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Determining factors affecting regional poverty levels in Türkiye: a comparison of ordered discrete choice models



Şeyda Ünver^{1*}, Ömer Alkan^{2,3*}, Ali Kemal Çelik⁴ and Hayri Abar^{5,6}

Abstract

Background This study aims to determine the factors affecting the poverty rate among the households in question by region, the western, central, and eastern regions underwent research separately.

Methods This study uses the ordered discrete choice models: the heteroskedastic ordered logistic regression, generalized ordered probit, and partial proportional odds models.

Results Based on the findings of the data, statistically significant relationships between the variables; age, gender, levels of education, marital status, the number of equivalent individuals within the household, the existence of individuals under the age of 5 within the household, the presence of individuals over the age of 65 within the household, working status, the number of working individuals within the household, financial difficulty, the presence of income generated through real estate (rent) or securities, residential homeownership, chronic diseases, and the year of data collection were spotted.

Conclusions Poverty is a multidimensional concept that can emerge due to several economic and social factors. Therefore, the policies that can be developed to reduce poverty can vary. To solve the problem of poverty, countries identify the factors that cause poverty and develop policies accordingly. Factors influencing household poverty levels across regions in Türkiye were identified, and several policy recommendations aimed to alleviate poverty were offered, considering the results achieved in this study. Given the results, Non-Governmental Organizations (NGOs) must implement practical projects that provide in-kind and cash assistance to those in need, offer employment opportunities, and improve the productivity of the impoverished. Continuous aid to the poor without expecting anything in return encourages them to be lazy, which may have a negative effect by increasing their dependency on getting help. In our country, an institutional monitoring mechanism should be established to measure the

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*Correspondence: Şeyda Ünver seyda.unver@atauni.edu.tr Ömer Alkan oalkan@atauni.edu.tr

Full list of author information is available at the end of the article



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effectiveness of the in-kind and cash aids provided by central government institutions, local governments, and various non-governmental organizations in the fight against poverty.

Keywords Poverty, Ordered models, Categorical data analysis, Household, Türkiye

Introduction

Comprehending poverty has been one of the most fundamental endeavors of humankind for centuries. The first definition of poverty was made by Seebohm Rowntree in 1901. Rowntree defined poverty as "a level of income that is inadequate to meet the minimum level of basic needs such as nutrition and housing/rent required to maintain physical activity" [1]. The World Bank defines poverty as the lack of sufficient resources or capabilities for households or individuals to meet their needs [2]. Similarly, the Turkish Statistical Institute describes poverty as the inability to satisfy basic human necessities [3]. In other words, poverty signifies a state of "lack", specifically the deprivation of essential material resources required to meet one's needs [4]. In general, poverty types have been defined as absolute, relative, rural, urban, subjective, objective, temporary, chronic, social exclusioncapability, ultra-poverty, mixed poverty, and new poverty. Townsend used the term relative poverty for the first time in the early 1960s in their book published in 1979. The relative poverty approach proposed by Townsend criticizes the absolute poverty approach and argues that poverty studies should be based on the average welfare level of society [5]. The UNDP defines relative poverty as the lack of income required to meet basic needs other than food, such as clothing, shelter, heating, energy, etc [6]. TurkStat, on the other hand, defines relative poverty as the case where individuals are below a certain percentage of the average welfare level of society. In other words, TurkStat considers individuals or households with income and expenditures below a certain threshold compared to the general level of the society relatively poor [3]. In the relative poverty approach, an individual is considered poor if they can meet their needs at an unacceptable level compared to what is considered normal [7]. The relative poverty threshold is a specific proportion of a society's average or median income/expenditure. This approach generally accepts half of the average or median income (or expenditure) as the poverty threshold. Individuals whose income or expenditure levels fall below this threshold are considered impoverished under the relative poverty definition [8].

A careful review of the Turkish literature reveals that poverty is associated not only with monetary factors such as income but also with non-monetary dimensions, including gender, age, and education [9]. Poverty represents a socioeconomic issue in Türkiye, creating various channels across the nation's social and economic foundations [10-12]. The Turkish economy is characterized by a significant dichotomy between its developed western and less developed eastern regions. F Dogruel and S Dogruel [13] highlighted the historical roots of regional disparities in Türkiye. At the same time, BC Karahasan [14] emphasized the persistence of this dichotomy and local diversity in regional convergence during the post-2000 period. These regional disparities and significant inequalities underline the importance of social policies for investigating poverty in Türkiye, a developing nation.

The distribution of natural and social resources over space is not equal in absolute terms. Therefore, economic and social development varies across time and space [15, 16]. This difference pushes advantageous places forward while leaving others behind [17]. It was seen that this case paved the way for the spatial inequality problem. This issue manifests not only between countries but also within the regions of a single country [18]. Regional development disparities remain a critical and unresolved challenge for Türkiye. For decades, regional differences have persisted in the country [14]. Geographically, Türkiye is located between Europe and Asia, suffering from the unequal distribution of resources and wealth in a west-east dichotomy. Considering the high welfare levels in Northern Europe and the relatively underdeveloped eastern and southern parts of Europe, Türkiye serves as a conceptual and geographical bridge. It is characterized by high-income provinces near European countries in the west and low-income provinces bordering Asia and the Middle East in the east. The eastern regions, predominantly landlocked and mountainous, are less developed in various respects than the country's western half. These geographic features inevitably lead to economic and social isolation, often resulting in negative agricultural productivity and diversity outcomes. However, regional disparities cannot be explained solely by geography. Other underlying causes of these differences can be institutionally shaped by a region's political, social, and cultural landscape. National and local economic policies also influence regional disparities. For instance, the externalities created by industrialization policies can be favourable for some regions but detrimental to others, leading to differing levels of industrial concentration. Similarly, trade policies impact the spatial shifts of economic activities [19].

Poverty studies on Türkiye have primarily been conducted on a country basis or sectoral and urban-rural basis. The common outcome of these studies is that poverty rates have been on a downward trend since the 1970s [20, 21]. However, considering that not all regions follow the same trend, it is essential to study this issue on a regional basis and develop region-specific policies. The present study aimed to compare the factors affecting the poverty level of households by region in Türkiye by applying ordered discrete choice models.

Discrete choice models analyze and predict a decisionmaker's selection from a comprehensive, finite set of alternatives [22]. When the dependent variable is categorical, three types of discrete choice models are used: binary, multinomial, and multivariate models [17, 23]. Multinomial models are applied when choices must be made among more than two alternatives, often referred to as multinomial regression models in the literature. These are extensions of binary choice models used when considering two alternatives [24, 25].

Multinomial discrete choice models are categorized into two types based on the dependent variable's structure: ordered and unordered. Ordered models include ordered logistic regression, generalized ordered logistic regression, partial proportional odds models, heteroskedastic ordered logistic regression, ordered probit models, generalized ordered probit models, and stereotype ordered regression models. Unordered models include multinomial probit, multinomial logit, conditional logit, mixed logit, nested logit, and cross-nested logit models. In cases where multiple alternatives exist, some dependent variables are inherently ordered [24]. Examples include evaluating students' understanding of a course through a letter grading system or assigning military personnel to duty classes based on their skills [26, 27]. With the increasing prevalence of categorical choice models, the application of models involving inherently ordered variables has expanded in the literature [28]. This study employs ordered discrete choice models, including the heteroskedastic ordered logistic regression, generalized ordered probit, and partial proportional odds models. The generalized ordered probit model is particularly suitable for relaxing the parallel curves assumption of standard ordered models by allowing differences in threshold values [29]. The partial proportional odds model is a specialized generalized ordered logistic model proposed as an alternative when the parallel curves assumption is violated [30]. The heteroskedastic ordered logistic regression model, a specific case of heterogeneous choice models, accommodates ordered dependent variables and provides a more flexible specification of the variance equation [31].

In the present study, the hypothesis questions focused on the poverty levels of households living in Türkiye according to regions were as follows:

Research question 1 Are the poverty levels of households differ depending on the region? **Research question 2** Is there a relationship between economic characteristics, housing characteristics, health, other indicators, sociodemographic characteristics of households, and poverty levels?

Research question 3 Are the factors associated with the poverty levels of households in regions with different levels of development the same?

Literature review

A literature review revealed that the research on poverty in Türkiye, aside from the measurement methods of poverty, primarily includes sociological examinations of poverty and the causes of poverty [32–35]. The primary purpose of the present research is the need for widespread poverty studies in Türkiye in terms of measurement and analysis. Socioeconomic factors affect the poverty level of households and create regional differences [36]. Different regions have different infrastructures, economies, and populations, resulting in an environmental location variation [37]. This, in turn, affects the differences in households' poverty levels across regions [38, 39].

More studies are needed on regional differences in poverty levels in Türkiye. Moreover, the literature on applying ordered discrete choice models and determining household poverty levels is limited. To the best of our knowledge, this is the first study to examine the factors affecting the poverty level of households by region using the ordered discrete choice model in the Turkish example, utilizing the most comprehensive data set regarding the number of observations. In this manner, the results may contribute to the existing literature on ordered discrete choice models.

