

# SUBJECTIVE POVERTY LINES AND THE YODEN INDEX: INSIGHTS FROM SLOVAK AND CZECH DATA

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## Abstract

Understanding the evolving trends in key socio-economic indicators is crucial for shaping public opinion and informing policy decisions. However, the European Union lacks official subjective poverty statistics, despite recognizing their importance. In addition, the absence of the Minimum Income Question (MIQ) in the EU-SILC survey from 2021 onwards poses a challenge in monitoring subjective poverty levels in the EU.

In this study, we utilize a question from the EU-SILC survey that assesses respondents' ability to make ends meet with their household income, providing an avenue to estimate SPLs.

We demonstrate the application of the Youden index to the context of subjective poverty, defining SPLs as the income level that distinguishes subjectively poor households from non-poor households. However, multiple approaches can be employed to determine the optimal cutpoint based on the Youden index, making the establishment of a SPL less straightforward. Using data from the Slovak and Czech subsamples of the EU-SILC survey, we compare SPL estimates derived from different procedures, including simple maximization, maximization based on LOESS, spline and kernel smoothings, and bootstrapped samples. We further compare these estimated SPLs to those based on the MIQ, providing valuable insights into the subjectivity of poverty measurement.

**Key words:** Subjective poverty, Youden index, EU-SILC, Slovakia, Czechia.

**JEL Code:** I30, I32

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## Introduction

Poverty is a multifaceted phenomenon that has been extensively researched in the social sciences. Various approaches have been employed to define and measure poverty, depending on the research focus. While the objective concept of measuring poverty is widely adopted, subjective approaches have gained increasing prominence in recent years. Subjective poverty research provides valuable insights into how individuals and households perceive poverty. This method of poverty measurement reflects the household's views on a socially acceptable

minimum standard of living and is based on the belief that “*individuals themselves are the best judges of their own situation*” (Flik and Van Praag, 1991). It goes beyond purely objective economic measures and allows for a more comprehensive understanding of the challenges faced by people living in poverty (Kuivalainen, 2014). Economists have reevaluated their perspective on subjective phenomena and generally acknowledge that “*objective and subjective dimensions of well-being are both important*” (Stiglitz et al., 2009).

The estimation of a poverty line is typically a crucial step in the process of measuring poverty. When estimating a subjective poverty line (SPL), one of the most commonly employed approaches is known as the intersection method. This method is based on the Minimum Income Question (MIQ), which asks individuals about the income level they believe is necessary to meet their household’s needs. The subjective poverty line is then defined as the point at which the estimated function, describing the relationship between the subjective minimum income (as reported in response to the Minimum Income Question) and the actual income, intersects the line where subjective minimum income and actual income are equal (Želinský et al., 2021).

While this approach had been widely adopted in various contexts since the 1970s, it is worth noting that as of the 2021 survey year, the Minimum Income Question (MIQ) is no longer included in the European Union Statistics on Income and Living Conditions (EU-SILC). The EU-SILC survey serves as the primary data source for information on income, poverty, social exclusion, and living conditions. Until 2020, the MIQ was a mandatory variable within the survey, but it was removed starting from the 2021 EU-SILC wave.

European Union member states are no longer obligated to collect data on this variable regularly. Consequently, the standard approach to estimating SPLs based on the MIQ cannot be applied, making it challenging to monitor trends in subjective poverty levels in the EU. As a result, alternative methods need to be developed.

However, it is important to note that the survey still incorporates the Deleek attitude question, which prompts respondents to evaluate the ease or difficulty of making ends meet while considering their actual income. As indicated by prior research, this question can also be employed to estimate subjective poverty lines using binary classifiers such as the Youden index (Želinský, Ng, and Mysíková, 2020). We contribute to the literature on alternative methods for estimating subjective poverty lines by evaluating the impact of different techniques for estimating the Youden index on the resulting subjective poverty line estimates.

## 1 Methodology and description of data

In our analysis, we employ the Deleeck attitude question, as presented in the EU-SILC survey: “Can you make ends meet with the actual income of your household with great difficulty; difficulty; some difficulty; fairly easily; easily; very easily?” Respondents can select one of six categories, which leads to a somewhat arbitrary classification of households as poor or non-poor. Consequently, we find it necessary to categorize these responses into two groups: those indicating subjective poverty and those indicating non-poverty. In this study, we classify households as subjectively poor if they report making ends meet with difficulty or great difficulty. This categorization results in a binary outcome, which we subsequently use to estimate the monthly disposable household income threshold that best discriminates between the poor and non-poor within our sample.

