

ASSESSING THE IMPACT OF SOCIAL WELFARE ON INCOME INEQUALITY AND SUSTAINABLE ECONOMIC DEVELOPMENT IN THE EUROPEAN UNION

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Abstract

Income inequality is a major challenge for the European Union, with significant implications for economic sustainability, social stability and cohesion between Member States. This study aims to analyse the impact of economic and social factors on income distribution in the EU, using the GINI coefficient as the dependent variable. Given the importance of public policies in reducing economic disparities, the research investigates the relationships between economic growth, employment, education, poverty and social protection on income inequality over the period 2014-2023. The methodology used is based on a generalized linear regression model estimated using Eurostat data to determine the influence of each variable on income distribution. The results suggest that economic expansion contributes to reducing inequality. Also, the at-risk-of-poverty rate positively influences income inequality, reflecting the limited effectiveness of social protection mechanisms. In addition, employment does not automatically reduce inequality, being influenced by job insecurity and wage differentials. Based on these findings, the study recommends a number of European public policies, including increased investment in education and lifelong learning, improving the efficiency of social transfers, implementing progressive tax policies and stimulating employment in productive sectors. The results are useful for economic and social policy makers in the European Union, informing the formulation of effective strategies to reduce income inequality and promote inclusive growth.

Keywords: social welfare, income inequality, sustainable economic development, public policies

Clasificare JEL : A13, H24, Q01

1. Introduction and context of the study

Income inequality is one of the most complex and persistent economic and social problems in the European Union, with significant implications for economic growth, social cohesion and political stability. Although the European Union promotes economic convergence between Member States and the fight against social disparities, differences in income distribution continue to be a structural reality, both between and within countries. The level of income inequality is influenced

by multiple dimensions, including labor market dynamics, tax policies, investment in education and health, and the effectiveness of social protection systems. In recent years the European Union has implemented a number of strategies aimed at tackling economic inequality and promoting social inclusion. Among them, the Europe 2020 Strategy, adopted in 2010, set ambitious targets to reduce poverty and improve access to education and quality jobs. In this context, the European Pillar of Social Rights, launched in 2017, was a key step in strengthening social justice and equity in the EU, establishing principles on fair access to education, employment and social protection. Following on from these initiatives, the EU 2030 Strategy for Sustainable Development and the Action Plan for the European Pillar of Social Rights propose concrete measures to reduce inequalities by increasing employment, reducing the pay gap and investing in education and training. Also, the Recovery and Resilience Mechanism adopted in response to the pandemic-generated economic crisis includes a key component dedicated to tackling inequality by funding social programs and support measures for vulnerable groups. Despite these efforts, income inequality remains a major challenge, highlighted by significant differences between Member States in GINI coefficients, minimum wage levels and access to essential social services.

Specialized studies (Certomà et al., 2023; De Wettinck & van Mourik, 2024; Kanitsar, 2022; Kemeny & Storper, 2024) offers multiple explanations for the mechanisms that influence income inequality, but there is no absolute consensus on the main economic and social forces shaping this phenomenon in the European context. On the one hand, classical economic theories argue that economic expansion, as measured by gross domestic product, can reduce inequality by increasing employment opportunities and improving living conditions.

The main objective of this research is to examine the relationships between income inequality and several relevant socio-economic factors, using econometric methods to determine the extent to which they influence income distribution in the European Union. Using a generalized linear regression model, the study aims to provide a rigorous empirical analysis, testing fundamental hypotheses about the impact of economic growth, the effectiveness of social policies and the importance of education in reducing economic disparities.

The importance of this research stems from the need for better calibrated public policies that allow for a sustainable reduction in income inequality and contribute to more inclusive economic growth in the European Union. In this context, the study contributes to the scientific literature on the factors influencing income inequality and explores economic and social solutions to support equitable and sustainable development in the European Union.

The novelty of this research lies in the integrated approach to income inequality in the European Union through a complex econometric analysis using recent data from 2014-2023 and applying a generalized linear regression model. Unlike previous studies (Grybauskas et al., 2022; Sharma & Mishra, 2022; Tawiah et al., 2024; Wang et al., 2023), which have focused either on the relationship between economic growth and income distribution or on the impact of isolated social policies, this research aims to examine multiple dimensions of inequality simultaneously, including factors such as GDP, the share of the population at risk of poverty, employment rates, education and health expenditure.

The study goes on to review the literature on the impact of social welfare on income inequality and sustainable economic development in the European Union, design the econometric model, present the results and finally formulate policy recommendations.

2. Literature review

Literature reviews play a key role in understanding the factors influencing income inequality and its impact on sustainable economic development. The economic literature is replete with theoretical and empirical analyses that emphasize how public policies, tax systems and structural changes in the economy influence income distribution. At the same time, recent literature highlights the crucial role of new technologies and globalization in changing traditional economic paradigms. Tackling this issue requires an integrated analysis that considers both the historical dimension of economic theories and recent advances in policies to reduce inequality.

