

Employment in the public sector and its impact on the economic performance of V4 countries

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Abstract: The aim of this study is to analyze the impact of public sector employment on the economic performance of the Visegrad Four (V4) countries—the Czech Republic, Hungary, Poland, and Slovakia—over the period from 2010 to 2023. The research specifically focuses on employment in key public service sectors, including public administration, defense, education, healthcare, and social services. These sectors are examined in relation to three fundamental macroeconomic indicators: Gross Domestic Product (GDP), Gross Value Added (GVA), and collective government consumption. A quantitative research approach was adopted, utilizing comprehensive data from Eurostat. The methodology includes time series analysis, descriptive statistics, regression and correlation analysis, as well as ANOVA tests to assess the statistical significance of the observed relationships. The findings reveal a consistently strong and positive correlation between the number of public sector employees and the selected macroeconomic indicators across all four countries. This suggests that public sector employment plays a significant role in supporting and potentially enhancing economic performance. The study addresses a notable research gap, as most existing literature tends to focus on national-level analyses and often overlooks the broader, comparative perspective. Furthermore, the role of the public sector as a direct contributor to economic value creation is frequently underrepresented in economic discourse. By offering a cross-country comparison, this research contributes a novel viewpoint on how public employment influences economic outcomes. In addition, the study lays the groundwork for future research, particularly in exploring how ongoing trends such as digitalization and the integration of artificial intelligence may reshape employment structures and productivity within the public sector. These developments could have profound implications for both employment policy and economic strategy in the V4 region.

Keywords: GDP, value added, public sector, economic performance, collective government consumption

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Introduction

In recent decades, new technological innovations, sustainable and intensive growth, as well as the integration of digitalization and artificial intelligence into both manufacturing and non-manufacturing processes, have been actively promoted as potential drivers of improved economic performance. Governments have sought to implement these elements within the public sector, particularly in public administration. Currently, the most influential factors reshaping the trajectory of economic performance include ongoing climate change, the Industry 4.0 and 5.0 industrial revolutions, the global COVID-19 pandemic, and the war in Ukraine. Nevertheless, GDP remains the primary metric for accurately assessing economic performance and facilitating international comparisons.

In this study, we also aim to highlight changes in the generation of gross value added (GVA) within the public sector, which includes the NACE Rev. 2 categories: public administration, defense, education, human health, and social work activities. The evolution of GVA serves as a relevant indicator of the sector's contribution to GDP. Another key indicator in our analysis is the level of collective government consumption. When compared with public sector employment figures, these indicators provide insight into how various governments managed the critical economic developments following the financial and economic crisis, the effects of which persisted until 2010—the starting point of our analysis.

The entire period under review is marked by the implementation of digitalization in work processes. There are frequent reports suggesting that the introduction of digitalization and artificial intelligence will lead to job losses in the public sector, particularly in public administration. AI is especially applicable to roles that do not require a high level of formal education, involve limited social interaction, and are based on routine, repetitive manual tasks. On the other hand, it is important to note that digitalization also creates new jobs. It will primarily lead to changes in job requirements, with workers needing to acquire new skills and competencies.

In addition to digitalization, the period under study is shaped by the COVID-19 pandemic and the war in Ukraine. COVID-19 disrupted global economies by restricting the movement of people and goods—both domestically and internationally—resulting in significant changes in unemployment and GDP. The ongoing pandemic, which began in 2020, continues to have a global impact on National economies. Early forecasts during this crisis were highly pessimistic, with some predicting a more severe economic downturn than in 2009. Since the onset of the pandemic, large numbers of people—particularly in industrial sectors—have lost their jobs (Beckman et al., 2021). Based on these circumstances, one might assume that the V4 governments reduced public sector employment and implemented spending cuts, thereby increasing value added through the digitalization of services and processes. However, as demonstrated in the analytical section of this study, the opposite is true: public sector employment in the V4 countries increased throughout the 2010-2023 period.

