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### **Subjective poverty lines based on the EU-SILC survey<sup>1</sup>**

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#### **Abstract**

In the paper, the authors propose a new method of constructing subjective poverty lines, which is a modification of the classic approaches applied to this problem. It is less demanding in terms of necessary input data, which makes it applicable to the EU-SILC survey data. The possibility of using data from a survey conducted in accordance with a methodology that is harmonized throughout the EU is an important advantage of the suggested approach. The paper presents the results of assessment of the so-called subjective poverty in Poland based on varied approaches, including newly proposed one. The paper shows the importance of the models and assumptions used in discussed approaches for the obtained estimates referring the poverty thresholds and the extent of poverty. The particular value of such assessment of subjective poverty which are based solely on the opinions of respondents without using arbitrary assumptions is emphasised.

#### **Introduction**

Poverty is a social and political issue. However, it always concerns specific people and households, so it is of individual nature. Therefore, when we talk about an assessment of this phenomenon, it does not seem justified to limit its statistical measurement only to the so-called objective methods in which the opinions of the society and its members on the subject (social perception of the phenomenon) are omitted from the very beginning. Therefore, for many years attempts have been made to develop various methods of measurement of the so-called subjective poverty. These methods which refer to the opinion of individuals on their material situation allow both verification and supplementation of the poverty picture obtained with objective measurement methods. This paper can be treated as a voice in the discussion on the possibilities of more widespread use of subjective approach to poverty measurement - not only in the context of one country, but also in the context of international comparisons. The authors present here an analysis of the possibility of using the results of a living conditions and income survey, harmonised at the EU level (EU-SILC), for this purpose. This paper includes a proposal of a new method of calculation of subjective poverty lines as well as its comparison with the methods used so far in this field such as the Leyden Poverty Line (LPL), the Subjective Poverty Line (SPL), or the method developed by Deleeck and colleagues (the so-called CSP method).

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<sup>1</sup> The results presented in the paper are obtained as the result of experimental work and should not be treated as official data of GUS

The proposed solution is inspired first of all by the idea of the LPL method, the direct application of which to the EU-SILC data is not possible due to insufficient information.

The results of empirical analyses presented in the paper concern only Poland. In the next step, the authors intend to test the proposed solution for other countries in which the EU-SILC is conducted.

### **Construction of subjective poverty lines inspired by LPL**

The construction of the Leyden Poverty Line (LPL) (Goedhart et al., 1977, Flik and Van Praag, 1991) according to the original method requires the estimation of parameters of the individual income utility function (WFI) at the level of each unit (household). This requires the information about respondents' answers to a special set of questions called IEQ (Income Evaluation Question). These questions concern the indication of household income levels that the respondent would describe as "very bad", "bad", "insufficient", "sufficient", "good", "very good" (the respondent gives 6 income levels). IEQ questions put a heavy burden on the respondent, also due to their speculative nature, and are asked in a few surveys carried regularly. In particular, they do not appear in the EU-SILC survey, which is a key survey of European income statistics, providing comparable results for different countries. The method of constructing subjective poverty lines suggested in the paper is based on the ideas of the LPL method, introducing modifications that allow to obtain subjective poverty lines inspired by the LPL using only the information contained in the EU-SILC survey, without using the answers to IEQ questions. Due to the close conceptual connection with LPL, this approach has been provisionally called as a quasi-LPL, although the analysis of empirical results and the discussion presented in the final part of the paper show significant differences in interpretation in relation to the original LPL.

An important concept used in the LPL approach is the Welfare Function of Income (WFI). WFI is defined on the individual level and expresses the relationship between particular level of income and the utility which it gives to the given household (the utility is the numerical measure of individual "well-being"). The individual WFI function is presented as a lognormal distribution function with  $\mu$  and  $\sigma$  parameters, specific for each household. The starting point for the construction of LPL is the concept of an individual poverty line, i.e. the level of income which ensures the achievement of a certain level of  $\alpha$  utility by the individual household. When calculating the poverty line in this approach, both the individual poverty line as well as LPL, we calculate it for a given level of usability  $\alpha$  (e.g. 0.4, 0.5, 0.3). Considering the above assumptions, the individual poverty line of an  $i$  household, denoted by  $y_{\alpha i}$ , is the solution to the equation:

$$\Phi \left( \frac{\ln(y_{\alpha i}) - \mu_i}{\sigma_i} \right) = \alpha \quad (1)$$

where  $\Phi$  means standard normal distribution function,  $\mu_i$  and  $\sigma_i$  parameters of WFI specific for household  $i$ .

