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SUBJECTIVE ASPECTS OF ECONOMIC POVERTY – ORDERED RESPONSE MODEL APPROACH

Abstract

In the paper the subjective economic poverty in Polish households is analysed. The study is based on the Household Budget Survey carried out by the Central Statistical Office in Poland. Subjective measures are estimated using households' answers to questions about the own satisfaction with their financial situation. The inspiration for this research comes from J. Schwarze's article [17] where ordered logit model was applied to estimate the equivalence scale elasticity. Such a model implicitly assumes that the effects of the explanatory variables are identical at each cut-off point between categories, what is known as the "parallel regression assumption". The paper indicates the violation of this assumption for the sample of Polish households of retirees as the whole, while the assumption cannot be rejected when we exclude the poorest and richest households.

Some of the results described here are similar to typical findings in poverty research, such as U-shaped relationship between age and subjective income satisfaction. Different results are found with regard to gender of household head. Also, as compared with other research data for Poland, the method applied here produces higher equivalence scale elasticity.

1. Introduction

Recent years have seen a growth of economists' interest in the determinants of income satisfaction to analyze individual well-being. This growth has been linked to the parallel increase in the availability of both qualitative and quantitative data on poverty and standards of living.

A variety of approaches have been proposed to quantify poverty and welfare through instruments that rely on respondents' subjective assessments. One of the earliest attempts was proposed by B.M.S. Van Praag [21], with the Income Evaluation Questions (IEQ). The question is based on asking respondents what income they would consider "very bad" to "very good" (with a number of options in-between). The answers are then used to construct an utility function allowing to assess welfare. A similar method asks respondents what income they consider the minimum necessary "to make ends meet" (Minimum Income Question, MIQ). This idea originated from Th. Goedhart et al. [8]. Objectively measured income normalized by the subjective poverty line may then be used as the welfare indicator [11].

This study presents a different approach. It tries to explain the interviewees' perception of what they consider to be the actual income. To do this, ordered response models are applied. The research uses the idea first proposed by J. Schwarze – estimation of the subjective equivalence scale elasticity by the use of ordered logit model [17]. In the paper we modify this method. The contribution of this paper is to explore whether the effects of household's income, household's size, some of demographic and social determinants are the same across all of the categories of the income satisfaction. Results of the research are important in the context of using J. Schwarze's idea to estimate equivalence scale elasticity.

Moreover, as the study focuses on households of retirees, it has also empirical advantages. There has been a shortage of research on aspects of subjective well-being of retirees in the economics literature. This study attempts to fill in this void by examining the determinants of the subjective aspects of economic well-being of Polish retirees. Improvements in this research field may be important for economic researchers. Understanding the factors that determine subjective economic well-being enables policymakers to evaluate and possibly reform present retirement institutions, such as public and private pension programs.

2. Equivalence elasticity

We assume that economic well-being is represented by "adjusted" disposable income[1]. To adjust household's income to its size and composition, equivalence scales are most commonly used. B. Buhmann et al. [3] showed that nearly all equivalence scales might be approximated by n^e, where n is household's size and e is the scale elasticity parameter. If d denotes the total disposable income of household, the "adjusted" income of each household is: $d_e = \frac{d}{n^e}$, where n is the number of members in household and e is the equivalence elasticity.

The equivalence elasticity characterizes the amount of economies of scale that households are assumed to achieve, and ranges from 0 (an additional household member is assumed to use no extra resources and is equivalent to unadjusted household income) to 1 (no economies of scale, equivalent to a *per capita* income). Therefore, household's income ($e = 0$) and household's income per capita ($e = 1$) are the two extreme cases of a welfare analysis in which the elasticity of scale plays a fundamental role. The smaller the value of e, the higher are the assumed economies of scale. An equivalence elasticity lower than unity implies the existence of economies of scale in household's needs: any additional household

[1] The disposable income is composed of factor income plus social cash benefits less tax.

member needs a less than proportionate increase of the household income in order to maintain a given level of welfare.

