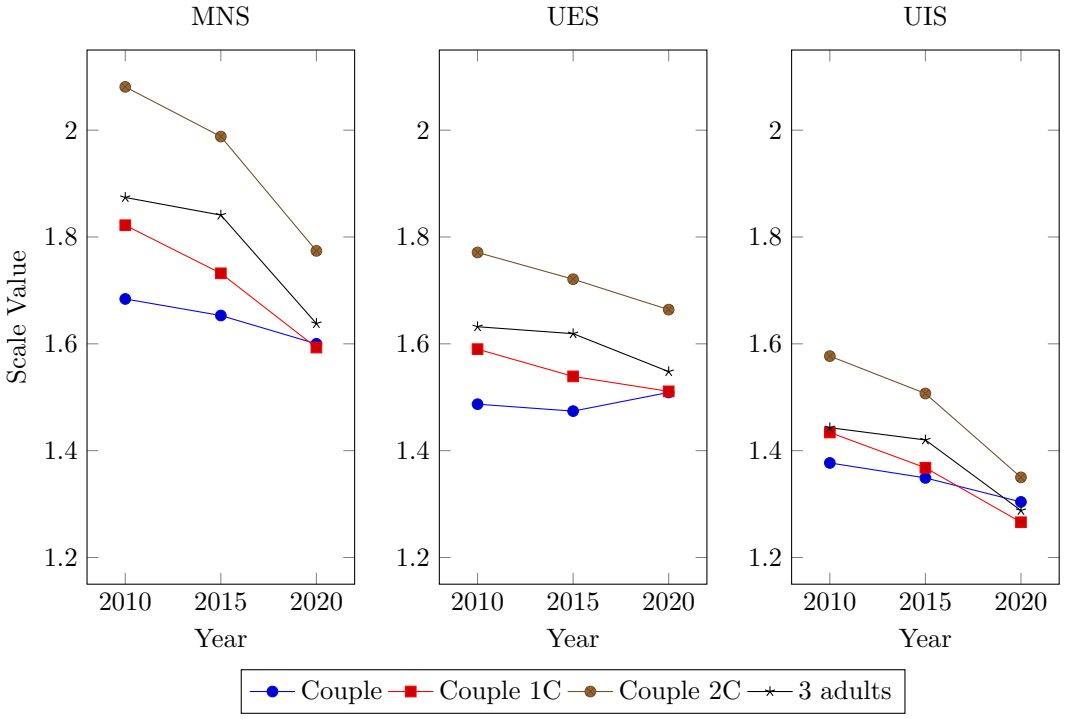


Figure 6: Evolution of Equivalence Scales Over Time

Source: Authors' calculations.
Notes: Figure presents simpler household types for clarity (reference household: single adult); cross-section data used for each year (PPP adjusted); C denotes child(ren); UES estimated at median utility level of each year (2010: 360, 2015: 354, 2020:168). Regression analysis using country fixed effects and pooled sample of each respective year. The 2020 estimates require cautious interpretation: EU-HBS 2020 data were collected during COVID-19 disruption, and several countries employ 2015 data adjusted to 2020 price levels, introducing potential estimation errors.

This reduction occurs through a mechanical effect: since equivalence scales measure household needs relative to single-person households, differential inflation patterns mechanically affect scale values: when larger households face lower inflation than the reference single adult, either through different consumption bundles or greater economies of scale in purchasing, their relative expenditure requirements decline.

Empirical evidence supports this mechanism but reveals mixed patterns across contexts. Messner and Rumler (2024) find that single households in Austria faced the highest inflation rates, with inflation marginally decreasing with household size. Similarly, Idson and Miller (1999) document that households with children faced lower inflation than childless households in the United States. However, Sologon et al. (2024) find heterogeneous patterns across European countries, with no consistent relationship between household composition and inflation exposure. At the EU level, Caisl et al. (2023) show that singles exhibit above-average effective inflation compared to larger households, primarily because they are overrepresented among low-income and older households with high budget shares in expenditure categories hit harder by inflation.

The decline in equivalence scales over time suggests that households can now reach similar living standards with relatively fewer extra resources as they grow. In other words, economies of scale in consumption have become stronger. This likely reflects three related changes: (i) new technologies and better infrastructure mean more spending goes on items that can be shared within the household (such as housing), (ii) consumption has shifted away from food and other basic necessities toward goods with high fixed costs and low extra cost for additional users, and (iii) higher living standards have increased spending on discretionary items that are easy to share, which lowers the relative cost of an additional household

Table 4: Price effects - Comparison of HH Types (2024 vs 2020)

HH Type	MNS		UES		UIS	
	2020	**2024 (% Δ)**	**2020**	**2024 (% Δ)**	**2020**	**2024 (% Δ)**
Single parent	1.251	1.242 (-0.7%)	1.228	1.219 (-0.7%)	1.080	1.079 (-0.1%)
Couple	1.600	1.592 (-0.5%)	1.509	1.504 (-0.3%)	1.304	1.300 (-0.3%)
Couple 1C	1.593	1.579 (-0.9%)	1.511	1.500 (-0.7%)	1.266	1.263 (-0.2%)
Couple 2C	1.774	1.758 (-0.9%)	1.664	1.652 (-0.7%)	1.350	1.346 (-0.3%)
Couple 3+C	1.724	1.708 (-0.9%)	1.624	1.612 (-0.7%)	1.318	1.314 (-0.3%)
3 adults	1.638	1.630 (-0.5%)	1.548	1.544 (-0.3%)	1.288	1.285 (-0.2%)
4+ adults	1.972	1.959 (-0.7%)	1.832	1.823 (-0.5%)	1.439	1.434 (-0.3%)
3+ adults w. C	1.372	1.364 (-0.6%)	1.336	1.329 (-0.5%)	1.118	1.117 (-0.1%)
Other	1.263	1.259 (-0.3%)	1.237	1.233 (-0.3%)	1.090	1.089 (-0.1%)

Source: Authors' calculation.
Note: Single adult household is the reference household type (scale value = 1).

member.

These structural shifts have direct policy implications. Declining scales imply that static equivalence scales (such as mOECD) increasingly overstate requirements for larger households. Policymakers should consider periodic scale updating to reflect evolving consumption or sensitivity testing to different equivalence scale estimates (Doorley et al., 2024), particularly as structural trends reshape household consumption patterns. Given these spatial and temporal shifts, we next quantify how alternative scales change poverty and inequality indicators.

