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# A SPATIAL ANALYSIS OF THE IMPACT OF EDUCATION ON SOCIAL-ECONOMIC INEQUALITIES: A SPOTLIGHT ON ROMANIA

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**Abstract**
This study examines the influence of higher education graduates, labour productivity, and public expenditure on the wage share of GDP in Romania in the 42 Romanian NUTS 3 regions in the 2014-2021 period using a dynamic panel data model. The wage share, calculated as employee compensation divided by GDP, serves as a proxy for income inequality, though it does not reveal individual wage distribution. However, the impact on income inequality remains unclear. Increased public spending, particularly on social programmes, translates to a lower wage share indicating reduced income inequality in Romania's specific case. The relation between labour productivity and wage share is not significant because of the public sector wage policies that prioritize catching up to private sector wages or inflation, rather than reflecting actual productivity gains. By strategically investing in education, reforming the public sector, and fostering a productive business environment, Romania can leverage its educated workforce and public spending to achieve a more equitable and prosperous future.

**Keywords**: Income inequality; Wage share; Higher education; Labour productivity.

## 1. INTRODUCTION

Despite the progress in the last years, Romania remains one of the countries with the highest income inequality in the EU. This increase in income inequality is partly due to the transition to a market economy, which has led to the concentration of wealth in the hands of a reduced number of people. Another cause is represented by the large informal economy in Romania, which makes it difficult for the government to collect taxes and provide social services to the poorest members of society. Other particular phenomena that increase income inequality are related to: a) the expansion of higher education that provides skilled graduates that require higher wages; b) higher labour productivity in private sector compared to the public one and c) the inefficient allocation of public expenditure. Less public income because of the informal market determines lower public expenditure for the wages of the people working in the public sector.

Given the importance of the income inequality issue for Romania, the aim of this study is to assess the impact of higher education, labour productivity and public expenditure on income inequality in Romania using a regional approach. The analysis is conducted for the 42 Romanian NUTS 3 regions (i.e. 41 counties plus Bucharest municipality) in the 2014-2021 period using a dynamic panel data model that alleviates the endogeneity issue.

This study employs wage share of GDP (wage share) as a proxy for income inequality because of data availability. The wage share of GDP is an indicator that reflects the distribution of income. It is countercyclical since it decreases when GDP grows and increases when GDP falls. Higher wage determines an increase in wage share, as expected. The wage share of GDP has been declining in many developed countries over the past few decades. This trend has been attributed to a number of factors including globalization, technological change, and the decline in unionization rates. However, the wage share of GDP continued to increase in Romania, because after the last global economic crisis important political leaders supported wage rising so as to grow total demand and enhance economic growth (Lupu et al., 2023).

Considering the high wage share of GDP in Romania and the specific framework in Romania that has been already described at the beginning of this section, the research questions of this study are:

- Does higher number of faculty graduates enhance the wage share of GDP?
- Does the labour productivity impact the wage share of GDP?
- Does public expenditure influence the wage share of GDP?

Relevant responses to these research questions are provided by conducting a deep analysis that combines the theoretical framework provided by the literature review with the empirical findings based on regional data for Romania. After this section, the study provides an overall image of the topic using several research directions from literature. To support the hypotheses, the next sections cover data and methodology description, results, conclusions and policy proposals.

## 2. LITERATURE REVIEW

This section focuses on a couple of directions of research: indicators to measure income inequality, factors that determine income inequality and its consequences, empirical evidence relating to the impact of factors used in this analysis on income inequality.

Income inequality is the disparity of incomes across a population. It is a measure of how unevenly income is distributed among individuals or households within a society (Ravallion, 2014). Income inequality can be measured in various ways, but some of the most common measures include the Gini coefficient, the



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

Lorenz curve, income percentile ratios, Theil index, coefficient of variation, Atkinson measure, wage share to GDP, mean logarithmic deviation, and quintile shares (Silber, 2012). Given the lack of data availability for all these indicators, this study employs wage share of GDP as a measure of inequality. This indicator is relevant for Romania, since after the last global economic crisis, the policymakers in this country focused on rising wages to grow total demand and enhance economic growth (Lupu et al., 2023). However, rising wages might increase wage share of GDP as a measure of income inequality. In this context, it is necessary to identify those factors that enhance wage share in Romania. Since this hypothesis has not been previously checked for Romania, the novelty of this study is given by the identification of the regional drivers of wage share in Romanian counties.

Income inequality can be caused by many factors, including:

- differences in skills and education: individuals with higher levels of education and skills tend to earn more income (Lee et al., 2013). Therefore, the number of higher educated graduates is considered as a potential source of wage share increase in Romanian regions.
- differences in employment opportunities and labour productivity: individuals who work in high-paying jobs or with higher labour productivity tend to earn more income than those who work in low-paying jobs or with lower productivity (Nikoloski, 2009).
- differences in wealth: individuals with more wealth tend to earn more income from investments and other sources (Muntaner et al., 2019; Van, 2024).
- differences in public expenditure: governments can use public expenditure to reduce income inequality by targeting spending towards low-income individuals and families, to invest in infrastructure for creating jobs and economic opportunities in low-income communities or to provide tax breaks and other incentives to businesses that create jobs in low-income communities (Recepoğlu, 2022).
- government policies: government policies, such as tax rates and social welfare programmes, can affect the distribution of income (Hailemariam et al., 2021; Alshammari and Almutairi, 2024).

