THE RURAL POPULATION AND THE POVERTY THREAT

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ABSTRACT

In many European countries, there is an increasing possibility of poverty threat. This paper undertakes a comprehensive investigation into the determinants of rural poverty in 27 European countries, utilizing Eurostat data from 2010 to 2020. The research aims to identify factors influencing poverty threats in rural areas with a detailed focus on social protection expenditure. Two regression models are employed to address these objectives. The primary model analyses the impact of social protection expenditure, rural employment, and freight transport on poverty threats. The supplementary model examines the relationship between social protection expenditure, rural households and the older population. The key findings prove that social protection expenditure significantly reduces poverty threats. However, economic activities such as rural employment and freight transport show no statistically confirmed impact on poverty reduction in rural areas.

Introduction

Sustainability, in general, is a global goal that addresses different aspects such as poverty, health, education, gender equality, water and sanitation, climate change and others. 17 Sustainable Development Goals (SDGs) that integrate social, economic, and environmental are included in "The 2030 Agenda". Many of these goals have a direct impact on rural areas, where the conditions for achieving them may be different from those in urban areas, particularly in terms

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of access to opportunities in general. It is, therefore, necessary to address the needs of rural areas in the context of these objectives.

Rural space is globally interconnected and interdependent, and the interaction of local and global actors creates and trans-forms rural places (Woods, 2007). While the concept of "global countryside" has generated much research on rural economic restructuring, food chains, tourism, and migration, studies on poverty and rural inequality have not received adequate attention. Bajusová et al. (2018) emphasize the role of rural entrepreneurship and business entities in enhancing the competitiveness and sustainability of rural regions in Slovakia.A major turning point occurred in 2004 when two major publications on the issue of rural poverty were presented (Lee et al., 2005, Milbourne, 2004). Similarly, Commins (2004) noted little coverage of poverty and exclusion in rural research in its review article on rural poverty and social exclusion. While overall quantitative poverty levels may not be characteristic of rural areas, the authors have shown (Lee et al., 2005) that the risks of poverty have been socially distributed in rural areas somewhat differently from their urban counterparts.

The phenomenon of poverty is associated with the term "social exclusion" due to its multidimensional nature (van Bergen et al., 2019). The European Union's Poverty Program, which has existed since 1974, ended in 1994 when the Council of Europe rejected the new Poverty Program (Avramov, 2002). Since then, it has been argued that social exclusion rather than poverty is the main goal of the European Union's social policy. The European Parliament's decision of 2008 obliges the Member States of the European Union to ensure equal access to resources and services and promote the integration of disadvantaged groups into mainstream society through active integrated approaches (Allen et al., 2012). State intervention is commonly expected in this area, but there is no consensus on the most effective methods and tools and the extent of public spending to reduce poverty (Caminada & Goudswaard, 2012). One of the alternative approaches to poverty assessment, linking microeconomic and macroeconomic approaches, may be the modification of the Human Development Index (Terzi, 2013). Following the study of causal dynamics, (Heger et al., 2020) improved the landscape as the essence of approaches to poverty reduction. This improvement can take various forms and can be linked to employment and entrepreneurship (Besshaposhny et al., 2021; Fields, 2019; Korsgaard et al., 2015). However, this does not mean a simple implementation of approaches and principles to entrepreneurship in poor rural areas, rich countries, and areas (Moradi et al., 2020), although the use of modern technologies is proving essential (Asongu & Odhiambo, 2019). According to Posada Henao & González Calderón (2010), transportation is a key factor in economic development. Employment and stimulus are impossible without adequate infrastructure, especially transport, which is even more urgent for a viable rural economy (Marr, 2015).