Hence:

$$\ln(y_{ai}) = \mu_i + \sigma_i \Phi^{-1}(\alpha) \quad (2)$$

where  $\Phi^{-1}$  means an inverse function to the  $\Phi$ .

The idea of LPL approach is to derive subjective poverty lines (poverty thresholds) describing the whole population (not individual households) on the basis of individual poverty lines. The original LPL, however, assumes knowledge about the parameters of individual WFI functions for each household, and, therefore, also about individual poverty lines. These parameters, estimated on the basis of IEQ questions, are the starting point for further calculations.

In order to derive poverty lines for the whole population, one should take into account the relationship between the WFI function of a given household (the value of its parameters) and the actual income of this household. It is assumed that the value of the  $\mu$  parameter of the WFI function is a positive function of the actual income of the household, which means that:

- households with higher actual income need higher income to achieve the same level of utility (individual well-being);
- the utility of a given level of income is lower in the case of households with higher actual income.

This dependence can be saved in the following form:

$$\mu_i = \beta_0 + \beta_1 \ln(y_i) + \beta_2 \ln(s_i) \quad (3)$$

where  $y_i$  is the actual income of the household,  $s_i$  the size of the household measured by the number of people,  $\beta$  – parameters of the described relationship constant in the population.

Equation (3) assumes that the parameter  $\mu$  depends on the actual income and the number of people in the household. This means that the calculated poverty lines (thresholds) will vary according to the household size measured by the number of people. In addition to or instead of to the number of people, other characteristics of the household can also be placed as explanatory variables in this equation, what allows to obtain poverty thresholds differentiated by these characteristics.

By substituting (3) in equation (2) and assuming a constant value of parameter  $\sigma_i$  for the whole population, one can describe the individual poverty line as a function of income:

Equation (3) assumes that the parameter  $\mu$  depends on the actual income and the number of people on the household. This means that the designated poverty lines (thresholds) will vary according to the size of the household as measured by the number of people. In addition to or in addition to the number of people in this equation, you can also put other characteristics of the household as explanatory variables, which allows you to achieve poverty thresholds differentiated according to these characteristics.

By substituting (3) in equation (2) and assuming a constant value of parameter  $\sigma_i$  for the whole population, one can describe the individual poverty line as a function of actual income:

$$\ln(y_{ai}) = \beta_0 + \beta_1 \ln(y_i) + \beta_2 \ln(s_i) + \sigma \Phi^{-1}(\alpha) \quad (4)$$

To derive a poverty line for the population, a level of actual income is sought, at which the household would find itself on the poverty threshold. Thus, assuming  $y_{ai} = y_i$  and denoting this

income level as  $y^*_{ai}$ , a formula is obtained that allows to determine poverty lines according to the LPL method:

$$\ln(y^*_{ai}) = \frac{\beta_0 + \beta_2 \ln(s_i) + \sigma \Phi^{-1}(\alpha)}{1 - \beta_1} \quad (5)$$

The value of the poverty threshold determined this way depends only on the size of the household, and in general it may also depend on the additional characteristics of the household included in the equation (3). It does not depend, however, on the actual income of the household or on the individual WFI function. Therefore, LPL poverty lines are poverty thresholds defined for certain subpopulations, groups of households (e.g. households of a certain size), they are not individual characteristics of a single household.

By redefining the parameters, i.e. assuming  $\gamma_0 = \beta_0 / (1 - \beta_1)$ ,  $\gamma_1 = \beta_2 / (1 - \beta_1)$ ,  $\gamma_2 = \sigma / (1 - \beta_1)$  equation (5) can be represented as:

$$\ln(y^*_{ai}) = \gamma_0 + \gamma_1 \ln(s_i) + \gamma_2 \Phi^{-1}(\alpha) \quad (6)$$

For the modification of the LPL method presented in the paper, it is important that the  $\gamma$  parameters, like  $\beta$  and  $\sigma$ , are constant for the entire population. To determine the subjective poverty lines, knowledge about  $\gamma$  parameters is sufficient; knowledge about the  $\beta$  and  $\sigma$  parameters is not necessary.

This equation describes the level of income constituting the poverty threshold if we fix the level of utility  $\alpha$  corresponding to the poverty threshold. However, we can also treat them more generally, as a formula connecting the level of utility with the level of actual income for a given population. This statement is also significant for the proposed modification of the LPL method.

The procedure for estimating subjective poverty lines in the original LPL method is as follows:

- 1) For each household, individual parameters of WFI ( $\mu_i$  and  $\sigma_i$ ) are estimated on the basis of IEQ questions.
- 2) The  $\beta$  parameters, constant for the whole population, are estimated using regression based on equation (3).
- 3) Subjective poverty lines for the assumed utility level  $\alpha$  are calculated by means of formula (5), using the estimated values of  $\beta$  parameters and assuming the average of  $\sigma_i$  for the population as  $\sigma$ .