Given the limited data availability, this paper explains wage share of GDP based on public expenditure, labour productivity and number of higher education graduates. We expect to have a direct influence of these factors on wage share of GDP in the Romanian counties.

The identification of these indicators that increase wage share of GDP might be relevant for income inequality. For example, more income inequality can lead to reduced economic growth by discouraging investment and innovation (Lerman and Yitzhaki, 1985). Income inequality can generate increased social unrest, such as crime and political instability Alesina and Perott, 1996). Income inequality can reduce social mobility, since it makes it more difficult for people to move up the economic ladder (Andrews and Leigh, 2009).

The identification of relevant sources of income inequality can help government to implement suitable policies as responses to this issue. For example, governments may promote policies to support more

investment in education and skills training to increase the earning potential of low-income individuals (Abdullah et al., 2015). Encouraging job growth in high-wage sectors might create more well-paying jobs for all workers (Mandel, 2017). Raising the minimum wage can help to reduce poverty and inequality, while expanding social welfare programmes provides a safety net for low-income individuals and families (Muntaner and Lynch, 2020).

The suitable policies to reduce income inequality are designed depending on the impact of various factors on wage share of GDP. In this study we will focus only on the impact of a couple of factors for which empirical evidence from literature is provided. For Romania, we expect to have these factors as drivers of wage share of GDP.

The empirical evidence in literature supports the hypothesis that higher education increases the income inequality. For example, for France, Bunel and Guironnet (2017) showed that higher education graduates employed in senior occupation groups have higher salaries, which amplifies income inequality. The same conclusion was formulated by Hendel et al. (2005) for the US, who showed that higher educated people drive down the salary for unskilled employees.

The evidence is mixed when labour productivity impact on income inequality is assessed. For example, Sharimakin et al. (2015) demonstrated the capacity of more labour productivity to reduce income inequality in Nigeria in the period 1981-2013. For the US, Guest and Swift (2008) showed the capacity of long-run labour productivity to reduce the income inequality, but not for UK and Australia, where more labour productivity enhanced income inequality.

There is also mixed evidence regarding the impact of public expenditure on income inequality. Using a sample of 91developing and 31 developed countries and running dynamic panel threshold regressions, Sidek (2021) showed that more public expenditure reduced income inequality only in developing countries. Using dynamic panel data models, like in our study, Sánchez and Pérez-Corral (2018) analysed the connection between social public expenditure and income inequality for EU-28 in the 2005-2014 period. In the New EU Member States, that include Romania, the authors showed that public expenditure on health and social protection is negatively connected with income inequality. Moreover, public spending on education had not any significant impact on income inequality in none of the countries from EU-28. On the other hand, for a large sample of countries, Sylwester (2002) provided evidence on the capacity of public expenditure on education to reduce income inequality measured using Gini index. Moreover, for the US, Artige and Cavenaile (2023) showed that more public education spending reduced the income inequality. Other studies revealed a positive effect of public expenditure on income inequality. For example, Sidek (2021) supported this hypothesis for developed countries based on a dynamic panel



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

threshold regression, while Demiryürek Ürper (2018) drew the same conclusion for Turkey in the period 1987-2016 using an OLS regression.

Given the theoretical background resulted from the literature review, the next section provides details on the data and methodology used to check the impact of mentioned factors on income inequality.

## 3. DATA AND METHODOLOGY

The wage share of GDP as a measure of income inequality is explained based on number of higher education graduates, labour productivity and public expenditure. The wage share of GDP, also known as the labour share of GDP, or wage share for simplicity, is the share of national income that is paid to labour.

There are not data related to income inequality measures at regional level in Romania. The Gini index is available only at national level, but there are no data at regional level. Therefore, this study proposes the construction of a specific indicator called wage share of GDP that is considered one of the income inequality measures by Stanford (2018) who provides details on definition, measurement and the use of this indicator in international comparisons, especially for Australia. The wage share can be defined in various ways, but empirically it is usually defined as total labour compensation or labour costs over nominal GDP or gross value added).

According to Hogrefe and Kappler (2013), the wage share of GDP, also known as the labour share of GDP, is the share of national income that is paid to labour and it is calculated by dividing total compensation of employees by gross domestic product (GDP). This formula proposed by Hogrefe and Kappler (2013) is also used in this study by dividing the overall compensation of employees in a county to GDP of that county to have a regional perspective of the indicator and make comparisons between Romanian regions with respect to wage share of GDP.