In the study the economies of scale are calculated on the basis of the interviewees' perception of what they consider to be the actual income. More precisely, measurement is based on survey question: "Considering your monthly disposable income, is your household able to make ends meet: (1) with great difficulty, (2) with difficulty, (3) with some difficulty, (4) without difficulty, (5) with ease, (6) with great ease?"

Assuming that income satisfaction u^* is a continuous latent variable, the model can be written as:

$$u^* = \alpha_0 + \alpha_d \ln d + \alpha_n \ln n + \sum_{j=1}^{k} \gamma_j s_j , \qquad (1)$$

where: u^* – income satisfaction,
d – household's income,
n – number of persons in household,
s_j – j-th control variable, $j = 1, \ldots, k$; the set of control variables can include socio-demographic variables (such as gender, education, age, civil status), the size-class of locality variables and other,
$\alpha_0, \alpha_d, \alpha_n, \gamma_1, \gamma_2, \ldots, \gamma_k$ – parameters to be estimated.

The continuous latent variable u^*, however, cannot be observed. What can be observed instead is income satisfaction u measured on an ordinal scale from 1 to 6.

Because

$$\alpha_d \ln d + \alpha_n \ln n = \ln \frac{d^{\alpha_d}}{n^{-\alpha_n}} = \alpha_d \ln \frac{d}{n^{-\alpha_n/\alpha_d}} , \qquad (2)$$

the equivalence elasticity e can then be identified as:

$$e = -\frac{\alpha_n}{\alpha_d}. \qquad (3)$$

In the next parts of the paper the method of estimating parameter of equivalence elasticity is presented.

3. Determinants of subjective poverty

The set of factors considered as potential explanatory variables in poverty research may be divided into two groups: attributes of the household's head and attributes of whole household [15]. The first group encompasses characteristics such as:

– age of the family head,
– gender of household's head,
– level of education of the household's head.

The second group contains, for instance, the following attributes:
– household's disposable income,
– number of household's members,
– place of residence (rural, small towns, large cities).

Many studies have found a negative correlation between age and subjective well-being, but only up until to a certain age. The relationship is U-shaped and has its turning point around a certain age and after this point subjective welfare is likely to increase with age [4]. A personal determinant such as gender also plays a role for subjective well-being. Many studies reported males to be less satisfied than females (for instance, [6] for Switzerland, [2] for Great Britain and the USA, [22] and [23] for Germany). Studies such as [5] and [20] have found positive influences of education on financial satisfaction – the highest the level of education, the less subjective poverty.

The view accepted by economists is that household's income and size have statistically significant impact on measures of subjective economic well-being. Considering locality of size-classes, there is no explicit opinion. M. Shucksmith, S. Cameron and T. Merridew [18] maintained that there were no essential differences between urban and rural areas in Europe; urban-rural differences would therefore arise to a greater degree in poorer countries where the process of modernization was more uneven. B.S. Frey, S. Luechinger and A. Stutzer [7] stated that people living in rural areas tended to be more life-satisfied than those living in towns.

One of the purposes of this study is to examine the impact of various potential determinants of subjective economic poverty in Polish retirees' households.

4. The data

In the cited J. Schwarze's paper a set of panel data was used. The panel data analysis has an important advantage – it enables different scale use by the respondents to be controlled. Moreover, only with panel data it is possible to control the unobserved heterogeneity. This means that in the study of correlation and/or causality when there are more explanatory variables than the ones observed, which is usually the case, it is possible to control their effects using panel data. Unfortunately such an appropriate data on Polish households are not available. Thus cross-section data are used.

Data employed in this study come from the Household Budget Survey (HBS) carried out by the Central Statistical Office in 2005 and 2006. The observation unit is a household. A household consists of individuals living together and sharing the household's finances. The Household Budget Survey does not contain any information referring to households from collective homes, such as students' hostels, social welfare homes (the so called collective households) as well as households of the diplomatic corpus of foreign countries. The households of foreign citizens with permanent or long-lasting residence in Poland and speaking

Polish are included in the survey. The number of households participating in the survey in each year was about 30,000. The monthly rotation of households implemented assumes that every month of the year a different group of households participated in the survey [10].

