

## PUBLIC SECTOR IMPACT ON INCOME INEQUALITY IN CEE COUNTRIES<sup>2</sup>

*The paper focuses on examining the impact of the public sector, specifically the tax system and expenditure structure, on income inequality in CEE countries from 1998 to 2021. A panel data estimation technique is used to analyse this relationship. The findings of the research indicate that the tax systems in the CEE countries, characterised by limited progressivity and low shares of income taxes in total tax revenues, do not contribute effectively to reducing income inequality (shares of personal income tax, direct taxes and VAT are positively connected with GINI). In contrast, social and education spending are negatively associated with income inequality. These results suggest that expenditure policies have a stronger impact than tax measures in addressing income inequality in CEE countries.*

*Keywords: income inequality; public sector; CEE countries; panel regression*

*JEL: D31; E01; H23; H53; D63*

### 1. Introduction

Unequal distribution of income is a market failure that necessarily results from the functioning of the market and the primary distribution of income based on the participation of economic agents in the factor market. A key policy objective of governments is to reduce inequality in the distribution of income, which is mainly associated with the redistributive function, one of the three functions performed by the modern state in its interventions in the economy (Musgrave and Musgrave, 1989).

The public sector can influence the level of income inequality through various channels, such as tax policy and government expenditure measures. This impact can come from both discretionary and non-discretionary (based on automatic budget stabilisers) fiscal policies. Furthermore, the public sector can affect both the primary income distribution and the secondary distribution of income (after taxes and transfers). The impact on market incomes occurs through more complicated and indirect transmission channels. Alfonso et al. (2008)

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emphasise that public policies also influence income inequality indirectly through their impact on income opportunities, human capital and institutions.

Tax policy plays a crucial role as one of the main direct channels through which governments can influence income inequality. The extent of this influence depends on the scope and effectiveness of the tax system. Different types of taxes are associated with income inequality to varying degrees and operate through diverse transmission mechanisms.

The structure of the tax system is an important determinant of income inequality. According to Joumard et al. (2012), certain countries with relatively small tax and social security systems, such as Australia, achieve a similar redistributive effect as countries with higher taxes and transfer payments, such as Germany. This is because these countries are more likely to base their tax systems on progressive income taxes, which are more effective at reducing income inequality than other types of taxes. On the other hand, tax systems that are mainly based on indirect taxes, such as in the countries of Central and Eastern Europe (CEE), are considered to be more regressive and less effective in reducing income inequality.

The main indirect tax, value-added tax (VAT), is a consumption tax that violates the principle of vertical equity. This means that individuals with different capacities to pay taxes bear the same tax burden, potentially exacerbating income inequality. Indirect taxes are perceived as more regressive (Beramendi and Rueda, 2007; Joumard et al., 2012; Chan and Ramly, 2019, etc), especially when compared to progressive income taxation. Under a VAT system, poorer individuals experience a higher loss of welfare compared to wealthier individuals. Chan and Ramly (2019) highlight that VAT has a negative impact on income distribution, as lower-income households spend a higher proportion of their income on VAT. This increases the wealth gap between the rich and the poor.

The impact of personal income taxes on income inequality is theoretically straightforward and clear. However, the progressivity of these taxes and hence the degree of vertical equity are crucial factors to consider when assessing their impact. Personal income taxes also act as important automatic stabilisers for government budgets. Increasing the progressivity of personal income taxes can help reduce income inequality by increasing their redistributive effect. However, several authors report a flattening trend of personal income tax systems over time in developed countries, with declining tax rates for the highest income groups (e.g. Piketty and Saez, 2007; Joumard et al., 2012; Wildowicz-Szumarska, 2022, etc.). This trend is very pronounced in Central and Eastern European (CEE) countries, many of which have moved from progressive to proportional taxation of personal income. As a result, the role of personal income taxes in reducing income inequality has weakened.

Social security contributions, on the other hand, are a good example of a regressive tax once a maximum insurable income (where applicable) is reached. However, a different trend has been observed in most OECD countries since 2000. According to Joumard et al. (2012), labour taxes, including social security contributions, have become more progressive. However, this goal is typically not achieved by focusing solely on increased progressivity and higher tax rates. Instead, it is often achieved through targeted measures such as reducing social security contributions for low-income groups or increasing the tax-free minimum for income taxation. Several countries, including Austria, Finland, Germany, Italy, Slovakia and others, have implemented such approaches to effectively address income inequality.

Corporate income taxation also has the potential to reduce income inequality. However, the limited share of revenue generated by this type of tax, coupled with the reduction of tax rates in some Central and Eastern European (CEE) countries due to tax competition within the European Union, weakens the likelihood of a significant impact. It is important to highlight that the impact of corporate income tax on income distribution is related to the final economic incidence of the tax burden, which is influenced by the possibility of tax burden shifting.

Public expenditure and its allocation through the government budget play an important role in shaping income inequality. In assessing this impact, particular attention is paid to the allocation and effectiveness of public spending. Social transfers are widely recognised as an important component of public expenditure with a significant impact on income inequality. While their impact is mainly on the secondary distribution of income, it is important to note that certain social transfers (e.g. employment-generating measures and training vouchers for the unemployed) can also have an impact on the primary distribution of income.

Expenditure that is specifically targeted at the lowest income groups, rather than being universally distributed without regard to income criteria, is more likely to be effective in reducing income inequality. These direct and targeted social transfers can take the form of in-kind benefits, such as social housing, social care, public canteens and active employment-generating measures, or cash payments, including benefits, allowances and scholarships. However, Alfonso et al. (2008) highlight a growing trend to replace income transfers targeted only at the poor with universal programmes, particularly in areas such as health and education. These universal programmes benefit all citizens, not just the poor, and can influence income growth through the primary distribution of income, while transfers play a role in the secondary distribution of income by the state.

The government's impact on income inequality in the market distribution is mainly associated with public spending on education and health (e.g. Chan and Ramley, 2018; Zhang, 1996; Anderson et al., 2016). Anderson et al. (2016) highlight that government spending on basic health and education services, as well as certain types of infrastructure such as rural roads, water and sanitation, and housing, are widely recognised as contributing to poverty reduction. These investments can increase the productivity and income potential of poor households. In addition, Chan and Ramley (2018) note that public spending aimed at improving welfare through education and health, contribute to the development of human capital. This, in turn, increases employment opportunities in an economy and helps to reduce income inequality.

