



SUSTAINABLE HOUSEHOLD INCOME IN EU COUNTRIES ENSURING A LIFE OUT OF POVERTY

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Abstract

The identification of the structure of sustainable household disposable income in times of economic uncertainty is the aim of this paper. The research provides household income components in order to achieve a sustainable income ensuring life out of poverty. The analyses were based on the EU-SILC 2020 database of primary data (N = 232,816 EU households). The binary logistic regression verified that households capable of generating savings have the highest chances of achieving a sustainable income. There is also a positive influence of the investment income (interests, dividends, rental income), but with a lower impact than expected. On the contrary, the presence of social transfers in income reduces the likelihood of sustainable income. Social income is beneficial to households in poverty but it is essential to ensure that it is properly targeted.

Keywords

Household Income, Sustainable Income, Income Poverty, EU-SILC

I. Introduction

Over the last decade, EU economies saw growth tied to improving living standards, including household well-being, health, education, job opportunities, and environmental protection (Dragoi, 2020). However, interruptions from health, war, energy, and migration crises (Młodkowski, 2020; Vavoura and Vavouras, 2022), as well as the climate crisis (Burns and Tobin, 2022), have had recessionary effects on various sectors and affected households' quality of life (Bonatti et al., 2017). Quality of life is primarily shaped by lifestyle and preferences driven by household income (OECD, 2020).

The factors that affect household income are known – they are mainly demographic factors (Corsi et al., 2016; Kis and Gábos, 2016; Dolls et al. 2019; D'Albis et al., 2021) and socio-economic factors related to household members' economic activities (this means forms

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of activities, sectors of employment, etc. (Navarro and Salverda, 2019; Veneri and Murtin, 2019). However, there is a research gap in household income structure, namely in terms of the identification of household income structure that would ensure a sustainable income even in times of crises or economic uncertainty, and the desired quality of life.

The paper aims to identify the structure of household disposable income in EU countries and to determine the effect of individual income components on income sustainability ensuring living out of poverty in times of economic uncertainty. The focus will be on understanding how the household income components affect the chances of living out of poverty. The research question is: What is the sustainable disposable household income structure ensuring the life outside poverty in EU countries? A sub-aim of the paper is to identify segments of EU countries based on similarities in household income structures in relation to income poverty rates.

II. Literature Review

Household income is a critical factor that influences living conditions and reflects a population's socio-economic status (OECD, 2020). Additionally, household income plays a significant role in consumer behaviour, with price-sensitivity or prioritizing of gathering information about products rather than focusing on price (Achar et al., 2016).

Disposable household income is crucial in assessing the standard of living and poverty (Burlacu, 2016; European Commission, 2011). The EU-SILC (EU-Statistics on Income and Living Conditions) infrastructure measures household income in relation to household living conditions. EU-SILC also provides demographic and socio-economic factors affecting income (Wirth and Pforr, 2022; Vladisavljevic and Mentus, 2019; Colgan, 2022). Disposable income is derived from all household income is reduced by taxes and increased by transfers. An important component of household income is an investment income (Iacono and Ranaldi, 2021; Szymborska 2019). Weller and Wenger (2017) state that the investment incomes help the diversity in household income. Also, savings can generate income but there is a risk of their depreciation with inflation (Gopinath, 2020). Considerable heterogeneity in income and consumption behaviour patterns has been identified between and within EU countries (Duarte et al, 2021).

The income situation of a household depends on many factors, especially demographic and socio-economic ones (Veneri and Murtin, 2019). Vojtková and Šoltés (2018) talk about household labour intensity as an indicator of labour potential. Kis and Gábos (2016) and Branyiczki (2015) consider the economic status of household members expressed in terms of work intensity as the most important determinant of income. Branyiczki (2015) added that consumers' educational attainment was an equally important factor, with higher educational attainment being associated with higher income. Skilled human capital plays a key role in poverty reduction (Cartone et al., 2024). Similarly, Hofmarcher (2021) explains the significant impact of investment in education as an effective anti-poverty strategy in Eastern Europe. Corsi et al. (2016) and Navarro and Salverda (2019) spoke about gender differences in income levels.

Social transfers are an important component of household income (Kis and Gábos, 2016). D'Agostino et al. (2020) pointed out that social transfers have not been set up effectively

in many countries. There are apparent differences between EU countries regarding income inequality in the context of old-age pension settings (Ebbinghaus, 2021). According to Kuitto et al. (2022) old-age pensions reduce old-age poverty but do not contribute significantly to poverty alleviation. The question, therefore, remains what is the appropriate mix of social transfers, because, as stated by Stiglitz et al. (2019), an inappropriate mix of social assistance instruments is ineffective in reducing poverty rates.