Determinants that have an effect on the household poverty level can be classified as sociodemographic characteristics, energy use, environmental quality, assets (property ownership), ownership of durable goods, housing characteristics, environmental indicators, household composition, material deprivation indicators, financial constraints, financial conditions, healthy living indicators, and nutrition. Sociodemographic and socioeconomic characteristics comprise the demographic characteristics of the household head and other household-related characteristics.

The age of the head of the household stands out as a variable affecting the poverty level in previous research. The household head's age is a vital demographic factor related to poverty [40]. Previous research has reported that as the age of the household head advances, the poverty rate decreases [40–43]. Contrary to these results, some previous studies have reported that the probability of being poor is highest in the group of individuals aged 64 and over when age groups are examined [44–46]. On

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the other hand, some previous research has found no statistically significant relationship between poverty and age [47, 48].

The gender of the household head has been identified as another sociodemographic variable affecting the poverty level in previous research. Researchers have examined various issues related to the relationship between poverty and gender [49, 50]. Many previous studies have reported that households with female heads are more likely to be poor than households with male heads [48, 51, 52]. Unlike these results, another study found no evidence that female headship increases poverty [53].

In the literature, marital status has been regarded as another determinant that may affect the level of poverty. Since the pioneering research by M Bane [54], LJ Waite [55], and L White and SJ Rogers [56], the marital status of the household head has been recognized as the most crucial effect of family structure on poverty. Previous research examining individuals' marital status showed that the group with the highest risk of being poor was married individuals [41, 51]. Another research concluded that married, divorced, or separated individuals were more likely to be poor than single individuals [57]. Contrary to these results findings, some other previous researchers have found that being divorced, being never married, and being single significantly increase the likelihood of being poor [58–60].

Previous research identified education as another sociodemographic variable affecting poverty levels. R Gounder and Z Xing [61] argued that education is generally accepted as an outcome and instrument of poverty reduction. Previous research reported that poverty tends to be inversely related to education level [51, 58, 59, 62]. Another study found that the probability of being poor is high in households where the education level of the household head's spouse is low [44].

The dependency ratio stands out as another sociodemographic variable that has an effect on the poverty level in previous studies. The dependency ratio shows the ratio of young (<15 years) and old (>65 years) unemployed individuals in a household to actively employed individuals (15–65) in a household [40]. Previous research has concluded that a higher dependency ratio leads to a higher incidence of poverty [63, 64]. B Shaukat, SA Javed and W Imran [40] reported that a household with a lower dependency ratio is less likely to be poor with more adults and fewer children. The present study stated that the higher the number of working adults in a given family, the less likely the family is to fall into poverty.

The literature, among the variables related to the labor market, reported full-time jobs, part-time jobs, permanent and temporary jobs, sector by activity code, current activity status, and employment status (wage, casual, employer) as other determinants that may have an effect on the poverty level. N Evcim, S Güneş and HS Karaalp-Orhan [41] set the reference group for the current activity status variable as the employees. The researchers found that the risk of being poor was 1,705-fold higher for jobseekers and 1,382-fold higher for retired people than those currently employed. Another study has reported that part-time jobs were associated with a 4.5-fold higher poverty risk for men and 3.1 times higher poverty risk for women. Also, comparing permanent and temporary employment, temporary jobs increased the probability of poverty 5.7-fold for men and 4.6-fold for women [65]. These job characteristics were found to be critical determinants of employees' economic status, as reported in previous research [50, 66].

Environmental quality factors affecting households' poverty levels include access to clean water, sanitation, air, and other environmental problems. Previous research has reported that 30% of individuals living in urban areas were exposed to air and other environmental problems. In rural areas, this ratio was 10%. Also, this research concluded that those living in rural areas might need help accessing health services and necessary support services due to remoteness to health centers and lack of appropriate infrastructure [67, 68]. A Pienkhuntod, C Amornbunchornvei and P Nantharath [69] stated that results from countries worldwide showed that the two essential ways in which environmental quality had a negative effect on the health of people experiencing poverty were water and indoor air pollution. Reducing poverty and improving environmental quality are two fundamental objectives of the Sustainable Development Goals [70]. In Türkiye, the increased use of low-quality fuels in urban areas, linked to poverty, has led to a rapid rise in urban air pollution. Access to water resources and water pollution are significant issues arising from the discharge of waste into aquatic environments in both rural and urban areas, as well as from the contamination of water with chemical fertilizers and pesticides used in agriculture. Groups such as farmers and fishermen are disproportionately affected by pollution [71].

In the literature, material deprivation indicators are among the determinants that can affect household poverty levels. Previous research found a negative relationship between the benefit level of social assistance and material deprivation [72]. Another study reported that the age of the household head, educational attainment, and household type are essential determinants of material deprivation [73]. Another research concluded that long-term unemployment ratios have a significant effect on material deprivation when only macro variables are taken into account. However, this effect disappears when micro variables are considered [74]. Ş Ünver and Ö Alkan [75] reported that individuals with low education and income levels, poor health status, married and unemployed are more likely to experience material deprivation.

Homeownership is another sociodemographic variable affecting the poverty level in previous research. A Acar, B Anil and S Gursel [76] found that homeownership reduces the likelihood of individuals being poor. Another study reported that homeownership decreased the probability of being multidimensionally poor [77]. Housing characteristics are another variable affecting the poverty level in previous research. One previous study reported that one-person households, those with low educational attainment, those with a migrant background, and those living in areas with high rental prices were at higher risk of falling into relative income poverty due to housing costs [78]. Another stated that a smaller space could lead to health or psychological problems, such as a lack of privacy [79]. J Yildirim, MA Bakır and A Savas [80] found that approximately 22% of detached and semi-detached housings do not have a bathroom; approximately 8% do not have a kitchen; 35% lack water heating; and 5% do not have a piped water system. The researchers associated this result with the fact that low income may prevent households from accessing assets and housing amenities that improve the standard of living. O Ozdamar and E Giovanis [81] stated that those who did not report problems with a leaky roof, damp walls or rotting window frames, problems with heating in the housing, and those who were not exposed to pollution or other environmental problems were expected to have significantly better health.

The literature reports that healthy living indicators are among the determinants that may affect household poverty levels. F Karim, A Tripura, M Gani and A Chowdhury [82] found that the proportion of moderately poor mothers (34.6%) who were ill in their last pregnancy and received treatment from qualified/trained doctors was lower than that of extremely poor (50%) and nonpoor (72%). A Pienkhuntod, C Amornbunchornvei and P Nantharath [69] argued that smoking or tobacco use is not only a household income burden but also a leading risk factor for health problems. P Torabi Kahlan, H Navvabpour and A Bidarbakht Nia [83] reported domestic violence as one of the most important determinants of poverty in rural areas. The literature reported that there are many studies on violence against women and girls, time poverty, and power poverty, which are known to exist in the gender inequality literature and have been investigated mainly in qualitative research and using small-scale surveys [84, 85]. A previous study in Türkiye concluded that economic violence against women increases poverty among women in all societies [86]. In a similar vein, Ö Alkan and Ş Ünver [87] stated that poverty is one of the social factors affecting physical violence against women in Türkiye.

Materials and methods

To utilize in the implementation phase of the present study, necessary official correspondences were carried out, and the Income and Living Conditions Survey micro datasets for the years 2014–2019 were provided. There were three separate data sets in the Income and Living Conditions Survey (Household, Individual, and Individual Registration). All variables in the Individual and Individual Registration datasets were combined in the Household dataset. The data were not filtered. The data include no extreme values since the data consists of categorical variables. Any extreme cases are represented by the highest or lowest category. All observations in the dataset were utilized for analysis.

In the household data set, the equivalent household usable income variable was provided from the total household usable income variable. First, the variable of an equivalent number of individuals in the household was created to establish the equivalent household disposable income variable. The age of the individual variable in the Individual Registration dataset was used to create the equivalent number of individuals in the household. The Individual Registration dataset contains the age data of all household individuals. According to the number of individuals in each household, the variable of the equivalent number of individuals was created. The weight of each member in the household varies according to their age when calculating the equivalent number of members in the household variable. The head of the household receives a coefficient of 1, the adult (aged 14 and above) receives a coefficient of 0.5, and the individual aged 13 and below receives a coefficient of 0.3. For instance, in a 4-person household with two children, the equivalent number of household members would be 2.1 (1+0.5+0.6). The total household disposable income variable is divided by the equivalent number of individuals in the household to obtain the equivalent household disposable income variable. Thereby, by determining the equivalent household disposable income for all individuals in the Individual Registration dataset, the median value of the equivalent household disposable income variable created in the Individual Registration dataset was calculated.