Poverty and social isolation remain a problem in rural communities with high levels of fuel poverty, limited access to health, recreation, and education centres, and a small suffering network of rural transport partnerships, according to (McGuire et al., 2022). For tracking progress against poverty, the living wage methodology provides a wide

range of options for obtaining a transparent local measure. According to van de Ven et al. (2021), it can be used, for example, to assess development opportunities for rural households and employers in rural areas, including farmers hiring labor. In addition to the prevailing methods of examining poverty, Watmough et al. (2019) highlight a modern approach using remotely sensed satellite data to monitor development in low- and middle-income countries and spatial estimates of welfare and poverty.

As part of the forecast of the potential risk of poverty, socioeconomic research was carried out during the second decade of the 21st century, focusing on the relationship between social expenditure and poverty (Sawulski & Kutwa, 2022). Based on the aforementioned research results, the negative relationship between social spending and poverty is confirmed, at least in the short term (Szymańska, 2023). The rural elderly population is certainly exposed to the potential risk of poverty, especially with the declining share of the population (Labianca & Valverde, 2019). Redistributive processes, the associated social benefits and social incomes, and their impact on poverty reduction in 2011-2015 in 28 EU countries were examined by (Halaskova et al., 2021). The effectiveness of public social spending in 22 OECD countries in 2004-2012 was examined by (Kim & Kim, 2017), and the relationship between social transfers and poverty rate variation based on Eurostat data for the period 2008-2016 was analyzed by (Miežienė & Krutulienė, 2019). However, public budgets are becoming unsustainable, and the path to recovery is focused on both the revenue and expenditure side.

A descriptive study (Bertolini et al., 2008) on rural poverty in Europe demonstrates the diversity of rural-urban disparities across European countries and explains the different drivers of rural poverty. Shucksmith et al., (2009), Weziak-Bialowolska (2016), as well as Meloni et al. (2024), used a transnational comparative data set that shows that increased rural poverty and the gap between rural and urban poverty can be found mainly in poorer, eastern and southern European countries, the conclusion was also confirmed by detailed analysis of Eurostat data in the EU-28 from (Copus et al., 2015).

Materials and methods

The paper employs multiple regression models to reveal relationships between selected socioeconomic factors and rural poverty. The starting point of this paper was two research questions created by the authors, which express the general idea of research:

Q1 Is the poverty threat in rural regions affected mainly by economics or more likely by other factors?

Q2 Does social protection expenditure depend on the ageing population and on the spatial distribution of households by degree of urbanization?

These questions, grounded in existing literature, fill research gaps in understanding rural poverty threat.

Research Question 1 addresses the debate over primary poverty drivers, recognizing mixed findings on economic versus social-economic influences. Some research

emphasizes aspects like employment, while others focus on factors such as social protection. Research Question 2 relates demographic changes and urbanization moving in rural areas to social protection policies, expanding on existing literature.

Together, these questions provide a comprehensive examination of rural poverty determinants and policy responses, addressing important uncertainties in European rural poverty research. The main data source used in the paper was Eurostat and national statistical offices in the last decade. Data from 27 European countries (except Malta, added Norway) in the years 2010 and 2020 were analyzed. Malta was excluded because its values were extremely outliers. And even though Norway is not an EU member country, it belongs to Europe there is evident similarity with Scandinavian countries – EU members. The final number of countries which were included in regression models was 27. This time period was chosen because there is no sense in analyzing year-by-year changes in variables used in this paper. In terms of finding answers to the research questions, the ten-year time horizon was a compromise between the availability of consistent data on relevant parameters and the possibility of recording changes in the evolution of the phenomenon under study. Only variables that are considered by the authors to have a direct impact on the phenomenon under study in the context of the SDGs in relation to the rural population are included in the models. Other potential variables were excluded from the study due to the simplicity of the model used and potential collinearity.

Originally, these data in the regional statistics section were included by other typologies or by the degree of urbanization. For the purposes of the paper, values were used to indicate the share of values in predominantly rural regions on the sum of values in predominantly urban regions plus intermediate regions plus predominantly rural regions or as the share of rural regions on the sum of total regions. The only exception that did not consider the degree of urbanization was social protection. Social protection was monitored for the economy as a total.

