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The Efficiency of European Union Countries in Addressing Severe Material and Social Deprivation in 2023

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Abstract

The work deals with examining the severe material and social deprivation (SMSD) in the European Union (EU) countries in 2023 using the Data Envelopment Analysis (DEA) method. SMSD is an indicator reflecting the share of the population unable to meet basic material and social needs. The introduction defines key factors influencing SMSD, such as gross disposable income, employment rate, the share of individuals with tertiary education, and the proportion of people living in households with very low work intensity. The results show that efficient countries, such as Finland, Estonia or Italy, optimally utilize available resources to reduce SMSD, while inefficient countries, such as Slovakia, Spain or Greece have room for improving the effectiveness of their policies. The work identifies challenges and opportunities for enhancing socio-economic strategies in the EU and suggests ways to optimize resource utilization to promote social inclusion.

Keywords: severe material and social deprivation, European Union countries, data envelopment analysis

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1. INTRODUCTION

Socio-economic indicators play a key role in assessing the standard of living and well-being of a country's population. One such indicator is Severe Material and Social Deprivation (SMSD), which, according to the Eurostat definition, refers to the share of the population that cannot afford at least 7 out of 13 deprivation items that are considered desirable or even necessary by most people to achieve an adequate quality of life. These items are divided into two categories (Eurostat, 2025g) – household-level items (e.g., the ability to cover unexpected expenses, the ability to keep the home adequately warm) and individual-level items (e.g., replacing worn-out clothing with new ones, engaging in regular leisure activities).

The efficiency of EU countries in addressing SMSD varies depending on available resources, economic conditions, and constraints. Analysing efficiency can help identify countries with similar resources that achieve better results in reducing SMSD. Less efficient countries can take inspiration from the approaches of more successful ones, leading to better resource utilization and improving conditions for vulnerable groups. Such analysis provides valuable insights that can contribute to enhancing existing solutions in the EU and supporting the exchange of best practices among countries.

In 2023, Slovenia recorded the lowest SMSD rate among EU countries, with only 2% of the population experiencing severe material and social deprivation. On the other hand, Romania had the highest SMSD rate, with as much as 19.8% of its population affected by this issue (Figure 1).

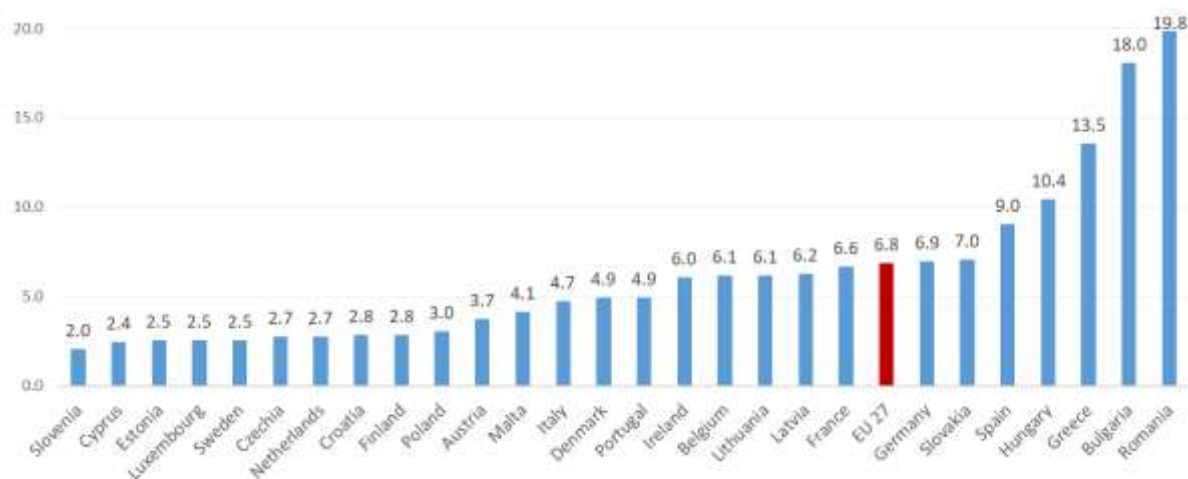


Figure 1. Severe material and social deprivation rate in EU countries in 2023

Source: Own construction based on data from Eurostat (2025a)