The study's data for 2014–2019 was employed, as TurkStat started to provide data based on geographical regions as of 2014. The Statistical Regional Unit where individuals live is given in the Statistical Regional Units. Türkiye is divided into 26 regions at Level 2 under the Classification of Statistical Regional Units [88]. The present study grouped these regions as Western, central, and Eastern. These regions and the provinces in these regions are shown in Table 1. Each region was analyzed

Area	Code	Province
Western	TR10	İstanbul
Region (1)	TR21	Tekirdağ, Edirne, Kırklareli
	TR22	Balıkesir, Çanakkale
	TR31	İzmir
	TR32	Aydın, Denizli, Muğla
	TR33	Manisa, Afyon, Kütahya, Uşak
	TR41	Bursa, Eskişehir, Bilecik
	TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova
	TR61	Antalya, Isparta, Burdur
Central	TR51	Ankara
Region (2)	TR52	Konya, Karaman
	TR62	Adana, Mersin
	TR63	Hatay, Kahramanmaraş, Osmaniye
	TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
	TR72	Kayseri, Sivas, Yozgat
	TR81	Zonguldak, Karabük, Bartın
	TR82	Kastamonu, Çankırı, Sinop
	TR83	Samsun, Tokat, Çorum, Amasya
Eastern	TR90	Trabzon, Ordu, Giresun, Rize, Artvin,
Region (3)		Gümüşhane
	TRA1	Erzurum, Erzincan, Bayburt
	TRA2	Ağrı, Kars, Iğdır, Ardahan
	TRB1	Malatya, Elazığ, Bingöl, Tunceli
	TRB2	Van, Muş, Bitlis, Hakkâri
	TRC1	Gaziantep, Adıyaman, Kilis
	TRC2	Şanlıurfa, Diyarbakır
	TRC3	Mardin, Batman, Şırnak, Siirt

 Table 1
 Statistical classification of territorial units-level 2

separately to determine the factors affecting the poverty level of households by region.

Measures and variables

TurkStat, in their poverty study, established the incomebased poverty line by employing a certain proportion (40%, 50%, 60%, or 70%) of the median income per equivalent Individual according to the LFPR data [89]. Previous research established the income-based poverty line utilizing 40%, 50%, 60%, and 70% of the median income per equivalent Individual [90–92]. In all models established in the present study, the poverty level variable, which was used as the dependent variable, was created according to these ratios. The poverty level variable was created by grouping households into five categories: below 40% of median income (the poorest group), 40-50% of median income (2nd poverty category), 50-60% of median income (3rd poverty category), 60-70% of median income (4th poverty category) and above 70% of median income (non-poor group). Households below 40% of the median income are the poorest, whereas households above 70% are non-poor. The present study adopted ordered logistic regression models to examine the effect of various factors available in the LRP data set for each category of the poverty level. The independent variables that may affect the poverty levels of the households used in the study were evaluated in four categories, following the independent variables used in previous research. Some categories of independent variables closely related to each other were combined to be suitable for all models and avoid multicollinearity. The independent variables used in the study are age, sex, education level, marital status, the number of equivalent members in the household, presence of individuals aged 5 and under in the household, presence of individuals aged 65 and above in the household, the combination of children, employment status, the number of employed individuals in the household, financial problems, receiving monetary or in-kind child support, presence of income from real estate (rent) or securities, residence ownership, the number of rooms in residence, chronic diseases, and year.

Research method

Survey statistics in Stata 15 (Stata Corporation) were used to account for the complex sampling design and weights. Weighted analysis was performed. The ordered discrete choice models used in the present study are the ordered logistic regression model, generalized ordered logistic regression model, partial proportional odds model, heteroskedastic ordered logistic regression model, ordered probit model, generalized ordered probit model, and stereotype ordered regression model.

Results

Descriptive statistics

Frequencies and percent results for the dependent variable are given in Table 2 and for the independent variables in Table 3 according to the region of residence in Türkiye.

Table 2 Descriptive statistics of dependent variables

Dependent variable:	Western Region (n = 59,579)		Central Region (n = 46,639)		Eastern Region (<i>n</i> = 33,489)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Lower than 40% of the median income (the poorest group)	1,776	3.0	2,502	5.4	5,479	16.4
40–50% of the median income	1,713	2.9	2,224	4.8	3,526	10.5
50–60% of the median income	2,503	4.2	2,818	6.0	3,396	10.1
60–70% of the median income	3,330	5.6	3,377	7.2	2,974	8.9
Higher than 70% of the median income (non-poor group)	50,257	84.4	35,718	76.6	18,114	54.1

Neither good nor bad

Independent Variables **Central Region** Western Region **Eastern Region** (n = 59, 579)(n = 46, 639)(n = 33, 489)f % f % f % Sociodemographic Characteristics Age 15-34 10,195 17.1 7,287 15.6 6,433 19.2 35-54 26.990 45.3 21.146 45.3 15,775 47.1 55 and higher* 39 33.7 22,394 37.6 18,206 11,281 Male* Sex 47,700 80.1 37,913 81.3 28,710 85.7 Female 19.9 14.3 11,879 8,726 18.7 4,779 Education Level Elementary and below* 64.9 30,773 66 24,261 72.4 38,661 High school and above 20,918 35.1 15,866 34 9,228 27.6 Marital Status Single* 15.2 12,997 21.8 9,112 19.5 5,085 84.8 Married 46.582 78.2 37.527 80.5 28,404 Number of equiva-1-2.5 52,739 88.5 38,798 83.2 20,915 62.5 lent members in the 2.6 and higher* 6,840 11.5 7,841 16.8 12,574 37.5 household 47,367 79.5 35,708 76.6 63 Presence of individuals No* 21,085 aged 5 and under in the Yes 12,212 20.5 10,931 12,404 37 23.4 household Presence of individuals No* 45.679 76.7 34,924 74.9 25,491 76.1 aged 65 and above in Yes 13,900 23.3 11,715 25.1 7,998 23.9 the household Child combination Households with no children* 54.5 49.9 34.8 32,465 23,255 11,651 Household with only a girl child 8.848 14.9 6,964 14.9 4,735 14.1 Household with only a boy child 9,852 16.5 7,832 16.8 5,689 17 Households with both male and 8,414 14.1 8,588 18.4 11,414 34.1 female children **Economic Status Employment Status** No* 22,970 38.6 18,557 39.8 12.099 36.1 63.9 Yes 36,609 61.4 28,082 60.2 21,390 Number of employed No employee* 15,509 26 13,017 27.9 7,639 22.8 individuals in the 1 employee 24,543 41.2 19,787 42.4 15,726 47 household 2 and higher 19,527 32.8 13,835 29.7 10,124 30.2 Financial Problem No* 43,334 72.7 33,140 71.1 19,234 57.4 Yes 16,245 27.3 13,499 28.9 14,255 42.6 Monetary or in-kind No* 57,316 96.2 44,049 94.4 26,323 78.6 child support Yes 2,263 3.8 2,590 5.6 21.4 7,166 Presence of income No* 34,227 57.4 60.5 22,685 67.7 28,209 from real estate (rent) or Yes 25,352 10,804 32.3 42.6 18,430 39.5 securities **Residential Properties** Residence Possession 25,919 43.5 17,744 38 11,987 35.8 No* Yes 33,660 56.5 28,895 62 21,502 64.2 The Number of Rooms Two or below* 5,175 8.7 3,506 7.5 4,607 13.8 in the Residence 44.9 31.8 3 26,724 14,849 12,431 37.1 4 and higher 27,680 49.1 46.5 28,284 60.6 16,451 **Health and Other Parameters** Chronic Diseases No* 34,912 58.6 25,623 54.9 19,516 58.3 Yes 24,667 41.4 21,016 45.1 13,973 41.7 Health Status 18.3 Poor/Very Poor* 6,220 10.4 6,192 13.3 6,125 Good/Very Good 37,100 62.3 26,918 57.7 18,896 56.4

16,259

27.3

29

13,529

8,468

25.3

Table 3 Descriptive statistics of independent variables

Independent Variables		Western Re (<i>n</i> = 59,579	Western Region (<i>n</i> = 59,579)		Central Region (n=46,639)		egion 9)
		f	%	f	%	f	%
Year	2014*	9,566	16.1	7,637	16.4	5,532	16.5
	2015	9,716	16.3	7,575	16.2	5,458	16.3
	2016	9,794	16.4	7,558	16.2	5,066	15.1
	2017	9,906	16.6	7,634	16.4	5,309	15.9
	2018	10,241	17.2	8,017	17.2	5,796	17.3
	2019	10,356	17.4	8,218	17.6	6,328	18.9

Note * Indicates the categories taken as reference for the relevant variable

According to Tables 2 and 3% of the households with a median income of less than 40% are from the Western, 5.4% from the central, and 16.4% from the eastern regions. In the households with a median income between 40% and 50%, 2.9% were from the western, 4.8% from the central, and 10.5% from the eastern region. In the households with a median income between 50% and 60%, 4.2% were from the western, 6% from the central, and 10.1% from the eastern regions. In the households with a median income between 60% and 70%, 5.6% were from the Western, 7.2% from the central, and 8.9% from the eastern regions. In the households with a median income of more than 70%, 54.1% were from the Eastern, 76.6% from the central, and 84.4% from the western region.

