COMPETITIVENESS DIVERGENCE IN THE VISEGRAD FOUR COUNTRIES: TRENDS AND FORECAST UNTIL 2035

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Abstract

The issue of competitiveness is currently a very topical subject, not only from the perspective of scientific studies, but also in the focus of European Union representatives´ attention and economic practitioners. The present article engages with the question of the competitiveness of the Visegrad Four countries. The objective of the study was to analyze the development of competitiveness, identify differences in the development of competitiveness between the Visegrad Four countries in the time series from 2007 to 2025, and forecast its development using the WCI index until 2035. The findings indicated that the Czech Republic continues to uphold and enhance its dominant standing within the region, while Slovakia exhibits a pronounced adverse trend, with the imminent risk of enduring underperformance. The development of the coefficient of variation has revealed a growing divergence in competitiveness among the Visegrad Four countries since 2020, which may negatively affect regional cohesion.

Key words:
Competitiveness, World Competitiveness Index, Visegrad Four countries, variation coefficient.

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INTRODUCTION

The issue of competitiveness has emerged as a prominent theme in professional literature and has garnered significant attention from European Union representatives and economic practitioners. Several international institutions are involved in the monitoring and evaluation of the competitiveness of national economies. These include the World Bank, the Institute for Management Development, the World Economic Forum, and the European Union (Kalusová & Škriniar, 2018). The capacity to engage in competition is associated with the ability to utilize resources efficiently, promote innovation, and attract investment. In practice, indices such as the Global Competitiveness Index (GCI), the World Competitiveness Index (WCI), and, at the regional level, the Regional Competitiveness Index (RCI), are most used for monitoring, measuring, and comparing competitiveness. The utilization of indices is predicated on a range of factors, including but not limited to innovation, infrastructure, and digital readiness. The objective of the paper was to analyze the development of competitiveness, identify differences in the development of competitiveness between the Visegrad Four countries in the time series from 2007 to 2025, and forecast its development using the WCI index until 2035. The Visegrad Four constitutes consist of the Central European countries: The countries under consideration in this study are Slovakia (SK), the Czech Republic (CZ), Hungary (HU), and Poland (PL). These countries, located within the Central European region, exhibit notable parallels in their historical development, cultural and intellectual values, and shared interests in the realm of pan-European integration. The Visegrad Group countries formally acceded to the European Union in 2004 (Kalusová, Škriniar, 2018). This research confirms the World Economic Forum's assertion regarding the growing disparities in the competitiveness of European countries. This study specifically examines this trend within the V4 countries.

Literature overview

The concept of competitiveness has emerged as a prominent focal point in contemporary economic discourse, political strategy formulation, and academic research. The term "sustainable economic growth" refers to the ability of a country, region, or business to create and maintain conditions that support long-term improvements in living standards and economic

productivity. The ability to use resources efficiently, promote innovation, and attract investment is linked to the concept of "smart growth." In professional discourse, the term "competitiveness" is employed across various levels, including national, regional, and local contexts. A substantial body of research has been conducted about competitiveness, with numerous studies drawing upon the foundational definition established by the OECD (1997). This definition stipulates that a nation's competitiveness is determined by its capacity to produce goods and services that align with the demands of international markets within a framework of free and fair competition. A central tenet of this definition is the promotion of increased real income for the population of a particular nation. As demonstrated in the research works of numerous authors (e.g., Durand, Madashi & Terribile, 1998; Aiginger, 1998), competitiveness is defined as a nation's capacity to attain elevated levels of productivity, technological innovation, and stability in pivotal macroeconomic indicators. This line of thinking is also supported by Kitson, Martin, and Tyler (2004). These scholars emphasize that competitiveness cannot be reduced to economic indicators alone; rather, it must include social and environmental aspects. Boschma (2004) also underscores the significance of innovation potential and geographical proximity as pivotal factors in the realm of regional development and competitive advantage.