The study focuses on households of retirees-households whose exclusive or prevailing source of livelihood is an old age pension. Subjective measures are based on households' answers to questions about their own satisfaction with their financial situation. Table 1 presents numbers of Polish retirees' households according to assessment of subjective income situation.

Table 1. Number of Polish retirees' households with distinct levels of income assessment

Income status	Category	Number of households in HBS in year:		Relative number of households HBS in year (%):	
		2005	2006	2005	2006
Very poor	$j = 1$	1150	1088	13	11
Poor	$j = 2$	2024	1953	24	20
Insufficient	$j = 3$	3738	4335	43	44
Scarcely enough	$j = 4$	1373	1976	16	20
Good	$j = 5$	289	383	3	4
Very good	$j = 6$	40	59	Less than 1	1
Total	All	8614	9794	100	100

Source: own calculations based on Household Budget Survey data.

Due to the small number of households declaring their situation as good and very good, they are joined with those estimating their income position as scarcely enough, so in an econometric analysis four levels (categories) of income assessment are taken into account.

5. Econometric framework

The study applies an ordered logit model that uses a continuous but unobserved variable y^*. The starting point in such a case is usually a model with latent variable [14]:

$$y_i^* = \mathbf{x}_i \boldsymbol{\beta} + \varepsilon_i \,,\ i = 1, 2, ..., h, \tag{4}$$

where: $\boldsymbol{\beta}$ – a column vector of parameters $\beta_1, ..., \beta_k$, to be estimated,

$\mathbf{x}_i$ – a row vector representing the characteristics of individual i,

ε_i – random error,

h – number of individuals,

the subscript i refers to the observation number,

y^* – the latent variable which represents the response, if it could be measured accurately on the continuous scale. Let us assume a set of cut-points $\delta_0, \delta_1, \cdots \delta_m$, such that $-\infty = \delta_0 < \delta_1 < \cdots \delta_m = \infty$, that divide $(-\infty; \infty)$ into m intervals. The relationship between the latent variable and the realized outcome is: $y_i = j$ if and only if

$$\delta_{j-1} < y_i^* \le \delta_j{}^2, i = 1, 2, ..., h, j = 1, ..., m. \tag{5}$$

Substitution of (4) into (5) followed by some algebra yields:

$$\delta_{j-1} - \mathbf{x}_i \boldsymbol{\beta} < \varepsilon_i \le \delta_j - \mathbf{x}_i \boldsymbol{\beta}. \tag{6}$$

It leads to the following probabilities of each outcome:

$$P(y_i = j | \mathbf{x_i}) = F\left(\delta_j - \mathbf{x}_i \boldsymbol{\beta}\right) - F\left(\delta_{j-1} - \mathbf{x}_i \boldsymbol{\beta}\right), \tag{7}$$

where F – cdf of iid error terms ε_i.

In practical applications the following models are usually used [1]:

– ordered logit model with $F(z) = \Lambda(z) = \dfrac{1}{1 + \exp(-z)}$, (8)

– ordered probit model with $F(z) = \Phi(z) = \int\limits_{-\infty}^{z} \dfrac{1}{\sqrt{2\pi}} \exp\left(-\dfrac{t^2}{2}\right) dt$. (9)

From an empirical point of view, it usually does not matter which model is used. Logit and probit models typically yield very similar results. This is because the distribution functions for the logit and probit are similar, differing slightly only in the tails of their respective distributions. In this study logit model is implemented.

The slope parameters $\beta_1, \beta_2, \ldots, \beta_k$ have no intuitive interpretation. For the probabilities, the marginal effects of the regressors are:

$$\frac{\partial P(y_i = j | \mathbf{x})}{\partial x_l} = -\beta_l \left\{ \frac{d\Lambda\left(\delta_j - \mathbf{x}\boldsymbol{\beta}\right)}{dz} - \frac{d\Lambda\left(\delta_{j-1} - \mathbf{x}\boldsymbol{\beta}\right)}{dz}_{|z = \mathbf{x}\boldsymbol{\beta}} \right\}. \tag{10}$$

The term in braces can be positive or negative, so one must be very careful in interpreting the slope parameters $\beta_1, \beta_2, \ldots, \beta_k$ in the ordered logit model. Only the