Descriptive statistics of key variables related to rural poverty and socioeconomic situation in European countries for 2010 and 2020 are presented in Tables 1 and 2. The analyzed variables include Social Protection (SP), Rural Households (RH), Older Population (OP), Poverty Threat (PT), Rural Employment (REM), and Freight Transport (TR). Social Protection measures government expenditure as a percentage of GDP, while Rural Households represent the share of households in rural areas. Older Population refers to the percentage of the rural population aged 65 and older in fair health, and Poverty Threat quantifies those living below 60% of the median income. Rural Employment indicates the fraction of employment in rural areas, and Freight Transport denotes the percentage of road freight from these regions. The statistical measures cover mean, minimum, maximum, and standard deviation, providing insights into data tendencies and variability.

Table 1. Descriptive statistics of variables 2010

Variable	data	Abbr.	Mean	Min.	Max.	Std.Dev.
Social protection	the general government expenditure on social protection as % of GDP	SP10	17,51852	12,10000	24,80000	3,31384
Rural households	households in rural areas as % of total households	RH10	35,10296	2,81000	60,30000	16,41636
Older population	the population in rural areas in fair health status at age 65+ as % of total population in rural areas	OP10	41,42593	24,90000	53,50000	8,04337
Poverty threat	% of the population in rural areas with income below 60% of median equalised income	PT10	7,35556	0,10000	19,50000	4,81818
Rural employment	employment in predominantly rural regions as % of total employment	REM10	25,97862	0,56988	55,47735	15,45844
Freight transport	road freight loaded in predominantly rural regions as % of total loading road freight	TR10	30,31783	0,80000	65,50329	18,58419

Source: Eurostat and authors' calculations

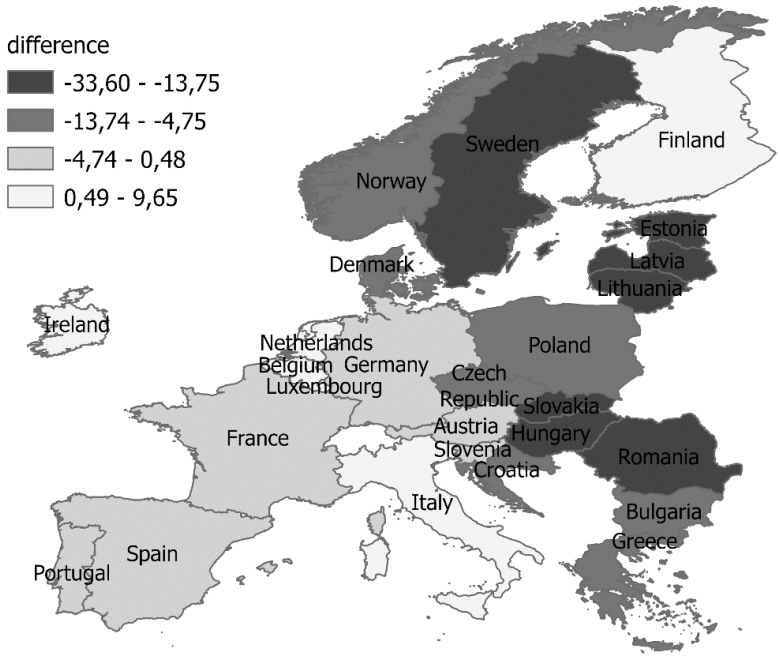
Table 2. Descriptive statistics of variables 2020

Variable	data	Abbr.	Mean	Min	Max	Std.Dev.
Social protection	the general government expenditure on social protection as % of GDP	SP20	18,52593	9,90000	27,20000	4,54182
Rural households	households in rural areas as % of total households	RH20	28,51481	9,61000	44,82000	8,80514
Older population	the population in rural areas in fair health status at age 65+ as % of total population in rural areas	OP20	5,88889	1,20000	16,70000	3,49046
Poverty threat	% of the population in rural areas with income below 60% of median equalised income	PT20	42,00000	21,70000	55,60000	9,42440
Rural employment	employment in predominantly rural regions as % of total employment	REM 20	31,42459	1,03438	59,88293	18,34534
Freight transport	road freight loaded in predominantly rural regions as % of total loading road freight	TR20	23,90269	0,53297	53,20161	14,74072

