Article

The Determinants and Effects of Competitiveness: The Role of Digitalization in the European Economies

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Abstract: Improving national competitiveness is fundamental to raising long-term economic growth rates and enhancing living standards. The determinants of competitiveness change along with macroeconomic factors, business environment and consumer demand. These changes are visible in the growing importance of digitalization of enterprises of all sectors that has become a critical factor for competitiveness in recent years and will likely become even more essential. The main determinants of competitiveness performance in the European Union (EU) were analyzed in the proposed research. The study included a holistic approach to competitiveness and economic growth and aimed to reveal the factors that determine and contribute to the growth of European economies, as well as to identify clusters of the EU countries. The criteria of competitiveness that are significant for estimation of competitiveness factors and their relationship with economic growth were revealed by using factor analysis. The results indicate that the most significant factors are F1 Macroeconomic Stability, F2 Research and Development (R&D) and Digitalization, F3 Foreign Direct Investment and F4 Trade Openness. By applying cluster analysis, the EU countries were grouped into five clusters on the basis of the contribution of competitiveness factors to economic growth.

Keywords: national competitiveness; competitiveness factors; digitalization; EU countries; European economies

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1. Introduction

High competitive performance remains the main precondition of the national economies in increasing GDP per capita and well-being, i.e., better conditions for health, social protection and living standards. However, strong international competition fostering effective economic development should not turn into a destructive force, especially for a holistic model of long-term inclusive, environmentally sustainable and knowledge-driven growth. It is worth noting that sustained, inclusive and sustainable economic growth is one of the Sustainable Development Goals to be achieved by 2030 according to the 2030 Agenda for Sustainable Development of the United Nations [1]. The factors that determine competitiveness and the competitiveness itself have been studied thoroughly. Nonetheless, the concept of competitiveness is constantly evolving along with the driving forces or determinants of competitiveness. One of the classical and comprehensive definitions of competitiveness specifies it as the ability to produce goods and services that meet the test of international markets and at the same time maintain high and sustainable levels of income or, more generally, the ability of regions to generate, while being exposed to external competition, relatively high income and employment levels [2]. Competitiveness is determined and can be assessed by many factors and their combinations; the Institute

for Management Development (IMD) has developed a list of 330 criteria by which they assess the competitiveness of 64 economies of the world. The results are published in the World Competitiveness Yearbook (2021) [3] which is the leading annual report that analyzes and compares the competitiveness performance of world countries. The estimation of competitiveness is carried out according to four main factors: Economic performance (81 criteria): Macro-economic evaluation of the domestic economy, employment trends and prices; Government efficiency (72 criteria): Extent to which government policies are conducive to competitiveness; Business efficiency (74 criteria): Extent to which the national environment encourages enterprises to perform in an innovative, profitable and responsible manner; and Infrastructure (107 criteria): Extent to which basic, technological, scientific and human resources meet the needs of business.

Additionally to the competitiveness factors mentioned above, digitalization has become a critical factor for competitiveness recently. There is a rapid development of ICTs, which pressures enterprises to conduct business within the framework of the Fourth Industrial Revolution (Industry 4.0); with global markets and strong competition, some traditional manufacturing firms are implementing new maintenance innovations and policies, based on digitalization and a data-driven approach [4–6]. This further indicates that the application of modern information–communication technologies (ICTs) by enterprises is an important factor in sustainable development. Studies indicate, that enterprises have to evaluate their business processes and identify which can be improved via ICT solutions such as information systems, cloud infrastructure, etc. [4,7,8].

The COVID-19 outbreak has led to unstable economic performance, high market volatility, uncertainty and unprecedented challenges, which have affected the entire world's economy and, first of all, small- and medium-sized enterprises (SMEs) that generally struggle with profitability and liquidity, thus becoming particularly vulnerable to external shocks [9]. The post-pandemic recovery of European economies by increasing their openness will require the digital transformation of businesses and the public sector, creation of a clean-tech economy and high-value jobs and, respectively, investing in excellent R&D performance and innovation capacity. These have become priorities for enhancing Europe's long-term competitiveness. Meanwhile, it is necessary to take into account the disparities across the EU Member States in the current level of competitiveness and in the prospects of competitive development. These differences reflect mainly cross-country differences in the technological level of production and export, macroeconomic performance, government and business efficiency, infrastructure and the level of digitalization. More specifically, those are disparities in the determinants of economic growth and human development. As reported by the World Economic Forum [10], “contrasts are often stark even within sub-regions—in the EU, Germany's overall competitiveness score (81.8) is 20 points higher than Greece (62.6)—or among two neighbouring countries”. The Global Competitiveness Index performance differs visibly between Switzerland (82.3), as a Member State of the European Free Trade Association (EFTA), and Italy (71.5); there are also major differences among some of the neighboring countries of the EU: the Netherlands (82.4) and Belgium (76.4), Germany (81.8) and Poland (68.9), Germany (81.8) and the Czech Republic (70.9) and Austria (76.6) and Hungary (65.1).

Different outcomes of competitiveness across the EU economies refer to disparities in competitiveness factors that determine a country's capability to achieve sustained growth and improve economic well-being. The central question in the relationship between competitiveness and economic growth is which criteria among the main factors of competitiveness are the most significant and to what extent they determine economic growth. For macroeconomic adjustment and policy making, it is necessary to highlight what combination of these factors affects the creation of economic resilience and how European economies can enhance long-term competitiveness and induce the most effective growth. The aim of this study was to reveal the factors of competitiveness performance that determine and contribute to the growth of European economies and, based on the effects of these factors, to identify the clusters of the EU countries. The hypothesis was: the most significant

determinants of the competitiveness of European economies are related to macroeconomic factors, R&D and digitalization, and they are relatively stable.

The article is structured as follows: Section 2 presents a review of the theoretical and empirical literature related to national competitiveness factors and their effects on economic development. Section 3 provides a discussion of the main aspects of EU competitiveness. Section 4 describes the data set used for the investigation of the competitiveness indicators of EU countries. Section 5 comprises the estimation of the competitiveness determinants and their relationship with economic growth in the EU countries, research limitations and suggestions. Section 6 offers a discussion, and Section 7 provides conclusions of the study.

2. Review of the Related Literature

Although there are different concepts of national competitiveness in the scientific literature, the general problem of the lack of a widely accepted definition of this notion has become significant from the standpoint of international macroeconomics and international economic policy. As Delgado et al. [11] emphasized, “different views of competitiveness have confused the public and scholarly dialogue, and have obscured the development of an integrated framework to explain causes of cross-country differences in economic performance”. Another similar finding was reached by Siudek and Zawojńska [12], who noted, “competitiveness reveals itself as a confusing term which is often used almost interchangeably with other concepts like productivity, innovation or market share”. Olczyk [13] pointed to the lack of a generally accepted theory of international competitiveness and theoretical foundations of many of its concepts, concluding that the concept of international competitiveness is very broad, because it can be examined at different levels (e.g., regional, sectoral, industry or company level), and it is also based on a multitude of concepts. As shown by this study, international competitiveness theory does not start from classical/neoclassical theories of international trade but from models of imperfect competition (Dixit and Stiglitz’s model), even though it is mostly measured using trade/export performance. Alexandros and Metaxas [14] also claimed that at the macroeconomic level, the definition of competitiveness is strongly disputed, and this is a multidimensional and dynamic concept, a wide and multileveled term.