In 2023, Romania, Bulgaria, and Greece recorded the highest SMSD rates in the EU, with values significantly above the EU-27 average. Despite this, it is encouraging to note that since 2015, these countries have experienced a downward trend in SMSD rates, signalling an improvement in living conditions. This trend is further supported by the findings of Sedefoğlu

and Dudek (2024), who analysed severe material and social deprivation (SMSD) and material and social deprivation (MSD) in EU countries using 13 deprivation items and Eurostat data from 2015 – 2022. Their results indicate a notable decline in SMSD rates across the EU with Romania, Bulgaria and Greece still exhibiting the highest SMSD rates, but also demonstrating visible progress.

The SMSD rate is closely linked to key factors such as employment, education, disposable income, and low work intensity. These factors influence the population's ability to secure a decent standard of living. These indicators form the basis for assessing the efficiency of countries in eliminating severe material and social deprivation.

Employment plays a crucial role in reducing SMSD, as it not only provides income, but also enhances social integration and access to additional benefits. Research by Wolf et al. (2022) confirms that employed individuals, even if classified as poor, experience lower levels of deprivation compared to unemployed individuals. Moreover, higher overall employment rates, along with strong social protection systems, contribute to reducing SMSD.

Higher education is associated with a lower risk of SMSD. Research by Calegari et al. (2024) has shown that households led by individuals with tertiary education experience significantly lower levels of deprivation compared to those with lower educational attainment.

Household income plays a significant role in explaining SMSD. Dudek (2019) confirms that countries with lower income levels experience significantly higher deprivation rates. However, findings indicate that reducing SMSD requires not only raising household income but also implementing effective social protection policies and addressing long-term unemployment.

According to Steinbacher (2024), it is essential to distinguish between welfare performance and welfare efficiency. Welfare performance reflects the outcomes achieved by social systems, such as the extent to which countries reduce poverty and deprivation, while welfare efficiency refers to how effectively welfare efforts (e. g. public social spending) are translated into these outcomes. Steinbacher (2024) shows that higher spending does not automatically guarantee better welfare performance, as countries differ substantially in their ability to convert resources into improved social outcomes. This distinction provides an useful conceptual basis for examining how efficiently EU countries transform socio-economic inputs into reductions in severe material and social deprivation.

Samuelson and Nordhaus (1992) define efficiency as the most effective use of an economy's resources to satisfy people's needs and demands. Efficiency means that no resources are wasted. An economy is producing efficiently when it cannot increase the production of one good without decreasing the production of another – when it operates on the production possibility frontier.

Efficiency can be expressed as the ratio of outputs to inputs (Kočišová, 2021):

$$Efficiency = \frac{outputs}{inputs} \quad (1)$$

Measuring efficiency helps compare the performance of different units under the same conditions and serves to identify the optimal use of inputs to achieve maximum outputs. Assessing the efficiency and performance of production units helps distinguish between efficient and inefficient units, which can be crucial for enhancing competitiveness.

The objective of this paper is to analyse and compare the efficiency of EU countries in eliminating severe material and social deprivation in 2023, with an emphasis on identifying reference units and providing recommendations to improve the efficiency of other countries. To achieve this, we address the following research questions (RQ):

RQ1: Are high input resources a guarantee of efficiency in the fight against SMSD in EU countries?

RQ2: Do SMSD rates reflect the efficiency of EU countries in combating SMSD?

2. LITERATURE SURVEY

While the existing literature provides valuable insights into deprivation measurement, poverty trends and the socio-economic determinants of SMSD, most studies remain descriptive and rarely assess how efficiently countries transform socio-economic resources into improved outcomes. Sedefoğlu and Dudek (2024) compared country rankings based on the severe material and social deprivation (SMSD) rate with indicators constructed using different normalization and weighting methods. Bulgaria and Romania remained the most deprived countries, while Luxembourg consistently achieved the best results.