Public expenditure on education, with a particular focus on increasing the proportion of people with secondary and tertiary education, can contribute to the reduction of income inequality by promoting equal opportunities in the labour market. It is crucial to ensure equal access, quantity and quality of education for all members of society as it is considered a vital public good. Zhang (1996) emphasises that higher education improves the labour skills of the population, which leads to higher average incomes and consequently reduces income inequality. Furthermore, Chan and Ramley (2018) argue that spending on education can also contribute to reducing inequality through the 'compensation' effect proposed by Knight and Sabot (1983). By providing comprehensive and accessible education, as well as free or affordable healthcare to the entire population, income inequality can be reduced. Such policies create more equitable living and working conditions, leading to greater equality of income opportunities. This type of expenditure is seen as an investment in human capital, as

it improves skills and promotes equality. According to Wildowicz-Szumarska (2022), healthcare spending has the potential to increase the productivity of low-income workers, thereby reducing inequality.

The latest World Inequality Report highlights that variation in income inequality after taxes and transfers is mainly driven by differences in inequality before taxes and transfers. Pre-tax inequality accounts for a significant proportion of the observed variation in after-tax inequality levels across countries (Chancel et al., 2022). This suggests that redistributive policies are unable to cope with rising inequality. Černiauskas et al. (2022) argue that market income inequality has increased at a higher rate than redistribution, and the impact of redistributive policies has weakened over time in many countries. The effectiveness of these policies depends not only on their design, but also on trends in the primary distribution of market income, which is influenced by resource ownership. In this context, it is important to recognise that the effectiveness of public redistributive policies in addressing income inequality is also influenced by factors that shape the primary distribution of market income.

Based on the above, it is clear that effectively tackling income inequality requires attention to both the secondary and primary distribution of income. In this context, targeted and prioritised public spending plays a crucial role in increasing the effectiveness of public policies aimed at reducing inequality.

This paper contributes to the existing literature by examining the influence of the public sector, specifically the tax system and expenditure structure, on income inequality in CEE countries over the period 1998-2021. Based on empirical evidence, the paper provides evidence that different fiscal policies affect inequality outcomes in different ways. The focus on CEE countries is particularly relevant as these economies share a common history of transition to market-based systems and a lower degree of state intervention in the economy compared to the EU average. By providing empirical evidence and insights into the relationship between the public sector and income inequality in CEE countries, this research can assist policymakers in developing more targeted and effective policies. The central hypothesis of this study is that due to the predominance of indirect taxes in the tax structure of CEE countries, the contribution of the tax system to reducing income inequality is likely to be relatively limited compared to measures focused on the expenditure side of the budget, such as increased public spending on social security, education and health.

The paper is structured as follows. The next section provides a brief review of the relevant empirical literature in the field. The third part presents the dynamics of income distribution, tax system indicators and public expenditure in CEE countries. The fourth part describes the methodology adopted. The fifth part presents the main findings of the panel model estimation, aiming to verify the research hypothesis. The last part presents the main conclusions drawn from the analysis and the discussion.

## **2. Empirical Literature Review**

The public sector plays an important role in influencing income inequality and the empirical literature has examined various aspects of its impact. Among these, the structure of the tax

system has emerged as an important determinant of income inequality. In the case of Central and Eastern European (CEE) countries, value-added tax (VAT) accounts for the largest share of tax revenue. The regressive nature of VAT in terms of income inequality, as stated in theory, has been supported by several empirical studies (e.g. Leahy et al., 2011; Martinez-Vazquez et al., 2012; Chan and Ramley, 2018; Schmutz and Schaltegger, 2018; Alavuotunoki et al. 2019, etc.).

Chan and Ramly (2018) assessed the impact of value-added tax (VAT) on income inequality in 105 countries, including developed and developing countries, over the period 1984-2014, considering the influence of countries' level of development on the relationship between VAT and income inequality. Using the Generalised Method of Moments (GMM), the study findings revealed distinct patterns. In the model covering all 105 countries and in the model specific to developed countries with established and efficient tax collection processes, the results showed that increases in VAT revenue are associated with increases in income inequality. However, an inverse relationship is observed in the group of developing countries. This suggests that the impact of VAT on income inequality depends on the level of development of a country.

The confirmation of Chan and Ramly's (2018) findings on the positive relationship between VAT and income inequality in developed countries is also supported by Alavuotunoki et al. (2019) through panel model estimation. However, when considering low-income countries, no evidence is found that VAT leads to an increase in wealth inequality. In addition, Martinez-Vazquez et al. (2012) and Leahy et al. (2011) also provide evidence that indirect taxes increase income inequality. Leahy et al. (2011) conducted a study that examined the impact of different reforms of the VAT system in Ireland on income distribution. The results show that even when simulating rate changes such as the removal of VAT on food or children's clothing, the burden of VAT on disposable income remains highest for the poorest households. In addition, the introduction of a flat rate on all goods and services, regardless of their value, would disproportionately affect the poorest households and would not contribute to reducing income inequality. However, the authors recognise that introducing a zero rate on all food products could potentially have a positive impact on reducing income inequality. Furthermore, in a study focused on Switzerland, Schmutz and Schaltegger (2018) find that VAT does not have a significant impact on income inequality, as measured by the Gini coefficient.

The empirical literature is dominated by evidence that VAT is regressive and contributes to income inequality. However, there are some empirical studies that provide evidence of the opposite relationship. For example, Bye et al. (2012) find evidence of a reduction in inequality due to VAT in Norway. However, it should be noted that Norway has a tax system structure characterised by a lack of defined social security contributions and a reliance on direct taxes. This suggests that the impact of VAT on inequality may depend on the specific structure of the tax system.

The impact of income taxes on reducing inequality has also been examined in a number of empirical studies (Weller, 2007; Duncan and Peter, 2012; Martinez-Vazquez et al., 2012; Chen et al., 2018; Clifton, 2020; Carneiro et al., 2022, etc.). Theoretically, income taxes are considered to have a stronger association with reducing income inequality due to their progressive nature and the application of principles of horizontal and vertical equity.

