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Analysis of the Impact of Government Spending on Income Inequality in the EU Member States

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ABSTRACT

This paper examines the impact of government spending and other economic factors on income inequality in the 27 Member States of the European Union for the period 2012-2023, using a linear regression model on panel data. The study focuses on analysing the influence of various components of government spending, including health, education, public order, social protection and other economic sectors, as well as the effects of public debt and at-risk-of-poverty on income distribution. This is done in the context of European strategies aimed at promoting social and economic cohesion, such as the European Pillar of Social Rights, the Strategy for a Green and Digital Europe and the 2030 Agenda for Sustainable Development. The results of the study show that public spending on health and education has a significant negative effect on income inequality, confirming the importance of these sectors in promoting social equity. The analysis also reveals a significant positive association between the risk of poverty and income inequality, indicating the need for more effective redistributive measures to reduce economic polarization. The study contributes to the literature by integrating a recent period characterized by multiple economic and social crises, including the COVID-19 pandemic. The novelty of the research also lies in the detailed assessment of the effects of different categories of government spending on income distribution, providing relevant recommendations for European public policies, including strengthening investments in health, education and social protection to reduce economic and social inequalities and achieve the economic and social cohesion objectives set at the European Union level.

1. Introduction

Income inequality is one of the European Union's most persistent economic and social challenges, affecting economic stability, social cohesion and sustainable development prospects of the Member States. Although the European Union has, over the decades, implemented several public policies aimed at promoting economic and social convergence, significant differences in income distribution continue to persist between and within Member States. This issue has become increasingly relevant in the context of successive economic crises, such as the sovereign debt crisis of 2008-2010, the migration crisis and, more recently, the COVID-19 pandemic, which have exacerbated existing vulnerabilities and created new challenges for Member States in fighting poverty and reducing economic disparities.

Public spending policies play a central role in the European Union's efforts to reduce economic and social inequalities and are essential for achieving the objectives of the Europe 2020 Strategy, the European Pillar of Social Rights and, more recently, the 2030 Agenda for Sustainable Development. In this context, public spending on health, education and social protection are seen as fundamental pillars in ensuring inclusive economic growth and greater social equity. However, while certain categories of public spending contribute directly to reducing income inequality, other types of spending may have neutral or even negative effects on income distribution, depending on government priorities and the efficiency of their implementation.

The aim of this study is to investigate the impact of different components of government spending on income inequality in the 27 EU Member States over the period 2012-2023 using a panel data model. The study aims to identify the extent to which spending on health, education, public order, social protection and other economic sectors influences income distribution, given the commitments made by the European Union to promote economic and social cohesion.

The novelty of the study lies in applying a comprehensive analysis of a recent period, including the effects of the COVID-19 pandemic and associated economic recovery measures, in a context where Member States have implemented diverse strategies to mitigate the impact of economic and social crises. The study also

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distinguishes itself by integrating a broad set of explanatory variables reflecting government spending on various economic and social functions and factors such as public debt and the at-risk-of-poverty rate. Therefore, the analysis provides a detailed insight into the dynamics of income inequality in the European Union, thus contributing to the literature and providing relevant recommendations for the formulation of effective and equitable public policies.

The main objectives of the study are:

O1: Literature review on the impact of different categories of government spending on income inequality

O2: Design an econometric model to assess the effects of general economic factors such as public debt and the at-risk-of-poverty rate on income inequality

O3: Propose policy-relevant recommendations for European public policies, based on empirical evidence, to promote economic and social cohesion and reduce income disparities between and within Member States.

These objectives are intended to provide a comprehensive perspective on the effects of government spending on income inequality in the European Union, contributing both to the literature and to the formulation of more efficient and equitable fiscal public policies.

2. Literature review

In the context of accelerating economic, social and institutional transformations, income inequality has emerged as one of the most pressing challenges in public policy analysis. It reflects not only an increasingly polarized economic reality, but also deep social tensions affecting societal cohesion, fiscal sustainability and political stability. Both classical economic theories and contemporary contributions emphasize the fundamental role of the state in redistributing income through public expenditure policies. These can be used not only to ensure the provision of public goods, but also as instruments to correct social imbalances generated by free market mechanisms. However, the literature often emphasizes the ambivalent nature of state intervention, stressing that the efficiency and direction of the redistributive impact depends importantly on the structure, targeting and quality of public spending (Li et al., 2024; Miao et al., 2023; Paranata, 2025).

