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DETERMINING POVERTY FACTORS USING LOGIT MODELS

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ABSTRACT

This study examines the factors of poverty across six European countries—three in Southern Europe (Greece, Spain, Portugal) and three in Central/Northern Europe (Germany, the Netherlands, Belgium)—using 2023 cross-sectional data from the EU Statistics on Income and Living Conditions (EU-SILC). Focusing on individuals aged 30 to 65, the analysis applies logistic regression to assess the impact of nine socioeconomic variables on the probability of living below the poverty line. The findings reveal that four factors—ability to afford a holiday, ability to cover unexpected expenses, access to a car, and participation in leisure activities—are statistically significant predictors of poverty in all countries examined. Notable differences are observed in the significance and magnitude of other variables, such as education level and social activity, highlighting the influence of national socioeconomic contexts. The results underscore the value of targeted, evidence-based social policies that address both shared and country-specific drivers of poverty.

KEYWORDS: - Poverty, Income, Economic Factorss, Logistic Regression, EU Silc.

1.0 INTRODUCTION

Over the years, numerous efforts have been undertaken to establish a universally accepted definition of poverty. A widely recognized conceptualization initially describes poverty as the inability of an individual to satisfy essential survival needs, including housing, nutrition, and other basic resources necessary for an adequate standard of living (Gordon, 2005). Relative poverty, on the other hand, is determined by an individual's income relative to the median income in their country of residence, typically defined as income below a certain percentage of the national average (Okalow, 2023).

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Other definitions have also emerged on the international stage, such as the poverty threshold set at $2.15 per day, a benchmark aimed at ensuring adults meet basic daily needs (Chen, 2024), and the Multidimensional Poverty Index (MPI), which accounts for various dimensions of deprivation beyond income alone (Global Multidimensional Poverty Index, 2022).

The European Union provides a comprehensive definition: "People are considered to be living in poverty if their income and resources are insufficient to maintain an acceptable standard of living within their societal context. Poverty often results in multiple disadvantages, including unemployment, low income, inadequate housing, limited access to healthcare, and barriers to lifelong learning, cultural activities, sports, and recreation. Consequently, impoverished individuals frequently experience exclusion and marginalization from typical societal activities (economic, social, and cultural) and may face restricted access to fundamental rights."

Several key factors influence the extent and severity of poverty. Economic factors, including wages, unemployment rates, and individual purchasing power, significantly affect poverty levels. Social factors such as gender, age, employment type, and education also play critical roles. Additionally, institutional and governmental factors, including a country's infrastructure quality, healthcare provision, and social welfare measures like pensions or remittances, substantially impact poverty (Myers, 2018). Finally, macroeconomic factors such as conflicts, pandemics, and climate change events have recently demonstrated their profound influence on poverty dynamics globally (Concern Worldwide, 2024).

Regarding the EU-SILC (European Union Statistics on Income and Living Conditions), this initiative involves the standardized collection of household and individual data, compliant with relevant legislation (European Commission, 2020). It notably includes information from the 27 EU member states and additional countries such as Norway, Switzerland, and Turkey. The data collected by EU-SILC covers both household and individual levels, categorized into four primary file groups: Household Register (D-File), Household Data (H-File), Personal Register (R-File), and Personal Data (P-File). The D-File and R-File map households and individuals, respectively, while the H-File and P-File contain specific survey data. Furthermore, EU-SILC data is structured into two temporal categories: cross-sectional data, providing snapshots at specific points in time, and longitudinal data, capturing changes over extended periods (European Commission, 2015).

2.0 LITERATURE REVIEW ON POVERTY AND REGRESSION MODELING

Poverty remains a significant issue across the globe, impacting social, economic, and political spheres. Its measurement, effects, and determinants have been the focus of intense studies.

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Regression analysis is one of the most popular methods of analysis in poverty studies, due to its ability to investigate relationships between poverty indicators and explanatory variables.
Poverty, often defined as the deprivation of basic human needs, has multifaceted dimensions including income poverty, capability deprivation, and social exclusion (Sen, 1999). Scholars emphasize the importance of understanding poverty beyond mere income measures, incorporating access to healthcare, education, sanitation, and housing (Alkire & Foster, 2011). This multidimensional perspective provides a richer framework for analyzing poverty.

