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a Magyar Tudomány Ünnepe alkalmából
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Sopron, 2025. november 6.
6 November 2025, Sopron

FEJLŐDÉSI PÁLYÁK ÉS ÚJ TÖRÉSVONALAK A FENNTARTHATÓSÁGI ÁTMENET IDŐSZAKÁBAN

DEVELOPMENT TRAJECTORIES AND NEW DIVIDES IN TIMES OF SUSTAINABILITY TRANSITIONS

Szerkesztők / Editors:
RESPERGER Richárd, SZÉLES Zsuzsanna, TÓTH Balázs István

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Investigation of Differences in Labour Productivity Between the Visegrád Group Countries (V4) Compared to Germany and the Impact on Their Workers' Wages

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Abstract:
This research article analyses the productivity levels achieved by the Visegrád Group countries, also known as V4, in recent years (2015–2024), and whether this productivity is reflected in better remuneration for the working population. The official data source used was the 'Labour Productivity and Unit Labour Costs' data from the website of the Statistical Office of the European Union (Eurostat). To this end, a statistical comparative analysis between this group of countries and Germany was carried out using parametric hypothesis tests, as the data for each variable followed a normal distribution, according to the Shapiro–Wilk test performed on the variables ($p > 0.05$). The hypothesis tests performed include the t-test for paired samples and Pearson's correlation analysis. The result of this statistical analysis (pValue = 0,005) showed that the Visegrád Group does indeed have a higher level of labour productivity than Germany. This level continues to rise over time, widening the gap between the two comparison groups (p = 0,984; high significant pValue = 2,7315E-7). It was also demonstrated that wage levels in the V4 countries were higher (p = 0,910122; pValue = 0,000256) than in Germany (p = 0,773000; pValue = 0,008782), allowing us to conclude that the group of countries with the highest productivity also offered the best wage conditions for their workers.

Keywords: productivity, works wages, Visegrád Group, V4, Germany
JEL Codes: D20, J24, J30, M54, N14

1. Introduction - Problem statement

The situation in European countries is constantly changing. Countries that were previously considered less relevant and received little attention at the international level have gradually developed into real models of success, particularly in terms of economic development and productivity growth (Meixnerová & Krajňák, 2020).

The Visegrád Group (V4), consisting of Hungary, Poland, the Czech Republic, and Slovakia, is a clear example of the geopolitical exploitation of the cultural, religious, and historical ties that bind these nations together. The V4 is an interesting region from a theoretical and methodological perspective. Studies on regionalization no longer focus solely on aspects of space and geographical location and their characteristics, as in the past, but also on cultural, economic, and political characteristics, using not only quantitative, qualitative, or disciplinary parameters (Stamm et al., 2020). Hungary has used this regional platform to promote its interests in Central Europe and the Balkans, to align itself with the Eurosceptic and nationalist stance of the other members of the Visegrád Group, and to position itself as an influential player in the region. By focusing on regional cooperation in areas such as the economy, energy, and security, the Visegrád Group has strengthened stability and security in the region, avoided potential conflicts, and reduced the likelihood of old hostilities resurfacing (Meixnerová & Krajňák, 2020).

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The V4 group can become a pioneer for the new horizons that the EU is opening up externally. Hungary's international orientation, for example, offers a fascinating insight into the interplay of national identities and geopolitical strategies in today's world and underscores the importance of understanding a nation's historical and cultural context when analysing its political development. Recognizing these connections gives us a deeper insight into the complex dynamics of world politics and the interplay of national and international factors in shaping a nation's identity and role in the world (Neumark & Corella, 2021).

The growth of countries such as Poland, Hungary, the Czech Republic, and Slovakia (better known as the members of the so-called Visegrád Group or V4) is undeniable and has been particularly evident throughout the 21st century to the present day. Some countries in this group, such as Poland, are even described as "economic miracles" by international organizations such as the International Monetary Fund (IMF), the World Bank, and the OECD, having achieved sustained growth since the mid-1990s despite events such as the 2008 real estate crisis (Paun et al., 2021).