Table 3 shows that approximately 47% of the household heads in the 35–54 age group are from the eastern region. Approximately 86% of the household heads in the eastern region are male. Examining Table 4, approximately 35% of the household heads in the western region have a high school education level and above. In comparison, approximately 72% of the household heads in the eastern region have an elementary education level and below. Also, the marital status of approximately 20% of the household heads in the central region is single. In comparison, the marital status of about 85% of the household heads in the eastern region is married. Evaluating Table 3, approximately 12% of the households in the western region have 2.6 or more equivalent members, while approximately 38% of the households in the eastern region have 2.6 or more equivalent members. Examining Table 3, approximately 55% of households without children are from the Western region, while approximately 34% of households with male and female children are from the Eastern region. Approximately 64% of households in the eastern region are employed, while approximately 39% of households in the central region are not employed. Approximately 28% of the households in the central region have no employed members, while 33% of the households in the western region have two or more employed members.

Model estimation

Examining the comparison criteria of the models used in the study, the model with the lowest AIC and BIC values of the regression models and the model with the largest Pseudo R^2 value is the best. In the model established for the Western region, the best model was found to be the Heteroskedastic Ordered Logistic Regression model. In the model for the Central region, the best model is the Generalized Ordered Probit Regression model. In the model for the Eastern region, the best model is the Partial Proportional Odds model. Therefore, only the analysis results of the best models will be interpreted in the present study.

To ensure robustness and consistency, a variety of models were estimated and compared, including "the ordered logistic regression model, the generalized ordered logistic regression model, the partial proportional odds model, the heteroscedastic ordered logistic regression model, the ordered probit model, the generalized ordered probit model, and the stereotype ordered regression model". The parallel lines assumption was applied to standard ordered models, and for the standard ordered logistic regression model, which did not satisfy the Brant test, alternative ordered models that do not require this assumption were estimated. Multicollinearity among independent variables was assessed, and no significant multicollinearity issues were detected.

The estimation coefficients of the best models for the western and central regions are given in Table 4. Table 4 indicates that the estimation results of the Heteroskedastic Ordered Logistic Regression model for the western region were significant for the following variables: education level, marital status, the number of equivalent members in the household, presence of individuals aged 5 years and younger in the household, presence of individuals aged 65 years and older in the household, the combination of children, the number of working individuals in the household, financial problems, receiving monetary or in-kind child support, presence of income from real estate (rent) or securities, ownership of the housing, the number of rooms in the housing, chronic diseases, health status, and year. Table 4 shows the estimation coefficients

Independent Variables					
independent variables		Threshold value	Thrashold value	Thrachold value	Threshold value
	Coemcient	between 1	between 2	between 3	between 4 and 5
Sociodemographic Characteristics			unu s		
Age (Reference: 55 ±)					
15 24	0.027	0 1528	0 1003	0.178	0.21/8
25 54	-0.027	0.100	0.100	0.17	0.214
Education (Poference: Elementary and be	-0.004	-0.120	-0.10	-0.107	-0.139
High school and above	0 E00 ³	0 46 48		0 6653	0 7 2 7 3
High school and above	0.599	0.404	0.59	0.005	0.757
Marital Status (Reference: Single)	0.2003	0.1003	01158	0 1728	0.2.4.28
Married	-0.398	-0.189	-0.115	-0.173	-0.242
Sex (Reference: Male)	0.000	0.01	0.001	0.017	0.010
Female	-0.082	0.01	0.031	0.017	0.012
Number of equivalent members in the ho	usehold (Reference:	1-2.5)	2	>	
2.6 and higher	-0.523ª	-0.511ª	-0.49ª	-0.439ª	-0.404ª
Presence of individuals aged 5 and under	in the household (Re	ference: No)			
Yes	-0.098 ^a	-0.022	-0.06 ^d	-0.069 ^a	-0.059 ^b
Presence of individuals aged 65 and abov	e in the household (F	Reference: No)			
Yes	-0.092 ^b	-0.053	-0.077 ^a	-0.077 ^a	-0.065 ^a
Child combination (Reference: Household	without children)				
Household with only a girl child	-0.659 ^a	-0.042	-0.184 ^a	-0.328 ^a	-0.435 ^a
Household with only a boy child	-0.612 ^a	-0.11 ^b	-0.219 ^a	-0.352 ^a	-0.465 ^a
Households with both male and female	-0.987 ^a	-0.272 ^a	-0.448 ^a	-0.629 ^a	-0.748 ^a
children					
Economic Status					
Employment Status (Reference: No)					
Yes	0.063	0.007	-0.017	-0.044	-0.035
Number of working individuals in the hou	isehold (Reference: N	lo employee)			
1 employee	0.486 ^a	0.517 ^a	0.492 ^a	0.471 ^a	0.444 ^a
2 and higher	1.111 ^a	0.649 ^a	0.713 ^a	0.77 ^a	0.811 ^a
Financial distress (Reference: No)					
Yes	-0.325 ^a	0.359 ^a	-0.372 ^a	-0.378 ^a	-0.387 ^a
Monetary or in-kind child support (Refere	nce: No)				
Yes	-0.497 ^a	-0.668 ^a	-0.674 ^a	-0.66 ^a	-0.619 ^a
Presence of income from real estate (rent)	or securities (Refere	nce: No)			
Yes	0.475ª	0.444 ^a	0.455ª	0.457 ^a	0.461 ^a
Residential Properties					
Residential homeownership (Reference: N	lo)				
Yes	0 35 ^a	0.213 ^a	0.227 ^a	0.246 ^a	0.264 ^a
The Number of Rooms in Residence (Refe	rence: 2 or below)	0.215	0.227	0.2 10	0.201
		0.461a	0.47a	0.483a	0.447 ^a
4 and higher	0.655ª	0.788ª	0.47	0.4029	0.8039
Health and Other Parameters	0.055	0.766	0.055	0.092	0.095
Chronic Discossos (Poference: No)					
Chronic Diseases (Reference: NO)	0.1013	0.025	o o=b	0.0.455	0.010
Yes	0.121	0.035	0.075	0.046°	0.012
Health Status (Reference: Poor/Very Poor)	3	>			2
Good/Very Good	0.529°	0.41/ª	0.418ª	0.384°	0.383°
Neither good nor bad	0.356°	0.279°	0.281°	0.278°	0.29°
Year (Reference: 2014)					
2015	-0.034	-0.014	-0.005	-0.001	-0.03
2016	-0.051	-0.001	-0.028	-0.01	-0.028
2017	-0.106 ^b	0.042	0.03	0	-0.042
2018	-0.086 ^c	-0.079 ^c	-0.062 ^c	-0.068 ^b	-0.077 ^a
2019	-0.006	-0.088 ^b	-0.073 ^b	-0.085 ^a	-0.093 ^a

 Table 4
 Coefficient results for the best models for the west and central region

Independent Variables	HOLOGIT	GOPROBIT						
	Coefficient	Threshold value between 1 and 2	Threshold value between 2 and 3	Threshold value between 3 and 4	Threshold value between 4 and 5			
Fixed Term		0.717 ^a	0.293 ^a	0.033	-0.181			
Cut-off Point 1	-1.817 ^a							
Cut-off Point 2	-1.229 ^a							
Cut-off Point 3	-0.739 ^a							
Cut-off Point 4	-0.315 ^a							

Table 4 (continued)

^ap < 0.01; ^bp < 0.05; ^cp < 0.10; HOLOGIT: Heteroskedastic ordered logistic regression model; GOPROBIT: Generalized ordered probit model 1: Lower than 40% of the median income (the poorest group); 2: 40–50% of the median income; 3: 50–60% of the median income; 4: 60–70% of the median income; 5: More than 70% of the median income

of the generalized ordered probit model for the central region. Evaluating the estimation results of the generalized ordered probit regression model, age, education level, marital status, the number of equivalent members in the household, presence of individuals aged 5 years and younger in the household, presence of individuals aged 65 years and older in the household, the combination of children, the number of employed individuals in the household, financial problems, receiving monetary or in-kind child support, presence of real estate (rent) or securities income, ownership of the residence, the number of rooms in residence, chronic diseases, health status, and year variables were found to be significant.

The estimation coefficients of the ordered regression models for the eastern region are given in Table 5. Examining the estimation results of the Partial Proportional Odds model in Table 5, the variables of age, educational attainment, marital status, the number of equivalent members in the household, presence of individuals aged 5 and below in the household, the combination of children, employment status, the number of employed individuals in the household, financial problems, receiving monetary or in-kind child support, presence of income from real estate (rent) or securities, ownership of the residence, the number of rooms in residence, chronic diseases, health status and year are significant were found to be significant.