From a theoretical perspective, the conceptual foundations of state intervention to reduce inequality originate in the classic contributions of Musgrave (Musgrave, 1996) which defined the triple function of the modern state - allocative, redistributive and stabilizing. This view has been taken up and nuanced in recent research, which argues for a holistic approach to fiscal and budgetary policies. Thus, public spending cannot be analysed in isolation but must be placed within an analytical framework that considers the architecture of the tax system, institutional efficiency and general economic conditions. Studies in this direction include (Coccia, 2022; Guerrero et al., 2022; Kleider & and Toubeau, 2022) which emphasizes that the redistributive effect of government spending depends not only on its volume and functional purpose, but also on its interaction with other structural factors such as the level of development, the tax system and the coherence of governance mechanisms. The assessment of fiscal policies must therefore go beyond simply accounting for allocations and integrate qualitative, institutional and contextual dimensions.

For example, other studies (Hemerijck et al., 2023; Neidhöfer et al., 2024; Yang & Zhou, 2022) propose a conceptual framework in which income inequality is the result of the interaction between market forces, public redistribution and social mobility. This approach is complemented by other research (Nae et al., 2024; Ricci, 2025; van Niekerk, 2020), which have highlighted that without proactive public policies, structural trends in the globalized economy lead to a progressive concentration of income and wealth.

From an empirical perspective, a robust consensus has formed around the idea that investing in education is one of the most effective ways to reduce income inequality in the long run (Artige & Cavenaile, 2023; Kling et al., 2022; Ullah et al., 2024). Diverse specialized studies (Li et al., 2024; Valentini, 2024; Zheng & Graham, 2022) have shown that government spending on education is associated with significant decreases in the Gini coefficient and increases in intergenerational mobility. In the European context, studies (Amjad et al., 2024; European Commission, 2023; OECD, 2023a) have shown that the redistributive effect of education is maximized when combined with active social inclusion policies and equal access to digital educational infrastructure.

Similarly, spending on public health is widely recognized for its potential to reduce economic inequality, particularly by expanding access to essential health services. OECD coordinated studies (OECD, 2023b, 2024) and research results published by different authors (Heylen, 2023; Qin et al., 2024; Vosoughkhosravi et al., 2024) emphasizes that higher budget allocations to health correlate with lower levels of income inequality and improvements in income-differentiated health indicators. More recently, topical studies (Carrieri & Principe, 2024; Gabani et al., 2024) shows that the redistributive effects of health spending are magnified in countries with universal coverage and regressive co-payment mechanisms.

On the other hand, the literature on defense and law and order spending frequently shows no or even a regressive impact on income distribution (Digdowiseiso et al., 2022; Raifu & Aminu, 2023; Ullah et al., 2024). Research by other authors (Bylund et al., 2023; Natili & and Visconti, 2023; Yohou, 2023), has shown that such expenditures generate limited benefits for vulnerable groups and may reduce the fiscal space for social policies.

Thus, they are associated with an increase in economic polarization in contexts where they are oversized or misdirected.

A particular area is spending on social protection and pensions. While there is theoretical agreement on their redistributive effect, the empirical literature shows large variations depending on the institutional architecture. Some authors (Hu & Stauvermann, 2024; Lee, 2024; Popova, 2023) have shown that in countries with universal pension systems and progressive contributions, social spending significantly reduces inequality. In contrast, where systems are fragmented or poorly integrated with progressive taxation, the redistributive effect is much reduced (Blanchet et al., 2022; Oude Nijhuis, 2021; Razavi, 2022).

An emerging literature focuses on economic development and infrastructure spending. Some research (Gansauer, 2025; López-Bazo, 2022; Rosik & Wójcik, 2023) have shown that such spending can have indirect redistributive effects by stimulating job creation and reducing regional disparities. Research by Nogueira et al. (Nogueira et al., 2024) and Taylor et al. (Taylor et al., 2025) have shown that the positive impact on social equity is contingent on the existence of equal access policies and a participatory governance framework.