Martinez-Vazquez et al. (2012) conducted a study that examines the impact of discretionary fiscal policy measures, including changes in income taxes (personal and corporate) and public spending, while also taking into account the impact of indirect taxes. The study uses a large panel data set covering developed and developing countries from 1970 to 2006. The empirical analysis shows that progressive income taxation, when considered independently, has a positive impact on income inequality, with a stronger effect observed with higher levels of progressivity and a larger share of income tax revenues in GDP. The authors also find a positive effect of corporate income taxes in reducing inequality, although this effect diminishes significantly in highly open or globalised economies. This finding supports Harberger's (1998) thesis regarding the reinterpretation of the impact of corporate income taxes in open versus closed economies. The results of Martinez-Vazquez et al. (2012) generally support the main theoretical propositions regarding the impact of different types of taxes on inequality.

Furthermore, Carneiro et al. (2022) find that in the United States, a tax reform that combines a reduction in the basic tax rate and an increase in the progressivity of income taxation, while leaving the tax burden on the richest quintile unchanged, leads to a reduction in income inequality. Weller (2007) also finds evidence that increasing the progressivity of income taxation reduces income inequality. The study covers a range of countries with different tax rates and progressivity of the tax system between 1981 and 2002. Duncan and Peter (2012) analyse the effect of changes in the structural progressivity of national income tax systems on observed and actual income inequality over the period 1981-2005 for a large panel of countries. They find that progressivity reduces observed income inequality. Wildowicz-Szumarska (2022) comes to a similar conclusion regarding the progressivity of personal income taxation for EU countries. In their study on the determinants of income inequality, Chen et al. (2018) argue that direct taxes play an important role in reducing inequality.

The impact of public spending on income inequality has also been studied in the empirical literature. A number of papers have examined the impact of public spending on income inequality, with most authors recognising that social spending plays a significant role (e.g. Alfonso et al., 2008; Martinez-Vazquez et al., 2012; Johansson, 2016; Doerrenberg and Peichl, 2012; Sanchez and Perez-Corral, 2018; Chen et al., 2018; Doumbia and Kinda, 2019; Ionut et al., 2021; Wildowicz-Szumarska, 2022, etc.).

Existing studies use different methodologies, country samples, time periods and other variables to examine the relationship between government spending and income inequality. After reviewing 80 separate studies with over 900 estimates, Anderson et al. (2016) conclude that there is substantial evidence that certain types of government spending have consistently contributed to reducing income inequality in different countries and regions around the world. Moreover, for developed countries, Alfonso et al. (2008) find that public spending related to the redistributive function of the state (excluding pensions) and education outcomes have a significant impact on income distribution. Johansson (2016) reaches a similar conclusion for OECD countries, demonstrating that social spending can reduce inequality through the promotion of redistribution and risk sharing. These findings are further supported by Doerrenberg and Peichl (2012) for OECD countries and Sanchez and Perez-Corral (2018) for EU countries.

The impact of social transfers on income inequality depends on the organisation of the social system and the social model adopted. Joumard et al. (2012) conducted an analysis of different social systems in OECD countries, based on the distribution of income over the life cycle (e.g. pensions) or between individuals (e.g. family and housing support). Their research led to several notable conclusions. First, old-age pensions, which account for a significant share of social transfers, have low progressivity and therefore a limited impact on income inequality. Similarly, unemployment benefits have a minimal effect on inequality as they are often correlated with income levels. It is mainly the duration for which individuals receive these benefits that affect their progressivity. Moreover, family support programmes based on income criteria show the highest degree of progressivity. However, their impact on income inequality is limited by their relatively small share in total transfers.

Empirical evidence has also shown that public spending on education and health has an impact on income inequality. Malla and Pathranarakul (2022) conducted a study that demonstrated a negative relationship between education spending, health spending and income inequality in developed countries. Similarly, the study by Martinez-Vazquez et al. (2012) found that increases in public spending on social security, education, health and housing have a positive impact on income distribution. In the context of EU countries, Wildowicz-Szumarska (2022) found a significant negative relationship between public spending on health and income inequality. However, the research found an inverse relationship for education spending, which is attributed to poor targeting of the main benefits captured by the urban middle class. Another study by Clifton et al (2020) focused on 17 Latin American countries and showed that spending on education plays a role in reducing income inequality.

The literature review shows that the influence of the public sector on income inequality through the tax system and public spending is a topic of interest in empirical research. However, this relationship has not been extensively studied, especially in Central and Eastern European (CEE) countries. These countries share certain characteristics and have the lowest government revenue and expenditure as a percentage of GDP within the European Union, suggesting a relatively smaller role of the state in the economy.

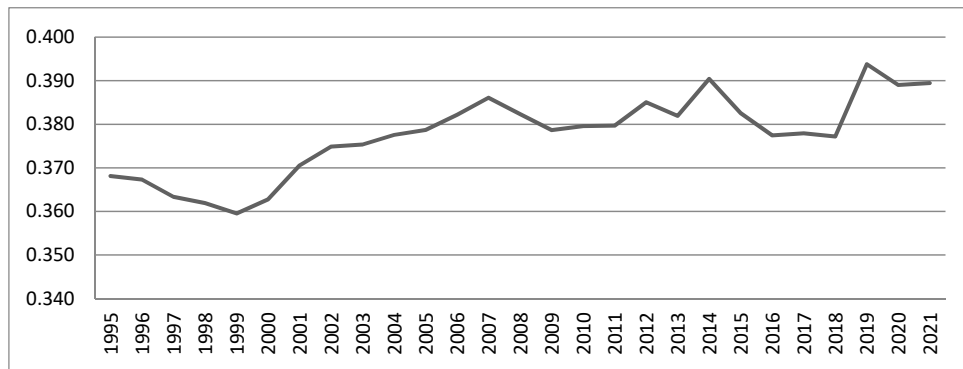
The impact of the level of government intervention in the economy and the size of public expenditure on income inequality has also been examined in empirical studies. Malla and Pathranarakul (2022) show a negative relationship between the size of government and income inequality in developed countries. This relationship is further supported by Doerrenberg and Peichl (2012) and Fournier and Johansson (2016) in their studies focusing on OECD countries.