Income inequality has been intensively studied from the perspective of classical and contemporary theoretical models and is a central issue in political economy and debates on the sustainability of economic development. The theory of Kuznets (Kuznets, 1955), income inequality evolves along an inverted U-shaped curve, suggesting that in the early stages of economic growth, capital accumulation and structural shifts towards more productive industries lead to a concentration of income in the hands of an economic elite. However, once economies reach a high level of development, economic growth, coupled with the expansion of public services and fiscal redistribution mechanisms, reduces income disparities and improves social cohesion (Balasoiu et al., 2023; Botta et al., 2021). However, the assumption of a natural reduction in income inequality with economic development has been amply challenged by recent research, which highlights the tendency of free markets to favor the disproportionate accumulation of capital among privileged economic groups. Contemporary studies (Broz et al., 2021; Guriev & Papaioannou, 2022; Valentini et al., 2023) shows that, in the absence of effective redistributive policies, capital income tends to grow faster than labor income, thus amplifying economic polarization. Research by Dorn and Hanson (2021) also highlights that market liberalization and globalization have led to an increase in inequality, as segments of the population with limited access to education and productive resources remain disadvantaged in the face of accelerated economic change (Eichengreen et al., 2021; Onuogu et al., 2024). In this sense, modern perspectives have emphasized the influence of capital distribution on social inequality, arguing that market mechanisms are not sufficient to ensure economic equity. In other topical studies (Ahmad et al., 2023; Sharma & Mishra, 2022; Shinwari et al., 2024) emphasizes that income distribution is not only the result of natural economic dynamics, but also of political and institutional decisions that influence how resources are allocated. Progressive tax policies play a central role in reducing economic inequality by ensuring a fair distribution of income through a differentiated tax system that shifts resources from the economically better-off to the financially vulnerable. Recent studies (Balasoiu et al., 2023; OECD, 2024b) shows that economies that implement progressive taxation effectively not only reduce economic disparities, but also stimulate economic growth by redistributing income to sectors that favor consumption and social investment.

Investing in education and health is another fundamental pillar of economic and social equity, contributing to a better trained and more productive workforce. The literature emphasizes that countries with well-developed education systems have higher economic mobility and more equitable income distribution (Guan et al., 2024; Xu et al., 2023). Quality education and accessibility to health services not only reduce socio-economic disparities, but also contribute to strengthening macroeconomic stability through a healthier and more innovative workforce.

Labor market regulations are also a key factor in preventing exploitation of the workforce and ensuring a level playing field for employees. Comparative studies between developed and emerging economies (International Monetary Fund, 2023; OECD, 2024a) shows that better regulated labor markets reduce the risk of in-work poverty, encourage economic inclusion and protect vulnerable groups from uncontrolled economic fluctuations. Measures such as setting an adequate minimum wage, guaranteeing access to fair employment contracts and promoting collective bargaining are seen as key to maintaining an inclusive and balanced economy. In the

absence of such measures, economic inequality may deepen, undermining economic stability and reducing opportunities for large segments of the population. Sustainable economic development requires not only continued GDP growth, but also a pattern of equitable distribution of economic benefits so that all sections of society have access to resources and opportunities (Chang & Fang, 2023; Henderson & Loreau, 2023; van Niekerk, 2024). This view is supported by theories of welfare economics, which argue that long-term economic prosperity cannot be achieved without a minimum degree of social cohesion and the implementation of effective mechanisms to reduce economic disparities (Akarsu et al., 2024; Gidage & Bhide, 2024; Hemerijck et al., 2023).

Empirical analysis of income inequality shows that economic and social policies have a significant impact on reducing disparities. Diverse studies (Bação et al., 2024; Neuhuber & Schneider, 2024; Ullah et al., 2024) shows that countries with high public spending on social protection have lower GINI coefficients, suggesting a direct correlation between state interventions and economic equity. World Bank studies (Choudhary et al., 2024; Thomas, 2023) highlights the effectiveness of progressive taxation and social transfers in reducing economic disparities. In a broader context, various research (Brändle & Kuckertz, 2023; Goldstone et al., 2023; Stopforth et al., 2024) emphasizes the role of education and training in increasing social mobility and reducing structural inequalities. In this respect, it highlights the social protection systems in the Nordic countries, characterized by an optimal mix between employee protection and labour market stimulation, providing an example of good practice in combating economic inequality (Barth et al., 2023; Ferragina, 2022; Graafland & Verbruggen, 2022).

