

MACROECONOMIC DETERMINANTS OF LABOUR PRODUCTIVITY: AN EMPIRICAL ANALYSIS OF THE REPUBLIC OF NORTH MACEDONIA

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ABSTRACT

This study examines the determinants of labour productivity in the Republic of North Macedonia, with a particular emphasis on key macroeconomic variables such as gross investment, employment, workers' compensation, inflation, gross national income per capita, and human capital. Labour productivity is recognized as a pivotal indicator of labour market efficiency, and worker welfare, and a crucial driver of sustainable economic growth. Despite improvements in employment levels and reductions in unemployment, labour productivity in North Macedonia remains suboptimal, exhibiting stagnation and insufficient growth, especially when contrasted with increasing wages. Through the application of both correlation and regression analyses, this paper explores the strength and causal relationships between labour productivity and macroeconomic variables, highlighting their role in shaping national competitiveness and economic development. The findings align with both theoretical and empirical literature, reinforcing the significance of human capital, gross investment, and overall economic performance in driving productivity improvements. This study contributes to the discourse on structural challenges within North Macedonia's labour market and provides a basis for policy interventions aimed at fostering sustainable productivity growth and enhancing international competitiveness.

Keywords: *Labour market, Productivity of labour, Determinants.*

JEL classification: *J11, J20, J24.*

1. INTRODUCTION

The productivity of the factors of production constitutes a critical determinant of sustainable economic growth. Factor productivity accounts for a substantial proportion of the variation in GDP per capita across national economies. In assessing the characteristics and performance of the labour market, in addition to employment and unemployment as a basic indicator of labour market conditions and characteristics, labour productivity is one of the most significant indicators of labour market performance. Labour productivity not only provides valuable insights into the functioning of labour markets but also serves as a fundamental indicator of workers' material well-being and the prospects for sustainable rates of economic growth and development.

This study focuses on the concept of partial productivity, specifically labour productivity, as a core indicator of labour market performance in the Republic of North Macedonia. The level of labour productivity affects not only the competitiveness of national economies but also reflects the efficiency and effectiveness with which production factors are allocated (Samuelson and Nordhaus, 1995). Thus, sustained increases in labour productivity are essential for enhancing national economic performance and improving international competitiveness (Porter, 1990) (Krugman, 1994). In developing countries such as North Macedonia, labour productivity is generally characterized by relatively low levels and insufficient growth rates. These pronounced disparities in productivity, coupled with suboptimal growth rates, contribute to widening the gap between labour productivity in developed and developing countries. From 2015-2023, labour productivity in North Macedonia exhibited lower growth rates compared to the increase in real wages, particularly in sectors such as manufacturing, construction, and the public sector, where wage growth significantly exceeded average levels (World Bank, 2024). In this analysis, labour productivity is defined as the annual output per worker, representing a critical indicator of labour market performance in North Macedonia. This study concentrates on the macroeconomic variables influencing labour productivity, namely gross investment, employment, workers' compensation, inflation, gross national income per capita, and human capital. The selection of these variables as determinants of labour productivity is both theoretically sound and empirically grounded, as their causal relationships with productivity have been thoroughly examined in numerous studies (Verdoorn, 1998; Diewert and Nakamura, 2007; Fischer *et al.*, 2009; Cruz, 2023). Additionally, theoretical literature provides substantial support for the links between macroeconomic indicators and labour productivity (Romer, 1990; Hsieh and Klenow, 2010). Empirical analyses focusing on Southeast European countries, including North Macedonia, support the thesis that economic development, labour market characteristics, and price stability significantly influence labour productivity (Trpeski *et al.*, 2022; Trenovski *et al.*, 2023; Trpeski *et al.*, 2024).

This paper is structured as follows: the introduction addresses the relevance of the research topic and justifies the selection of the macroeconomic determinants. The subsequent section provides a review of the theoretical and empirical background, outlining key research contributions and the theoretical framework guiding the analysis. The methodology and data section presents a detailed description of the variables and methodological approach adopted in the study. The results section reports the findings from econometric, correlation, and regression analyses. Finally, the conclusion summarizes the key findings and their implications for policy and future research.

2. THEORETICAL AND EMPIRICAL BACKGROUND

The macroeconomic determinants analysed in this study—namely human capital, employment, workers' compensation, inflation, and Gross National Income (GNI) per capita—are recognized as key drivers of labour productivity from both theoretical and empirical

perspectives. Human capital is consistently linked to productivity improvements, as a more skilled workforce enhances efficiency and innovation. Employment trends provide insights into the labour market's absorptive capacity, though a trade-off between rising employment and stagnant productivity has been observed in certain sectors. Workers' compensation, particularly through the lens of efficiency wage theory, suggests that higher wages can incentivize productivity growth, while inflation's impact on labour productivity is debated, with perspectives ranging from cost-push to demand-pull dynamics. Finally, GNI per capita, as an indicator of economic development, reflects the broader relationship between economic progress and labour productivity, with higher levels of development fostering more productive labour environments.