1. Literature review

Most studies examining the impact of public sector employment on economic performance focus on the national level and assess developments primarily through GDP as a measure of the overall economy (Qamruzzaman et al., 2021; Demir, 2021; Gómez-Puig, 2018; Liu et al., 2024; Jansen et al., 2024). Our study, however, focuses on analyzing and comparing employment and its impact on the performance of the V4 economies in an international context.

The COVID-19 pandemic posed major challenges to the labor market, revealing significant disparities across regions, sectors, and social groups. As Barrot et al. (2020) demonstrate, the pandemic underscored the need for investment in resilient economic structures and technological innovation. Moreover, it highlighted the importance of inclusive policies to support vulnerable worker groups and ensure a balanced economic recovery.

The pandemic not only disrupted local labor markets but also had a profound impact on global supply chains. As Bălăsoiu (2021) notes, many companies relocated production capacities closer to domestic markets to reduce reliance on foreign partners. This shift, driven by the need to maintain supply stability amid mobility restrictions, boosted local employment in technologically advanced regions but also widened the gap between developed and less developed economies—many of which were already vulnerable before the pandemic. Olhager and Harfeldt-Berg (2024) analyze longitudinal data from Sweden (2010-2015 vs. 2020-2022) and confirm that the pandemic led to a decrease in offshoring and an increase in backshoring of industrial capacity in high-tech environments. This study offers empirical insight into how firms moved production back “closer to home”.

Addressing this new reality requires more than identifying problems; it demands innovative approaches, solutions, and policies capable of meeting emerging challenges and supporting the labor market. In this context, a thorough examination of the current state of employment and other factors influencing economic performance beyond 2020 is essential.

The sharp decline in economic activity triggered by pandemic-related uncertainty had a significant impact on the labor market (Claveria & Sorić, 2023). There is a positive relationship between consumer confidence and subsequent consumption, with the effect being most pronounced among individuals with high socioeconomic status (Hampson et al., 2021). The International Labour Organization has also emphasized that the convergence of various macroeconomic trends has created uncertainty about whether the decline in working hours, employment, and labor force participation is temporary or indicative of a more structural shift toward labor-saving transformations (World Employment and Social Outlook, 2022).

In response to these dramatic changes, the post-2020 labor market has begun transitioning toward greater flexibility—particularly through hybrid work models and the growing acceptance of remote work. These new models have reduced employees’ dependence on traditional workplaces and enabled businesses to continue operations during pandemic-related restrictions. Another notable shift is the rising demand for skills in areas such as information technology and digital literacy, which have proven essential for adapting to the digital economy (Arandas et al., 2024).

Another factor that has not yet led to a significant decline in public sector employment is artificial intelligence (AI). AI is increasingly becoming an integral part of various aspects of human activity. Its presence is evident not only in the technological domain but also in everyday human-machine interactions. According to Balogová (2022), modern AI systems are used for facial, speech, and image recognition, as well as for analyzing emotions and other expressions of social intelligence. These capabilities allow AI to be applied across sectors—from logistics to decision-making processes that affect people's lives, such as court proceedings, offender assessments, and social welfare decisions.

Today, every citizen should possess basic digital skills to function effectively in modern society (Spante, 2018; Mattar et al., 2022; Zhao et al., 2021). The European Commission recognizes this challenge and is actively pursuing various initiatives to promote digital literacy among citizens, aiming to enhance Europe's competitiveness. These initiatives focus on research, funding, and education and are crucial for advancing digitalization at all levels (Lopez-Meneses et al., 2020).

Although several studies have explored the potential of digitalization in production processes (Crawford-Visbal, 2020; Guzmán-Simón et al., 2017; Kim et al., 2018), they have not been directly linked to the public sector. This topic has yet to be thoroughly examined from a business-oriented perspective.

2. Research methodology

In the course of this study, we employed several research methods appropriate to the study's objectives and the nature of the problem under investigation. The aim of the study is to identify the impact of public sector employment—specifically in the areas of public administration, defense, education, human health, and social work activities—on economic performance, as measured by GDP, gross value added (GVA), and collective government consumption.

