

## Article

# Towards Social Justice: Investigating the Role of Labor, Globalization, and Governance in Reducing Socio-Economic Inequality within Post-Communist Countries

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**Abstract:** In the midst of contemporary global challenges, including the repercussions of the pandemic, geopolitical conflicts, and transitional shifts, a notable surge in attention toward income inequality has materialized, garnering significant focus from both national and international entities. The urgency surrounding this issue is amplified by the imperative need for economic sustainability, recognizing poverty and inequalities as fundamental global security threats. Particularly within Europe, the persistent disparities in living standards, evident across and within countries, serve as potent indicators of enduring poverty and inequality. These concerns underscore potential barriers to the European Union's pursuit of convergence and cohesion, aligning with the Sustainable Development Goals (SDGs), which prioritize addressing poverty (SDG 1) and reducing inequalities (SDG 10) for sustainable development. This study aims to scrutinize the dynamics of income inequality, concentrating on post-communist countries in Central and Eastern Europe (CEE). Employing panel data analysis, the research identifies and tests variables influencing income inequality in the region, specifically emphasizing labor market structures, globalization, economic development, and governance mechanisms, which hold particular relevance for the region's context. The primary findings underscore the potential impact of enhancing these sectors in mitigating income inequality within the specified region. These insights provide a foundation for informed policy-making, presenting opportunities to address and mitigate inequalities effectively. They pave the way for fostering pathways toward greater equality and equitable socio-economic development within post-communist nations, ensuring a more inclusive and sustainable future.

**Keywords:** socio-economic inequalities; determinants; poverty; Sustainable Development Goals; economic and social development; panel data; GMM



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## 1. Introduction

The perennial issue of income inequality has persistently ignited intense debates, particularly among economists, gaining significant traction in the aftermath of economic downturns following the largest wave of European accession. This heightened emphasis on income distribution reflects an increasingly pressing economic and social concern, notably prominent within emerging European nations where inequalities surpass the European Union's (EU) average. The enduring presence of heightened inequality poses multifaceted challenges, amplifying deficits at the household level, augmenting poverty rates, fostering social exclusion, and contributing to political instability. Such persistent inequalities can threaten overall societal cohesion [1] and weaken the collective unity of the Union.

The prominence of income inequality on recent political agendas, notably within the framework of the 2030 Agenda for Sustainable Development, underscores its recognition as a major contemporary issue. The EU has identified combating income inequality as a critical objective for sustainable and inclusive growth, emphasizing the multidimensional nature of this challenge. Inequality of opportunity often translates into disparities in income, perpetuating a cycle difficult to break without substantial reforms. While a certain level of inequality might be inherent and even beneficial in a market economy [1], excessive disparities can erode economic growth, fuel political polarization, trigger macroeconomic imbalances, and diminish overall societal well-being.

The economic and social landscape in CEE economies exhibits a diverse range of circumstances, reflecting the impact of historical legacies, post-communist transitions, and EU accession. On the positive side, many CEE nations have experienced robust economic growth and improved living standards since joining the EU. However, challenges persist, particularly in the areas of inequality and labor markets. Income inequality remains a concern, with disparities between the rich and poor, as well as urban and rural areas. Labor markets have undergone transformations due to globalization, contributing to both opportunities and challenges. While some sectors have thrived, others have faced job displacement and wage pressures. Additionally, the quality of governance varies across the region, with some countries demonstrating effective institutions and transparency, while others grapple with corruption and political instability.

Researching inequality in CEE countries is crucial for achieving the Sustainable Development Goals as it provides a nuanced understanding of the multifaceted challenges that hinder progress toward sustainable development. Inequality acts as a pervasive barrier, impeding efforts to eradicate poverty, promote inclusive economic growth, and ensure social justice. By delving into the root causes and consequences of inequality, research can inform evidence-based policy interventions that target vulnerable populations and address systemic disparities. Furthermore, understanding the intricate connections between different forms of inequality—be it income, gender, education, or access to resources—helps to identify synergies and trade-offs across various SDGs. Tackling inequality is not only a goal in itself (SDG 10: Reduced inequalities) but also a cross-cutting theme that influences the success of other goals. Comprehensive research on inequality thus serves as a vital tool for policymakers, stakeholders, and international organizations, enabling them to design targeted strategies and foster sustainable development that leaves no one behind.

Over time, many academic papers have highlighted diverse factors contributing to income inequality. It should be pointed out that these factors arise from a complex interplay of multifaceted elements (e.g., geography) [2]. It is also worth noting that even if this body of literature explores the main drivers of income inequality, it is widespread, and not many research studies focus on the analysis in CEE countries.

The motivation for developing this study is reflected by the persistence of issues related to inequality, particularly evident in the European Union and notably pronounced within CEE countries, as well as by the identification of a set of policy recommendations that would serve to improve the social condition in CEE countries to reduce and subsequently close the gap between Western and Eastern Europe.