If we do not have individual information about answers to the IEQ questions, i.e. a set of utility assessments of different income levels for each household, we are not able to determine neither the individual WFI functions at household level nor the individual poverty lines. Therefore, we do not have the information specified in step 1). However, if we had an evaluation of the utility of our own actual income made by each household, we could estimate the values of  $\gamma$  parameters in equation (6) by regression on the basis of data concerning the entire population. This observation is the essence of the proposed approach, referred to as quasi-LPL.

In the EU-SILC survey, we do not have an evaluation of our own actual income made by the household on a scale corresponding to the IEQ questions. However, we have an evaluation of our own income situation made on a different scale. This is the answer to the question (the so-called ‘‘Deleek question’’) on how a household with its actual income can ‘‘make ends meet’’:

“with great difficulty”, “with difficulty”, “with some difficulty”, “rather easily”, “easily” or “very easily”.

The use of the Deleeck scale instead of the scale used in IEQ to evaluate the utility of income is the first and most important conceptual difference between the proposed approach and the original LPL. However, this is not a concept that has no basis in literature. The interchangeable use of these scales, although in a slightly different context, is proposed as one of the approaches in *Flik, Van Prag* (1991) when discussing various variants of the CSP method.

The second element of the proposed approach, which is original and may raise discussion, is the connection of the answer on the descriptive scale used to assess the utility (in our case, the Deleeck question) with the numerically expressed utility level. The following formula was used:

$$u = (j - 0.5) / m \quad (7)$$

where the  $u$  is the utility level assigned to a given answer (value of the WFI function),  $j$  is the answer number on the scale (e.g. for the Deleeck scale  $j = 1$  corresponds to the answer “with great difficulty”),  $m$  – the number of possible answers on the scale (for the Deleeck scale  $m = 6$ ).

Such a correspondence between utility level and the response scale does not appear *explicitly* in the original LPL method. However, the method used in LPL to estimate the parameters  $\mu_i$  and  $\sigma_i$  at household level, which are estimated as the individual average and standard deviation of income levels declared in the IEQ question by given household, corresponds to the assumption that these levels can be treated as WFI quantiles covering evenly the interval (0, 1). This in turn means that the utility levels corresponding to the particular scale responses evenly cover the range (0, 1), which is recorded in formula (7). This formula assumes the division of the interval (0, 1) into  $m$  equal parts corresponding to particular responses and assigns a level of utility that is the centre of the relevant part. The formula  $u = j / (m + 1)$  was also taken into account, i.e. the division of the interval (0, 1) into  $m + 1$  equal parts and the assigning to particular responses utility levels that are the borders between parts. In the end, however, the formula (7) was chosen.

The full procedure for estimating subjective poverty lines in the proposed modification of the LPL method, referred to as quasi-LPL, looks as follows:

1) For each household, a utility evaluation of the actual income  $u_i$  is obtained on the basis of the answer to the Deleeck question using the formula (7).

2) Parameters  $\gamma$ , constant for the whole population, are estimated by regression the equation (6), where  $y_{\omega i}^*$  is substituted by the actual income of the given household, and  $\alpha$  by assessed utility of this income  $u_i$ .

3) Subjective poverty lines for the assumed utility level  $\alpha$  are determined by formula (6), using the estimated values of  $\gamma$  parameters.

## Subjective poverty lines – other approaches

In addition to the approach proposed in the paper, referred to as quasi-LPL, calculations using other approaches, known from literature, to the problem of subjective poverty lines were also made and presented. Their description can be found, for example, in Flik, Van Praag (1991).

In the approach called **SPL** (subjective poverty line, the term introduced by Kapteyn, Van de Geer, Van de Stadt, 1985, the approach originally described in Goedhart et al., 1977), data from the answers of the respondents to the question concerning only one level of income, which defines the specifically understood boundary of poverty are used. This is called the Minimum Income Question (MINQ), i.e. a question about the minimum, absolutely necessary net income, so that the respondent's household could “make ends meet”. As in the LPL approach, where the relationship between the actual income level and the  $\mu$  parameter of the income utility (WFI) is assumed, the SPL approach assumes an analogous relationship between the actual income and the level of minimum income. This can be described with the following formula:

$$\ln(y_{\min,i}) = \delta_0 + \delta_1 \ln(y_i) + \delta_2 \ln(s_i) \quad (8)$$

where  $y_{\min,i}$  the minimum income declared by household  $i$  in the MINQ question,  $\delta$  means the parameters of the relationship, constant in the population.