The issue of social exclusion and material deprivation in Romania is addressed by Mandalac and Iatagan (2023), who highlight the negative impact of these indicators on social equality and economic stability. They emphasize that the pandemic further deepened socio-economic disparities, placing Romania at the top of the EU rankings in terms of social exclusion and material deprivation.

Łuczak and Kalinowski (2020) analysed material deprivation levels in EU countries in 2016, utilizing the TOPSIS method to assess severe material and social deprivation. Their findings identified five distinct country groups based on deprivation levels, with older EU member states experiencing lower deprivation compared to newer members.

The development of material and social deprivation over time is examined by Traversa et al. (2024), who focus on analysing SMSD trends in EU member states between 2005 and 2022.

Šoltés et al. (2020) analysed poverty and social exclusion among young people in EU countries using multivariate statistical methods. The study emphasizes that the young population is the most vulnerable in the EU, and improving measurement methods of youth poverty and social exclusion should be a key focus of EU policies.

Only a limited number of studies, such as Kovářová (2024), apply efficiency-oriented frameworks. Kovářová (2024) analysed the efficiency of EU countries in reducing SMSD in line with the Europe 2020 Strategy. Using Data Envelopment Analysis, the study evaluates efficiency in poverty reduction across different years. Findings show that only five countries (Croatia, Italy, Ireland, Romania, Spain) met technical efficiency every examined year. The study also highlights the role of income and employment policies in poverty reduction, suggesting that better-targeted social transfers could enhance efficiency.

Our study aligns closely with the study by Kovářová (2024), which also focuses on structural economic indicators rather than direct deprivation measures. Kovářová (2024) employs a similar approach, using employment rate, adjusted gross disposable income of households, tertiary education attainment rate, very low work intensity rate, and additionally it includes the income quintile share.

The selection of these indicators for this study was motivated by their proven relationship to SMSD in previous research, as well as their availability for EU countries, which allows them to be used in assessing the efficiency of states in addressing SMSD.

From a methodological perspective, existing research mostly uses composite indicators or multivariate techniques, which are informative but do not evaluate efficiency directly. In the broader literature on public sector performance, two dominant approaches are typically contrasted: the non-parametric Data Envelopment Analysis (DEA) introduced by Charnes et al. (1978), and the parametric Stochastic Frontier Analysis (SFA) proposed by Aigner et al. (1977). DEA is widely applied in social policy evaluation because it does not require specifying the functional form of the production process and can incorporate multiple socio-economic inputs and outputs. In contrast, SFA separates statistical noise from inefficiency and allows for statistical inference but requires strong distributional and functional assumptions and is less suitable when multiple outputs or bounded indicators such as SMSD are involved (Coelli et al., 2005). Given these considerations, DEA offers better methodological flexibility for assessing how EU countries transform socio-economic resources into lower levels of SMSD.

3. DATA AND METHODS

The data used to calculate the efficiency of EU countries were sourced from the public database of Eurostat, the official statistical office of the European Union. We focused on evaluating the efficiency of 27 EU countries based on selected socio-economic indicators for the year 2023. The indicators used, such as the employment rate, poverty rate, and education level – commonly applied in assessing severe material and social deprivation in individual countries – are

described in the Table 1.

Table 1. Description of variables

Variable	Description	Input/Output
Y1: Percentage of people not severely materially and socially deprived	Complement to the severe material and social deprivation indicator (100% - original indicator)	Output
X1: Employment rate	In %	Input
X2: Gross disposable income of households per capita	Measured in Purchasing Power Standard (PPS) – a synthetic common currency that eliminates price level differences between countries	Input
X3: Tertiary education attainment rate	Population aged 25-34	Input
X4: Percentage of people not living in households with very low work intensity	Complement to the indicator of people living in households with very low work intensity (100% - original indicator)	Input

Source: Own construction based on data from Eurostat (2025a; 2025b; 2025c; 2025d; 2025e)

The average SMSD rate for the EU-27 in 2023 was 6.8%, reflecting a decline from 9.7% in 2015. While there were some fluctuations in 2020 and 2023, the overall trend reveals a steady reduction in SMSD across the EU, based on data from Eurostat. This points to enhanced socio-economic conditions and underscores the effectiveness of measures aimed at reducing SMSD.