Source: Eurostat and authors' calculations

The European Union has identified the issue of rural depopulation as one of priorities' areas for policy interventions. However, an evaluation of the effectiveness of these policies during the period under review has not yielded conclusive results, as illustrated in Figure 1 - Rural Households share (change between 2010 – 2020). Negative values represent the decreasing share of rural households; in a simplified way, households move from rural regions to other regions. Over the period under review, there were markedly different trends in the share of rural households, with a one-third to one-fifth decline in the case of Sweden, Romania, and Estonia. This trend in Sweden is consistent with the evolution of the rural population share, as Sweden, Finland, Ireland, and Iceland are among the countries that have shown the most significant decline in the rural population share between 2010 and 2020, more than 20 percentage points. In contrast, Belgium, Luxembourg, Finland and the Netherlands have shown an increase in the share of rural households, albeit of the order of only a few percentage points, which in the case of Belgium and the Netherlands has also been accompanied by a corresponding increase in the share of the rural population.

Figure 1. Rural households share (change between 2010 – 2020)



Source: Eurostat and authors' calculations

For the purpose of answering research questions, the authors used Multiple regression as one of the best methods for explaining economic links. Numeric estimations of the strength of links were calculated using STATISTICA 14 software. Two models were designed, which should explain and answer research questions, so there was the model for question no. 1 and question no. 2. In the first step of the research,

the factors that influence the threat of poverty in rural areas were examined. The main model analyses social expenditure, employment and road freight transport were chosen as explanatory variables.

We specified the empirical model as:

$$PT = a + b_1 * SP + b_2 * TR + b_3 * REM,$$

where PT is poverty threat, SP is social protection, TR is freight transport, REM is rural employment, a is intercept, and $b_{1,2,3}$ are coefficients of the independent variables, they indicate change proportion PT with SP, TR or REM change.

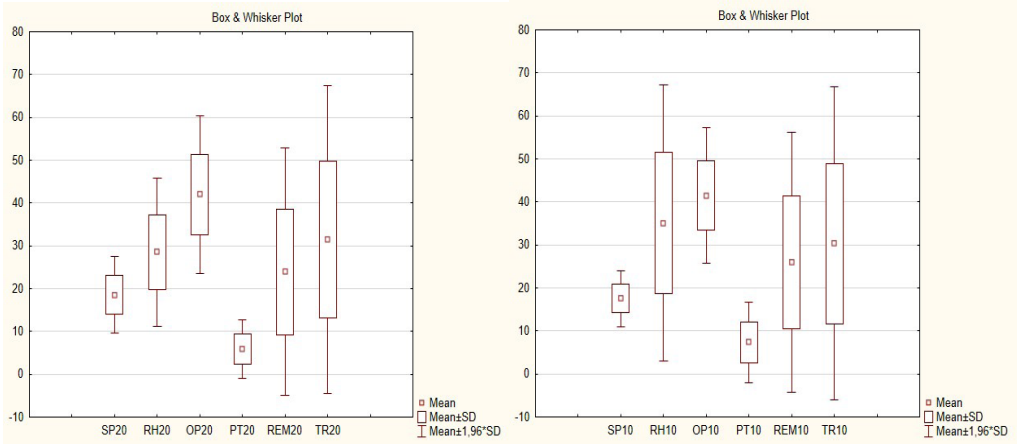
Next, the relationship among social expenditure on one side and rural households and older people on the second side was examined in the two-dimensional space. To understand the relationship among these categories, the following equation was formed as a supplementary model:

$$SP = a + b_1 * RH + b_2 * OP$$

where SP is social protection, RH is rural households, OP is older population, a is intercept and $b_{1,2}$ are coefficients of the independent variables, they indicate a change proportion SP with RH and OP change.