The values of the  $\delta$  parameters can be found using the regression based on the set of observations concerning the studied population. When looking for the poverty line, the minimum income is set as equal to the actual income. Assuming  $y_{\min,i} = y_i$  and denoting this level of income as  $y^*_{\min,i}$ , a formula defining the level of poverty line in the SPL approach is obtained:

$$\ln(y^*_{\min,i}) = \frac{\delta_0 + \delta_2 \ln(s_i)}{1 - \delta_1} \quad (9)$$

This threshold, in case of the form of relationship (8) adopted here, depends only on the size of the household, so it can be denoted as  $y^*_{\min}(s)$ . In general, if the formula (8) other household characteristics were taken into account, it would also depend on these characteristics.

The **CSP** approach (*The Centre for Social Policy, Deeleck, 1977*) uses as the data source the answers of the respondents to two questions, described earlier in the paper: MINQ, i.e. the question about minimum income and Deeleck question, where respondents assess the material and budgetary situation of their own household. As the poverty line, the average value of the minimum income (based on the MINQ question) is appropriately calculated for the group (subpopulation) of households that find themselves “on the poverty line”. This group is comprised by households which in Deeleck's question declare that with their income they can “make ends meet” “with some difficulty”.

As the minimal income, which is the basis for calculating the poverty threshold, the minimum of the minimal income  $y_{\min}$  (declared in the MINQ question) and the actual household income is used. The average is calculated in a two-step procedure, with the rejection of observations identified in the first step as outliers. This is to make estimates more robust. Because in other approaches poverty thresholds are diversified by household size, also CSP poverty lines were calculated for subpopulations distinguished according to this criterion.

In this approach, the poverty line is calculated solely on the basis of the responses of a relatively small group of respondents who, according to a specific criterion, were qualified as having income close to the poverty line. The answers of other respondents are not taken into account when establishing the poverty line. This approach gives the “right” to set the poverty line only to respondents for whom living near this line is a real experience (in other words, we assume that only such persons/households can credibly assess the level of minimal income). This is an element that distinguishes CSP from the other concepts of subjective poverty lines, the construction of which takes into account the responses of all respondents, treating them equally.

The information needed to determine subjective poverty lines according to SPL and CSP approaches (i.e. answers to MINQ and Deeleck question) is regularly collected in the EU-SILC survey.

### **Empirical results and discussion of them**

Subjective poverty lines according to the presented approaches were calculated on the basis of the results of the Polish edition of the EU-SILC survey of 2015. They refer to the disposable household income in Poland for the year 2014. The income amounts (thresholds) are expressed in PLN and represent the average monthly income (the income for the whole year from EU-SILC has been divided by 12). The dataset on the basis of which the calculations were carried out, has 12,179 observations (households).

The subjective poverty lines (thresholds) obtained using the approach proposed in the paper, defined as quasi-LPL, were compared with the results of the use of other approaches discussed, i.e. SPL and CSP. For comparison, also relative poverty measures for the same data set were presented, as well as other indicators related to subjective poverty which in the authors' opinion may be treated as equivalent or competitive measures of the phenomenon.

When calculating poverty thresholds (as average values) in the CSP method and when estimating regression parameters in the quasi-LPL and SPL methods, the weights representing the number of people in a household were used (household estimation weight \* number of people in the household).

In the case of the quasi-LPL method, the following parameters estimates for the formula (6) were obtained by regression:

$$\ln(y) = 7.6379 + 0.6486 \ln(s_i) + 0.4926 \Phi^{-1}(u(y)) \quad (10)$$

$$(R^2 = 0.443)$$

In the case of the SPL method, the following regression results were obtained for formula (8):

$$\ln(y_{min}) = 5.2397 + 0.2963 \ln(y) + 0.2654 \ln(s) \quad (11)$$

$$(R^2 = 0.464)$$

which after transformation to formula (9) gives:

$$\ln(y_{min}^*) = 7.4457 + 0.4210 \ln(s_i) \quad (12)$$

Equations (10) and (12) have a form that allows their parameters to be compared. They allow to calculate subjective poverty lines (poverty thresholds) according to the quasi-LPL and SPL methods for different household sizes (in the case of the quasi-LPL, the utility level  $\alpha$  defining the poverty threshold should additionally substitute the  $u$  value in formula (10)).

Table 1 presents the values of poverty thresholds for households of various sizes (from 1 to 6 people) obtained using the approaches considered. For comparison, the values of relative poverty thresholds, calculated on the basis of equivalent income using the OECD modified scale (poverty threshold at 60% median) were also included in the statement. This is a measure known as *at-risk-of-poverty rate* (AROP), commonly used in the analysis of income and poverty based on data from EU-SILC. Because the applied definition of relative poverty uses the scale of equivalence, not the size of the household, the presented thresholds of relative poverty refer to specific examples of the household composition described in the last row of the table.

