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Veröffentlichungsversion / Published Version
Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:
Fialová, K., & Mysíková, M. (2021). Intra-household distribution of resources and income poverty and inequality in Visegrád countries. *International Journal of Social Economics*, *48*(6), 914-930. https://doi.org/10.1108/IJSE-10-2020-0671

Received 7 October 2020
Revised 21 December 2020
Accepted 26 January 2021

Intra-household distribution of resources and income poverty and inequality in Visegrád countries

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Abstract

Purpose – The authors aim to demonstrate the impact of allowing for unequal intra-household distribution of resources on income poverty and income inequality.

Design/methodology/approach – The paper applies a collective consumption model to study the intra-household distribution of resources in Visegrád countries (V4). It utilises subjective financial satisfaction as a proxy for indirect utility from individual consumption to estimate the indifference scales within couples instead of the traditional equivalence scale. The European Union Statistics on Income and Living Conditions (EU-SILC) 2013 and 2018 data are applied.

Findings – This study's results indicate substantial economies of scale from living in a couple that are generally higher than implied by the commonly applied equivalence scale. The sharing rule estimates suggest that at the mean of distribution factors, women receive a consumption share between 0.4 and 0.6; however, some of the results are close to an equal sharing of 0.5. The female consumption share rises with her contribution to household income. Regarding income poverty and inequality, the authors show that both these measures might be underestimated in the traditional approach to equal sharing of resources.

Originality/value – The authors add to the empirics by estimating indifference scales for Czechia (CZ), Hungary (HU), Poland (PL) and Slovakia (SK), countries that have not been involved in previous research.

Keywords Inequality, Income poverty, Collective household model, Equivalence scale, Indifference scale

Paper type Research paper

Introduction

Comparison of income levels across households of different size and composition is a crucial issue for many political considerations in the social area, including the measurement of social inequalities and poverty, the calculation of means-tested social benefits or when designing tax system and other income-related policies. A large part of consumption is being shared within households, generating economies of scale. Furthermore, the way consumption of resources is shared is also important. When two individuals decide to live together, their financial resources are altered in two ways. First, their joint consumption may exceed the consumption sums they would attain when living alone due to returns to scale. Second, in cases where resources are not shared equally within the household, consumption of one household member may rise more than the consumption of the other member according to their relative bargaining power in the household decision-making process.

The work was supported by the Czech Science Foundation under Grant no. 18-07036S "Methodology and reality of poverty: Czech Republic in the European context". The EU-SILC datasets were made available on the basis of contract no. 247/2019-EU-SILC-HBS between the European Commission, Eurostat, and the Institute of Sociology of the Czech Academy of Sciences. Responsibility for all conclusions drawn from the data lies entirely with the authors. No potential conflict of interest was reported by the authors.

International Journal of Social Economics
Vol. 48 No. 6, 2021
pp. 914-930
Emerald Publishing Limited
0306-8293
DOI 10.1108/IJSE-10-2020-0671

The traditional unitary household model introduced equivalence scales for the comparison of economic well-being of different-sized households. Under the household utility approach, a family acts as if it maximises a joint preference function subjected to a single budget constraint (Samuelson, 1956; Becker, 1974). According to the income pooling assumption, it is irrelevant how household members contribute to the family budget, and income redistribution within the household does not influence household behaviour. The income pooling hypothesis has been widely tested and mostly rejected (Attanasio and Lechene, 2002; Browning *et al.*, 1994; Lundberg *et al.*, 1997; Phipps and Burton, 1998; Thomas, 1990; Ward-Batts, 2008). It has been shown that within-couple income distribution influences the expenditure and consumption structure of households, the labour supply of household members and the relative financial satisfaction of partners (for a literature review, see Mysíková, 2016). In cases where the assumption about equal sharing of resources fails to meet reality, traditional equivalence scales are biased and misleading [1]. Though Browning *et al.* (2006) discuss that rejecting income pooling is not sufficient to reject the unitary household model, recent research has developed under collective models of household (Chiappori, 1988, 1992).

Collective models relax the assumption of equal income sharing within a household and allow for individual utility functions of household members. A comprehensive study by Browning *et al.* (2013) defines the individual indifference scale instead of the traditional equivalence scale. This concept represents an empirically implementable alternative to equivalence scales that lack most of their weaknesses: the concept does not rely on household utility; instead, it works with individual preferences, does not comprise interpersonal utility comparisons and does not require identical preferences (for a detailed discussion, see Chiappori, 2016).

This article adds to the limited research with collective household models in the countries of Central and Eastern Europe. Equivalence scales (potentially extended to indifference scales) represent a crucial step in the construction of income poverty and inequality measures. The OECD-modified scale, commonly applied to EU statistics, was adopted in the 1990s. Central and Eastern European countries adopted the scale when joining the EU, without any empirical justification as to its appropriateness in the acceding countries (e.g. Mysíková and Želinský, 2019). Within this region, we focus on Visegrád countries (V4), which exhibit below-EU-average income poverty and inequality measures [2]. In this regard, Czechia (CZ) and Slovakia (SK) have reached one of the most favourable positions among the whole European Union. The issue of intra-household distribution of resources is thus particularly relevant in Visegrád countries. Extending the research to the dimension of household division of resources may change the perspective of poverty and income inequalities in the region substantially. While such estimations have already been conducted for Western European countries, to our best knowledge, no analysis is available for the countries of Central and Eastern Europe.

We use the 2013 and 2018 European Union Statistics on Income and Living Conditions (EU-SILC) data on subjective financial satisfaction as a measure of indirect utility from individual consumption and aim to identify possible bias in the equivalence scale estimate due to unequal returns to scale of particular household members in V4, i.e. CZ, SK, Hungary (HU) and Poland (PL). We follow the model developed by Browning *et al.* (2013) and modified by Bütikofer and Gerfin (2017) to estimate household indifference scales. We estimate the structural parameters of the household consumption function and the allocation of resources within households to examine how income-based poverty and inequality measures differ by applying indifference scales instead of traditional equivalence scales.

The article is structured as follows. The next section reviews the theoretical concept of the collective household model and the results of empirical literature. The following section presents the applied model and estimation strategy. After describing the data, we present and discuss the results. The next section deals with the application of our results to poverty and inequality measurement, and the results are concluded in the final section.