The study focuses on the development of these key indicators, tracking their evolution from 2010 to 2023. Particular emphasis is placed on quantitative analysis and the verification of relationships between variables, which enables the confirmation of the following hypotheses:

H1: There is a statistically significant relationship between the number of employees in the public sector and the value of GDP.

H2: There is a statistically significant relationship between the number of employees in the public sector and the value of gross value added.

H3: There is a statistically significant relationship between the number of employees in the public sector and the level of collective government consumption. We worked with quantitative data obtained from Eurostat, covering the period from 2010 to 2023. Several analytical methods were applied to process these data.

As a primary tool, we used time series analysis, which allowed us to observe the development of selected indicators over time. To describe and compare trends, we applied descriptive statistics, calculating average values, percentage changes, and absolute differences between periods. The results were presented using both Chartical and tabular formats. To verify the relationships between variables, we employed regression analysis. Regression models were constructed based on the

dataset and evaluated using the p-value, coefficient of determination (R^2), and regression slope. Finally, we conducted a synthesis of the analytical results, which enabled us to draw overall conclusions and assess the validity of the tested hypotheses.

We first carried out a correlation analysis (1), using Pearson's correlation coefficient for the calculations.

$$r_{xy} = \frac{n \sum_{i=1}^n x_i y_i - \sum_{i=1}^n x_i \sum_{i=1}^n y_i}{\sqrt{[n \sum_{i=1}^n x_i^2 - (\sum_{i=1}^n x_i)^2][n \sum_{i=1}^n y_i^2 - (\sum_{i=1}^n y_i)^2]}} \quad (1)$$

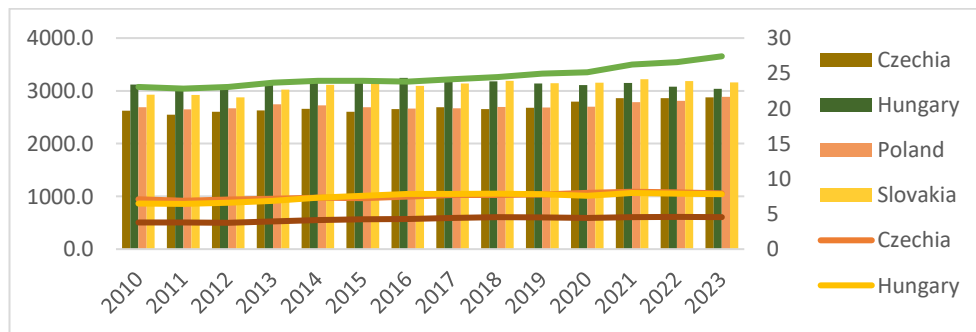
The Pearson correlation coefficient ranges from -1 to 1. A positive value indicates that the variables move in the same direction—both increase or decrease together. A negative value indicates that the variables move in opposite directions—when one increases, the other decreases. Based on the value of the correlation coefficient, we can assess the strength of the relationship, ranging from very weak ($r = 0-0.1$) to nearly perfect ($r = 0.9-1$). In addition to Pearson's correlation coefficient, we also calculated the coefficient of determination (r^2), which assesses the goodness of fit of the chosen model. We also performed a significance test (2) for the correlation coefficient to determine whether the observed relationship is statistically significant.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \quad (2)$$

3. Research results and discussions

The total number of employees in the public sector increased in all V4 countries over the 2010–2023 reference period. Specifically, the number of employees rose by 11.6% in the Czech Republic, 20.4% in Hungary, 18.9% in Poland, and 19.7% in the Slovak Republic. For illustration, Figure 1 presents the number of employees in the relevant sectors, along with their share in the total labor force.