### **3. Trends on Income Distribution, Tax System Indicators and Public Expenditure in CEE Countries**

Income inequality in Central and Eastern European (CEE) countries is a challenge for public policy. The Gini coefficients, which measure income inequality on the basis of disposable income after taxes and transfers, show a rising trend for the CEE average (see Figure 1). The upward trend of these coefficients suggests an increase in inequality, which could be

attributed to both growing disparities in market incomes and a declining role of the public sector in reducing inequality. Despite this unfavourable trend in income inequality in the CEE countries on average, it should be noted that in some of them (Estonia, Croatia, Latvia, Slovenia and, to a very small extent, the Czech Republic and Slovakia) the opposite process is reported. The main reason for the rising trend in the average Gini coefficient in the CEE countries is the significant increase in the coefficient in Lithuania, Hungary and Bulgaria.

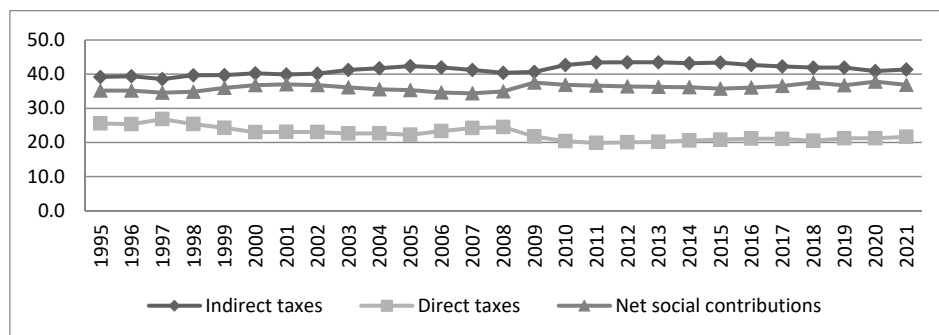
**Figure 1. Gini coefficients in CEE countries on average**



Source: WID.

The effectiveness of the public sector in reducing income inequality is influenced by the structure of the tax system and the structure and targeting of public spending. In the case of Central and Eastern European (CEE) countries, there is a notable imbalance between the shares of indirect and direct taxes, with indirect taxes dominating (see Figure 2). This revenue structure in the CEE countries differs significantly from the EU-27 average observed between 1995 and 2021. According to Eurostat data, the revenue structure of the EU-27 is relatively balanced in 2021, with indirect taxes accounting for 31.3% and direct taxes for 31.6% of total revenue (see Figure 3).

**Figure 2. Shares of indirect taxes, direct taxes and social security contributions in total tax revenue in CEE countries on average (%)**

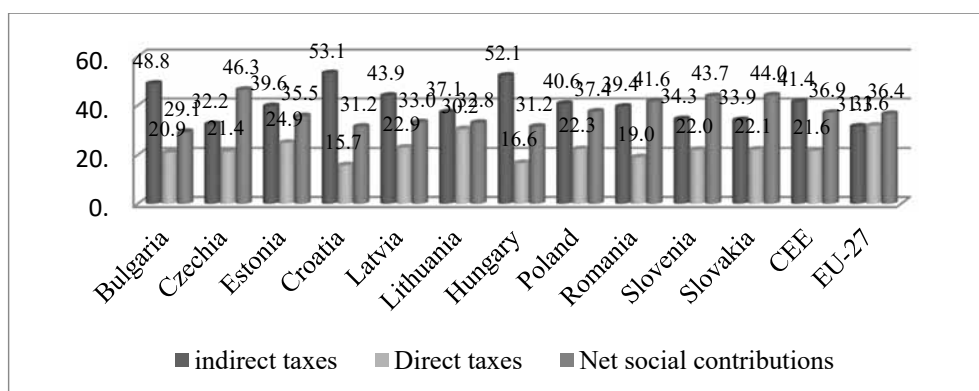


Source: Eurostat.



On average, the share of indirect taxes has increased in the CEE countries, reaching around 40% in recent years. In contrast, direct taxes have shown the opposite trend, with a share of around 20% in the latter part of the period. The values of the indicators show that the share of indirect taxes is about twice that of direct taxes. There is also considerable variation between countries in the share of tax revenue, with only Lithuania showing a difference of less than 10 percentage points between direct and indirect taxes. Croatia, Hungary and Bulgaria stand out as having the highest shares of indirect taxes (see Figure 3).

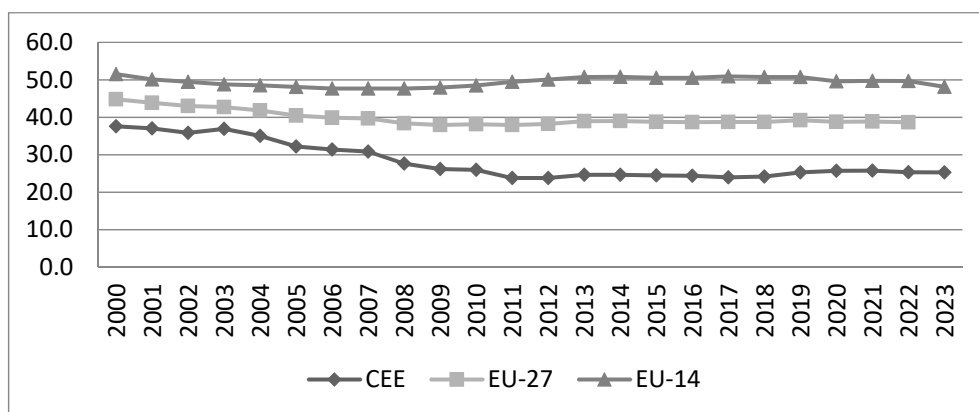
**Figure 3. Shares of indirect taxes, direct taxes and social security contributions in total tax revenue in CEE countries, 2021(%)**



Source: Eurostat.

Tax systems that rely mainly on value-added tax (VAT) to generate tax revenue are generally considered to be less effective in reducing income inequality than systems that rely mainly on direct taxes, in particular income taxes with a progressive tax structure.