All data presented below are summarized in Table 2. The employment rate (ER) is an indicator that reflects the share of employed individuals aged 20 – 64. In 2023, the average employment rate in European Union countries was 76.2%.

Attaining tertiary education (EDU) is an important prerequisite for labour market participation. Tertiary education corresponds to levels of 5 – 8 according to the ISCED 2011 (International Standard Classification of Education) for the data from 2014 onwards. In 2023, an average of 43.1% of individuals aged 25 to 34 in the European Union had completed tertiary education.

Gross disposable income (GDI) of households reflects the economic strength of the population. In 2023, the annual average gross disposable income of households per capita in the European Union was 28 011 PPS (Purchase Power Standard) (Eurostat Glossary, 2025f).

The indicator of people living in households with very low work intensity (VLWI) refers to households where working-age members worked less than 20% of their potential working time during the previous year. In 2023, an average of 8.0% of the EU population lived in such households.

Table 2. Values of the input indicators used for the efficiency analysis of EU-27 countries in 2023

Country	SMSD	ER	GDI	EDU	VLWI
Austria	3.7	78.9	32 502	43.5	5.7
Belgium	6.1	73.5	32 047	50.0	10.5
Bulgaria	18.0	76.3	NA	35.8	7.0
Croatia	2.8	70.7	19 556	38.8	5.5
Cyprus	2.4	79.9	27 778	61.6	4.4
Czechia	2.7	81.6	24 700	33.7	5.1
Denmark	4.9	80.5	27 948	49.0	9.8
Estonia	2.5	83.2	19 937	43.5	5.9
Finland	2.8	79.1	28 772	39.2	8.7
France	6.6	75.6	31 218	51.9	9.2
Germany	6.9	83.8	34 820	38.4	9.9
Greece	13.5	67.7	19 520	44.5	8.3
Hungary	10.4	80.9	20 663	30.1	4.9
Ireland	6.0	78.8	26 460	62.7	9.1
Italy	4.7	66.4	27 344	30.6	8.9
Latvia	6.2	78.3	17 709	45.1	7.0
Lithuania	6.1	78.4	23 438	57.4	8.0
Luxembourg	2.5	71.1	39 399	60.2	3.9
Malta	4.1	79.1	25 373	46.2	3.6
Netherlands	2.7	84.3	32 135	54.5	8.2
Poland	3.0	77.8	21 683	46.3	3.9
Portugal	4.9	78.1	23 334	41.5	6.3
Romania	19.8	68.7	19 740	22.5	5.2
Slovakia	7.0	77.5	19 411	39.8	4.6
Slovenia	2.0	77.3	23 953	40.7	3.8
Spain	9.0	71.5	24 614	52.0	8.4
Sweden	2.5	83.9	28 758	54.1	8.0

Source: Own construction based on data from Eurostat (2025a; 2025b; 2025c; 2025d; 2025e)

While variables such as social transfers, income inequality indices or demographic factors are relevant in broader socio-economic analyses, they were not included in this study as the aim of our model is to evaluate how effectively countries transform key structural socio-economic inputs into lower SMSD levels.

To evaluate the efficiency of EU countries in reducing severe material and severe deprivation, we applied the Data Envelopment Analysis method.

Data Envelopment Analysis (DEA) is a non-parametric method used to evaluate the efficiency of production units. Relative efficiency refers to the estimated efficiency of an assessed production unit within a given group of entities, considering predefined criteria. Any change in the number of entities or in the set of inputs and outputs leads to different DEA analysis results (Kočišová, 2021).

This method was developed by Charnes, Cooper, Rhodes (1978), who applied linear programming techniques to identify efficient units.