Rapid economic changes caused by digitalization and globalization have also brought new challenges for income distribution. More research (Didier, 2024; Martins-Neto et al., 2024; Parteka et al., 2024) have shown that digitization and automation of production have increased economic productivity, but this technological progress has also polarized the labour market. This has increased demand for high-skilled workers, while jobs for the low-skilled have been eliminated, widening economic disparities. At the same time, economic globalization has facilitated the relocation of jobs to regions with lower production costs, thus affecting the middle class in developed economies and contributing to rising economic inequality (Rodrik, 2024; Wu et al., 2024). These trends suggest the need for flexible and integrated economic strategies to ensure a smooth transition to a digitized economy. Recent research (Cevik & Jalles, 2023; Nguyen et al., 2023; Rodríguez-Pose & Bartalucci, 2024; World Bank, 2025) highlights the impact of climate change on income inequality, highlighting that poorer regions are often the most vulnerable to the negative effects of environmental degradation. Green transition policies must therefore be accompanied by measures to protect vulnerable social groups and provide equitable solutions for sustainable economic growth.

Research in the literature has examined the effects of economic crises on income disparities, highlighting that recessions disproportionately affect vulnerable groups, which calls for the implementation of quick and effective economic support measures. For example, recent studies on the 2008 economic crisis (Ebbinghaus & Weishaupt, 2022; Guriev & Papaioannou, 2022; Missos et al., 2024) have shown that countries that have implemented protective social policies have been able to mitigate the negative impact on income distribution compared to economies that have favored austerity measures.

A review of the literature shows that income inequality is influenced by multiple variables, from fiscal and social policies to globalization and digitalization. To ensure sustainable economic development, it is essential that public policies are well calibrated and adapted to new economic and social realities. Future research should focus on the interaction between technology, sustainability and economic equity to develop more inclusive and efficient economic models. This area of research continues to evolve with direct implications for the formulation of economic development strategies at the global level, underlining the importance of proactive and adaptable policies in response to rapid market changes.

3. Methodology

The methodology of this research is based on the analysis of the impact of social welfare on income inequality and sustainable economic development in the European Union, using statistical data extracted from the Eurostat platform for the period 2014-2023. The econometric model adopted falls into the category of generalized linear regression models, allowing a rigorous assessment of the relationship between the independent variables, represented by the relevant socio-economic indicators, and the dependent variable, the GINI coefficient, as a measure of income inequality. The analysed indicators are presented in Table 1.

Table no. 1 Presentation of indicators

Notation	Indicators	U.M	Source
RPOVST	At-risk-of-poverty rate after social transfers	Percentage	Eurostat (Eurostat, 2025a)
ELVED	Early leavers from education and training	Percentage	Eurostat (Eurostat, 2024a)
HLIFB	Healthy life years in absolute value at birth	Percentage	Eurostat (Eurostat, 2024e)
EXPHEC	Health care expenditure by financing scheme	Million euro	Eurostat (Eurostat, 2024c)
GINI	Gini coefficient of equivalised disposable income	Percentage	Eurostat (Eurostat, 2025b)
EMPLO	Employment	Percentage of total population	Eurostat (Eurostat, 2024b)
GDP	GDP and main components (output, expenditure and income)	Chain linked volumes, index 2010=100	Eurostat (Eurostat, 2024d)
RPARED	Participation rate in education and training (last 4 weeks) from 18 to 64 years	Percentage	Eurostat (Eurostat, 2024f)

Source: Author based on Eurostat data

The econometric model used in this research is a generalized linear regression model, chosen because it allows quantifying the impact of each explanatory variable on income inequality, providing a thorough understanding of the mechanisms through which social welfare influences economic cohesion in the European Union. This model ensures a robust estimation of the effects of each explanatory variable, controlling for collinear influences and possible endogeneity problems by using appropriate statistical tests. The reliability of the model is checked by means of statistical significance tests, by analysing the coefficients of determination and by using informational criteria, such as the Akaike criterion, to compare specification alternatives.

The choice of the GINI coefficient as the dependent variable in this study is motivated by its ability to measure income inequality in a standardized and comparable way across EU Member States. In the context of the European Union, reducing inequality is a strategic objective with direct implications for sustainable economic growth and social cohesion. An unequal income distribution can amplify structural problems such as social exclusion, limited access to education and health and economic instability. Thus, analysing the impact of social welfare on income inequality through the GINI coefficient provides relevant insights into the effectiveness of social and economic policies implemented at European level. Furthermore, research in this area (Blotevogel et al., 2022; Hadzi-Vaskov et al., 2023; Hussain et al., 2023; Ochi et al., 2024) suggests that income inequality is not only a consequence of economic factors but also a cause of fragile economic growth and social instability.

The selection of explanatory variables was based on a theoretic-empirical approach, including key factors such as gross domestic product (GDP), the share of the population at risk of poverty after social transfers, the share of early leavers from education and training, healthy life expectancy at birth, health expenditure according to the financing scheme, employment rate, and the participation rate in education and training among adults aged 18-64.