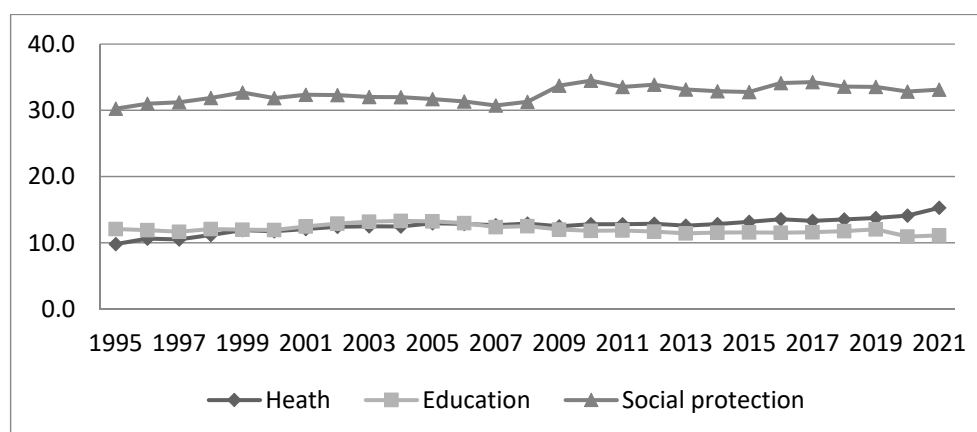
**Figure 4. Top statutory personal income tax rates (%)**



Source: Eurostat.

In the old EU Member States (EU-14), no significant change in top income tax rates was observed after 2004. In the CEE countries, however, there is a noticeable trend of changes in top income tax rates until 2011, leading to a downward trend in the share of direct taxes in general government revenue (see Figure 4). This trend explains the observed downward trend in the share of direct taxes in budget revenues and the significant disparity between the shares of indirect and direct taxes in the CEE countries.

**Figure 5. Shares of public expenditure on health, education and social protection in total revenue in CEE countries on average (%)**



Source: Eurostat.

The reduction of personal income tax rates and the introduction of flat tax systems in most CEE countries have played an important role in reducing the redistributive impact of fiscal policy. These changes have reduced the overall progressivity of the tax system. As a result, it becomes crucial for the public sector to prioritise the expenditure side of the budget, in particular by allocating public funds to key areas such as social protection, health and education to promote welfare. This trend is evident in the CEE countries, where public spending on social protection and health shows a notable increase over the period 1995-2021. However, education expenditure shows a contrasting trend (see Figure 5), but exhibits the lowest dynamics (measured by the coefficient of variation of the values for different years of the period) compared to the other two public cost areas, indicating a relatively stable level of public investment in education over the years.

#### 4. Methodological Approach

This section presents the methodology used to assess the impact of the tax system and expenditure structure on income inequality in the CEE countries (Bulgaria, the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia). The analysis applies a panel data estimation technique: the seemingly unrelated

regression (SUR) model, which is chosen because the null hypothesis of no cross-section dependence (correlation) in the residuals (based on the Breusch-Pagan LM test and Pesaran scaled LM) is rejected for OLS regression, which also detects heteroskedasticity. This model selection is also influenced by the relatively larger number of time periods (T) compared to the number of countries (N). The SUR approach allows the estimation of panel data models with a long time dimension but a small cross-sectional dimension (Olbryś, 2012; Xu et al., 2016). SUR estimation involves the use of a feasible generalised least squares (FGLS) estimator, where OLS is applied to each individual-specific equation (Xu et al., 2016). This approach allows to capture of the specific effects of each country, while accounting for potential heteroskedasticity and cross-sectional correlation in the data.

Five separate models are evaluated using the following formal representation of the panel model (equation 1):

$$GINI_{it} = \alpha + \beta PSV_{it} + \gamma CV_{it} + \varepsilon_{it} \quad (1)$$

Where:

$GINI_{it}$  - the dependent variable for the country “i” at period “t”

$\alpha$  – constant

$\beta, \gamma$  – parameters, representing the association between the dependent and a given independent variable

$PSV_{it}$  – a vector of public sector variables for the country “i” at period “t”

$CV_{it}$  – a vector of control variables for the country “i” at period “t”

$\varepsilon_{it}$  – the error term

The dependent variable is income inequality, measured by the Gini coefficient after taxes and transfers. The data for this variable is obtained from the World Inequality Database (WID). The independent variables of interest in the study are related to the public sector and vary in the five different models. The main model evaluated includes several tax variables. These include the share of VAT revenue in total revenue, the share of personal income tax revenue in total revenue, the share of corporate income tax revenue in total revenue and the share of net social contributions in total revenue. By looking at the shares of different taxes in total revenue, the study aims to assess the impact of the tax structure on income inequality. Furthermore, by including each type of tax separately in the regressions, the analysis can take into account differences in their impact on income inequality. In addition, the model includes the top statutory personal income tax rates as an indicator of the progressivity of personal income taxation

On the government expenditure side, the model includes public expenditure on social protection, health and education, expressed as a share of total public expenditure based on the COFOG classification. This allows the study to analyse the impact of specific categories of expenditure that contribute most directly to the welfare of members of society and are therefore expected to have the greatest impact on reducing income inequality. The role of government in the economy with respect to income inequality is captured by including public

expenditure as a share of GDP as an explanatory variable in the model. This variable reflects the overall size and involvement of the state in the economy, which may have an impact on income distribution.

The second model differs from the main model in that the revenue shares of personal and corporate income taxes are replaced by the share of direct taxes in total revenue. This adjustment allows a specific focus on the impact of direct taxes as a whole on income inequality. The third model uses the main types of social costs (family and children and old age) as a percentage of total public expenditure, instead of total social security expenditure, in an attempt to capture their different impacts on income inequality. This also allows for a more detailed examination of the specific categories of social expenditure that may have a significant impact on income inequality. The fourth and fifth models differ from the main model by including only cost-side variables and only revenue-side variables respectively as explanatory variables.

To increase reliability and explanatory power, all three models include a set of control variables. The selection of these variables is based on previous research on the determinants of income inequality (Chan and Ramley, 2018; Peshev et al., 2019; Roine and Waldenström, 2015; Alavuotunki et al., 2019; Wildowicz-Szumarska, 2022; Martinez-Vazquez et al., 2012; Anderson et al., 2016, etc.). The selected control variables include various factors that have been found to be relevant in explaining income inequality. These variables include changes in population, GDP per capita (as a percentage of the EU average), unemployment rate, economic openness (measured by the share of exports and imports in GDP), educational attainment (indicated by the share of the population with tertiary education, levels 5-8) and financial development (approximated by the consolidated private sector credit flow as a percentage of GDP). A detailed description of the variables used in the models can be found in Table 2 in the Appendix.