In recent decades, the concept of competitiveness has also been disseminated at the regional level. The terms "regional competitiveness" and "systemic competitiveness" underscore the significance of local actors, innovation, and institutions. As Huggins and Thompson (2015) have demonstrated, a region's competitiveness is contingent upon the capacity of companies to compete and capture the value generated within a specific territory. However, according to Malecki (2007) and Békés (2015), the competitiveness of a region is also influenced by factors such as infrastructure, the quality of human capital, and the prevailing institutional environment. According to Chiţea (2015) and Pelinescu et al. (2017), regional competitiveness is associated with the degree of specialization of regions, their capacity to attract investment, and the creation of sustainable employment opportunities. However, as noted by certain authors (e.g., Krugman, 1997), the application of the concept of competitiveness to regions can be problematic and result in erroneous policy decisions. Conversely, Begg (1999) and Huovari, Kangasharju & Alanen (2000) posit that regional competitiveness is a legitimate concept, provided it is understood as the capacity to support economic activity and ensure the relative prosperity of the population. This approach underscores the distinction between determining factors (e.g., quality of human capital, innovation, accessibility, agglomeration) and competitiveness outputs (e.g., GDP per capita, taxable income). Concurrently, they emphasize that this is a comprehensive concept that extends beyond mere outcome measurement. It encompasses the prerequisites for development and the capacity of the regional system to function effectively.

A multitude of other factors must be considered, including but not limited to export performance, research and development activity, and the quality of public administration. In this case, the competitiveness of a nation or region is determined by a multitude of economic, social, technological, and institutional factors. The most frequently cited factors include labor productivity, technological innovation, institutional quality, infrastructure level, access to education and digital skills, and public administration efficiency (Postula & Raczkowski, 2020; Stančíková & Melecký, 2019). In his seminal theory of competitive advantage, Michael Porter (1985) distinguishes between external (price-cost) and internal (non-price) factors of competitiveness. The internal factors that contribute to the success of a business include the ability to innovate, the quality of human resources, research and development, and the business environment. As posited by Porter (1985) and Durand et al. (1998), external factors are associated with prices, wage costs, and export performance. Contemporary approaches tend to prioritize systemic competitiveness, defined as the capacity of a region or nation to operate as a cohesive entity, characterized by effective institutions, collaborative interactions among actors, a culture of innovation, and the intelligent utilization of resources. This approach

underscores the necessity to allocate resources into human capital, research, and digitization as pivotal elements for sustained growth (Sadki et al., 2020; Huggins & Thompson, 2015). In the present moment, it is imperative to direct attention toward the intelligent development of the nation, the enhancement of internal and external competitiveness, the assurance of economic inclusion through equitable distribution, and the mitigation of economic inequalities. These factors are critical in increasing income, reducing poverty and its associated risks, and enhancing the quality of life for the population (Timofti, Movileanu1 & Șargo, 2020).

Regrettably, it must be acknowledged that the European Union has consecutively underperformed in comparison to the major global economies over the course of two consecutive years. However, according to the European Commission, the EU possesses all the necessary resources to reverse this trend, including its educated workforce, capital, savings, single market, and unique social infrastructure, provided that it addresses existing barriers and structural deficiencies (TASR, 2025).

Measuring Competitiveness

The assessment of a nation's or region's competitiveness necessitates the utilization of multifaceted indicators that encompass diverse facets of economic, social, and institutional advancement. In practice, the most used indices are the Global Competitiveness Index (GCI), the World Competitiveness Index (WCI), and the Regional Competitiveness Index (RCI), or indices based on specific factors such as innovation, infrastructure, or digital readiness.

As Hrabovská (2018) observes, the prevailing methodologies employed to assess regional competitiveness are predicated on the formulation of a set of indicators, the evolution of which is intended to ascertain the competitiveness of the region in question. For instance, the analysis of the competitiveness of 17 regions in Spain (Navarro, 2017) is based on an analysis of 15 areas of competitiveness. Several studies have employed a modified Global Competitiveness Index (GCI), which is published by the World Economic Forum, to analyze competitiveness (Bucher, 2018; Popescu et al., 2017; Perez-Moreno, Rodriguez, & Luque, 2016). The Global Competitiveness Index (GCI) is a tool used to assess the competitiveness of nations across various dimensions. These dimensions include, but are not limited to, institutions, infrastructure, macroeconomic stability, healthcare, education, labor market efficiency, technological readiness, and innovation capacity. The index offers a comprehensive representation of the state of productivity and growth potential of economies (World Economic Forum, 2017–2018). Due to the exigencies posed by the global pandemic of Coronavirus (SARS-CoV-2), the standard publication of the Global Competitiveness Index (GCI) was suspended from 2020 to 2022. Consequently, the World Economic Forum (WEF) published special reports on the resilience and transformation of economies.