Regression analysis is commonly employed to establish the determinants of poverty and predict its incidence. Linear regression equations have been the predominant poverty studies, analyzing continuous dependent variables such as income levels or poverty scores (Ravallion, 1996). More recent literature increasingly applies logistic regression and probit models in the estimation of binary outcomes, such as the probability of households falling under the poverty line (Wooldridge, 2010). There are many studies illustrating the usefulness of regression models in poverty dynamics analysis. Ravalli on and Chen (2004),for example, used regression methods to predict poverty trends based on household survey data and showed the effect of economic growth and distributional changes in poverty reduction.

Likewise, logistic regression models have been applied successfully in research analyzing the determinants of household and community poverty, where education, employment, family size, and geographical location have been established as significant factors (Bourguignon & Chakravarty, 2003).

For all their usefulness, regression models are not without limitations. Endogeneity, omitted variable bias, and multicollinearity issue soften call into question the validity of regression estimates. Scholars recommend advanced methods, such as instrumental variable methods and panel data analysis, to solve these methodological problems (Angrist & Pischke, 2009).

Current developments also acknowledge the application of mixed methods, integrating regression analysis with qualitative data, in order to further inform poverty mechanism insights (Tashakkori & Teddlie, 2010). Such integration provides policy applicability through detailed insight into the lived experience of poverty.

In summary, regression modeling is still a core method in poverty research, providing invaluable insight into its determinants and dynamics. Ongoing methodological innovation should out the prospect of even greater precision and success in reducing poverty through evidence-based policy intervention.

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3.0 METHODOLOGY OF THE RESEARCH

3.1 Data

In this study, we focus on six countries, three in southern Europe (Greece, Spain, Portugal) and three in northern Europe (Germany, the Netherlands, Belgium). The data are provided by Eurost at and in particular, by the survey on Income and Living Conditions (EU-SILC). More specifically, all data concern 2023, which was the most recent available data.

For the statistical modelling, we choose nine variables. Below we present the definitions based on the Methodological Guidelines and Description of EU-SILC Target Variables *(European Commission, 2023)* and Codebook EU-SILC 2021 cross-sec file 2021 *(Leibniz Institute for the social sciences, 2024).* So, the selected variables are:.

1. **HS040 – Ability to Afford a One-Week Holiday (Holiday)**
   Indicates whether the household can afford a one-week annual holiday away from home using its own resources or social networks. The answer is "YES" if all household members can afford it, even if they do not want to go. Reasons like lack of time are not accepted for a "NO" answer.

2. **PH040 – Unmet Need for Medical Examination or Treatment (Unmet med need)**
   Captures whether an individual needed medical examination or treatment but did not receive it, delayed it, or did not seek it due to significant barriers. This includes traditional and alternative healthcare professionals under national healthcare systems.

3. **HS060 – Ability to Handle Unexpected Expenses (Unexpected Spents)**
   Assesses whether the household could cover unexpected financial expenses using its own resources, without external help or incurring debt. Installment payments or loans do not count as self-resourced payments.

4. **PE041 – Educational Attainment Level (Educ 1/2/3/4)**
   Refers to the individual's highest level of completed education, classified into 24 categories ranging from no education to tertiary education, which were later grouped for analysis purposes.

5. **HS090 – Access to a Computer (Computer)**
   Determines if the household has access to a computer. "YES" includes rental, borrowing, or shared use if the access is sufficient. Lack due to financial reasons is considered "Not affordable."

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6. **HS110 – Access to a Car (Car)**
   Captures whether the household owns or has access to a car. Includes rental, borrowing, or shared cars if usage is unrestricted. Company cars for private use count, but professional-use-only vehicles and motorcycles are excluded.

7. **PD050 – Social Activity: Eating/Drinking Out (Food/Drink)**
   Indicates if the person goes out for a meal or drink with friends or family at least once a month. Financial or social exclusion is distinguished depending on the reason for non-participation.

8. **PD060 – Regular Leisure Activities or Hobbies (Leisure Act)**
   Observes whether the person participates in leisure activities regularly outside the home (e.g., sports, concerts, cinema). Activities must occur several times a year and usually involve some cost.

9. **PD080 – Internet Access at Home (Internet)**
   Indicates whether the individual has full personal-use internet access at home via any device. All personal needs must be met for the response to be "YES."