Figure 1. Evolution of public sector employment and its share in the total labor force (2010–2023) (Thousands of persons / secondary axis in %)

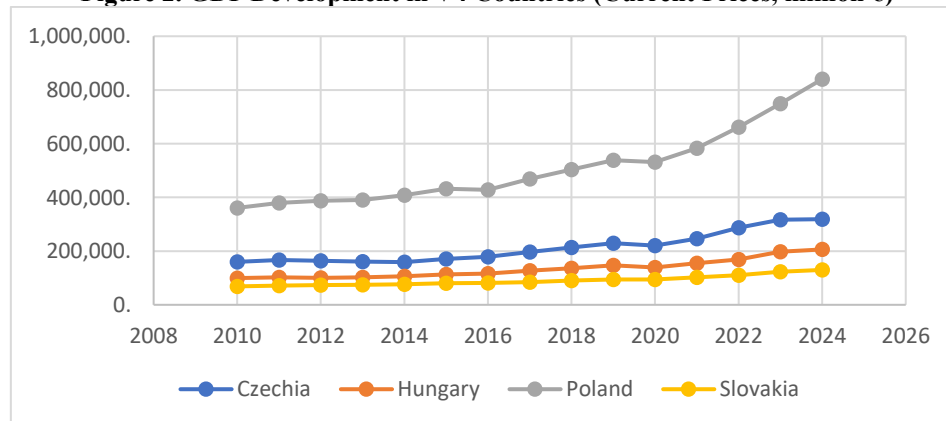


Source: Eurostat, Author's contribution

As shown in Figure 1, there were no significant differences in the share of public sector employees in the total workforce. On average, Hungary had the highest share at 23.6%, followed by Slovakia at 23.2%, Poland at 20.4%, and the Czech Republic at 20.2%. Both the number of employees and their share in the labor force showed an upward trend. The lowest employment levels were recorded in 2011 for Poland (3,042.5 thousand), Hungary (857.4 thousand), and the Czech Republic (917.5 thousand), and in 2012 for Slovakia (499.7 thousand). This confirms that public sector employment has been growing since the beginning of the observed period. Peak employment was reached in 2021 and 2022, with a slight decline in 2023 in all V4 countries except Poland. The median share of public sector employees in the labor force was: Czech Republic – 19.9%, Hungary – 23.6%, Poland – 20.2%, and Slovakia – 23.6%.

Figure 2 shows the development of GDP at current prices, a fundamental macroeconomic indicator of a country's economic performance. All countries experienced positive GDP growth throughout the observed period, except in 2020, when the COVID-19 pandemic caused a temporary decline. Growth resumed in subsequent years. Comparing the beginning and end of the period, GDP increased by 99.9% in the Czech Republic, 106.2% in Hungary, 132.7% in Poland, and 89.1% in Slovakia.

Figure 2. GDP Development in V4 Countries (Current Prices, million €)



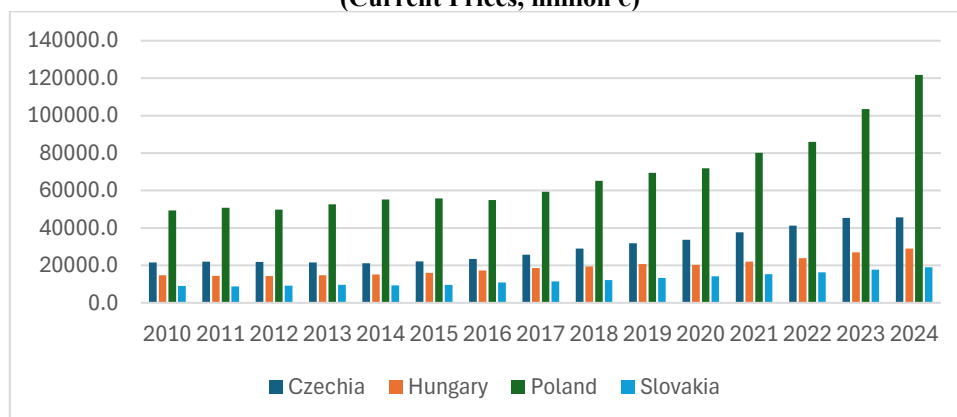
Source: Eurostat, Author's contribution

The relationship between public sector employment and gross domestic product (GDP) is an important aspect of economic analysis that can influence public policy decisions. Many authors have focused on research that analyzes how the public sector can contribute to economic growth and employment, and how these factors affect GDP. Petrovic et al. (2021) examined that an increase in public investment has a strong positive effect on output, employment, wages and consumption during periods of economic downturn. Studies on public services in the EU have shown that the efficiency of public spending in different areas of public services can have a significant impact on economic indicators such as GDP per capita and employment (Halaskova et al., 2018). Analyses in Italian regions show that investment in social