4.4 Parametric Estimations and Distributional Implications

Alternative equivalence scales embody different views about household needs, economies of scale, and the relative costs of adults and children, but these differences only become policy-relevant once they are reflected in summary measures such as at-risk-of-poverty rates and inequality indices. Official European income statistics typically fix the mOECD scale as a convention, thereby treating one particular configuration of economies of scale and adult/child weights as normatively given. We instead consider MNS, UIS and UES, summarising each in a simple linear parametric form and then using these parametric representations to re-compute equivalised household incomes and assess how sensitive poverty and inequality indicators across European countries are to the choice of equivalence scale.

To facilitate comparison with conventional parametric scales, we estimate linear equivalence scale formulas of the form

$$s = 1 + \alpha(A - 1) + \beta C, \tag{22}$$

where A denotes adults and C denotes children. Table 5 presents the estimated parameters for each scale type (estimates from the pooled EU sample with 2010-2020 data, see Table 4). The MNS yields parameters closely aligned with the mOECD scale, though with marginally stronger economies of scale. The UES exhibits more pronounced economies of scale, while the UIS reveals the strongest sharing economies. All three scales consistently show $\alpha > \beta$, confirming that adults impose larger marginal costs than children. Estimation was done with an ordinary least squares regression on five point estimates for simple household types for each scale.[13]

Regan and Kakoulidou (2025)'s analysis for Ireland demonstrates that choice of equivalence scales impacts poverty and inequality indicators; with higher adult weights leading to lower poverty rates and inequality

[13]The power-law specification of equivalence scales provides a complementary perspective by measuring overall household size elasticity. The estimated elasticities range from 0.52 (MNS) to 0.30 (UIS), with the MNS statistically insignificant from the LIS square-root scale.

Table 5: Parametric Equivalence Scale Weights

Scale	α (Adult)	β (Child)	$\alpha - \beta$
MNS	0.447	0.254	0.193
UES	0.350	0.198	0.152
UIS	0.222	0.127	0.095
mOECD (reference)	0.500	0.300	0.200

Source: Authors' calculation.
Notes: Regression (OLS) estimates based on five representative household types: single adult (reference), couple, couple with one child, couple with two children, and three adults. Specification: $s - 1 = \alpha(A - 1) + \beta C$, estimated without constant term. α measures marginal cost of additional adult, β measures marginal cost of child.

indices, while higher child weights elevate inequality measures. The choice of household definition similarly affects distributional outcomes. The estimated parameters were used to estimate the effects of applying different equivalence scales on income distribution. Using household income data from EU-HBS 2020 we estimate at-risk-of-poverty rates and Gini coefficients, using household equivalised incomes computed with parameters from Table 5, and compare them with indicators computed based on mOECD scale. Estimations were done with software DASP version 3.03 (Araar & Duclos, 2007).

The poverty analysis reveals sensitivity of at-risk-of-poverty rates (60% of median threshold) to equivalence scale choice, see Figure 7 (and Table 17 in Appendix). This sensitivity is more pronounced than the inequality effects, confirming established findings that poverty measures are more responsive to equivalence scales than summary inequality indicators. MNS demonstrates smallest deviations from mOECD, while the UIS increases the thresholds and rates the most (ranging from 0.28 percentage points relative to mOECD in Ireland to 6.37 in Denmark). Country-specific patterns demonstrate heterogeneous responses: Spain's poverty rate decreases from 19.7% under mOECD to 18.8% under MNS but increases to 20.5% under UIS, while Malta shows a monotonic increase. These findings underscore the critical normative dimension of equivalence scale selection in official poverty measurement, as the choice between mOECD (reflecting moderate scale economies) and UIS (reflecting strong scale economies) can shift a significant portion of individuals across the poverty threshold while simultaneously altering the demographic composition of the measured poor population.

The consequences of the choice of the equivalence scale on the measurement of income inequality in European countries are less pronounced (see Table 18 in the Appendix). Under the MNS, changes in inequality are modest and mixed. We find decreases in Western Europe (e.g., Belgium, Luxembourg) and small positive changes in Germany and the Baltic, while some countries mainly in Central Europe show non-significant differences, which is consistent with the evidence that the Gini index is relatively less sensitive to moderate equivalence scale changes than poverty rates and often exhibits small adjustments dependent on composition. By contrast, the UES and especially the UIS produce broader increases in measured inequality, matching expectations: UES raises Gini by about +0.01 in several countries (Bulgaria, Germany, Denmark, Finland, Latvia, Slovenia). UIS shows the strongest impact, with notable increases of +0.025 in Finland and around +0.02 in Germany, Denmark, Lithuania, and Slovenia, with widespread +0.01 rises across many others.

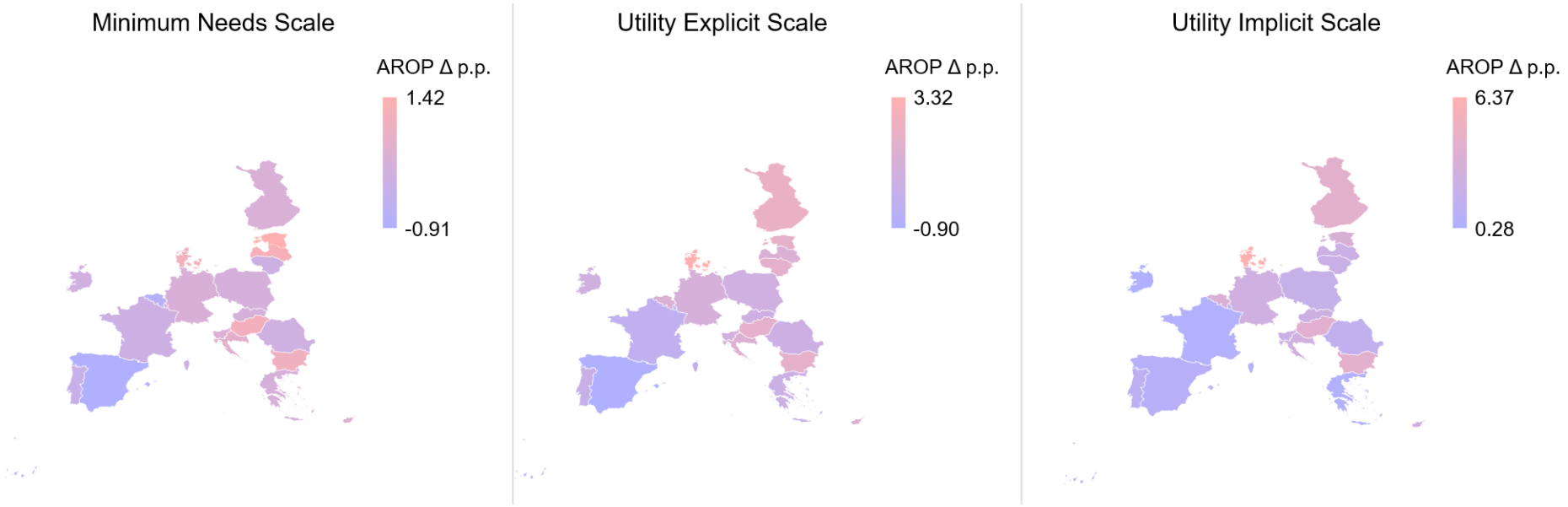


Figure 7: At-risk-of-poverty rates change across European countries

Source: Authors' calculations with DASP. Visualisation using Microsoft Excel Map charts.