Public debt is also increasingly being addressed as a moderating factor of the redistributive capacity of the state. Some specialized studies (Ekouala Makala, 2022; Menguy, 2023; Stavick, 2023) have shown that high debt levels limit governments' fiscal maneuverability, especially in times of crisis. In a recent paper, El-Naser et al. (El-Naser et al., 2025) emphasizes that countries with public debt above 90% of GDP have high volatility in social spending, which disproportionately affects groups at risk of poverty.

At-risk of poverty is addressed in the literature both as a determinant and because of inequality. Authors Rahman & Pingali (Rahman & Pingali, 2024), Remeikienė & Gaspareniene (Remeikienė & Gaspareniene, 2023) and Carrosio De Vidovich (Carrosio & and De Vidovich, 2023) have shown that persistent inequality increases the likelihood of exposure to poverty and erodes the capacity of social systems to act as an economic shock absorber. In this respect, well-targeted social transfers calibrated to poverty thresholds play a key role in reducing both phenomena simultaneously.

A key element recurrent in the literature is the quality of governance. A number of studies (Di Giorno et al., 2024; Elberry et al., 2022; Miranda-Lescano et al., 2024) have shown that the redistributive efficiency of public spending is closely linked to institutional transparency, control of corruption and administrative capacity. In the absence of these conditions, budget allocations may become regressive, even if they are significant in volume.

The literature strongly supports the idea that the structure and quality of government spending decisively influence income inequality, but warns of the need for a well-functioning, coherent and equitable institutional framework. The present study joins these contributions by providing a systematic comparative perspective on European Union Member States over the period 2012-2023, integrating relevant indicators such as COFOG detailed government expenditure, public debt and at-risk-of-poverty. In doing so, it complements the existing literature, addressing thematic and methodological gaps and providing a solid empirical basis for the formulation of public policies oriented towards equity and sustainable social cohesion.

3. Methods

The methodology of the paper is based on a quantitative analysis carried out by applying the Ordinary Least Squares (OLS) method on a dataset collected from the Eurostat platform, covering the 27 EU Member States for the period 2012-2023. This period was selected to capture the evolution of the impact of government expenditure on income inequality over a sufficiently long time span to allow the identification of consistent and economically and socially relevant trends.

To conduct the analysis, several relevant indicators were collected to capture the variability in government spending and other factors that may influence income inequality as shown in Table 1. The dependent variable of the study is the Gini coefficient of disposable income (GNI), used as a measure of income inequality in each Member State for each year in the range analysed.

Table 1. Indicators analysed

Symbol	Indicators	U.M	Source
GDEBT	General government gross debt	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025d)
GFCF	General government gross fixed capital formation	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2024)
GEPS	General government expenditure by function (COFOG) General public services	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)
GED	General government expenditure by function (COFOG) Defence	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)
GEP	General government expenditure by function (COFOG) Public order and safety	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)
GEEA	General government expenditure by function (COFOG) Economic affairs	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)

Symbol	Indicators	U.M	Source
GEH	General government expenditure by function (COFOG) Health	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)
GEE	General government expenditure by function (COFOG) Education	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)
GECG	General government expenditure by function (COFOG) Central government	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025c)
POVR	At-risk-of-poverty rate	Percentage	Eurostat (Eurostat, 2025a)
GNI	Gini coefficient of equivalised disposable income	Percentage	Eurostat (Eurostat, 2025e)
EPEN	Expenditure on pensions	Percentage of gross domestic product (GDP)	Eurostat (Eurostat, 2025b)