Our paper adds value to the current literature by enriching it with findings from CEE countries, providing a starting point for debates on adopting the most effective measures to reduce income inequalities. Initially, we offer an extensive examination of the key factors that can impact income inequality dynamics, explicitly tailored to CEE countries, an area that has been somewhat overlooked. As far as we are aware, this research adds to a relatively small body of work addressing this subject within this specific group of nations. Secondly, the study investigates the influence of a particular factor, namely, the informal economy, on income distribution within a cluster of states characterized by a significant presence of informal economic activities. This contributes to the body of literature on informality. From our point of view, this is a relevant element of innovation, being one of the first studies treating such a topic.

Furthermore, we will formulate suitable policies and recommendations to alleviate the problem of income disparities. This will address a gap in the current literature regarding income distribution within CEE countries, where the body of research remains inconclusive, underscoring the necessity for further investigation. In this context, the paper's primary aim is to analyze the four fundamental pillars of income distribution determinants among CEE countries, driving the principal factors that policymakers need to consider shortly.

The originality of this paper stems from an extensive diagnostic model, making a distinctive contribution to the discourse on income inequality by focusing on the often-overlooked CEE countries, a region marked by unique socio-economic challenges. While the issue of income inequality has gained significant attention on global agendas, particularly within the framework of the 2030 Agenda for Sustainable Development, there is limited literature that delves into its nuanced dynamics within the CEE context. This paper not only enriches the existing literature by providing a comprehensive analysis of the key determinants tailored to CEE countries but also breaks new ground by examining the impact of the informal economy on income distribution, an innovative approach within this specific group of nations. This study's novel perspective and rigorous exploration of factors influencing income disparities within CEE countries serve as a foundation for policy formulation and further research in the pursuit of sustainable and inclusive growth.

This paper's structure is outlined as follows: The introduction provides an introduction to the topic of income inequality, emphasizing the significance of the research and its key contributions to the existing literature. Following that, the second part is devoted to presenting both the data and the research methodology, focusing on the variations in income inequality in post-communist economies. Subsequently, the third part details the primary findings of the study. Finally, the paper concludes by summarizing key conclusions, drawing policy implications from the empirical outcomes, and suggesting avenues for future research.

## 2. Literature Review

The existing literature on income distribution dynamics in the EU, especially focusing on post-communist states, identifies key determinants as labor market institutions, globalization, economic development, and governance. Several studies contribute to understanding the complex relationships among these factors and their impact on income inequality [3–23]. CEE countries exhibit notable economic disparities, with varying levels of income inequality. The literature highlights that these disparities are influenced by factors such as differing rates of economic growth, unequal access to education and employment opportunities, and the persistence of informal economic activities [24].

A considerable body of literature investigates the correlation between labor market institutions and income inequality. The labor market in CEE countries is characterized by diverse challenges. High levels of informal employment, unequal access to quality jobs, and variations in wage levels across different sectors are pressing issues. These aspects contribute to income inequality, and understanding their dynamics is crucial for informed policy interventions [25]. Some studies suggest that, overall, more robust labor market institutions result in mitigating income disparities across countries and over time [26,27], while others discovered empirical evidence that has shown that there is a link between Employment Protection Legislation (EPL) and the Gini coefficient, more precisely, as [28] discovered, a positive relationship. Furthermore, according to [6], income inequality is attributed to weakened labor market institutions and a lower minimum wage level, which is considered an essential element in reducing poverty and income inequality [29]; raising the minimum wage could boost income for low wage earners, thereby aiding in the reduction of income inequality within a society. Nevertheless, there remains a lack of consensus regarding the impact of the minimum wage on income distribution, and different opinions exist, claiming both positive [30] and negative impacts [29]. There is much discussion concerning the minimum wage's contribution to reducing poverty and pay disparity in many countries, highlighting the significance of assessing the minimum wage as a factor

in inequality [31–34]. Under the labor market institutions umbrella, some other factors have the potential to impact the fluctuation of income inequality; these include active and passive labor market policies [26], union density [27], and the extent of collective bargaining coverage [35]. The theory of human capital pointed out that “people increase their future earnings by forgoing current earnings and spending money on their education” [5].

Furthermore, expanding the supply of tertiary education (it signifies individuals who have completed post-secondary education, including undergraduate and postgraduate studies. These individuals have acquired advanced skills and knowledge in specific fields, making them part of the workforce with higher education qualifications) has been observed to lower the income of skilled workers, thereby decreasing income inequality. Alternatively, [36] proved that human capital positively impacted income inequality, highlighting a direct relationship between the level of education and income distribution. Since the key articles by [3], education has always been regarded as a factor that may reduce inequality. However, the impact of sloppy measurement on empirical investigations is sometimes ambiguous [7].