Taking into consideration competitiveness at a macro level, it should be noted, for example, that from the point of view of Krugman [15], national competitiveness, which is associated with improved living standards, is determined by raising productivity that creates the competitive advantage of a country in international trade. Furthermore, Krugman [15], highlighting the conceptual differences between the competitiveness of a country and a firm, emphasized that trade among nations is not a game “without a result”. At the same time, with regard to the objective of improving national competitiveness, he noted that it can lead to misallocation of resources, protectionism and trade wars. Meanwhile, Krugman [16] believed that the new trade theory acknowledges that differences among countries are one reason for trade, but it adds another: countries may trade because there are inherent advantages to specialization. However, it is worth noting that Hay [17], revising Krugman’s stylized depiction of the trade game, extended this model. A series of the model extensions included exploration of variable comparative advantage, variations in the levels of sector-specific employment across the business cycle, competition in status goods and the liberalization of services markets. Hay [17] also considered that the privileging of cost competitiveness specifically, rather than the pursuit of competitiveness per se, can be jeopardy for the European social model as cost competitiveness threatens to become not just a dangerous obsession but a dangerously obsessive compulsion. It is noteworthy that Porter [18] had a similar view to Krugman’s of national productivity as the main determinant of macroeconomic competitiveness. Porter [18] conceptualized, “Standard of living is determined by the productivity of a nation’s economy, which is measured by the value of the goods and services (products) produced per unit of the nation’s human, capital, and physical resources. Productivity, then, defines competitiveness”. However, revealing the crucial importance of microeconomic competitiveness for sustainable improvements

in economic prosperity, Porter [19] specified that productivity ultimately depends on the microeconomic capability of the economy, focusing on the sophistication of companies (both local and subsidiaries of multinationals), the quality of the national business environment and the externalities arising from the presence of clusters of related and supporting industries. Furthermore, Ketels [20] also proved that the microeconomic foundations need to be considered to assess and improve competitiveness, since there is a strong correlation between GDP per capita and microeconomic competitiveness, i.e., more than 80% of the variation of GDP per capita across the sample of countries can statistically be explained by the variation in the Business Competitiveness Index score. Ketels [20] also considered that two different definitions of competitiveness in both the productivity-based view and the market-share-based view, which is under a decline in the real exchange rate, could lead to exactly opposite policy assessments. Liu [21] analyzed national competitiveness under the Fourth Industrial Revolution through an ecosystematic approach, focusing on the interdependence of macroeconomic factors, their cross-border differences that determine national competitiveness and micro-level factors of the firm's competitiveness. Measuring the impact of management practices on the relationship between innovations and global competitiveness, Feldmann et al. [22] argued that innovations themselves cannot ensure competitiveness in companies or nations and require the simultaneous use of the best management practices. Runiewicz-Wardyn [23] believed, that sticking to only a few selected measures, such as productivity or innovation, can lead to an inaccurate or usually too narrow assessment of competitiveness. The authors considered the notion of competitiveness as the ability to turn economic prosperity into the broader measures of the country's well-being. In the era of digitalization, the ability to adopt and use digital technology both for companies and for the public sector can, directly and indirectly, create competitive advantages [24,25], digitalization might be a critical factor to consider as a determinant of competitiveness.

Siggel [26], taking an integrated approach, examined competitiveness relative to comparative advantage. Based on the traditional and new theories of trade, Smit [27] stated that comparative advantage, which arises as a result of country differences, continues to be the dominant explanation of trade flows at the level of inter-industry trade, whereas at the level of intra-industry trade, economies of scale become the dominant explanation of trade flows in differentiated products. For example, Falkowski [28] applied the revealed comparative advantage index to evaluate the real competitiveness of the Baltic States in contemporary trade in high-technology goods. Given the context of economic globalization in the international market, Zhang and London [29] noted that every country is trying to generate a competitive advantage in various sectors to improve the international competitiveness of their product and expand market share. Vietor and Weinzier [30] explored the areas in which government spending directly affects competitiveness: infrastructure, research and development, private investment, education and the regulatory system. Adamkiewicz [31] defined national competitiveness as "the ability of a nation to provide a conducive environment for its firms to prosper". This study revealed three orthogonal dimensions of national competitiveness, namely the institutional and micro-environmental potential, government efficiency in health and education and the public security of business.

Without concentrating on the concepts of price competitiveness and external balances, Aiginger [32] proposed defining competitiveness as the ability of a country or location to create welfare and indicated that in advanced countries specifically, policies promoting this will create positive spillovers into other economies. Nevertheless, competitiveness is also particularly significant at the regional level. Here, the questions Gardiner et al. [33] asked arise: How can regional competitiveness be measured? What are the connections between regional competitiveness and regional economic prosperity? Kitson et al. [34] explained that there is still no generally agreed theoretical or empirical framework for answering these questions and the focus on regional export shares as a measure of regional competitiveness is problematic. Dimian and Danciu [35] identified the creation of an environment capable to create added value and welfare as a key determinant of competitiveness in the EU

Member States by features such as: availability of financing, quality of the administrative and legislative framework, the opening of markets, entrepreneurship, human capital, innovation and knowledge dissemination, information and communications technology and sustainable development. Iacovoiu [36] concluded that the main source of competitiveness at the regional level, namely in the EU countries, is the ability of local firms to support innovation in the technological, managerial and organizational field; moreover, the innovation index reflects more accurately the net outward investment position to the extent to which the sources of innovation and competitiveness are specific to companies. In the opinion of Cellini and Soci [37], under a higher return on capital in the host countries, foreign direct investment (FDI) can be rightly seen as an indicator of competitiveness because new inbound capital is expected to act as an extra engine for growth, thus accelerating the overall pace of expansion. Regarding the competitiveness of EU manufacturing, O'Mahony and Van Ark [38] focused on two measures—relative (to the US) levels of labor productivity and unit labor costs—and indicated that a country's (or an industry within a country) relative competitive position at a point in time depends on its dollar levels of output per hour, its nominal compensation per hour and the market exchange rate. It is worth adding, according to the findings of Kegels and Linden [39], that the competitiveness of Belgium is hampered by relatively high unit labor cost, at least in comparison to its neighboring countries. Gabrisch and Staehr [40] offered evidence of the divergence in unit labor costs among the countries in Northern Europe and the countries in Southern and Eastern Europe that may thus be partly the result of capital flows from the core of Europe to the periphery prior to the global financial crisis. Nonetheless, as the authors specified, capital flows are likely to lead to changes in cost competitiveness in the short term while the reverse effect is subdued or non-existent and current account developments may be an important indicator of the macroeconomic performance in the future. Albu et al. [41] suggested that the overall growth effect of low wage and unit labor cost development is negative in Germany and destabilizes the euro area. In addition to cost competitiveness, Aiginger and Firgo [42] investigated the concept of “outcome” competitiveness and introduced a composite index that covers its three pillars (income, social and ecological pillars) to define outcome competitiveness under new perspectives in a broader way for the regions of Europe. In terms of outcome competitiveness under new perspectives, the authors named the top regions to be Austria, Germany, Finland, France, the Netherlands, Sweden and the UK, with Western and Northern European regions leading and Southern and Eastern regions lagging behind.