As the coefficient values in Tables 4 and 5 only give an idea about the direction of the relationship between the dependent and independent variables, the best models for the western, central, and eastern regions, namely the heteroskedastic ordered logistic regression model, the generalized ordered probit regression model, and the partial proportional odds model, respectively, are interpreted based on the marginal effect values calculated in Tables 6 and 7, and 8.

In the study, the Variance inflation factor (VIF) values of the independent variables in the models established for the western, central, and eastern regions were tested for multicollinearity in the model. VIF values of 5 and above cause moderate multicollinearity, while 10 and above cause high multicollinearity [93]. Tables 6 and 7, and 8 show the VIF values of the study. In the present study, no variables cause multicollinearity among the variables.

According to the Heteroskedastic Ordered Logistic Regression Model given in Table 6, the probability of a household in the western region with a household head in the 15-34 age group to be in the poorest group is 47.3% higher than the reference group (households with a household head aged 55 years and above). In contrast, the probability of being in the non-poor group is 1.9% lower than the reference group. The probability of being in the poorest group is 144.2% lower than the reference group (households with a household head with primary education or below). The probability of being in the nonpoor group is 14.3% higher than the reference group. A household with a married head is 36.7% less likely to be in the poorest group than the reference group (household with a single head of household) and 5.3% less likely to be in the non-poor group than the reference group. Table 6 shows that a household with a married head of household is 8.5% more likely to be in the 3rd poverty category than the reference group and 18.2% more likely to be in the 4th poverty category than the reference group.

A household with a female head is 27.8% less likely to be in the poorest group than the reference group (household with a male head) and 14.3% less likely to be in the 2nd poverty category than the reference group. A household with 2.6 or more equivalent members is 65.5% more likely to be in the poorest group than the reference group (household with 1-2.5 equivalent members). In comparison, the probability of being in the non-poor group is 10.6% fewer than in the reference group. A household with individuals aged 5 and under is 20.2% less likely to be in the poorest group than the reference group (household with no individuals aged 5 and under) and 0.1% less likely to be in the non-poor group than the reference group. A household with a member aged 65 and over is 49.6% more likely to be in the poorest group than the reference group (households with no member aged 65 and over). In comparison, the probability of being in the non-poor group is 3.1% less than the reference group. A

Table 5 Partial proportional odds model coefficient results for the eastern region

Independent Variables	PPO						
	Threshold value be- tween 1 and 2	Threshold value be- tween 2 and 3	Threshold value be- tween 3 and 4	Thresh- old value between 4 and 5			
Sociodemographic Characteristics							
Age (Reference: 55 +)							
15–34	-0.319 ^a	-0.319 ^a	-0.319 ^a	-0.319 ^a			
35–54	-0.231 ^a	-0.231 ^a	-0.231 ^a	-0.231 ^a			
Education (Reference: Elementary and below)							
High school and above	0.873 ^a	0.993 ^a	1.058 ^a	1.19 ^a			
Marital Status (Reference: Single)							
Married	-0.322 ^a	-0.347 ^a	-0.342 ^a	-0.472 ^a			
Sex (Reference: Male)							
Female	-0.012	-0.012	-0.012	-0.012			
Number of equivalent members in the household ((Reference: 1-2.5)						
2.6 and higher	-1.255 ^a	-1.26 ^a	-1.14 ^a	-1.061 ^a			
Presence of individuals aged 5 and under in the ho	usehold (Reference: No)						
Yes	-0.121 ^a	-0.121 ^a	-0.121 ^a	-0.121 ^a			
Presence of individuals aged 65 and above in the h	ousehold (Reference: No)					
Yes	0.05	0.05	0.05	0.05			
Child combination (Reference: Household without	children)						
Household with only a girl child	-0.233 ^a	-0.272 ^a	-0.5 ^a	-0.613 ^a			
Household with only a boy child	-0.223 ^a	-0.312 ^a	-0.518 ^a	-0.657 ^a			
Households with both male and female children	-0.667 ^a	-0.83 ^a	-1.018 ^a	-1.191 ^a			
Economic Status							
Employment Status (Reference: No)							
Yes	0.234 ^a	0.052	0.035	0.095 ^c			
Number of working individuals in the household (F	Reference: No employee)						
1 employee	1.08 ^a	1.113 ^a	0.964 ^a	0.873 ^a			
2 and higher	1.611 ^a	1.792 ^a	1.732 ^a	1.738 ^a			
Financial distress (Reference: No)							
Yes	-0.431 ^a	-0.515 ^a	-0.585 ^a	-0.622 ^a			
Monetary or in-kind child support (Reference: No)							
Yes	-1.175 ^a	-1.175 ^a	-1.175 ^a	-1.175 ^a			
Presence of income from real estate (rent) or secur	ities (Reference: No)						
Yes	0.668 ^a	0.668 ^a	0.668 ^a	0.668 ^a			
Residential Properties							
Residential homeownership (Reference: No)							
Yes	0.295 ^a	0.295 ^a	0.295 ^a	0.295 ^a			
The Number of Rooms in Residence (Reference: 2 c	or below)						
3	0.663 ^a	0.663 ^a	0.663 ^a	0.663 ^a			
4 and higher	1.148 ^a	1.241 ^a	1.267 ^a	1.257 ^a			
Health and Other Parameters							
Chronic Diseases (Reference: No)							
Yes	0.101 ^c	0.185 ^a	0.23 ^a	0.198 ^a			
Health Status (Reference: Poor/Very Poor)							
Good/Very Good	0.596 ^a	0.596 ^a	0.596 ^a	0.596 ^a			
Neither good nor bad	0.297 ^a	0.297 ^a	0.297 ^a	0.297 ^a			
Year (Reference: 2014)							
2015	-0.037	-0.037	-0.037	-0.037			
2016	-0.148 ^a	-0.148 ^a	-0.148 ^a	-0.148 ^a			
2017	0.044	-0.095	-0.121 ^b	-0.098 ^c			
2018	-0.208 ^a	-0.208 ^a	-0.208 ^a	-0.208 ^a			
2019	-0.257 ^a	-0.257 ^a	-0.257 ^a	-0.257 ^a			

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Table 5 (continued)

Independent Variables	PPO							
	Threshold value be- tween 1 and 2	Threshold value be- tween 2 and 3	Threshold value be- tween 3 and 4	Thresh- old value between 4 and 5				
Fixed Term	1.161	0.389 ^a	-0.168	-0.579 ^a				
Cut-off Point 1								
Cut-off Point 2								
Cut-off Point 3								
Cut-off Point 4								

^ap<0.01; ^bp<0.05; ^cp<0.10; PPO: Partial Proportional Odds Model, 1: Lower than 40% of the median income (the poorest group); 2: 40–50% of the median income; 3: 50–60% of the median income; 4: 60–70% of the median income; 5: More than 70% of the median income

household with only a girl child is 57.2% more likely to be in the poorest group than the reference group (household with no children) and 12.5% less likely to be in the nonpoor group than the reference group.

A household with a working head is 28.8% more likely to be in the poorest group than the reference group (households without a working head). A household with 1 employed member is 109.7% less likely to be in the poorest group compared to the reference group (household with no employed members) and 11.4% more likely to be in the non-poor group compared to the reference group. Similarly, a household with 1 employed member is 68.8% less likely to be in the 4th poverty category than the reference group. A household having financial problems is 80.2% more likely to be in the poorest group than the reference group (households not experiencing financial distress) and 7.8% less likely to be in the non-poor group than the reference group.

The Generalized Ordered Probit Regression Model given in Table 7 shows that the probability of being in the poorest group is 36.4% higher for a household with a household head aged 15-34 in the central region compared to the reference group (households with a household head aged 55 and above). In comparison, the probability of being in the non-poor group is 8.7% lower than in the reference group. The probability of being in the poorest group is 112.7% lower than the reference group (households with a household head with elementary education or below). In comparison, the probability of being in the non-poor group is 25.5% higher than in the reference group. Table 7 shows that a household with a married head of household is 39.8% more likely to be in the third poverty category and 49.4% more likely to be in the fourth poverty category than the reference group. A household with 2.6 or more equivalent members is 114.5% more likely to be in the poorest group than the reference group (households with 1-2.5 equivalent members). In comparison, the probability of being in the non-poor group is 18% less than in the reference group. A household with a member aged 65 and above is 2.7% less likely to be in the non-poor group than the reference group (household with no member aged 65 and above).