The poverty lines obtained by means of different methods differ not only in the level but also in the different scale of progression with the increase in the size of the household. To better illustrate this, Table 1 also shows empirical equivalency scales corresponding to different methods of poverty assessment. They show the threshold value for a household of a given size related to the threshold value for a single-person household.

In the case of the quasi-LPL method, calculations for a wide range of utility levels  $\alpha$  defining the poverty threshold were made and presented. In the case of the original LPL, the poverty lines are usually defined for utility level 0.4 or 0.5. The list includes the usual levels, although it was extended by lower levels of  $\alpha$ . The reasons for this approach are further discussed in the discussion of results. In the result tables, the  $\alpha$  value is given in brackets near the method designation, with 0.33 representing  $\alpha = 1/3$ .

Table 2 presents the estimates of the extent of poverty (i.e. poverty rates) obtained using particular methods. The first numeric column presents the percentage of households, the second column shows the percentage of people in households considered to be at risk of poverty by applying each of the considered approaches. These indicators may, of course, vary between methods depending on the issue of which sizes of households are more frequently considered to be poor. All indicators refer to the population (they were calculated using estimation weights).

In addition to poverty indicators obtained using the methods described above, Table 2 also includes some measures constructed quite simply on the basis of subjective evaluations expressed by respondents, which can also be considered as describing the extent of subjective poverty. These are the percentage of households (and the percentages of persons belonging to such households), which:

- declared in the MINQ question the value of the minimal income necessary to “make ends meet” higher than the actual income of the household;



- declared in Deeleck's question that they “make ends meet” “with great difficulty” or “with difficulty”<sup>2</sup>.

Table 1. Poverty thresholds for monthly income in PLN obtained using different methods.

Household size (number of persons)	1	2	3	4	5	6
<b>Subjective poverty thresholds by method</b>						
Quasi-LPL (0.25)	1 489	2 334	3 036	3 658	4 228	4 759
Quasi-LPL (0.3)	1 603	2 513	3 269	3 939	4 553	5 124
Quasi-LPL (0.33)	1 679	2 631	3 423	4 125	4 768	5 366
Quasi-LPL (0.4)	1 832	2 872	3 736	4 502	5 203	5 856
Quasi-LPL (0.5)	2 075	3 253	4 232	5 100	5 895	6 634
SPL	1 712	2 224	2 592	2 889	3 142	3 366
CSP	1 485	2 425	2 912	3 029	3 363	3 381
<b>Relative poverty threshold</b>						
At risk of poverty rate (60% of median)	1 163	1 744 / 1 512	2 093	2 442	2 791	3 140
<b>Empirical equivalence scales</b>						
Quasi-LPL	1.00	1.57	2.04	2.46	2.84	3.20
SPL	1.00	1.30	1.51	1.69	1.84	1.97
CSP	1.00	1.48	1.75	1.91	2.00	2.00
At risk of relative poverty rate	1.00	1.50 / 1.30	1.80	2.10	2.40	2.70
Household composition for relative poverty (adults + children)	(1+0)	(2+0) / (1+1)	(2+1)	(2+2)	(2+3)	(2+4)

Table 2. Poverty rates (percentage of persons and households affected by poverty) obtained using different methods.

	<b>Poverty rates [in %]</b>	
	<b>Households</b>	<b>Persons (households' members)</b>
<b>Subjective poverty by method/measure</b>		
Quasi-LPL (0.25)	32.2	32.3
Quasi-LPL (0.3)	37.5	38.0
Quasi-LPL (0.33)	41.0	41.2
Quasi-LPL (0.4)	47.6	47.7
Quasi-LPL (0.5)	57.9	58.1
SPL	27.6	22.0
CSP	28.0	24.3
Actual income < declared minimal income	28.8	25.3

<sup>2</sup> See e.g. Buttler F. (2013)

Making ends meet with difficulty or great difficulty	30.4	29.7
<b>Relative poverty</b>		
At risk of poverty rate (60% of median)	17.0	17.6

The subjective income thresholds obtained using the quasi-LPL method for the  $\alpha$  values of 0.5 and 0.4 were much higher than in the other methods compared, both subjective poverty lines and relative poverty assessment. From the point of view of interpretation, it is difficult to treat them as poverty thresholds, taking into account that about 50% (or even more than 50% for  $\alpha = 0.5$ ) households and people in households are below the threshold. This leads to the conclusion that if we would like to create poverty lines based on this approach, the  $\alpha$  utility level should be set at a level lower than 0.4. The results of calculations for such levels are therefore presented in Tables 1 and 2.