The factors extensively examined in relation to income distribution include the degree of globalization and economic progress. The integration of CEE countries into the global economy has brought both opportunities and challenges. The literature indicates that globalization has led to increased foreign direct investment in some nations, contributing to economic growth. However, it has also exposed these countries to external economic shocks, impacting employment rates and income distribution [37,38]. The relationship between inequality and economic growth are rooted in [39], which posits that inequality rises until a certain threshold is gained, establishing an equilibrium between urban and rural populations. As urbanization increases (with rural populations transitioning to urban regions), the divergence between these regions diminishes, resulting in an automatic reduction of inequality from its peak level. Ref. [40] suggests that GDP per capita exhibit a negative impact as a factor influencing income disparities. Ref. [41] argues that countries with greater economic trade typically witness improved living standards and decreased income inequality. Meanwhile, Ref. [42] demonstrated a direct correlation between income distribution, trade openness, and foreign direct investment (FDI), emphasizing education’s equalizing impact on income inequality. The influence of international trade openness on income inequality has been debated [43,44], and empirical findings vary. Some studies find no significant impact of trade openness on inequality [45], while others identify a positive effect, particularly pronounced in less affluent countries [46]. According to the literature, unemployment reflects a country’s development level and significantly negatively impacts income inequality [47].

Numerous research studies on inequality frequently provide contradictory findings [48]. Not only are there several ways through which inequality is determined, but the primary channels also vary based on the level of development. According to [49]’s theory, globalization and international commerce will lessen inequality in emerging countries by lowering the talent premium, but the converse would be true for wealthy nations. Under the umbrella of globalization, technological advancements have been acknowledged as a factor affecting income distribution, exhibiting both types of impact. Ref. [50] reveals the most powerful impact of technological progress as a factor of income inequality. Relevant empirical results on the impact of technological progress have also been reached by [9], highlighting that (i) Central European nations, along with the United Kingdom have achieved a degree of economic development and redistribution that reduces the link between shifts in labor productivity and a rise in income distribution; (ii) Countries at the periphery, largely reliant on larger economies and lacking a robust reallocation system, are significantly affected by digital advancements; (iii) The higher the level of development in a country, the less affected it is by the influence of digital progress on income distribution; (iv) Conversely, higher levels of income inequality within a country lead to more significant reactions to digital progress.

Rising inequality presents a challenge wherein certain economic participants are unable to fully capitalize on the opportunities brought about by technological progress and globalization. This limitation results in inefficient utilization of labor and capital, ultimately hindering economic growth. Ref. [16] emphasized that a country's policies regarding redistribution and economic openness are vital contributors to the increase in inequality.

Governance represents another crucial factor that could impact the fluctuations in income inequality. This includes the quality of institutions strongly related to income inequality [22,51], especially in former communist states [52], which highlighted a direct connection between corruption, inequity and shadow economy. The quality of institutions varies across CEE countries, influencing the effectiveness of policies aimed at addressing income inequality. Reports from international organizations and grey literature highlight concerns related to corruption, governance inefficiencies, and the rule of law in certain nations. These institutional factors significantly impact the success of initiatives aimed at reducing income disparities [53]. Their findings reinforce the intuitive justification concerning the informal sector's aim in illustrating the trade-off between corruption and inequality. The data suggest that the marginal impact of corruption on inequality decreases as the informal sector becomes larger: once the informal sector represents just over a fifth of the GDP, reducing corruption is no longer effective in diminishing inequality. Therefore, in nations characterized by weak institutions and a substantial informal economy, a higher level of corruption can potentially reduce inequality by offering low-wage workers an alternative through the magnifying glass of the informal economy as a safety valve [50,51]. Both corruption and the shadow economy are widespread issues that all nations encounter on several levels [54,55]. They have effects on the social, economic, and political spheres. Subornation, misappropriation, nepotism, or the taking of property are all examples of corruption, commonly defined as the exploitation of public or private office for personal benefit [52]. As a result, corruption leads to inefficient resource allocation or waste, raises business costs, worsens economic inequality and poverty, undermines the institutional foundation of the state and its fiscal system, and reduces public trust in the government [56]. Conversely, the informal economy is characterized as an unregistered economic activity that bolsters the GDP by evading tax payments and disregarding regulations [18]. Another well-known determinant of income inequality in the literature is social spending, with its role in reducing income inequality through social transfers. According to [53], social expenditures have a greater capacity to mitigate income inequality in developed nations as opposed to emerging ones. This underscores that higher education in developed European Union countries mitigates income inequality because a skilled workforce commands higher wages, thus narrowing the income gap. Instead, greater education levels in developing countries tend to exacerbate income discrepancy. This is because when access and opportunities for higher education are more unequal, it results in more significant disparities in income distribution within a country.