Theoretical concept and literature review

The standard collective household model developed by Chiappori (1988) and Apps and Rees (1988) (surveyed by Vermeulen, 2002) assumes that the outcomes of household decision-making are Pareto efficient no matter how decisions are made. The model is implemented by assuming a household welfare function as a weighted sum of an individuals' private utility functions: $\mu U^f(x^f) + U^m(x^m)$. The Pareto weight μ is then defined as a function of prices, total household expenditure and distribution factors that do not directly affect individual preferences, budget constraint or household technology. Pareto weight reflects the bargaining power of household member f, the influence over the decision-making process and allocation of resources in the household.

Browning *et al.* (2013) developed a collective model based on three major components: individual utility functions, the consumption technology function and the sharing rule. Unlike the consumption technology function, the sharing rule is a standard part of the collective household model and describes household behaviour by allocating the fraction η to females and the fraction $(1-\eta)$ to males; i.e. the share of household resources at the disposal of each household member defined as a function of factors affecting individual bargaining power. The authors present, under certain assumptions, the ability to find a unique Pareto weight that corresponds with any sharing rule η and vice versa. As opposed to the Pareto weight μ, the sharing rule η does not depend on any cardinalisation of the utility function. The authors present the necessary conditions to estimate individual preferences, the consumption technology function, the sharing rule and the model using household expenditure data. However, their model is very complex and difficult to estimate; therefore, several simplifications have been introduced in the literature (e.g. Lewbel and Pendakur, 2008; Cherchye *et al.*, 2012; Lise and Seitz, 2011). Alessie *et al.* (2006) work with a reduced version of the model and use data on subjective financial satisfaction to estimate it. Their results show that the female share of household consumption is significantly determined by her share of household income in most of the examined countries.

Bütikofer and Gerfin (2017; hereafter BG) further developed the approach of Browning *et al.* (2013) and Alessie *et al.* (2006). BG use data on subjective financial satisfaction as a proxy for an indirect utility function, which, in turn, empirically depends on individual characteristics and income. The model assumes that households consume their income each period and, hence, involves household income instead of expenditures. The method is easily applied to a comparison of singles and couples. An indifference scale then equates the utility of a single to the utility of the same person if he/she lived in a couple. As opposed to traditional equivalence scales, indifference scales differ for male and female partners. In other words, if there is no equal sharing of resources, the estimate of the equivalence scale can be biased because there is no unique indifference scale for both spouses in a couple household. BG show that in 2000–2008 Swiss data, the sum of individual consumption of both spouses exceeded household income by a factor of 1.39. This outcome is based on indifference scales estimated at 0.75 for men and 0.64 for women at the mean of the estimated sharing rule. The female consumption share rises with the ratio of female wage relative to the male wage.

Results of other studies based on the collective household model of Browning *et al.* (2013) are generally consistent with these outcomes. Browning *et al.* (2013) utilise Canadian expenditure data from 1974 to 1992 and obtain estimates of the overall scale economy parameter between 1.27 and 1.41, a benchmark estimate of the sharing rule at 0.65 and estimated indifference scales between 0.50 and 0.70 for men and between 0.58 and 0.74 for women. Cherchye *et al.* (2012), using Dutch pensioner expenditure data from 1978 to 2004, indicate the overall scale parameter of living in a couple at 1.32. The indifference scales for men in couples drop from 0.81 (evaluated in the bottom total real expenditure quartile) to 0.50 (top total real expenditure quartile) and for women increase from 0.49 to 0.82, respectively. Lewbel and Pendakur (2008) also use Canadian expenditure data from 1990 to 1992 and work

with a simplified version of the model. They report an indifference scale of 0.78 for men with average characteristics and 0.70 for women, a benchmark sharing rule estimate of between 0.36 and 0.46. Allesie *et al.* (2006) employed the European Community Household Panel longitudinal data on financial satisfaction in ten European countries. Their estimates of the overall economies of scale parameter are mostly above 1.4, and their sharing rule estimations evaluated at the mean of distribution factors are mostly above 0.5.

The model and estimation strategy

Browning *et al.*'s (2013) household behaviour model has three components: (1) separate utility functions for each household member, (2) a consumption technology function, which is related to economies of scale and characterises the degree of joint goods consumption and (3) a sharing rule that defines the within-household allocation of resources. In our approach, we follow the model modification by Bütikofer and Gerfin (2017) who define a structural collective household model based on empirical indirect utility function with PIGLOG preferences as follows:

$$V_i = z_i\alpha + \beta \ln x_i + \varepsilon_i, \tag{1}$$

where V_i is individual utility, z_i are individual characteristics, x_i is individual consumption and ε_i is the error term. The model rests on several assumptions. First, preferences are egoistic, and individuals only care about their own consumption. Further, individual utility only depends on individual consumption and is not directly affected by living arrangements. It also assumes single individuals consume their whole income each period, while total couple consumption exceeds the sum of individual incomes due to returns to scale. This can be described by the equation

$$\left(x^m + x^f\right) = \tau y^h, \tag{2}$$

where x^m and x^f is the consumption of a man and woman living in a couple, respectively; y^h is household income, and τ is consumption technology that transforms income into consumption and reflects returns to scale. For τ to equal 1, there are no returns to scale, and all consumption is strictly private. Theoretically and in contrast, for τ to equal 2, all household consumption would be public. Consumption of an individual living in a couple is then determined by total household income, returns to scale and by a sharing rule of η. The sharing rule determines a share of household resources at a woman's disposal and is defined as follows:

$$\eta = \gamma^0 + d^h\gamma^d, \tag{3}$$

where γ^0 estimates the female share of total household consumption at the mean of normalised values of distribution factors, and d^h is a vector of household distribution factors that are the same for both partners in a household. Among the distribution factors, the relative income of partners is the most commonly used one (Bonke and Browning, 2009), while other possible factors being hourly wage ratio, age or educational difference between spouses, relationship duration or total household expenditure. The consumption of a man and a woman, respectively, in a couple are as follows:

$$x^f = \eta\tau y^h \text{ and } x^m = (1-\eta)\tau y^h. \tag{4}$$

Combining the equations together, we get indirect utility functions for both single and couple households as follows. For singles, we get

$$V_i = z_i\alpha + \beta \ln y_i^h + \varepsilon_i. \tag{5}$$

For women in couple households, we have

$$V_i = z_i\alpha + \beta \ln(\gamma^0 + \gamma^d d_i^h) + \beta \ln\tau + \beta \ln y_i^h + \varepsilon_i, \tag{6}$$

and for men it is

$$V_i = z_i\alpha + \beta \ln\left[1 - \left(\gamma^0 + \gamma^d d_i^h\right)\right] + \beta \ln\tau + \beta \ln y_i^h + \varepsilon_i. \tag{7}$$

The model is estimated by nonlinear least squares. Restricting β to be identical for singles and couples enables identification (Browning *et al.*, 2013; Lise and Seitz, 2011; Alessie *et al.*, 2006).