Some arguments justify that wage share of GDP (total compensation of employees divided by GDP) can be a measure of income inequality are provided by Rio and Lores (2019). First, a higher wage share of GDP indicates a larger portion of the economic pie is going to workers in the form of wages and salaries. Conversely, a declining wage share suggests a shrinking slice for workers, potentially leading to greater income concentration at the top. Second, while it does not directly measure the distribution within the labour force, a lower wage share can imply profits and returns on capital are rising faster than wages (Guerriero and Sen, 2012). This can widen the income gap between those who own capital (wealthy) and those who rely solely on wages (workers). Third, by comparing wage share across different periods, one can see if the share of income going to workers is increasing or decreasing. A sustained decline in wage share can be a sign of rising income inequality.

However, there are also limitations. This indicator does not indicate how wages are distributed among different worker groups. High earners within the labour force could still be capturing a larger share, even with a steady wage share overall. A high unemployment rate can reduce the overall wage share, even if wages for employed workers have not declined. This can make it a less clear-cut measure in periods of high unemployment. Wage share only considers compensation, not government transfers like social security or welfare. These programess can play a role in mitigating income inequality.

Overall, wage share of GDP is a useful indicator to get a general sense of income inequality, particularly regarding the distribution between labour and capital. However, it is important to acknowledge the limitations and use it in conjunction with other metrics for a more comprehensive picture.

The wage share of GDP is an important economic indicator that can be used to assess the distribution of income in a country. A higher wage share of GDP indicates that a larger share of national income is going to labour, while a lower wage share of GDP suggests that a larger share of national income is going to capital owners. As proxy for total compensation of employees we employed the average monthly net nominal salary gain that was adjusted with inflation by dividing it to index of consumer prices. Therefore, the average monthly net real salary is divided by real GDP to get wage share to GDP.

High wage share does not necessarily mean income equality. First, a high wage share could indicate that most workers are getting a good share of the 'pie', but it does not indicate whether the distribution among workers is even (Alarco Tosoni, 2014). There could still be a big gap between high earners and low earners. Second, wages are just one type of income. The rest goes to profits, rents, and interest. A rising wage share could mean a shrinking share for other income types, but it would not necessarily change how income is distributed among people. So, while wage share is a useful metric, it is just one piece of the puzzle to understand income inequality. Gini index is a better measure of income inequality, but the data for this indicator are not available for Romanian regions.

The number of higher education graduates refers to bachelor, master, doctoral and post-doctoral graduates each year and was provided by the Romanian National Institute of Statistics.

The nominal labour productivity per person denoted as labour productivity is provided by Eurostat as a national accounts indicator (ESA 2010) and reflects a measure of the value of goods and services produced per person employed.

Public expenditure is the money spent by governments on public goods and services. Public goods and services are those that benefit everyone, or at least a large group of people, and cannot be easily excluded from those who do not pay for them. Public expenditure is typically funded through taxes, fees, and borrowing. Public expenditure is provided by Ministry of Development, Public Works and Administration,



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

Directorate for local fiscal and budgetary policies. Public expenditure is an important tool for governments to achieve their economic and social goals. However, it is important to note that public expenditure can also be a burden on taxpayers. Governments must weigh the benefits of public expenditure against the costs when making budget decisions.

The analysis is conducted for the 42 counties (NUTS 3 Romanian regions) and the data cover the period 2014-2021. According to Table 1, the minimum wage share was 0.023 and it was registered in 2017 by Prahova county. The highest value of wage share was recorded in 2020 by Ilfov county. The Covid-19 pandemic induced the increase in public expenditure in all the counties because of the measures taken by government and local authorities to cope with the effects of epidemic: more direct spending on healthcare to expand testing and treatment capacity, purchase of personal protective equipment, and payments for vaccines and treatments; more economic support measures (furlough schemes, business loans, and tax breaks, to help businesses and individuals); and more social safety nets to support vulnerable groups, such as the unemployed, the elderly, and the disabled.

TABLE 1 - DESCRIPTIVE STATISTICS

| Variable | Mean | Standard deviation | Minimum value | Maximum value |
|---|---|---|---|---|
| wage share | 0.414 | 0.235 | 0.023 | 1.104 |
| higher education graduates | 3407.475 | 7223.837 | 20 | 44675 |
| public expenditure | 1443305018 | 1274986733 | 476645164 | 10451702563 |
| labour productivity | 19186.394 | 7342.831 | 6600 | 51300 |

Source: authors' elaboration.

Cluster analysis was conducted to establish more groups of counties according to wage share and then according to number of higher education graduates in 2014 and 2021. K-means method was used to construct the clusters. Table 2 suggests less counties with high wage share in 2021 compared to 2014.

TABLE 2 - CLUSTER ANALYSIS ACCORDING TO WAGE SHARE IN ROMANIAN COUNTIES (2014 AND 2021)

| Wage share | Number of counties in the cluster | | Final Cluster Centers | |
|---|---|---|---|---|
| | 2014 | 2021 | 2014 | 2021 |
| Low | 9 | 19 | 0.77 | 0.25 |
| Medium | 14 | 10 | 0.46 | 0.86 |
| High | 19 | 13 | 0.21 | 0.53 |

Source: own calculations in MATLAB.

The maps for 2014 and 2021 reveal an increase in the number of clusters with lower wage share in the last year compared to 2014, but overall, this indicator has grown in the entire country. In the West and East of the country, the income inequality based on wage tends to be more persistent (see the maps in Figure 1).