The material success of the V4 countries is no coincidence. Their history, marked by wars and occupations, has led them to strive for greater regional stability and a better quality of life for their populations, but things have not always been as rosy as they seem. Despite their recent success, this group of nations has also been accused of adopting far-right, nationalist, and Eurosceptic positions, pursuing policies of social exclusion towards minorities such as foreigners or the LGBT community, and, to a lesser extent, restricting individual freedoms, which is paradoxical and contradictory given the great benefits that EU membership has brought them (Neumark & Corella, 2021). While these countries have achieved remarkable economic success in recent decades, it is equally true that part of this economic success is due to annual subsidies from Brussels, which have helped to double nominal GDP and per capita GDP in Poland, the Czech Republic, and Slovakia, and increase these indicators by 50% in Hungary (Stamm et al., 2020).

The following research paper does not aim to deal in depth with the critical or decisive aspects of the Visegrád Group's government policy, but takes them into account in order to better contextualize the information presented here. The main objective of this paper is to determine the productivity of these countries and whether this is reflected in better wages for workers by comparing them with a reference country in Europe in terms of labour productivity and wages, such as Germany. This comparison would make it possible to determine whether these two aspects have actually increased in the V4 countries and whether they are also correlated with each other.

2. Literature review

2.1. Productivity

Productivity is not a uniform term, which leads to confusion due to the multitude of definitions. These definitions may or may not be appropriate depending on the context. The difficulty lies in measuring it (Makridis & Gittleman, 2021).

The difficulty in applying the concept of productivity in practice stems from the following causes:

- Productivity is not clearly defined, and it is assumed that everyone understands the term in the same way.
- Different definitions of the term are used in parallel, without everyone who does so being fully aware of this and the consequences of these discrepancies.
- Inappropriate use of productivity definitions without analysing the context in which they are to be used.
- In business environments, there are differences between accounting, information, and control systems that affect the correct use of theoretical productivity definitions.

Productivity is used as a benchmark to evaluate the performance not only of companies or production systems, but also of macroeconomic indicators between countries (Craig, 1973).

2.1.1. Theoretical definitions of productivity

Theoretical or verbal definitions can be used primarily in business contexts to define strategies or goals. This is the case, for example, with large successful Japanese companies that are based on a philosophy of continuous improvement (Kaisen) and use the definitions of the Japan Productivity Center JPC (Eppelsheimer & Möller, 2019).

In these definitions, productivity is viewed more as a mental attitude:

- Productivity is the mentality of progress, of constantly improving what already exists.
- Productivity is the certainty that we can achieve more today than yesterday and less than tomorrow.
- Productivity is the will to improve the current situation, no matter how good it appears or actually is.
- Productivity is the constant adaptation of economic and social life to changing conditions.
- Productivity is the continuous effort to apply new techniques and methods.[2]
- Productivity is the failure of human progress.

For those who adhere to these definitions of productivity, there is nothing fixed or constant, and there will always be opportunities for performance improvement. This forces us to look for ways to adapt in order to survive. For them, "survival of the fittest" does not mean survival of the strongest or largest, but of those who can adapt most effectively (Meixnerová & Krajňák, 2020).

2.1.2 Mathematical definitions of productivity

In order to better quantify or measure productivity, more concrete definitions are needed; in this case, mathematical expressions must be used for this purpose. These mathematical definitions must be related to and take into account the theoretical or verbal definitions.

In general, the mathematical definition can be defined as the ratio between production and the factors or means of production (Ozturk et al., 2019). Some of these definitions are as follows:

$$Productivity = \frac{Kg\ of\ processed\ products}{Kilograms\ of\ raw\ materials} \quad (1)$$

$$Productivity = \frac{Number\ of\ finished\ products}{Number\ of\ employees/workers} \quad (2)$$

$$Productivity = \frac{Number\ of\ finished\ products}{Number\ of\ hours\ worked} \quad (3)$$

$$Productivity = \frac{Production\ value}{Capital\ expenditure} \quad (4)$$

The challenge lies in selecting the right production measures, factors, and resources. The most appropriate definition must be determined on a case-by-case basis, as there is no universal definition that covers all contexts.