The informal economy plays a crucial role in income distribution within the CEE region. The literature suggests that the prevalence of informal economic activities, which often go unreported and untaxed, contributes to income disparities [57]. This sector's impact on the overall economy [58,59] and its role in shaping income distribution patterns remain significant research gaps [60]. According to [19,61], the relationship between inequality and informality is mediated by a third factor: the official economy. Higher inequality decreases the formal economy, leading to a greater informality mostly in transition countries; higher informality could, on the one hand, exacerbate inequality by diminishing the efficacy of redistributive policies or, on the other hand, could alleviate inequality by furnishing income sources for unemployed and marginalized workers. According to [62], the minimum wage plays a significant role in the relationship between the informal economy, the official economy, and income distribution. Particularly in developing countries, it serves as a long-term supportive element for the informal sector.

While the existing literature provides valuable insights into the dynamics of income distribution, several gaps persist. Conflicting findings on the impact of labor market

institutions, minimum wage, and globalization highlight the need for a comprehensive analysis tailored to the unique context of post-communist states. Additionally, the role of the informal economy and its interplay with governance mechanisms remains an understudied aspect. This study aims to address these gaps by offering a nuanced examination of the determinants of income inequality in post-communist Central and Eastern European countries, providing a foundation for informed policy-making and contributing to the broader understanding of income distribution dynamics.

Considering the effects of labor, globalization, and the government sector simultaneously is important for comprehensively addressing and reducing inequality. Each of these factors plays a distinct yet interconnected role in shaping economic structures and social dynamics. Labor policies influence employment conditions, wage distribution, and overall workforce inclusivity. Simultaneously, globalization introduces both opportunities and challenges, influencing income distribution, job markets, and economic growth. The government sector, through its policies and governance structures, impacts resource allocation, social safety nets, and the overall fairness of income distribution. Examining these elements in isolation may lead to incomplete insights and ineffective policy interventions. A holistic approach that considers the interplay between labor, globalization, and government policies allows for a more nuanced understanding of the root causes of inequality and facilitates the development of comprehensive strategies. It recognizes the systemic nature of inequality, acknowledging that actions in one domain can have ripple effects across others. This integrated perspective is essential for formulating sustainable and inclusive policies that address the multifaceted nature of inequality and promote long-term socio-economic development.

### 3. Data and Methodology

Finding solutions that may successfully address social concerns and promote a fairer income distribution requires examining the variables impacting income disparity. This, in turn, leads to a broader inclusion of the population in socio-economic activities, ultimately raising the quality of life for all residents. Additionally, it plays a pivotal role in stabilizing economic and social conditions, fostering greater socio-economic cohesion, and bolstering the ability of economies to withstand future uneven crises.

In pursuit of the paper's main goals, the empirical analysis identifies the primary factors contributing to income inequality within ten CEE countries. Croatia is excluded from this analysis due to insufficient available data. Employing panel data regression analysis with annual data spanning from 2008 to 2019, this study explores various model specifications based on the four identified pillars of determinants in the literature. The general model specification is as follows:

$$\text{Gini}_{it} = \beta_0 + \beta_1 \times \text{lmiproxy}_{it} + \beta_2 \times \text{ec.dvlproxy}_{it} + \beta_3 \times \text{globproxy}_{it} + \beta_4 \times \text{govproxy}_{it} + \beta_5 \times \text{ctrl}_{it} + \varepsilon \quad (1)$$

$i$  = no. of cross sections;

$t$  = time period;

$\beta_0$ —constant coefficient;

$\beta_{1-5}$ —the coefficients of the income-distribution-influencing factors.

Hence, we have included four different categories of potential influencing factors of income distribution in the model specifications (labor market institutions, globalization, economic development level, and governance). Additionally, we have introduced supplementary control variables, namely: (i) the percentage of workers in the services field, known for typically receiving higher income compared to those in the industry field; (ii) the percentage of individuals residing in urban regions including suburbs, considering that the impact of the minimum wage can differ based on the worker's geographical location [63]; and (iii) inflation, as low levels of inflation are associated with higher income inequality [64]. As inflation rises, inequality decreases, reaching a minimum point at an inflation rate of roughly 13%, after which it rises again.

In the rigorous process of estimating our data, a comprehensive set of tests was employed to ensure the utmost accuracy. Firstly, we utilized the Hausman test to evaluate the choice between fixed-effects models (FEM) and random-effects models (REM). The outcome of this initial test suggested the retention of random-effects results. Following this, we employed the Breusch–Pagan Lagrange (L.M.) multiplier to assess the consistency of the random effects and make a decision between a random-effects regression and a conventional OLS regression. Our assessment also included an examination of multicollinearity, incorporating methods such as scrutinizing the correlation matrix and calculating the Variance Inflation Factor (VIF) [65].