The units whose efficiency is being evaluated are called Decision Making Units (DMUs). We consider n production units. The efficiency of the selected production units is assessed based on their inputs, which are the factors used by the units, denoted as $x_{ij}; i = 1, 2, \dots, m; j = 1, 2, \dots, n$ and outputs, which are the results achieved by the production units, denoted as $y_{rj}; r = 1, 2, \dots, s; j = 1, 2, \dots, n$.

The optimized production unit is denoted as DMU_q . The relative efficiency of DMU_q is obtained by solving a maximization problem defined as the ratio of weighted sum of outputs to the weighted sum of inputs, under the conditions that the weights are nonzero and that the efficiency score of each unit does not exceed 1. This problem can be mathematically expressed using the following relationships:

$$\begin{aligned} \max \quad & \frac{\sum_{r=1}^s u_r y_{rq}}{\sum_{i=1}^m v_i x_{iq}} & (2) \\ & \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1 & j = 1, 2, \dots, n \\ & u_r \geq 0 & r = 1, 2, \dots, s \\ & v_i \geq 0 & i = 1, 2, \dots, m \end{aligned}$$

where

u_r, v_i – optimized weights of individual inputs and outputs,

y_{rq} – empirical value of output r for DMU_q ,

x_{iq} – empirical value of input i for DMU_q ,

y_{rj} – empirical value of output r for the j -th DMU ,

x_{ij} – empirical value of input i for the j -th DMU .

Model (2) serves as the baseline model for the entire group of DEA models. It represents a fractional programming problem, which, for practical reasons, is transformed into a linear programming problem by introducing a constraint that ensures the weighted sum of inputs for DMU_q is equal to one:

$$\begin{aligned}
 \max \quad & \sum_{r=1}^s u_r y_{rq} & (3) \\
 & \sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0 \quad j = 1, 2, \dots, n \\
 & \sum_{i=1}^m v_i x_{iq} = 1 \\
 & u_r \geq 0 \quad r = 1, 2, \dots, n \\
 & v_i \geq 0 \quad i = 1, 2, \dots, m
 \end{aligned}$$

Model (3) is the primary input-oriented CCR model proposed by Charnes, Cooper, & Rhodes (1978), assuming constant returns to scale. For this primary linear programming problem, a dual linear programming problem can also be constructed:

$$\begin{aligned}
 \min \quad & \theta_q & (4) \\
 & \sum_{j=1}^n y_{rj} \lambda_j \geq y_{rq} \quad r = 1, 2, \dots, s \\
 & \sum_{j=1}^n x_{ij} \lambda_j \leq \theta x_{iq} \quad i = 1, 2, \dots, m \\
 & \lambda_j \geq 0 \quad j = 1, 2, \dots, n
 \end{aligned}$$

Model (4) is dual input-oriented CCR model, where θ_q represents the overall technical efficiency calculated using this model, and λ_j is the weight assigned to the unit DMU_j , indicating the representation of an efficient production unit in determining optimal inputs and outputs for an inefficient production unit.

The dual input-oriented model can be interpreted as the degree of radial reduction required to achieve efficiency. The solution provides the overall technical efficiency score θ_j for each production unit DMU_j , which can take values less than or equal to one. Production units DMU_j with a technical efficiency score below one are considered inefficient. To achieve efficiency, the input values must be radially reduced by $(1 - \theta_j)100\%$ (Kočišová, 2021).

Banker, Charnes, Cooper (1984) later derived a model that assumes the production of units with variable returns to scale, known as BCC model, with its formulation provided, for example, by Huguenin (2012). The difference between the CCR and BCC models lies in the addition of the constraint $\sum \lambda_j = 1$. Introducing this constraint removes the restriction from the CCR model that a production unit must achieve scale efficiency.

For the analysis, we selected the input-oriented CCR model because we assume that all EU countries should be capable of achieving the same efficiency levels given the same input and output levels.