Equivalence scale has been traditionally defined as the ratio of income (or expenditure) of two different types of households that exhibit a similar living standard, i.e. the ratio of cost functions of two different types of households evaluated at the same level of utility. In contrast, indifference scale, introduced by Browning *et al.* (2013), equates the utility of an individual living alone to the utility of the same person if he/she lived in a couple. That means it reflects the necessary change in expenditure to put the individual on the same indifference curve in both situations. BG take a couple as a point of reference and define the indifference scale as a proportion of household income that individual living in a couple needs to attain the same level of utility when living alone. Under the model specification defined above, a female indifference scale can be obtained by equating $V(y^s) = V(\eta y^c \tau)$, where y^s is the income of the single household, and y^c is the income of the couple household, which give a female indifference scale of $\theta^f = \eta\tau$ and a male indifference scale of $\theta^m = (1-\eta)\tau$. Indifference and equivalence scales are formally identical for equal resource sharing, i.e. $\eta = 0.5$.

To proceed with the analysis, we must accept a necessary assumption that individual financial satisfaction is a valid approximation of the indirect utility of an individual. Such an assumption is largely utilised in recent research on happiness and well-being (for a broad discussion of potential critiques of this assumption, see BG). Further, utilisation of subjective satisfaction variables as a proxy for utility was validated by psychological research (Frey and Stutzer, 2002). Utilising subjective income evaluation data for estimating individual utility functions has had a long tradition since the 1970s (see the overview in Van Praag and Frijters, 1999), and subjective approaches have recently been more frequently employed in household behaviour modelling (e.g. Bonke and Browning, 2009; or BG).

To enable identification, a key assumption must be made that individual preferences are the same regardless of living single or with a spouse. As a result, the only difference for an individual when living with a spouse is access to a more efficient consumption technology and specific allocation process (Browning *et al.*, 2013).

Since financial satisfaction is an ordinal variable, an ordered response model (e.g. ordered probit) would be a natural choice of estimation method. However, the utility function is nonlinear with respect to parameters τ and γ; therefore, a different method must be used [3]. One way to solve this issue has been proposed by van Praag and Ferrer-i-Carbonell (2006) as an attempt to cardinalise the ordinal data, known as the probit-OLS (POLS) approach. In POLS, the equidistant responses to satisfaction questions are replaced by transformations, which reflect the distribution of reported satisfaction levels within the sample. The POLS transformation involves calculating the relative frequencies of the different response categories and then obtaining a standard, normally distributed, cardinal-scaled and unbounded variable by inserting these frequencies into a standard normal distribution function. The resulting transformed variable is still ordinal scaled but not equidistant and, consequently, can be used as the dependent variable in a nonlinear regression (for a broader discussion of this procedure's feasibility in nonlinear settings, see BG). Moreover, the

estimated coefficients have the same interpretation as in the ordered probit model, i.e. shifting the thresholds which generate the distribution of responses in the sample (see van Praag and Ferrer-i-Carbonell, 2004 and 2006, for more details on POLS approach) [4].

A longitudinal perspective would enable estimation of the unobserved individual heterogeneity common in similar research on the topic (e.g. parameter μ_i in eq. (1), BG, p. 436). However, a longitudinal dataset containing financial satisfaction is unavailable for Central and Eastern European countries [5]. This might potentially bias our estimates of preference parameters; nevertheless, we believe that our estimates still yield relevant results.

Data

We use the subjective financial satisfaction data module of EU-SILC, a household survey harmonised across all EU member states that has been compulsorily conducted annually since 2005. The survey incorporates an ad-hoc module each year; for the purpose of this research, we use the modules "2013 – well-being" and "2018 – material deprivation, well-being and housing difficulties", which include the question of individual financial satisfaction. The variable refers to the degree of satisfaction the respondents felt about their household financial situation on a scale from 0 (not at all satisfied) to 10 (completely satisfied) at the time of the interview.

Similar to other research in collective household models, we only focus on households without children; our sample is limited to childless households of singles and couples. The couple is defined as male and female partners living together, either married or cohabiting. The method, based on financial satisfaction, is estimated on the individual level by definition. We limited our samples to persons aged 20+. The sample sizes range from 2,864 (SK in 2013) to 7,072 (PL in 2018). Estimations are weighted by personal cross-sectional weights.

The key variable in Equations (5)–(7) is the (log of) total disposable household income. Total disposable household income includes labour and non-labour income as well as various social benefits (including pensions) received at both the individual and household level. Distribution factors include female income contribution, relative education (difference in years of education, male minus female), relative age (age difference, male minus female) and total disposable household income. Female income contribution is defined as the female individual income divided by the sum of female and male individual incomes. As some income variables are collected at the household level (e.g. housing or social exclusion allowances), the share of female income includes income assignable to individual partners only (income from employment and self-employment, unemployment, sickness and disability benefits, education-related allowances, pensions and survival benefits) [6]. Distribution factors are normalised to zero mean.

Table 1 presents descriptive statistics of the distributional factors. Mean female income contribution is around 0.44 in CZ, HU and SK. PL has a lower female contribution accompanied by a higher degree of variability. Mean age difference between spouses stands at approximately 2.5 years in all countries. The difference in education is less homogeneous across states: the largest disparities in favour of men are in CZ (0.8 years of education), followed by HU (0.5 years) and SK (0.4 years); the lowest differences are in PL (0.15 years).