Theoretical and empirical literature emphasizes the pivotal role of human capital in achieving sustainable increases in labour productivity, which is essential for achieving sustainable economic development (Temple, 1999; Fischer *et al.*, 2009). Empirical research consistently demonstrates a positive correlation between higher levels of human capital and the rate of labour productivity growth (Temple, 1999; Fischer *et al.*, 2009; Syverson, 2011). In addition to this direct relationship, several studies also investigate the effects of increasing human capital in contexts characterized by labour market disequilibria and significant disparities (Kahn, 2010). The Macedonian labour market continues to experience persistently high unemployment, low participation rates, and a pronounced mismatch between workers' skills and market demand. This misalignment hampers the optimal allocation of labour and results in the underutilization of human capital. The low degree of alignment between the supply and demand for labour, particularly due to skill mismatches, leads to suboptimal allocation of workers. Consequently, many individuals with higher education, qualifications, and skills are employed in positions that do not fully utilize their potential, thereby limiting overall productivity. This misallocation exacerbates the underutilization of human capital, which should otherwise play a crucial role in promoting sustainable productivity growth and enhancing labour market performance in North Macedonia. This, the inclusion of human capital as a key determinant of labour productivity, is well-supported by both theoretical and empirical framework (Syverson, 2011).

The inclusion of employment as a factor influencing labour productivity provides critical insights into the labour market's absorptive capacity, as well as its overall performance. Several empirical studies on the relationship between employment and labour productivity have concentrated on developed economies (Calligaris, 2023). In North Macedonia, despite the upward trend in employment in recent years, labour productivity has remained stagnant or even declining in certain sectors, suggesting that the labour market is absorbing non-productive employment. This trend indicates a potential trade-off between employment and productivity, where increases in employment occur at the expense of productivity, resulting in a rise in unproductive employment (Morris, 1958). Therefore, the inclusion of employment as a variable in the analysis is both justified and essential.

Regarding the relationship between workers' wages and labour productivity, this study examines both classical economic theories and the Keynesian approach, with a particular focus on efficiency wage theory. According to efficiency wage theory, causality flows from real wages to productivity, positing that higher wages incentivize greater productivity by increasing the costs of job loss and enhancing worker motivation (Akerlof, 1984). Conversely, marginal productivity theory suggests that increases in labour productivity drive real wage growth (Snowdon and Vane, 2005). Classical economic thought asserts that wage levels follow the labour productivity trend (Mankiw, 2000), while efficiency wage theory contends that wages are set above equilibrium to enhance worker efficiency and reduce turnover and moral hazard (Mankiw, 2000).

A significant labour force deficit, combined with the considerable mismatch between workforce skills and labour market demand, contributes to low levels of labour productivity and weakens the relationship between productivity and workers' compensation (McGowan and Andrews, 2017). Empirical evidence from the Western Balkans, particularly after 2015, suggests a weak or nonexistent correlation between wage growth and labour productivity (Trenovski *et al.*, 2023). In North Macedonia, wage growth, particularly in the manufacturing, construction, and public sectors has outpaced labour productivity, further exacerbating the disparity between the two (World Bank, 2024). Therefore, workers' compensation, measured as the average monthly gross wage, is included as a variable in this analysis. Gross wages are included as an indicator of total worker compensation for two reasons. First, there is a lack of publicly available data on total compensation, including financial, material, and non-material benefits. Second, in the context of the Macedonian labour market, financial bonuses and tangible or intangible rewards remain rare, benefiting only a small portion of the workforce. Thus, the monthly gross salary is considered a realistic indicator of the total compensation of the average Macedonian worker and is therefore justified as a key variable in the analysis.

When analysing the causal relationship between labour productivity and the general price level in the economy, two primary theoretical postulates typically emerge, offering opposing views on the nature of this relationship. The first, the conventional theoretical conception, assumes a cause-and-effect relationship that originates in labour productivity and subsequently influences the inflation rate. It posits that changes in labour productivity directly impact the dynamics and level of inflation. According to this view, improvements in labour productivity reduce the likelihood of inflationary pressure. In other words, as labour productivity rises, firms can produce greater output with the same resources, exerting downward pressure on prices. This causality is referred to as the "cost-push perspective," wherein higher labour productivity reduces production costs, leading to lower product prices and, consequently, reduced inflation. The second, alternative theoretical perspective posits that the causal relationship runs from inflation to labour productivity, suggesting that changes in inflation levels significantly influence labour productivity. This perspective highlights the role of inflation in affecting real wages. Higher inflation erodes the purchasing power of wages, demotivating workers and increasing the likelihood of a decline in labour productivity. From this "demand-pull perspective," inflationary pressures negatively impact labour productivity (Akerlof, 1984; Snowden and Vane, 2005). Empirical research on Western Balkan countries points to the existence of short-term causality between wages and labour productivity (Slaveski and Kozheski, 2024).

Gross National Income (GNI) per capita, a key macroeconomic determinant included in this analysis, reflects the level of economic development and the purchasing power of a country's population. Several empirical studies examining the relationship between GDP per capita and labour productivity are based on the assumption that higher levels of economic development exert a direct influence on labour productivity (Syverson, 2011). A higher degree of economic development suggests a more advanced technical-technological infrastructure, which leads to a shift in the production structure, favouring sectors that generate higher value-added products (Verdoorn, 1998; Macdonald, 2010).

3. METHODOLOGY AND DATA

To examine the causal relationship between specific macroeconomic indicators and labour productivity, one of the key indicators of labour market performance in North Macedonia for the period 1992–2022, a regression analysis was conducted using the ordinary least squares (OLS) method. The logarithmic value of labour productivity, represented as output per worker, serves as the dependent variable in the regression model. The independent variables in the

regression analysis include human capital, gross capital formation, employment, workers' compensation, inflation, and gross national income per capita. Table 1 below provides a detailed description of these variables.