In addition to the conclusions regarding the suggested  $\alpha$  level treated as a poverty line, it should be considered whether and how the results allow us to infer about the method, its quality and usability of the application.

The high threshold values for  $\alpha = 0.4 / 0.5$  and the need to adopt lower  $\alpha$  levels for poverty evaluation clearly indicate that – contrary to the authors’ original intentions – the proposed approach is not equivalent and is not a direct substitution of the original LPL method. In the original LPL, lower values of poverty thresholds and lower poverty rates are obtained at the same level of  $\alpha$  (see e.g. Flik and Van Praag, 1991, for Poland Podgórski, 1997). It would be dangerous to directly compare the poverty line obtained using the proposed method with the results of the original LPL or refer the level of  $\alpha$  in both methods to the same utility function.

By determining the interpretation discrepancy between the two approaches, one can ask, however, whether this should be the reason to criticise the proposed approach, or whether the results seem strange, difficult to explain or interpret. According to the authors, it does not have to be that way.

The most likely source of the discrepancy between the two approaches seems to be the use of the Deeleck scale to assess the utility of income instead of the scale used in the IEQ question. However, taking into account the scale adopted (Deeleck scale), the results obtained regarding the subjective poverty lines do not seem strange nor surprising in any way. To justify this, Table 3 presents the distribution of the assessments of the financial and budgetary situation of households obtained using the Deeleck question. In the lower part of the 6-point scale (including the first 3 responses) there are 67.2% of households and 67.8% of persons (members of households). Such part of the population evaluate their situation by declaring that their income allows “to make ends meet” at least with some difficulty (or with greater difficulty). Therefore, it is not surprising that using these answers as an evaluation of income utility and assuming the poverty line corresponding to the middle point of the scale ( $\alpha = 0.5$ ), we obtain a group covering more than half of the population.

Taking into account that the answer “with some difficulty” is considered adequate to describe their own situation by a major part of the population, it seems most logical to treat only the first

two answers, i.e. “with difficulty” and “with great difficulty” as the symptom of subjective poverty. This remark may be a contribution to the discussion of the “proper” level of  $\alpha$  that allows to define subjective poverty with the approach proposed by the authors. According to the formula (7), the position “with difficulty” corresponds to  $\alpha = 0.25$ . Taking this into account, it may seem sound to treat  $\alpha = 0.25$  or  $\alpha = 1/3$  (i.e. the midpoint of the interval corresponding to the answer “with difficulty” (0.25) or the borderline (1/3) between the intervals corresponding to the answers “with difficulty” (“already poverty”) and “with some difficulty” (“not yet poverty”)) as the line of poverty. Another choice may be  $\alpha = 0.3$  as a rough value close to these proposals. These are  $\alpha$  values that were included in the calculations presented in Tables 1 and 2.

Table 3. Distribution of assessments concerning difficulties in “making ends meet” in the population (Deleeck question answers).

<b>Making ends meet</b>	<b>Percentage of households</b>	<b>Percentage of persons (households' members)</b>
with great difficulty	11.3	10.2
with difficulty	19.1	19.5
with some difficulty	36.8	38.1
rather easily	24.5	24.6
Easily	7.1	6.6
very easily	1.3	1.0

The possibility of a reasonable application of utility thresholds at the level of 0.4 or 0.5 in the original LPL in comparison with the obtained results regarding quasi-LPL may indicate that respondents more “optimistically” evaluate a given income level using the terms/concepts used in IEQ questions (good/bad, sufficient/insufficient) than assessing “the possibility of making ends meet” at a given level of income. It can also be concluded that the answer “with some difficulty” to Deleeck's question is not treated by the respondents as synonymous with real problems or the perception of their income as too low (unsatisfactory). This is additionally confirmed by the conclusions from the previous discussion of the threshold level  $\alpha$  for the quasi-LPL method and recommendations in this respect. It can also be noted that also the minimum income declared in the MINQ question is understood by the majority of respondents as much lower than that at which there are “some difficulties” in “making ends meet”. This is indicated by the results of applying the SPL method, which give the results quite close to the quasi-LPL only at low  $\alpha$  levels (in terms of thresholds values for smaller households; poverty rates are lower for SPL even in comparison with  $\alpha = 0.25$ ).

It follows from the above considerations that the identity or direct correspondence between the IEQ scale and the Deleeck scale cannot be assumed, and the interchangeable use of these scales is a procedure influencing the results and their interpretation. This does not exclude justified use of any of the scales, but it is important to remember about the differences in interpretation and not to treat the obtained results as directly equivalent.