As the study of Habánik et al. [43] illustrated, increasing the competitiveness of the EU members can be achieved through regional development enhancement of the EU regions and regional discrepancies elimination. The authors analyzed the competitiveness of the Slovak economy through the Global Competitiveness Index, noting that there is no perfect universally accepted measure of competitiveness. Meanwhile, Dijkstra et al. [44] maintained that the Global Competitiveness Index is indeed the most internationally recognized index covering a fairly comprehensive set of aspects relevant to competitiveness. Taking into consideration the Global Competitiveness Index, Zagoršková et al. [45] did not find a positive relationship between the level of competitiveness and economic growth of the EU Member States. Rusu and Roman [46] used the Global Competitiveness Index in the applied regression models, and the results show differences with regard to the impact of the economic factors on competitiveness, according to the stage (efficiency-driven, in transition between efficiency and innovation and innovation-driven) of development of Central and Eastern European countries. Kolluru and Suresh [47], focusing on the global competitiveness index, presented the results of clustering the European countries; namely, cluster 1 (Switzerland, the Netherlands, Germany, Sweden, UK, Finland) and cluster 2 (Norway, Denmark, Austria, Luxemburg, Belgium, France, Ireland) are the more resilient and less vulnerable economies.

In the theoretical and especially empirical literature on competitiveness, which is quite extensive, the findings, regarding the approach to national competitiveness and its definitions, are rather controversial. Furthermore, there is no most common integrated

concept of macroeconomic competitiveness. Various theoretical approaches to national competitiveness and conceptual divergence in this term complicate the investigation of the competitiveness determinants that might be the most significant for driving economic growth. In addition, numerous studies of national competitiveness did not examine its main factors, which generate economic growth and development.

The authors of the present research revealed the determinants of national competitiveness, which impact the economic growth in the EU Member States, and highlighted the main effects of competitiveness based on clustering these countries.

3. Empirical Assessments of the Competitive Development of the European Economies

3.1. Specifics of the Competitiveness Performance in the EU

Enhancing national competitiveness is fundamental for boosting the rate of economic growth and improving living standards. In terms of increasing the openness of European economies, long-term competitiveness requires a stable inflow of investments in strategic infrastructure, human capital and generating new knowledge activities. It is necessary, as well as ensuring high efficiency of resources allocation, for the creation of sustainable value-added not only in science-intensive sectors but also in the entire industry structure.

However, significant differences in the competitiveness among European countries become the real challenges for restoring and strengthening economic growth. As recent data of the EU Regional Competitiveness Index for 2019 [48] showed, the differences in the basic sub-index, efficiency sub-index and innovation sub-index reflect, to a large extent, the internal disparities within and across different regions and can affect the level of inequality across the EU Member States. Specifically, large cross-regional disparities exist among the countries of Nordic and Western Europe, where the index is equal to 0.5–1 and more than 1 and countries of Southern, Eastern and South-East Europe, where the index varies from -1 to -0.2 . Meanwhile, there are such disparities even among Western and Nordic European countries; in particular, the index fluctuates from -1 to 0.2 in Portugal and Spain and from -1 to -0.2 in Italy. Its variance in France is -0.5 to 0.5 ; in Sweden, Finland and the UK, it is from -0.2 to 1 , whereas in Denmark, Germany, Belgium, the Netherlands and Austria, this index is 0.2 to more than 1 . High variability in the regional competitiveness can predetermine noticeable differences in the national competitiveness across the EU Member States. Moreover, the weaker performance of some European economies may contribute to reducing the competitiveness of the EU as a whole relative to highly advanced countries and fast-growing regions in the global economy.

From the standpoint of the Global Competitiveness Index (GCI) that shows the capability of a country to achieve sustained economic growth and human development, cross-country disparities in the EU are more recognized among the most technologically advanced, innovative and dynamic economies such as the Netherlands, where GCI is (82.4), German (81.8), Swedish, Great Britain, Danish (81.2), Finnish (80.2) and French (78.8) economies and economies with lower scores such as Cyprian (66.4), Hungarian (65.1), Bulgarian (64.9), Romanian (64.4), Greek (62.6) and Croatian (61.9) economies, according to the World Economic Forum (2019).

The largest gap is in the product markets, labor markets, financial systems, business dynamism and innovation capability pillars across the 12 pillars of the Global Competitiveness Index. According to the view of the IMD World Competitiveness Ranking (2020), there are also big differences among the development levels of economies of Denmark (2), the Netherlands (4), Sweden (6), Ireland (12), Hungary (47), Bulgaria (48), Greece (49), Romania (51), Slovakia (57) and Croatia (60). These differences appeared in factors ranking as the economic performance, government efficiency, business efficiency and infrastructure. The competitiveness gap in these factors is placed among European economies with a high level of competitiveness performance such as Germany (17), France (32), Spain (36) and Italy (44). The cross-country competitiveness disparities are noticeable among neighboring countries, for example, the Netherlands (4) and Belgium (25), Austria (16) and Italy (44), the Czech Republic (33) and Slovakia (57), Slovenia (35) and Croatia (60) and the Baltic States:

Estonia (28), Lithuania (31) and Latvia (41). Large regional competitiveness variances and highly heterogeneous scores of national competitiveness indicate that convergence in competitiveness performance is not observed for European economies, especially, among Northern and Western versus Central, Eastern and Southern European countries.

Competitiveness as a whole is associated with increasing economic welfare, prosperity and a higher quality of life due to productivity growth; the authors used the World Economic Forum [10] concept of competitiveness that considers productivity as the most important determinant of long-term economic growth. It is worth noting that, in order to reach a higher level of sustained growth and ensure high income levels, the EU economies need to strengthen productivity-driven, long-term competitiveness and enhance comparative advantages in production with a high added value. The ability to maintain European competitiveness over the long term requires knowledge-based assets leading to technological advances. According to the European Innovation Scoreboard for 2020 [49], the EU has the innovation performance lead over the United States and China (96 percent and 92 percent, respectively, relative to the EU-27's 100 percent), but its performance falls behind Japan (102 percent relative to the EU-27's 100 percent), Australia (111 percent), Canada (122 percent) and South Korea (134 percent) as the most innovative countries.

According to the Digital Economy and Society Index (DESI) 2020 report based on the 2019 data and the status of the digital economy and society prior to the outbreak of COVID-19, the most significant progression is noted in Ireland, followed by the Netherlands, Malta and Spain. These countries also perform well above the EU average indices as measured by the DESI score. Common to these Member States are clear policies and targeted investments in all areas measured by the DESI. Finland and Sweden are among the leaders in overall performance in digital activities, but in terms of progression over the last five years, they are just slightly above average, together with Belgium and Germany [50].