Moving forward, we undertook a crucial step to test for heteroskedasticity in the multiple regression model for panel data evaluation, a concern of significant importance due to its potential to undermine the robustness of statistical inferences [66,67]. In response, we employed the statistical test proposed by [68] to identify the presence of heteroskedasticity. Another consideration was given to autocorrelation, a concern arising from strong similarities causing error components to correlate over time.

In exploring cross-sectional dependence, we employed the Breuch–Pagan LM, Pesaran scaled L.M. tests, and Pesaran CD. Furthermore, the assessment of homoskedasticity and normality of residuals was conducted using the Panel Heteroskedasticity L.R. and Jarque-Bera tests, respectively.

To address the issue of cross-sectional heteroskedasticity without altering coefficient values, we employed standard corrected heteroskedasticity errors based on improved estimator errors. The presence of residual autocorrelation was evaluated using Durbin–Watson statistics. We assessed the model’s goodness of fit using modified R2, RMSE, and the model’s standard error, and validated the model using the Fisher test. This systematic approach to testing not only ensures the reliability of our estimation process but also provides a robust foundation for drawing meaningful statistical inferences from the data. The suggested econometric models were estimated using EViews 9.0.

Inequality is a dynamic phenomenon with a strong relationship with the control variables, suggesting a possible endogeneity issue. Regression models with endogeneity have an explanatory variable that correlates with the error term [69]. One or more regressors are called endogenous if the non-correlation assumption is false. The problem of endogeneity often arises due to various factors, including omitted variables, measurement errors in the included variables, and simultaneity between the dependent and independent variables, as highlighted by [70]. We think that using system GMM and random-effect regression will assure the reliability of our conclusions [70–72]. The comprehensive clarification of the variables utilized in the empirical analysis, along with their definitions and the corresponding data sources, is available for examination in Table 1.

**Table 1.** List of variables and data sources.

Variable	Source
Endogenous	
Gini Coefficient (pp) (Gini)	Eurostat data base
Exogenous variable	
	Labor market institutions (lmi)
Minimum monthly salary, annual average (%) (MMWBI)	Eurostat data base
Minimum monthly wage (%) (MMWICS)	Eurostat data base
Strictness of employment protection index, individual and collective dismissals (%) (EPL1)	Employment Protection Database, OECD
Active labor market policy expenditure (% GDP) (ALMP)	Eurostat data base

Table 1. Cont.

Variable	Source
Economic development (ec.dv1)	
Gross domestic product per capita (euro/cap.) (GDP/cap.)	Eurostat data base
Economic growth/cap. (%) (ECG/cap.)	Eurostat data base
Unemployment rate (%) (UNM)	Eurostat data base
Employed population with tertiary education (%) (TERED)	Eurostat data base
Employees in the industry (%) (EMP_IND)	Eurostat data base
Education expenditure (% GDP) (ED_SPEND)	Eurostat data base
Globalization (glob)	
Share of high-tech exports (%) of Total Exports (HIGHTECHEXP)	Eurostat data base
Openness of the economy (%GDP) (OPENESS)	Eurostat data base
Governance (gov)	
Rule of law (pp) (RULE_OF_LAW)	World Bank
Government Effectiveness (pp) (GOV_EFFECT)	World Bank
Control of Corruption (pp) (CONT_CORR)	World Bank
Informal economy (% GDP) (SHADOW_EC)	Global Economy
Control variables (ctrl)	
Employees in the services sector (%) (EMP_SEV)	Eurostat data base
Harmonized index of consumer prices (%) (HIPC)	Eurostat data base

#### 4. Results and Discussion

##### *Investigating the Principal Drivers of Income Distribution in CEE Countries through Panel Data Analysis*

Income inequality in CEE countries recorded significant values in the period 2008–2019, this persistence of inequalities being primarily caused by the effect of the economic crisis, the status of emerging countries, and the characteristics associated with post-socialist countries, together with the policies adopted later regarding education, labor market, and social insurance. At the same time, the lack of educational policies to encourage adaptability to new technology has contributed to maintaining this high level.

The trends observed in CEE countries contrasted sharply with the increasing income inequality reported in many western countries. Given that the downward trend is concentrated in the period 2008–2013, it can be stated that first, the economic crisis has shown an equalizing role, and the upward trend that has followed may be the result of post-crisis adjustments that have not been effective in terms of the view of reducing income inequalities.

In our analysis, the results of the Hausman test indicate that the random-effects estimator is consistent. The consideration of random effects has further been supported by the highly significant results of the L.M. test at the 1% level, which addresses significant variations among countries. Because REM is typically used in large micro panels with multiple cross-sectional units to avoid generating many fixed effects dummy variables and knowing that the FEM is preferred in small panels, we have estimated our models using both approaches and compared the results, but we only kept the results from REM.