Notes: Change of At-risk-of-poverty rates for different equivalence scales compared to estimates with the mOECD scale. Income data from EU-HBS 2020, (moving) relative poverty line at 60% median equivalised income, p.p. denotes percentage points.

5 Conclusion

Three decades after the introduction of the mOECD scale, European consumption patterns have transformed, yet the equivalence scales used to measure poverty and inequality have not. Our demand-system estimates reveal that this static approach might overstate the resource needs of larger households, with direct consequences for how we identify the poor and allocate social benefits.

Using EU-HBS 2010–2020 in an LES framework, we recover three complementary scales: minimum needs, utility explicit, and utility implicit, and find that required resources fall with the welfare level at which comparisons are made. We document that expert scales (e.g., mOECD) tend to overstate required resources for larger households, especially at higher living standards, and for large households for which the square root scale might reflect better economies of scale.

We also confirm heterogeneity across European regions. Across Europe, the cost of living is not uniform. A single common scale improves comparability but can conceal economically relevant cross-region variation; sensitivity analysis or region-specific calibrations should be considered in comparative work. Over the past decade, scales have declined 5-15%, consistent with strengthening consumption economies of scale. Holding 2020 consumption baskets fixed, a counterfactual analysis applying 2020-2024 HICP growth shows that relative price changes alone reduce scales by 0.1-0.9%, underscoring the need to revisit static weights during rapid structural change.

Methodologically, each approach serves a different purpose. MNS is suited to needs-based targeting and minimum-income design; UES is appropriate when a specific welfare benchmark is policy-relevant; UIS offers a preference-invariant yardstick for comparability and typically reveals the strongest economies of scale. In periods of rapid basket and relative price change, as in the post-COVID energy and food shocks, demand-system scales dominate static expert rules because they update the mapping from expenditures to needs as preferences and prices evolve; our 2024 HICP counterfactual illustrates the price-channel mechanism.

The implications for inequality and poverty measurement are significant. Applying demand-based scales rather than the mOECD scale alters measured inequality and poverty rates, with poverty measures proving more sensitive to the equivalence scale choice. The UIS, which reflects the strongest consumption economies, increases measured Gini coefficients by up to 0.03 points in some countries while shifting significant portions of the population across the poverty threshold. These effects vary systematically by country and household composition, altering both the level and demographic profile of the measured poverty. Policymakers designing tax-benefit systems face consequential normative choices embedded in equivalence scale selection, as the gap between expert scales and empirically-grounded alternatives has widened over decades of structural economic change.

These findings challenge the premise that a single, time-invariant equivalence scale can adequately capture differences in household needs across Europe. The decline in scale values between 2010 and 2020, combined with regional variation and sensitivity to welfare levels, suggests that equivalence scales are neither constant across space nor stable over time. As European households devote larger shares of spending to goods and services that can be shared within the household, consumption economies of scale strengthen and expert-based judgments may become increasingly misaligned with observed behaviour. Ongoing changes driven by digitalisation, climate policies, and demographic shifts are likely to reinforce these pressures. Transparent choices about equivalence scales, and routine sensitivity checks using empirically grounded alternatives, are therefore important for credible poverty metrics and for the policies that depend on them. As European consumption patterns and relative prices continue to evolve, so too should the equivalence scales used in distributional analysis.

References

Aaberge, R., Langørgen, A., & Lindgren, P. Y. (2024). A European equivalence scale for public in-kind transfers. *The Journal of Economic Inequality*, *22*(1), 1–32. https://doi.org/10.1007/s10888-023-09586-6.

Araar, A., & Duclos, J.-Y. (2007). *DASP: Distributive analysis Stata package*. PEP, World Bank, UNDP and Université Laval.

Araar, A., & Verme, P. (2019). *Prices and welfare: An introduction to the measurement of well-being when prices change*. Springer International Publishing. https://doi.org/10.1007/978-3-030-17423-1.

Banks, J., Blundell, R., & Lewbel, A. (1997). Quadratic Engel curves and consumer demand. *The Review of Economics and Statistics*, *79*(4), 527–539. October 21, 2025, https://www.jstor.org/stable/2951405

Bellù, L. G., & Liberati, P. (2005). *Equivalence scales: Subjective methods*. Food and Agriculture Organization of the United Nations, FAO.

Bishop, J. A., Grodner, A., Liu, H., & Ahamdanech-Zarco, I. (2014). Subjective poverty equivalence scales for Euro Zone countries. *The Journal of Economic Inequality*, *12*(2), 265–278. https://doi.org/10.1007/s10888-013-9254-7.

Browning, M. (1992). Children and household economic behavior. *Journal of Economic Literature*, *30*(3), 1434–1475. May 19, 2025, https://www.jstor.org/stable/2728065

Browning, M., Chiappori, P.-A., & Lewbel, A. (2013). Estimating consumption economies of scale, adult equivalence scales, and household bargaining power. *The Review of Economic Studies*, *80*(4), 1267–1303. https://doi.org/10.1093/restud/rdt019.

Caisl, J., Hermida, L., Levy, H., & Menyhért, B. (2023). *The uneven impact of high inflation* (OECD Papers on Well-being and Inequalities No. 18). OECD Publishing, Paris. November 16, 2025, https://www.oecd.org/en/publications/the-uneven-impact-of-high-inflation_59e2b8ae-en.html

Chiappori, P.-A. (2016). Equivalence versus indifference scales. *The Economic Journal*, *126*(592), 523–545. https://doi.org/10.1111/ecoj.12371.

Clements, K. W., Si, J., Selvanathan, E. A., & Selvanathan, S. (2020). Demand elasticities for 9 goods in 37 countries. *Applied Economics*, *52*(24), 2636–2655. https://doi.org/10.1080/00036846.2019.1693698.

Conniffe, D. (1992). The non-constancy of equivalence scales. *Review of Income and Wealth*, *38*(4), 429–443. https://doi.org/10.1111/j.1475-4991.1992.tb00453.x.