infrastructure has a positive and long-term effect on investment, GDP and employment, but the reduction of the gender employment gap is only evident in some regions (Reljic et al., 2025).

These trends indicate positive economic development across the V4 region. Given the study's focus on public administration, defense, education, human health, and social work activities, it is also important to monitor the gross value added (GVA) generated by these sectors. Figure 3 presents the development of GVA in the sectors under review.

**Figure 3. Development of Gross Value Added in the Public Sector
(Current Prices, million €)**



Source: Eurostat, Author's contribution

Just like GDP, GVA also showed a positive trend. Between 2010 and 2024, GVA increased by 111.4% in the Czech Republic, 97.5% in Hungary, 146.5% in Poland, and 111.7% in Slovakia. When analyzing the share of these sectors in total GDP, the values were relatively similar across the V4 countries: Hungary had the highest share at 14.3%, followed by the Czech Republic (13.8%), Slovakia (13.5%), and Poland (13.3%). Median values ranged narrowly from 13.39% (Poland) to 13.54% (Czech Republic) and 13.44% (Slovakia).

Table 1. Share of Public Sector GVA in Total GVA (2010–2023, %)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
CZ	14.9	14.6	14.8	15.0	14.7	14.4	14.5	14.5	15.1	15.4	16.7	16.8	15.8	15.6
HU	17.4	16.6	17.0	17.0	16.8	16.8	17.4	17.2	16.9	16.6	17.3	16.8	16.6	15.9
PL	15.6	15.2	14.5	15.2	15.2	14.5	14.5	14.4	14.7	14.6	15.3	15.8	14.6	15.3
SK	14.4	13.6	13.8	14.2	13.5	13.3	14.8	15.1	15.0	15.8	16.7	16.8	16.5	15.7

Source: Eurostat, Author's contribution

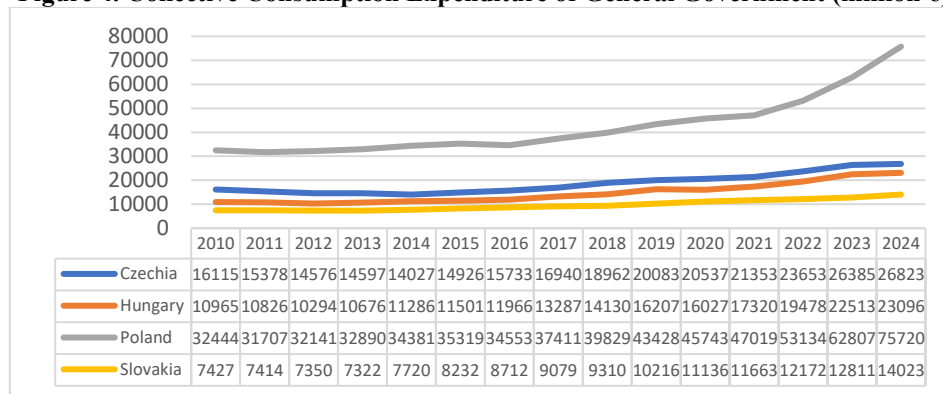
The data show no major differences in the evolution of the share of public sector GVA across countries, with variations narrowing toward the end of the period and differing by only tenths of a percent in 2023.

The relationship between public sector employment and gross value added (GVA) is a key subject of economic analysis, as it significantly shapes public policy decisions.