The World Competitiveness Index (WCI) is a comprehensive metric that assesses nations across four primary domains: economic performance, government efficiency, business efficiency, and infrastructure. Within each of these factors, five sub-factors are identified. It is important to note that these sub-factors do not necessarily contain the same number of criteria. For instance, a greater number of criteria are required to assess the sub-factor Education than to assess the sub-factor Prices. Irrespective of the number of criteria they contain, the sub-factors have equal weight in the overall consolidation of results. Each sub-factor has a weight of 5% (20 x 5 = 100). The WCI is published by the International Institute for Management Development (IMD) in Switzerland. In contrast to the GCI, it places greater emphasis on management approaches, real economic performance, and expert opinions. The WCI integrates hard statistics and surveys of managers, encapsulating the practical reality of the business environment. It provides a comparison of countries' competitiveness for investors and entrepreneurs, while also offering analyses of the effectiveness of public administration, the education system, and infrastructure.

The Regional Competitiveness Index (RCI), administered by the European Commission, focuses on NUTS 2 regions within the European Union and assesses them in three areas: basic, efficient, and innovative factors of

competitiveness. It is imperative to consider the availability of education, technological sophistication, institutions, market size, and the level of the business environment (Stančíková & Melecký, 2019). The Global Competitiveness Index (GCI), particularly notable for its comprehensible structure, serves as the foundation for the development of regional competitiveness indices, including those that reflect the specific conditions of the Slovak Republic. For instance, the study by Širá, Kiseľáková, and Šofranková (2017) employs the Global Competitiveness Index to construct a regional competitiveness index for the Slovak Republic. The regional competitiveness index in the regions of the Slovak Republic, based on the European Commission's methodology, was also applied in a study by Jašková and Havierniková (2016). In the conclusions of their research, the authors noted the heterogeneous development of regional competitiveness in the regions of Slovakia.

Some authors argue that despite the increasing popularity of competitiveness indices, there is still no unified theoretical framework that would integrate all approaches, as some authors have noted. The concept of competitiveness is frequently employed as a "framework concept" without the presence of precisely defined methods or measurable boundaries (Békés, 2015; Chiţea, 2015).

Goal and Methodology

The objective of the study was to analyze the development of competitiveness, identify differences in the development of competitiveness between the Visegrad Four countries in the time series from 2007 to 2025, and prognosticate its development using the WCI index until 2035.

The World Competitiveness Index (WCI) was selected for monitoring competitiveness, despite the prevalence of the Global Competitiveness Index (GCI) within the scientific community. However, as previously stated, the occurrence of the novel strain of coronaviruses, known as SARS-CoV-2, which is responsible for the illness known as "covid-19," resulted in a cessation of the standard publication of the GCI in the period between 2020 and 2022. Secondary data published on an annual basis by the IMD World Competitiveness Center (World Competitiveness Ranking) was used in the preparation of the present document. The IMD has been providing data and analysis in this area for 37 years. The study employs a multifaceted approach, encompassing global, regional, and subregional economic perspectives, complemented by insights from a domestic survey of top managers in 69 global economies.

The coefficient of variation (CV) was employed to ascertain the disparities in WCI development across the V4 countries. The CV quantifies the extent of relative variability within the data set. Specifically, it calculates the ratio of the standard deviation to the arithmetic mean, thereby demonstrating the magnitude of the standard deviation in relation to the mean value. The coefficient of variation is a measure of the dispersion of data values relative to the mean. It is expressed as a percentage, with a high coefficient indicating a greater relative variability of the data. Within the framework of the WCI, it serves as a metric for assessing the degree of disparity in competitiveness among the V4 countries. As the coefficient of variation (CV) increases, the disparities in competitiveness among the individual V4 countries become more pronounced.