[2] The $\delta_0, \delta_1, \ldots, \delta_m$ are unknown parameters to be estimated with $\beta_1, \beta_2, \ldots, \beta_k$.

signs of the changes in $P(y_i = 1|\mathbf{x})$ and $P(y_i = m|\mathbf{x})$ are unambiguous. The marginal effects of the regressor x_l on the probabilities $P(y_i = 1|\mathbf{x})$ are:

$$\frac{\partial P(y_i = 1|\mathbf{x})}{\partial x_l} = -\beta_l \left(\Lambda\left(\delta_1 - \mathbf{x}_i \boldsymbol{\beta}\right)(1 - \Lambda\left(\delta_1 - \mathbf{x}_i \boldsymbol{\beta}\right)) \right),\ l = 1, 2, \ldots, k. \tag{11}$$

Since $\Lambda(1-\Lambda) \geq 0,$, then the derivative of $P(y_i = 1|\mathbf{x_i})$ has the opposite sign from β_l. By similar logic, as

$$\frac{\partial P(y_i = m|\mathbf{x})}{\partial x_l} = \beta_l \left(\Lambda\left(\delta_{m-1} - \mathbf{x}_i \boldsymbol{\beta}\right)(1 - \Lambda\left(\delta_{m-1} - \mathbf{x}_i \boldsymbol{\beta}\right)) \right), \tag{12}$$

therefore the change in $P(y_i = m|\mathbf{x})$ must have the same sign as β_l (e.g. [9]).

The parameters of ordered response model can be estimated by maximum likelihood method. For the selection between nested models likelihood ratio test may be conducted. It compares two models M0 and M1, where M0 is nested in M1 [1]. The likelihood ratio statistics has the following form:

$$LR = -2\left(\ln \hat{L}_0 - \ln \hat{L}_1\right), \tag{13}$$

where: $\ln \hat{L}_0$ – the log-likelihood of model with p restrictions (corresponds with model M0),
$\ln \hat{L}_1$ – the log-likelihood value for full model (corresponds with model M1).

The large sample distribution of LR is chi-squared, with degrees of freedom equal to the number of restrictions imposed. If $LR > \chi^2(p, \alpha)$, then M0 is rejected, otherwise M0 is preferred [1].

To compare alternative non-nested models Akaike (AIC) and Bayesian (BIC) information criteria are used:

$$AIC = \frac{-2\ln L}{h} + \frac{2k}{h}, \tag{14}$$

$$BIC = \frac{-2\ln L}{h} + \frac{k \cdot \ln h}{h}, \tag{15}$$

where: h – number of observation,
k – number of slope parameters in model,
$\ln L$ – logarithm of likelihood.

The model with smaller values of information criteria is preferred. Information criteria penalize models with additional parameters. Therefore, the AIC and BIC model order selection criteria are based on parsimony.

There is a wide variety of measures of the goodness of fit often called pseudo-R-square statistics. Most often cited is the measure based on likelihood ratio (also known as McFadden R-Squared):

$$pseudo-R^2 = 1 - \frac{\ln \hat{L}_{Full}}{\ln \hat{L}_{Intercept}}, \tag{16}$$

where $\ln \hat{L}_{Intercept}$ denotes the value of the restricted log-likelihood when all slope coefficients are equal to zero and $\ln \hat{L}_{Full}$ – the log-likelihood value for a full model (without any restrictions imposed on parameters).

In the research the Stata Statistical Software is applied. To detect a specification error the Stata command *linktest* is used. The idea behind linktest is that if the model is properly specified, one should not be able to find any additional predictors that are statistically significant except by chance. *Linktest* uses the predicted value (_hat) and predicted value squared (_hatsq) as the predictors to rebuild the model. The variable _hat should be a statistically significant predictor, since it is the predicted value from the model. This will be the case unless the model is completely misspecified. On the other hand, if the model is properly specified, variable _hatsq should not have much predictive power except by chance. Therefore, if _hatsq is significant, then the linktest is significant. This usually means that either relevant variables are not included or applied link function is not correctly specified.