To demonstrate the variability of variables, the authors used Figure 2. There is clear evidence of the large variability of TR.

Figure 2. Box and Whisker plot of variables in 2010 and in 2020



Source: authors' calculations

To ensure the reliability and validity of the regression analysis, several key assumptions were tested. First, the normality of residuals was assessed using Q-Q plots and histograms, confirming that errors were approximately normally distributed. Second,

multicollinearity among predictor variables was examined with Variance Inflation Factors, indicating no significant multicollinearity. Homoscedasticity was evaluated by plotting standardized residuals against predicted values, showing an even spread. The independence of errors was confirmed through the Durbin-Watson test. For the poverty threat variable, slight skewness was corrected with a log transformation to improve model fit. Some heteroscedasticity was detected in the 2020 model, addressed with robust standard errors in analysis. The Durbin-Watson statistics confirmed the absence of autocorrelation. These diagnostic checks enhance the credibility of the regression results and provide insight into the model's limitations. Future research could benefit from larger sample sizes and advanced modelling techniques to further enhance robustness.

A study of rural poverty in European countries using regression analysis has several potential limitations and biases. Bias may arise if relevant variables not subsequently captured in the models are excluded. Similarly, bias may arise already in the measurement of the data. Findings may be affected by endogeneity and simultaneity bias. The assumption of linear relationships between variables may not hold for all aspects of the phenomenon under study, and misspecification of the functional form could lead to biased estimates. While heteroskedasticity and autocorrelation alone may not bias coefficient estimates, they may bias standard errors, which affects the reliability of hypothesis tests and confidence intervals. The high correlation between independent variables such as social protection expenditure and rural employment may lead to unstable coefficient estimates.

Results

Based on statistical analyses by the main model (Table 3), poverty threat is indeed statistically significantly influenced by social protection expenditure. So, if social expenditure decreases, it can cause an increasing poverty threat. These partial results were statistically proven in both observed years. In contrast, the link between poverty threat and rural employment and road freight transport realized in rural areas was not statistically confirmed. The model showed a non-significant influence of rural employment in both observed years, although in 2020, there was a proven negative correlation, which is an expected way to decrease the poverty threat in rural areas. In the case of the economic variable – Freight transport, the expected influence was not proven.

Table 3. The regression results in 2010 and 2020 for the main model

	b*	Standard error of b*	b	Standard error of b	t(24)	p-value
Intercept10			18,34639	4,54944361	4,032668	0,000518692
SP10	-0,541191	0,170965908	-0,78686	0,248576749	-3,165493	0,004320123
TR10	0,3320397	0,255287006	0,086085	0,066186321	1,300652	0,206258893
REM10	0,0227234	0,252399513	0,007082	0,078669441	0,090029	0,929042995
Intercept20			11,45297	2,990736882	3,829482	0,000858343

SP20	-0,507050	0,186446384	-0,389676	0,143287039	-2,719553	0,01222367
TR20	0,5214968	0,403025278	0,099222	0,076681305	1,293955	0,208523899
REM20	-0,258480	0,411393971	-0,061205	0,097414223	-0,628304	0,53599453

Source: authors' calculations

The results of the main statistical model show the following dependencies:

$$PT10 = 18{,}346 - 0{,}787 * SP10 + 0{,}086 * TR10 + 0{,}007 * REM10$$

$$PT20 = 11{,}453 - 0{,}389 * SP20 + 0{,}099 * TR20 - 0{,}061 * REM20$$

The next step involved a more detailed analysis of the variable for which a statistically significant effect was identified in the main model. The multiple regression model proved the relationship between SP, OP, and RH. The evidence is given in Table 4.