Table 1: Description of variables

Variable	Definition and description of variables	Source
Labour productivity	Labour productivity represents the total output (measured in gross domestic product, GDP) produced per unit of labour (measured by the number of employed persons) over one year. It measures the efficiency of resource utilization in the economy to produce goods and services. Labour productivity serves as an indicator of the economy's competitiveness and labour market performance.	International Labour Organization (ILO) database
Human capital	The human capital index reflects the level of human capital in North Macedonia. It is based on the human capital a child born today can expect to attain by age 18, considering health and educational risks. This index highlights the effects of improvements in health and education systems on future labour productivity.	World Bank database
Gross capital formation	Gross capital formation (gross investment) includes all expenditures on fixed assets in the economy, along with net changes in inventory levels. Investments in fixed assets include investments in land, plant, machinery, and equipment, as well as infrastructure projects such as roads, railways, schools, hospitals, industrial facilities, and residential complexes.	World Bank database
Employment	Employment is defined as individuals capable of working who, during a specified reference period, were engaged in any activity related to the production of goods or provision of services for compensation or profit. The employment rate is the ratio between individuals engaged in formal, paid productive activity and the total working-age population.	International Labour Organization (ILO) database
Workers' compensation	Workers' compensation is represented by the annual average of workers' monthly gross wages. Gross wages consist of net wages received by employees plus contributions for social security, health insurance, and pensions.	State Statistical Office Database
Inflation	Inflation is the annual percentage change in the general price level, represented by the Consumer Price Index (CPI).	World Bank database
Gross national income per capita	Gross national income per capita is the sum of GDP and net income from abroad (dividends, interest, and profits), divided by the population. It serves as an indicator of economic well-being, representing the annual income per capita.	World Bank database

(Source: Authors' contribution)

To analyse the individual relationships between labour productivity and various macroeconomic indicators, five regression estimations using the ordinary least squares (OLS) method are employed in this study. The use of the OLS method minimizes the sum of squared residuals, thus providing objective and unbiased estimates of the individual coefficients. Consequently, this method is deemed appropriate for examining the causal relationship between specific macroeconomic variables and labour productivity, as evidenced by its extensive application in the empirical literature (Kahn, 2010; Vergeer and Kleinknecht, 2010). The rationale for incorporating five separate and independent regression estimations lies in the need to analyse the individual causal effects of each independent variable on labour productivity, which is a fundamental indicator of labour market performance in North Macedonia. Each regression equation includes an additional independent variable to assess its impact on labour productivity. The regression estimates are presented below:

- (1) $\text{Log(Productivity of labour)} = \beta_0 + \beta_1 \text{Employment} + \beta_2 \text{Human Capital} + \varepsilon$
- (2) $\text{Log(Productivity of labour)} = \beta_0 + \beta_1 \text{Employment} + \beta_2 \text{Human Capital} + \beta_3 \text{Gross capital formation} + \varepsilon$
- (3) $\text{Log(Productivity of labour)} = \beta_0 + \beta_1 \text{Employment} + \beta_2 \text{Human Capital} + \beta_3 \text{Gross capital formation} + \beta_4 \text{Workers' compensation} + \varepsilon$
- (4) $\text{Log(Productivity of labour)} = \beta_0 + \beta_1 \text{Employment} + \beta_2 \text{Human Capital} + \beta_3 \text{Gross capital formation} + \beta_4 \text{Workers' compensation} + \beta_5 \text{Inflation} + \varepsilon$
- (5) $\text{Log(Productivity of labour)} = \beta_0 + \beta_1 \text{Employment} + \beta_2 \text{Human Capital} + \beta_3 \text{Gross capital formation} + \beta_4 \text{Workers' compensation} + \beta_5 \text{Inflation} + \beta_6 \text{Log(Gross national income per capita)} + \varepsilon$

In the model, β_0 represents the intercept coefficient, while $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ represent the coefficients associated with the individual independent variables. ε denotes the random error term in the model. To ensure the validity, objectivity, and impartiality of the results, diagnostic tests were conducted to detect the presence of autocorrelation, heteroskedasticity, and multicollinearity in the regression models. The potential presence of autocorrelation was assessed using the Breusch-Godfrey test (Stock and Watson, 2007). It is important to note that, in certain cases, autocorrelation in regression models may arise from the multiplicative and prolonged effects of individual independent variables included in the model. However, for the purposes of this analysis, the presence of autocorrelation is treated as problematic, as it may result in a spurious regression. The results of the Breusch-Godfrey test indicate that there is no significant autocorrelation among the residuals in the model. To assess heteroskedasticity—i.e., the presence of varying degrees of residual variance—White's test was applied. The results demonstrate that, at a 5% significance level, the assumption of homoscedasticity cannot be rejected.

Concerning the issue of multicollinearity among the independent variables in the model, it is important to note that when specifying the regression models—particularly in the selection of independent variables—there exists the potential for high multicollinearity. However, a certain degree of correlation between independent variables should not be considered problematic. In fact, it is both justified and logical, given that economic processes and relationships are inherently interconnected, making it practically impossible to have a complete absence of correlation between macroeconomic indicators. Therefore, the analysis of multicollinearity in the regression models is focused on identifying instances of high multicollinearity, specifically whether the independent variables are correlated to an extent that would compromise the stability of the model or result in a heightened degree of bias in the regression results. For this analysis, the degree of multicollinearity was assessed using the variance inflation factor (VIF).

The application of the VIF involves the formation of auxiliary regressions, where each independent variable is treated as a dependent variable and expressed as a function of all other independent variables. The results indicate that the observed degree of correlation among the variables does not undermine the stability of the model.