III. Data and methods

The EU-SILC (European Union – Statistics on Income and Living Conditions) database has been used as the primary data source, specifically, the EU-SILC 2020. In total, data from 232,816 European households have been used.

Household disposable income, defined as gross income minus taxes, mortgage interest and social insurance, is a key variable in the EU-SILC dataset (Eurostat, 2022). Household poverty determination is based on calculating a poverty threshold and an equivalised household income. Equivalised household income takes into account household composition, especially in terms of the age of household members. The poverty threshold is 60% of the median equivalised disposable income. If equivalised household income is below the poverty threshold, the household is considered to be at risk of poverty (Eurostat, 2021). All data have been cross-sectional weighted to ensure that the dataset would be representative.

The binary logistic regression tested the effect of individual components of household disposable income on the probability of living out of poverty. The logistic regression model allows for determining the chances of living out of poverty, i.e. achieving a sustainable income. The life out of poverty is expressed by a dichotomous Anti-Poverty variable taking values of 1 (household living out of poverty) or 0 (household living in poverty).

The examined factors affecting the chances of a sustainable income out of poverty have been as follows:

- * Household income components expressed as relative shares of total disposable household income (shares of old-age pensions, social benefits, family allowances, social exclusion allowances, housing allowances, alimonies, inter-household income, income from rental, interests, dividends and profit from capital investments)
- * Savings (1 – household puts money aside, 2 – household needs to draw on savings, 3 – household needs to borrow money, 4 – household neither puts money aside nor needs to draw on savings or borrow money)
- * Household type (1 – one-person household; 2 – 2 adults, no dependent children, both adults under 65; 3 – 2 adults, no dependent children, at least one adult over 65; 4 – other households without dependent children; 5 – single-parent household, one or more dependent children; 6 – 2 adults, one dependent child; 7 – 2 adults, two dependent children; 8 – 2 adults, three or more dependent children; 9 – other households with dependent children; 10 – other)
- * Ownership of the flat or the house (1 – outright owner; 2 – owner paying mortgage)

The binary logistic regression model can be expressed by an equation showing the relationship between the probability of a $P^{(x)}(Y = 1)$ phenomenon, i.e., life out of poverty with a sustainable income, under conditions given by the values of the explanatory variables (x):

$$\ln \left(\frac{P^{(x)}}{1 - P^{(x)}} \right) = \beta_0 + \sum \beta_i x_i. \quad (1)$$

The $\ln(P/(1 - P))$ formula (called the logit of P), can be expressed as a weighted sum of the values of the independent variables. The logit of P is the logarithm of the probability of occurrence of the phenomenon under study. The model can also be expressed by the following equation:

$$P \left(Y = \frac{1}{x} \right) = P^{(x)} = \frac{\exp(\beta_0 + \sum \beta_i x_i)}{1 + \exp(\beta_0 + \sum \beta_i x_i)}, \quad (2)$$

where β_i parameter estimates are obtained from the measurement matrix of X . If β_i is equal to zero, then the parameter does not affect the observed phenomenon (Hebák et al., 2015). The quality of the logistic model has been assessed by the Nagelke R Square.

The cluster analysis identified segments of EU countries showing similarities in household disposable income structures. Objects in a cluster are highly similar to each other and minimally similar to objects in other clusters (Nisbet et al., 2017). The K-means algorithm was applied to identify homogeneous groups of research objects based on selected characteristics. According to Hebák et al. (2015), the K-means algorithm is an iterative procedure that minimises the function of:

$$f_{KP} = \sum_{h=1}^k \sum_{i=1}^n \mu_{ih} ||x_i - \bar{x}_h||^2, \quad (3)$$

where the $\mu_{ih} \in \{0, 1\}$ elements indicate whether the i -th object belongs (value 1) or doesn't belong (value 0) to the h -th cluster and is a vector of average values of the h -th cluster. The following conditions must be met:

$$\sum_{h=1}^k \mu_{ih} = 1 \quad \text{for } i = 1, 2, \dots, n \quad \text{and} \quad \sum_{i=1}^n \mu_{ih} > 0 \quad \text{for } h = 1, 2, \dots, k. \quad (4)$$

The EU-SILC data have been processed by the IBM SPSS Statistics 25 software.