Control variables related to individual characteristics of household members include gender, education and age and employment status. Household level control variables further include self-assessed ability to make ends meet, reference to the degree of urbanisation of the place of residence, flat/house size and dwelling ownership type. The self-assessed ability to make ends meet (five dummies with "making ends meet very easily" as a reference group) should supplement the picture of the household financial situation. The degree of urbanisation is proxied by dummies for medium and densely populated areas (thinly populated areas serve as a reference group). The flat/house size is expressed by the number of

Table 1.
Distribution factors: Descriptive statistics (means)

		Female contribution	Education difference	Age difference	Ln household disp. income	*N*
CZ	2013	0.435 (0.120)	0.764 (2.372)	2.396 (4.137)	9.097 (0.526)	1,260
	2018	0.434 (0.118)	0.830 (2.458)	2.459 (4.167)	9.096 (0.514)	952
HU	2013	0.437 (0.168)	0.421 (2.717)	2.624 (4.473)	8.647 (0.569)	1,692
	2018	0.434 (0.118)	0.830 (2.458)	2.459 (4.167)	9.096 (0.514)	1,623
PL	2013	0.401 (0.206)	0.165 (3.905)	2.592 (3.807)	8.804 (0.655)	1951
	2018	0.411 (0.192)	0.132 (3.489)	2.305 (3.834)	8.860 (0.647)	1844
SK	2013	0.448 (0.137)	0.429 (2.432)	2.551 (4.029)	8.997 (0.507)	816
	2018	0.449 (0.141)	0.401 (2.445)	2.393 (3.869)	9.140 (0.489)	1,205

Note(s): Households of couples only. Std. dev. in parentheses
Source(s): EU-SILC cross UDB 2013 and 2018 – version of 2019–03; authors' calculations

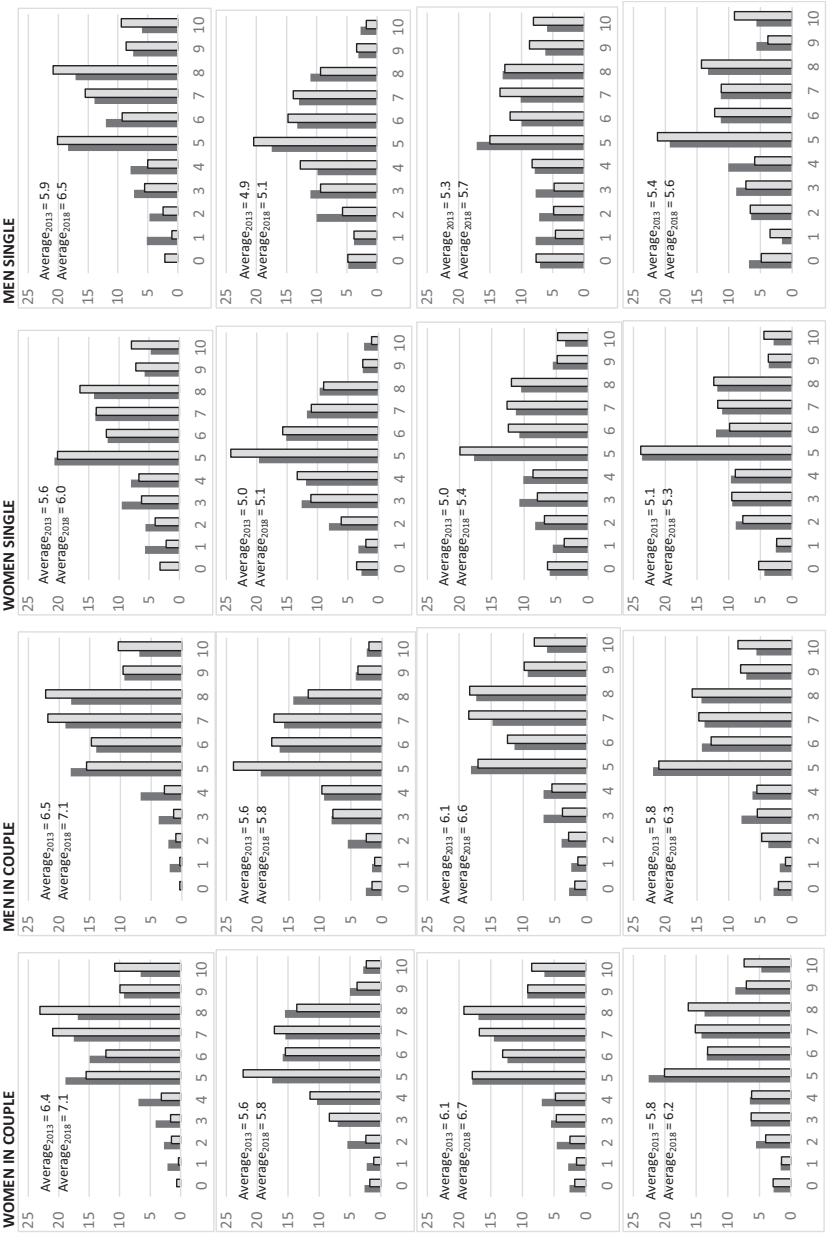
habitable rooms. Dwelling ownership type reflects the household's financial demands. We include a dummy variable for outright owners and a dummy variable for owners paying a mortgage (the reference group being tenants paying rent) since the financial burden represented by paying a mortgage and rent can differ across countries, depending on the situation of housing and financial markets.

Further, we provide several robustness checks. Inspired by Saunders *et al.* (1994) and García-Carro and Sánchez-Sellero (2019), we run our estimations on a subsample of individuals from households, which report making ends meet with some difficulty or fairly easily (two middle categories out of six). The model assumes households consume their whole income each period, which is hardly realistic for households making ends meet with great difficulty (possible borrowers) on the one hand or very easily (possible savers) on the other hand. We also run separate estimates for individuals older than 55 years because the sample of individuals of reproductive age is limited due to the focus on childless households only. Finally, married individuals are considered separately from cohabiting couples as their behavioural patterns can differ.