The application of a unit root test reveals that most variables are stationary at a level, while some variables show stationarity at their first difference. These variables include public health expenditure, public education expenditure, public social expenditure, the share of the population with tertiary education and GDP per capita. Furthermore, the analysis confirms the absence of multicollinearity, as no variance inflation factors (VIF) above 10 are found. Only one variable has a VIF slightly above 5 in the main and second models and two variables in the third model (Annex Table 3). It should also be noted that the five equations have a normal distribution, as the p-value for the null hypothesis of the Jarque-Berra test is higher than 0.05.

The panel study period is from 1998 to 2021, limited by data availability. All variables used in the analysis data are obtained from Eurostat, except for the Gini coefficient, for which data from the World Inequality Database (WID) is used.

## 5. Results

The estimation of the main panel model shows that the coefficients of most of the public sector explanatory variables of interest are statistically significant at the 5% significance level. However, the coefficient of public health expenditure is not statistically significant.

The results suggest that the role of the state in the economy, represented by the share of public expenditure in GDP, has a negative impact on income inequality in the CEE countries. This result indicates that a higher share of public expenditure in GDP is associated with lower income inequality. Furthermore, this factor stands out as one of the most influential factors in the model, as evidenced by the high value of the coefficient in comparative terms (see Table 1).

The model results also show that an increase in the share of VAT in revenue is associated with an increase in the GINI coefficient, which is consistent with previous empirical findings (Leahy et al., 2011; Martinez-Vazquez et al., 2012; Chan and Ramley, 2018; Schmutz and Schaltegger, 2018; Alavuotunoki et al., 2019, etc.). Similarly, an increase in the share of personal income tax is also positively associated with income inequality. The results also suggest that a higher share of corporate income tax is related to lower income inequality, which is in line with the findings of Martinez-Vazquez et al. (2012) and suggests that the tax burden is partly borne by workers (see Table 1). However, corporate income taxes account for a relatively small share of budget revenues in CEE countries, reflecting their low tax rates. Moreover, the estimation of Model 2 shows that the share of direct taxes (the sum of all direct taxes) in total revenue is positively correlated with income inequality in CEE countries (see Table 4 in the Appendix).

**Table 1. Regression results (main model)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PIT	0.003025	0.000549	5.511565	0.0000
CIT	-0.003014	0.000797	-3.782321	0.0002
VAT	0.003691	0.000580	6.364701	0.0000
SOCCONTRIB	-0.002015	0.000510	-3.948039	0.0001
TOPSTAXRATE	-0.000308	0.000144	-2.142724	0.0332
PUBLEXP GDP	-0.005196	0.000435	-11.95476	0.0000
SOCEXP	-0.001909	0.000865	-2.205950	0.0284
HEALTHTEXP	0.000846	0.001521	0.556490	0.5784
EDUCATIONEXP	-0.006011	0.001909	-3.149031	0.0019
POPULTERTIARY	0.000736	0.001599	0.460121	0.6459
UNEMOLOYMENT	0.002544	0.000304	8.363148	0.0000
CREDITS	-0.000570	0.000205	-2.776345	0.0059
GDPCAP	0.000254	0.000840	0.301998	0.7629
OPENNESS	-0.000734	0.000159	-4.613185	0.0000
POPULATION	-2.34E-07	3.17E-08	-7.393890	0.0000
C	0.538103	0.045809	11.74656	0.0000
R-squared	0.920499			
F-statistic	180.6235			
Prob(F-statistic)	0.000000			
Jarque-Berra test	1.826561			
Prob.	0.401206			

*Source: Application of the models in E-views based on Eurostat and WID data.*

The demonstrated effect of VAT is not surprising, but the impact of the personal income tax share on income inequality does not follow the expected theoretical relationship. The observed positive relationship between the personal income tax share and inequality can be explained by the low progressivity and the introduction of a flat tax in most countries for most of the period analysed. Wildowicz-Szumarska (2022) points out that eight of the eleven

CEE countries (Bulgaria, Romania, the Czech Republic, Hungary, Lithuania, Latvia, Estonia and Slovakia) abolished progressive taxation and introduced proportional taxation of personal income at different periods. For example, Slovakia had proportional taxation only in the period 2004-2012. Poland also introduced a two-step and flattened tax scale (18% and 32%) from 2009 to September 2019, resulting in relatively low top marginal personal income tax rates.

The impact of the personal income tax share on income inequality should be analysed in conjunction with the trends in this share over the period considered. On average, the CEE countries show a significant decrease in the personal income tax share due to a reduction in progressivity, with this share falling from 17% in 1998 to 13.9% in 2021 as a result of tax policy changes leading to lower progressivity. This suggests that in the CEE countries, the reduction in this tax share is positively associated with a reduction in inequality, suggesting that policies to reduce inequality are implemented through the expenditure side of the budget. Apparently, the importance of these taxes in generating tax revenue is declining sharply in the CEE countries, while governments are relying less on them to implement policies to reduce income inequality. With low shares of personal income taxes, they cannot be expected to play a significant role in reducing inequality. The CEE countries are at the bottom of the EU rankings for this indicator, with all but Lithuania having values lower than the EU average in the last years of the survey period.

As Martinez-Vazquez et al. (2012) very accurately point out, not all personal income taxes are created equal in terms of their structure and resulting overall level of progressivity. In countries with flat income taxes, the negative relationship between the share of personal income tax and income inequality may not exist. This is what the results of the present study show for the CEE countries. Some of the empirical studies reviewed show a negative relationship between personal income taxes and income inequality, but mainly in countries with higher personal income tax progressivity than that observed in the CEE countries.

The increasing share of net social contributions in total revenue is associated with a decrease in income inequality, as indicated by the significant negative coefficient. These contributions are directly related to the redistributive role of social and health expenditure, as they are collected in social security funds in the CEE countries. Moreover, the statistically significant impact of social security contributions on income inequality, despite the fact that part of them is paid by employers, suggests a successful transfer of the tax burden to workers in the CEE countries.

Results from the study demonstrate that the top statutory personal income tax rate is negatively correlated with income inequality, which supports the theoretical hypothesis and is in line with previous research findings on the positive effect of progressivity in reducing income inequality (e.g. Wildowicz-Szumarska, 2022; Martinez-Vazquez et al., 2012; Doerrenberg and Peichl, 2012, etc.). However, it is important to consider the relatively small coefficient value associated with this variable in the main model (see Table 1) and its statistical insignificance in the second model (see Table 4 in the Appendix).