Gross Domestic Product (GDP) - reflects each country's economic size and level of aggregate output. In economic theories, an increase in GDP is associated with an increase in living standards, but the effects on inequality can vary depending on income distribution and redistributive policies (Bodea et al., 2021; Hillen & Steiner, 2025; D.-H. Kim & Lin, 2023; H. Kim & Rhee, 2022). GDP has been included in the model to examine whether economic growth contributes to reducing inequality or, on the contrary, accentuates income polarization.

At-risk-of-poverty rate after social transfers (RPOVST) - measures the percentage of the population that, even after state intervention through social transfers, is below the poverty line. The variable was selected to assess the effectiveness of social protection mechanisms and their impact on reducing economic disparities.

The share of early leavers from education and vocational education and training (ELVED) - is a key factor in social mobility and reducing income inequality. Early school leavers generally have lower earnings and limited employment opportunities, which may contribute to increased inequality. This variable therefore allows an assessment of the influence of education on income distribution.

Healthy Life Expectancy at Birth (HLIFB) -reflects quality of life and access to health services, with direct implications for the labour capacity and productivity of the population. Poor health can reduce individual incomes and contribute to the perpetuation of poverty, so this variable is relevant in analysing the relationship between social welfare and income inequality.

Expenditure on health care under the financing scheme (EXPHEC) - is an important indicator of governments' commitment to population well-being. Health spending can reduce inequalities by improving access to quality health services, thus preventing social exclusion of vulnerable people. The employment rate (EMPLOYMENT) - is a key determinant of the level of individual incomes and the reduction of inequality. This variable reflects the degree of integration of the population into the labour market and the impact of economic policies on income distribution. Moreover, a higher employment rate is generally associated with a reduction in economic disparities due to increased access to stable sources of income.

Participation rate in education and training of adults aged 18-64 (RPARED) -is important for the adaptability of the labour force in a changing economy. Lifelong learning contributes to reducing economic disparities by increasing the skills of the employed and increasing access to better paid jobs.

The general equation of the generalized linear regression model used to analyse the impact of welfare on income inequality is expressed as follows:

$$GINI = \alpha + \beta_1 \cdot GDP + \beta_2 \cdot RPOVST + \beta_3 \cdot ELVED + \beta_4 \cdot HLIFB + \beta_5 \cdot EXPHEC + \beta_6 \cdot EMPLO + \beta_7 \cdot RPARED + \varepsilon$$

Where, GINI represents the dependent variable, which measures income inequality; α , is the constant term; $\beta_1, \beta_2, \beta_3, \dots, \beta_7$ are the regression coefficients that indicate the impact of each explanatory variable on the GINI coefficient; GDP, RPOVST, ELVED, HLIFB, EXPHEC, EMPLO and RPARED are the independent variables, which reflect the socio-economic factors influencing income inequality; ε is the random error term, which captures the influences of other factors not included in the model.

We formulate the following hypotheses:

Hypothesis 1 (H1): The increase in gross domestic product has a negative effect on income inequality, suggesting that economic expansion can help reduce social disparities through a more equitable distribution of financial resources.

Hypothesis 2 (H2): An increase in the at-risk-of-poverty rate after social transfers leads to a significant increase in the GINI coefficient, indicating that existing social protection mechanisms are not sufficiently effective in reducing income inequality.

Hypothesis 3 (H3): Increases in employment rates do not automatically lead to a reduction in income inequality, but may accentuate economic polarization due to wage differentials, labour market segmentation and the quality of available jobs.

Hypothesis 4 (H4): An increase in the participation rate of adults in education and training contributes to reducing income inequality, demonstrating the importance of lifelong learning in improving professional skills and access to better paid jobs.

5. Results and Discussion

The descriptive statistics presented in Table 2 reflect the significant variations in the main socio-economic indicators analysed at the European Union level, highlighting the structural differences between Member States in terms of income distribution, economic growth, employment, access to education and health, and the effectiveness of social protection policies. The analysis of these variables is essential to understand the mechanisms influencing income inequality and to identify the determinants of economic and social cohesion in the European context.