Source: Elaborated by authors

The choice of the variables used in this analysis is based on the literature examining the relationship between government spending, fiscal policy and income inequality, as well as on economic and social criteria relevant in the context of the European Union (Avram & Popova, 2022; Haelg et al., 2022; Hussain et al., 2023). The dependent variable of the study is the Gini coefficient of equivalized disposable income (GNI), a standardized indicator of income inequality commonly used for international comparisons, with the ability to reflect changes in the income distribution at both the lower and upper ends of the income distribution. The explanatory variables were selected to capture the different dimensions of government intervention in the economy and their effects on income inequality, given their conceptual relevance and the availability of data for the period under analysis. Thus, gross public debt (GDEBT) and gross fixed capital formation (GFCF) are included to capture the impact of the tax burden and public investment on income distribution, as high debt levels may limit the government's ability to implement effective redistributive policies, while public investment can stimulate growth and reduce inequality through job creation and improved access to basic services. Similarly, the variables reflecting government spending by various functions according to the COFOG classification (European Union, 2002) (GEPS, GED, GEP, GEEA, GEH, GEE, GECG) are included to allow for a detailed decomposition of state intervention in the economy, given that these expenditures have different effects on inequality depending on their purpose. Spending on health and education, for example, is often associated with a reduction in inequality due to increased access to essential services and the promotion of equality of opportunity, while spending on public order may have less impact on income distribution. Government spending on economic affairs can influence inequality in varying ways, depending on the degree of accessibility of the benefits to different social groups. In addition, the inclusion of the at-risk-of-poverty rate (POVR) aims to capture the effects of income distribution on the most vulnerable groups, as higher levels of poverty are often associated with more pronounced inequality. Expenditure on pensions (EPEN) is included to capture the role of public transfers in reducing inequality, as these components of the social protection system contribute directly to income redistribution and to alleviating economic disparities, especially if they are well targeted and cover a significant proportion of the population.

Thus, the selection of the variables is based on sound theoretical reasoning, taking into account the multiple dimensions of government expenditure and public intervention on income distribution, and their availability in the Eurostat database for the period 2012-2023 ensures methodological consistency and adequate comparability across EU Member States.

The econometric analysis is performed using the Ordinary Least Squares (OLS) method, which estimates the relationship between the dependent variable and the explanatory variables by minimizing the sum of squares of the residuals.

The estimated regression aims to capture the effects of different components of government spending and other economic and social factors on income inequality, the generalized formulation being expressed by equation:

$$GNIit = \beta 0 + \beta 1 GDEBTit + \beta 2 GFCFit + \beta 3 GEPSit + \beta 4 GEDit + \beta 5 GEPit + \beta 6 GEEAit + \beta 7 GEHit + \beta 8 GEEit + \beta 9 GECGit + \beta 10 POVRit + \beta 11 EPENit + \epsilon it \quad (1)$$

where i is the country, t is the year, and ϵit is the error term.

The estimated coefficients provide information on the extent to which each explanatory variable influences the Gini coefficient, thus allowing us to analyse the direction and intensity of these effects.

The following hypotheses have been formulated investigating the relationship between government spending, economic factors and income inequality in the EU Member States:

Hypothesis 1 (H1): Public spending on health (GEH) and education (GEE) has a negative effect on income inequality (GNI), as investments in these areas contribute to increasing access to essential services and promoting equality of opportunity, which reduces economic and social disparities.
Hypothesis 2 (H2): Government defense expenditures (GED) have a significant positive effect on income inequality (GNI), suggesting that allocating significant budgetary resources to this sector may reduce the effectiveness of redistributive policies and increase economic disparities.
Hypothesis 3 (H3): The at-risk-of-poverty rate (POVR) has a significant positive effect on income inequality (GNI), suggesting that an increase in the proportion of the population at risk of poverty is associated with an increase in income inequality.

4. Results and discussions

This section presents the results of the analysis aimed at investigating the impact of different components of government spending and other economic factors on income inequality within the European Union, in the light of the institutional efforts and coordinated strategies implemented at EU level to promote economic, social and territorial cohesion. The study covers the period 2012-2023, a period marked by significant challenges such as the post-2008 economic crisis, the migration crisis, the COVID-19 pandemic and the transition to a green and digital economy, factors that have prompted adjustments in public policies aimed at reducing economic and social disparities between and within Member States. Table 2 presents the disaggregated statistics of the indicators analysed.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GNI	324	29.862	3.93	20.9	40.8
GDEBT	324	69.497	38.617	8.5	209.4
GFCF	324	3.672	1.08	1.6	6.6
GEPS	324	5.86	1.687	2	11.3
GED	324	1.224	0.545	0.2	3.1
GEP	324	1.746	0.444	0.7	2.8
GEEA	324	5.653	1.86	2	17.2
GEH	324	6.373	1.512	2.5	10.1
GEE	324	4.973	.992	2.5	7.8
GECG	324	30.135	6.447	13.4	53.4
POVR	324	16.557	3.826	8.6	25.4
EPEN	324	10.775	3.013	3.87	17.93