IV. Results

The structure of household disposable income in EU countries and its effect on sustainable household income

The representative EU-SILC data show that household income consists not only of income from employment or business, but also largely of social transfers – mainly old-age pensions and social benefits such as housing or family allowances. To compare EU countries with different currencies and purchasing power parities, the presented models use relative values of the observed variables, namely the share of individual income components in the total household income (for example the share of old-age benefits in the total household income).

The influence of the individual components of household income on the Anti-poverty variable (with 1 indicating sustainable income and 0 for poverty) is shown in the following model (Table 1). In addition to household disposable income components, the model includes three categorical variables: Savings, Ownership and Household type.

Table 1: Factors influencing Anti-Poverty Variable (Variables in the Equation in the final model)

	B	S.E.	Wald	df	Sig.	Exp(B)
Old-age benefits	–0.008	0.000	1046587.851	1	0.000	0.992
Social benefits	–0.020	0.000	2638223.950	1	0.000	0.980
Housing allowances	–0.016	0.000	98915.962	1	0.000	0.984
Family allowances	–0.021	0.000	335666.872	1	0.000	0.979
Social exclusion allowances	–0.023	0.000	521838.562	1	0.000	0.977
Alimonies	0.001	0.000	350.278	1	0.000	1.001
Interhousehold income	–0.021	0.000	385789.744	1	0.000	0.980
Income from rental	0.004	0.000	8536.778	1	0.000	1.004
Interests, dividends, profit from capital investments	0.004	0.000	12021.097	1	0.000	1.004
Savings			3852242.431	3	0.000	
Savings (1)	0.999	0.001	2614779.877	1	0.000	2.716
Savings (2)	–0.011	0.001	127.428	1	0.000	0.990
Savings (3)	–0.795	0.001	553846.908	1	0.000	0.451
Household type			1944532.659	9	0.000	
Household type (1)	–0.095	0.004	575.431	1	0.000	0.909
Household type (2)	0.673	0.004	28071.795	1	0.000	1.961
Household type (3)	0.864	0.004	45817.457	1	0.000	2.373
Household type (4)	0.712	0.004	30630.919	1	0.000	2.038

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	B	S.E.	Wald	df	Sig.	Exp(B)
Household type (5)	0.347	0.004	7075.300	1	0.000	1.415
Household type (6)	0.731	0.004	32449.282	1	0.000	2.078
Household type (7)	0.591	0.004	21411.009	1	0.000	1.806
Household type (8)	0.307	0.004	5442.442	1	0.000	1.359
Household type (9)	0.252	0.004	3855.016	1	0.000	1.287
Ownership (1)	−0.005	0.001	65.745	1	0.000	0.995
Constant	1.641	0.004	170187.448	1	0.000	5.159

Source: own processing of the EU-SILC dataset (Eurostat, 2022)

The logistic regression model (Table 1) was created by applying binary logistic regression using the Forward method: Conditional in step 13. Based on the classification, the resulting model correctly predicted 84.9% of the values of Anti-Poverty, the dependent variable. Nagelkerke R Square had a value of 0.261.

The model (Table 1) showed that the probability of a household living out of poverty (i.e. the chance of a sustainable income) decreased when old-age pensions and social benefits were included in household income. Those who received part of their income from another household (the Interhousehold income variable) were less likely to have a sustainable income. On the other hand, households that had investment income (Rental Income, Interest, Dividends and Capital Gains) in their disposable income had higher chances of having a sustainable income. However, the chances were only slightly higher. The Exp(B) coefficient clearly showed that with each additional percentage point of investment income in household disposable income, the probability of sustainable income increased by 1.004. The Savings variable had a more significant impact on sustainable income. Households that saved regularly were the most likely to achieve this (category 1). Compared to the reference group, households that built up savings were 2.7 times were likely to have a sustainable income. Household type shows that households consisting of two adults, one over 65, had the highest chance of living outside income poverty. In second place were households with two adults and one child. On the other hand, single-person households (category 1) had the lowest chances of achieving a sustainable income. Regarding the Ownership, it turned out that households without mortgages had slightly lower chances of achieving a sustainable income.

Segmentation of countries by household income structure

Disposable household income structures varied among EU countries. The K-means algorithm of the cluster analysis grouped countries into three clusters based on their income structures (Table 2). The first segment, comprising Bulgaria, Greece, Poland and others, was characterised by a high share of old-age pensions in household disposable income. The total percentage of social benefits in income amounted to a few per cent. Over two per cent of household income came from investment and rental income. Households also reported inter-household incomes.