The distribution of reported financial satisfaction levels by country, household type and gender is depicted in Figure 1. Generally, the highest levels of financial satisfaction can be found in CZ, followed by PL and SK, with HU reporting the lowest level of financial satisfaction for both women and men living in both household types. Between the two examined years, financial satisfaction increased in CZ, PL and SK and HU recorded only a marginal change. Individuals living in couples report significantly higher satisfaction levels compared to single individuals, the largest difference being in PL. There are no significant differences in satisfaction levels between men and women living in couples. Yet, as regards to single individuals, men report higher levels of financial satisfaction than women in CZ, PL and SK. This picture corresponds with the situation in Western European countries described by Alessie *et al.* (2006) but contrasts with the results of Bonke and Browning (2009), who show that women generally exhibit higher levels of financial satisfaction.

Results and discussion

Table 2 presents the results of the model estimations for both years in all V4 countries. The estimated consumption technology parameter τ shows that scale economies raised the sum of individual household member consumption to around a 1.4 multiple of household income in CZ in both years (1.43 in 2013 and 1.38 in 2018). In other countries, the estimates differ between the two periods: scale economies increased in HU and SK and fell in PL. Yet, all these figures (except for SK in 2013) suggest larger returns to scale than those predicted by the standard OECD-modified equivalence scale corresponding to the scale parameter of 1.33.



Source(s): EU-SILC Cross UDB 2013 and 2018—version of 2019-03, authors' calculations

Figure 1.
Distribution of financial satisfaction by gender and household type

Table 2.
Baseline model estimation results

	CZ		HU		PL		SK	
	2013	2018	2013	2018	2013	2018	2013	2018
B	0.283***	0.471***	0.431***	0.214***	0.248***	0.221***	0.455***	0.608***
τ	1.428***	1.374***	1.431***	1.777***	1.636***	1.460***	1.239***	1.405***
γ_0	0.403***	0.464***	0.495***	0.429***	0.527***	0.569***	0.601***	0.466***
Female contribution γ	0.067***	0.058***	0.071***	0.019	0.070**	0.096***	0.050**	0.069***
Education difference γ	0.056***	0.003	0.022	0.035	0.021	0.000	0.022	0.040**
Age difference γ	−0.012	−0.003	−0.005	−0.014	−0.014	0.007	0.012	0.011
Household income γ	0.026	0.018	0.019	0.016	−0.021	−0.021	−0.018	0.012
Female	0.072**	0.064**	0.039	0.070*	0.005	−0.015	−0.138**	0.030
Secondary education	0.011	0.087**	0.073***	0.113***	0.048	0.058**	0.021	−0.027
Tertiary education	0.149***	0.152***	0.147***	0.244***	0.083*	0.068*	0.184***	0.137**
Age	0.004***	0.001	0.002	0.002	0.004***	0.002	0.006***	0.000
Employed	0.078*	−0.051	−0.033	0.065	−0.003	0.088**	0.090	0.019
MEM with great difficulty	−2.366***	−2.423***	−1.849***	−2.392***	−2.149***	−2.062***	−2.054***	−1.886***
MEM with difficulty	−1.769***	−1.780***	−1.324***	−1.761***	−1.569***	−1.479***	−1.414***	−1.484***
MEM with some difficulty	−1.196***	−1.249***	−0.832***	−1.278***	−1.187***	−1.031***	−1.148***	−1.161***
MEM fairly easily	−0.667***	−0.737***	−0.310	−0.750***	−0.640***	−0.451***	−0.679***	−0.708***
MEM easily	−0.439***	−0.463***	0.089	−0.307*	−0.342***	−0.133*	−0.263	−0.504**
Densely populated area	−0.033	0.068**	−0.155***	−0.017	−0.109***	−0.020	−0.105**	−0.038
Medium populated area	−0.030	0.064**	−0.116***	−0.050	−0.029	0.016	−0.112***	−0.083**
Rooms	0.002	0.006	0.003	0.045***	0.001	0.015	0.017	
Owner	0.123***	0.072**	−0.052	0.036	−0.096*	−0.011	0.056	−0.022
Mortgage	0.125**	−0.016	−0.221***	−0.032	−0.007	−0.116	−0.086	0.030
Constant	−1.752***	−3.436***	−2.554***	−0.959**	−1.115***	−1.173***	−3.180***	−4.226***

Note(s): Nonlinear least squares. Dependent variable: satisfaction with financial situation (POLS transformation). ***denote a 1% significance level, **denote a 5% significance level and *denotes a 10% significance level. MEM stands for "make ends meet"
Source(s): EU-SILC cross UDB 2013 and 2018 – version of 2019–03; authors' calculations

The estimated sharing rule γ_0 indicates that at the mean of distribution factors, women receive a consumption share 0.40–0.46 in CZ and HU, 0.53–0.57 in PL and 0.47–0.60 in SK. Yet, only two of these outcomes are significantly different from 0.5 (i.e. the parameter indicating equal sharing of resources): 0.40 in CZ and 0.60 in SK in the year 2013 [7]. The sharing rule is significantly positively driven by female income contribution in most cases (except HU in 2018). A 0.1 increase in female income contribution leads to a rise in female consumption share of less than one percentage point (the estimated parameter mostly implies about a 0.7 percentage point). In CZ in the year 2013 and SK in the year 2018, education difference among partners has a significant positive effect. Other distribution factors do not exert a significant effect on the sharing rule. These outcomes suggest that bargaining power and distribution of resources within the couple are mostly driven by distribution of income within the household. At the mean of distribution factors, the sharing rule most slightly disfavours women, though it is very close to equity (0.5) in some cases. A sharing rule privileging women can be found in SK (in 2013) and PL (mainly in 2018).

Table 3 displays the estimates of model parameters and indifference scales for the baseline model together with robustness-check estimations on three subsamples. At the mean of distribution factors, the female indifference scale is the lowest in CZ among the V4 countries, at 0.58 in 2013 and 0.64 in 2018, according to the results of the baseline model. The highest female indifference scales are in PL, exceeding 0.80 at the mean of distribution factors in both periods, while HU and SK have moderate levels, 0.65–0.76, in the two periods.

For instance, in CZ in the year 2013 the outcome means that a woman needs 0.58 of total household disposable income to be as well off as when living alone, while a man needs 0.85. These values correspond to mean female income contribution (0.435). When evaluated at equal female contribution to income (0.5), the female indifference scale increases to 0.69, meaning that she would need substantially more than half of the household income to reach the same utility level as when living alone. In this case, a man would require 0.74 of the household income. The respective values of the female/male indifference scale are 0.48/0.94 for zero female contribution to household income and 0.89/0.53 for female contribution to household income equal to one. BG achieve similar outcomes and interpret this disparity between female and male indifference scales as a consequence of unequal wages that give less bargaining power to women, limiting the potential to enforce their preferences in the household.