The main model results on the influence of different aspects of the tax system on income inequality in the CEE countries are confirmed by the estimated coefficients of the fourth

model, which examines the impact of taxes on income inequality without including types of public expenditure as explanatory variables (see Table 6 in the Appendix).

The results on the impact of different tax revenues are indicative of the overall effect of the tax system on income inequality. In CEE countries, where the tax structure is significantly unbalanced and dominated by indirect taxes, the ability of the tax system to reduce income inequality is limited, according to the results of this empirical test. Although VAT is not directly related to income, an increase in its share of tax revenue implies a decrease in the share of direct taxes, which are considered to have a stronger and more direct impact on reducing income inequality. Despite the regressive nature of VAT in terms of income inequality, it remains an important component of tax systems as it provides stable revenue to the government budget and effectively serves the fiscal function of taxation. The generation of budget revenues, on the other hand, creates opportunities to implement policies aimed at reducing inequality through the expenditure side of the budget.

On the expenditure side, the expected effects as described in the theoretical and empirical literature (e.g. Chen et al., 2018; Doumbia and Kinda, 2019; Wildowicz-Szumarska, 2022; Alfonso et al., 2008; Johansson, 2016; Martinez-Vazquez et al., 2012; Doerrenberg and Peichl, 2012; Sanchez and Perez-Corral, 2018; Ionut et al, 2021; Malla and Pathranarakul, 2022; Clifton et al., 2020, etc.), are evident from the estimated coefficients of the main model (see Table 1) and from the additionally estimated fifth model, which excludes tax variables and examines only the impact of expenditure-side policies on income inequality (see Table 7 in the Appendix). In particular, an increase in public social expenditure and public expenditure on education leads to a reduction in income inequality. Among the independent fiscal variables of interest, public expenditure on education has the highest impact, as shown by the value of its coefficient. In the third model, where public expenditure on family and children and on old age are included as a share of total public expenditure instead of total public expenditure on social protection, they are found to be statistically insignificant contributors to income inequality at the 5% significance level (see Table 5 in the Annex).

The results suggest that tax systems in CEE countries, characterised by low progressivity and a low share of income taxes in total tax revenues, do not contribute effectively to reducing income inequality. On the other hand, social and educational spending is negatively correlated with income inequality. This suggests that expenditure policies are more effective than tax measures in reducing inequality in CEE countries. These findings are in line with previous empirical studies (e.g. Martinez-Vazquez et al., 2012; Joumard et al., 2012, etc.).

## **6. Conclusion and Discussion**

The results of this study highlight the limited impact of tax systems in CEE countries on reducing income inequality. The prevalence of regressive indirect taxes, weak progressivity and the low share of personal income taxes in total tax revenue hinder the progressivity of the tax system and suggest that revenue measures alone are not sufficient to tackle inequality. This suggests that the tax systems in these countries primarily fulfil a fiscal function rather than actively tackling income inequality. As a result, policies aimed at reducing income inequality through targeted public spending are more effective. The study also highlights the

important role of social protection and education spending in reducing income inequality in CEE countries. It is therefore important to target resources for social programmes and education as they have a direct impact on improving income equality in CEE countries.

To increase the impact of the tax system on reducing inequality, certain measures can be taken to enhance progressivity. One approach is to introduce or increase the tax-free minimal income while making small adjustments to tax rates where necessary. These measures can serve as an initial step to address any lack of progressivity in the tax system. Reforms in the tax area should be carried out while considering a number of objectives, some of which may be in competition with each other. These objectives include achieving efficiency and justice, reducing income inequality, minimising excessive tax burdens, ensuring sufficient revenue for the budget, promoting high levels of tax collection, reducing the informal economy and tackling tax competition. Achieving these objectives is challenging and it is crucial to prioritise current needs as much as possible. Although the impact of the public sector on income inequality, mainly through the expenditure side of the budget, is relatively limited, it is important to note that public expenditure policies can influence both the secondary and primary distribution of income in the market. This is their advantage over tax measures. Therefore, generating a stable flow of revenue to the government budget through the tax system and effectively targeting and prioritising expenditure towards the goal of reducing income inequality can lead to better outcomes in this area.

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**Appendix**

**Table 2. Variables description**

Variable	Description	Source	Type
GINI	GINI coefficient after taxes and transfers	WID	Dependent
PIT	personal income tax revenue as a share of total revenue	Eurostat	Independent of interest
CIT	corporate income tax revenue as a share of total revenue	Eurostat	Independent of interest
DIRTAXES	direct tax revenue as a share of total revenue	Eurostat	Independent of interest
VAT	VAT revenue as a share of total revenue	Eurostat	Independent of interest
SOCCONTRIB	net social contributions as a share of total revenue	Eurostat	Independent of interest
TOPSTAXRATE	top statutory personal income tax rates	Eurostat	Independent of interest
PUBLEXP GDP	public expenditures as a share of GDP	Eurostat	Independent of interest
SOCEXP	public expenditures on social protection as a share of total public expenditure	Eurostat	Independent of interest
HEALTHTEXP	public expenditures on health as a share of total public expenditure	Eurostat	Independent of interest
EDUCATIONEXP	public expenditures on education as a share of total public expenditure	Eurostat	Independent of interest
FAMILY	public expenditures on family and children as a share of total public expenditure	Eurostat	Independent of interest
OLDAGE	public expenditures on old age a share of total public expenditure	Eurostat	Independent of interest
POPULTERTIARY	education level (identified by the share of population with tertiary education (levels 5-8))	Eurostat	Independent control
UNEMOLOYMENT	unemployment rate	Eurostat	Independent control
CREDITS	financial development (approximated by the consolidated private sector credit flow as a percent of GDP)	Eurostat	Independent control
GDPCAP	GDP per capita (as a percent of the EU average)	Eurostat	Independent control
OPENNESS	openness of the economy (measured by export and import share in GDP)	Eurostat	Independent control
POPULATION	change in the population	Eurostat	Independent control