The variation coefficient is used to compare the variability of files with different diameters and is set as:

$$v_x = \frac{s}{\bar{x}}$$

Where $\bar{x}$- average,

s - standard deviation, while the „s“ has been set as follows:

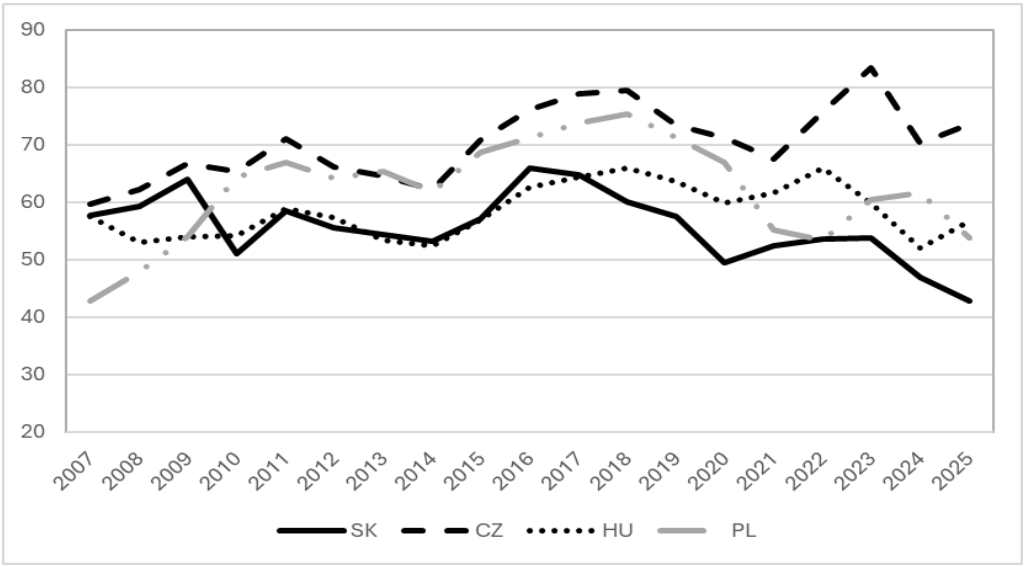
$$s = \sqrt{s^2} = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}}$$

The MS Excel spreadsheet program was employed to compile the forecast for the development of the WCI competitiveness indicator. The linear regression, upper confidence limit, lower confidence limit, and coefficient of determination R^2 are determined.

Findings and discussion

In this section, an in-depth analysis of the competitiveness of the Visegrad Four countries is conducted using the WCI index. In the initial phase, an analysis is conducted of the development of this index in individual countries in the time series 2007–2025. This is done in order to capture long-term trends and identify periods of growth or decline in competitiveness. Subsequently, the development of the coefficient of variation is determined to facilitate a comparison of the dispersion of values between countries. This enables determination of whether there is convergence or divergence. In the final phase, forecasts will be developed for the development of the WCI index by 2035. The aim of this forecasting activity is twofold: first, to provide a prediction of the future direction of competitiveness in the individual V4 countries, and second, to identify potential risks and opportunities for their economic policy.

Figure 1: WCI development in the V4 countries from 2007 to 2025



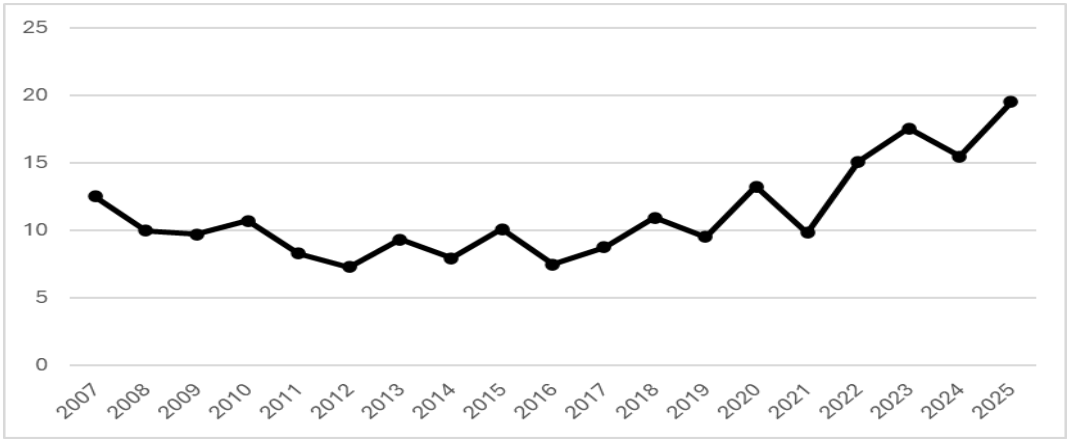
Source: Own processing based on data from the World Competitiveness Booklet 2007-2025 IMD