In our case, the Decision Making Units (DMUs) represent European Union countries, whose efficiency in reducing SMSD is assessed based on the following inputs: employment rate, gross disposable income, population with tertiary education attainment, population not living in households with very low work intensity. The output variable is the population that is not severely materially and socially deprived. In practical terms, an efficiency score of 1 indicates that a country uses its socio-economic inputs in the most efficient way observed within the sample. Countries with scores below 1 are considered inefficient, meaning that they would need to reduce their input levels proportionally while maintaining the same SMSD outcome in order to reach the efficiency frontier. The value $(1 - \theta_j)$ shows the potential percentage reduction in inputs required to achieve efficiency.

The function *dea* from the *Benchmarking* package in the R programming language was used to calculate technical efficiency (Figure 2). This function allows the implementation of DEA analysis using various models and settings. The *dea* function was applied with the following parameters:

X: input matrix,

Y: output matrix,

RTS = "crs": assumption of constant returns to scale (CRS),

ORIENTATION = "in": input-oriented model.

```
library(Benchmarking)
# inputs and outputs
inputs <- as.matrix(data[, c("X1", "X2", "X3", "X4")])
outputs <- as.matrix(data[, "Y1"])
# CCR model (input-oriented)
dea_results <- dea(X = inputs, Y = outputs, RTS = "crs", ORIENTATION = "in")
# efficiency scores
efficiency_scores <- data.frame(DMU = data$DMU, Efficiency = eff(dea_results))
```

Figure 2. R script for efficiency assessment of countries using the input-oriented CCR DEA model

Source: Own construction

4. RESULTS AND DISCUSSION

Using the DEA model described earlier, we quantified the efficiency scores of EU countries in addressing severe material and social deprivation in 2023, with values ranging from 0.931 to 1.000 (Table 3), where a score of 1 indicates an efficient country that optimally utilizes its inputs relative to its outputs, while score below 1 signifies inefficiency and potential for improvement in input utilization.

Table 3. Technical efficiency of EU countries in 2023 assessed by DEA model

Country	Efficiency	Country	Efficiency	Country	Efficiency
Austria	0,964	France	0,971	Malta	0,948
Belgium	0,992	Germany	0,971	Netherlands	0,996
Bulgaria	NA	Greece	0,931	Poland	0,973
Croatia	1,000	Hungary	0,984	Portugal	0,972
Cyprus	0,966	Ireland	0,977	Romania	1,000
Czechia	0,994	Italy	1,000	Slovakia	0,950
Denmark	0,992	Latvia	0,989	Slovenia	0,977
Estonia	1,000	Lithuania	0,975	Spain	0,951
Finland	1,000	Luxembourg	0,963	Sweden	0,996

Source: Own construction

It was not possible to calculate efficiency for Bulgaria, as the missing data on gross disposable income prevented the inclusion of this country in analysis.

Figure 3 displays the map of EU countries, color-coded based on their efficiency scores – green for the efficient countries and red for the least efficient ones.