The determination of the cut-off point relies on sensitivity and specificity classification measures derived from a 2×2 confusion matrix. When exploring various cut-off points, there exists a trade-off between sensitivity and specificity, and our aim is to optimize both of these measures simultaneously. One effective approach to achieving this balance is by maximizing the Youden index (Thiele and Hirschfeld, 2020). Previous research has applied the Youden index to the context of subjective poverty, defining a cut-off point (SPLs) as the income level that distinguishes subjectively poor households from non-poor households (Želinský et al., 2020). The Youden index is a function of ‘c’ that maximizes the sum of sensitivity ( $Se$ ) and specificity ( $Sp$ ) classification measures.:

$$J(c) = \max_c \{Se(c) + Sp(c) - 1\} \quad (1)$$

The determination of a cut-off point can be based on the ‘raw’ data or involve various smoothing techniques or bootstrapping. In this specific study, we employ the following approaches: splines smoothing, LOESS smoothing, kernel smoothing, and bootstrapping. Each of these methods may yield different results. However, when analysing subjective poverty dynamics, the focus is on identifying patterns in time series rather than exact values. Therefore, we compare the estimates of subjective poverty lines derived from different procedures with the standard SPLs based on the MIQ and the intersection method.

The analysis presented in this study is based on the Czech and Slovak subsamples of the EU-SILC (EU-SILC cross-sectional UDB version of 2022-09). We utilize data covering the entire available periods (2005-2021 for Czechia and 2005-2020 for Slovakia). Due to constraints related to paper length, we illustrate our approach using a subsample of single-adult

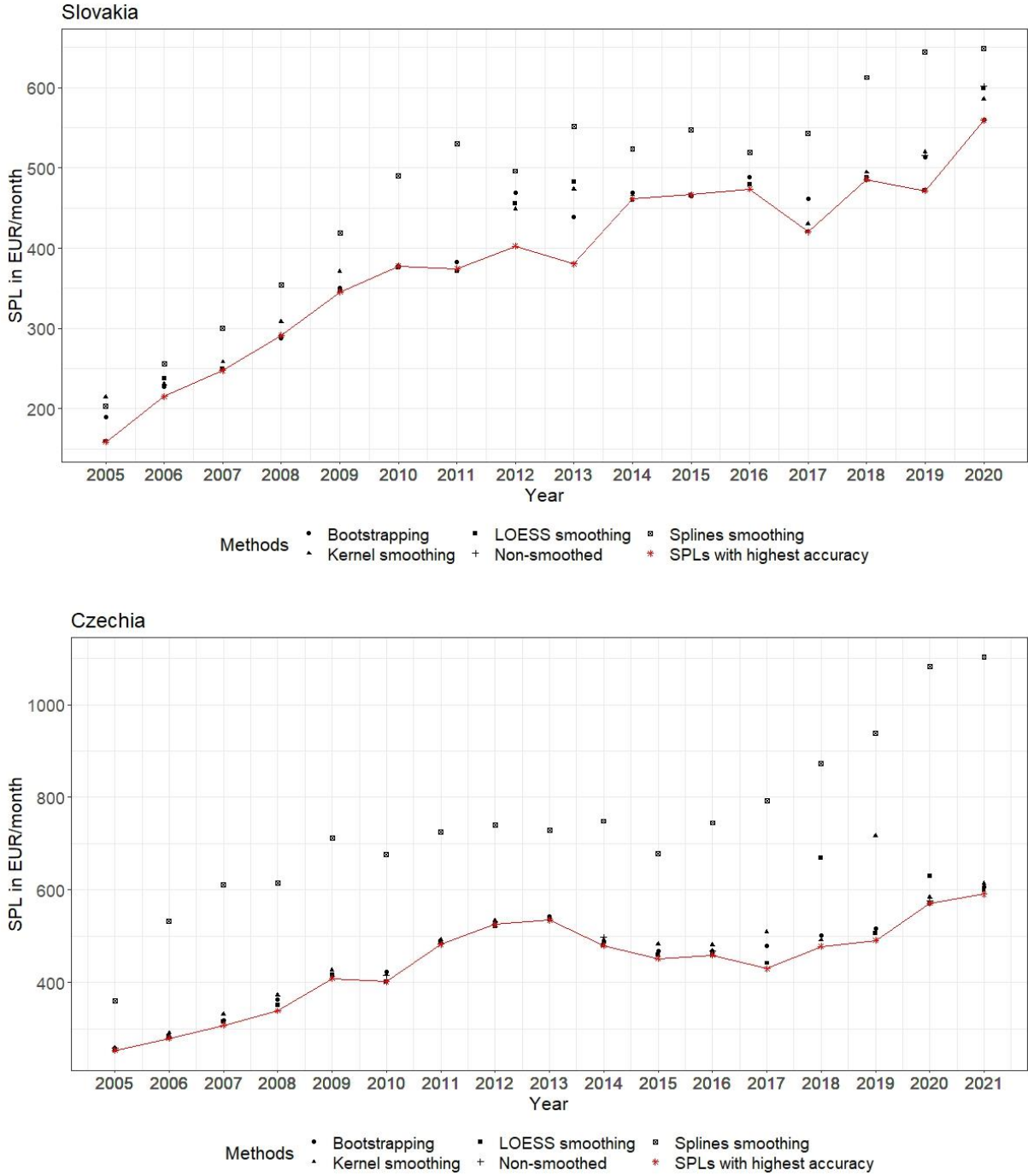
households. Since the household structure is one of the key variables influencing the results, this subsample provides a focused perspective.