Source: Elaborated by authors using Stata program

Table 2 presents the descriptive statistics for the variables used in the regression model, including the mean, standard deviation, minimum and maximum values, and the total number of observations available for each variable. The dependent variable GNI (Gini coefficient) has a mean of 29.86 and a standard deviation of 3.93, with minimum and maximum values ranging from 20.9 to 40.8, indicating significant variability in income inequality across Member States and over the period analysed. In terms of explanatory variables, gross public debt (GDEBT) shows a relatively high average of 69.50% of GDP, with a substantial standard deviation of 38.62%, reflecting significant differences across EU Member States. Likewise, gross fixed capital formation (GFCF) has a low average of 3.67% of GDP, with low variability, while health (GEH) and education (GEE) expenditure have averages of 6.37% and 4.97% of GDP respectively, indicating a higher investment in health than in education. Spending on defense (GED), public order and security (GEP), and economic affairs (GEEA) have relatively low averages of 1.22%, 1.75%, and 5.65% of GDP, respectively, with moderate standard deviations, suggesting cross-country variation in the allocation of resources to these areas. In contrast, government expenditure on central government (GECG) has a high average of 30.14%, indicating a significant share in national budgets. The at-risk-of-poverty rate (POVR) averages 16.56%, with a standard deviation of 3.83%, suggesting notable cross-country variation in the proportion of the population at risk of poverty. Expenditure on pensions (EPEN), with an average of 10.78% and a standard deviation of 3.01%, shows considerable dispersion in social protection policies across Member States.

Table 3 on the variance inflation factor (VIF) presents the results of a multicollinearity analysis carried out for the independent variables used in the regression model to assess the degree to which they are correlated with each other.

Table 3. Variance Inflation Factor - VIF

Variables	VIF	1/VIF
GDEBT	4.626	0.216
EPEN	3.903	0.256
GEPS	3.474	0.288
GEH	2.593	0.386
GFCF	2.309	0.433
GEE	1.958	0.511
GED	1.916	0.522
GEP	1.865	0.536
GEEA	1.800	0.556
POVR	1.717	0.582
GECG	1.609	0.621
Mean VIF	2.525	.

Source: Elaborated by authors using Stata program

This analysis indicates that the regression model used is not affected by multicollinearity and that the estimated coefficients are reliable and statistically relevant.

The correlation matrix presented in Table 4 provides a comprehensive assessment of the bivariate relationships between the variables used in the regression model. Correlations are measured by the Pearson coefficient, which ranges between -1 and 1, with values close to these extremes indicating strong negative or positive correlations.

Table 4. Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) GNI	1.000											
(2) GDEBT	0.043	1.000										
(3) GFCF	-0.090	-0.428	1.000									
(4) GEPS	-0.087	0.722	-0.182	1.000								
(5) GED	0.303	0.147	0.352	0.052	1.000							
(6) GEP	0.296	0.108	0.216	0.007	0.396	1.000						
(7) GEEA	-0.041	0.160	0.339	0.255	0.118	0.384	1.000					
(8) GEH	-0.506	0.176	-0.089	0.137	-0.143	-0.279	0.040	1.000				
(9) GEE	-0.307	-0.119	0.379	0.199	0.201	-0.243	0.064	0.320	1.000			
(10) GECG	-0.121	0.223	0.181	0.423	0.134	-0.054	0.406	0.116	0.258	1.000		
(11) POVR	0.850	0.039	-0.012	-0.135	0.332	0.389	0.027	-0.476	-0.270	-0.136	1.000	
(12) EPEN	-0.090	0.713	-0.255	0.594	0.148	-0.048	0.057	0.535	0.159	0.137	-0.085	1.000

Source: Elaborated by authors using Stata program

The dependent variable, GNI (Gini coefficient), shows the strongest positive correlation with the POVR variable (0.850), suggesting that an increase in the risk of poverty is strongly associated with an increase in income inequality, which is theoretically to be expected. Also, there is a notable positive correlation between GNI and GED (0.303), as well as between GNI and GEP (0.296), indicating that defense and public order spending may contribute to increases in income inequality. On the other hand, GNI is significantly negatively correlated with GEH (-0.506) and GEE (-0.307), suggesting that spending on health and education contributes to reducing income inequality, which is also confirmed by the regression results. These negative correlations are consistent with the literature that emphasizes the role of social policies in promoting economic and social equity.