We explored various model specifications, evaluating the analytical influence of different variables and eliminating those that did not demonstrate a statistically significant impact. The main empirical findings of the random-effects models are outlined in Table 2, highlighting the following drivers of income inequality that preserved their statistical significance in all specifications, and provide valuable information in the context of the research.



**Table 2.** Empirical results of income inequality determinants with random-effects models and endogeneity testing of the main determinants of income inequality in CEE countries using dynamic panel data estimation.

	Empirical Results of Income Inequality Determinants—Random Effects						Endogeneity Testing—GMM				
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5
Independent variables											
Lagged dep.variable (Gini t−1)							0.478 ***	0.155 ***	0.507 ***	0.491 ***	0.482 ***
	Labor market institutions										
MMWBI	−0.02 ***	−0.001 ***	−0.02 ***	−0.01 ***			−0.0026 **	−0.012 *	−0.007 **		
MMWBI × URB	0.0001 ***	0.0001 ***	0.0001 ***				0.0006 *				
EPL1					2.79 **					6.852 ***	
ALMP						1.73 *					1.76 *
	Economic development										
GDP/cap.				0.08 ***							
ECG/cap.	−0.15 ***				−0.59 ***	−0.50 **	−0.054 *		−0.612 **	−0.464 *	−0.62 *
UNM						0.246 ***					
TERED	0.47 ***	0.30 ***	0.50 ***	0.28 ***	0.596 ***	0.549 ***		0.68 *	0.007*	0.056 *	0.098 *
EMP_IND		−0.48 ***									
ED_SPEND		−0.98 ***	−0.50 **	−0.4	−0.175			−3.25 **	−0.682 *	−0.056 *	−0.489 *
	Globalization										
HIGHTECHXP		−0.004 ***	−0.006 ***	−0.079 ***				−0.503 **	−0.128 *	−0.141 *	−0.122 *
OPENESS	−0.07 ***	−0.04 ***	−0.068 ***	−0.07 ***	−0.04 ***	−0.057 ***	−0.019 *		−0.008 *	−0.013 *	−0.017 *
RULE_OF_LAW	−3.58 ***								−0.493 *		
GOV_EFFECT		−2.44 ***	−2.76 ***	−4.12 ***	−9.58 ***	−8.40 **		−5.52 **			
CONT_CORR			−0.07 **				−2.31 *			−3.26 *	−1.73 *
SHADOW_EC	−0.05 **				−0.151	−0.242 **	−0.41 **		−0.37 **	−0.46 ***	−0.37 **
SHADOW_EC. × ECG/cap.		0.003 *	0.004 ***		0.026 **	−0.284		0.001 *	0.026 *	0.018 *	0.028 *
	Control variables										
EMP_SEV				0.20 ***							
HIPC				−0.03							

Table 2. Cont.

	Empirical Results of Income Inequality Determinants—Random Effects						Endogeneity Testing—GMM				
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5
Constant	34.57	48.04	38.75	20.6	22.07 ***	32.29 ***					
Obs.no.	120	120	120	120	120	120	120	120	120	120	120
F-test	127.99 ***	78.56 ***	77.51 ***	102.81 ***	34.92 ***	37.24 ***					
RMSE	2.08	1.61	1.86	1.64	2.57	1.78					
S.E. of Reg.	2.15	1.69	1.94	1.71	2.68	2.62					
Adj.R <sup>2</sup>	0.88	0.85	0.85	0.88	0.719	0.732					
Testing for random effects											
Breusch-Pagan Lagrange multiplier (LM)	19.7	3.15	8.73	24.42	81.26	92.5					
	0	−0.07	0	0	0	0					
Testing the normality											
Jarque-Bera	3.05	2.65	0.48	4.74	4	1.18					
	−0.21	−0.26	−0.78	−0.09	−0.135	−0.55					
Testing for cross-sectional dependence/contemporaneous correlation: using Breusch-Pagan LM test of independence											
Breusch-Pagan LM	114.7	96.71	119.23	109.39	130.51	110.94					
	0	0	0	0	0	0					
Pesaran Scaled LM	7.34	5.45	7.82	6.78	9.01	6.95					
	0	0	0	0	0	0					
Pesaran CD	0.96	1.82	1.46	3.4	3.46	3.4					
	−0.33	−0.06	−0.14	0	0	0					
Testing for heteroskedasticity											
Panel Cross Section Heteroskedasticity L.R. test	55.09	46.81	54.92	35.11	46.54	55.47					
	0	0	0	0	0	0					
Sargan J-stat							97.65 ***	65.78 ***	82.41 ***	69.25 **	81.35 ***
No. of instruments (groups)							10	10	10	10	10

Note: \*\*\*, \*\*, \* mean statistically significant at 1%, 5% and 10%; () represents the prob-ability.

Minimum wage, employment protection index, and active labor market policies serve as indicators of labor market institutions.

Economic growth, unemployment rate, the share of the employed population with tertiary education, and education expenditures serve as economic development proxies.