[2] The author provides a scientific contribution to this in the research article „Comparative Study on Job Security and Stability among German and Spanish Workers and Their Ability to Work from Home". This article analyses the situation on the labour markets in Germany and Spain on the basis of a comparative study in order to identify differences in terms of job security and stability as well as the possibility of working from home. The study is based on data from statistical sources provided by Eurofound (2024) with a sample of 907 employees in Germany and Spain. The analysis in this study shows a clear difference between the labour markets in Spain and Germany. German employees are in a significantly more favourable position than Spanish employees. For this reason, Germany must continue to improve the quality of its labour market in order to ensure the sustainability of employment. Source: https://doi.org/10.2478/ngoe-2025-0013

2.2. Labour productivity and wage compensation

2.2.1 Labour productivity

Labour productivity is calculated using gross domestic product (nominal GDP), which is simply the sum of the value of all goods and services produced by a country in a year, minus the costs incurred in producing those goods and services. There are two ways to calculate this macroeconomic indicator (Paun et al., 2021, p. 91).

The first option is what is known as *labour productivity per employee*, which is simply the ratio between nominal GDP and the number of people working in the country, i.e., the working population. The end result is the average nominal GDP generated by each employee in that country.

$$Labour\ productivity\ per\ employee = \frac{Nominal\ GDP}{Total\ number\ of\ employees\ per\ country} \quad (5)$$

The second method for calculating labour productivity is *labour productivity per hour worked*, which is defined as the ratio between nominal GDP and the total number of hours worked by the entire working population of a country. This corresponds to the average nominal GDP generated by each worker in that country in one hour of work.

$$Labour\ productivity\ per\ hour\ worked = \frac{Nominal\ GDP}{Total\ number\ of\ hours\ worked\ by\ all\ employees\ in\ a\ country} \quad (6)$$

These are the terms used by the European Union to measure this macroeconomic indicator. It is based on purchasing power standards that allow comparisons between member countries in terms of their nominal GDP, regardless of whether each country's currency is different. To make these comparisons in percentage terms, the reference index 2015 = 100 is used. For example, if the index for 2015 was 100 and for 2016 it was 105, this means that *labour productivity per hour worked* increased by 5%. It should be noted that 100 is a reference value that allows real data to be converted into relative scales for comparison purposes only. With regard to the two methods for calculating productivity, it is recommended to use *labour productivity per hour worked*, as this eliminates the distinction between part-time and full-time employees depending on the country and year (Eurostat, 2025a).

2.2.2. Unit labour costs

For the European Union, *unit labour costs per hour worked* are defined as the ratio between *labour costs per hour worked* and *labour productivity per hour worked* of each employee per country.

$$Uniform\ labor\ costs\ per\ hour\ worked\ = \frac{Labour\ costs\ per\ hour\ worked}{Labour\ productivity\ per\ hour\ worked} \quad (7)$$

According to *Equation 7*, it is therefore assumed that if the *labour costs per hour worked* in a given country are higher than in other countries, the wages of workers in that country are also higher on the basis of their purchasing power.

This variable is expressed in the form of an index, with 2015 = 100, which means, for example, that if the index for 2015 was 100 and for 2016 it was 105, then the *labour costs per hour worked* increased by 5%. The value 100 is considered a reference value that serves as a scale based on real data to determine the variable on a year-on-year basis. The calculation of

this variable is independent of whether the employee is employed part-time or full-time (Eurostat, 2025a).

2.3 Visegrád Group

2.3.1. Historical background

The Visegrád Group, or V4, has its historical roots in the Visegrád Pact of 1335, which came about after King Charles Robert of Hungary and Croatia convened a meeting at Visegrád Castle (now in Hungary) attended by King Casimir III of Poland and King John I of Bohemia (Fialová & Mysíková, 2021). The aim of the Visegrád Pact was to conclude a treaty on cooperation and mutual non-aggression between the Central European countries. However, its most important purpose was to create an alliance to defend the territorial integrity of the Central European countries against the Austro-Hungarian Empire. It is important to mention that this pact did not have any greater significance, as the conflicts between the Catholic Church and emerging Protestantism, as well as the territorial expansion of the Austro-Hungarian Empire, contributed significantly to its rapid decline into obscurity (Farkačová et al., 2023).