The model results are presented in Table 5.

Table 5. Linear regression model

GNI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
GDEBT	-0.015	0.006	-2.54	0.012	-0.027	-0.003	**
GFCF	-0.409	0.153	-2.66	0.008	-0.711	-0.107	***
GEPS	0.222	0.121	1.84	0.067	-0.015	0.459	*

GNI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
GED	0.884	0.277	3.19	0.002	0.339	1.430	***
GEP	-0.609	0.335	-1.82	0.070	-1.269	0.051	*
GEEA	-0.018	0.079	-0.23	0.819	-0.173	0.137	
GEH	-0.374	0.116	-3.22	0.001	-0.602	-0.145	***
GEE	-0.413	0.154	-2.68	0.008	-0.716	-0.110	***
GECG	0.008	0.021	0.39	0.694	-0.034	0.051	
POVR	0.786	0.037	21.02	0	0.712	0.859	***
EPEN	0.089	0.072	1.24	0.215	-0.052	0.230	
Constant	21.435	1.319	16.24	0	18.838	24.031	***

Mean dependent var	29.862	SD dependent var	3.930
R-squared	0.760	Number of obs	324
F-test	89.575	Prob > F	0.000
Akaike crit. (AIC)	1367.658	Bayesian crit. (BIC)	1413.027

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

Source: Elaborated by authors using Stata program

The linear regression model presented reveals several significant relationships between the independent variables and the dependent variable, the Gini coefficient (GNI), indicating that a significant part of the variability in income inequality can be explained by government expenditure and other economic factors. The value of the adjusted coefficient of determination (R-squared) is 0.760, suggesting that about 76% of the variation in income inequality across EU Member States over the period analysed is explained by the variables included in the model, demonstrating a high explanatory power. The F-test value (89.575) and the associated significance ($p<0.01$) indicate that the overall model is statistically significant.

Hypothesis 1 (H1), that public spending on health (GEH) and education (GEE) has a negative effect on income inequality, is validated by the regression results which indicate that both estimated coefficients for these variables are negative and statistically significant. The coefficient for GEH is -0.374, with a very high level of significance ($p=0.001$), while the coefficient for GEE is -0.413, also significant ($p=0.008$). These results support the hypothesis that investments in health and education contribute to reducing income inequality by improving the population's access to essential services and promoting equality of opportunity. The negative impact of these expenditures on income inequality is consistent with theoretical and empirical expectations in the literature (Cerra et al., 2021; Topuz, 2022; Uzar, 2023), which emphasizes the importance of public policies in reducing economic and social disparities.