High technology exports and economic openness serve as globalization indicators.

The rule of law, government effectiveness, control of corruption, and the shadow economy are indicators of the governance environment.

Overall, our study suggests positive and negative relationships between labor market institutions and income inequality, a result confirmed through the literature by [25] and [6]. One noteworthy finding from the first pillar pertains to the adverse effect of the minimum wage on income inequality, mainly supported for emerging countries by research conducted by [5,6]. Raising the minimum wage might help lower-paid workers make more money, which would help to lessen income disparity. Concerning the impact of the minimum wage on income inequality, there remains contention among scholars, as some argue for a positive and contrary effect [30]. The notion of redistributivity, involving the redistribution of resources from other economic sectors to low-income workers, forms the basis for understanding the connection between income inequality and minimum wage. The existing literature suggests a positive correlation between EPL and income inequality, and our study supports and aligns with this finding, which is consistent with [28].

Our investigation into the relationship between active labor market policies and income inequality in CEE countries echoes findings observed in the study by [26]. While the existing literature presents diverse perspectives on the impact of economic development proxies, our analysis indicates a predominantly negative effect, consistent with the arguments put forth by Refs. [14,40]. Their assertion that heightened economic growth leads to broader social expenditures, involving more individuals in education and healthcare systems, aligns with our findings, contributing to the mitigation of income inequality.

In the context of EU countries, the traditional negative correlation between the unemployment rate and income inequality is challenged by our analysis, which reveals a contrasting positive influence in CEE countries. Furthermore, a significant positive association between income inequality and the percentage of the working population with a university education is identified. This correlation is primarily attributed to the uneven income distribution within the studied nations and restricted access to higher education, aligning with the research of [36].

Our results regarding education expenditures reveal a substantial negative impact on income inequality, corroborating the insights from [73]. Their suggestion that increased government expenditure on education contributes to lower income inequality resonates with our findings. Despite inconclusive results in the existing literature, our analysis sheds light on the noteworthy negative and significant impact of high-technology exports on income inequality, suggesting a potential role for these exports in reducing disparities in post-communist states.

Economic openness's indirect influence on income inequality, in accordance with the observations made by [41], underscores the complexity of the relationship. While emerging market economies experience a reduction in inequality with economic exposure, advanced economies witness an increase, albeit not statistically significant. Only when accounting for market inequality does the detrimental impact of trade openness on inequality in developing countries become apparent, hinting at the necessity for redistributive measures.

A significant finding emerges regarding the substantial impact of the quality of the governmental environment on income inequality, supported by the study conducted by [20]. Our analysis affirms that enhancements in institutional regulations and improved control over corruption contribute to decreased income inequality.

Lastly, the empirical analysis reveals a noteworthy negative impact of the informal economy on income inequality, aligning with the arguments presented by [19,61]. Their assertion that higher informality can decrease inequality by providing income sources for unemployed and marginalized workers finds support in our findings. Overall,

our discussion contributes valuable insights to the understanding of income inequality dynamics in the context of CEE countries, opening avenues for further research and policy considerations.

This particular group of countries have a recognized interplay between the formal and informal economies. The informal economy's influence on income inequality notably underscores its mediating role, which involves influencing the relationship between various economic factors (in our case, the formal economy and income inequality). These insights are consistent in part with [68,69], who emphasized the informal economy's negative impact on income inequality in emerging nations and the positive impact on income inequality in developed ones. These results also substantiate the findings of [61,74].

Furthermore, in our analysis, endogeneity has been tested using GMM; the empirical findings from the GMM estimation, which investigates the primary drivers of income inequality in CEE countries, are outlined in Table 2.

Notably, the lagged income inequality variable displayed statistical significance in all models. This implies that the level of income inequality from the preceding year influences income inequality in the subsequent years.

## 5. Conclusions

Amidst global challenges and the persistent impact of factors such as green and digital transitions, the pandemic, and geopolitical conflicts, this study significantly contributes to the discourse on income inequality, focusing specifically on CEE countries. Rooted in the recognition of income inequality as a critical contemporary issue, our research highlights its multidimensional nature and emphasizes its implications for sustainable development. The study aligns with the SDGs, particularly SDG 1 (No poverty) and SDG 10 (Reduced inequalities), which are pivotal for achieving inclusive growth and societal well-being. By scrutinizing the dynamics of income inequality in post-communist CEE countries, we identify key determinants such as labor market structures, globalization, economic development, and governance mechanisms that have specific relevance to the region. The empirical findings underscore the potential impact of enhancing these sectors in mitigating income inequality within CEE countries, laying the groundwork for informed policy-making and fostering more inclusive socio-economic development.