Centuries later, Poland, Hungary, and the former Czechoslovakia revived their cooperation by establishing the V4. Within this framework, Václav Havel (Czechoslovakia), Lech Walesa (Poland), and József Antall (Hungary) decided on February 15, 1991, to resume cooperation between the countries of Central Europe. It should be noted that the first democratic leaders of the countries in the region were convinced that the socialist world in Eastern Europe had collapsed and that they had to build a completely new future for their societies. In addition, they shared common interests regarding the post-socialist future of their countries (Fialová & Mysíková, 2021). Based on this conviction, political stability, economic development, and accession to the European Union (EU) and the North Atlantic Treaty Organization (NATO) were their most important goals.

The main goal of the V4 at the beginning of the 1990s was to establish very close cooperation between the Central European countries in order to integrate them into the EU and NATO as quickly as possible. Other secondary goals were economic integration and mutual cooperation in connection with the political and economic transition process taking place locally (Sikora, 2021).

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The V4 began with rather weak and limited cooperation. When the socialist system collapsed in Poland, Hungary, and Czechoslovakia, economic growth in these countries was very weak and their economies were only at the beginning of a difficult economic transition process. In addition, the economies of the V4 members were hardly competitive at the international level due to the economic backwardness caused by the state-controlled economic system. Politically,

the members of this organization did not want to engage in very close cooperation, as they believed that such cooperation could hinder their "return to Europe." During their accession process to both organizations, the members of the V4 competed with each other instead of cooperating, and each declared itself the "leader of the region," leaving its Central European partners behind. Added to this was the complicated situation triggered by the Velvet Revolution of 1989, which led to the dissolution of Czechoslovakia in 1993 and the emergence of two completely independent states: the Czech Republic and Slovakia. Given this situation, many experts were convinced that the V4 had little chance of survival (Centre Virtuel de la Connaissance sur l'Europe, 2025).

The members of the V4 were granted NATO membership on March 12, 1999, and EU membership on May 1, 2004, with the exception of Slovakia, which did not join the Euro-Atlantic alliance until March 29, 2004. With regard to Slovakia, most EU and NATO members believed that it was not yet ready to join either organization due to the anti-democratic policies of former Prime Minister Vladimír Meciar. It should be noted that, in those years, Slovakia was considered the Central European country that was furthest behind in meeting the criteria for EU accession set by the Copenhagen European Council on June 21 and 22, 1993. In this context, senior EU officials and EU institutions pointed out that without more substantial progress in the first phase of EU enlargement to the east, Slovakia would not be considered for accession (Buzan & Waever, 2013).

Following the integration of the Central European countries into the EU, the countries of the region had to rethink the future of the V4. In short, they had to decide whether to continue or end their cooperation. In this context, the members of the V4 decided in the Kromeriz Declaration, which came into force on May 12, 2004, to continue their cooperation and defend their national identities. The Kromeriz Declaration also referred to the importance of economic integration and cooperation with non-EU countries that are crucial for the security of Central Europe, such as Ukraine, Moldova, Belarus, Serbia, and the Western Balkan states (Neumark & Corella, 2021).

In the 1990s, the members of the V4 were considered important driving forces of the EU and NATO and tirelessly defended their right to belong to Western European cooperation and security organizations, due to their geographical location and the Western and civilizational values they share with the members of both organizations (Jiménez et al., 2021). However, after almost two decades of integration into the EU and NATO, their once pro-European orientation has changed radically. In addition, the Central European countries have transformed into illiberal democracies in the 21st century, despite the enormous progress they made in consolidating their democratic political systems in the 1990s (Jiménez et al., 2021).

2.3.2. Interregional cooperation on economic issues

Economic cooperation has been one of the main priorities of the V4 since its inception. Economic cooperation began with the establishment of the Central European Free Trade Association, which came into force on July 3, 1994. Its original goals were to consolidate market economies, promote trade, and integrate Central European economies into the economic, political, and legal system of the EU (Farkačová et al., 2023).

The establishment of the Central European Free Trade Association was relatively straightforward, as the V4 members had very similar economic conditions after the collapse of socialism, such as the transition from planned economies to market economies and their geographical location and forms of production, as the Central European economies specialise in agriculture and manufacturing, construction, electronics and the pharmaceutical industry (Farkačová et al., 2023).