**Table 3. Variance inflation factor results**

	Centered VIF				
	main model	Second model	Third model	Fourth model	Fifth model
PIT	4.462704		5.071622	4.164325	
CIT	2.449786		2.814017	2.426470	
VAT	4.629010	5.136005	5.166323	4.448880	
SOCCONTRIB	5.169233	3.997598	5.276412	4.582143	
TOPSTAXRATE	2.266089	2.044174	2.305247	2.041338	
PUBLEXP GDP	3.447966	2.945329	3.421658	3.148388	1.458464
SOCEXP	1.526484	1.395627			1.390856
HEALTHTEXP	1.214211	1.204347	1.225412		1.152209
EDUCATIONEXP	1.241187	1.248239	1.160172		1.162592
POPULTERTIARY	1.178973	1.177153	1.178006	1.143630	1.053904
UNEMOLOYMENT	1.381391	1.305225	1.497603	1.357779	1.211381
CREDITS	2.048552	1.894756	1.829877	2.078118	1.647191
GDPCAP	2.179438	1.739156	1.771951	1.641535	1.645618
OPENNESS	1.306490	1.275957	1.243266	1.241458	1.238397
POPULATION	1.290191	1.216496	1.486351	1.242688	1.136875
DIRTAXES		2.571930			
FAMILY			1.536674		
OLDAGE			1.190042		

Source: Estimated in E-views based on Eurostat and WID data

**Table 4. Regression results (second model)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIRTAXES	0.002122	0.000581	3.650456	0.0003
VAT	0.004059	0.000607	6.689675	0.0000
SOCCONTRIB	-0.002503	0.000503	-4.970906	0.0000
TOPSTAXRATE	-0.000202	0.000141	-1.431628	0.1536
PUBLEXP GDP	-0.005110	0.000417	-12.25815	0.0000
SOCEXP	-0.001757	0.000815	-2.156437	0.0321
HEALTHTEXP	0.000218	0.001460	0.148966	0.8817
EDUCATIONEXP	-0.006228	0.001807	-3.447518	0.0007
POPULTERTIARY	-0.000572	0.001548	-0.369857	0.7118
UNEMOLOYMENT	0.002556	0.000274	9.314037	0.0000
CREDITS	-0.001041	0.000203	-5.125144	0.0000
GDPCAP	0.001639	0.000776	2.110651	0.0359
OPENNESS	-0.000652	0.000156	-4.179958	0.0000
POPULATION	-2.12E-07	2.55E-08	-8.323248	0.0000
C	0.518315	0.048150	10.76462	0.0000
R-squared	0.902133			
F-statistic	154.7305			
Prob(F-statistic)	0.000000			
Jarque-Berra test	5.486959			
Prob.	0.064346			

Source: Application of the models in E-views based on Eurostat and WID data

**Table 5. Regression results (third model)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PIT	0.003502	0.000578	6.064727	0.0000
CIT	-0.004098	0.000843	-4.858622	0.0000
VAT	0.004345	0.000673	6.454006	0.0000
SOCCONTRIB	-0.001298	0.000559	-2.321519	0.0212
TOPSTAXRATE	-0.000395	0.000153	-2.584239	0.0104
PUBLEXP GDP	-0.005206	0.000470	-11.06840	0.0000
FAMILY	0.001364	0.001589	0.858512	0.3916
OLDAGE	-0.000532	0.001182	-0.450544	0.6528
HEALTHTEXP	-0.000946	0.001730	-0.546846	0.5850
EDUCATIONEXP	-0.005964	0.002082	-2.865146	0.0046
POPULTERTIARY	0.002343	0.001622	1.444203	0.1501
UNEMOLOYMENT	0.002672	0.000392	6.809994	0.0000
CREDITS	-0.000374	0.000226	-1.656868	0.0990
GDPCAP	0.000870	0.000825	1.054574	0.2928
OPENNESS	-0.000875	0.000185	-4.718915	0.0000
POPULATION	-3.08E-07	3.62E-08	-8.507622	0.0000
C	0.487564	0.048388	10.07619	0.0000
R-squared	0.918813			
F-statistic	153.4895			
Prob(F-statistic)	0.000000			
Jarque-Berra test	2.483956			
Prob.	0.288812			

Source: Application of the models in E-views based on Eurostat and WID data

**Table 6. Regression results (fourth model)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PIT	0.003264	0.000564	5.786016	0.0000
CIT	-0.002750	0.000824	-3.337692	0.0010
VAT	0.004077	0.000579	7.044535	0.0000
SOCCONTRIB	-0.001808	0.000513	-3.526337	0.0005
TOPSTAXRATE	-0.000444	0.000149	-2.982392	0.0032
PUBLEXPBGP	-0.004523	0.000442	-10.24184	0.0000
POPULTERTIARY	0.000730	0.001614	0.452487	0.6513
UNEMOLOYMENT	0.002605	0.000295	8.829179	0.0000
CREDITS	-0.000425	0.000207	-2.047710	0.0417
GDPGAP	0.001275	0.000735	1.734104	0.0842
OPENNESS	-0.000691	0.000150	-4.611334	0.0000
POPULATION	-2.13E-07	3.44E-08	-6.190231	0.0000
C	0.489208	0.047342	10.33348	0.0000
R-squared	0.905237			
F-statistic	188.6640			
Prob(F-statistic)	0.000000			
Jarque-Berra test	2.596419			
Prob.	0.273020			

Source: Application of the models in E-views based on Eurostat and WID data

**Table 7. Regression results (fifth model)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PUBLEXPBGP	-0.006888	0.000338	-20.37212	0.0000
SOCEXP	-0.002011	0.000909	-2.211015	0.0280
HEALTHTEXP	0.000105	0.001497	0.069938	0.9443
EDUCATIONEXP	-0.007045	0.001835	-3.838113	0.0002
POPULTERTIARY	-0.002474	0.001719	-1.439408	0.1513
UNEMOLOYMENT	0.003223	0.000284	11.33395	0.0000
CREDITS	-0.000440	0.000216	-2.040899	0.0424
GDPGAP	0.001437	0.000868	1.655504	0.0991
OPENNESS	-0.000708	0.000171	-4.144158	0.0000
POPULATION	-2.42E-07	2.82E-08	-8.581138	0.0000
C	0.632299	0.015803	40.01155	0.0000
R-squared	0.815276			
F-statistic	106.3647			
Prob(F-statistic)	0.000000			
Jarque-Berra test	4.052838			
Prob.	0.131807			

Source: Application of the models in E-views based on Eurostat and WID data