In the second segment, the share of social transfers in household income was about the same as in the first segment, but the ratio of old-age pensions to social benefits was different. Countries in the second segment, including Belgium or Ireland had a much higher share of social benefits than the first segment. A higher percentage of income was taken up by family and housing allowances and many other non-standardised benefits that directly target at-risk groups. Although the share of investment income here was the highest compared to the other segments, it was still a tiny percentage (1.51%).

The third segment of countries did not have such solid social measures and had the lowest share of social transfers, with old-age pensions outweighing social benefits in household incomes. The percentage of old-age pensions in disposable income here was similar to the previous segment 2, and the share of benefits was similar to cluster 1.

Table 2: Final EU country cluster centres by household income structure

	Segment 1	Segment 2	Segment 3
Share of individual income components in total household disposable income	BG, DE, EL, FR, HR, PL, PT, RO	BE, DK, FI, IE, LU, SE, SI	AT, CY, CZ, EE, ES, HU, IT, LT, LV, MT, NL, SK
Social transfers	45.60%	46.30%	37.85%
Old-age pensions	36.44%	28.66%	28.04%
Social benefits	9.16%	17.64%	9.81%
Family allowances	2,70%	2,97%	2,53%
Social exclusion allowances	1.29%	1.35%	1.32%
Housing allowances	0,66%	1,64%	0,63%
Income from rental	1.36%	0.77%	1.04%
Interests, dividends, profit from capital investments	1.08%	1.51%	1.03%
Interhousehold income	1.58%	0.44%	1.60%
Alimonies	0.45%	0.24%	0.56%
Income poverty	18.00%	14.00%	16.30%

Source: own processing of the EU-SILC dataset (Eurostat, 2022)

The sustainable income can be also assessed using the income poverty indicator, which has been added in the last row of Table 2 after completing the clustering procedure. Based on the comparison of the income poverty indicators in segments, it appears that a combination of individual types of social benefits is effective, as in segment 2.

Regarding income differentiation, it is clear that investment income, whether income from investment rents or interest and dividends earned on investments, accounts for only a tiny part of households' disposable income in EU countries. The highest share of investment income in household disposable income was in Malta (4.12%), followed by Germany (3.85%).

Robustness analysis

To validate the model in Table 1 through robustness analysis, three countries were chosen, each representing a different segment. Greece, characterized by a high percentage of old-age pensions and above-average rental income (3.97%), represented the first segment. Denmark represented the second segment as a country with a well-adjusted social policy and households accustomed to investing (investments accounted for 3.19% of disposable income on average). The Czech Republic represented the third segment.

The models for the three selected countries (Table 3) contained, like in the model for EU-wide household data, first variables determining household income structure. Again, all three models were created by binary logistic regression, using the Forward method. Data on model quality are presented in Table 4. It turned out that the primary model developed best fitted the representative of the countries of the second segment – Denmark (52.5% explained variability).

Table 3: Factors influencing Anti-Poverty Variable in Greece, Denmark and the Czech Republic

	EL: Exp(B)	DK: Exp(B)	CZ: Exp(B)
Old-age benefits	0.997	1.009	0.976
Social benefits	0.984	0.992	0.975
Income from rental	0.993	1.073	1.034
Family allowances	0.895	0.945	0.998
Social exclusion allowances	0.970	0.006	0.914
Housing allowances	1.067	1.066	0.974
Interhousehold income	0.994	0.987	0.985
Alimonies	0.997	0.958	1.009
Interests, dividends, profit from capital investments	1.029	0.993	1.131
Savings			
Savings (1)	5.077	1.262	2.334
Savings (2)	1.086	0.694	0.818
Savings (3)	0.600	0.483	0.837
Household type			
Household type (1)	6.650	0.143	0.416
Household type (2)	8.158	0.511	0.927
Household type (3)	11.380	3.229	4.464
Household type (4)	5.967	2.037	8.166
Household type (5)	15.702	0.238	0.172

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	EL: Exp(B)	DK: Exp(B)	CZ: Exp(B)
Household type (6)	14.850	1.022	0.694
Household type (7)	18.685	0.947	0.488
Household type (8)	20.243	0.528	0.299
Household type (9)	8.873	–	–
Ownership (1)	0.581	1.038	1.554
Constant	1.220	315.408	17.846

Source: own processing of the EU-SILC dataset (Eurostat, 2022)

Table 4: Model quality assessment

	EL	DK	CZ
Nagelkerke R Square	0.311	0.525	0.386
The overall percentage of correctly predicted Anti-Poverty values	86.3	93.5	88.6

Source: own processing of the EU-SILC dataset (Eurostat, 2022)

There were differences in household income structures between the three representatives (differences shown in bold in the Table 3). The segment represented by Denmark is distinguished from other countries by the effect of the share of old-age pensions in household income. It shows that there was a higher chance of a sustainable income with an increasing share of old-age pensions in household income. This may indicate an appropriate setting of social policy instruments. Greece and Denmark do not confirm to the original model in terms of housing benefits, where housing allowances had a negative effect on sustainable income. In terms of investment, the conclusions of the overall model – that diversification in income and the inclusion of investments brought higher chances of sustainable income – were mostly confirmed. The most substantial positive effect of investment income components was found in the Czech Republic, where the probability of sustainable income increased 1.131 times with each additional percentage of investment income.