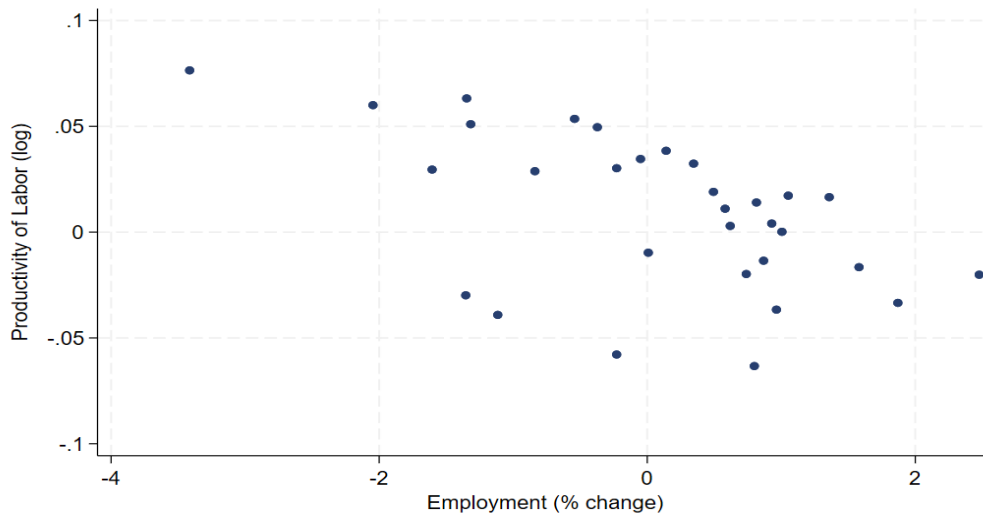
4. RESULTS

4.1. Results from correlation analysis

The analysis of the economy through the lens of the new structural economics employs a neoclassical approach to examine the impact of macroeconomic determinants on the performance and structure of national economies, as well as the prospects for establishing sustainable economic growth rates (Lin, 2011). This approach is based on the assumption that a country's economic structure is endogenous, meaning it is shaped by specific internal factors, and that the primary role of the state is to maintain macroeconomic stability while fostering an optimal business environment. This environment, in turn, provides the business sector with opportunities to leverage comparative advantages, enabling the efficient allocation of resources and the establishment of sustainable growth rates in labour productivity. In terms of labour market performance, particularly the relationship between macroeconomic determinants and worker productivity, this approach emphasizes the economic structure of the country. Labour productivity is influenced by various factors, including price stability, income levels, labour market characteristics and performance, employment characteristics, and the level of human capital (Limakunnas *et al.*, 2004; Winden and Reitsma, 2016). Among these labour market characteristics, the focus is particularly on the so-called dual labour markets, which are a common feature of developing countries. A key division in the labour market is between the formal and informal sectors. The formal labour market is typically associated with higher wages and labour productivity, largely due to better access to technology and capital. In contrast, the informal sector is characterized by lower wages, inadequate labour productivity, and a lack of access to additional capital. Consequently, labour productivity in North Macedonia is also influenced by the prevalence of informal economic activities and the informal labour market. This approach contrasts with classical economic thought, which emphasizes labour supply and demand, the presence of complete information, and the flexibility of economic agents operating under perfectly competitive conditions as the basis for determining workers' wages.

The results of the correlation analysis provide valuable insights into the intensity and direction of the relationship between individual macroeconomic determinants and labour productivity, which is a fundamental indicator of labour market performance. The analysis reveals a low (0.1849) and statistically insignificant correlation coefficient between labour productivity and the employment rate. This suggests an absence of a significant relationship between labour productivity and employment, indicating that employment growth in North Macedonia does not have a statistically significant impact on changes in labour productivity. The scatter plot depicted in Figure 1 further illustrates a negative relationship between these two variables, showing that an increase in the employment rate is accompanied by a decrease in the logarithmic values of labour productivity. These findings suggest that rising employment in North Macedonia may be associated with a decline in labour productivity, indicating the presence of the phenomenon known as "unproductive employment" (Morris, 1958).

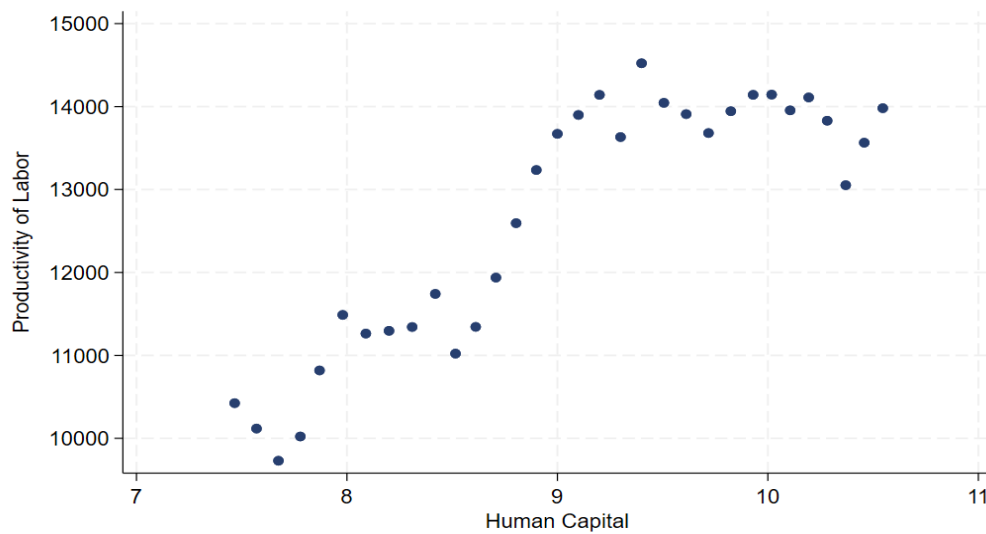
Figure 1: Correlation between labour productivity and employment