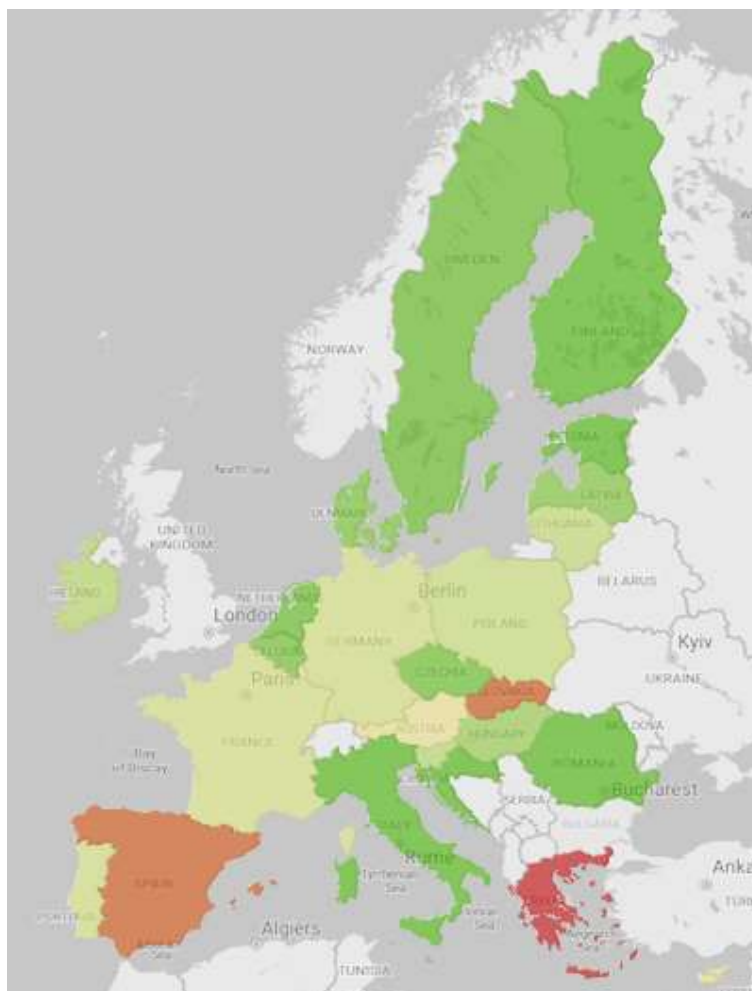


Figure 3. Efficiency of EU countries in addressing severe material and social deprivation

Source: Own construction in Power BI

The analysis identified five efficient countries with an efficiency score of 1. These efficient countries include Croatia, Estonia, Finland, Italy, and Romania. These countries optimally utilize their inputs and are considered reference units for other countries. This means that other countries could take inspiration from their input combinations to achieve higher efficiency.

Łuczak and Kalinowski (2020) evaluated the level of SMSD in EU countries using the TOPSIS method and rated Romania as one of the three countries with the worst situation. In our analysis, Romania is considered efficient because, despite its very limited resources and unfavourable conditions, it manages to achieve a relatively high output – a greater proportion of the population that is not deprived. Romania is an example of how high levels of deprivation do not automatically mean inefficiency but rather reflect the limited inputs that the country works with.

Similarly, Italy is considered efficient, even though at first glance, it exhibits some unfavourable statistical characteristics. Italy has the lowest employment rate among the EU countries and a relatively low share of tertiary-educated residents. Despite these disadvantages, it achieves a

high proportion of people who are not socially deprived, indicating efficient use of available resources.

These results can be compared with the study of Kovářová (2024), which analysed the efficiency of EU countries in 2008, 2010, 2014, 2017 and 2019. The study identified five countries (Croatia, Ireland, Italy, Romania and Spain) that were efficient in all the analysed years, indicating their stable ability to use available resources efficiently. The study showed that in 2019, Belgium, Croatia, Germany, Ireland, Italy, Latvia, Romania and Spain were evaluated as efficient. Of the countries identified as efficient in 2019 by Kovářová (2024), only Croatia, Italy, and Romania remained efficient in our analysis.

Countries that are not fully efficient but have an efficiency score above 0.99 show only minimal deviation from full efficiency and can be considered almost efficient. These include Belgium, (0.992), Czechia (0.994), Denmark (0.992), Netherlands (0.996), and Sweden (0.996).

The analysis identified several countries with efficiency scores below 1, indicating inefficiency in addressing SMSD. The inefficient countries include Austria, Cyprus, Greece, France, Germany, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia, and Spain. These countries have the potential to improve their input utilization to enhance their effectiveness in combating SMSD.

Slovakia has an efficiency score of 0.950, meaning its inputs could be reduced by 5% [$(1-0.950) \times 100 = 5\%$] while maintaining the same output as it currently achieves. To improve, Slovakia could analyse reference countries such as Finland or Italy and focus on optimizing its inputs, particularly those that are overutilized compared to efficient countries.

Greece, with the lowest efficiency score of 0.931, could reduce its inputs by 6.9%, indicating significant room for improvement.

Luxembourg has some of the highest gross disposable income and education level in the EU. The share of the population that is not deprived is also high, but given its significantly above-average resources, a higher non-deprivation rate would be expected. As a result, Luxembourg was classified as an inefficient country with efficiency score of 0.963. This suggests that Luxembourg could improve resource utilization by investing targeting socially disadvantaged groups.