As demonstrated in Figure 1, the Czech Republic (CZ) has consistently exhibited the highest WCI values among the countries examined during the entire period under review, positioning it as the leader among the V4 countries. Since 2007, there has been a consistent growth trend, which culminated in the 2016–2018 period (values above 75), with an absolute maximum recorded around 2023 (above 80). This trend suggests a consistent enhancement in competitiveness, which is presumably facilitated by robust institutions and a superior business environment. A correction is anticipated in 2024–2025, yet CZ will continue to dominate as a leader among the V4 countries. Poland (PL) exhibits a weaker position during the 2007–2009 period, yet a substantial increase is observed in the subsequent 2010–2018 span, with WCI values stabilizing within the range of 65 to 75. This growth signifies an enhancement in competitiveness, primarily attributable to economic modernization and the amelioration of the business environment. However, following 2019, a decline was observed, accompanied by subsequent slight fluctuations, suggesting vulnerability to internal or external shocks. In Hungary (HU), the WCI has exhibited a consistent upward trajectory since the inception of the period under scrutiny, reaching its zenith between 2016 and 2018 (approximately 65–66). Since 2019, a slight decline has been observed, which is expected to turn into stagnation in 2021–2025. This may signal the exhaustion of growth potential or problems with the

sustainability of positive development. Among the V4 countries, Slovakia (SK) exhibits the most deficient values. During most of the period under review, WCI values remained below 60. Following a period of substantial growth in 2016, the index reached a peak value of 65.9. This was subsequently followed by a protracted decline, which ultimately led to a nadir below the 45-point threshold in 2025. This phenomenon is indicative of Slovakia's enduring challenges in enhancing competitiveness, particularly in the domains of public institution efficiency, innovation, and the business environment.

Subsequently, an analysis will be conducted to ascertain the development of the WCI variation coefficient for the V4 countries, with the objective of determining their convergence or divergence.

Figure 2: Development of the WCI variation coefficient in the V4 countries from 2007 to 2025 in %