(Source: Authors' calculations)

The analysis of the positive relationship between labour productivity and other macroeconomic determinants reveals a statistically significant and positive correlation between labour productivity and changes in human capital, gross investment, workers' earnings, and the logarithmic value of gross national income per capita. Specifically, the correlation coefficient between human capital and labour productivity is 0.88, indicating a strong, positive, and statistically significant relationship between the two variables in North Macedonia. This positive correlation is visually represented by the scatter plot in Figure 2, which demonstrates that improvements in human capital are associated with increased labour productivity. The findings suggest that the growth of human capital has a substantial positive impact on labour productivity, particularly up to a human capital index level of 9 points. Beyond this level, further increases in human capital indices continue to have a positive, albeit less significant, impact on labour productivity. This positive relationship between human capital growth and labour productivity is consistent with numerous empirical studies that underscore the importance of human capital in enhancing productivity (Windén and Reitsma, 2004; Ezoji *et al.*, 2019). In their analysis of highly developed countries, Windén and Reitsma (2004) emphasize that the accumulation of human capital and improvements in labour force participation positively affect labour productivity. Additionally, empirical research highlights that increases in human capital, particularly in terms of improved educational and health indicators, have a significant positive impact on labour productivity. In conclusion, the empirical data on the relationship between labour productivity and human capital in North Macedonia are consistent with other studies analysing this relationship. Therefore, increasing investments in human capital, particularly in education and health, is expected to lead to long-term growth in labour productivity in North Macedonia.

Figure 2: Correlation between labour productivity and human capital

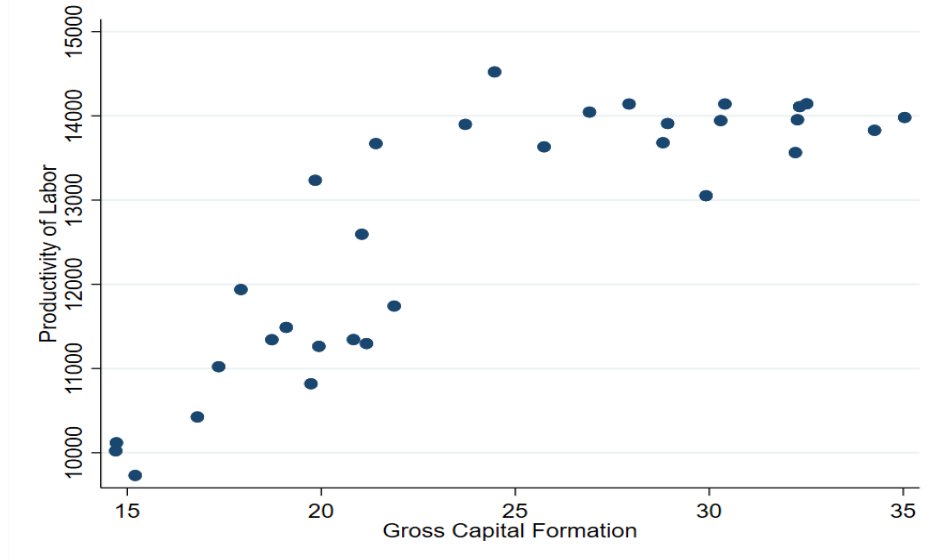


(Source: Authors' calculations)

Labour productivity is a critical factor in establishing and sustaining stable economic growth. The significant disparities in economic development between countries are largely attributed to variations in productivity levels, as well as the factors that influence it, such as human capital, technological progress, gross capital formation, and institutional efficiency (Mendez-Guerra, 2017). Gross capital formation, or gross investment, refers to the net inflow of resources directed towards the production of goods and the provision of services in the economy. This includes expenditures on physical capital, machinery, equipment, and infrastructure, forming the foundation for enhancing a nation's productive capacity. As such, gross capital formation is one of the key determinants of labour productivity. Increased investment leads to improvements in technology, expanded production capacities, and the creation of infrastructure, all of which enhance worker efficiency and production effectiveness. Empirical literature highlights the substantial contribution of gross investments, particularly in the public sector, to labour productivity, as well as their multiplier effects on private sector investments (Nourzad, 1995; Trpeski *et al.*, 2019). The results of the scatter diagram presented in Figure 3 indicate a positive relationship between gross capital formation and labour productivity. The distribution of data points suggests a strong correlation between these two variables in North Macedonia, reflecting the positive effect of physical capital investments on labour productivity. In other words, investments in physical capital have a beneficial impact on improving the efficiency and effectiveness of workers in the production process. However, the data distribution on the graph reveals that the correlation between gross capital formation and labour productivity is not entirely linear, with certain deviations observed. This suggests an incomplete transfer of the positive effects of increased gross capital formation on labour productivity, pointing to the existence of factors that limit labour efficiency. According to the empirical literature, key constraints on labour productivity growth in developing countries include the level and quality of education, the technological base, and the alignment between workers' skills and job requirements—particularly those emerging from advanced technologies. Moreover, the sectoral composition of Gross Domestic Product (GDP) can significantly influence labour productivity levels. Certain sectors, by nature, are capital-intensive and tend to exhibit higher labour productivity due to increased investments in advanced technology, whereas labour-intensive sectors require substantially higher investments for labour productivity growth to match that of capital-intensive sectors.

In conclusion, the correlation analysis underscores that increased investments in gross capital—particularly in technology, infrastructure, and equipment—serve as a foundation for generating higher output per unit of labour, thereby contributing to enhanced labour productivity in North Macedonia.