Creedy, J. (1998). Measuring the welfare effects of price changes: A convenient parametric approach. *Australian Economic Papers*, *37*(2), 137–151. https://doi.org/10.1111/1467-8454.00011.

Creedy, J. (2001). Indirect tax reform and the role of exemptions. *Fiscal Studies*, *22*(4), 457–486. https://doi.org/10.1111/j.1475-5890.2001.tb00049.x.

Cutillo, A., Romeo, A., & Celardo, L. (2025). Equivalence scales for the distribution of consumption expenditures in Italy: Proposed methods to update the Carbonaro Scale. *Rivista Italiana di Economia Demografia e Statistica*, 7–18. https://doi.org/10.71014/sieds.v79i2.330.

Daley, A., Garner, T. I., Phipps, S., & Sierminska, E. (2020). *Differences across countries and time in household expenditure patterns: Implications for the estimation of equivalence scales* (IZA Discussion Paper No. 13246). https://papers.ssrn.com/abstract=3602422

de Vos, K., & Zaidi, M. A. (1997). Equivalence scale sensitivity of poverty statistics for the member states of the European Community. *Review of Income and Wealth*, *43*(3), 319–333. https://doi.org/10.1111/j.1475-4991.1997.tb00222.x.

de Ree, J., Alessie, R., & Pradhan, M. (2013). The price and utility dependence of equivalence scales: Evidence from Indonesia. *Journal of Public Economics*, *97*, 272–281. https://doi.org/doi.org/10.1016/j.jpubeco.2012.09.006.

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *American Economic Review*, *70*(3), 312–26. November 23, 2025, https://EconPapers.repec.org/RePEc:aea:aecrev:v:70:y:1980:i:3:p:312-26

Deaton, A. S., & Muellbauer, J. (1986). On measuring child costs: With applications to poor countries. *Journal of Political Economy*, *94*(4), 720–744. https://doi.org/10.1086/261405.

Donaldson, D., & Pendakur, K. (2004). Equivalent-expenditure functions and expenditure-dependent equivalence scales. *Journal of Public Economics*, *88*(1), 175–208. https://doi.org/10.1016/S0047-2727(02)00134-2.

Doorley, K., Duggan, L., Kakoulidou, T., & Roantree, B. (2024). *Equivalisation (once again)* (Economic Paper No. tep0124). Trinity College Dublin, Economics Department. January 27, 2025, https://econpapers.repec.org/paper/tcdtcduee/tep0124.htm

Dudel, C., Garbuszus, J. M., Ott, N., & Werding, M. (2021a). Income-(in)dependent equivalence scales and inequality measurement. *German Economic Review*, *22*(2), 235–255. https://doi.org/10.1515/ger-2020-0008.

Dudel, C., Garbuszus, J. M., & Schmied, J. (2021b). Assessing differences in household needs: A comparison of approaches for the estimation of equivalence scales using German expenditure data. *Empirical Economics*, *60*(4), 1629–1659. https://doi.org/10.1007/s00181-020-01822-6.

Eurostat. (2025a). *[nama_10_cp18] Household final consumption expenditure by purpose (COICOP 2018).* June 21, 2025, https://ec.europa.eu/eurostat/databrowser/view/nama_10_cp18___custom_17215892/default/table

Eurostat. (2025b). *[prc_hicp_aind] HICP - annual data (average index and rate of change).* June 16, 2025, https://ec.europa.eu/eurostat/databrowser/view/prc_hicp_aind___custom_17095307/default/table?lang=en

Eurostat. (2025c). *[prc_ppp_ind] Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates.* June 16, 2025, https://ec.europa.eu/eurostat/databrowser/view/prc_ppp_ind___custom_17095538/default/table?lang=en

Eurostat. (2025d). *Household budget survey - microdata - Eurostat.* July 9, 2025, https://ec.europa.eu/eurostat/web/microdata/household-budget-survey

Ferreira, M. L., Buse, R. C., & Chavas, J.-P. (1998). Is there bias in computing household equivalence scales? *Review of Income and Wealth*, *44*(2), 183–198. https://doi.org/10.1111/j.1475-4991.1998.tb00267.x.

Frisch, R. (1959). A complete scheme for computing all direct and cross demand elasticities in a model with many sectors - the econometric society. *Econometrica*, 177–196. October 6, 2025, http://www.econometricsociety.org/publications/econometrica/1959/04/01/complete-scheme-computing-all-direct-and-cross-demand

Gerfin, M., Stutz, H., Oesch, T., & Strub, S. (2009). *Kinderkosten in der Schweiz.* Eidgenössisches Département des Innern (EDI) Bundesamt für Statistik (BfS). Neuchâtel. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-430347

Gürer, E., & Weichenrieder, A. (2020). Pro-rich inflation in Europe: Implications for the measurement of inequality. *German Economic Review*, *21*(1), 107–138. https://doi.org/10.1515/ger-2018-0146.

Hagenaars, A. J. M., de Vos, K., & Zaidi, M. A. (1994). *Poverty statistics in the late 1980s – research based on micro-data.* Eurostat.

Hobijn, B., & Lagakos, D. (2005). Inflation inequality in the United States. *Review of Income and Wealth*, *51*(4), 581–606. https://doi.org/10.1111/j.1475-4991.2005.00170.x.

Hsieh, H.-Y., Lewbel, A., & Pendakur, K. (2024). *Economies of scale to consumption in collective households.* September 28, 2025, https://drive.google.com/file/d/1ADCcfZSUfUx-_xlBvLViSybDxb06f8oP/view?usp=sharing&usp=embed_facebook

Idson, T., & Miller, C. (1999). Calculating a price index for families with children: Implications for measuring trends in child poverty rates. *Review of Income and Wealth*, *45*(2), 217–233. https://doi.org/10.1111/j.1475-4991.1999.tb00329.x.

Kakwani, N. C. (1977). On the estimation of consumer unit scales. *The Review of Economics and Statistics*, *59*(4), 507–510. https://doi.org/10.2307/1928717.

Kalbarczyk-Steclik, M., Mista, R., & Morawski, L. (2017). Subjective equivalence scale – cross-country and time differences. *International Journal of Social Economics*, *44*(8), 1092–1105. https://doi.org/10.1108/IJSE-09-2015-0251.

Koch, S. F. (2023). Basic needs (in)security and subjective equivalence scales. *Social Indicators Research*, *169*(3), 723–757. https://doi.org/10.1007/s11205-023-03178-7.

Koulovatianos, C., Schröder, C., & Schmidt, U. (2005a). On the income dependence of equivalence scales. *Journal of Public Economics*, *89*(5), 967–996. https://doi.org/10.1016/j.jpubeco.2004.09.005.