The variable HS040, HS060 and PH040 are binary (0-1) variables, and they are used as they are in the modeling. For the remaining variables, which have 3 levels, two dummy variables are created.

For the variable PE041 which concerns education, we convert the initial 24 categories into 5. More specifically, the categories selected were:

- The individual has not received any education (value 1 in the model)
- The individual is a primary school graduate (value 2 in the model)
- The individual is a high school graduate (value 3 in the model)
- The individual is a high school graduate and/or a vocational school (value 4 in the model)
- The individual has received education from a higher education institution (value 5 in the model)

As mentioned, the purpose of this work is to identify the factors that influence poverty in the 3 Mediterranean countries (Greece, Spain, Portugal) and the 3 Central European countries (Germany, Netherlands, Belgium). For this purpose, it was considered important to examine the ages between 30 and 65, as younger ages could be students, while older ages would likely include many retirees, which takes these social groups out of the productive total. Thus, from the

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total of 238.011 samples provided by Eurostat for the six countries in total, after the separation based on age, this number was limited to 115.089.

The target variable is the 'Poverty' and it is binary (0= above poverty line, 1=below poverty line). Therefore, a model with “Poverty” as dependent variable will reveal if the independent variables as statistically significant, thus they influence whether an individual is more likely to be below the poverty line. As the dependent variable is binary, the model used is the logistic regression (ref). The formula for logistic regression is:

$$P(Y) = \frac{1}{1 + e^{-(b_0 + b_1 X_1 + b_2 X_2 + \cdots + b_k X_k)}}$$

This equation says that the probability of an outcome, P(Y), can be predicted from a function of the variables, X_1, X_2,…,X_k.

4.0 RESULTS

For each country, the result of the modeling is presented in the following table. The Table 1 presents the beta coefficients (Odds) and their significance at a=5%.

Table 1: Aggregate Results

	Ελλάδα (5402)	Ισπανία (22427)	Πορτογαλία (9323)	Γερμανία (20934)	Ολλανδία (1946)	Βέλγιο (5740)
Holiday	4,408*	2,079*	1,670*	2,019*	2,461*	2,024*
Unexpected spents	1,276*	1,981*	1,724*	2,122*	2,662*	1,864*
Unmet med need	0,338*	1,095	0,678*	1,855*	0,759	0,732
Educ(1)	0,848	0,590*	0,786		0,955	0,721
Educ(2)	0,752	0,470*	0,526*	0,462*	0,471*	0,481*
Educ(3)	0,569	0,108*	0,334*	0,349*	0,853	0,135*
Educ(4)	0,557*	0,207*	0,230*	0,297*	0,371	0,308*
Computer	2,167*	1,274*	1,151	1,588*	2,228*	1,444*
Car	1,511*	2,285*	2,083*	2,682*	3,278*	2,531*
Food/Drink	1,212*	1,104*	1,671*	1,089	0,841	1,010
Leisure act	6,254*	1,340*	1,557*	1,407*	2,287*	3,316*
Internet	0,811	1,022	1,235*	1,341*	1,204	0,727

For our analysis, the significance level is chosen equal to a=5%>. Therefore, any variable with a p-value lower than 0.05 is considered statistically significant for the respective country. As for the Odds, these are given for each variable in the tables as Exp(B), and are essentially the ratio of the probabilities of one category being below the poverty line to the probabilities of the reference

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category being at the poverty line. The first category was chosen as the reference category. Thus, for each variable, the reference category is the one that takes the value '1'. Therefore, the denominator in the Odds each time is the probability of the reference category (with a value of 1) being at the poverty line. For all variables except PE041, the fraction is unique as they are binary, i.e. they take values 1 and 2. As for PE041, the results will give 4 fractions (Odds), as t[1]he chances of the individual belonging below the poverty line in the remaining categories with values 2,3,4 and 5 are divided by the chances of category 1.

Finally, due to the large volume of samples per country, any assumption that is necessary so that there is no weak point in the model (e.g. collinearity assumption) is met. Indicatively, the country with the smallest sample is the Netherlands with 1946 cases in the model. Despite the size of the initial sample which was 115089, because data from some cases per variable were missing, the final number of samples is 65772. Also, in the tables for each country, the sample number for each is indicated in parentheses.