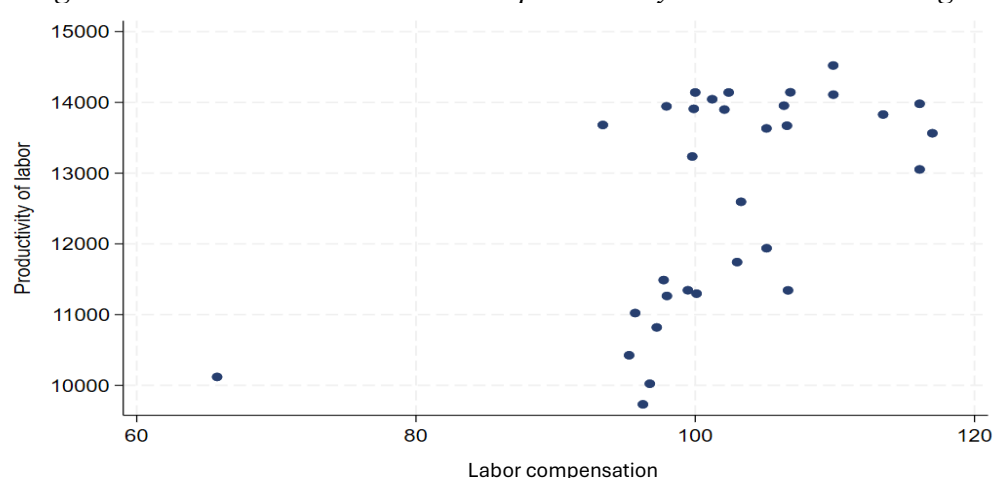
Figure 3: Correlation between labour productivity and gross capital formation



(Source: Authors' calculations)

The correlation coefficient between labour productivity and workers' earnings reflects the relationship between the output produced by workers and the compensation they receive in the form of wages. A coefficient value of 0.57, along with a statistically significant relationship, indicates a stable and positive connection between these two variables. However, both the value of the correlation coefficient and the scatter plot shown in Figure 4 suggest considerable potential for improving this relationship. Specifically, the scatter plot illustrates that the increase in labour productivity and the movement of workers' compensation do not exhibit a proportional relationship. While a positive correlation exists, there remains scope to strengthen this connection. These results imply that a significant portion of labour productivity growth is not adequately reflected in higher wages or other forms of financial compensation for workers.

Figure 4: Correlation between labour productivity and workers' earnings



(Source: Authors' calculations)

The relationship between labour productivity and inflation has been explored both through theoretical frameworks and empirical research (Akerlof, 1984; Freeman and Yerger, 2000; Snowden and Vane, 2005; Kumar *et al.*, 2012). Theoretical concepts generally emphasize that high inflation rates negatively affect labour productivity, primarily by reducing workers' purchasing power and disrupting price signals, which leads to suboptimal resource allocation and reduced efficiency and effectiveness. In the case of North Macedonia, the correlation coefficient between inflation and labour productivity is -0.42, indicating a negative and statistically significant correlation between these two variables.

Table 2: Results of correlation analysis

Correlation Probability	Log (Productivity of labour)	Employment	Human capital	Gross capital formation	Workers' compensation	Inflation	Log (Gross national income per capita)
Log (Productivity of labour)	1.0000						
Employment	0.1849 <i>0.3111</i>	1.0000					
Human capital	0.8818 <i>0.0000</i>	0.5312 <i>0.0018</i>	1.0000				
Gross capital formation	0.8452 <i>0.0000</i>	0.5794 <i>0.0005</i>	0.9494 <i>0.0000</i>	1.0000			
Workers' compensation	0.5685 <i>0.0007</i>	0.2475 <i>0.1721</i>	0.6658 <i>0.0000</i>	0.6083 <i>0.0002</i>	1.0000		
Inflation	-0.4180 <i>0.0240</i>	0.2306 <i>0.2288</i>	-0.3879 <i>0.0376</i>	-0.2533 <i>0.1848</i>	-0.2325 <i>0.2248</i>	1.0000	
Log (Gross national income per capita)	0.8666 <i>0.0000</i>	0.6450 <i>0.0001</i>	0.9602 <i>0.0000</i>	0.9454 <i>0.0000</i>	0.5694 <i>0.0007</i>	-0.1669 <i>0.3868</i>	1.0000

(Source: Authors' calculations)

Although this analysis does not delve into the causal relationship, the results align with established theoretical frameworks and correspond with relevant empirical studies. Specifically, the findings suggest that rising inflation, represented by an increase in the general price level—an indicator of price instability—coincides with a decline in labour productivity.

4.2. Results from regression analysis

To determine the causal relationship between specific macroeconomic indicators and labour productivity trends in the Republic of North Macedonia, a regression analysis was conducted using the Ordinary Least Squares (OLS) method. While the previously conducted correlation analysis provides insights into the intensity and direction of the relationship between macroeconomic indicators and labour productivity, applying regression analysis is deemed essential for assessing the performance of the Macedonian labour market, particularly in establishing causality. Table X presents the results of five regression estimations, which include

additional independent variables—namely, additional macroeconomic determinants of labour productivity—thus enhancing the robustness of the regression analysis.