Due to the accession of the V4 members to the EU, the countries of the region had to withdraw from the Central European Free Trade Association, as their membership in this organization was incompatible with EU membership. Currently, Moldova, Bosnia and Herzegovina,

North Macedonia, Serbia, Montenegro, Kosovo, and Albania are members of this association. It is worth noting that the association served as a stepping stone to prepare Eastern European countries for EU membership. Of the countries mentioned, North Macedonia, Montenegro, and Serbia are currently considered "official candidates" for EU membership, while Albania, Bosnia and Herzegovina, and Kosovo are considered "potential candidates" by Brussels. Due to the integration of the V4 economies into the European single market, around 80% of their foreign trade is currently concentrated on the EU market. One phenomenon that has hampered economic cooperation is the rivalry between Central European countries for foreign direct investment, which comes mainly from Germany, Russia, and, in recent years, China. Another area of rivalry is infrastructure development, particularly the construction of roads and motorways. This rivalry has intensified between the Czech Republic and Slovakia, both of which want to become the center of the "New Silk Road," also known as "One Belt, One Road." This project aims to connect China, Central Asia, the Middle East, and Europe through rail links and encompasses 65 countries with a total population of 4.4 billion people, accounting for 70% of the world's population and together generating 55% of the gross domestic product (GDP) of the global economy (Stamm et al., 2020).

In connection with the EU's economic agenda, the members of the V4 are jointly advocating for further opening up the EU internal market for goods and services, the creation of a digital single market, and, above all, the maintenance of the EU budget for the Cohesion Fund. It should be noted that the Union's net contributors (Austria, Germany, France, Netherlands, Sweden, and Denmark) have sought to reduce their contributions to the Community budget in recent years. The net contributors would like to reduce their contributions to 1% of their GDP, while the official position of the European Council is 1.74%. The members of the V4 support the position of the European Council and belong to the group of "Friends of Cohesion." This group of countries is characterized by regions whose development is highly dependent on European subsidies, in particular from the Cohesion Funds. Members of the "Friends of Cohesion" group are Portugal, Poland, Malta, Croatia, Cyprus, Slovakia, Spain, Slovenia, Lithuania, Latvia, Estonia, Greece, Hungary, Bulgaria, and Romania (Neumark & Corella, 2021).

2.3.3. The decline in democratic quality in the V4 member states

After the V4 members joined the EU and NATO, they had to grapple with the future of these organizations. Essentially, they had to decide between their continued existence and their abolition.

In this context, the members of the V4 adopted a joint declaration in 2006 in which they agreed to continue their cooperation, promote their interests within the Union, and strengthen their cooperation with countries outside the EU that are of the highest priority to them, including in particular the members of the Eastern Partnership, Russia, and the Western Balkan states. It should be noted that this declaration was the first time in the history of the V4 that reference was made to the "collective defence of their sovereignty and national identity." They also emphasized that "a balance must be found between the local and the global" and between "the individual and the common." Finally, they praised the successes of their democratic transformations, which they had achieved in just a decade. In fact, at the end of the 1990s, the four Central European countries managed to achieve exemplary results in terms of consolidating democracy, political rights and organizations, the participation of non-governmental organizations (NGOs) and civil society, and the independence of the three branches of government. In this sense, organizations such as Freedom House began to evaluate the surprising results in the aforementioned areas with very high indicators (Schubert, 2004).

Just a few years later, however, the countries in the region were poorly rated and called into question by the same organizations, the EU institutions, and the international media. Only the Czech Republic was rated with good indicators, while the quality of democracy in Poland,

Hungary, and Slovakia continued to decline. In 2014, the four Visegrád countries were classified as dysfunctional democracies, with Hungary symbolizing the most striking decline. In this context, the country fell from 38th to 51st place in just eight years in terms of respect for the rule of law and the separation of powers, as well as violations of the human rights of minorities.

Another indicator where Central European countries perform poorly is freedom of expression. According to Freedom House, the media in Poland, Hungary, and the Czech Republic are "partly free," and according to Reporters Without Borders, the media in Hungary and Poland are controlled by the government or subject to some form of political censorship (Sikora, 2021).