Table no. 2 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GINI	270	29.757	3.961	20.9	40.8
GDP	270	120.106	22.627	78.07	240.036
RPOVST	270	16.593	3.877	8.6	25.4
ELVED	270	8.911	3.824	2	21.9
HLIFB	270	61.901	4.735	51.4	73.6
EXPHEC	270	50079.517	88881.7	795.04	488677
EMPLO	270	72.936	6.142	53.1	83.5
RPARED	270	17.502	7.803	6.6	42.4

Source: Elaborated by author using STATA 18 program

The GINI coefficient, used to measure income inequality, shows an average of 29.757, indicating a moderate level of economic disparities, but its variability between the countries analysed is significant, with values ranging from 20.9 to 40.8. These discrepancies suggest that, although there are common European policies aimed at reducing inequality, their effectiveness differs considerably depending on the specifics of each national economy. A key factor influencing this distribution is Gross Domestic Product per capita, which averages 120.106, but with considerable deviations between 78.07 and 240.036, reflecting disparities in the level of economic development between Member States. These economic differences underline the fact that while advanced economies have greater resources to implement effective redistributive policies, countries with lower GDPs find it difficult to reduce income inequality. In terms of the social dimension of well-being, the at-risk-of-poverty rate after social transfers averages 16.593, suggesting that despite state interventions in the form of social benefits and support policies, a significant share of the EU population continues to face economic vulnerabilities. The extreme values of this indicator, which range from 8.6 to 25.4, confirm the differences in the effectiveness of national poverty reduction policies, which are influenced by the level of public spending and the structure of the labour market. Education plays a key role in social mobility, and the rate of early leavers from education and training shows an average of 8.911, with a minimum of 2 and a maximum of 21.9, indicating significant discrepancies between Member States in terms of access and retention in the education system. These results suggest that in countries with high school drop-out rates, opportunities for labour market integration are limited, which may contribute to the maintenance of income inequality in the long run. Another key dimension of social well-being is health, reflected in this study by healthy life expectancy at birth, which averages 61.901 years but varies considerably between 51.4 and 73.6 years. These differences can be attributed to unequal access to health services, the level of funding of the health care system and environmental factors, highlighting the need for more equitable health policies at the European level. In this context, health expenditure under the funding scheme shows a high average of 50,079.517, but with considerable dispersion, ranging between 795.04 and 488,677, indicating major differences in the allocation of resources to

health systems between EU countries. This high variability highlights the fact that some countries invest heavily in health infrastructure and public services, while others have limited financial resources, which can directly affect quality of life and equity of access to health care.

The labour market is another important determinant of income distribution, with an average employment rate of 72.936, with a minimum of 53.1 and a maximum of 83.5, suggesting a relatively high participation of the population in productive economic activities. However, these high values do not guarantee an equitable distribution of income, as the nature of jobs, wage differentials and the degree of labour market segmentation can significantly influence income distribution. On the other hand, the participation rate of adults in education and training, which has an average of 17.502 and ranges from 6.6 to 42.4, emphasizes the importance of lifelong learning in reducing economic inequality. Countries with higher levels of this indicator tend to offer greater opportunities for retraining and labour market integration, thus contributing to reducing income disparities and increasing social mobility. The descriptive statistics analysed reflect the existence of significant differences between the EU Member States in terms of income inequality and its determinants as well as the need for common policies at European level aimed at reducing these disparities.

The evolution of the GINI coefficient in the Member States of the European Union over the period 2014-2023 is presented in Figure 1.