Given the Table above it's concluded that:

- From the initial set of nine variables, four of them are statistically significant in all countries. These are Holiday, Unexpected Spends, Car and Leisure act.
- Starting with Holiday, while it gets odds from 1.67 to 2.461, in Greece the price reaches 4.408. This may mean that Greeks place more importance on being able to enjoy at least one week of vacation away from home in a year than the other five countries. On the contrary, the lowest number belongs to Portugal
- Moving on to the Car variable, the results show that the Odds value in every Central European country is higher than in every Mediterranean country. This probably suggests that the car may be a more integral part of life and everyday life for Central Europeans than for Mediterranean's. A similar conclusion cannot be drawn for computer access as the Odds values do not follow a similar or opposite pattern
- As for the Leisure Act, here too Greece has by far the highest Odds value (6.254) as the second highest is Belgium's 3.316 while the average of the remaining four is approximately 1.67. This could be an indication of a stronger desire to acquire a hobby/activity primarily for the residents of Greece and then Belgium compared to the other countries of interest
- Regarding the Internet, this was a statistically insignificant variable for four of the six countries, while for Portugal it was marginally statistically significant with Significance=0.049 (with a threshold of 0.05, 95% confidence level). This is likely due to

[1] The values of the odds of Table 1 with the asterisk (*) beside declare the statistically significant variables for each country

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the fact that access to the Internet is now very easy and an integral part of the life and everyday life of European citizens, which does not leave much room for someone not to use it.

- Interestingly, the Food/Drink variable is statistically significant in all three Mediterranean countries and none in any of the Central European countries. This suggests that either social ties with family or friends are stronger in Mediterranean countries or that these countries prioritize spending time and money on those close to them to some extent
- Finally, the education component provided several contradictory points between countries. Thus, in Greece, it appears that to reduce the likelihood of living below the poverty line compared to someone without a formal education, one must have at least a degree from a higher education institution. A possible translation of this is that in Greece either there is a gap in the labor market in such positions that require such a degree or that Greeks do not turn to jobs as unskilled workers. On the contrary, for the Netherlands, to have also less chance it is enough to be only a high school graduate. That is, probably the labor market in professions that require university education is saturated or the Dutch turn to a large extent to work as unskilled workers. Portugal and Germany presented the most expected results, as the higher the level of education, the lower the probability of living below the poverty line compared to someone who has not received any education. In conclusion, Spain and Belgium showed that every level of education is important in reducing the chances of living below the poverty line (compared to someone with no education) with the change compared to Germany and Portugal that a high school graduate is less likely to live below the poverty line than someone with a higher education (both using someone with no education as a comparison measure

5.0 DISCUSSION

This study's findings reveal a complex, dual-layered landscape of poverty determinants across Europe, characterized by both shared indicators and significant national variations. The universal statistical significance of the ability to afford a holiday, cover unexpected expenses, access a car, and participate in leisure activities suggests that these four factors represent a core set of material and social deprivations that consistently define poverty across diverse European socioeconomic contexts1. However, the analysis also uncovers distinct regional and national patterns that underscore the importance of local context in shaping the experience of poverty2. A clear regional divergence is evident in the finding that access to a car is a more critical poverty indicator in Central/Northern European countries, possibly reflecting a greater reliance on private transportation for daily life and employment3. Conversely, the significance of social dining in all three Mediterranean nations, but not in their northern counterparts, points to cultural differences where such activities may be more central to social integration4.

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Perhaps the most compelling evidence for country-specific dynamics lies in the variable impact of education. The results show no uniform relationship between educational attainment and poverty reduction; for instance, in Greece, only a higher education degree appears to offer a significant buffer against poverty, whereas in the Netherlands, a high school education is sufficient5555. This variability likely reflects deep-seated differences in national labor markets, wage structures, and the value placed on different skill levels6666. The exceptionally high odds ratios for leisure and holiday deprivation in Greece further suggest that the inability to participate in these common social customs is a particularly acute marker of exclusion in that specific cultural context7777. Ultimately, these findings support the conclusion that while broad anti-poverty strategies can be guided by common indicators, effective policy interventions must be finely tuned to address the unique social, cultural, and economic realities of each nation8.

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