Several studies confirm that public sector employment can contribute positively to GVA by providing essential services, stabilizing employment, and supporting household income (Jagrič et al., 2021). However, some research points to a nonlinear relationship: Baerlocher (2022) suggests an inverted U-shaped effect, where moderate levels of public sector employment support economic growth, but excessive levels may hinder labour market flexibility and innovation. Similarly, Zikou et al. (2018) argue that an expanding public sector can crowd out regional entrepreneurship, negatively impacting regional economic dynamics. These findings underline the importance of balancing the size and efficiency of the public sector to maximize its contribution to GVA.

The final indicator analyzed is the collective consumption expenditure of general government. Despite the challenging economic environment in recent years, there was no dramatic increase in collective consumption in the V4 countries. The highest increase was recorded in the Czech Republic (60%), followed by Slovakia (53%), Hungary (47.5%), and Poland (42.8%). Figure 4 illustrates this development.

Figure 4. Collective Consumption Expenditure of General Government (million €)



Source: Eurostat, Author's contribution

In the next section, we examine the correlation between public sector employment and the observed indicators for each country individually. We used regression and correlation analysis to assess these relationships.

Table 2 presents the results of the correlation analysis for each indicator. Among the countries studied, Hungary is the only one that exhibits a moderate correlation across all indicators, with a correlation coefficient of 0.66 for collective government consumption and 0.77 for both GDP and gross value added. In contrast, the other countries demonstrated a strong correlation between public sector employment and the examined indicators.

Table 2. Correlation Analysis of Key Indicators in V4 Countries

<i>Czechia</i>	<i>EMPLOY</i>	<i>GDP</i>		<i>EMPLOY</i>	<i>Value added</i>		<i>EMPLOY</i>	<i>CC</i>
EMPLOY	1.00		EMPLOY	1.00		EMPLOY	1.00	
GDP	0.83	1.00	Value added	0.83	1.00	CC	0.83	1.00
<i>Hungary</i>	<i>EMPLOY</i>	<i>GDP</i>		<i>EMPLOY</i>	<i>Value added</i>		<i>EMPLOY</i>	<i>CC</i>
EMPLOY	1.00		EMPLOY	1.00		EMPLOY	1.00	
GDP	0.71	1.00	Value added	0.71	1.00	CC	0.66	1.00

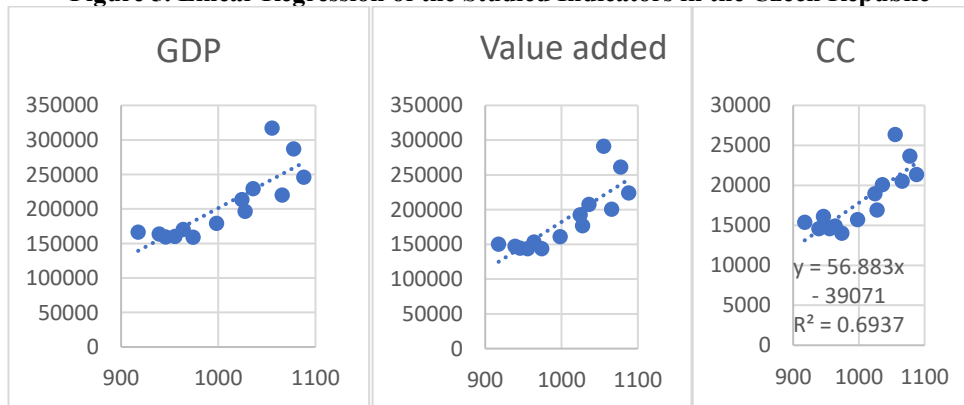
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<i>Poland</i>	<i>EMPLOY</i>	<i>GDP</i>		<i>EMPLOY</i>	<i>Value added</i>		<i>EMPLOY</i>	<i>CC</i>
EMPLOY	1.00		EMPLOY	1.00		EMPLOY	1.00	
GDP	0.98	1.00	Value added	0.98	1.00	CC	0.97	1.00
<i>SLOVAKIA</i>	<i>EMPLOY</i>	<i>HDP</i>		<i>EMPLOY</i>	<i>Value added</i>		<i>EMPLOY</i>	<i>CC</i>
EMPLOY	1.00		EMPLOY	1.00		EMPLOY	1.00	
HDP	0.83	1.00	Value added	0.82	1.00	CC	0.85	1.00

Source: Author's contribution

The following figures illustrate the linear relationships between the studied indicators under the conditions of the Czech Republic. As confirmed by the correlation table above, the detailed analysis also verified the dependence between the variables using the ANOVA test. In all cases, the resulting p-values were below 0.05, indicating statistically significant relationships.