The divergence between efficient and inefficient countries can be partly explained by differences in labour-market performance, the design of social protection systems and the structure of welfare models. Efficient countries such as Finland and Estonia tend to combine relatively well-functioning labour markets with targeted social support and more coherent policy implementation, which enables them to achieve comparatively strong outcomes even with moderate resources. In contrast, inefficient countries often face structural challenges such as weaker labour-market integration, less effective targeting of social assistance, or gaps in

education and work-intensity policies. These policy and structural differences help explain why countries with similar levels of deprivation or similar resource endowments may achieve very different efficiency scores in reducing SMSD.

While Sedefoğlu and Dudek (2024) evaluate SMSD based on absolute deprivation levels, our DEA analysis focuses on efficiency in utilizing resources to combat SMSD. While the study ranks Romania among the most deprived, our DEA analysis identifies it as one of the most efficient, suggesting it achieves relatively good outcomes given its constraints.

Compared to the results by Kovářová (2024), we can see several differences. Estonia and Finland, which were not classified as efficient in the study, achieved efficiency in our assessment. Germany and Latvia, considered efficient in 2019 by the study, were evaluated as inefficient in our analysis. Unlike Kovářová (2024), who evaluated Spain as effective in all analysed years, our analysis shows its significant decline to one of the least efficient countries in the EU.

This discrepancy can be caused by several factors, such as the different periods analysed. The efficiency of countries may have changed over time due to economic, social, or political factors. Another reason for the differences may be the different methodology. The previous study used an output-oriented DEA model that focuses on maximizing outputs for given inputs, while our analysis used an input-oriented DEA model that optimizes the use of inputs to achieve a given output.

An important finding of our analysis, as well as the study by Kovářová (2024) is that countries' efficiency does not always correlate with low levels of material deprivation. For example, Romania was identified as effective in both studies, although it is among the countries with the highest poverty rates. This suggests that the DEA evaluates relative efficiency within the countries analysed, not the absolute level of social deprivation.

To conclude, we have addressed the research questions outlined in the introduction. Based on the conclusions presented above, the results provide the answers to these questions.

5. CONCLUSION

DEA analysis helps us identify not only efficient countries but also those with room for improvement in reducing severe material and social deprivation. It shows that efficiency is not just about absolute numbers but about a country's ability to use its resources to achieve positive outcomes. The results can serve as a basis for policy-making that better reflects the real needs of the population and improves quality of life, particularly in the context of social inclusion.

Inefficiency may indicate either an opportunity for optimization in countries with high inputs or a need for support and investment in countries with low inputs. Efficient resources allocation and a focus on effective policies can help improve the overall situation and bring countries closer to more efficient reference countries. In 2023, the most efficient EU countries in

addressing severe material and social deprivation were Finland, Estonia, Italy, Romania, and Croatia, while the least efficient countries were Greece, Malta, and Slovakia.

To improve socio-economic strategies in the EU and optimize resources in the fight against severe material and social deprivation, several proposals could be considered, such as supporting tertiary and vocational education, especially in countries with a low share of highly educated individuals, promoting flexible work arrangements (e.g., remote work, part-time jobs) for individuals with lower work intensity or those caring for children or elderly household members, strengthening social security systems to protect vulnerable groups. We recommend using examples from efficient countries such as Finland, Italy, or Romania to share strategies and experiences with less efficient countries, as well as employing analytical methods like Data Envelopment Analysis for regular policy efficiency assessments.

These results also carry important implications for EU cohesion and social policy frameworks. Improving how efficiently countries use their socio-economic resources to reduce SMSD can help narrow the gaps between EU member states and support the Union's goals of reducing inequalities and strengthening social inclusion. More efficient resource allocation, better-targeted transfers, and the exchange of successful practices between highly efficient and less efficient countries may contribute to lowering deprivation disparities across the Union.

Future research could explore multi-year or dynamic DEA models to track changes in efficiency over time, compare EU and non-EU countries, or extend the set of inputs and methods to better understand the drivers of severe material and social deprivation.

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