The results of the first regression model indicate that human capital exerts a positive and statistically significant impact on labour productivity growth. Specifically, the coefficient for the human capital variable is 0.14, suggesting that a 1% increase in human capital, on average, leads to a 0.14% increase in labour productivity, *ceteris paribus*. Additionally, this regression model incorporates employment as one of the key determinants of labour productivity dynamics. The results for the employment variable reveal a statistically significant, negative relationship between employment growth and labour productivity. In particular, the findings show that a 1% increase in employment corresponds to a 0.1% decline in labour productivity. This outcome confirms earlier findings that the Macedonian labour market absorbs "non-productive employment," implying that the expansion of employment includes workers whose participation reduces overall labour productivity.

The second model builds upon the previous regression model by incorporating gross capital formation (gross investment) as an additional independent variable. The regression results indicate a statistically significant causal relationship between gross investment and labour productivity. Specifically, the coefficient for gross investment is 0.0082367, suggesting that a 10% increase in gross investment, on average, leads to a 0.8% increase in labour productivity, *ceteris paribus*. Although the effect is moderate, gross investments exert a positive influence on labour productivity. In terms of other independent variables, human capital continues to exhibit a positive and statistically significant relationship with labour productivity, while employment maintains a statistically significant, inverse causal relationship with labour productivity. The adjusted coefficient of determination is 0.8951, indicating a good fit for the model and high explanatory power for the variability in labour productivity based on changes in the independent variables.

In the third model, workers' compensation is added as an independent variable. The results show a negative but statistically insignificant causal relationship between workers' compensation and labour productivity. Conversely, employment maintains a statistically significant and negative relationship with labour productivity, while human capital and gross investments continue to have a positive and statistically significant impact on labour productivity. The fourth model introduces inflation as an additional determinant of labour productivity. In this model, human capital and gross investment remain statistically significant and continue to show a positive association with labour productivity. Employment retains its statistical significance and reflects an inverse causal relationship with labour productivity, with a coefficient of 0.268671. Regarding inflation, the model identifies a statistically significant, yet weak, relationship with labour productivity, indicating that changes in inflation do not substantially influence labour productivity trends.

Table 3: Results of the conducted regression analysis using the method (OLS)

Estimation	Metric	Employment	Human Capital	Gross capital formation	Workers' compensation	Inflation	Log(Gross national income per capita)	Constant	Adjusted R ²
(1)	Coef. p-value	- .0124 702 0.000	.144467 9 0.000					8.61166 6 0.000	0.882 0
(2)	Coef. p-value	- .0138 394 0.000	.095395 6 0.001	.008236 7 0.040				8.90858 5 0.000	0.895 1
(3)	Coef. p-value	- .0142 71 0.000	.107178 2 0.000	.007953 5 0.045	- .001388 8 0.201			8.96717 5 0.000	0.897 7
(4)	Coef. p-value	- .0268 671 0.000	.154335 3 0.000	.008918 6 0.012	.000503 6 0.700	.004395 9 0.000		8.77619 6 0.000	0.914 0
(5)	Coef. p-value	- .0212 218 0.000	- .037191 8 0.060	.003027 8 0.034	.000925 6 0.074	- .000202 9 0.706	.829625 8 0.000	3.58424 8 0.000	0.917 5

(Source: Authors' calculations)

The fifth regression model, the most comprehensive within this analysis, includes the following independent variables: employment, human capital, gross investments, workers' compensation, inflation, and the logarithmic value of gross national income per capita. For employment, the regression coefficient of -0.0212218 indicates a statistically significant negative impact on labour productivity, suggesting that an increase in employment results in a further decline in labour productivity. Additionally, the coefficient for human capital is -0.0371918, suggesting a negative association between human capital and labour productivity in this model. However, it should be noted that this relationship loses its statistical significance at the 95% confidence level. In contrast, gross investments (gross capital formation) maintain their statistical significance and exhibit a positive impact on labour productivity. At the 95% significance level, the workers' compensation and inflation variables are found to be statistically insignificant. The logarithmic value of gross national income per capita demonstrates a strong positive effect on labour productivity (coefficient = 0.8296258, p-value = 0.000), which significantly increases the adjusted coefficient of determination. This highlights that the model explains nearly 92% of the variability in labour productivity.

4.3. Discussion of the results of the regression analysis

The regression models presented in this analysis provide a comprehensive overview of the causal relationships between key macroeconomic determinants and labour productivity, which is a critical indicator of labour market performance in North Macedonia. The analysis includes five models, each incorporating different combinations of independent variables (employment,

human capital, gross capital formation, workers' compensation, inflation, and gross national income per capita) to assess their impact on the dependent variable, labour productivity. Below is a summary of the significance of individual variables in determining labour productivity.

With respect to human capital, this variable consistently exhibits a strong, positive, and statistically significant relationship with labour productivity, particularly in the first three models. These findings underscore the importance of investments in education, healthcare, and the development of skills and qualifications, which collectively enhance the overall quality of human capital. The statistical significance of human capital in models (1) through (4) suggests that it plays a critical role in determining labour productivity. However, in the final regression model (5), its significance diminishes, primarily due to the inclusion of other variables such as gross national income per capita, which absorbs some of the explanatory power that human capital held in previous models.

Employment, as an independent variable, demonstrates a statistically significant negative impact on labour productivity across all models. Although this finding contradicts conventional economic theory, which suggests that higher employment levels typically enhance productivity, the characteristics of employment in the Macedonian labour market reveal a trend of increasing employment accompanied by stagnant or declining labour productivity. This negative coefficient reflects the "quality" of additional employment, specifically the phenomenon of "unproductive employment," which reduces overall labour productivity. A considerable proportion of employment is concentrated in sectors such as agriculture, manufacturing, services, and retail, which produce low-value-added goods and are characterized by low efficiency, thereby contributing to the negative relationship between employment growth and labour productivity.