From the knowledge-driven economy perspective, improving the innovation environment, namely, the capacity for innovations, private sector companies' expenditures and public investment in R&D, government procurement of advanced technology products, university–industry collaboration in R&D and strong digital infrastructure, should become the main factor of the EU innovative capabilities to compete with leading economies. In addition, these capabilities dependent on long-term investments in human capital, generating knowledge, ICT-based innovations and the production of cutting-edge products will enable European economies to develop as highly productive. Their ability to raise productivity will increasingly predetermine the potential and dynamics of future economic growth and, as a consequence, the level of competitiveness under the conditions of the digital technology transformation.

3.2. The Main Issues of the European Economies' Competitiveness

It has to be noted that the analyzed specifics of the competitiveness performance of European economies point out regional disparities to a significant extent within and across the EU Member States. The persistence of these variances as well as cross-country differences in competitiveness becomes a key issue both for the macroeconomic adjustment at the national level and public policies at the supranational level of the EU. The creation of competitive advantages in the science-intensive services and high-tech industries of European countries in the global production value chains should be identified as a strategic issue of strengthening the innovation performance for the EU.

The EU also faces challenges of reducing the gap in sustainable and inclusive economic growth among its old and new members. Sustainable development, the efficiency of human resources, the flexibility of the labor market, social inclusion and ensuring gainful employment should be considered as the driving elements of the European economies' national competitiveness.

Figure 1 shows that there is a correlation between the human resources share in science and technology and the nominal labor productivity per person employed. Human resources in science and technology as an indicator of a knowledge-based economy are

one of the determinants of the EU countries' labor productivity. Furthermore, the variation of this indicator statistically explains 51% of the variation of nominal labor productivity per person employed across the EU countries.

Figure 1. Human resources in science and technology and labor productivity, 2019. Source: Eurostat.

Overall, the trend suggests that the higher the human resources share in science and technology, the higher the nominal labor productivity per person employed. However, it is worth comparing the EU countries that, at similar levels of human resources, achieve very different outcomes of productivity. Such variations in low and high levels of productivity exist, for example, among Bulgaria and Hungary, Slovakia, Portugal and especially Italy. Moreover, similar differences in labor productivity under the same human resources share in science and technology exist among Croatia and the Czech Republic, Poland and Spain, Lithuania and Austria and among Cyprus, Estonia and France; large variances to a significant extent prevail among the UK, Denmark and Ireland. It should be emphasized that considerable differences in the levels of labor productivity appear not only among new and old European countries but also among the most technologically advanced economies of old Europe. For instance, despite Italy having a low share of human resources in science and technology, its labor productivity is above the UK level, a country with a higher percentage of human resources in science and technology. In addition, in comparison with the UK, Finland and the Netherlands, labor productivity is higher, although the human resources share in science and technology is lower in Austria, France and Belgium. A significant gap in the level of labor productivity relative to Sweden and Luxembourg is evident in Ireland, where the share of human resources in science and technology to a certain extent is lower than in these countries. Such disparities are also visible among new European countries, especially among Romania and Bulgaria and Czech Republic and Latvia. It is worth noting that cross-country variations in labor productivity and human resources in science and technology among the specified EU old and new Member States are inconsistent with the main trend of these indicators' changes. The dispersion in the level of labor productivity across these countries can be determined by differences in how economic, technological, structural, organizational and social factors impacted productivity growth.

In terms of the current downturn in the EU, insufficient investments in production factors and new knowledge activities impede productivity growth, which is fundamental for European competitiveness over the long term. Figure 2 shows that the higher the level of investments is, the more high-tech export there will be. Especially, these indicators stand out for Ireland. However, it is not a perfect correlation for the EU countries as a whole.

For example, the UK, Germany, the Netherlands, France and Malta among new European countries have substantially higher levels of high-tech exports relative to the gross fixed capital formation. In comparison with these countries, in Estonia, Sweden, Hungary and the Czech Republic, although they exhibit the highest levels of investment, the percentage of high-tech exports is lower. It is notable that there is no strong relationship between the gross fixed capital formation and high-tech exports, but there exists a pronounced gap in the indicator of high-tech exports at similar levels of investment among such countries as the UK, Italy and Portugal, the Netherlands and Slovakia, Malta, Germany and Romania and Austria and Finland.

Figure 2. Gross fixed capital formation and high-tech exports, 2018. Source: Eurostat.

It is worth stressing that technological diffusion is a prerequisite for the creation of new firms and employment in innovative “markets of tomorrow”. Increasing incentives to direct financial resources toward long-term investments in the real economy, rather than maximizing short-term profits or supporting financial markets, is among the top priorities that the World Economic Forum (2020) highlights for the revival of economies and achieving economic transformation under the post-pandemic crisis. From this point of view, the macroeconomic stability and the business environment are conducive to the inflow of foreign direct investments, namely to advanced technological manufacturing; thus the key strategic sectors are the main issues of the competitiveness-enhancing investment increase in European economies.

Meanwhile, taking into account the main issues facing the EU countries noted above, a natural question arises: to what extent are there differences in the national competitiveness performance across the EU countries? From the standpoint of the long-term development potential and the ability to compete globally, the authors used GDP per capita as the leading indicator of economy-wide productivity and as the main indicator of the outcome competitiveness. As the key dimension relevant for competitiveness performance, the authors used the Global Competitiveness Index. The GCI 4.0 explains over 81% of cross-country variation in income levels and 70% of cross-country variation in long-term growth when accounting for the catch-up effect as reported by the World Economic Forum (2019). The GCI with an aggregation of 103 indicators encompasses factors impacting productivity, growth and human development and consists of such pillars as Institutions, Infrastructure, ICT adoption, Macroeconomic stability, Health, Skills, Product market, Labor market, Financial system, Market size, Business dynamism and Innovation capability. The GCI indicates that economic development is highly volatile in terms of the global demands, prices and exchange rates fluctuations, and the economic system is not determinate. Conse-

quently, this index can impact the choice of the macroeconomic policy adjustment direction for achieving the resilience of economic growth. In addition, the GCI allows authors to apply a holistic approach toward long-term growth, taking into consideration economic, innovation, social and environmental factors.

Figure 3 depicts the relationship between the Global Competitiveness Index and GDP per capita for the EU countries.

Figure 3. Global Competitiveness Index and GDP per capita, 2019. Source: Eurostat, World Economic Forum; World Bank, World Development Indicators database.