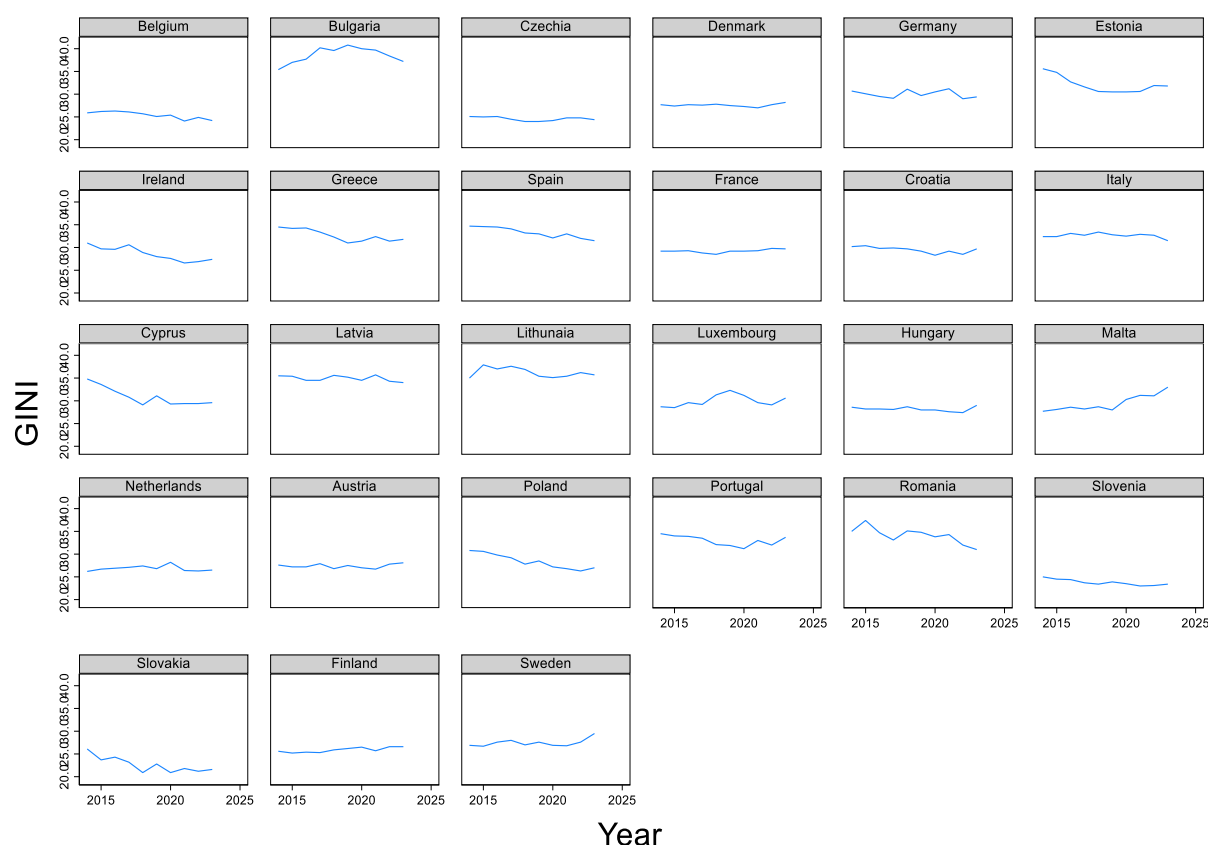


Figure 1. Evolution of the GINI coefficient in the EU Member States between 2014-2023

Source: Elaborated by author using STATA 18 program

Figure 1 shows the evolution of the GINI coefficient over the period 2014-2023 for the EU Member States, with each individual graph reflecting the trend of this indicator for a given country. The GINI coefficient, used to measure income inequality, ranges between 20 and 40, with higher values indicating a more unequal income distribution. Trend analysis shows that income inequality has behaved differently across countries. In some countries, such as Ireland, Cyprus, Estonia, Estonia, Portugal and Slovakia, there is a downward trend in the GINI coefficient, suggesting an improvement in the fairness of income distribution over this period. In contrast, other countries,

such as Bulgaria, Luxembourg, Malta and Romania, show an upward trend, indicating an increase in economic disparities.

In many countries, such as Germany, France, Austria, Germany, the Netherlands, Poland and Sweden, the GINI coefficient has remained relatively constant with minor fluctuations over the years, suggesting a balance between the factors determining income distribution. Also, in countries such as Greece, Latvia and Lithuania, trends are more volatile, indicating swings in the level of income inequality, possibly due to changes in economic and social policies. The figure highlights that while there is economic convergence in the European Union, differences in income distribution between Member States remain significant and country-specific trends are influenced by factors such as economic growth, social policies and tax reforms implemented at national level.

Table 3 presents the Variable Inflation Factor (VIF) analysis used to detect the presence of collinearity between the independent variables in the econometric model used.

Table no. 3 Variance inflation factor

Variable	VIF	1/VIF
EMPLO	2.378	0.421
GDP	1.658	0.603
RPOVST	1.590	0.629
RPARED	1.573	0.636
ELVED	1.293	0.773
HLIFB	1.239	0.807
EXPHEC	1.207	0.829
Mean VIF	1.562	.

Source: Elaborated by author using STATA 18 program

Table 3 shows that all VIF values are below 2.5, which indicates a low level of collinearity among the variables included in the model. The mean VIF value is 1.562, confirming that the model does not exhibit multicollinearity problems. Therefore, the regression coefficients can be interpreted with confidence, without the risk of biased estimates due to high correlations between explanatory variables.

Table 4 presents the matrix of correlation coefficients, which provides information about the degree and direction of linear relationships between the variables used in the model.

Table no. 4 Matrix of correlations

Variables	GINI	GDP	RPOVST	ELVED	HLIFB	EXPHEC	EMPLO	RPARED
GINI	1.000							
GDP	-0.031	1.000						
RPOVST	0.860	-0.025	1.000					
ELVED	0.384	-0.074	0.396	1.000				
HLIFB	0.001	0.127	-0.062	0.162	1.000			
EXPHEC	-0.008	-0.187	-0.086	0.183	0.228	1.000		
EMPLO	-0.334	0.449	-0.449	-0.228	-0.081	0.057	1.000	
RPARED	-0.380	0.000	-0.392	-0.146	0.074	0.099	0.509	1.000

Source: Elaborated by author using STATA 18 program

The correlation analysis suggests that the main determinants of the level of income inequality in the European Union are the poverty rate and access to education, while variables such as gross domestic product or health expenditure do not have a significant direct impact on income distribution. These findings underline the importance of policies supporting social inclusion, increasing employment and skills development through lifelong learning as key tools for reducing economic disparities at the European level.