Figure 5. Linear Regression of the Studied Indicators in the Czech Republic



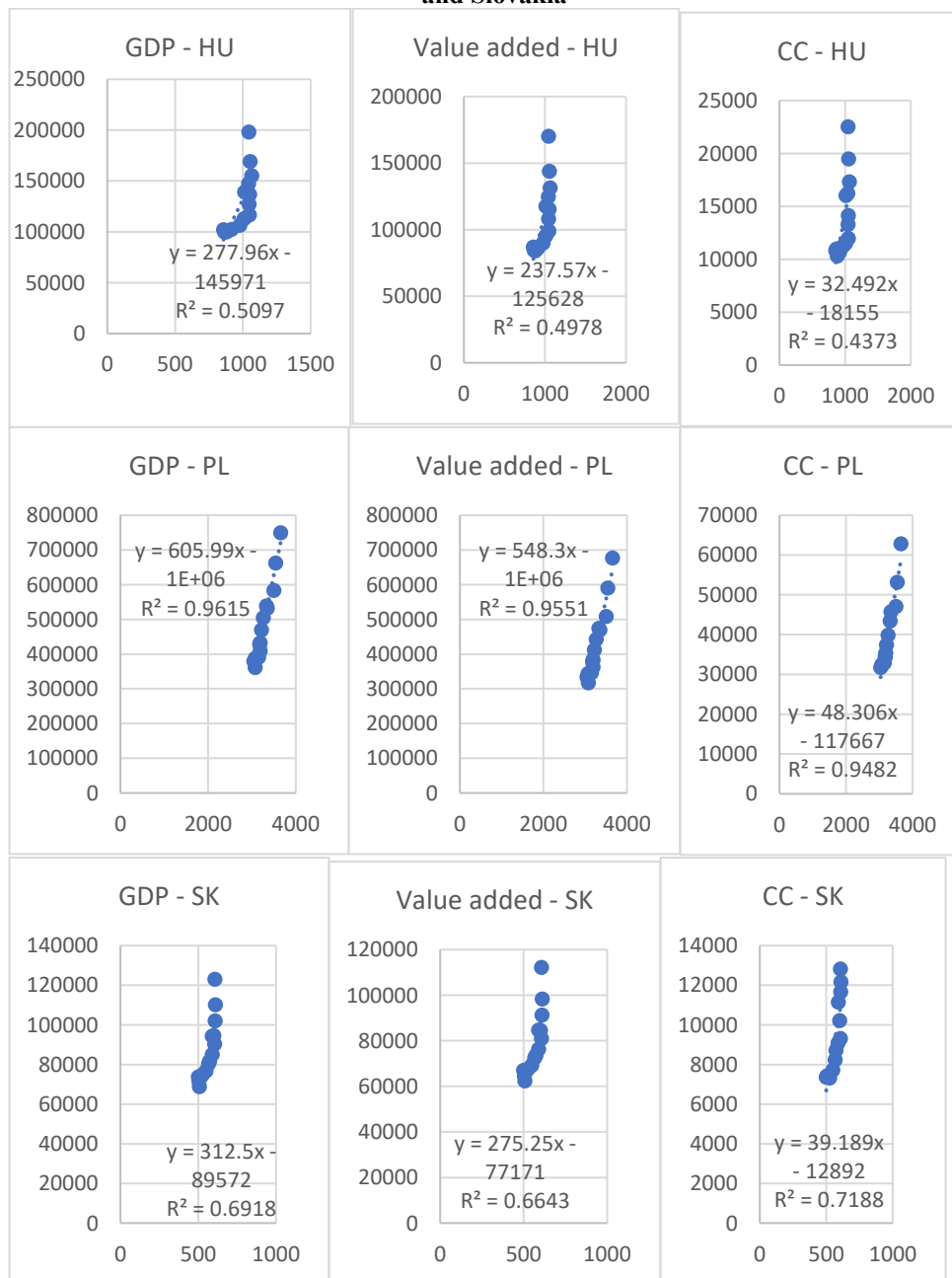
Source: Eurostat, Author's contribution

The interdependence between the studied indicators was also confirmed in the other V4 countries. Chart 6 presents all the linear regression equations derived from the analysis. With the exception of Hungary, the confidence levels for the regression models in each country were approximately 0.7. Poland stood out with a notably higher reliability, exceeding 0.94. Caponi and Nobili (2017) explicitly confirm the role of public employees in generating multiplier effects through increased government consumption. Faruque (2021) conducted a panel study involving 39 developing countries over the period 1990–2019, which confirmed a statistically significant and positive relationship between government final consumption and economic growth. Since government consumption includes public sector wages, the study implies that increases in public sector employment lead to higher levels of government spending. The author emphasizes that public sector employees significantly contribute to government consumption, which in turn stimulates overall economic activity. These findings support the hypothesis that the number of public sector employees is closely related to the level of collective government consumption.

As in the case of the Czech Republic, all hypotheses were verified through regression analysis. In every instance, the p-value was below 0.05, confirming a statistically significant relationship between the observed indicators and the number of

employees in the sectors of public administration, defense, education, human health, and social work activities.

Figure 6. Linear Regression of the Examined Indicators in Hungary, Poland, and Slovakia



Source: Eurostat, Author's contribution

These findings carry significant implications for economic policy-making, particularly in the areas of public employment and government expenditure. Given the confirmed correlation between collective consumption and GDP, it can be inferred that investments in public services—such as healthcare, education, and social care—generate a multiplier effect on overall economic performance. Public sector employees thus play a crucial role not only in service delivery but also in stimulating aggregate demand within the economy.