The variations in the GCI can statistically explain more than 51% of the variation of GDP per capita across the European countries. Large variations in the GCI are evident mainly among old and new European countries. Furthermore, among countries of old Europe relative to Greece and Portugal, there is a wide dispersion in the indicators of GDP per capita and the GCI. Luxembourg stands out as a country that has the highest GDP per capita, whereas its GCI is lower than in France, Finland, Denmark, Sweden, the Netherlands, the UK and Germany. At the same time, the cross-country gaps in GDP per capita level at a similar GCI are the most apparent for Hungary and Bulgaria, Malta and Lithuania, Ireland and Spain and Denmark, Sweden and the UK. From the standpoint of the economic theory of the developmental stages, countries are able to reach higher income and living standards at the innovation-driven stage when competitiveness is increasingly driven by the capacity of a country to boost the production of new, differentiated and unique goods with higher added value. Therefore, companies of these countries must compete at the global technological frontier and supply cutting-edge products to enhance their competitive advantage. Namely at this stage of the development, business sophistication and innovation have higher relative weights in the GCI. Meanwhile, despite that Cyprus, the Czech Republic, Estonia, Greece, Malta, Portugal, Slovakia and Slovenia are at the innovation-driven stage of their development, the authors found a significant competitiveness gap between the samples of these countries and highly competitive European economies. It should be noted that, to improve the competitiveness of the specified countries that have moved into the innovative stage of their development, it is not sufficient to adopt dominant technological products. On this point, especially in terms of international value chains, strong competitiveness performance requires productivity-enhancing investments such as business enterprise, governmental sectors and R&D creating fundamental knowledge that allows devising the most effective advanced technologies and achieving strong innovation capacity.

Taking into account the revealed specifics and the main issues of the competitiveness performance in the EU, it is necessary to emphasize that there exists both an intrinsic heterogeneity of regions and significant heterogeneity in outcome competitiveness across the European countries. Therefore, it is advisable to define what determinants of competitiveness are significant for the European economies' sustained development in terms of openness and, from the competitiveness point of view, to highlight the clusters of countries relative to the key driving factors of the economic growth and productivity.

4. Research Methods and Data

In this article, we aimed to reveal the factors of competitiveness performance that determine and contribute to the growth of European economies and, based on the effects of these factors, identify the clusters of the EU countries. We used the IBM SPSS Statistics software platform and performed cross-sectional data analysis for the EU countries to reveal what criteria of competitiveness factors (each of which consists of five sub-factors) can be exploited further for the estimation of their relationship with economic growth. We conducted factor analysis to explore the determinants of competitiveness that are significant for European economies.

After the factors influencing the competitiveness of the EU economies were calculated, we applied cluster analysis, which allowed us to show groups of the EU countries from the standpoint of the contribution of complex competitiveness factors to the economic growth. This allowed us to differentiate the impact of similar competitiveness factors on the economic outcome in the EU countries as well as to point out the aspects of the competitiveness performance of European economies that could be strengthened, especially for post-pandemic recovery of economic development.

In the factor analysis, we used the data from Eurostat, OECD and World Bank datasets of 28 countries of the EU for 2017, 2018 and 2019. Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. From a set of p variables, factor analysis extracts a reduced set of m components or factors that accounts for most of the variance in the p variables. In other words, a set of p variables is reduced to a set of m underlying superordinate dimensions. These underlying factors are inferred from the correlations among the p variables. Each factor was estimated as a weighted sum of the p variables [51,52]. The i th factor is thus

$$F_i = W_{i1}X_1 + W_{i2}X_2 + \dots + W_{ip}X_p \quad (1)$$

One may also express each of the p variables as a linear combination of the m factors,

$$X_j = A_{1j}F_1 + A_{2j}F_2 + \dots + A_{mj}F_m + U_j \quad (2)$$

where U_j is the variance that is unique to variable j , variance that cannot be explained by any of the common factors.

5. The Estimation of Determinants and Effects of the Competitiveness of EU Economies

As described previously, in the determination of the competitiveness factors, we took into account four main competitiveness factors of the national environment developed by the Institute for Management Development (IMD) and published in the World Competitiveness Yearbook (2021) [3] which is the leading annual report on the competitiveness of countries. These factors are Economic Performance, Government Efficiency, Business Efficiency and Infrastructure, and we added another factor of R&D and Digitalization that we consider increasingly significant for ensuring competitiveness. Considering the emerging impact of digitalization, we added it as the fifth factor to the classical factors of the Competitiveness Index.

Each of these factors comprises five sub-factors with grouped criteria that highlight various issues of competitiveness. According to such sub-factors, we studied 68 competitiveness indicators from which, in view of the correlation relationship, 17 indicators were selected as most applicable for factor analysis. Therefore in this article, the factor Economic Performance consists of such sub-factors as Domestic Economy, International Trade and International Investment. Factors Government Efficiency and Business Efficiency feature sub-factors Public Finance and Finance, respectively.

The factor Infrastructure is divided into such sub-factors as Basic Infrastructure and Scientific Infrastructure. The selected competitiveness indicators of the EU countries included in the main factors and sub-factors of competitiveness are presented in Table 1.

Table 1. Competitiveness indicators of the EU countries.

Competitiveness Factors	Competitiveness Sub-Factors	Competitiveness Indicators
Economic Performance	Domestic Economy	Final consumption expenditure of households and non-profit institutions serving households
	International Trade	External balance of goods and services, % of GDP Exports of services, % of GDP Imports of goods and services, % of GDP Terms of trade (export/import) trade unit value indices, by reporting country: 2015 = 100
	International Investment	Inward FDI stocks in % of GDP Outward FDI stocks in % of GDP Foreign direct investment in the reporting economy (flows), % of GDP FDI flow intensity, market integration Foreign direct investment, net outflows, % of GDP Private sector credit flow, consolidated, % of GDP
Government Efficiency	Public Finance	Net external debt, % of GDP
Business Efficiency	Finance	Private sector credit flow, consolidated, % GDP
Infrastructure	Basic Infrastructure	Population growth (annual %)
	Scientific Infrastructure	Research and development personnel, full-time equivalent (% of the labor force) Research and development personnel, business enterprise sector, full-time equivalent (% of the labor force) Researchers in research and development, percentage of active population, full-time equivalent Patent applications to the European patent office (EPO) per million inhabitants European patent applications per country of residence of the applicant European patent applications include direct European applications and international (PCT) applications that entered the European phase during the reporting period
Digitalization	The Digital Economy and Society Index (DESI)	A composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU Member States across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services.

The factor of Digitalization is added to the classical factors of competitiveness thus reflecting the role of digital performance in determining competitiveness. It is based on the data of the DESI and reflects the digital performance of the EU Member States. DESI is a composite index calculated annually by the European Commission, and it summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU

Member States across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services [51].

Since we examined the determinants of competitiveness that can impact significantly the economic growth in European countries, GDP per capita was used as an indicator of the economic activity, i.e., as a measure for both the total production and the total income, in relation to the EU average set to equal 100. The dependent variable GDP per capita was measured as volume indices of real expenditure per capita and was expressed in PPS (EU 28 = 100) which eliminates the differences in price levels among countries and allows meaningful volume cross-country comparisons of GDP.