Moreover, the structure of employment is a significant constraint on higher labour productivity growth rates. A substantial portion of workers in the Macedonian labour market have either no formal education or only primary education. Additionally, there is a significant mismatch between workers' qualifications and the skills demanded by the labour market, further hindering productivity growth. The severe labour force deficit results in the employment of workers in roles for which they lack adequate qualifications, a key factor limiting the establishment of sustainable labour productivity growth rates.

Gross investments, represented by the independent variable gross capital formation, demonstrate a positive and statistically significant effect on labour productivity in North Macedonia. This relationship aligns with other empirical studies and theoretical postulates, which emphasize the importance of capital investments in enhancing productivity and promoting economic growth. However, in the case of North Macedonia, while the effects of gross investments on labour productivity are positive, they are not fully transmitted to employment and overall labour productivity. Specifically, the incomplete transfer of the positive effects of gross investments is attributed to the insufficient multiplier effect these investments generate within the Macedonian economy. Apart from primary employment, often resulting from public investments, particularly long-term infrastructure projects—there is a lack of multiplier effects on additional labour hiring and economic activities. Some empirical studies analysing public expenditure in North Macedonia conclude that public spending has a negative multiplier effect, contributing to a reduction in economic activity and crowding out private-sector investment (Filipovski *et al.*, 2016).

The relationship between workers' earnings and labour productivity is a fundamental indicator of labour market performance and reveals the extent to which the benefits of labour productivity growth are shared with workers. Labour productivity reflects the total output produced per unit of labour over a given period, while workers' compensation represents the earnings received on that basis. This relationship offers insight into the share of wages in the distribution of total income. In North Macedonia, the data suggest that increases in workers'

compensation negatively impact labour productivity. This outcome is primarily due to the fact that rising compensation translates into higher labour costs for companies, particularly when labour costs constitute a significant portion of total production expenses. If wage growth outpaces labour productivity growth—leading to higher costs per unit of output—this may result in higher prices for final products, potentially creating inflationary pressure.

Regarding the impact of inflation—or price stability—on labour productivity, the regression analysis suggests that inflation does not play a significant role in determining labour productivity. Over the past decade, labour productivity in North Macedonia has exhibited low and insufficient growth, while the economy, except for the COVID-19 pandemic (2020–2021) and the global financial crisis (2008–2009), has been characterized by price stability. Thus, the combination of low productivity growth and stable inflation rates during most of the analysed period points to a weak or insignificant causal relationship between these two indicators.

In summary, the results of the separate regression estimations highlight the significant influence of human capital, gross investments, and gross national income as key determinants of labour productivity. These findings align with relevant empirical research that underscores the positive impact of human capital and gross investments on labour market performance (Fischer *et al.*, 2009; Trpeski *et al.*, 2024). Conversely, the negative impact of unemployment on labour productivity suggests inefficiencies in resource allocation and structural weaknesses within the labour market, leading to the underutilization of the economy's most crucial resource—human capital.

5. CONCLUSION

The analysis conducted through Ordinary Least Squares (OLS) regression models has provided valuable insights into the causal relationships between key macroeconomic determinants and labour productivity in the Republic of North Macedonia. While the correlation analysis offered a preliminary understanding of the intensity and direction of these relationships, the regression analysis was crucial in establishing causality and assessing the overall performance of the labour market.

The findings of the analysis highlight the significant positive impact of human capital, gross investments, and gross national income per capita on labour productivity. These results emphasize the importance of investing in education, healthcare, and skill development, as these factors collectively enhance human capital, which in turn plays a vital role in improving labour productivity. Moreover, gross investments, particularly in infrastructure and technology, were found to positively influence productivity, although their full impact was not entirely transferred to the broader labour market due to limited multiplier effects within the economy.

The negative relationship between employment growth and labour productivity, as observed in all regression models, reveals structural weaknesses in the labour market. The phenomenon of "unproductive employment" and the concentration of labour in low-efficiency sectors such as agriculture and retail suggest that additional employment does not necessarily lead to higher productivity. Furthermore, the high proportion of workers with low educational attainment and the mismatch between worker qualifications and labour market demands have been identified as significant constraints on achieving sustainable labour productivity growth.

Although the data indicates a negative relationship between rising workers' compensation and labour productivity, this outcome is likely attributable to the increased labour costs that contribute to higher overall production expenses and exert inflationary pressures on the economy. This finding suggests that wage growth, when not aligned with corresponding increases in productivity, can lead to cost inefficiencies, thereby reducing the overall competitiveness of firms. Moreover, the results indicate that inflation, or the prevailing level of price stability, does not exert a significant influence on labour productivity. This is

particularly true in the case of North Macedonia, where inflation rates remained relatively stable during the majority of the analysed period, thus mitigating any potential impact on the productivity of labour.

Despite a significant reduction in the unemployment rate and a corresponding increase in employment in recent years, the labour market in the Republic of North Macedonia remains far from equilibrium. Labour productivity has stagnated over a long period of time, with some sectors even experiencing declines. The simultaneous rise in employment alongside declining labour productivity suggests that the labour market in North Macedonia is operating sub-optimally, reflecting inefficiencies in the allocation of labour resources and broader structural issues within the economy.

In conclusion, the findings of this analysis are consistent with relevant empirical research, which underscores the critical role of human capital and gross investments in improving labour productivity and enhancing labour market performance. However, structural inefficiencies and the underutilization of human capital in the Macedonian labour market continue to pose significant challenges that must be addressed to achieve sustainable productivity growth and foster long-term economic development.

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