At the same time, it is essential to consider qualitative aspects of public administration. Efficient management of public resources and optimization of workforce size can enhance productivity and reduce inefficient spending. Future research should aim to expand the analysis by incorporating additional variables, such as employee education levels, institutional technological capacity, and regional disparities in public sector employment, which may influence the economic impact of government activities.

4. Conclusions

The number of employees in the public sector increased across all V4 countries throughout the observed period. A positive development was also seen in GDP growth, which occurred in every year except 2020, when the COVID-19 pandemic caused a temporary decline. Following that year, economic growth resumed. This GDP growth was underpinned by the positive development of gross value added (GVA). In Poland, the Czech Republic, and the Slovak Republic, GVA grew at a faster rate than GDP, while in Hungary, GVA growth lagged behind GDP growth. The results of the regression and correlation analyses confirmed a strong relationship between public sector employment and its potential impact on GDP, GVA, and collective government consumption. These findings provide a valuable foundation for further research in this area. Looking ahead, a decline in public sector employment is anticipated in many regions due to the increasing implementation of artificial intelligence and the digitalization of work processes. These changes will likely be introduced first within public administration and the broader public sector. However, current investments in digitalization and computerization have not yet had a significant impact on employment levels. This is supported by our analysis, which shows no decline in public sector employment over the past 15 years. The future effects of ongoing digitalization on employment trends and economic dynamics represent a promising area for further research. While digitalization poses a threat to certain jobs, it also creates new employment opportunities. It is therefore essential that the public sector invests in developing the digital skills of its workforce and that the education system is adapted accordingly. The objective of this study was achieved. The results of the regression and correlation analyses, supported by ANOVA testing, confirmed the validity of the proposed hypotheses. Hypotheses H1, H2, and H3 were all confirmed.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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