Also, examining Table 7, a household with only a male child is 62.6% more likely to be in the 2nd poverty category than the reference group and 84.8% more likely to be in the 3rd poverty category than the reference group. A household with male and female children is 63.1% more likely to be in the poorest group than the reference group (households without children). In comparison, the probability of being in the non-poor group is 32.4% less than the reference group. A household with 2 or more employees is 148.4% less likely to be in the poorest group than the reference group (household with no employees) and 34.7% more likely to be in the non-poor group than the reference group. A household experiencing financial problems is 16.5% less likely to be in the non-poor group than the reference group (households without financial hardship). A household that receives monetary or inkind child support is 32% less likely to be in the non-poor group than the reference group (households that do not receive monetary or in-kind child support). A household with income from real estate (rent) or securities is 17.4% more likely to be in the non-poor group than the reference group (household with no income from real estate (rent) or securities). The probability of being in the 2nd poverty category is 43.1% less than the reference group, and the probability of being in the 3rd poverty category is 39.9% less than the reference group (see Table 7). In a similar vein, the probability of being in the 4th poverty category is 33.4% less than the reference group.

The Partial Proportional Odds Model in Table 8 shows that the probability of being in the poorest group is 36.4% higher for a household head aged 15–34 in the central region than the reference group (households with a household head aged 55 and above). In comparison, the probability of being in the non-poor group is 8.7% lower than in the reference group. The probability of being in the poorest group is %76% lower than the reference group (households with a household head with elementary education or below). In comparison, the probability of being in the non-poor group is 47.3% higher than the

Table 6 Marginal effect results for the western region

Independent Variables	Heteroskedastic Ordered Logistic Regression Model					
	1	2	3	4		
	M.E	M.E	M.E	M.E		
Sociodemographic Characteristics						
Age (Reference: 55 +)						
15–34	0.473 ^a	0.318 ^a	0.234 ^a	0.162 ^a	2.35	
35–54	0.404 ^a	0.29 ^a	0.226 ^a	0.169 ^a	2.46	
Education (Reference: Elementary and below)						
High school and above	-1.442 ^a	-1.205 ^a	-1.043 ^a	-0.876 ^a	1.24	
Marital Status (Reference: Single)						
Married	-0.367 ^a	-0.058	0.085 ^c	0.182 ^a	1.94	
Sex (Reference: Male)						
Female	-0.278 ^a	-0.143 ^b	-0.075	-0.023	1.87	
Number of equivalent members in the household (Re	ference: 1-2.5)					
2.6 and higher	0.655ª	0.66 ^a	0.633ª	0.582ª	1.32	
Presence of individuals aged 5 and under in the hous	ehold (Reference: N	No)				
Yes	-0.202 ^b	-0.086	-0.03	0.012	1.71	
Presence of individuals aged 65 and above in the hou	isehold (Reference:	No)				
Yes	0.496 ^a	0 363 ^a	0.286 ^a	0.217 ^a	165	
Child combination (Reference: Household without ch	ildren)	0.000	0.200	0.217	1.00	
Household with only a girl child	0.572ª	0.668ª	0.682ª	0.657ª	16	
Household with only a box child	0.581 ^a	0.653ª	0.657 ^a	0.625ª	1.62	
Households with both male and female children	0.947 ^a	1.059 ^a	1.063 ^a	1.012 ^a	1.02	
Fronomic Status	0.5 17	1.000	1.005	1.012	1.57	
Employment Status (Reference: No)						
	0.288 ^b	0.158 ^b	0.092c	0.04	2.86	
Number of working individuals in the household (Ref	erence: No employ	0.150	0.092	0.04	2.00	
	-1 007ª	-0 03a	_0.813 ^a	-0.6889	3 10	
2 and higher	1,022	-0.95 1 164a	1 1 778	1 1 258	2.60	
z and higher	=1.022	-1.104	-1.177	-1.125	5.09	
	0 0003	0.6663	0 5 7 5 8	0.401a	1 1 /	
Non-story on in kind shild support (Defense on No.)	0.002	0.000	0.575	0.401	1.14	
Monetary or in-kind child support (Reference: No)	0.0169	07539	0.0019	0 (1 1 9	1.00	
	0.810	0.753	0.091	0.011	1.06	
Presence of income from real estate (rent) or securitie	es (Reference: NO)	1.000	0.0623	0.71.03	1.00	
Yes	-1.222-	-1.006-	-0.863-	-0./18-	1.09	
Residential Properties						
Residential homeownership (Reference: No)	0.53	0.4023	0.4523	0.4003	1.22	
Yes	-0.5	-0.483°	-0.453"	-0.409	1.23	
The Number of Rooms in Residence (Reference: 2 or b	pelow)			2		
3	-1.56/*	-1.215"	-1.002ª	-0./99ª	3.55	
4 and higher	-2.067ª	-1.634ª	-1.365°	-1.105ª	3.73	
Health and Other Parameters						
Chronic Diseases (Reference: No)	Ŀ					
Yes	-0.21 ^b	-0.19 ^a	-0.173ª	-0.152ª	1.96	
Health Status (Reference: Poor/Very Poor)						
Good/Very Good	-1.141ª	-0.978ª	-0.86ª	-0.733ª	4.25	
Neither good nor bad	-0.783 ^a	-0.668ª	-0.586ª	-0.498 ^a	2.8	
Year (Reference: 2014)						
2015	0.242 ^b	0.172 ^b	0.133 ^a	0.098 ^b	1.69	
2016	0.295 ^a	0.214 ^a	0.168 ^a	0.126 ^a	1.7	
2017	0.035	0.071	0.084 ^c	0.089 ^b	1.71	
2018	0.301 ^a	0.234 ^a	0.193 ^a	0.154 ^a	1.73	
2019	0 351 ^a	0.225 ^a	0.157 ^a	0 101 ^a	1 74	

 $a_p < 0.01$; $b_p < 0.05$; $c_p < 0.10$; 1: Lower than 40% of the median income; 2: 40–50% of the median income; 3: 50-60% of the median income; 60-70% of the median income; 5: More than 70% of median income; M.E: Marginal effect

Table 7 Marginal effect results for the central region

Independent Variables	Generalized Ordered Probit Regression Model					
•	1	2	3	4		
	M.E	M.E	M.E	M.E		
Sociodemographic Characteristics						
Age (Reference: 55 +)						
15–34	0.364 ^a	0.407 ^a	0.196 ^c	0.356 ^a	2.28	
35–54	0.307 ^a	0.43 ^a	0.205 ^b	0.154 ^b	2.37	
Education (Reference: Elementary and below)						
High school and above	-1.127 ^a	-1.319 ^a	-1.141 ^a	-1.1 ^a	1.31	
Marital Status (Reference: Single)						
Married	0.456 ^a	0.042	0.398 ^a	0.494 ^a	2.14	
Sex (Reference: Male)						
Female	-0.023	-0.1	0.011	0	2.1	
Number of equivalent members in the household (Re	ference: 1-2.5)					
2.6 and higher	1.145 ^a	0.821 ^a	0.489 ^a	0.283 ^a	1.48	
Presence of individuals aged 5 and under in the hous	ehold (Reference: I	No)				
Yes	0.052	0.187 ^b	0.123	0.034	1.72	
Presence of individuals aged 65 and above in the hou	sehold (Reference	: No)				
Yes	0.124	0.19 ^b	0.107	0.034	1.56	
Child combination (Reference: Household without ch	ildren)					
Household with only a girl child	0.101	0.636ª	0.842 ^a	0.812 ^a	1.63	
Household with only a boy child	0.263 ^b	0.626ª	0.848 ^a	0.853 ^a	1.69	
Households with both male and female children	0.631ª	1.178ª	1.364 ^a	1.096 ^a	2.29	
Economic Status						
Employment Status (Reference: No)						
Yes	-0.016	0.083	0.133	0.011	3.03	
Number of working individuals in the household (Ref	erence: No employ	/ee)	0.100	0.011	0.00	
1 employee	-1 153ª	-0.813 ^a	-0.613 ^a	-0 318ª	3 16	
2 and higher	-1 484 ^a	-1 401 ^a	-1 24 ^a	-0.986 ^a	3 5 3	
Financial problems (Reference: No)	1.101	1.101	1.2 1	0.900	5.55	
Yes	0.827	0.688ª	0 549 ^a	0.422ª	1 14	
Monetary or in-kind child support (Reference: No)	0.027	0.000	0.5 15	0.122		
	1 / 1 1	1 205 ^a	0.898a	0 375 ^a	11	
Presence of income from real estate (rent) or securitie	(Reference: No)	1.205	0.090	0.575	1.1	
	-1.069	-0.820 -	-0.654ª	-0 530 ^a	1.08	
Pesidential Properties	1.005	0.029.d.	0.054	0.555	1.00	
Residential homeownership (Reference: No)						
Voc	_0 501ª	-0 431 ^a	-0 300a	-0.3349	1 21	
The Number of Rooms in Residence (Reference: 2 or h		051	0.599	0.554	1.21	
	-0.034ª	-0.840a	-0.718 ^a	-0 1 70 ^b	3 66	
5 4 and higher	-0.934 1 706 ^a	-0.649 1.571 ^a	-0.710 1.400ª	-0.179 0.764ª	2.00	
4 and higher	-1.700	-1.371	-1.422	-0.704	5.07	
Chronic Diseases (Peference: No)						
	0.094	0.100b	0.002	0.002	2.05	
Health Status (Poference: Poer/Very Peer)	-0.064	-0.199	-0.002	0.085	2.05	
Good Many Good	0.0453	0.7418	0 45 53	0 2 7 4 3	2 00	
Good/ Very Good	-0.945	-0.741	-0.455	-0.374	5.90 2.40	
Voar (Poference: 2014)	-0.017	-0.499	-0.200	-0.309	2.42	
1015	0.022	0.051	0.017	0.110	1 (7	
2015	0.032	-U.U5 I	0.017	0.000	1.0/	
2017	0.002	0.108	-0.032	0.080	1.0/	
2017	-0.102	-0.025	0.075	0.171	1.08	
2010	U.186	0.071	0.112	0.113	1.71	
2019	0.2065	0.097	U.153	0.125	1./3	