Selected indicators of competitiveness were used to estimate the determinants and effects of European economies' competitiveness. Our empirical approach was based on the aggregation of competitiveness indicators into a complex measure. As noted by the OECD [53], statistical models such as principal components analysis (PCA) or factor analysis (FA) could be used to group individual indicators according to their degree of correlation. More specifically, PCA/FA could be used to select a single or a subset of variables to include in the construction of a composite index that can explain the variation of the overall data set adequately [53]. To identify the dimensions of the competitiveness of the European economies, we applied factor analysis, namely principal component factor analysis. For measuring sampling adequacy, we took into account the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity to proceed to factor analysis. Table 2 displays the KMO and Bartlett's test results, according to which the KMO values are greater than 0.6 for 2017 and 2018, and the value for 2019 is above 0.5. As a stylized fact it is known that, if $KMO > 0.5$, the sample is adequate. Bartlett's test significance is the p-value (Sig.) of $0.000 < 0.05$. These results indicate acceptable data adequacy, i.e., the data are sufficient and suitable for conducting factor analysis that is supported by significant Bartlett's test and is applicable to the selected variables. Hence, the sample is adequate, and the factor analysis is valid.

Table 2. KMO and Bartlett's tests.

2017			2018			2019		
Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.639	Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.598	Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.559
Bartlett's Test of Sphericity	Approx. Chi-Square	911.837	Bartlett's Test of Sphericity	Approx. Chi-Square	799.220	Bartlett's Test of Sphericity	Approx. Chi-Square	725.347
	df	153		df	153		df	153
	Sig.	0.000		Sig.	0.000		Sig.	0.000

Therefore, we could examine the total variance to assess the factor structure. For identifying the number of factors, the extraction method of the principal component analysis and the Kaiser criterion were used. Four factors were extracted, which met the criterion that factors have eigenvalues larger than 1. For 2017, four factors explain 88.93% of the cumulative variance in competitiveness performance. The first factor explains 39.34% of the variance, the second factor explains 26.37%, the third factor explains 12.24%, and the fourth factor explains 10.99% of the variance. For 2018, four factors explain 83.12% of the cumulative variance. The first factor explains 33.20% of the variance, the second factor, 23.70%, the third factor, 17.23%, and the fourth factor, 9.99%. For 2019, four factors explain 78.67% of the total variance. The first factor explains 31.45% of the variance, the second factor, 20.92%, the third factor, 17.26%, and the fourth factor, 9.03%. The indicator of the total variance has a very high value due to four factors, and only 11.07%, 16.88% and 21.33% of the variance are explained by other factors, respectively, for these years.

For 2019, the fifth complex factor with a value of 7.25% was added, which would increase the size of the explained dispersion to 85.02%. However, for further description, the

fifth factor was not included in the model, and a model with four complex factors (similar to the models for 2017 and 2018) was used in the study to make the model comparable with the models used in 2017 and 2018.

The principal components were revealed based on the method of a varimax orthogonal rotation. For 2017, Table 3 shows the factor loads for the four selected factors after rotation. Each factor consists of variables that have factor loads greater than 0.5 and contribute to the factor structure.

Table 3. Rotated component matrix ^a.

	F1	F2	F3	F4
Consumption	−0.709	−0.530	0.214	−0.198
External balance	0.901	0.228	−0.140	0.131
Exports of services	0.833	−0.062	0.129	0.480
Imports	0.874	−0.090	0.028	0.265
Terms of trade	−0.170	−0.079	−0.221	−0.786
Inward FDI stocks	0.799	0.002	0.458	0.352
Outward FDI stocks	0.769	0.054	0.569	0.271
FDI flows	0.710	0.005	0.572	0.371
FDI flow intensity	−0.813	−0.044	−0.469	−0.159
FDI net outflows	0.182	0.182	0.894	0.047
Net external debt	−0.910	−0.150	−0.308	−0.082
Credit flow	−0.846	0.034	−0.140	0.197
Population growth	0.485	0.386	−0.113	0.681
R&D personnel	0.151	0.953	0.165	−0.053
R&D personnel, business	0.149	0.953	0.075	0.031
Researchers in R&D	−0.028	0.955	0.076	−0.025
Patent applications	−0.150	0.931	0.100	0.118
DESI	0.078	0.769	−0.126	0.335

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

^a Rotation converged in 6 iterations.

F1 (Component) Macroeconomic Stability includes indicators that reflect consumption as an element of aggregate demand, as well as indicators of international trade: external balance of goods and services, exports of services, imports of goods and services, indicators of international investment—*inward FDI stocks*, *outward FDI stocks*, *FDI flows* in the reporting economy and *FDI flow intensity*—an indicator of government efficiency relative to public finance, *i.e.*, *net external debt*, and an indicator of business efficiency relative to finance that is private sector credit flow. The largest factor loads were obtained by such indicators as exports of services (0.833), imports of goods and services (0.874) and external balance of goods and services (0.901). Meanwhile, *FDI flow intensity* (−0.813), private sector credit flow (−0.846) and *net external debt* (−0.910) are negatively correlated with F1 which can be due to the international macroeconomic environment instability, restrictive monetary adjustment and macroeconomic imbalances at the national level associated with low government regulation efficiency. F2 was labeled as Research and Development (R&D) and Digitalization. This component comprises indicators with positive coefficients of the highest factor load, namely *R&D personnel—full-time equivalent* (0.953), *R&D personnel—business enterprise sector, full-time equivalent* (0.953), *researchers in R&D* (0.955), *patent applications to the European patent office* (0.931) and *DESI* (0.769). F3, Foreign Direct Investment, is formed by *net outflows of foreign direct investment*, also with a positive coefficient of the highest factor load. Terms of trade have the largest negative load (−0.786) in F4 Trade Openness.

For 2018, the four selected factors after rotation are presented in Table 4.

Table 4. Rotated component matrix ^a.

	F1	F2	F3	F4
Consumption	−0.447	−0.608	−0.393	0.342
External balance	0.627	0.301	0.418	−0.469
Exports of services	0.785	−0.005	0.555	−0.174
Imports	0.686	−0.040	0.559	−0.241
Terms of trade	−0.459	−0.386	0.212	0.425
Inward FDI stocks	0.934	0.013	0.309	−0.006
Outward FDI stocks	0.239	−0.108	0.756	0.051
FDI flows	−0.976	−0.099	−0.029	0.002
FDI flow intensity	0.978	0.094	0.103	−0.037
FDI net outflows	−0.057	0.195	−0.713	−0.328
Net external debt	−0.940	−0.181	−0.086	0.213
Credit flow	−0.217	0.053	0.341	0.814
Population growth	0.282	0.369	0.782	−0.071
R&D personnel	0.177	0.938	−0.151	0.059
R&D personnel, business	0.140	0.936	−0.027	0.151
Researchers in R&D	0.001	0.939	−0.143	0.011
Patent applications	−0.014	0.420	−0.178	0.583
DESI	−0.030	0.775	0.331	−0.032

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

^a Rotation converged in 9 iterations.