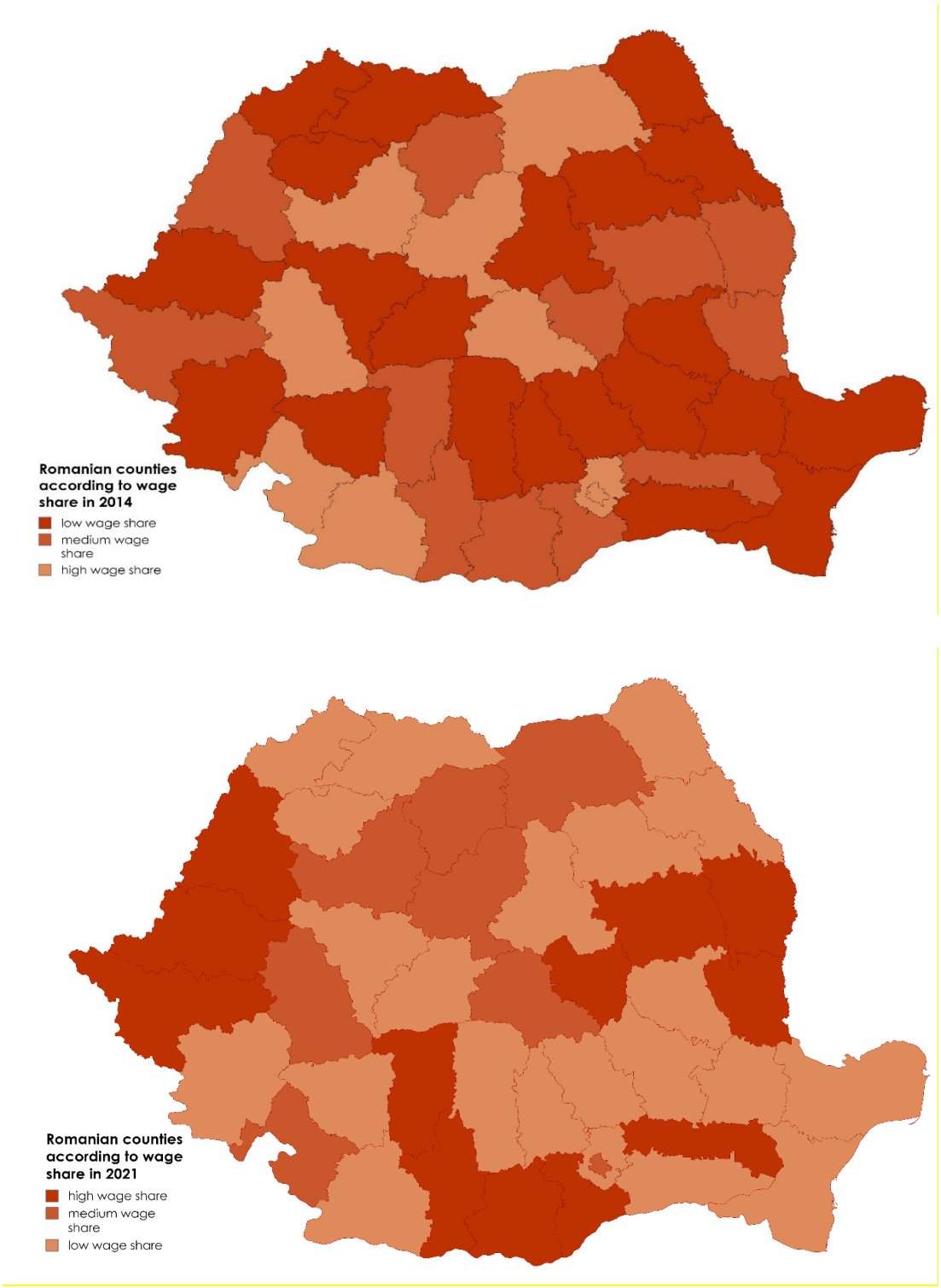


FIGURE 1 - ROMANIAN COUNTIES ACCORDING TO WAGE SHARE IN 2014 AND 2021. SOURCE: MAPS BASED ON MAPCHART

Table 3 suggests that the groups of countries according to the number of higher education graduates remained stable due to the maintenance of the historical university centres in Romania.



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

TABLE 3 - CLUSTER ANALYSIS ACCORDING TO NUMBER OF HIGHER EDUCATION GRADUATES IN ROMANIAN COUNTIES (2014 AND 2021)

| Number of higher education graduates | Number of counties in the cluster | | Final Cluster Centers | |
|---|---|---|---|---|
| | 2014 | 2021 | 2014 | 2021 |
| Low | 38 | 38 | 1510.50 | 1512.36 |
| Medium | 3 | 3 | 11801.81 | 12317.00 |
| High | 1 | 1 | 42104.71 | 44675.00 |

Source: own calculations in MATLAB.