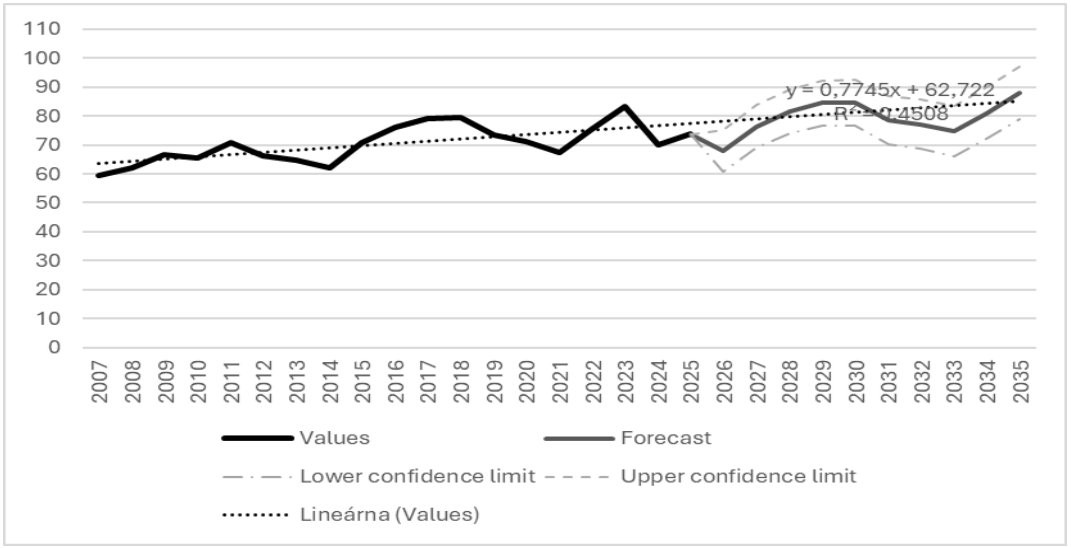


Source: Own calculations and processing

As illustrated in Figure 2, from 2007 to 2015, the variation coefficient demonstrated notable stability, fluctuating within the range of 7% to 12%. The initial value of VK in 2007 was 12.49%, and until 2012, a decline was observed, with the indicator reaching its minimum of approximately 7.29%. In recent years, the development exhibited volatility until 2019, when it reached a value of 9.51%. From 2016 to 2019, the variation coefficient remained within the range of 8-11%, indicating a slight increase in variability without significant fluctuations. This phenomenon may be interpreted as a period of relative stability in the competitiveness differential among the V4 countries. In the final period of 2020–2025, there was a substantial increase in the variation coefficient, from approximately 13.26% in 2020 to over 19.4% in 2025. This marked increase indicates an accelerating divergence in competitiveness, suggesting that the disparities between the V4 countries are rapidly expanding.

The increasing variation coefficient since 2020 indicates a divergence and suggests a decline in the homogeneity of the V4 region in terms of competitiveness. While the countries exhibited a certain degree of similarity at the onset of the period under examination, the disparities between them increased considerably by the conclusion of the period in question. This development may have significant consequences for the cohesion of the region and the coordination of economic policies in Central Europe.

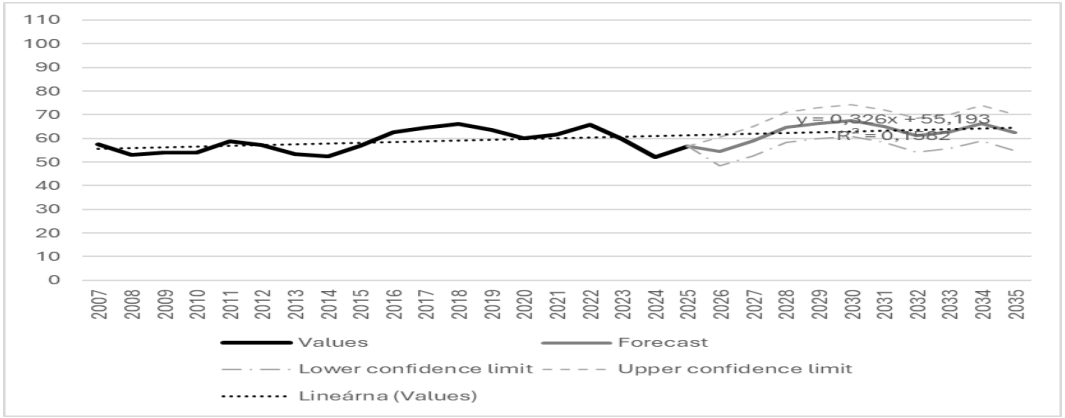
Figure 3: WCI prognosis in CZ until 2035



Source: Own processing based on data from the World Competitiveness Booklet 2007-2025 IMD

As illustrated in Figure 3, the WCI growth trend is anticipated to persist in the Czech Republic. By the year 2035, the index value is projected to range between approximately 90 and 100 points, with the upper confidence limit indicating the possibility of reaching around 105 points and the lower limit around 85 points. The projected growth of the WCI indicates that the Czech Republic should endeavor to maintain and potentially strengthen its leading position in the V4 region regarding competitiveness. However, to meet this optimistic scenario, it is imperative to persist in allocating resources to innovation, digital infrastructure, and the enhancement of public institutions.