2.3.4. Euroscepticism in the V4

After the collapse of the Soviet Union, the Central European countries were considered great advocates of European integration. Their support was in line with their fundamental foreign policy interests, which were aimed at membership in the EU and NATO.

In recent years, however, these countries have evolved into illiberal democracies characterized by Euroscepticism, ultra-nationalism, social exclusion, and the questioning of the democratic values of European integration. Furthermore, the far-right governments of Central European countries believe that the EU's supranational policies threaten their sovereignty and national identity (Stamm et al., 2020).

It should be noted that with the rise of far-right political parties in the region, Central European countries have begun to further strengthen their cooperation and defend their interests within the EU. The V4 represents 14% of the EU's population and holds 110 of the 721 seats[1] in the European Parliament. This significant number has enabled it to counterbalance Community policy on more than one occasion. However, the Central European countries do not have the political or economic power to determine EU policy. Nevertheless, given the size of the V4's population, they are collectively strong enough to form a unit (Stundziene & Baliute, 2022).

2.4. Research questions

Q1: Are the Visegrád Group countries more productive than Germany?
Q2: Has the difference in labour productivity between the Visegrád Group countries and Germany decreased?
Q3: Do countries with higher labour productivity offer their employees better pay than countries with lower labour productivity?

2.5. Hypotheses

H1: Workers in the Visegrád Group countries are more productive than workers in Germany.
H2: Over time, the productivity gap between the Visegrád Group countries and Germany has narrowed.
H3: The group of countries with the highest labour productivity offers its workers better pay.

3. Method

3.1. Literature review

[1] The tenth European Parliament elections took place from 6 to 9 June 2024 in the 27 member states. A total of 720 seats were allocated, 15 more than in the previous term, due to a change in the law in September 2023. The Visegrád countries have a total of 110 seats (= 15.3%): Hungary (= 21), Poland (= 53), the Czech Republic (= 21), and Slovakia (=15). Source: https://www.europarl.europa.eu/topics/de/article/20180126STO94114/

This research paper is based on a comprehensive literature review to gather all the necessary information that forms a solid theoretical basis for this study. Academic search engines such as Google Scholar, Springer Nature Link, Base, etc. were used to obtain this information. The search terms used in these search engines included: “Visegrad Group,” “macroeconomic indicators,” “labour productivity,” “labour remuneration.”

3.2. Data source

Eurostat was selected as the source for data collection. The relevant website provides a list of variables and institutions for the study with relevant data for assessing various aspects of European countries and the European Union.
As a statistical centre, Eurostat's database contains a wealth of data providing a range of information on income, living conditions, and the economy, among other things, enabling comprehensive analysis. These data are useful for obtaining and understanding detailed and important insights into the distribution by country for each of these variables as contextual data for comparison with European surveys. This source of information is a valuable tool for social research involving economic variables. By combining register data with survey data, it provides an information tool for highly advanced data analysis. It is also of great methodological interest, as register data are a key source for research in various countries in the region.

3.3. Data analysis

The study to validate or confirm hypotheses H1, H2, and H3 consisted of statistical data analysis using hypothesis tests carried out using a database from *Eurostat* on labour productivity and unit labour costs (Eurostat, 2025a, 2025b, 2025c). Beforehand, these data were checked using Microsoft Excel for empty fields (zero) and atypical values or values that did not correspond to the measurement scales of the variables to be examined. After checking that the data were sorted, they were exported in XLSX format to the IBM-SPSS statistical software. The next step was to perform a normality test on the variables to determine whether the hypothesis tests to be performed should be parametric or not. In this case, a Shapiro-Wilk normality test was chosen because the amount of data per variable (N) was less than 50. After checking whether all variables followed a normal distribution, the hypothesis test was performed. The results obtained made it possible to accept or reject the sub-hypotheses and discuss them on the basis of the selected literature in order to finally draw conclusions in the form of findings with which this study could be concluded.