Our results are robust across different subsamples. Estimates made for individuals from households reporting making ends meet with some difficulty or fairly easily generally confirm our baseline results; an exception is a substantially lower returns to scale parameter in CZ in the year 2013. This is also the case for estimates on the subsample of individuals older than 55 in CZ in the year 2013 (while in HU in the year 2018, this subsample indicates returns to scale larger than 2). Further, the sharing rule attributes an almost similar share to men and women at the mean of distribution factors in the CZ subsample of older individuals, higher female indifference scales compared to the baseline model as a consequence. This equalising tendency for the older individuals' subsample is also evident in SK. Estimates made on subsamples of married couples and singles (excluding cohabiting couples) generally confirm baseline model results with an exception for HU in 2018, where the estimated parameters of sharing rule and distribution factors are not statistically significant.

Application to income poverty and inequality measures

Our estimations of the returns to scale parameter and sharing rule enable calculation of poverty and inequality measures that account for within-household distribution of resources. Equivalence scales, traditionally assuming zero within-household inequality, are used to adjust total household income to an individual-level equivalent. The European approach

		Baseline[a]		Make ends meet 3+4[b]		Individuals aged 55+[c]		Married couples[d]	
		2013	2018	2013	2018	2013	2018	2013	2018
CZ	Scale parameter τ	1.428**	1.374**	1.255**	1.347**	1.283**	1.355**	1.415**	1.399**
	Sharing rule γ_0	0.403**	0.464**	0.430**	0.448**	0.498**	0.494**	0.401**	0.468**
	Female indifference scale	0.575	0.637	0.540	0.603	0.639	0.669	0.567	0.654
	Male indifference scale	0.853	0.737	0.715	0.744	0.644	0.686	0.847	0.745
HU	Scale parameter τ	1.431**	1.777**	1.415**	1.771**	1.447**	2.556**	1.464**	1.191*
	Sharing rule γ_0	0.495**	0.429**	0.501**	0.531**	0.535**	0.454**	0.490**	0.197
	Female indifference scale	0.709	0.762	0.709	0.939	0.774	1.161	0.717	0.235
	Male indifference scale	0.723	1.015	0.705	0.831	0.673	1.395	0.747	0.957
PL	Scale parameter τ	1.636**	1.460**	1.598**	1.420**	1.813**	1.280**	1.705**	1.475**
	Sharing rule γ_0	0.527**	0.569**	0.550**	0.589**	0.530**	0.554**	0.528**	0.558**
	Female indifference scale	0.863	0.831	0.879	0.836	0.960	0.708	0.900	0.823
	Male indifference scale	0.773	0.630	0.719	0.584	0.853	0.571	0.805	0.652
SK	Scale parameter τ	1.239**	1.405**	1.218**	1.336**	1.322**	1.443**	1.313**	1.421**
	Sharing rule γ_0	0.601**	0.466**	0.619**	0.482**	0.531**	0.487**	0.599**	0.454**
	Female indifference scale	0.744	0.654	0.753	0.645	0.702	0.703	0.787	0.645
	Male indifference scale	0.495	0.750	0.464	0.692	0.620	0.741	0.526	0.776

Note(s): Estimates by nonlinear least squares. Dependent variable: satisfaction with financial situation (POLS transformation). **denote a 1% significance level, *denotes a 5% significance level (indifference scales are not marked by significance). [a]Baseline estimates are the same as in Table 2. [b]Sample limited to individuals from households, which report making ends meet with some difficulty or fairly easily (two middle categories out of six). [c]Sample limited to individuals older than 55 years. [d]Couple sample limited to married individuals only
Source(s): EU-SILC cross UDB 2013 and 2018 – version of 2019–03; authors' calculations

Table 3.
Estimated parameters: baseline model and robustness checks

applies the OECD-modified equivalence scale, which assigns a weight of 1 to the first adult, a weight of 0.5 to the second and each subsequent adult household member and a weight of 0.3 to each child, with the corresponding scale parameter τ equalling 1.333 [8].

As shown by Phipps and Burton (1998), the particular assumption about the within-household distribution of resources matters a lot for poverty estimations. Lise and Seitz (2011) estimate consumption inequality using a collective household model and show that the traditional approach may produce misleading results. The authors conclude that the growth in between-household inequality may have been offset by falling within-household inequality in the United Kingdom since the late 1960s and estimate that within-couple inequality accounted for 25% of total inequality among couples by 2000. A similar outcome is provided by BG, who state that ignoring the within-couple distribution of resources leads to an underestimation of inequality in consumption by 16%. Alessie *et al.* (2006) conclude that accounting for intra-household inequality results in modest increases in inequality measured by Gini coefficients with differentiated impact across Western European countries.

The OECD-modified equivalence scale not only assumes within-household equality but also equals economies of scale across countries. The latter assumption was questioned already at the time the scale was established (Hagenaars *et al.*, 1994), and the sensitivity of

income poverty to the equivalence scale has been tested (e.g. Ravallion, 2015). Mysíková and Želinský (2019) showed that income poverty in CZ is highly sensitive to the adult weight, while the sensitivity is lower in other V4 countries.

In the European environment, the at risk of poverty rate (income poverty hereafter) is applied to measure income poverty in official statistics. It is defined as the share of population with equivalised disposable income below a poverty threshold, which is set at 60% of national median equivalised disposable income. The poverty thresholds thus differ across countries, and as such, this relative income poverty indicator measures income inequality rather than poverty. Our analysis is relevant for deriving equivalised income in the construction of income poverty.

Table 4 contrasts income poverty rates using the OECD-modified equivalence scale and our estimated equivalence and indifference scales to derive equivalised income. Except SK in 2013, our estimated economies of scale are higher than those assigned by the OECD-modified scale, meaning that the weight of the second adult under the OECD-modified scale terms would be lower than 0.5. Table 4 first provides the official income poverty statistics, i.e. based on a total population sample without the sample selections made in our analysis. CZ is the only country where the income poverty rate rose between the two periods; however, the Czech values are constantly the lowest (even within the EU). We hold the income poverty threshold fixed at the level derived by official statistics on the total EU-SILC sample in order to show the impact of equivalence and indifference scales on income poverty more clearly [9]. The income poverty rates using the OECD-equivalence scale on our restricted sample (childless singles and couples) are mostly higher for females than for males, with an enormous difference in CZ in 2018.