Savings had the most significant effect in Greece, where households with savings were 5.077 times more likely to have a sustainable income. In Greece, households with two adults and at least two children had the highest chances of earning a sustainable income. In Denmark, these were with two adults, one of whom was over 65, which did not live with children. In the Czech Republic, households with two adults and children had the highest chances of achieving sustainable income. In terms of home ownership, those households in the Czech Republic and Denmark that did not have a mortgage were 1.554 and 1.038 times more likely to have a sustainable income than mortgaged households.

V. Discussion and Conclusion

Using the results of the EU-SILC surveys, it is possible to draw conclusions on the issue of income structure and its impact on the sustainability of income of European households as one of the decisive factors of quality of life. The Anti-poverty binary variable was used as the determinant variable of sustainable income. The final binary logistic regression model consisted of variables influencing household income, with as much as 85% of correctly predicted values. The model shows that the strongest positive effect on sustainable income was found for the variable Savings. Households were up to 2.7 times more likely to achieve a sustainable income than the reference group, i.e. the households without savings. Also Wolf et al. (2022) verified a strong link of savings to sustainable income and the positive impact on living standards.

Iacono and Ranaldi (2021) observed the growth of capital and rental incomes in household income. According to Szymborska (2019), households with assets in real estate or financial investments occupied higher positions in the income distribution. The positive impact of investment income is also evident in this paper. However, the effect of investment income was not as high as we expected. The positive effect of Savings and Investment Income on household income sustainability can be distorted in the short term by irregular events (like economic crises) that undermine the regularity of saving (European Commission, 2011). However, in the longer term, investment income is part of sustainable household income. Inflation, which accompanies any crisis, also significantly impacts the amount and regularity of savings (Gopinath, 2020). According to Vanlaer et al. (2020), household saving behaviour is influenced by consumer confidence, which is lower in times of crisis and economic uncertainty. On the other hand, Fitzgerald et al. (2022) found that households' savings grew during the pandemic crisis because they had nowhere to spend during lockdowns. Levenko (2019) added that household savings were mainly affected by an uncertain future, which partly supported the need for this component in sustainable income over a longer period.

Conversely, the chances of a sustainable income decrease if social transfers (consisting primarily of old-age pensions and social benefits). Social income is an important support for households in case of poverty. According to the performed segmentation, the focus on the payment of specific social transfers as opposed to the payment of old-age pensions is more appropriate. In country segment 2, there is a noticeable focus on social benefits and at the same time the lowest poverty rate. The more appropriate orientation of social policy towards targeted social benefits is in accordance with the findings of Kluge (2019), D'Agostino et al. (2020) and Ebbinghaus (2021). The Household type also contributed to the sustainability of household income which is in line with Bartošová and Bína (2018). Households with two adults, one of whom was 65 or over, were the most likely of all EU citizens to have a sustainable income. Single-person households were the least likely to achieve a sustainable income. The influence of other socio-demographic factors such as gender (Corsi et al., 2016) or economic activity (Navarro and Salverda, 2019; Veneri and Murtin, 2019) on household income must be taken into account when designing effective social policy instruments.

The determining factors of income sustainability varied across segments, mainly due to different economic and social policy settings. For example, in segment 1 (represented by Greece), rental income slightly reduced the chance of achieving a sustainable income; however, the same factor had the opposite effect in other segments. This may have been influenced by the pandemic and the reduction in tourism, which were crucial to the Greek economy and household income (Komodromos, 2022; Zavras, 2021). Based on the results of the robustness analysis, the resulting model best fitted segment 2 represented by Denmark. The setting of social policy instruments was appropriate in this segment, as even the presence of old-age pensions in household income slightly increased the probability of living out of poverty. Thus, we can conclude that the parameters of social policies in these countries indicated their effectiveness. A deeper analysis of their structure can contribute to a positive development of the quality of life of the EU population. K-means cluster analysis used in the paper proved suitable for a deeper understanding of differences in social policies.

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