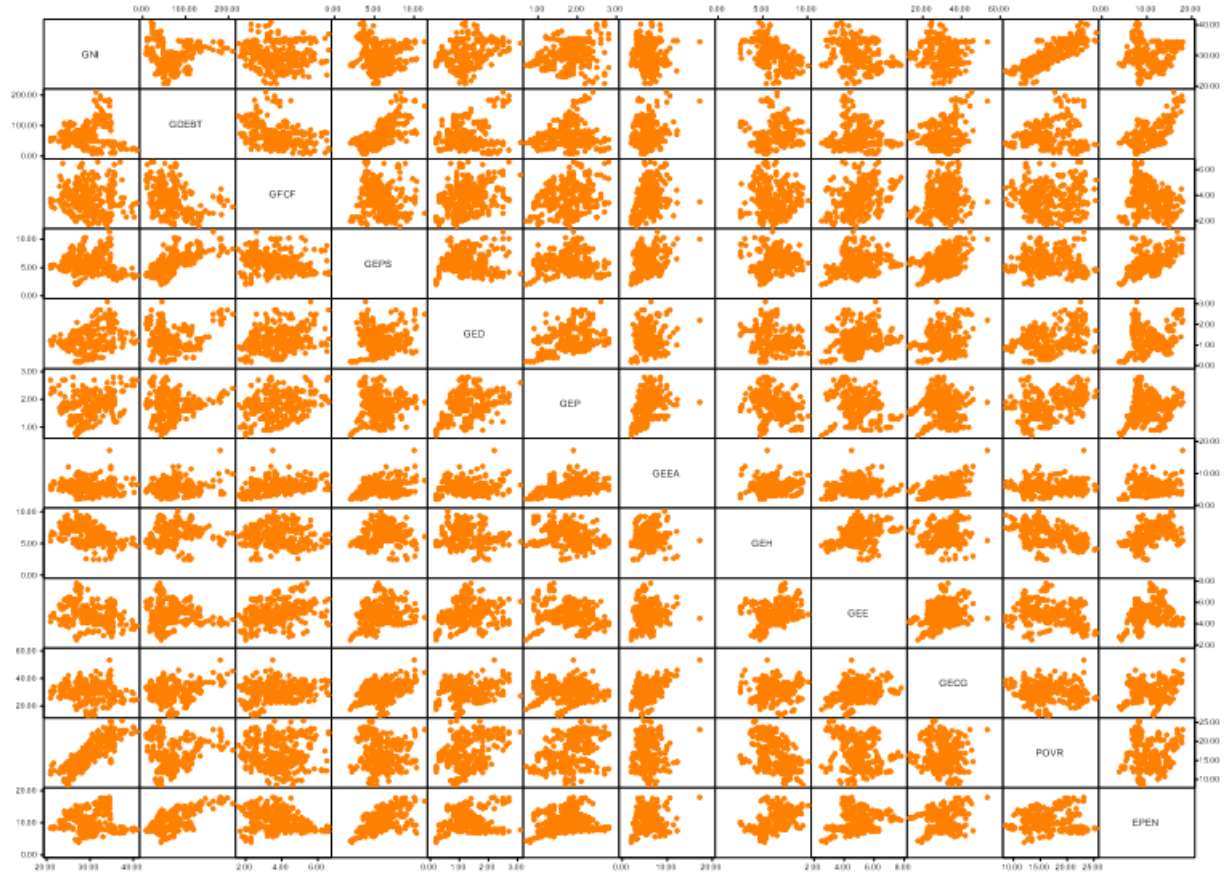
Hypothesis 2 (H2), which suggests that government defense spending (GED) has a significant positive effect on income inequality, is also confirmed by the regression results. The coefficient associated with this variable is positive ($\beta = 0.884$) and statistically significant ($p = 0.002$). This finding indicates that the allocation of substantial resources to the defense sector may contribute to increasing income inequality, possibly by reducing the funds available for social programs and by directing economic benefits to privileged groups in society. The validation of this hypothesis is consistent with theoretical arguments that defense spending tends to have a limited redistributive effect and, in certain contexts, may even amplify economic disparities (Biscione & and Caruso, 2021; Dorn et al., 2024; Furceri et al., 2022; McGauvran et al., 2024).

Hypothesis 3 (H3), that the at-risk-of-poverty rate (POVR) has a significant positive effect on income inequality, is unequivocally validated, as the coefficient on the POVR variable is positive ($\beta=0.786$) and highly significant ($p=0.000$). This strong positive association suggests that an increase in the proportion of the population at risk of poverty is consistently associated with an increase in income inequality. This finding is fully consistent with the literature (Anderson & Weaver, 2025; Erauskin & Turnovsky, 2019; Hellwig & Marinova, 2022; Hummler & Vierus, 2025; Marangos & and Anthrakidis, n.d.) showing that, in the absence of adequate redistributive mechanisms, an increase in the risk of poverty tends to amplify economic polarization and contribute to rising inequality.

Figure 1 provides a complex visual representation of the bivariate relationships between the variables used in the regression model, including the Gini coefficient (GNI), various categories of government expenditure, public debt, the at-risk-of-poverty rate and other relevant economic and social indicators. This

matrix structure allows the simultaneous exploration of the interactions between each pair of variables, thus providing a holistic perspective on potential correlations and association patterns.

Figure 1. Matrix of scatterplots between model variables



Source: Elaborated by authors using Stata program 18

Analysing the scatterplots involving the Gini coefficient (GNI), it can be observed that the relationship with the POVR variable (at-risk-of-poverty rate) is marked by a clearly positive association, indicating that an increase in the risk of poverty tends to be associated with a significant increase in income inequality. This result is fully in line with the literature, which emphasizes that high levels of poverty directly contribute to the amplification of economic polarization within society.