Figure 4: WCI prognosis in HU until 2035

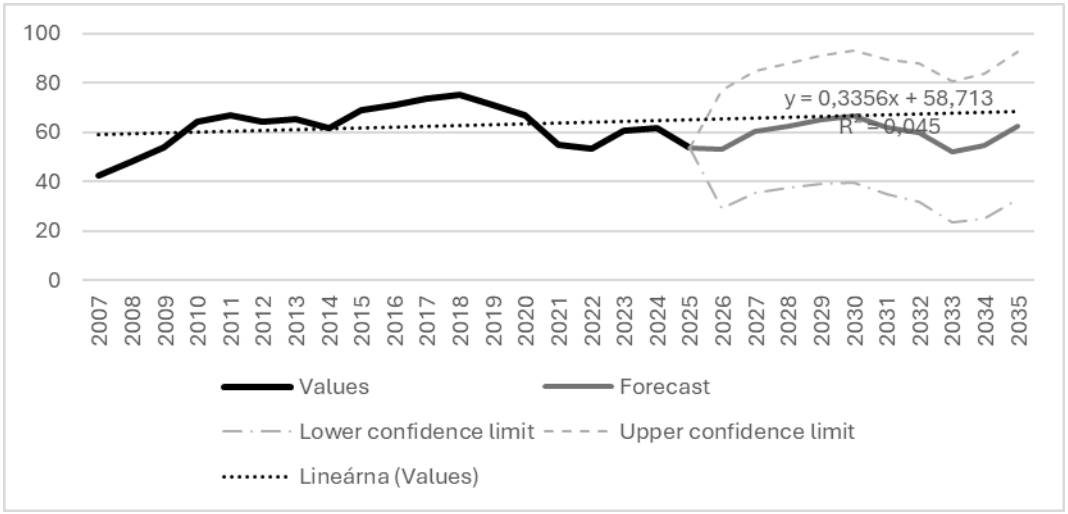


Source: Own processing based on data from the World Competitiveness Booklet 2007-2025 IMD

As illustrated in Figure 4, Hungary is projected to experience a negligible increase in competitiveness until 2035, with the WCI value anticipated to fluctuate within the range of 60 to 70 points. The lower and upper confidence limits indicate a broad spectrum of potential future scenarios, reflecting significant uncertainty regarding future developments. The coefficient of determination ($R^2 = 0.1027$) indicates that the linear trend accounts for a negligible portion of

the data variability, suggesting that the future evolution of Hungary's competitiveness is significantly influenced by external and internal factors that deviate from the prevailing trend. The prediction indicates stagnation or only a slight improvement in competitiveness, with no indication of dynamic growth. According to the prognosis, Hungary is likely to face the challenge of maintaining parity with the V4 countries by 2035 unless it undertakes more fundamental reforms to support the business environment, innovation, and the quality of public institutions. To overcome more pessimistic scenarios, Hungary must allocate resources specifically to education, digital technologies, and enhancing the efficiency of public administration.

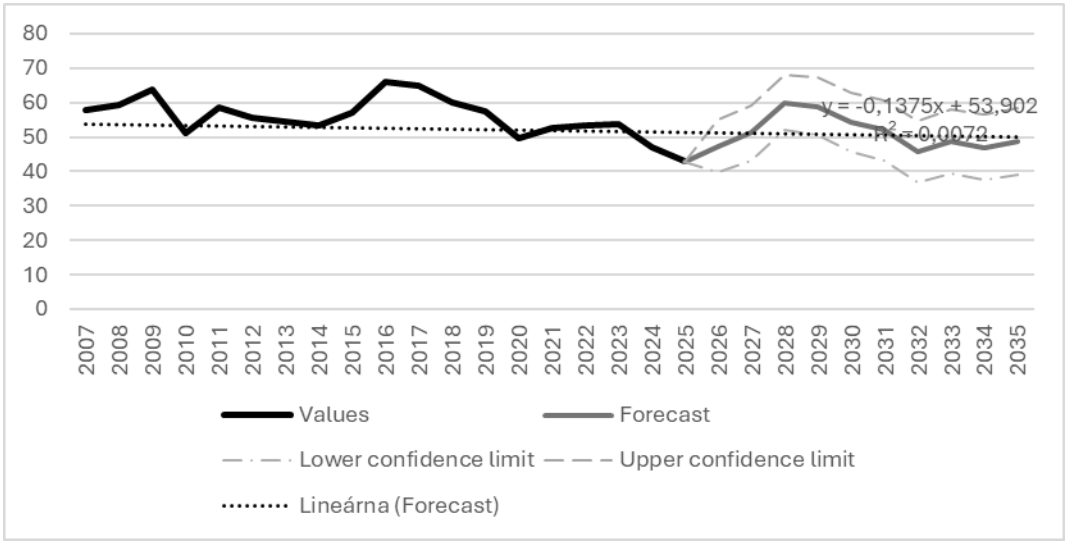
Figure 5: WCI prognosis in PL until 2035