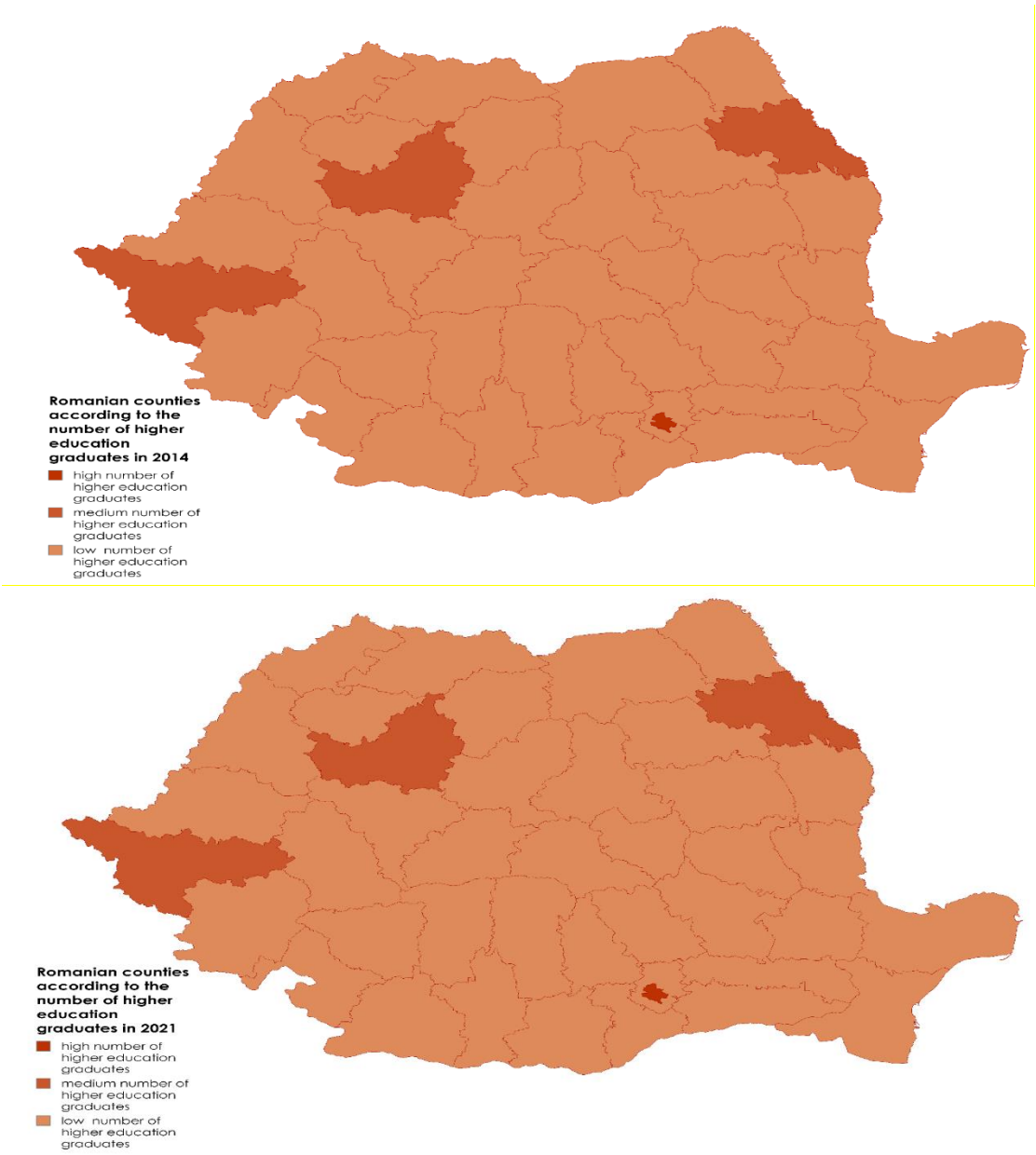


FIGURE 2 - ROMANIAN COUNTIES ACCORDING TO THE NUMBER OF HIGHER EDUCATION GRADUATES IN 2014 AND 2021.
SOURCE: MAPS BASED ON MAPCHART

The maps of the number of higher education graduates in Figure 2 remained unchanged, because there is a high university center in the capital- Bucharest- with the highest number of graduates and three other major university centers in Cluj, Iași and Timiș. The rest of the country does not have large university centers.

The panel data used in this study requires specific methods. Before establishing the most suitable panel data model, preliminary tests must be applied, namely cross-sectional dependent and panel unit root tests. The heterogeneity hypothesis is considered to be fulfilled since there are significant differences between counties in terms of wage share, public expenditure, higher education graduates, labour productivity. These differences are explained by the disparities between regions in terms of level of economic and social development, access to education.