The ordered response model takes the assumption that the explanatory variables of the model will have the same impact across each of the categories of the dependent variable, which is known as the "parallel regression assumption" [14]. It could well be that the coefficients of some or all of the explanatory variables are significantly different across each categorical choice, in which case alternative models must be considered. The parallel regression assumption may be tested with an approximate LR test and a Wald test [14]. If this assumption is violated, the generalized ordered logit model may be used. This model can be written as [24]:

$$P(Y_i > j) = \frac{\exp(\mathbf{x}_i \boldsymbol{\beta}_j)}{1 + \exp(\mathbf{x}_i \boldsymbol{\beta}_j)}, \; j = 1, 2, ..., m-1. \tag{17}$$

The ordered logit model is a special case of the generalized ordered logit model, where the betas are the same for each j, $j = 1, \ldots, m - 1$.

Ordered logit model approach assumes parameters $\beta_1, \beta_2, \ldots, \beta_k$ to be the same for all categories. This assumption can be tested by comparing the likelihood value obtained by fitting the ordered logit model with generalized ordered logit (this model allows those parameters to be different between the outcomes $j = 1, 2, \ldots, m - 1$). If $\ln\hat{L}_O$ and $\ln\hat{L}_G$ are respectively the log-likelihood values from the ordered model and generalized ordered one, then one can compute $LR_{OG} = -2(\ln\hat{L}_O - \ln\hat{L}_G)$ and compare it to $\chi^2\left(k(m-2),\alpha\right)$. Large values of LR_{OG} may be taken as the evidence of rejection of parallel regression assumption.

The LR test is an omnibus test for all variables. It does not let determine whether the coefficients for some variables are identical across the binary equations while other coefficients differ. The Wald test developed by Brant lets test the parallel regression assumption for each variable individually [14]. This could be helpful in identifying individual variables that were problematic.

The elasticity scale derived from formula (3) is non-linear combination of parameter estimates. In order to compute standard errors, test statistics, significance levels, and confidence intervals, the "delta method" is applied (e.g. [9]).

6. Results and discussion

The first step of research was an attempt to select models evaluated on the basis of data on all retirees' households in separate years. Unfortunately, it was not possible to obtain properly specified models fulfilling the parallel regression assumption. Then one tried to separate groups of households so the application of ordered logit models would be reasonable. It was stated that many parameters of models estimated for the poorest households differed from corresponding parameters obtained for the richest households. Finally, basing on data from both years, considering disposable income *per capita* only middle classes were taken into account. In the case of both years 15% of the bottom income distribution were ignored. In 2005 – 20% and in 2006 – 25% of the top income distribution were ignored. In such sub-samples parallel regression assumption was not violated. That also resulted in successful selection of explanatory variables, listed in Table 2, such as the hypothesis on proper specification of the model cannot be rejected.

The likelihood ratio test indicates, at the 5 percent level of significance, that the null hypothesis of parallel regression assumption cannot be rejected (for 2005: $LR_{OG} = 35.16$ and $\chi^2(24) = 36.42$, for 2006: $LR_{OG} = 30.20$ and $\chi^2(22) = 33.92$). In order to get more specific information on individual variables, Brant test was applied. Detailed results are presented in Table 3.

One can notice that in this case, none[3] of the variables revealed a problem of violation of parallel regression assumption at the 5 percent level of significance. If the assumption was violated, ordered logit model could not be used.

[3] Although *p*-value for lnd equals only 0.06 for 2005 data.

Table 2. Explanatory variables used in the empirical models

Name of variable	Description
Lnn	Logarithm of household's size (number of people in household)
Lnd	Logarithm of household's income
KlM1	Class of locality (1 for a city of 500,000 or more inhabitants, 0 otherwise)
KlM2	Class of locality (1 for a city of 200,000-500,000 inhabitants, 0 otherwise)
KlM3	Class of locality (1 for a city of 100,000-200,000 inhabitants, 0 otherwise)
KlM4	Class of locality (1 for a town of 20,000-100,000 inhabitants, 0 otherwise)
KlM5	Class of locality (1 for a town of less than 20,000 inhabitants, 0 otherwise)
KlM6	Class of locality (1 for rural, 0 otherwise)
Gender of HH	Gender of head of household (1 if household head is female, 0 otherwise)
Age of HH	Age of head of household
S-age of HH	Squared age of head of household
Single-adult H	Single-adult household (1 if one-person household, 0 – otherwise)
LZU	Number of sources of livelihood

Source: own selection based on econometric methods.