 $a_p < 0.01$; $b_p < 0.05$; $c_p < 0.10$; 1: Lower than 40% of the median income (the poorest group); 2: 40–50% of the median income; 3: 50–60% of the median income; 4: 60–70% of the median income; 5: Higher than 70% of the median M.E: Marginal Effect

Partial Proportional Odds Model VIF **Independent Variables** 1 2 3 4 M.E M.E M.E M.E Sociodemographic Characteristics Age (Reference: 55 +) 0.187^a 0.123^a 15-34 0.269 0.062^a 2.41 0.092^a 35-54 0.196^a 0.138^a 0.048^a 2.41 Education (Reference: Elementary and below) -0.76^a -0.765^a -0.581^a -0.582^a High school and above 1.35 Marital Status (Reference: Single) Married 0.275^a 0.236^a 0.136^b 0.352^a 2.21 Sex (Reference: Male) Female 0.01 0.007 0.005 0.002 2.18 Number of equivalent members in the household (Reference: 1-2.5) 0.749^a 0.272^a 0.046 1.8 2.6 and higher 1065 Presence of individuals aged 5 and under in the household (Reference: No) 0.102^a 0.071^a 0.046^a 0.023^a 1.75 Yes Presence of individuals aged 65 and above in the household (Reference: No) Yes -0.042 -0.029 -0.019 -0.01 1.45 Child combination (Reference: Household without children) Household with only a girl child 0.202^a 0.217^b 0.518^a 0.376^a 1.73 Household with only a boy child 0.194^a 0.287^a 0.502^a 0.425^a 1.86 Households with both male and female children 0.566^a 0.642^a 0.646^a 0.532^a 3.41 **Economic Status Employment Status (Reference: No)** -0.197^a 0.149^b 0.008 -0.122^c Yes 2.66 Number of working individuals in the household (Reference: No employee) 1 employee -0.857^a -0.548^a -0.023 0.129 3.2 2 and higher -1.322^a -1.14^a -0.494^a -0.289^a 3.41 Financial problems (Reference: No) Yes 0.365^a 0.381^a 0.311^a 0.177^a 1.16 Monetary or in-kind child support (Reference: No) Yes 0.967^a 0.618^a 0.34^a 0.087^a 1.36 Presence of income from real estate (rent) or securities (Reference: No) Yes -0.573^a -0.413^a -0.282^a -0.156^a 1.06 **Residential Properties Residential homeownership (Reference: No)** -0.248^a -0.17^a -0.11^a -0.054^a 1.2 Yes The Number of Rooms in Residence (Reference: 2 or below) 3 -0.532^a -0.318^a -0.16^a -0.021^a 2.39 4 and higher -0.949^a -0.765^a -0.45^a -0.142^a 2.58 **Health and Other Parameters Chronic Diseases (Reference: No)** 0.015 -0.086 -0 188^a -0148^a 2.36 Yes Health Status (Reference: Poor/Very Poor) -0.1^a Good/Verv Good -0.498^a -0.338^a -0.214^a 3.93 Neither good nor bad -0.244^a -0.158^a -0.094^a -0.036^a 1.99 Year (Reference: 2014) 2015 0.031 0.022 0.015 0.008 167 2016 0.125^a 0.088^a 0.059^a 0.031^a 1.64 2017 -0.038 0.175^a 0.085 -0.019 1.67 0.042^a 2018 0.176^a 0.123^a 0.082^a 1.72 0.216^a 0.099^a 0.051^a 2019 0.15^a 1.77

Table 8 Marginal impact results for eastern region

 $a^{-1}p < 0.01$; $b^{-1}p < 0.05$; $c^{-1}p <$

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reference group. The probability of a household with a married head of household being in the poorest group is 27.5% higher than the reference group (household with a single head of household). In comparison, the probability of being in the non-poor group is 20% lower than in the reference group.

Table 8 shows that a household with 2.6 or more equivalent members is 74.9% more likely to be in the 2nd poverty category than the reference group and 27.2% more likely to be in the 3rd poverty category than the reference group. A household with male and female children is 56.6% more likely to be in the poorest group than the reference group (households without children). In comparison, the probability of being in the non-poor group is 53.6% less than the reference group. A household having financial problems is 36.5% more likely to be in the poorest group than the reference group (households without financial distress) and 28.3% less likely to be in the nonpoor group than the reference group. Table 8 shows that a household experiencing financial distress is 38.1% more likely to be in the 2nd poverty category than the reference group and 31.1% more likely to be in the 3rd poverty category than the reference group. In a similar vein, the probability of a household experiencing financial distress to be in the 4th poverty category is 17.7% higher than the reference group.

Discussion and conclusion

Poverty is an essential threat to the world. It is one of the most critical problems of our era's past, present, and future and should be the focus of all countries. Poverty is not only a major problem for individuals but also a major problem for countries. Poverty is a multidimensional concept that can emerge due to several economic and social factors. Therefore, the policies that can be developed to reduce poverty can vary. To solve the problem of poverty, countries identify the factors that cause poverty and develop policies accordingly. Considering the results achieved in this study, factors affecting the poverty levels of households across different regions in Türkiye were identified, and several policy recommendations aiming to alleviate poverty were provided.

The present study aimed to compare the factors affecting the poverty level of households by region in Türkiye through an application of ordered regression models. According to the estimation results, the best model for each region was found according to the goodness of fit and relevant information criteria. All analysis results were evaluated through these best models. Accordingly, in the model established for the Western region, the male head of a household increased the probability of the household being poor. This result differs from previous research [48, 51, 94]. In those studies, this was attributed to women's dependence on men and the fact that poverty is an essential problem for women who have lost their husbands or are divorced [48, 95]. According to the results of the models for the central and eastern regions, households with married heads were more likely to be poor. This result aligned with previous research [41, 51, 57]. This was associated with the fact that newly married individuals may fall into temporary poverty due to wedding expenses and the financing required to set up a house. This may pose a challenge due to the transition and changes in their lifestyle dynamics [96]. On the other hand, this result differs from the findings of some previous studies [58-60, 97]. These studies argue that households with married couples are likely to be less poor as both members of the couple can participate in the labor market, or even if one is responsible for raising children at home, the other is entirely in the labor market and, therefore, has a higher income. Similarly, the household may benefit from economies of scale in purchasing goods and services and intent to save more than a single person. Also, these households may benefit more from government social security services [98].

In the models for the central and eastern regions, households with household members aged 5 years and younger, and in the models for the western and central regions, households with household members aged 65 years and older were more likely to be poor. This finding agrees with previous research [40, 63, 99]. According to the estimation results obtained from the models for the western and central regions, households with one employee were less likely to be poor than households with no employees. Also, in the models established for the western, central, and eastern regions, households with 2 or more employees in the household were less likely to be poor than those with no employees. This result was in agreement with those reported in previous research [41, 80]. In a similar vein, in the model for the western region, a household that participated in the survey in 2015 was more likely to be poor than a household that participated in the survey in 2014. Also, in the models established for the western and eastern regions, a household that participated in the survey in 2016 was more likely to be poor than a household that participated in the survey in 2014.

The results obtained from the present study showed that the probability of the household being poor decreased as the age of the household head increased in the models established for the western, central, and eastern regions. This result was in line with the literature [40-43]. This was associated with the fact that the income of the household head increased as their age increased, leading to being less prone to poverty. Also, with increasing age, the needs of individuals may decrease, and households can manage their income [100]. On the other hand, this result is different from the results

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of the previous studies [45, 46, 52, 101]. As explained in the life cycle theory, this can be associated with the fact that individuals' incomes are low when at young ages (due to lack of work experience), increase as they gain experience, and start to decline when they get older as their productivity decreases due to health problems [102, 103].

The probability of the household being poor declines as the education level of the household head increases in the models established for the western, central, and eastern regions. This result was in line with those reported in previous research [51, 58, 59, 62, 101]. Education provides the knowledge and skills needed to earn a decent income, escape poverty, and enter the labor market to increase productivity. In many developing countries, education has a crucial, pivotal role as a strategy against poverty and economic growth. Since education increases an individual's human capital, and this more significant capital increases that Individual's productivity and income, poverty is likely to be inversely proportional to the level of education. The direct effect of education on poverty reduction stems from its contribution to increasing the income or wages of individuals. The indirect effect of education on poverty is essential in terms of "human poverty." Because education increases the income of individuals, making it easier to meet their basic needs, thus, increasing their living standards. In this context, education policies should be developed to ensure that all individuals have equal opportunities and equal education, that there are no uneducated individuals, and that vocational training programs are developed to reveal the talents and skills of individuals [104].