The Pesaran's CD test is employed to verify the hypothesis of cross-sectional dependence (Pesaran, 2015):

$H_0: \rho_{ij} = \rho_{ji} = cor(e_{it}, e_{jt}) = 0, \ \ i \neq j$ (cross-sectional independence)

$H_1: \rho_{ij} = \rho_{ji} \neq 0, \ for\ some\ i \neq j$

$\rho_{ij}$- pair-wise correlation coefficient for errors

$$\rho_{ij} = \rho_{ji} = \frac{\sum_{t=1}^{T} e_{it} \cdot e_{jt}}{\sqrt{\sum_{t=1}^{T} e_{it}^2} \cdot \sqrt{\sum_{t=1}^{T} e_{jt}^2}} \quad (1)$$

The CD statistic relevant for unbalanced panels is given by:

$$CD = \sqrt{\frac{2}{N(N-1)}} \cdot \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \sqrt{T_{ij}} \cdot \hat{\rho}_{ij} \quad (2)$$

$T_{ij}$- no. of common observations between the i and j cross-sections

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t \in T_i \cap T_j} (\hat{e}_{it} - \bar{e}_i)(\hat{e}_{jt} - \bar{e}_j)}{\sqrt{\sum_{t \in T_i \cap T_j} (\hat{e}_{it} - \bar{e}_i)^2} \cdot \sqrt{\sum_{t \in T_i \cap T_j} (\hat{e}_{jt} - \bar{e}_j)^2}} \quad (3)$$

$$\bar{e}_i = \frac{\sum_{t \in T_i \cap T_j} (\hat{e}_{it})}{\#(T_i \cap T_j)} \quad (4)$$

Under cross-sectional dependence, the second-generation panel unit root tests like Pesaran's CADF test are employed. For stationary data series, dynamic panel data models could be built.

$$wage\ share_{ij} = a_i + b_1 wage\ share_{it-1} + b_2\ graduates_{it} + b_3\ labour\ productivity_{it} + b_4\ public\ expenditure_{it} + e_{it} \quad (5)$$



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

*i* is the index for region (county) and *t* is the index for year

$e_{it}$-error term

$a_i, b_1, b_2, b_3, b_4$- parameters

The matrix of correlation suggested no significant correlations between the explanatory variables (coefficients of correlations below 0.3). The principal benefit of dynamic panel GMM estimator is the ability to tackle the endogeneity in samples with short period and more cross-sections like our case. The errors' heteroskedasticity and autocorrelation are solved by considering the Windmeijer (2005) finite-sample correction in two-step system GMM estimator. Dependent and independent variables act like instruments. The Sargan over identification test is applied to verify the validity of the instruments. The Arellano and Bond (1991) test is used to check for serial autocorrelation.

The dynamic panel data model is recommended if the data series are stationary. Alternative models are fixed effect or random effect model, but are not suitable in this analysis since these models do not manage endogeneity. The next section presents the results based on the described method.

## 4. RESULTS

According to Table 4, the cross-sectional dependence is supported for all the data series at 1% significance level. This result allows us to consider the second-generation panel unit root tests in checking for stationarity.

TABLE 4 - THE RESULTS OF PESARAN (2004) CD TEST

| Variable | CD stat. | p-value |
|---|---|---|
| higher education graduates | 37.84 | <0.01 |
| labour productivity | 72.33 | <0.01 |
| public expenditure | 31.5 | <0.01 |
| wage share | 65.17 | <0.01 |

Source: own calculations in MATLAB.

Table 5 suggests that all the data series are stationary in level at 1% significance level. The CADF test was applied in two versions, since the test is sensitive to the number of lags. Therefore, dynamic panel data models could be run on stationary data.

TABLE 5 - THE RESULTS OF CADF TEST

| Variable | Data in level | | Data in the first difference | |
|---|---|---|---|---|
| | Constant+ Trend and one lag | Constant+ Trend and two lags | Constant and one lag | Constant and two lags |
| wage share | 0.414 | 0.235 | 0.023 | 1.104 |
| higher education graduates | 3407.475 | 7223.837 | 20 | 44675 |
| public expenditure | 1443305018 | 1274986733 | 476645164 | 10451702563 |
| labour productivity | 19186.394 | 7342.831 | 6600 | 51300 |

Source: own calculations in MATLAB. Note: ***p-value<0.01, **p-value<0.05, *p-value<0.1

According to Table 6, the number of higher education graduates and public expenditure had a direct impact on wage share in the period 2014-2021 in the NUTS 3 Romanian regions (more higher education graduates and more public expediture imply higher wage share of GDP). On the other hand, labour productivity had no significant effect on wage share. The wage share in the previous year directly influenced the wage share in the actual year, which suggests the tendency of increase in wage share. The results should be discussed with respect to wage share of GDP and to income inequality.

Graduates with specialized skills can contribute more to a company's output, potentially justifying higher wages, but without a sufficient increase in GDP. However, more higher graduates will not automatically lead to greater income inequality. First, higher graduates might command significantly higher salaries compared to those without degrees. This creates a wage gap that can contribute to income inequality, especially if lower-skilled workers' wages stagnate. Second, if higher graduates struggle to find jobs that match their skills (skill mismatch), they might end up in lower-paying positions, limiting the overall impact on the wage share. Additionally, some graduates might leave Romania for better opportunities abroad (brain drain), further reducing the impact on domestic wages. Third, generally, a more educated workforce leads to higher wages, higher productivity and economic growth. However, if education benefits are not equally distributed, it can exacerbate income inequality. For example, if higher education becomes increasingly expensive, it could become accessible only to the wealthy, further widening the gap. In poor Romanian countries, the access to quality higher education might be limited, while in rich ones, the access to higher education is easier and graduates could find a better paid job faster. Therefore, the disparities between regions are higher in terms of income, but inside each region the inequalities might reduce.