Table 3. Results of Brant test of parallel regression assumption

Explanatory variable	2005			2006		
	chi-square statistics	*p*-value	degrees of freedom	chi-square statistics	*p*-value	degrees of freedom
All variables	33.24	0.10	24	31.06	0.10	22
Lnn	3.64	0.16	2	4.48	0.11	2
Lnd	5.63	0.06	2	1.82	0.40	2
KlM1	0.10	0.95	2	3.77	0.15	2
KlM2	0.75	0.69	2	2.62	0.27	2
KlM3	reference group	–	–	reference group	–	–
KlM4	0.29	0.86	2	3.31	0.19	2
KlM5	0.43	0.81	2	4.39	0.11	2
KlM6	0.53	0.77	2	2.71	0.26	2
Gender of HH	4.95	0.09	2	0.39	0.82	2
Age of HH	1.19	0.55	2	0.41	0.81	2
Squared age of HH	1.29	0.53	2	0.39	0.82	2
Single-adult H	3.64	0.16	2	3.65	0.16	2
LZU	4.62	0.10	2	–	–	–

Source: own calculations obtained by using Stata software.

For the set of variables in Table 3 the Stata command linktest was used in order to detect a specification error. For 2005 data: the variable _hat was significant (with p-value = 0.04) and _hatsq was not significant (with p-value = 0.35) and for 2006 data: the variable _hat was significant (with p-value = 0.03) and _hatsq was not significant (with p-value = 0.28), so there was no evidence of misspecification.

To assess the impact of each determinant of subjective economic well-being in a multivariate setting, ordered logit models were analyzed. Table 4 lists estimated ordered logit coefficients and the corresponding standard errors.

Table 4. Ordered logit models estimation results[4]

Explanatory variable	2005		2006	
	parameter estimate	standard error	parameter estimate	standard error
Lnn	–1.8719	0.1700	–1.9830	0.1505
Lnd	3.0274	0.1358	3.0266	0.1255
KlM1	–0.2467	0.1158	–0.6699	0.1158
KlM2	0.0575	0.1178	–0.3618	0.1172
KlM3	reference group	–	reference group	–
KlM4	0.1974	0.1044	0.0706	0.1037
KlM5	0.4807	0.1146	0.0541	0.1138
KlM6	0.6297	0.1035	0.3096	0.0985
Gender of HH	–0.4079	0.0611	–0.2848	0.0562
Age of HH	–0.0585	0.0228	–0.0820	0.0214
Squared age of HH	0.0005	0.0002	0.0007	0.0002
Single-adult H	–0.3276	0.1182	–0.4331	0.1082
LZU	–0.1430	0.0418	–	–

Source: own calculations obtained by using Stata software.

Table 4 shows estimates for the parameters of ordered logit models. Both models include the socio-economic characteristics of the head of household such as age, age squared, gender and being the only person in a household. The research confirmed the U-shaped dependence between the level of subjective economic poverty and the age of a head of household. The turning point of this dependence was the age of 58. This is an optimistic result, because only 17% of retirees' households had their heads younger than 58 in each investigated year.

Women as heads of households more likely than men perceived their income situation as "very poor"[5]. It could be explained by the fact that women were

[4] For 2005 data pseudo-R^2 equals 0.08 and for 2006: 0.09, logarithms of likelihood are respectively: –6455.81 and –7222.27.

[5] Under *ceteris paribus* assumption.

usually heads of households if they were alone – widowed or divorced. It meant generally worse well-being of family. Also being one-person household did not increase the probability of the assessing the monthly disposable income as at least "scarcely enough". This research reported the low income satisfaction scores in solitude. In fact, being alone is usually a negative experience – lonely people are more likely to be emotionally disturbed. The level of education affected the subjective economic situation, however finally this household's head's attribute was not included in models. Since using Akaike (AIC) and Bayesian (BIC) information criteria the best models presented in Table 4 were chosen.