Table 4. The regression results in 2010 and 2020 for the supplementary model

	b*	Standard error of b*	b	Standard error of b	t(24)	p-value
Intercept 10			23,98377	4,088984	5,86546	0,000005
RH10	-0,351610	0,199083	-0,07098	0,040187	-1,76615	0,090090
OP10	-0,232828	0,199083	-0,09592	0,082022	-1,16950	0,253686
Intercept 20			29,16192	4,416780	6,602529	7,898E-07
RH20	-0,341384	0,182077	-0,176090	0,093918	-1,874942	0,0730208
OP20	-0,277401	0,182077	-0,133685	0,087746	-1,523537	0,1406936

Source: authors' calculations

The supplementary model for the group of analyzed countries does not prove the relationship among social expenditures and rural older population and households in both observed years. In other words, there was the idea that more aging population and more households in rural areas would require an increase in social expenditures in order to avoid the poverty threat in rural areas. Both years' models proved indirect dependencies. The analysis of social expenditure in relation to population ageing and the degree of urbanization presented only a partial explanation of the poverty threat.

The research clearly shows that social protection expenditure is essential for reducing rural poverty, with a significant negative correlation between social spending and poverty threat in both 2010 and 2020. However, the weakening impact of social protection on poverty - from -0.787 in 2010 to -0.389 in 2020 - raises concerns about the long-term effectiveness of current strategies, suggesting that other factors may be increasingly influencing rural poverty levels or that social protection is not adapting to changing rural dynamics.

The study found no significant influence of rural employment or freight transport on poverty threat, challenging the belief that economic activities inherently reduce

rural poverty. Notably, the lack of correlation between freight transport and poverty alleviation indicates that rural logistics' economic benefits may not reach the population directly, prompting a reevaluation of development strategies relying on transportation infrastructure. It is incontestable that support for rural development is closely associated with the implementation of information and communication technologies (Ma et al., 2023, Ignjatović et al., 2024).

An additional model exploring the link between social protection and rural demographics revealed interesting trends. The negative correlation between rural households and social protection expenditure, while not statistically significant, hints at potential disparities in welfare distribution between urban and rural areas. Similarly, the weak negative correlation between the older population and social protection expenditure raises concerns about support for aging rural residents.

Discussions

The key and main purpose of research activities was that the authors used statistical data and tried to verify and generalize the regularities of the relationships. One partial conclusion is that other variables that would perhaps better explain the patterns are not available at either the EU level or national statistical level in the required timeframe and structure. The role of the scientific community, scientific activities, and research is, among other things, to explain and analyze. The final thought of the authors is that we would like data to be able to be analyzed and then confirm or reject the reasoning and then make recommendations to the EU.

The authors´ findings can inspire specific measures to support the development of rural areas. It cannot be ruled out that it might be useful to focus on a few key areas, such as support for rural areas, improvement of infrastructure, support for small businesses and rural entrepreneurship, education and training, and so on. The paper confirms a relationship between social protection expenditure and the ageing rural population, but it does not fully explore how these dynamics interact with other demographic changes, such as migration patterns. More detailed research is needed on how demographic shifts influence social protection needs and poverty risks in rural areas.

If we are concerned with the monitored data in connection with the implementation of the common EU policy in the context of the SDGs, it can be stated that there is a proper justification for choosing the year 2020. Until the end of the mentioned year, EU development aid was implemented through several support programs that were financed from the EU budget and through the European Development Fund that operated between EU member countries. For example, within the multi-year financial period 2014-2020, the development policy was the content of the 4th chapter under the name "Global Europe", for which EUR 59 billion (i.e., 6% of the total budget) was allocated. Funds from the budget were distributed with the help of five thematic instruments, where the Development Cooperation Instrument was focused on the issue of solving issues related to poverty, which was further divided according to geographical areas.