Koulovatianos, C., Schröder, C., & Schmidt, U. (2005b). Properties of equivalence scales in different countries. *Journal of Economics*, *86*(1), 19–27. https://doi.org/10.1007/s00712-005-0141-y.

Lewbel, A. (2025). Equivalence scales. In *The Elgar Encyclopedia of Consumption*. September 28, 2025, https://drive.google.com/file/d/1_I3FMfoBGDz1bSSKJqN-KlreHFz_Tzhw/view?usp=sharing&usp=embed_facebook

Lewbel, A., & Pendakur, K. (2008a). Equivalence scales. In *The new Palgrave Dictionary of Economics* (pp. 1–6). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-349-95121-5_2056-1.

Lewbel, A., & Pendakur, K. (2008b). Estimation of collective household models with Engel curves. *Journal of Econometrics*, *147*(2), 350–358. https://doi.org/10.1016/j.jeconom.2008.09.012.

Menon, M., & Perali, F. (2010). Chapter 10. Econometric identification of the cost of maintaining a child. In *Studies in applied welfare analysis: Papers from the third ECINEQ meeting* (pp. 219–255, Vol. 18). Emerald Group Publishing Limited. https://doi.org/10.1108/S1049-2585(2010)0000018013.

Messner, T., & Rumler, F. (2024). *Inflation heterogeneity across Austrian households. Evidence from household scanner data* (ECB Working Paper No. 2024/2894). Social Science Research Network. Rochester, NY. November 11, 2025, https://papers.ssrn.com/abstract=4708141

Muellbauer, J. (1980). The estimation of the Prais-Houthakker model of equivalence scales. *Econometrica*, *48*(1), 153–176. https://doi.org/10.2307/1912023.

Mysíková, M., & Želinský, T. (2019). On the measurement of the income poverty rate: The equivalence scale across Europe. *Statistika: Statistics and Economy Journal*, *99*(4), 383–397. January 27, 2025, https://www.econstor.eu/handle/10419/236617

Mysíková, M., Želinský, T., Garner, T. I., & Fialová, K. (2022). Subjective equivalence scales in Eastern versus Western European countries. *Contemporary Economic Policy*, *40*(4), 659–676. https://doi.org/10.1111/coep.12579.

Mysíková, M., Želinský, T., Jirková, M., & Večerník, J. (2021). Equivalence scale and income poverty: Two approaches to estimate country-specific scale for the Czech Republic. *Social Indicators Research*, *156*(1), 21–45. https://doi.org/10.1007/s11205-021-02636-4.

Nelson, J. A. (1993). Household equivalence scales: Theory versus policy? *Journal of Labor Economics*, *11*(3), 471–493. https://doi.org/10.1086/298304.

Pollak, R., & Wales, T. J. (1979). Welfare comparisons and equivalence scales. *American Economic Review*, *69*(2), 216–21. January 27, 2025, https://econpapers.repec.org/article/aeaaecrev/v_3a69_3ay_3a1979_3ai_3a2_3ap_3a216-21.htm

Pollak, R. A., & Wales, T. J. (1978). Estimation of complete demand systems from household budget data: The linear and quadratic expenditure systems. *The American Economic Review*, *68*(3), 348–359. May 20, 2025, https://www.jstor.org/stable/1805266

Rapp, S., & Thévenon, O. (2025). *Parenting on a budget: The cost of raising children in changing family configurations and its policy implications* (OECD Papers on Well-being and Inequalities No. 36). OECD Publishing, Paris. August 18, 2025, https://www.oecd.org/en/publications/parenting-on-a-budget_bd0b594e-en.html

Ray, R. (1981). Do relative price changes affect the general equivalence scale? *Economics Letters*, *8*(3), 287–291. https://doi.org/10.1016/0165-1765(81)90080-X.

Regan, M., & Kakoulidou, T. (2025). How important are the unit of analysis and equivalence scales when measuring income poverty and inequality? Evidence from Ireland. *International Journal of Microsimulation*, *18*(2), 21–69. https://doi.org/10.34196/ijm.00321.

Sabates, R., Gould, B. W., & Villarreal, H. J. (2001). Household composition and food expenditures: A cross-country comparison. *Food Policy*, *26*(6), 571–586. https://doi.org/10.1016/S0306-9192(01)00021-5.

Schulte, J. N. (2007). *Equivalence scales: Identification and estimation: A cross-sectional analysis of German data* [Doctoral dissertation]. December 10, 2024, https://refubium.fu-berlin.de/handle/fub188/5769

Selvanathan, S., Jayasinghe, M., Selvanathan, E. A., & Rathnayaka, S. D. (2024). Dynamic modelling of consumption patterns using LA-AIDS: A comparative study of developed versus developing countries. *Empirical Economics*, *66*(1), 75–135. https://doi.org/10.1007/s00181-023-02465-z.

Sologon, D. M., Doorley, K., O'Donoghue, C., & Peluso, E. (2024). The gendered nature of the cost-of-living crisis in Europe. May 22, 2025, https://liser.elsevierpure.com/en/publications/the-gendered-nature-of-the-cost-of-living-crisis-in-europe/

Sologon, D. M., O'Donoghue, C., Kyzyma, I., Loughrey, J., & Linden, J. (2025). Distributional impact of soaring prices in Europe: A cross-national decomposition of inflation's regressivity and progressivity. *Review of Income and Wealth*, *71*(2), e70010. https://doi.org/10.1111/roiw.70010.

Sologon, D. M., O'Donoghue, C., Loughrey, J., Linden, J., & Kyzyma, I. (2022, November). *Welfare and Distributional Impact of Soaring Prices in Europe* (WorkingPaper No. 15738). IZA Institute of Labor Economics. IZA Institute of Labor Economics.

Stone, R. (1954). Linear expenditure systems and demand analysis: An application to the pattern of British demand. *The Economic Journal*, *64*(255), 511–527. https://doi.org/10.2307/2227743.

Svavarsdottir, G., Asgeirsdottir, T. L., Clark, A. E., & Stefansson, G. (2025). Equivalence scales revisited: Evidence from subjective data. *The Journal of Economic Inequality*. https://doi.org/10.1007/s10888-025-09686-5.

Temursho, U., & Weitzel, M. (2024). *Consumer demand in EU member states* [JRC Publications Repository]. https://doi.org/10.2760/376288.

van der Gaag, J., & Smolensky, E. (1982). True household equivalence scales and characteristics of the poor in the United States. *Review of Income and Wealth*, *28*(1), 17–28. https://doi.org/10.1111/j.1475-4991.1982.tb00603.x.