The factor load of variables that contribute significantly to F1 Macroeconomic Stability varies from 0.627 to 0.978. The indicator of FDI flows in the reporting economy has a sizeable negative load, and it points out that FDI decreases due to trade and investment policy uncertainty and low efficiency of goods markets can lead to declining aggregate supply and external and internal macroeconomic imbalances. F2 R&D and Digitalization has high positive loads from −0.608 to 0.939 with indicators of science and technology. Variables with factor loads from −0.713 to 0.782 significantly contribute to the structure of F3 Investment Activity. F4 Business Efficiency influenced by business risks is mainly dominated by the variable private sector credit flow (0.814).

In 2018, the same complex factors are persistent as in 2017, but minor changes in the primary factors are observed: the primary factor Consumption moved from the first complex factor to the second, and the factor Population growth moved from the fourth complex factor to the third. However, the factor Patent application remained lingering between the second and fourth factors, which indicates that these primary factors are not specific to any of the complex factors.

For 2019, Table 5 displays the factor loads for the four selected factors.

Such variables as external balance, terms of trade, inward FDI stocks, FDI flows, FDI flow intensity and net external debt are highly loaded in Factor 1 Macroeconomic Stability. The factor load of the most significant variables varies from −0.700 to −0.900 in Factor 1. Factor loads of science and technology indicators to a large extent identify Factor 2 R&D and Digitalization. Factor 3 Foreign Direct Investment is formed by FDI net outflows. The factor load of the most significant variables varies from −0.520 to 0.910 in Factor 4 Trade Openness.

Thus it can be observed that the first factor, Macroeconomic Stability, is the most stable and relevant with minimal changes in the course of 3 years, while the second stable factor is the second factor, R&D and Digitalization. Other factors change slightly during the years under study, and thus the hypothesis is approved—indeed the most significant determinants of the competitiveness of European economies are linked with macroeconomic factors, R&D and digitalization, and they are relatively stable during the analyzed time frame.

The obtained complex factors were used to group the EU Member States with the cluster analysis. Cluster analysis is a set of tools and algorithms that is used to classify different objects into groups in such a way that the similarity between two objects is maximal if they

belong to the same group and minimal otherwise. We used one of the clustering methods, k-means clustering. The aim of this method is to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean (cluster centers), serving as a prototype of the cluster [54,55].

Table 5. Rotated component matrix ^a.

	F1	F2	F3	F4
Consumption	−0.484	−0.394	0.363	−0.520
External balance	0.708	0.126	−0.201	0.583
Exports of services	0.596	−0.179	0.005	0.756
Imports	0.524	−0.204	−0.193	0.710
Terms of trade	−0.700	−0.055	0.072	0.047
Inward FDI stocks	0.794	−0.086	0.210	0.535
Outward FDI stocks	0.265	−0.138	0.429	0.718
FDI flows	−0.900	−0.085	0.101	−0.212
FDI flow intensity	0.874	0.006	0.380	0.214
FDI net outflows	0.008	−0.071	0.903	−0.149
Net external debt	−0.889	−0.018	0.110	−0.358
Credit flow	−0.283	0.438	0.327	0.251
Population growth	0.090	0.129	−0.176	0.910
R&D personnel	0.328	0.880	−0.158	−0.044
R&D personnel, business	−0.106	0.941	0.040	−0.111
Researchers in R&D	0.190	0.894	−0.203	−0.033
Patent applications	−0.073	0.549	0.169	−0.116
DESI	−0.009	0.712	−0.228	0.396

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

^a Rotation converged in 6 iterations.

The clusters of the EU Member States were formed based on the 3-year data period—for 2017–2019. We initially determined the number of clusters by using the hierarchical clustering and the elbow method. The preferred number of clusters was 5. Then with the k-means method, a grouping of EU Member States in five clusters was carried out using the approach of measuring the distance between clusters by Eiklid. The analysis of variance (ANOVA) showed statistical significance of all of these factors for the cluster analysis (Sign = 0.000 < 0.05). The overview of the cluster analysis is summarized in Table 6.

Table 6. Final cluster centers.

	Cluster				
	1	2	3	4	5
F1 Macroeconomic Stability	3.939	−0.082	1.531	−0.504	−1.223
F2 Research and Development (R&D) and Digitalization	0.350	−0.588	−0.146	1.154	−1.624
F3 Foreign Direct Investment	2.985	−0.030	−2.554	0.143	1.290
F4 Trade Openness	0.905	−0.513	1.219	0.197	2.581

The first cluster is characterized by all positive coordinates of the cluster centers, i.e., the Member States within this cluster are in an excellent position in F1 Macroeconomic Stability and F3 Foreign Direct Investments. A good position is also in the F2 R&D and Digitalization and F4 Trade Openness. This cluster is represented by one country—Luxembourg.

The second cluster has an opposite tendency: all cluster coordinates are negative, i.e., all factors have negative values, especially for F2 R&D and Digitalization and F4 Trade Openness. This cluster is represented by 15 Member States, which are mainly Eastern European and some Southern European: Bulgaria, Croatia, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Greece, Spain, Italy and Portugal.

For the third cluster, the first and the second coordinates are positive, but the second and the third ones are negative. Thus the Member States within this cluster have very good F1 Macroeconomic Stability and F2 Trade Openness, but F3 R&D and Digitalization and F3 Foreign Direct Investments are weaker. In this cluster, there are Malta and Ireland.

In the fourth cluster, only the first coordinate of the first cluster center is negative with an insignificant value of -0.50447 . This means that the Member States within this cluster are sufficiently macroeconomically stable (F1) with developed F2 R&D and level of digitalization and a good degree of F4 Trade Openness. These are nine leading Member States of the EU: Belgium, Denmark, Germany, France, the Netherlands, Austria, Finland, Sweden and the United Kingdom.

For the fifth cluster, the first two coordinates of the cluster centers are negative, but the third and the fourth ones are positive. It can be interpreted as issues in F1 Macroeconomic Stability and F2 R&D and Digitalization, but they have a very good position in F4 Trade Openness and F3 Foreign Direct Investments. This cluster is represented only by Cyprus.

From the analysis of distances from the cluster centers (Table 7), it can be concluded that the most diverse is the first cluster; the third and fifth clusters also have significant distinctions. These clusters are represented by one or two Member States.

Table 7. Distances among final cluster centers.

Cluster	1	2	3	4	5
1		5.307	6.069	5.383	6.019
2	5.307		3.489	1.937	3.701
3	6.069	3.489		3.763	5.140
4	5.383	1.937	3.763		3.904
5	6.019	3.701	5.140	3.904	

In 2018, the same five clusters remain with minor changes: two Member States are transferred from the second cluster to the fourth—the Czech Republic and Slovenia—but the fifth cluster is supplemented with Malta and Hungary.

In 2019, the situation returns to the division of 2017 with one distinction—Ireland is transferred from the third cluster to the second one.

For exploring the contribution of the independent variables Factor 1, Factor 2, Factor 3 and Factor 4 (factors of the competitiveness performance of European economies) to the dependent variable GDPc (GDP per capita), i.e., the impact of these factors on the economic growth, the Enter method of multiple regression analysis was applied:

$$\text{GDPc}(\text{estimate}) = b_0 + b_1 F1 + b_2 F2 + b_3 F3 + b_4 F4 \quad (3)$$

The regression results are presented in Table 8.