The higher wages provided for higher educated employees are in line with previous studies. For example, Bol and Heisig (2021) used a sample of 17,590 graduates from 29 countries, including post-communist states, and showed that specific skills of higher education graduates ensure higher salaries. The structural characteristics in terms of labour market disparities and field of study explained the direct impact of higher educated people on wage distribution in Germany (Kopecny and Hillmert, 2021).

More public expenditure implied more wage share of GDP. Some arguments might be provided for this result. First, a significant portion of government spending goes towards public sector salaries (teachers, nurses, government workers). Increased public expenditure often translates to higher wages for these employees, directly boosting the wage share of GDP. Second, government spending can create jobs in various sectors. Building infrastructure, for example, requires construction workers, engineers, and other employees. This increased demand for labour can push wages up in the private sector as well, further increasing the wage share.



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

The capacity of public expenditure to increase wage share of GDP might be also explained in connection with income inequality, but this dependends on how the government spends. Public spending often includes social programmes like unemployment benefits, minimum wage increases, and social security. These programmes directly increase the income of low- and middle-income earners, potentially reducing income inequality. First, if the government prioritizes spending on social programmes and benefits that target lower-income groups, it can help narrow the income gap. Second, if spending primarily benefits high-income earners (e.g., tax breaks for corporations), it may not significantly increase the wage share for the majority and could even exacerbate inequality. (Tanninen, 1999). For the particular case of the Romanian economy, we might explain why more public expenditure determined more wage share of GDP. Romania has a relatively large public sector compared to some European countries. This means a significant portion of the workforce relies on public sector wages. Increased public expenditure often translates to higher wages for these government employees, directly inflating the wage share of GDP (Artige and Cavenaile, 2023). Public sector wages in Romania have historically been lower than those in the private sector. However, in the last few years, increased public expenditure was directed towards raising public sector salaries to be more competitive. This increased the overall wage share as more income goes towards employee compensation. Romania has heavily invested in infrastructure projects after becoming an EU member state. The government spending createed new jobs in construction, engineering, and related fields. The increased demand for labour in these sectors pushed wages up across the board, not just for public sector employees. This also contributed to a higher wage share of GDP. Romania's social safety net has undergone reforms, with increases in minimum wage and social benefits. This directly injected money into the pockets of lower- and middle-income earners, potentially raising the overall wage share. However, increased public expenditure was financed through excessive borrowing, which lead to debt and inflation, which harm everyone in the long run. Given this particular context of the Romanian economy, we can conclude that more wage share of GDP might translate into less income inequality in the Romanian counties.

As Afonso et al. (2023) suggested, more public expenditure can generate higher salaries, which determines higher wage share. Our results are in line with Sidek (2021) who showed, using a dynamic panel threshold regression, that more public expenditure had the capacity to reduce income inequality in developing countries. On the other hand, for Turkey, Demiryürek Ürper (2018) found that more current expenditure increased income inequality in the period 1987-2016 based on OLS regression.

The effectiveness of public expenditure in reducing inequalities depends on factors such as the transparency of allocation processes, the efficiency of service delivery, and the effectiveness of social

policies. Additionally, addressing underlying structural factors, such as discrimination and unequal access to opportunities, is crucial for achieving long-term reductions in socio-economic inequalities.

The labour productivity had no singificant influence on wage share of GDP. First, as mentioned earlier, Romania has a large public sector. Public sector wages are often determined by government budgets and policies, not necessarily by productivity gains. This can disconnect wages from productivity growth in the overall economy. Second, public sector wage increases in Romania was focused on catching up to private sector wages or keeping pace with inflation, rather than directly reflecting productivity gains. This can inflate the wage share without a corresponding increase in national output. The result for Romania is contrary to the findings of Sharimakin et al. (2015) that demonstrated the capacity of more labour productivity to reduce income inequality in Nigeria in the period 1981-2013.

TABLE 6 - ARELLANO-BOND DYNAMIC PANEL-DATA ESTIMATIONS TO EXPLAIN WAGE SHARE BASED ON NUMBER OF HIGHER EDUCATION GRADUATES AND PUBLIC EXPENDITURE IN THE PERIOD 2014-2021 IN THE NUTS 3 ROMANIAN REGIONS

| **Variable** | **Model 1** | | | **Model 2 (robust variance estimator)** | | |
|---|---|---|---|---|---|---|
| | Coefficient | Calculated statistics | p-value | Coefficient | Calculated statistics | p-value |
| wage share in the previous year | 1.068*** | 14.63 | <0.01 | 0.962 | 7.76 | <0.01 |
| higher education graduates | 0.077* | 1.91 | 0.056 | 0.066** | 2.27 | 0.023 |
| public expenditure | 0.103** | 2.04 | 0.042 | 0.117* | 1.88 | 0.06 |
| labour productivity | - | - | - | 0.051 | 0.97 | 0.332 |
| constant | -2.565** | -2.32 | 0.02 | -3.409** | -2.18 | 0.029 |
| Arellano-Bond test for zero autocorrelation in first-differenced errors | - | - | - | Order 1 | -2.0949 | 0.0362 |
| | - | - | - | Order 2 | 0.99575 | 0.3194 |
| Sargan test | - | 28.15001 | 0.0136 | - | - | - |