A Appendix

Table 6: Regression Coefficients for Budget Shares

	Food	Alc & Tobacco	Clothing	Housing
Log total expenditure	-0.1022***	-0.0195**	0.0141***	0.0209
	(0.0281)	(0.0097)	(0.0044)	(0.0596)
Log total expenditure squared	0.0018	0.0002	-0.0007***	-0.0064**
	(0.0014)	(0.0005)	(0.0002)	(0.0029)
No. of children	0.0147***	-0.0012***	0.0054***	-0.0166***
	(0.0019)	(0.0002)	(0.0007)	(0.0026)
No. of adults	0.0277***	0.0017***	0.0005	-0.0168***
	(0.0012)	(0.0004)	(0.0005)	(0.0028)
Constant	0.9613***	0.2189***	-0.0212	0.8016**
	(0.1464)	(0.0508)	(0.0260)	(0.3070)
N	758102	512679	577320	762064

	Transport	Communication	Furnishings	Health
Log total expenditure	-0.1210***	0.0010	0.0053	-0.0223*
	(0.0456)	(0.0057)	(0.0106)	(0.0130)
Log total expenditure squared	0.0091***	-0.0008***	0.0007	0.0015**
	(0.0023)	(0.0003)	(0.0005)	(0.0007)
No. of children	-0.0045***	0.0019***	-0.0013***	-0.0069***
	(0.0010)	(0.0004)	(0.0004)	(0.0010)
No. of adults	-0.0038**	0.0044***	-0.0047***	-0.0060***
	(0.0015)	(0.0005)	(0.0008)	(0.0007)
Constant	0.3931*	0.0864***	-0.0604	0.1359**
	(0.2258)	(0.0301)	(0.0546)	(0.0640)
N	607264	730941	703741	611858

	Recreation	Education	Restaurants	Miscellaneous
Log total expenditure	0.0266**	0.0122	-0.0275	0.0504***
	(0.0118)	(0.0087)	(0.0183)	(0.0116)
Log total expenditure squared	-0.0001	-0.0006	0.0021**	-0.0018***
	(0.0006)	(0.0005)	(0.0009)	(0.0006)
No. of children	0.0010	-0.0056***	-0.0037***	0.0009
	(0.0009)	(0.0011)	(0.0008)	(0.0005)
No. of adults	-0.0058***	-0.0026***	-0.0056***	-0.0010
	(0.0007)	(0.0008)	(0.0006)	(0.0007)
Constant	-0.1668***	-0.0242	0.1413	-0.2119***
	(0.0629)	(0.0435)	(0.0953)	(0.0554)
N	677048	129143	471890	706839

Source: Authors' calculation.
Notes: Standard errors in parentheses. Country-year fixed effects included but not reported. Robust standard errors clustered by country-year. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Expenditure Elasticities by Household Type and Category

Household Type	Food	Alcohol & Tobacco	Clothing	Housing	Furnishings	Health
Single	0.496	0.254	1.014	0.731	1.408	1.180
Single parent	0.552	0.159	1.004	0.664	1.418	1.265
Couple	0.559	0.265	0.995	0.645	1.368	1.193
Couple 1C	0.540	0.178	0.995	0.609	1.369	1.285
Couple 2C	0.569	0.089	0.992	0.589	1.382	1.327
Couple 3+C	0.601	-0.047	0.992	0.575	1.367	1.322
3 adults	0.595	0.319	0.993	0.626	1.423	1.233
4+ adults	0.604	0.270	0.990	0.587	1.476	1.271
3+ adults w. C	0.623	0.202	0.998	0.607	1.433	1.255
Other	0.592	0.300	1.005	0.682	1.401	1.193

Household Type	Transport	Communication	Recreation	Education	Restaurants	Miscellaneous
Single	1.554	0.409	1.341	1.501	1.244	1.165
Single parent	1.536	0.439	1.302	1.102	1.252	1.142
Couple	1.499	0.258	1.310	1.413	1.258	1.135
Couple 1C	1.460	0.337	1.342	1.075	1.236	1.122
Couple 2C	1.500	0.252	1.305	1.044	1.231	1.122
Couple 3+C	1.501	0.242	1.292	1.040	1.265	1.121
3 adults	1.475	0.345	1.370	1.074	1.240	1.146
4+ adults	1.468	0.365	1.379	1.031	1.223	1.143
3+ adults w. C	1.495	0.417	1.331	1.051	1.232	1.157
Other	1.529	0.445	1.410	1.111	1.247	1.163

Source: Authors' calculation.
Note: Expenditure elasticities rounded to three decimal places.

Table 8: Subsistence Expenditure by Household Type

Household Type	Minimum Expenditure
Single	6,777.46
Single parent	8,463.43
Couple	11,192.16
Couple with 1 child	11,634.11
Couple with 2 children	13,190.08
Couple with 3+ children	13,156.11
3 adults	12,111.49
4+ adults	14,112.87
3+ adults w. C	10,697.90
Other	8,512.78

Source: Authors' calculation.
Note: Minimum expenditure represents the sum of subsistence consumption requirements across 12 expenditure categories, estimated from the Linear Expenditure System. Values in 2020 purchasing power standard (PPS), EU27=1. Average is population-weighted across household types.

Table 9: UES by Utility Level (all Household Types)

Household Type	Subsistence	25th Percentile	Median	Mean	75th Percentile
Single parent	1.249	1.244	1.211	1.178	1.162
Couple	1.651	1.635	1.505	1.377	1.312
Couple 1C	1.716	1.699	1.563	1.428	1.361
Couple 2C	1.945	1.922	1.738	1.556	1.464
Couple 3+C	1.940	1.917	1.734	1.552	1.461
3 adults	1.786	1.768	1.618	1.471	1.396
4+ adults	2.081	2.055	1.848	1.643	1.539
3+ adults w. C	1.578	1.566	1.470	1.375	1.328
Other	1.256	1.251	1.216	1.181	1.163

Source: Authors' calculation.
Note: All values are rounded to three decimal places.