We also observe an inverse relationship between GNI and public spending on health (GEH) and education (GEE), with these scatter plots suggesting that government investment in health and education is negatively correlated with the level of income inequality. This trend emphasizes the crucial role of social policies in promoting economic equity and ensuring more equitable access to basic services, which helps to mitigate income inequality.

Another notable aspect of the figure analysed is the positive relationship between government defense spending (GED) and the Gini coefficient, suggesting that the allocation of significant resources to defense may contribute to increasing income inequality, possibly by directing funds to sectors that do not favour the equitable distribution of economic resources. This result is in line with the hypothesis that military spending does not directly benefit vulnerable segments of the population, thus limiting the redistributive impact of the public budget. Moreover, the figure highlights the complexity of the relationships between public debt (GDEBT) and other explanatory variables, particularly in terms of its interaction with general public services expenditure (GEPS) and pension expenditure (EPEN). The scatter plots suggest that the effect of public debt on income inequality may be mediated by the way financial resources are distributed across different public policy sectors. This observation indicates that indebtedness may have an ambiguous impact on social equity, depending on government priorities in allocating funds. It can also be observed that the relationships between the variables are not always perfectly linear, with some scatterplots indicating possible non-linear shapes or complex relationships that may warrant the use of more sophisticated econometric models to capture the full dynamics between the variables. In the context of this observation, the use of linear regression may provide only a partial approximation of the economic reality, suggesting the need to explore alternative models that more faithfully capture the observed variations.

5. Conclusions

This study investigated the impact of government spending and other economic factors on income inequality in the European Union Member States for the period 2012-2023, using a linear regression model on a panel dataset. The results highlight that government policies, especially those related to health and education, play a crucial role in reducing income inequality, confirming the importance of European strategies aimed at increasing social and economic cohesion. The analysis clearly shows that public spending on health (GEH) and education (GEE) has a significant negative effect on income inequality, which is in line with the objectives set by the European Pillar of Social Rights, which promotes equal access to essential services, including quality health care and education accessible to all. In this context, the results suggest that increased investment in health and education could significantly contribute to reducing economic and social disparities, thus supporting the 2030 Agenda for Sustainable Development and the European Strategy on Economic, Social and Territorial Cohesion. In terms of the negative effects of defense spending (GED) on income equity, the results suggest that the resources allocated to this sector do not significantly contribute to improving social equity but rather exacerbate existing inequalities. This result is relevant in the context of the commitments made by the EU Member States in the Europe 2020 Strategy and subsequently in the Strategy for a Greener, Digital and Resilient Europe, where there is an increased emphasis on the efficient allocation of public resources to areas with a positive social impact. A more efficient targeting of government spending towards education, health and social protection could have more substantial beneficial effects on reducing income inequality. The analysis also confirms the hypothesis that the at-risk-of-poverty rate (POVR) has a significant positive effect on income inequality, underlining the importance of adequate social protection and the implementation of effective redistributive policies. This finding supports the measures set out in the Action Plan on the European Pillar of Social Rights, which promotes the guarantee of minimum standards of social protection for all social groups, especially the vulnerable. However, the study has some limitations that should be considered. First, the use of a simple linear regression model may not capture all aspects of the complex relationships between the variables analysed, especially when they involve non-linear interactions or indirect effects. The analysis has also not considered possible structural differences between Member States, such as different levels of economic development, political institutions or administrative culture, which could influence the impact of government spending on income inequality.

In terms of future research directions, extending the current model by using more advanced econometric methods, such as fixed and random effects models or dynamic panel data models, could contribute to a better understanding of the mechanisms underlying the observed relationships. Also, a differentiated analysis by groups of Member States, according to their level of economic development or institutional structure, could provide valuable insights into the effectiveness of different public policies in reducing income inequality. At the same time, integrating additional variables, such as measures of social inclusion, quality of public services or indicators of economic and social sustainability, could improve the quality of the results and the relevance of the conclusions drawn.

The research underlines the need to target government spending more effectively to reduce income inequality by strengthening investment in health, education and social protection, in line with the principles set out in the current European strategies. Adapting public policies to respond more effectively to existing economic and social challenges is a key priority for achieving the objectives of economic and social cohesion at EU level.

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