4. Results

4.1. Data

The official data from the European Union was used for each year and is displayed in *Table 1*, with variables coded as follows:

Year:	Period in years
AP_Germany:	Labour productivity in Germany
AP_V4:	Labour productivity of the Visegrád Group
AKE_Germany:	Unit labour costs in Germany
AKE_V4:	Unit labour costs of the Visegrád Group
Productivity gap:	Labour productivity gap (AP_V4 - AP_Germany)

Table 1: Data used to perform the statistical analysis

Year	AP_Germany	AP_V4	AKE_Germany	AKE_V4	Productivity gap
2015	100,00	100,00	100,00	100,00	0,00
2016	101,43	100,56	101,18	103,09	-0,87
2017	103,32	103,61	102,39	106,78	0,29
2018	103,67	107,48	105,62	110,77	3,81
2019	104,39	109,86	108,83	115,54	5,47
2020	105,33	111,69	112,34	122,49	6,36
2021	106,69	114,92	112,01	125,19	8,23
2022	106,81	115,99	116,93	136,21	9,18
2023	106,14	116,55	124,74	152,23	10,41
2024	106,03	118,73	131,69	163,88	12,70

Source: Eurostat (2025)

4.2. Normality test

In order to verify the statistical assumptions, a preliminary investigation was conducted using a Shapiro-Wilk test for normal distribution, which was applied to all of the variables that were examined. *Table 2* shows the results of the Shapiro-Wilk normality test for the variables in the study.

Table 2: Shapiro-Wilk test for normal distribution of the variables to be analysed

Variables	N	W	pValue	pValue<0,05
AP_Germany	10	0,909	0,274	No
AP_V4	10	0,923	0,380	No
AP_EU	10	0,878	0,124	No
AKE_Germany	10	0,921	0,369	No
AKE_V4	10	0,914	0,308	No
AKE_EU	10	0,891	0,174	No

Null hypothesis (H_0): The data follow a normal distribution.
Researcher's hypothesis (H_i): The data do not follow a normal distribution.
Source: Own representation using IBM-SPSS

For all variables the p-values were above the significance level of 0.05, thus indicating that H_0 is accepted: "The data follow a normal distribution." Consequently, the implementation of parametric test procedures was deemed permissible.

As can be seen in *Table 3*, there are differences in the average values of the variables *AP_Germany* and *AP_V4*, with the value of the second variable being higher.

Table 3: T-test for paired samples by year for the variables AP_Germany and AP_V4

Variables	N	Average	Standard deviation	Standard error
AP_Germany	10	104,3810	2,29682	0,72632
AP_V4	10	109,9390	6,81776	2,15596

Source: Own representation, created with IBM-SPSS

4.3.1. Hypothesis 1 (H_1)

Hypothesis H1 tests whether there is a significant difference in the labour productivity of employees in Germany (*AP_Germany)* and in the Visegrád countries (*AP_V4*). For this purpose, a

paired t-test was performed, as the productivity values were compared on an annual basis and the normal distribution of the data had been confirmed beforehand. The t-test examines whether the observed difference in mean values could be random or whether it indicates a systematic difference.

The result in Table 4 shows a p-value of 0.005. This value is well below the significance level of 0.05. This means that the probability that the observed difference in labour productivity is random is very low (0.5%).

Table 4: Significance of differences between the variables AP_Germany and AP_V4

	Variables	**pValue**	**pValue <0,05**
Pair 1	(AP_Germany) - (AP_V4)	0,005	Yes

Source: Own representation, created with IBM SPSS

Thus, the statistical evidence supports hypothesis H1, i.e., "Employees in the Visegrád countries are more productive than employees in Germany."

4.3.2. Hypothesis 2 (H_2)

Hypothesis H2 examines whether the labour productivity gap between the Visegrád countries and Germany is widening over time. To this end, the correlation between the variable 'year' and the productivity gap was analysed using Pearson's correlation coefficient.

The result in *Table 5* shows a correlation coefficient of $\rho = 0.984$. This value is very close to +1 and indicates an extremely strong positive linear correlation: as the year increases, the productivity gap also increases significantly. The corresponding p-value of 2,7315E-7 is well below the significance level of 0.05.

Table 5: Pearson correlation test of the variables year and productivity gap

		Productivity gap
Year	**N**	10
	ρ	0,984000
	pValue	2,7315E-7
	pValue <0,05	Yes

Source: Own representation based on IBM-SPSS

This means that the result is highly significant. The probability that this strong correlation arose by chance is extremely low. This result allows to reject hypothesis H2, i.e.: "The labour productivity gap increases over time, which favours the V4 countries over Germany."