There was found a statistical significant dependency between the place of residence and subjective income satisfaction – comparing logarithms of likelihood of models showed in Table 4 with models, where KlM1, KlM2, KlM4, KlM5 and KlM6 were not included, value of likelihood ratio statistic obtained for 2005 was 125.28 and 164.28 for 2006, so both values were greater than $\chi^2(5) = 11.07$. The households living in small cities (100,000-200,000 inhabitants) perceived their income situation as "very poor" less likely than households from large cities with 500,000 or more inhabitants, but more likely than rural households, *ceteris paribus*. It may be explained by lower costs of living in rural areas. The increase in number of sources of livelihood decreased the probability of assessing monthly disposable income as at least "scarcely enough" in 2005. The parameter estimated for number of sources of livelihood is not significant at 0.05 level in the model for 2006 data.

As expected, the estimated values for the household size variable are negative and for income – positive. The test on the household size coefficient was highly significant, suggesting the existence of economies of scale. The estimated scale elasticities are shown in Table 5.

Table 5. Estimates of equivalence scale elasticity

Year	Estimate of scale elasticity	Standard error	95% confidence interval
2005	0.6183	0.0471	[0.5259; 0.7107]
2006	0.6552	0.0378	[0.5811; 0.7293]

Source: own calculations obtained by using Stata software

The resulting scale elasticity was 0.62 for 2005 and 0.66 for 2006 data. The elasticities are at least significant at the 5% level for both models presented. Comparing the results with J. Schwarze's research in our study higher values of elasticities were derived. Other Polish researches based on the subjective approach also reported lower scale elasticities:

- S.M. Kot proposed his own so-called Cracow Income Evaluation Questions (CIEQ) and estimated equivalence elasticity 0.43 for 1998 data [13],
- B. Kasprzyk on the base of Leyden Income Evaluation Questions (LIEQ) obtained for 1997 estimate of parameter e = 0.25 [12],

– scale elasticity corresponding with equivalences scales calculated by J. Podgórski applying LIEQ method for 1994 was about 0.44 [16] (see also Table 6).

Objective methods derive generally higher equivalence scale elasticities than subjective ones. Econometric methods based on demand systems yield estimate of scales elasticity about 0.72 [19].

The range of equivalence elasticity for the OECD scale[6] 70/50 is about 0.7-0.8 and for the scale OECD 50/30: 0.5-0.7 for Polish households.

Table 6 compares different equivalent scales for various types of households. The scales shown below are usually used in Polish researches on income inequality and poverty.

Table 6. Comparison of alternative equivalence scales[7]

Number of household members	Subjective scale 2005	Subjective scale 2006	Podgórski's scale 1994	OECD scale 70/50 (adults only)	OECD scale 50/30 (adults only)	Szulc's scale[8] 1993
$n = 1$	1	1	1	1	1	1
$n = 2$	1.54	1.57	1.35	1.7	1.5	1.65
$n = 3$	1.97	2.05	1.62	2.4	2.0	2.20
$n = 4$	2.36	2.48	1.84	3.1	2.5	2.71
$n = 5$	2.71	2.87	2.03	3.8	3.0	3.19

Source: own calculations and [16; 19]

On average, Szulc's scale was between OECD 70/50 and 50/30 ones. Podgórski's scale appeared the most "flat". Scales calculated on the base of ordered logit models are very close to the OECD 50/30 scale. An old age pensioners' couple was found to require on average about 1.5 times higher income as a "comparable" single retired person to experience the same level of income well-being. This was a little less than the ratio of so-called "social minimum" calculated by the Institute of Labour and Social Studies (ILSS). In 2005 "social minimum" for one-person household was 780.3 zł and for couple of retirees: 1256.3 zł; in 2006 respectively: 801.3 zł and 1302.4 zł.

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[6] In so-called OECD scale 70/50 scale first adult has weight 1, each next adult 0.7, each child 0.5; in scale 50/30 first adult has weight 1, each next adult 0.5, each child 0.3.