Building upon the pressing economic and social concerns heightened by economic downturns, our study addresses the enduring challenges of income inequality within CEE countries. Through an extensive diagnostic model, we provide a distinctive contribution to the literature by focusing on a region marked by major socio-economic challenges. The research not only enriches the existing literature with a comprehensive analysis of key determinants tailored to CEE countries but also breaks new ground by examining the impact of the informal economy on income distribution, an innovative approach within this specific group of nations. The paper's originality lies in its exploration of often-overlooked factors influencing income disparities in CEE countries. In conclusion, our study serves as a foundation for evidence-based policy interventions, guiding policymakers to design targeted strategies for sustainable and inclusive growth in the pursuit of leaving no one behind in the post-communist CEE context. In order to do this, the government should focus on policies that reduce income inequality following the main determinants identified. According to our empirical results, some important policies in order to mitigate income inequality in CEE countries are as follows:

- Promoting Equitable Labor Market Institutions (SDG 10): The study suggests that well-structured labor market institutions are crucial in mitigating income inequality. In response to the negative impact of the minimum wage on income distribution, governments are recommended to implement active labor market policies. These policies can enhance protection for low-skilled workers, fostering a more inclusive workforce. Instituting effective minimum wage schemes becomes pivotal in promoting decent work and economic growth (SDG 8), reducing inequalities (SDG 10), and eradicating poverty (SDG 1). This recommendation is appropriate in the context of

CEE countries, where the informal sector plays a significant role (significantly higher degree of informality compared to the rest of the European countries).

- Investing in Education (SDG 4, 10): Given the positive impact of the share of the employed population with tertiary education rates on income distribution, increased investments in education are crucial. Understanding the specific challenges faced by CEE countries in the field of education (low access to education, high school dropout rates, low number of higher education graduates), policymakers are advised to enhance education expenditures, contributing to upskilling and empowering more individuals. This positively impacts income distribution and aligns with Sustainable Development Goal 10, aiming to reduce inequalities within societies.
- Embracing Technological Advancements (SDG 8, 9): The findings that economic growth has a negative impact under the development pillar highlight the importance of embracing technological advancements. Acknowledging the economic intricacies specific to CEE countries, coupled with the limited access and digital skills stemming from transitional experiences that have influenced educational systems and infrastructure development, policymakers are urged to prioritize the adoption of technology, particularly in the realm of education. This strategic emphasis aims to generate new employment opportunities and ultimately stimulate high-value technological exports. This aligns with SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure), contributing to sustainable industrialization and fostering innovation.
- Enhancing Governance and Rule of Law (SDG 16, indirectly related to SDG 10): This study underscores the significance of improving the quality of governance, ensuring the rule of law, and combating corruption. Given the negative impact of the rule of law and government effectiveness on income distribution, effective governance is recommended. This can lead to more equitable resource allocation and fairer income distribution within the CEE, taking into account the problems encountered in the region regarding European integration, political instability, and the rule of law. These measures align with SDG 16 (Peace, Justice, and Strong Institutions) and are indirectly related to SDG 10 (Reduced inequalities).

Incorporating these recommendations aligns with the SDGs by emphasizing the importance of decent work, education, technological advancement, and good governance in addressing income inequality and promoting sustainable development globally.

The research encountered notable limitations, primarily stemming from challenges related to data accessibility and completeness. For instance, data on the gray economy are only available up to 2015 for the considered countries. Additionally, the scarcity of existing studies investigating the determinants of income inequality in CEE countries poses a significant constraint on the study's comprehensiveness. Another limitation lies in the possibility of other variables, not considered in this study, acting concurrently and exerting an impact that was not accounted for in the analysis.

In future research, we will delve deeper into the evolving dynamics within the context of contemporary global challenges, such as the ongoing green and digital transitions. Exploring the long-term consequences of these multifaceted factors on income distribution will be paramount, necessitating extensive longitudinal analyses. Additionally, there is a pressing need for comparative studies between post-communist nations and the rest of EU to identify distinct patterns and influences. Further investigations should focus on nuanced aspects, including gender disparities and the connection to digitalization and greening.

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## Abbreviations

Acronyms for the variable

Acronym	The name of the variable
GINI COEF	Gini coefficient
MMWBI	Minimum monthly salary, annual average
EPL1	Strictness of employment protection index, individual and collective dismissals
ALMP	Active labor market policy expenditure
UNM	Unemployment rate
GDP/cap.	Gross domestic product per capita
ECG/cap.	Economic growth/cap
TERED	Employed population with tertiary education
EMP_IND	Employees in the industry
ED_SPEND	Education expenditure
HIGHTECHXP	Share of high-tech exports
OPENESS	Openness of the economy
RULE_OF_LAW	Rule of law
GOV_EFFECT	Government effectiveness
CONT_CORR	Control of corruption
SHADOW_EC	Informal economy
URB	Urbanization degree
EMP_SEV	Employees in the services sector
HIPC	Harmonised index of consumer prices

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