Table 10: Comparison of Equivalence Scales: With vs Without Fixed Effects

Household Type	mOECD	LIS	MNS		UIS		UES	
			w/	w/o	w/	w/o	w/	w/o
Single parent	1.47	1.56	1.25	1.26	1.09	1.10	1.21	1.21
Couple	1.50	1.41	1.65	1.68	1.34	1.34	1.51	1.50
Couple 1C	1.81	1.73	1.72	1.76	1.35	1.36	1.56	1.56
Couple 2C	2.12	2.00	1.95	2.00	1.47	1.48	1.74	1.73
Couple 3+C	2.50	2.29	1.94	2.00	1.47	1.47	1.73	1.73
3 adults	2.00	1.73	1.79	1.83	1.38	1.39	1.62	1.61
4+ adults	2.62	2.06	2.08	2.15	1.52	1.52	1.85	1.85
3+ adults w. C	2.72	2.21	1.58	1.61	1.24	1.25	1.47	1.47
Other	1.75	1.58	1.26	1.27	1.09	1.10	1.22	1.21

Source: Authors' calculation.
Notes: w/ = with fixed effects, w/o = without fixed effects. MNS = Minimum Needs Scale, UIS = Utility Implicit Scale, UES = Utility Explicit Scale.

Table 11: Sample Sizes by Country and Year

Country	**2010**	**2015**	**2020**	**Total**
Belgium	7,177	6,135	6,105	19,417
Bulgaria	2,982	2,966	2,952	8,900
Cyprus	2,707	2,876	2,876	8,459
Germany	53,996	52,412	51,734	158,142
Denmark	2,484	2,284	2,232	7,000
Estonia	3,632	3,395	5,021	12,048
Greece	3,512	6,150	6,256	15,918
Spain	22,203	22,130	19,170	63,503
Finland	3,551	3,673	3,138	10,362
France	15,797	16,978	16,978	49,753
Croatia	3,461	2,029	1,809	7,299
Hungary	9,937	7,185	5,450	22,572
Ireland	5,891	6,839	1,737	14,467
Italy	22,246	15,013	25,668	62,927
Lithuania	6,103	3,443	4,334	13,880
Luxembourg	3,492	3,167	1,411	8,070
Latvia	3,798	3,844	2,647	10,289
Malta	3,732	3,691	3,691	11,114
Poland	37,412	37,148	33,529	108,089
Portugal	9,489	11,398	11,701	32,588
Romania	31,336	30,625	28,917	90,878
Slovenia	3,924	3,750	3,532	11,206
Slovakia	6,143	4,785	4,633	15,561
Total	265,005	251,916	245,521	762,442

Source: Authors' calculation based on EU-HBS microdata 2010-2020.

Table 12: Descriptive Statistics for 2010

HH Type	Share (%)	Adults	Children	HH Total Expenditure (ln, 2010 PPS)				
				Mean	SD	p50	Min	Max
Single	30.1	1	-	9.20	1.24	9.47	1.71	12.47
Single parent	2.1	1	1.38	9.54	1.11	9.73	2.77	12.58
Couple	23.5	2	-	9.75	1.24	10.03	2.22	12.73
Couple, 1 C	6.5	2	1	9.82	1.26	10.16	2.43	12.44
Couple, 2 C	6.2	2	2	9.98	1.24	10.30	2.69	12.40
Couple, 3+ C	1.6	2	3.20	9.95	1.37	10.32	2.84	12.54
Three adults	7.8	3	-	9.80	1.31	10.18	2.56	12.52
4+ adults	5.6	4.24	-	9.85	1.39	10.29	2.92	12.69
3+ adults w. C	6.6	3.49	1.38	9.57	1.45	10.05	2.83	12.46
Other	10.0	2.18	0.31	9.29	1.39	9.68	2.13	12.37
Total	100.0	2.00	0.39	9.55	1.32	9.86	1.71	12.73

Source: Authors' calculation.
Notes: PPS denotes purchasing power standard. C denotes child(ren) (age 0-14).

Table 13: Descriptive Statistics for 2015

HH Type	Share (%)	Adults	Children	HH Total Expenditure (ln, 2015 PPS)				
				Mean	SD	p50	Min	Max
Single	32.3	1	-	9.25	1.23	9.52	1.96	12.78
Single parent	2.2	1	1.41	9.50	1.17	9.75	2.43	12.08
Couple	24.8	2	-	9.76	1.24	10.06	2.46	12.71
Couple, 1 C	6.1	2	1	9.82	1.21	10.15	2.64	12.36
Couple, 2 C	6.2	2	2	9.98	1.19	10.31	2.43	12.37
Couple, 3+ C	1.7	2	3.23	9.92	1.31	10.31	2.99	12.38
Three adults	7.1	3	-	9.82	1.29	10.18	2.77	13.40
4+ adults	4.9	4.25	-	9.99	1.31	10.36	3.08	12.61
3+ adults w. C	6.1	3.49	1.41	9.64	1.39	10.06	2.49	13.24
Other	8.6	2.35	0.15	9.39	1.47	9.81	2.19	12.58
Total	100.0	1.96	0.37	9.59	1.30	9.88	1.96	13.40

Source: Authors' calculation.
Notes: PPS denotes purchasing power standard. C denotes child(ren) (age 0-14).

Table 14: Descriptive Statistics for 2020

HH Type	Share (%)	Adults	Children	HH Total Expenditure (ln, 2020 PPS)				
				Mean	SD	p50	Min	Max
Single	31.7	1	-	9.13	1.20	9.47	1.67	13.02
Single parent	2.1	1	1.45	9.41	1.15	9.72	2.90	12.22
Couple	22.9	2	-	9.64	1.04	9.96	5.41	13.69
Couple, 1 C	6.0	2	1	9.60	1.05	9.94	6.50	12.75
Couple, 2 C	6.1	2	2	9.71	1.06	10.03	6.52	12.43
Couple, 3+ C	1.9	2	3.25	9.64	1.08	9.85	6.62	12.53
Three adults	7.0	3	-	9.60	1.08	9.91	6.05	13.36
4+ adults	4.6	4.27	-	9.81	1.08	10.13	5.20	12.91
3+ adults w. C	7.2	3.56	1.49	9.30	1.25	9.05	3.24	12.58
Other	10.6	2.40	0.20	8.94	1.91	9.64	2.76	13.18
Total	100.0	1.99	0.40	9.38	1.26	9.67	1.67	13.69

Source: Authors' calculation.
Notes: PPS denotes purchasing power standard. C denotes child(ren) (age 0-14).

Table 15: Budget Shares by Category and Year (%)

Category	2010	2015	2020
Food	14.78	14.41	15.13
Alcohol & Tobacco	2.07	2.02	1.91
Clothing	5.10	4.77	4.07
Housing	29.04	31.07	33.00
Furnishings	4.99	4.70	4.78
Health	3.37	3.55	3.56
Transport	13.46	12.79	11.87
Communication	2.73	2.69	2.72
Recreation	7.61	7.24	7.01
Education	0.86	0.94	0.97
Restaurants	5.97	5.92	5.34
Miscellaneous	10.02	9.89	9.64

Source: Authors' calculation based on EU-HBS microdata 2010-2020.