## **2 Results**

As depicted in Figure 1, all estimation techniques reveal similar trends SPLs for single-adult households in both Slovakia (top panel) and Czechia (bottom panel). However, as indicated by the figure, there are significant variations in the estimated SPLs. Notably, the splines smoothing method produces considerably higher SPL estimates in both Czechia and Slovakia. While the results in Slovakia exhibit a somewhat similar pattern, the differences are less pronounced.

Because different methods yield different results, for each time period, we select an SPL referred to as the optimal SPL. The choice of the optimal SPL is based on an accuracy metric, specifically the proportion of correct classifications. When we have five different SPLs for a particular year, we consider the one with the highest accuracy to be the optimal SPL. Among all the techniques used, the Youden index (non-smoothed) method most frequently provided the highest accuracy. Interestingly, the estimate with the highest accuracy is often associated with the lowest SPL. Results in Figure 1 further suggest that splines smoothing typically yields the highest estimates of SPLs, considerably higher in the Slovak case than in the Czech case.

**Fig. 1: Trends in SPLs in Slovakia and Czechia**



Note: The figure displays estimated SPLs based on various methods, with the red line indicating the optimal SPL (the one with the highest accuracy).

Source: authors' calculations based on data from EU-SILC

Crucially, the visual representation of the results indicates quite consistent trends in the SPL dynamics, regardless of the smoothing technique employed. To rigorously assess this aspect, we provide Spearman's correlation coefficients among the techniques used in our

analysis. The values presented in Table 1 reveal high correlations between the techniques, underscoring the similarity in SPL dynamics. This discovery is of particular significance because when tracking poverty dynamics, the trend holds greater importance than the exact value itself.