[7] It should be noticed that Podgórski's and Szulc's scales were obtained for the whole sample of households coming from Household Budget Survey and scales estimated in this study – only for retirees households.

[8] Szulc's scales presented in Table 6 are computed for households without children which heads were below 60.

7. Concluding remarks

In this paper recent data on subjective economic poverty of households of retirees in Poland was analyzed. Income satisfaction data from 2006 and for comparison from 2005 were taken into account. The inspiration for this research is J. Schwarze's paper in which ordered logit model had been applied to estimate the equivalence scale elasticity [17].

In the paper some problems of model specification were stressed. The ordered response model makes the assumption that the explanatory variables of the model will have the same impact across each of the categories of the dependent variable, which is known as the "parallel regression assumption". This assumption was tested with the approximate likelihood ratio test and the Brant test. The research demonstrated the violation of parallel regression assumption for the whole sample of households of retirees. Leaving out of account the poorest and richest households this assumption could not be rejected. In order to check specification of ordered logit models various statistical tests were conducted.

Using the ordered response model approach, impact of determinants of subjective economic well-being are analyzed. Some important results are derived under *ceteris paribus* assumption:

– rural households perceived their income situation as "scarcely enough" or "good" or "very good" more likely than households from large cities;
– subjective economic assessment of being "very poor" was more frequent in households with female heads than in those with male ones;
– income satisfaction was U-shaped with age;
– probability of assessing monthly disposable income as at least "scarcely enough" in one-person household was lower than in multi-person ones.

Like in J. Schwarze's research, compared with the other subjective approaches, higher scale elasticities were derived from income satisfaction data by the use of ordered logit models. Comparing the situation in one- and two-persons households one obtained results similar to those of the Institute of Labour and Social Studies.

This study improved the understanding of the mechanism underlying the income satisfaction responses. It seems that the application of ordered response model approach might be an interesting alternative to estimate equivalence scales from subjective data. Such equivalence scale questions are of considerable public policy interest, for example for the setting relative old age pension rates. Since only regular monitoring subjective well-being can produce a clear picture of the impact of social changes on people's perceptions and experiences, this study may serve as a starting point for further research which would investigate the influence of ongoing economic and social changes in Poland on the subjective economic poverty of its citizens.

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ANALIZA SUBIEKTYWNYCH ASPEKTÓW UBÓSTWA NA PODSTAWIE PODEJŚCIA WYKORZYSTUJĄCEGO UPORZĄDKOWANE MODELE LOGITOWE

Streszczenie

W pracy podjęto temat subiektywnego ubóstwa na podstawie danych z badań budżetów gospodarstw domowych przeprowadzonych przez Główny Urząd Statystyczny. W prezentowanej analizie wykorzystano odpowiedzi gospodarstw domowych na pytania dotyczące subiektywnego postrzegania swojej sytuacji dochodowej. Inspirację do badań w tym zakresie stanowił artykuł Schwarzego z 2003 r., gdzie w celu określenia elastyczności skali ekwiwalentności zastosowano modele logitowe kategorii uporządkowanych. Takie modele pośrednio zakładają, że efekt wpływu zmiennych objaśniających jest taki sam dla każdej z rozważanych kategorii, co w literaturze przedmiotu bywa nazywane „założeniem równoległych regresji". W pracy zakwestionowano spełnienie tego założenia w przypadku całej próby gospodarstw domowych emerytów, natomiast po wyłączeniu z próby gospodarstw najbiedniejszych i najbogatszych stwierdzono, że nie było podstaw do odrzucenia „założenia równoległych regresji".

Niektóre wyniki otrzymane w pracy są zgodne z typowymi wnioskami uzyskiwanymi w analizach ubóstwa, takimi jak np. U-kształtna zależność między wiekiem a subiektywną satysfakcją z dochodów. Natomiast odmienne konkluzje dotyczą wpływu płci głowy gospodarstwa domowego na postrzeganie własnej sytuacji finansowej. Ponadto, porównując otrzymane wyniki z różnymi rezultatami analiz przeprowadzonych na podstawie danych z polskich gospodarstw domowych, stwierdzono wyższe wartości elastyczności skali ekwiwalentności.