The presented empirical results show that the quasi-LPL approach, probably due to the use of Deeleck's question to evaluate the utility in place of evaluations on the scale used in the IEQ question, requires the adoption of lower limits of utility  $\alpha$  when defining subjective poverty than the original LPL. From an interpretative point of view it does not have to be a disadvantage of the proposed approach nor it does have to be a manifestation of weakness of such defined utility function. The poverty line by definition should correspond to a low or very low, and not a "medium" level of meeting needs. If the utility measure is defined as a number in the range (0; 1), then the model in which we adopt a relatively low value of poverty, e.g. 0.3 or 0.25, to produce reasonable results may seem interpretatively more natural than the one where a value close to the middle of the scale, 0.5 or 0.4, should be adopted as the poverty line. In some sense, this is consistent with the approach to relative poverty, where we take, for example, 60% of the median as the line, not the value close to the median.

Another significant difference between the original LPL and the quasi-LPL is that in the IEQ question, which provides the information used in the original LPL, the respondent has to assess the utility of a wide range of income levels. Of the six income levels he/she has to determine (as corresponding to different levels of utility), usually only one or two may be close to his/her actual income, and the remaining may be very distant not only from the current income but also from income levels he/she has ever achieved. This evaluation is therefore theoretical and highly speculative, not supported by real experience. Although in the formula (3) we take into account the dependence of such expressed utility assessment on the actual income of the respondent, one can have doubts as to the preciseness, reliability and stability of opinions of the respondent regarding such an abstract issue, the basis for further analysis. In the proposed quasi-LPL approach, only the utility of the actual income is assessed on the basis of the respondent's opinion. Respondents' evaluations regarding any other (theoretical) income level than the one currently achieved are not used. This element differentiating the methodology of both approaches seems to be an advantage of the proposed method in relation to the original LPL.

When returning to tables 1- 2. and comparing the results of the subjective poverty assessment using different approaches based on data from the EU-SILC survey, attention should be paid to the diversification of estimates, mainly regarding the value of poverty thresholds. In the case of quasi-LPL, the results corresponding to different values of the  $\alpha$  parameter are also different, but this results from the nature of the method and its assumptions.

While household poverty rates are fairly close for the quasi-LPL (0.25), SPL and CSP methods, the poverty thresholds for particular groups of households are significantly diversified. The increase in the threshold value along with the increase in the size of the household is the strongest in the case of the quasi-LPL and clearly the weakest in the case of SPL. The SPL method gives for 3-person households a threshold higher by only 50% compared to 1-person households. As for the value of the threshold for single-person households, SPL gives a result similar to quasi-LPL (0.33) and significantly higher than CSP, which in turn gives a result similar to quasi-LPL (0.25). It is worth noting that the empirical scale of equivalence corresponding to the thresholds obtained for the quasi-LPL method turned out to be quite close to the scale taken into account when assessing relative poverty<sup>3</sup>, although somewhat more

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<sup>3</sup> The so-called modified OECD equivalence scale

progressive. Another testimony to the discrepancies between the methods is that the quasi-LPL gives similar values of poverty rates at the level of households and people, while in the case of SPL and CSP the indicators concerning persons turned out to be significantly lower than household-related indicators.

The differences between results of the three approaches used to determine subjective poverty lines show how large the dependence of the obtained results on the adopted models and assumptions is. Therefore, two simple indicators, which can be treated as measures of subjective poverty and which are based solely on respondents' opinions are shown as an alternative to the use of subjective poverty lines constructed on the basis of formal models and assumptions that require complex statistical calculations. These are: percentage of households (persons in households) declaring a minimal income (MINQ question) higher than the actual income and the percentage of households (people on farms) declaring difficulties in “making ends meet”. In contrast to the subjective poverty lines constructed according to the described approaches, the criterion of poverty is solely the subjective assessment of a given respondent, not “objectivised” in any way by “averaging” assessments for the whole population. Of course, in this case the way of defining the measure affects the obtained result too, which is shown, for example, by the example of two mentioned indicators, yielding slightly different results. The simplicity of the indicators and the lack of use of advanced mathematical transformations and assumptions, however, means that their interpretation results from the definition itself and is much more natural and understandable for the recipient.

### **Discussion summary**

The properties of the four considered approaches to constructing subjective poverty lines (LPL, quasi-LPL, SPL, CSP) which may influence the choice of a particular approach to the poverty measurement are worth summarising. The original LPL method requires the availability of data from the IEQ question, the most extensive and burdensome for the respondent. The SPL and CSP methods require the MINQ question, while the CSP approach also requires the Deeleck's questions in which the respondent assesses his or her own financial and budgetary situation (“making ends meet”). In the quasi-LPL method, only Deeleck's question is used. In all four approaches, information on the actual household income is necessary.