Table 8. Regression results with data of 28 EU countries.

Coefficients	2017	2018	2019
Constant	101.286	101.679	101.964
b_1	28.373	29.198	30.500
b_2	23.429	25.587	17.601
b_3	11.249	7.867	17.189
b_4	12.457	−7.852	−6.424
β_1	0.645	0.632	0.709
β_2	0.537	0.563	0.465
β_3	0.286	0.337	0.375
β_4	0.328	−0.254	−0.154
Adj. R^2	0.87	0.88	0.87
F-test	0.000	0.000	0.000

According to the regression results, it can be concluded that all models are significant. The largest contribution to the dependent variable GDPc comes from F1 (Macroeconomic Stability), then F2 (R&D and Digitalization), then F4 (Trade Openness) and then F3 (Foreign Direct Investment).

Taking into account the large disparities in the competitiveness performance (Figures 1–3) revealed among Ireland, Luxembourg and the rest of the European countries, we recalculated the regression models, with the exception of Ireland and Luxembourg. The regression results are presented in Table 9, and they show that this model for three years is significant (for 2017, model significance is $F(4, 21) = 38.2, p < 0.001$; for 2018, model significance is $F(4, 21) = 34.2, p < 0.001$; for 2019, model significance is $F(4, 21) = 23.8, p < 0.001$). The most significant factors of competitiveness performance remain Macroeconomic Stability and R&D and Digitalization.

Table 9. Regression results with modified data for 26 EU countries, excluding Ireland and Luxembourg.

Coefficients	2017	2018	2019
Constant	91.846	92.154	92.423
b ₁	21.564	7.259	19.529
b ₂	4.191	20.327	4.872
b ₃	3.231	0.637	0.536
b ₄	2.173	1.173	0.575
β ₁	0.906	0.313	0.877
β ₂	0.176	0.875	0.219
β ₃	0.136	0.027	0.024
β ₄	0.091	0.051	0.026
Adj. R ²	0.86	0.84	0.79
F-test	0.000	0.000	0.000

Imitations and Suggestions

The main limitation of the current study is that the analysis did not take into consideration the different sectors and industries that could be affected differently by the determined factors of competitiveness. As the main aim of this study was to reveal the factors of competitiveness performance that determine and contribute to the growth of European economies, the noted limitations did not affect the objective of the study, but they rather outline guidelines for future research.

In addition, considering the importance of digitalization for the competitiveness of all sectors nowadays, it is suggested by the authors to address the various aspects of digitalization, for example, the analysis of the factors of the digitalization index and their individual effect on the competitiveness of the European countries in future research.

6. Discussion

National competitiveness that reflects the rise in living standards has become one of the major current issues of international macroeconomics and international economic policy. Although this issue has been intensively discussed and there is a large amount of research as well as alternative approaches in this area, there is no generally accepted definition and comprehensive concept of national competitiveness. Moreover, the definitions of competitiveness at the macroeconomic level are controversial, and this creates the prerequisites for the differentiation of theoretical approaches to national competitiveness. Our findings are consistent with the point of view of Olczyk [12] and Alexandros and Metaxas [13]. Unlike Zagoršková et al. [44], we found a positive relationship between the level of competitiveness and the economic growth for the EU Member States and specifics of cross-country differences.

We explored the factors of the national competitiveness of European economies, namely the EU Member States, which is the limitation of the current research. It should be noted that there is a lack of extensive investigation of the impact of competitiveness

factors on economic growth in the EU Member States. In this article, we found large cross-regional disparities in the competitiveness performance among countries of Nordic and Western Europe and countries of Southern, Eastern and South-East Europe. We revealed that the significant competitiveness gap among the EU countries existed mainly in such pillars of the Global Competitiveness Index as the product market, labor market, financial system, business dynamism and innovation capability, as well as in competitiveness factors ranking as economic performance, government efficiency, business efficiency, infrastructure and digitalization. In addition, cross-country competitiveness disparities are noticeable for neighboring European countries. Our finding is the following: convergence in the competitiveness performance was not observed for European economies, especially among Northern and Western versus Central, Eastern and Southern European countries.

The analyzed specifics of the competitiveness performance of European economies allowed us to highlight the main issues for the EU, among which are the creation of competitive advantages in science-intensive services, high-tech and digitalized industries in the global production value chains, reducing the gap in the sustainable and inclusive economic growth among old and new members of the EU, the intrinsic heterogeneity of regions and significant heterogeneity in the outcome competitiveness across European countries. Taking into account the analyzed correlation between human resource share in science and technology and the nominal labor productivity, we emphasized that the EU countries at similar levels of human resources achieve very different outcomes of productivity, and these differences are considerable not only between new and old European countries but also between the most technologically advanced economies of old Europe. It was found that cross-country variations of these indicators are inconsistent with their main trend. We also showed that there is no strong relationship between the gross fixed capital formation and high-tech exports. However, we found a pronounced gap in the indicator of high-tech exports at similar levels of investment among such countries as the UK, Italy and Portugal, the Netherlands and Slovakia, Malta, Germany and Romania and Austria and Finland. Analyzing the relationship between the Global Competitiveness Index and GDP per capita for the EU countries, we specified that cross-country gaps in the GDP per capita level at a similar GCI are most apparent for Hungary and Bulgaria, Malta and Lithuania, Ireland and Spain and Denmark, Sweden and the UK. We revealed that although Cyprus, the Czech Republic, Estonia, Greece, Malta, Portugal, Slovakia and Slovenia are at the innovation-driven stage of development, there is a significant competitiveness gap between these countries and highly competitive European economies. The same results can be observed when the DESI is analyzed. Therefore, we note that, for these countries to achieve strong competitiveness performance, it is necessary to increase productivity-enhancing investments and emphasize the role of R&D and digitalization.

7. Conclusions

In this article, we offer a holistic approach to the analysis of competitiveness performance to reveal which factors can determine the economic growth in European countries. We divided the investigated indicators of competitiveness into four groups of criteria of competitiveness factors, each of which consists of sub-groups. We applied factor analysis, namely the principal components analysis, to determine the competitiveness factors of European economies.

According to the Kaiser–Meyer–Olkin (KMO) test and Bartlett’s test of sphericity, the conducted factor analysis is reliable and allowed us to identify the orthogonal dimensions of competitiveness, namely F1 Macroeconomic Stability, F2 R&D and Digitalization, F3 Foreign Direct Investment and F4 Trade Openness. Our regression models allowed us to reveal the factors of competitiveness that can impact economic growth and showed that F1 Macroeconomic Stability, F2 R&D and Digitalization, F3 Foreign Direct Investment and F4 Trade Openness significantly contributed to GDP per capita and are the determinants of economic growth in the EU Member States.

The hypothesis of this study was that the most significant determinants of the competitiveness of European economies are linked with macroeconomic factors, R&D and digitalization and they are relatively stable. Indeed the regression analysis indicated the importance of Macroeconomic Stability (F1) and R&D and Digitalization, and their significance remained unchanged during the analyzed period of time.

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