**Tab. 1: Spearman’s coefficient of correlation between the methods**

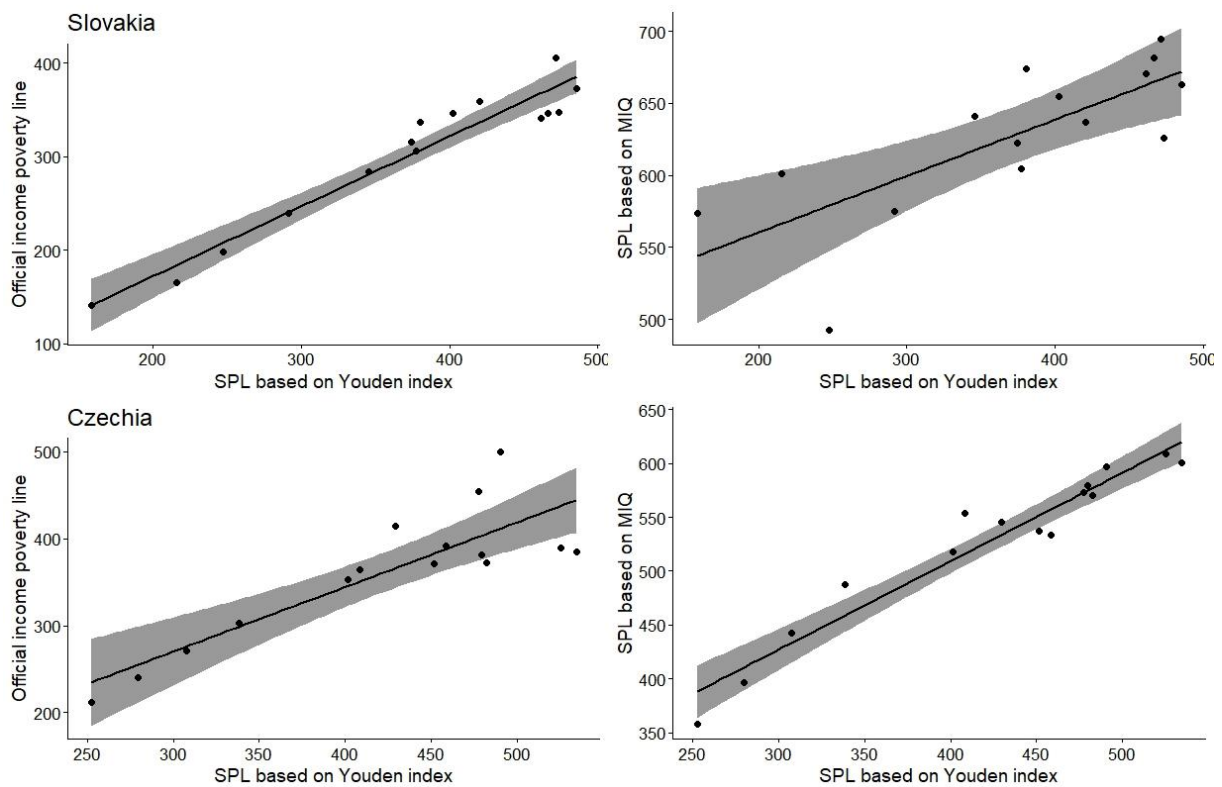
	<i>Panel A: Slovakia</i>			
	Bootstrapping	LOESS smoothing	Splines smoothing	Kernel smoothing
Youden index	0.979	0.924	0.888	0.788
Bootstrapping		0.909	0.847	0.821
LOESS smoothing			0.900	0.806
Splines smoothing				0.821
	<i>Panel B: Czechia</i>			
	Bootstrapping	LOESS smoothing	Splines smoothing	Kernel smoothing
Youden index	0.980	0.918	0.833	0.586
Bootstrapping		0.948	0.882	0.615
LOESS smoothing			0.855	0.519
Splines smoothing				0.554

Source: authors’ calculations

Next, we aim to assess the extent to which the SPL based on the Deleeck-type question is related to other poverty lines. To do so, we examine the correlation between the optimal SPL based on the Youden index and the official income poverty line (defined as 60% of the national median equivalized income), as well as the SPL based on MIQ and the intersection approach. These relationships are presented in the scatter plots in Figure 2.

The results for Slovakia reveal an exceptionally strong and highly statistically significant positive relationship between the SPL estimated with the highest accuracy and both the official income poverty rate reported by Eurostat ( $\rho = 0.954, p < 0.001$ ) and the SPL based on MIQ and the intersection approach, as reported by Želinský et al. (2022) ( $\rho = 0.761, p = 0.002$ ).

**Fig. 2: Correlation charts for Slovakia and Czechia**



Note: The figure illustrates the correlation between the optimal SPL, based on the Youden index, and both the official income poverty line and the SPL based on MIQ.

Source: authors' calculations

In the case of Czechia, we observe similar yet somewhat stronger results. The correlation coefficient between the SPL based on the Youden index and the official income poverty line is 0.786 ( $p < 0.001$ ), while the correlation between the SPL based on the Youden index and the SPL based on MIQ and the intersection approach is 0.95 ( $p < 0.001$ ).

These relatively strong correlations between the poverty lines estimated through different methods suggest that the SPL based on the Deleeck question and the Youden index effectively capture the concept of subjective poverty.

## Conclusion

To shape public opinion and guide policy decisions, it is imperative to comprehend evolving trends in key socio-economic indicators. However, the absence of official subjective poverty statistics within the European Union presents a challenge, necessitating scientific research in this critical dimension.

While subjective poverty indicators are a vital component of understanding living conditions in society, estimating subjective poverty lines can be approached in various ways.

Each method may yield different results, complicating interpretation. In this study, we demonstrate an alternative approach to estimating subjective poverty lines using the Youden index and employ multiple techniques for its estimation. Given that tracking trends in subjective poverty is of primary interest, the observed patterns hold more significance than the specific values. Our findings suggest that regardless of the technique employed, the qualitative trends in subjective poverty dynamics remain consistent. This key insight implies that in the absence of the MIQ question, an alternative approach based on the Deleeck question can be adopted.

From an empirical perspective, when examining trends in the selected countries, namely Czechia and Slovakia, we discern distinct patterns in estimated SPLs for single-adult households. Slovakia exhibits a pronounced upward trend in estimated SPLs over the study period, while Czechia demonstrates a moderately increasing trend.

Further research is essential to thoroughly assess the properties of estimates generated through the techniques employed in this study, an aspect we will focus on in our future research.

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