Regional policy within the SDGs is also aimed at reducing potential risks associated with poverty. In order to fulfil these goals within the framework of the development needs of EU regions, 351.8 billion euros were allocated for the program period 2014-2020 (Artelaris & Mavrommatis, 2020). The effectiveness of EU policies aimed at reducing rural poverty and promoting sustainable development remains inconclusive. Existing analyses of the evaluation of the effectiveness of EU policies have yielded inconclusive results. These analyses illustrate that errors and mistakes in economic reasoning, for both economic and non-economic reasons, reflect different linkages and relationships between sub-objectives of economic policy (Brown, 2004; Camaioni et al., 2016; Lipps & Schraff, 2021; Marković et al., 2022).

In a broader context, the performance of the transport sector can be used as an indicator of the performance of the economy. Although the transport sector has a significant impact on rural areas, the performance of rural freight transport, as measured in terms of volume, has not demonstrated a discernible effect on reducing the prevalence of poverty. The most likely explanation for this is that in rural regions, materials resources are handled for the production of products from other areas. Hence, the added value is realized outside rural areas.

Data limitations are mainly in reliance on Eurostat data, which has issues like discontinuities and missing information, highlighting the need for better data collection on rural poverty dynamics. Future research should develop robust methodologies to track rural poverty across Europe.

The limited validity of claims of generally elevated levels of poverty and deprivation in rural areas in Europe has been confirmed in a study by Bernard (2019). Not only do the differences in poverty between rural and urban areas vary in magnitude, but in some countries, these differences are completely skewed in favour of rural areas. This finding has been repeatedly noted. More importantly, there is clear evidence that these differences are far from random. Calculated point elasticities (Wilson et al., 2022) show that despite the apparent trade-off between the two objectives of reducing urban poverty and urban inequality, reducing urban inequality is more effective in reducing urban poverty than promoting growth.

The study relies heavily on Eurostat data, which the authors note has limitations due to discontinuity and missing data from some EU countries. This presents a research gap in terms of data availability and quality. Future studies could benefit from more comprehensive and consistent data collection to better understand rural poverty dynamics across different regions.

Conclusions

The main purpose of the paper is the broader need to analyze one of the aspects of life in rural areas. There is no doubt that without research and scientific contribution, it is not possible.

In the context of the study of the risk of poverty in rural areas, it is possible to confirm the significant connection with social expenditure. Additionally, the influence of rural employment, it is not possible to statistically confirm the connection with the development of freight transport. The mentioned statement lies in the independence of the mentioned business activities in the rural area, as the centres of freight transport and loading places are located outside the area of research – rural areas.

It is evident that a multitude of factors can exert influence on the allocation of financial resources to social protection programs. Furthermore, disparities in wealth and income across nations invariably impact the distribution of resources to social protection programs. The cultural and historical context, along with the associated values and norms in the domains of ageing, family care and social welfare, can also exert a significant influence on government decisions regarding social protection spending, irrespective of the prevailing demographic structure.

These findings highlight the complex nature of rural poverty in Europe and the essential role of social protection policies. The diminishing effect of these policies suggests that other influences or insufficient adaptations to rural changes are at play

The limitation of a more detailed analysis is the scarcity of data, particularly when considering the extent of urbanization. It is important to note that despite the urbanized nature of the European Union (EU), rural regions still encompass over 80% of the EU's land area and are home to approximately 25% of the total population.

The authors, on the basis of the results, recommend that policymakers to take the following steps: integrate social and economic policies for rural development by enhancing employment opportunities, supporting local businesses, and improving access to services; improve data collection and monitoring of rural poverty to understand dynamics and support evidence-based decisions; and foster collaboration among government agencies, local communities, and civil society to create effective strategies for reducing rural poverty and promoting sustainable development.

In summary, while the paper makes significant contributions to understanding rural poverty in Europe, addressing the identified research gaps could enhance its scientific impact and provide more actionable insights for policymakers. Future research could focus on developing models to capture the complexities of rural poverty in an urbanizing context, investigating the long-term effects of social protection measures, exploring the spatial distribution of economic benefits from rural activities.

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Conflict of interests

The authors declare no conflict of interest.

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