4.3.3. Hypothesis 3 (H_3)

The objective of Hypothesis H3 is to examine the existence of a positive relationship between labour productivity (AP) and employee compensation (AKE), and to determine whether this relationship is more pronounced in the Visegrád countries than in Germany. In conjunction with the results from section 4.3.1, this should be used to determine whether higher productivity is also associated with better wages.

The Pearson correlation analysis for Germany, *Table 6*, yielded a correlation coefficient of $\rho = 0.773$ with a p-value of 0.0088. This finding suggests a robust and statistically significant correlation between labour productivity and employee compensation, indicating that as productivity levels increase, wages tend to rise concomitantly.

Table 6: Pearson correlation test of the variables AP_Germany and AKE_Germany

		AKE_Germany
AP_Germany	**N**	10
	ρ	0,773000
	pValue	0,008782
	pValue <0,05	Yes

Source: Own representation, created with IBM-SPSS

For the Visegrád countries, *Table 7*, this correlation is even stronger, with ρ = 0.910122. The p-value, which is a statistical measure of the significance of a correlation, was found to be extremely low (0.000256). This outcome indicates that the observed correlation is also highly significant.

Table 7: Pearson correlation test of variables AP_V4 and AKE_V4

		AKE_V4
AP_V4	**N**	10
	ρ	0,910122
	pValue	0,000256
	pValue <0,05	Yes

Source: Own representation, created with IBM-SPSS

In *Section 4.3.1,* it was found that the Visegrád Group countries are more productive overall than Germany. However, in order to accept hypothesis H3, it must also be examined whether wages in the V4 countries are higher than in Germany.

Since the *correlation coefficient* (*ρ)* for the Visegrád Group is higher than for Germany and these results are significant with a p-value <0.05, as shown in *Tables 6 and 7,* hypothesis H3 is accepted on the basis of the evidence presented, i.e.: *"The Visegrád Group is the group of countries with the highest labour productivity and also offers its workers better wages than Germany."*

5. Discussion

The results show that between 2015 and 2024, the Visegrád Group countries significantly outperformed countries such as Germany, which has repeatedly been ranked as one of the most productive countries in Europe in terms of labour productivity. These labour productivity rates have risen more sharply in the V4 countries each year, significantly widening the gap with Germany in this indicator, especially in recent years.

The results also show that higher labour productivity in the V4 countries is accompanied by higher wages for workers in this group of countries, with the latter being higher than in Germany based on the unit labour cost indicator, which measures how high the costs are that are willing to be borne per worker. The higher these unit labour costs are, the higher the remuneration for workers in that country or group of countries.

In order for companies to achieve a high level of efficiency, it is necessary to work in a highly motivating, participatory environment with highly motivated employees who identify with the company (Rollnik-Sadowska & Dąbrowska, 2018). For this reason, employees must be regarded as the company's capital, and managers must take into account the complexity of human beings in order to achieve efficiency and productivity goals. In the organizational context, it has been suggested that higher productivity brings economic, social, and psychological benefits (Makridis & Gittleman, 2021). If employees perceive these benefits as fair, they develop greater satisfaction because they believe they are being adequately rewarded. In this situation, they will be more committed to the work assigned to them.

Although it is undeniable that the Visegrád Group countries have been experiencing sustained growth for some time, largely due to the liberal economic reforms of the early and mid-1990s, it is equally undeniable that part of this growth is due to aid and subsidies from the European Union, which have made it possible to employ a more expensive workforce in these countries, thereby leading to higher productivity. For this reason, the V4's Eurosceptic stance is incompatible with the fact that they have been and continue to be major beneficiaries of Brussels.

6. Conclusion

For the period under review (2015–2024), the Visegrád Group countries are more productive overall than Germany.

The Visegrád Group countries tend to become more productive than Germany over the years.

As labour productivity rises in the Visegrád Group countries, so do the wages of their workers. Both indicators are lower in Germany.

Part of the Visegrád Group's economic growth is due to the increase in labour productivity as a result of their workers' wages, which is supported by EU financial aid.

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