Source: own calculations in MATLAB. Note: ***p-value<0.01, **p-value<0.05, *p-value<0.1

The model with robust variance estimator confirms the direct impact of public expenditure and number of higher education graduates on wage share. The test for second-order autocorrelation indicates non-correlation for the second order, which suggests that the model is not misspecified. Sargan test was applied for the first model to check for over-identifying restrictions. Since the p-value is less than 0.05, the conclusion states the lack of over-identifying restrictions.

The results could not be generalized for other countries since there are significant difference between states in terms of investment in education, quality of education, structure of public expenditure. The results presented in this section will be better discussed in the next section in terms of policy proposals.



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

## 5. CONCLUSIONS

The high-income inequality has become obvious in Romania since 1990, when the transition to a functional market economy has been made with many costs (Precupetu, 2013). The main findings reveal the direct influence of the number of higher education graduates and public expenditure on wage share. People with higher education tend to have higher salaries compared to those with lower education and contribute to higher wage share. More public expenditure generated more wage share of GDP, which reduced income inequality.

More policy recommendations for Romania based on research findings might be formulated. It is necessary to invest in education with a focus on skill development. The research confirms that a higher number of graduates translates to a larger wage share of GDP. However, the impact on income inequality is unclear. To ensure that this translates to reduced inequality, focus on education that equips graduates with relevant skills for the job market. It is also useful to develop collaborations with business enviroment to understand the skill needs and tailor educational programmes accordingly. This ensures graduates have the qualifications employers seek, allowing them to access higher-paying jobs and reduce income disparity. Moreover, Romania should promote regional educational equity. The research does not specify if the increase in graduates is concentrated in certain regions. It is necessary to invest in improving educational quality and access in all counties, especially those lagging behind. This will create a more geographically balanced workforce with higher earning potential, reducing regional income inequality (Bergh and Fink, 2008).

The relation between labour productivity and wage share is not significant because of the public sector wage policies. It is necessary to conduct public sector reforms that incentivize efficiency and productivity. This could involve performance-based pay structures that reward productivity gains and streamlining public services to eliminate redundancies and improve efficiency of spending.

It is necessary to improve the business practices. Businesses can improve their productivity by streamlining their operations, reducing waste, and improving communication and collaboration between workers.

Governments have to play a more significant role in enhancing labour productivity by creating a favourable economic environment for businesses. This includes policies that promote competition, reduce bureaucracy, and invest more in infrastructure.

Enhancing labour productivity is an important way to boost economic growth and improve living standards. By investing in education and training, adopting new technologies, and improving business practices,

governments and businesses can help to create a more productive workforce and a more prosperous economy.

Higher salaries for higher education graduates should ensure higher labour productivity, which should reflect in more economic growth. The government should support more investment in new technology and equipment. When businesses are able to produce more output and generate higher profits, they are more likely to invest in new equipment, technology, and facilities. This investment can lead to further increases in labour productivity and economic growth. New technologies can help businesses to produce goods and services more efficiently. Governments and businesses can support the adoption of new technologies by providing financial incentives and tax breaks. For example, the use of computers and robots can help to automate many tasks in the manufacturing and service industries. This will lead to increased output and lower prices for consumers.

The research suggests that increased public expenditure on social programmes reduced income inequality in Romania. It is recommended to continue prioritizing social programmes like unemployment benefits, minimum wage increases, and targeted welfare. These programmes directly benefit lower- and middle-income earners, promoting a more equitable income distribution. While increased public expenditure can be a tool, it is useful to ensure efficient use of funds. Romania should implement mechanisms to monitor and evaluate the impact of public spending on the wage share and income inequality. This will help identify areas for improvement and ensure that resources are directed towards programmes with the most significant beenficial impact.

Despite these results of high importance for Romanian regions, the study is subject to a couple of limitations. For example, only a few variables were introduced in the models because of limited data availability. The study employs only a dynamic panel data model to deals with the endogeneity. We considered the overall public expenditure without any classification by type of sector where the public funds were allocated. Therefore, spatial effects should be considered in a future work when spatial panel data models will be constructed. For robustness check, the analysis will be conducted also at national level. In a future study, the impact of public spending and education on income inequality at national level will be assessed.

The pre-market skills of the higher education graduates determine higher salaries in specific sectors like IT, pharmaceutical sector and construction and less wages in agriculture or wood sector. These pre-market skills have the capacity to influence the wage share.



Theoretical and Empirical Researches in Urban Management
Volume 20 Issue 1 / February 2025

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