Table 5 presents the results of the Shapiro-Wilk test to check the normality of the residuals of the estimated econometric model. This test is used to determine whether the analysed data (regression residuals) follow a normal distribution, an essential condition for the validity of certain statistical methods, such as parametric tests and inferences based on linear regression models.

Table no. 5 Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
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Source: Elaborated by author using STATA 18 program

The results presented in Table 5 suggest that the assumption of normality of errors is satisfied, which confers robustness to the model and allows the use of parametric tests to check the significance of the coefficients. Normality of the residuals is an important condition in linear regression, as it guarantees the validity of the statistical significance tests and confidence intervals constructed from the model. The analysis therefore confirms that the estimates obtained can be considered reliable and the inferences derived from this model are relevant for understanding the relationship between the explanatory variables and the GINI coefficient.

Table 6 presents the results of the estimated econometric model, using generalized linear regression to analyse the relationship between the GINI coefficient and the included explanatory variables.

Table no. 5 Generalized linear models

GINI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
GDP	-0.017	0.007	-2.44	0.015	-0.03	-0.003	**
RPOVST	0.902	0.039	23.31	0	0.827	0.978	***
ELVED	0.033	0.035	0.93	0.351	-0.036	0.102	
HLIFB	0.068	0.028	2.42	0.016	0.013	0.123	**
EXPHEC	0	0	0.85	0.395	0	0	
EMPLO	0.118	0.03	3.96	0	0.06	0.177	***
RPARED	-0.067	0.019	-3.48	0.001	-0.104	-0.029	***
Constant	4.76	2.899	1.64	0.101	-0.922	10.442	
Mean dependent var		29.757	SD dependent var			3.961	
Number of obs		270	Chi-square			844.692	
Prob > chi2		0.000	Akaike crit. (AIC)			1135.530	

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Elaborated by author using STATA 18 program

The statistical results presented in Table 6 provide an overview of the estimated econometric model, highlighting the characteristics of the dependent variable, the explanatory power of the model and the specification selection criteria used. The mean of the dependent variable, with a value of 29.757, indicates that, on average, the GINI coefficient for the sample analyzed is around this level, suggesting a moderate degree of income inequality within the countries studied. The standard deviation of the dependent variable, equal to 3.961, reflects the variability of income inequality across observations, suggesting significant differences between the countries included in the analysis. The number of observations, 270, indicates the sample size used in the regression, which lends robustness to the estimates and provides a solid basis for interpreting the results. The chi-square test, with a value of 844.692, is an indicator of the overall significance of the model, showing whether the explanatory variables used are able to significantly explain the variation in the GINI coefficient. The associated probability value of this test, 0.000, indicates that the model is statistically significant at a very high level of confidence ($p < 0.01$), confirming that at least one of the independent variables has a significant impact on the dependent variable. The Akaike criterion (AIC), with a value of 1135.530, is used to assess model quality, penalizing specifications with an excessive number of parameters and favouring more parsimonious models. A lower value of the AIC criterion indicates a model that is more efficient in balancing estimation accuracy with model complexity. In this context, the value obtained can be compared with alternatives to determine whether the current model provides an optimal specification relative to others tested.

Analysis of the relationship between gross domestic product and income inequality, according to hypothesis H1, shows that the coefficient associated with GDP is negative, with a value of -0.017, indicating an inverse correlation between economic growth and the GINI coefficient. This relationship suggests that, as GDP increases, income inequality tends to decrease, thus supporting the hypothesis that economic expansion may facilitate the reduction of social disparities through a more equitable distribution of financial resources. The statistical significance

of this effect is confirmed by the p-value associated with the coefficient, which is 0.015, indicating that the relationship is significant at the 95% confidence level. Therefore, the model results support hypothesis H1, demonstrating that economic development can have a positive impact on the equity of income distribution. Regarding hypothesis H2, that an increase in the at-risk-of-poverty rate after social transfers leads to a significant increase in the GINI coefficient, the model results confirm this relationship. The estimated coefficient for the RPOVST is 0.902, indicating a strong positive impact on income inequality, and the associated p-value is 0.000, suggesting a high level of statistical significance ($p < 0.01$). These results highlight that a higher proportion of the population at risk of poverty contributes directly to the increase in economic inequality, which confirms hypothesis H2 and suggests that existing social protection mechanisms are not sufficiently effective in compensating for economic gaps and ensuring an equitable distribution of income. Analysing hypothesis H3, which argues that an increase in the employment rate does not automatically lead to a reduction in income inequality, the results indicate that the EMPLO coefficient is positive and has a value of 0.118, suggesting a direct relationship between employment and income inequality. The statistical significance of this coefficient is very high, with a p-value of 0.000, which confirms that this effect is not random. This relationship can be explained by the fact that high employment rates do not automatically guarantee an equitable distribution of income, as job quality, wage differentials and labour market segmentation may contribute to accentuate economic polarization. Thus, hypothesis H3 is validated, confirming that simply increasing employment is not sufficient to reduce income inequality. As for hypothesis H4, according to which an increase in the participation rate of adults in education and training contributes to reducing income inequality, the model results support this claim. The estimated coefficient for RPARED is negative, with a value of -0.067, indicating that an increase in this indicator is associated with a reduction in the GINI coefficient. The p-value associated with this coefficient is 0.001, which confirms the statistical significance of the relationship at the 99% confidence level ($p < 0.01$). These results suggest that continuing education plays a key role in improving job skills and increasing access to better paid jobs, which contributes to a more equitable distribution of income. Thus, hypothesis H4 is confirmed by the model, demonstrating the importance of lifelong learning in reducing economic inequality.