Source: Own processing based on data from the World Competitiveness Booklet 2007-2025 IMD

Poland is expected to experience moderate growth in competitiveness until 2035, with a projected WCI value of approximately 60–80 points. The upper confidence limit signifies the potential for attainment of up to 85 points, while the lower limit denotes the possibility of declining below 50 points. The low R^2 value (0.045) indicates the weak predictive power of the linear model, suggesting that the development of Poland's competitiveness is likely to be influenced by factors not captured by the linear trend. To achieve the upper scenario of the forecast and maintain its competitiveness growth, Poland must stabilize the business environment, improve the efficiency of public administration, and support innovation. Conversely, the absence of such measures would potentially compromise the nation's competitiveness when benchmarked against its regional counterparts.

Figure 6: WCI prognosis in SK until 2035



Source: Own processing based on data from the World Competitiveness Booklet 2007-2025 IMD

According to Figure 6, the prognosis for Slovakia indicates a slight continuing decline in the country's competitiveness. The WCI values could range between 40 and 55 points, with the upper confidence limit indicating the possibility of exceeding 60 points, while the lower limit predicts the risk of falling below 40 points. However, the R^2 value of 0.0072 indicates that the trend line possesses negligible explanatory power. The inherent volatility of these developments renders them unsuitable for reliable modeling using a linear forecast. The current forecast suggests that if Slovakia does not implement targeted measures to support the business environment, innovation, and institutional efficiency, it may continue to experience a decline in competitiveness compared to other V4 countries in the coming years. To stabilize and reverse the decline in competitiveness, it is imperative to address the systemic issues that underpin these fluctuations.

Conclusion

The results of the analysis of competitiveness development measured using the WCI in the Visegrad Four countries in the 2007-2025 time series indicate that the Czech Republic maintains the highest and most stable competitiveness, with a significant lead over the other countries from 2016 to 2023. The Slovak Republic exhibits the most unfavorable development. Its downward trend since 2017 suggests the presence of systemic problems that may be related to the efficiency of public administration, innovation, or the business environment. This finding suggests a divergence in the development of the WCI in the V4 countries, a hypothesis that was subsequently confirmed by the values of the coefficient of variation. The increasing trend of the coefficient of variation since 2020 indicates a divergence and suggests a deterioration in the homogeneity of the V4 region in terms of competitiveness. While the countries exhibited a certain degree of similarity at the beginning of the period under review, significant disparities emerged by the conclusion of the study in 2019. These findings suggest potential ramifications for regional cohesion and the coordination of economic policies in Central Europe. The prognosis for competitiveness in the individual countries surveyed indicate that the trend in competitiveness is likely to continue in the period from 2026 to 2035. The Czech Republic is expected to maintain its leading position. The situation in the Slovak Republic is of concern, as evidenced by the expectation that the WCI will not exceed 50 points for a minimum of two years. These findings underscore the necessity for prompt responses from political and economic actors to forestall

the further widening of competitiveness gaps between V4 countries and to ensure sustainable prosperity for the entire region. To reverse this negative trend, it is essential to adopt systemic reforms in the areas of public administration, innovation, and the business environment.

The social contribution of this paper is primarily evident in the capacity of our findings to furnish pivotal insights and contextual information to economic policymakers, experts, and the business community. By identifying trends and risks, the study enables a better understanding of the causes of differences in competitiveness between Central European countries and the creation of targeted measures to support economic growth. The outputs of the study can contribute to more effective targeting of public investment, particularly in the areas of education, innovation, and digital infrastructure, which are key to reducing regional disparities and strengthening economic stability. Concurrently, these forecasts function as a cautionary indicator for nations experiencing a decline in competitiveness, thereby stimulating public discourse and expediting the implementation of requisite reforms. At the supranational level, this work has the potential to promote cohesion among the V4 countries and contribute to better coordination of their economic policies, which is important for increasing the competitiveness of the entire region within the EU and the global market.

However, it is imperative to consider the limitations imposed by the use of a sole competitiveness index, which fails to encompass all the potential factors influencing competitiveness. A notable constraint pertains to the geographical scope, which is exclusively focused on Central European countries. This restriction precludes direct comparisons with other EU or OECD countries, thereby limiting the generalizability of the results.

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