Table 4 further shows the income poverty rates when we apply the estimated scale parameter τ instead of the OECD-modified one. We can see that income poverty rates decrease in all countries except SK in 2013. However, given the demographic disparity across countries, the difference between the rates for females and males moderately increases. And finally, applying the indifference scale compared to the estimated equivalence scale changes the rates for females and males in accordance with the estimated sharing rule: a sharing rule lower than 0.5 increases the income poverty rate for females and lowers it for males.

	CZ		HU		PL		SK	
	2013	2018	2013	2018	2013	2018	2013	2018
Total population sample	8.6	9.6	15.0	12.2	17.1	14.8	12.8	12.2
(1) Females	9.4	11.4	14.5	13.6	17.3	15.0	12.9	12.3
(2) Males	7.7	7.8	15.5	11.9	17.3	14.6	12.8	12.2
Poverty threshold (EUR, yearly)	4,616	5,453	2,670	3,254	3,098	3,944	4,042	4,477
Single and couple sample								
OECD-modified scale	9.1	18.0	10.7	14.3	14.2	21.4	9.4	9.3
(1) Females	10.6	23.3	9.4	14.4	14.1	22.3	9.8	9.3
(2) Males	7.3	11.0	12.3	14.1	14.3	20.0	8.8	9.4
Estimated scale τ	8.8	17.7	10.0	11.4	12.5	20.1	10.1	8.0
(1) Females	10.3	23.1	8.9	11.8	12.6	21.3	10.4	8.1
(2) Males	6.9	10.7	11.6	10.9	12.3	18.5	9.7	7.9
Indifference scale	9.2	18.1	10.0	11.5	12.4	20.7	13.3	8.5
(1) Females	11.5	24.0	8.9	12.5	12.3	20.6	9.2	9.4
(2) Males	6.4	10.4	11.4	10.2	12.5	21.0	19.7	7.3

Source(s): Eurostat database (variables ilc_li01 and ilc_li02) for total population sample; EU-SILC cross UDB 2013 and 2018 – version of 2019–03; authors' calculations

Table 4. Income poverty rate (fixed poverty threshold) in %

Nevertheless, using the indifference scale compared to the estimated equivalence scale mostly raises the total rates. The most considerable increase of the poverty rate (by 3 pp) can be found in SK in the year 2013, the very high sharing rule and income poverty rate of the male subgroup being responsible for it.

Income poverty rate captures income inequality below 60% of median and, thus, tells nothing about the upper part of the distribution. Figure 2 compares overall inequality by Gini coefficients based on equivalised income using the OECD-modified scale, our estimated scale parameter and the indifference scale. The larger the vertical distance from the 45-degree line, the more considerable the impact on income inequality. The top left panel, which ignores within-household inequality, shows that changing the equivalence scale from the OECD-modified to our estimated parameter basically increases income inequality only in HU in 2018 and in PL in both years. On the other hand, accounting for within-household inequality and employing the indifference scale (top right panel) increases income inequality in the year 2013 in SK and CZ.

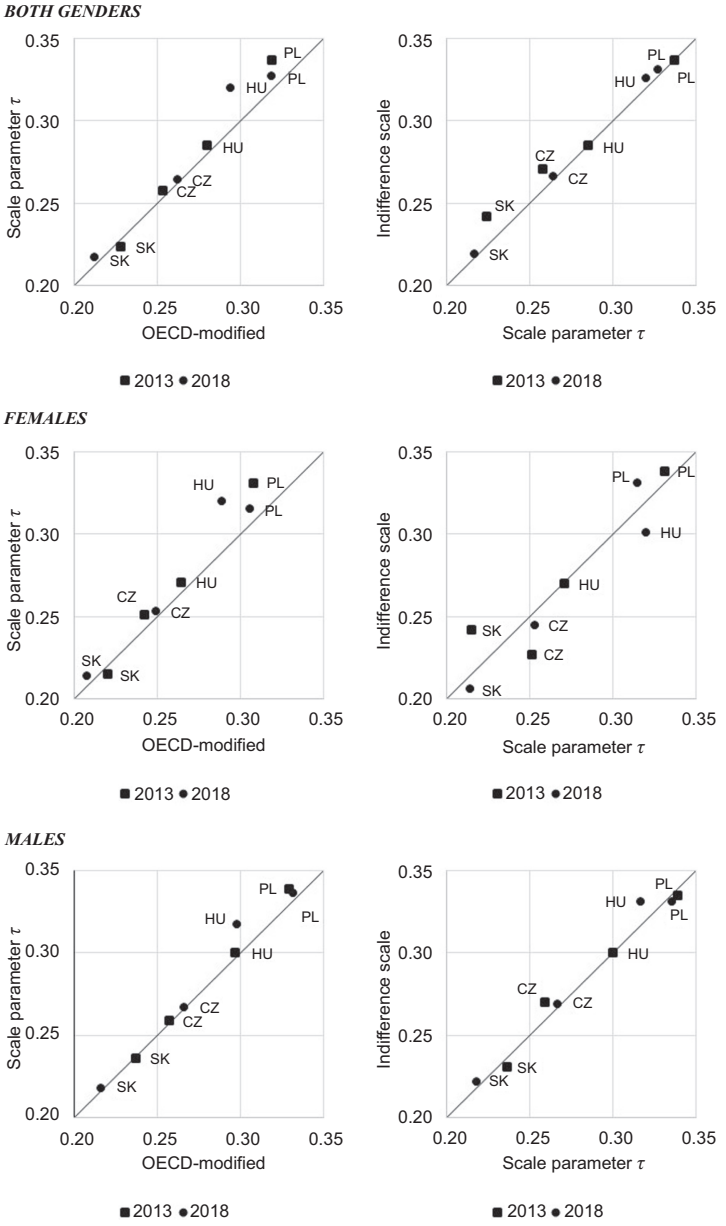
The impact of equivalence and indifference scales on income inequality is more profound for women. While the impacts for the male subsample are basically only apparent in HU, the impacts for female subsamples are more diversified. First, the estimated equivalence scale parameter mostly increases the Gini coefficients for females (middle left panel). However, second, the indifference scale lowers it back in most cases (middle right panel). Exceptions are SK in 2013 and PL, i.e. situations where the estimated sharing rule is higher than 0.5.