The regression model results confirm all four hypotheses. These findings are relevant for the formulation of economic and social policies aimed at improving social cohesion and promoting more inclusive growth in the European Union.

At European Union level, the development of public policies aimed at reducing income inequality and promoting sustainable economic growth must be based on an integrated approach, combining measures to foster social inclusion, educational reforms, active labor market policies and initiatives to improve the efficiency of social protection mechanisms. In this respect, an effective strategy should aim both at reducing economic disparities between Member States and at alleviating internal disparities between different social groups through a fairer distribution of economic opportunities and public resources. A first key objective of public policies at European level should be to strengthen education and training systems to reduce early school-leaving rates and improve access to higher education and retraining programs. The creation of lifelong learning frameworks and the development of partnerships between educational institutions and the business environment could facilitate the integration of young people and jobseekers into the labour market, thus reducing the risk of economic exclusion and contributing to better social mobility. In parallel, active employment policies should be geared towards providing incentives for employers to create stable and well-paid jobs, thus reducing labour market segmentation and ensuring a fairer distribution of income between different social groups. The second key objective is to reform and optimize social protection systems so that social transfers are more effectively targeted towards vulnerable groups without discouraging active participation in the labour market. A better calibrated approach to redistributive policies, including tax incentives for disadvantaged groups and support mechanisms tailored to the specific economic context of each Member State, could

contribute to reducing poverty and limiting the negative effects of income inequality on social cohesion. To this end, policy coordination at European level should focus on the exchange of best practices between Member States and the implementation of flexible mechanisms for adjusting social measures to the economic and demographic particularities of each region. The third key objective of public policies aimed at reducing income inequality should be to increase investment in public infrastructure, health and social services so as to improve equal access to resources and economic opportunities for all EU citizens. The development of progressive fiscal policies, which ensure a fairer distribution of the tax burden and allow the financing of effective social programs, could contribute to reducing economic disparities and strengthening macroeconomic stability. At the same time, integrating the principles of economic and social sustainability into the European Union's development strategies should become a priority, so that the reduction of income inequality is addressed not only from the perspective of the distribution of resources, but also by promoting more inclusive and sustainable economic models in the long term. Thus, an effective public policy strategy at EU level must be multidimensional, combining structural reforms in education, employment, social protection and taxation, to contribute to increasing social cohesion and reducing economic disparities between and within Member States. Only through an integrated and coordinated approach, based on solidarity and fairness, can the European Union ensure sustainable economic development and a fairer distribution of income for all its citizens.

5. Conclusions

The results of the econometric analysis show significant relationships between income inequality, as measured by the GINI coefficient, and the socio-economic variables included in the model, confirming the importance of factors such as economic growth, employment, education and social protection mechanisms in determining income distribution. The findings of this study suggest that economic expansion has a positive effect on income equity, but in the absence of appropriate policies, economic growth alone is not sufficient to reduce social disparities. Also, the at-risk-of-poverty rate after social transfers proves to be a strong determinant of inequality, underlining the need for more effective mechanisms to redistribute resources and support vulnerable groups. At the same time, continuing vocational education and training (CVET) is confirmed as an essential tool for reducing economic disparities, providing individuals with better opportunities for integration into the labour market and thus contributing to a fairer distribution of income.

However, the study has certain limitations that need to be considered namely the limited data collection period 2014-2023. Another limitation concerns the model used which does not consider long-term structural effects such as demographic changes, labour migration or the impact of technological transition on the labour market, factors that can significantly influence income distribution.

Future research directions aim to extend the analysis by integrating additional factors, such as fiscal policies, the impact of globalization and changes in the structure of the labour market, to gain a more detailed understanding of the mechanisms influencing income inequality. At the same time, exploring alternative econometric approaches, including the use of non-linear models and machine learning methods applied to the analysis of income inequality, could provide new insights into how economic and social factors interact to shape income distribution.

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