Of the approaches mentioned above, only the quasi-LPL is not based on data that requires the respondent to determine abstract income levels at which it would achieve a certain utility (i.e. IEQ or MINQ questions). In some sense, the same can also be said about the CSP method, because the respondent makes an abstract income assessment there (minimal income – MINQ question), but due to the fact that we only consider respondents in a situation close to the poverty line, the amount of the minimal income is “less abstract” for them. Such solution, i.e. determination of the poverty threshold based on the response of only a small subgroup of respondents, is, however, often a source of criticism of this method, as the threshold should apply to the whole population. The quasi-LPL approach is therefore the only one among those considered, where we do not require the respondent to evaluate the utility of income remote from the level of his or her actual income, and we take into account the observations of all respondents when determining the poverty threshold.

Another issue worth paying attention to is the combination of subjective and objective elements in the concept of subjective poverty lines (independently of the method used). This approach assumes determining poverty thresholds of an objective nature, i.e. constant for the whole population or its subsets distinguished due to objective features (e.g. household size). The poverty evaluation is based on a comparison of the actual income with these thresholds. The subjectivism of the approach manifests itself in the fact that the thresholds are constructed on the basis of subjective evaluations (opinions) expressed by the respondents, which, however, are only the starting point for calculations. The determination of poverty lines on their basis is based on more or less sophisticated statistical methods. This approach is described by the authors as “objectivised”.

When talking about subjective poverty, the “fully subjective” measures should rather be used, assuming the classification of a household as one affected by poverty solely on the basis of subjective opinions expressed by them, without elements of “objectification”. Examples of two simple indicators defined in this way are presented in the paper.

The “fully subjective” and “objectivised” approaches are not in principle equivalent and the differences between them important from the point of view of the interpretation of results should be remembered. In the “objectivised” approach, poverty thresholds for the population are determined, which is not possible in the “fully subjective” approach (because the subjective poverty threshold is individual, different for each household). Objectivisation prevents a situation in which a household with a higher income is considered poor (because it feels like it), while households with lower income and the same objective characteristics are not considered poor (because they consider their income to be enough). In the case of a “fully subjective” approach, this situation is possible and not considered incorrect. The method of analysis we adopt should depend on what information we want to obtain and on what topic we are going to conclude.

## **Conclusions**

The approach to determining subjective poverty lines suggested in the paper, described as quasi-LPL, may be an alternative to the original LPL method in a situation where we do not have data from the IEQ question, in which the respondent specifies income levels corresponding to different levels of utility. It can also be an alternative to the SPL and CSP methods in a situation where we do not have the answers to the MINQ question, in which the respondent determines the minimal income necessary to “make ends meet”. In addition, some features of the proposed approach have been identified that may support its use, disregarding the issue of data availability.

Despite the methodological affinity of the proposed approach with the original LPL method, it is not possible to use the results obtained as interpretatively coherent or comparable with LPL results. It was shown by both the empirical results and the presented theoretical considerations. In order to obtain reasonable results, the quasi-LPL requires the use of lower levels of the parameter  $\alpha$  (defining the utility threshold corresponding to the poverty line) than the original LPL. However, similarly to the LPL method, it is possible to use different values of  $\alpha$  for the analysis of poverty at various levels of utility defining the poverty threshold.

The construction of subjective poverty lines, which are the implementation of the “objectivised” approach, requires specifying appropriate models and adopting many assumptions, the specific form of which (e.g. connected with the choice of method) is often to a large extent an arbitrary decision of the researcher. The paper shows how much influence these choices exert on the estimates of the poverty thresholds and rates. Taking this into account, poverty measures based solely on the subjective assessment of the respondent, representing the “fully subjective” approach, seem to be particularly attractive. They do not require the use of arbitrary assumptions, what makes them less sensitive to the subjectivism of the researcher's approach. The simplicity of these measures facilitates the reception and interpretation by users, because a precise description of “what the given number means” is included in the definition of the indicator itself. It seems that this argument indicates the high utility of such measures and speaks for their use, although it does not exclude the soundness of using also the “objectivized” measures in certain cases, when the purpose of the analysis and the research questions justify it.

The strictly subjective measures are a significant complement to the image of phenomena analysed by the so-called objective indicators. In the case of poverty, this seems particularly important, as poverty can be largely subjective. It results e.g. from the fact of diverse human needs and the different feeling of their satisfaction. It may also concern diversified skills in managing the financial resources and, consequently, different utility of these resources.

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