Table 16: HICP Growth Rates by Consumption Category, EU27 (2020-2024)

Category	2020 Index	2024 Index	Growth Rate
All-items HICP	105.76	129.67	1.23
Food and non-alcoholic beverages	109.43	143.30	1.31
Housing, utilities and fuels	105.36	137.20	1.30
Restaurants and hotels	110.23	138.55	1.26
Transport	103.79	128.47	1.24
Alcoholic beverages, tobacco, narcotics	115.39	141.21	1.22
Furnishings and household maintenance	102.00	119.60	1.17
Miscellaneous goods and services	107.27	125.82	1.17
Recreation and culture	103.41	120.31	1.16
Education	102.53	116.32	1.13
Health	105.27	117.99	1.12
Clothing and footwear	100.76	111.19	1.10
Communications	94.34	93.80	0.99

Source: Authors' calculation based on Eurostat (2025b), annual averages, EU27 (2015=100).

Table 17: Poverty Lines by Country for Different Equivalence Scales

Country	**mOECD**	**MNS**	**UES**	**UIS**
Belgium	13465.03	14887.80	16400.00	18701.15
Bulgaria	2251.29	2377.61	2589.88	2958.58
Croatia	4152.00	4455.03	5048.47	6015.06
Cyprus	8127.20	8647.80	9702.33	11391.16
Denmark	22668.38	23689.20	25934.57	29768.40
Estonia	6364.80	6772.49	7358.95	8481.44
Finland	15200.33	15964.48	17329.20	19453.28
France	12963.20	13639.53	14811.34	16913.91
Germany	14050.80	14739.79	15989.92	18020.33
Greece	5746.00	6051.95	6682.47	7738.13
Hungary	3973.33	4226.09	4624.89	5318.40
Ireland	17705.79	18984.96	21235.19	24916.20
Latvia	4076.57	4361.17	4804.00	5444.68
Lithuania	4717.20	4918.18	5194.22	5866.57
Luxembourg	24480.00	25784.62	28078.59	32300.28
Malta	8838.60	9383.52	10437.41	12291.16
Poland	4294.50	4581.73	5095.75	6033.88
Portugal	6011.60	6353.28	7048.86	8183.58
Romania	2589.29	2739.85	3031.49	3531.75
Slovakia	5700.90	6067.04	6803.11	8087.09
Slovenia	8060.00	8535.04	9399.23	10947.15
Spain	8306.18	8677.25	9482.93	11171.19

Source: Authors' calculation.
Note: Poverty lines in euros, based on income and demographic data from EU-HBS 2020. mOECD denotes modified OECD scale, MNS denotes minimum needs scale, UES denotes utility explicit scale, and UIS denotes utility implicit scale.

Table 18: Differences in Gini Indices by Country and Equivalence Scale

Minimum Needs Scale				
Country	mOECD	MNS	Difference	p
Belgium	0.2495	0.2373	-0.0122	***
Bulgaria	0.2810	0.2826	0.0016	***
Croatia	0.2665	0.2662	-0.0003	
Cyprus	0.3068	0.3058	-0.0010	**
Denmark	0.2678	0.2704	0.0026	***
Estonia	0.2898	0.2909	0.0011	***
Finland	0.2865	0.2901	0.0035	*
France	0.3257	0.3240	-0.0018	***
Germany	0.2865	0.2881	0.0016	***
Greece	0.2927	0.2925	-0.0002	
Hungary	0.2761	0.2758	-0.0003	
Ireland	0.2914	0.2902	-0.0012	*
Latvia	0.3231	0.3247	0.0016	***
Lithuania	0.3063	0.3091	0.0028	***
Luxembourg	0.2742	0.2700	-0.0041	***
Malta	0.2834	0.2839	0.0005	
Poland	0.3056	0.3059	0.0002	
Portugal	0.3299	0.3277	-0.0022	***
Romania	0.3063	0.3070	0.0006	**
Slovakia	0.2125	0.2121	-0.0004	
Slovenia	0.2512	0.2536	0.0024	***
Spain	0.3014	0.2999	-0.0016	***

Utility Explicit Scale				
Country	mOECD	UES	Difference	p
Belgium	0.2495	0.2411	-0.0084	***
Bulgaria	0.2810	0.2863	0.0053	***
Croatia	0.2665	0.2682	0.0017	
Cyprus	0.3068	0.3060	-0.0008	
Denmark	0.2678	0.2764	0.0086	***
Estonia	0.2898	0.2943	0.0045	***
Finland	0.2865	0.2976	0.0111	***
France	0.3257	0.3240	-0.0017	***
Germany	0.2865	0.2931	0.0066	***
Greece	0.2927	0.2933	0.0006	
Hungary	0.2761	0.2781	0.0020	**
Ireland	0.2914	0.2914	0.0000	
Latvia	0.3231	0.3287	0.0056	***
Lithuania	0.3063	0.3141	0.0078	***
Luxembourg	0.2742	0.2659	-0.0083	***
Malta	0.2834	0.2873	0.0039	***
Poland	0.3056	0.3074	0.0018	***
Portugal	0.3299	0.3256	-0.0043	***
Romania	0.3063	0.3094	0.0031	***

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Slovakia	0.2125	0.2144	0.0019	**
Slovenia	0.2512	0.2590	0.0079	***
Spain	0.3014	0.2985	-0.0030	***

Utility Implicit Scale

Country	mOECD	UIS	Difference	p
Belgium	0.2495	0.2501	0.0006	
Bulgaria	0.2810	0.2945	0.0135	***
Croatia	0.2665	0.2739	0.0074	***
Cyprus	0.3068	0.3091	0.0023	
Denmark	0.2678	0.2883	0.0205	***
Estonia	0.2898	0.3025	0.0127	***
Finland	0.2865	0.3119	0.0253	***
France	0.3257	0.3268	0.0011	
Germany	0.2865	0.3034	0.0169	***
Greece	0.2927	0.2973	0.0045	***
Hungary	0.2761	0.2846	0.0085	***
Ireland	0.2914	0.2957	0.0043	*
Latvia	0.3231	0.3367	0.0135	***
Lithuania	0.3063	0.3238	0.0175	***
Luxembourg	0.2742	0.2644	-0.0098	***
Malta	0.2834	0.2953	0.0120	***
Poland	0.3056	0.3123	0.0067	***
Portugal	0.3299	0.3250	-0.0048	***
Romania	0.3063	0.3161	0.0098	***
Slovakia	0.2125	0.2213	0.0088	***
Slovenia	0.2512	0.2703	0.0191	***
Spain	0.3014	0.2991	-0.0024	***

Source: Authors' calculation.
Note: Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.