Conclusion

This paper utilised subjective data on financial satisfaction available in 2013 and 2018 EU-SILC data to estimate a collective household model developed by Browning *et al.* (2013) and modified by Bütikofer and Gerfin (2017). We explored intra-household distribution of income in V4 to estimate individual indifference scales and to identify a possible bias in poverty and inequality measures derived based on the traditional equivalence scale.

Our results confirm substantial overall economies of scale from living in a couple. The estimates of the sharing rule suggest that, at the mean of distribution factors, women receive a consumption share between 0.40 in CZ and 0.60 in SK in 2013, while these two end points being statistically, significantly different from the equal sharing parameter of 0.5. The results suggest that the bargaining power and the sharing rule of resource distribution within the couple are significantly, positively driven by distribution of income within the household, other factors being generally insignificant. At the mean of distribution factors, the female indifference scales among V4 countries is the lowest in CZ: around 0.60 with a slight increase between the two periods. The highest female indifference scales are in PL, exceeding 0.80 in both periods, while HU and SK exhibit moderate levels of 0.65–0.76. The lower indifference scales of women compared to men may be seen as a result of generally prevailing gender wage gaps. Higher wages provide men with greater bargaining power, which enables the allocation of more resources towards their private consumption. Clearly, large gender disparities in wages do not disappear by pooling incomes at the household level. Therefore, policies supporting equal pay for men and women may even affect the consumption behaviour of households and a shift in resources towards more private consumption among women.

We applied our estimates to identify their impact on income poverty (at risk of poverty rates) and inequality (Gini coefficients), which are commonly based on the OECD-modified equivalence scale. First of all, the overall scale parameter, estimated using financial satisfaction data—still considering an equal intra-household sharing of resources—was generally higher than 1.40, indicating higher economies of scale than implied by the standard OECD-modified equivalence scale (1.33) and, moreover, differentiated across countries. This outcome suggests that the recent, official EU approach using the unified OECD-modified



Source(s): EU-SILC Cross UDB 2013 and 2018 – version of 2019-03, authors' calculations

Figure 2.
Gini coefficients

scale for policy considerations in the fight against poverty and income inequality may not yield optimal solutions. Instead, differences across countries and intra-household inequalities should be taken into account.

Further, by relaxing the assumption of equal sharing, we show that the income poverty rate is often underestimated under the traditional approach. Regarding gender subsamples, the impact naturally corresponds to the estimated sharing rule: once the sharing rule disfavours women and lowers their income, their income poverty (with a fixed poverty threshold) rises and vice versa. The impact of indifference scale on increased overall income inequality is the most profound in CZ and SK. Applying the indifference scale affects income inequality within gender subsamples differently: while the impact on male income inequality is rather negligible, female income inequality is strongly affected by the estimated sharing rule. This time, once the sharing rule disfavours women, their income inequality decreases and vice versa. A sharing rule lower than 0.5 proportionally decreases the income of all female partners, so that the income distribution of women shrinks and results in lower inequality.

To summarise, our results indicate that accounting for intra-household inequality in some cases magnifies the between-household inequality and changes income poverty figures in V4. More specifically, it substantially increases the differences in poverty and inequality indices between genders. This once again confirms the importance of policies aimed at equal pay promotion that span further into other areas of social policy.

The methodological approach we employed is based on several assumptions. We tested the validity of some of them in the robustness checks. Yet, one of the key assumptions of collective model research is that individual preferences do not change according to living arrangements. While available EU-SILC data do not allow for testing the validity of this assumption, it is a common approach in collective model research that we follow, and we have left the testing of its validity in the Visegrád region for future research. Furthermore, in our research we have only focused on households without children. Including children in analyses of the within-household allocation of resources remains a major challenge for future research in the area since the presence of children may be one of the factors that substantially alters the negotiating power of spouses and the distribution of resources. Finally, validating our results with estimates made on longitudinal data once these are available for V4 remains for future research.

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Notes

1. Chiappori (2016) criticises the conceptual foundations of the approach based on equivalence scales as flawed, weak and centred upon an inadequate theoretical framework including non-testable assumptions regarding comparisons of utility levels across individuals. Moreover, it neglects intra-family inequality and allocation of resources. Consequently, any considerations based on such an approach lead to inappropriate policy conclusions.
2. In terms of the at risk of-poverty rate (Eurostat database, variable ilc_li02) and Gini coefficient of equivalised disposable income (Eurostat database, variable ilc_di12).
3. We cannot use the ordinal variable as a dependent variable in the nonlinear model since it would attach cardinal values to the satisfaction levels with equal distance between the values.
4. We employed a procedure in STATA developed by Kaiser (2018).
5. Though EU-SILC data contain longitudinal files, it is designed as a four-year rotational panel, while the financial satisfaction question included in ad-hoc modules of five-year intervals are not part of the longitudinal component.
6. Income variables in EU-SILC correspond to annual income. EU-SILC is conducted during the first and second quarter of the year in V4 countries, and the income reference period corresponds to the previous calendar year while most questions, including financial satisfaction, are related to the

current situation. We are aware of possible inconsistencies between the current and previous year reference periods. However, the income reference period is considered to provide the best approximation of current income (Eurostat, 2010), and it is applied in this way in official statistics. The female share of assignable income is based on gross income. Though we consider net income to be more relevant, only the gross version of some income sources are available (e.g. only gross income from self-employment is provided in CZ).

7. Based on confidence intervals (not stated in Table 2).

8. For instance, assume individuals with an actual income of EUR 10,000. Each partner in a couple is then assigned an equivalised income EUR 20,000/1.5 = EUR 13,333, yielding EUR 26,666 together. Compared to their actual total income of EUR 20,000 EUR, the scale parameter τ corresponds to 1.333.

9. However, note that once the scale changes the derived equivalised income of individuals, the national median, and so the 60% poverty threshold, would change as well. We hold the threshold fixed as only deriving the adjusted threshold on a sample of childless singles and couples might be misleading.

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