Households with financial distress are more likely to be poor than households without financial distress in the models constructed for the western, central, and eastern regions. This result aligned with previous research [105-107]. According to the results of the models established for the western, central, and eastern regions, it was determined that households receiving monetary or in-kind child support are more likely to be poor than households that do not receive monetary or in-kind child support. This result aligned with previous research [72, 108]. Social support, an essential tool in the combat against poverty, is financed through taxation and provides inkind and monetary assistance to all individuals below a certain minimum living level, as well as to people in need in a particular group, such as the unemployed, disabled, and orphans. To determine the efficacy of in-kind and monetary aid provided by central government institutions, local governments, and various non-governmental organizations (NGOs) in the combat against poverty in Türkiye, an institutional supervision mechanism should be established.

In the models established for the western, central, and eastern regions, households that own their houses are less likely to be poor than households that do not own their houses. This result was in agreement with those reported in previous research [76, 77, 107]. In cities with rapid population growth and where houses are difficult to purchase, it should be facilitated for individuals who want to own a house. Also, according to the results of the models established for the western, central, and eastern regions, it was determined that households with 2 or fewer rooms in the household are more likely to be poor than households with 3 and 4 or more rooms in the dwelling. This result was in line with those reported in previous research [79, 80]. Similarly, in the models established for the western, central, and eastern regions, households with real estate (rent) or securities income are less likely to be poor than households without real estate (rent) or securities income. This result is supported by similar results obtained in previous research [69, 109]. The benefit of asset ownership lies in the access to credit through which the assets can be converted. With the availability of this credit, investment in physical (land) and/or human capital (education) can be transformed into a better opportunity to end poverty. Improved asset ownership will positively affect the higher education attainment of children in poor households. Higher educational achievement will increase the likelihood that the next generation will find employment outside agriculture, often at higher wages. Therefore, it is necessary to carry out activities to increase employment and establish social policies that will increase the welfare level of poor individuals. Transformation projects should be applied to resolve the housing problem, long-term urban planning should be carried out, and relevant institutions, local governments, and NGOs should be encouraged to produce collaborative projects [1].

The analysis results of the present study showed that households with only male or female children are more likely to be poor than households without children in the models established for the western, central, and eastern regions. Also, in the models established for the western, central, and eastern regions, households with both male and female children are more likely to be poor than households without children. However, according to the models established for the western, central, and eastern regions, it was found that households with 2.6 or more equivalent members in the household are more likely to be poor than households with 1-2.5 equivalent members in the household. These results agree with the literature [40, 64, 99]. In the late 18th century, Thomas Malthus argued that high fertility was significantly associated with poverty. The indirect effects of population growth on poverty vary. The first is that rapid population growth decreases per capita income growth and welfare; hence,

poverty tends to increase. Second, rapid population growth in densely populated areas where land is scarce will decrease the number of landowners, leading to an increase in poverty. Lastly, larger households tend to have higher dependency ratios. Also, higher dependency ratios tend to increase the poverty of households. Because more people rely on insufficient income to survive, resulting in underinvestment in assets to mitigate the shocks in the future [110].

Poverty can be effectively combated by establishing policies including employment to reduce poverty, producing policies to increase the incomes of poor individuals, encouraging the private sector, preventing off-the-record employment, and increasing women's employment.

According to the results of the models for the western, central, and eastern regions, households with poor/ very poor health status of the household head are more likely to be poor. This was because poverty is associated with malnutrition, inadequate medical care, exposure to toxins, and low birth weight. This result was in line with those reported in previous research. It is imperative to have a pro-poor health system that emphasizes improving and protecting the health conditions of poor people [82, 111].

In the models established for the western, central, and eastern regions, households that participated in the survey in 2017, 2018, and 2019 were more likely to be poor than those that participated in the survey in 2014. In a similar vein, in the model for the western region, a household that participated in the survey in 2015 was more likely to be poor than a household that participated in the survey in 2014. Also, in the models established for the western and eastern regions, a household that participated in the survey in 2016 was more likely to be poor than a household that participated for the western and eastern regions, a household that participated in the survey in 2016 was more likely to be poor than a household that participated in the survey in 2016.

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Author contributions

ÖA conceived and led the design and development of the study proposal. ÖA and ŞÜ supervised data collection, led the data analysis and drafting the manuscript. ŞÜ, AKÇ and HA made substantial contributions to the conceptualization and design of the study, data interpretations and writing the manuscript. All authors read and approved the final version of the manuscript.

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Data availability

The data underlying this study is subject to third-party restrictions by the Turkish Statistical Institute. Data are available from the Turkish Statistical Institute (bilgi@tuik.gov.tr) for researchers who meet the criteria for access to confidential data. The authors of the study did not receive any special privileges in accessing the data.

Declarations

Ethics approval and consent to participate

The data were obtained through the joint teamwork of both the Turkish Statistical Institute (TSI) and the European Union Statistical Office (SOEU). We obtained this data from TSI in return for a contract without needing an ethics committee document and used it in our study. TSI is an institution that compiles, evaluates, and presents statistical information to decision-makers to prepare development plans and programs, make economic decisions, and address all other issues needed. TSI carries out internationally comparable statistical production activities according to the standards of organizations such as the European Union Statistical Office, the United Nations, OECD, ILO, etc. TSI collects data within the scope of the Official Statistics Program. The Official Statistics Program is prepared for five-year periods based on the Turkish Statistics Law No. 5429 to determine the basic principles and standards regarding the production and publication of official statistics and to ensure the production of up-to-date, reliable, timely, transparent and impartial data in areas of need at national and international levels [112]. TSI also conducts the Income and Living Conditions Survey within the scope of the Official Statistics Program put into effect by law. Since the Income and Living Conditions Survey is conducted within the scope of legal responsibility by the state, ethical approval is not required [113]. For this study, secondary data were employed. Official approval was received from the Turkish Statistical Institute to use the microdata set from the Income and Living Conditions Survey. The Income and Living Conditions Survey provides many indicators in the field of health, including the utilization of health services by individuals aged 15 and over, the degree of difficulty they experience in performing their daily activities, and their smoking and alcohol use habits. The Turkish Statistical Institute also received a "Letter of Undertaking" authorizing it to use the study's data. The letter of undertaking for the use of micro data without restrictions in dissemination: Article 1-This letter of undertaking determines the rules, principles and obligations of the use of micro data, which are safe to disclose apart from the Presidency. Article 2-This letter of undertaking regulates the use of micro data sets of Türkiye Health Survey in 2019, 2022, within the framework of the Directive on Access and Use of Micro Data in line with the purpose specified in Article 1. Article 3- The following provisions apply for the use of micro data: a) Findings obtained by the researcher as a result of incorrect calculation only bind the researcher. b) The researcher refers to the micro data of the Institution that he uses while disclosing the results obtained from the study. c) The researcher is obliged to send a copy of the published report, article, publication etc. to the Institution Library within three months at the latest. Subsequent micro data usage requests of the researcher who is found not to fulfill this obligation are not covered. d) The researcher cannot reproduce, give to third parties, sell or transfer the micro data set he obtained. Article 4-The researcher, by taking into account the principles of confidentiality defined in 13. and 14. articles of Turkish Statistical Institution numbered 5429 and Regulation on Procedures and Principles Regarding Data Confidentiality and Confidential Data Security in Official Statistics, is deemed to guarantee hereby that he shall not disclose the information, table, etc. violating this principle and shall only use micro data for statistical purposes.

Consent for publication

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Competing interests

The authors declare no competing interests.

Author details

¹Department of Econometrics, Faculty of Economics and Administrative Sciences, Ataturk University, 2nd Floor, Number: 227, Erzurum, Türkiye ²Department of Econometrics, Faculty of Economics and Administrative Sciences, Ataturk University, 2nd Floor, Number: 222, Erzurum, Türkiye ³Master Araştırma Eğitim ve Danışmanlık Hizmetleri Ltd. Şti., Ata Teknokent, Erzurum TR-25240, Türkiye

⁴Department of Quantitative Methods, Faculty of Economics and Administrative Sciences, Ardahan University, Ardahan, Türkiye ⁵Department of Economics, Faculty of Business and Economics, Gaziantep University, 1st Floor, No: 132, Şehitkamil, Gaziantep 27310, Türkiye

⁶Department of Data Analysis and Mathematical Modelling Building, Ghent University, A, floor 1, room 70, Coupure links 653, Gent 9000, Belgium Received: 24 September 2024 / Accepted: 14 December 2024 Published online: 11 February 2025

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