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Integration of Post-Communist Countries in the EU – Leaders and Losers?

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Abstract

The economic indicators of the new member states of the EU that joined after 2004 have been generally positive. In this paper, we analyse and interpret the economic development results of the 11 new Member States from the Eastern bloc. The set of individual economic indicators gives us a relatively realistic picture of the differences in development in individual post-communist countries. The paper points out several factors which, in principle, create two groups of countries for us in terms of the development of economic indicators: A more progressive group of countries, which for the most part is showing progress towards catching up with the EU average, and a less progressive group, whose pace of convergence is significantly slower.

Keywords: economic, development, the difference, post-communist countries, EU

JEL: E6, E62, F02, F62

Introduction and literature review

The EU is one of the most successful integration projects. It would be difficult to find a grouping of countries that is so diverse and yet still able and willing to deepen their mutual interaction. Integration processes within the EU take place at many levels, in various forms and cover a wide range of areas (Borsi and Metiu 2015; Hamadeh et al. 2017; Behun et al. 2018). The European Union's expansion by the Eastern bloc countries in 2004 was one of the turning points of modern European integration. The list of the countries includes Lithuania, Latvia, Estonia, Poland, the Czech Republic, Slovakia, Hungary, and Slovenia; in 2007, Romania and Bulgaria joined, and in 2013, Croatia became an EU country too. The quantity and quality of disparities between EU member states were therefore increased by the accession of these post-communist countries (Fredriksen 2012; Hagsten 2016; Novosák et al. 2017; Pascual Sáez, Alvarez-García, and Rodríguez 2017).

In general, the economic indicators of the new EU member states have developed positively since their accession (Cieślik 2014). Post-communist countries that have joined the EU have subsequently seen GDP (gross domestic product) growth, rising purchasing power parities, more stable inflation, rising labour productivity, reduced unemployment, as well as an increase in average hourly and total annual wages (Angus and Heston 2010; López 2011; Jagielski and Kutner 2013; Simionescu 2014; Magone, Laffan, and Schweiger 2016; Beugelsdijk, Klasing, and Milionis 2018; Dudzevičiūtė, Šimelytė, and Liučvaitienė 2018; Musabeh, Alrifai, and Kalloub 2018).

At the same time, this development must be seen in a broader perspective, when non-member European countries (e.g. Iceland, Switzerland, and Norway) have also shown positive development trends in these areas since 2004 (Popa 2012; Terazi and Şenel 2012; Caporale et al. 2014). Therefore, it is vital to sensitively perceive the individual effects of EU membership and to distinguish between the natural global (or at least European) economic trend and the specific impacts that EU membership has brought to a given Member State. If any European country joins the EU and its economic indicators subsequently improve, it does not automatically mean that it is only thanks to EU membership that the country has seen a positive increase (Thalassinos, Ugurlu, and Muratoglu 2012). Of course, we are aware that joining the EU opens a wide range of opportunities for the private sector of a new member state to expand into foreign markets, break down trade barriers and increase the movement of capital and investment. EU membership also brings benefits in the form of the opportunity to participate in the use of EU structural funds; it provides better legal protection for entrepreneurs and reduces corruption – by creating another level of control (Nikulin 2015; Dall'Erba and Fang 2017; Cohen and Ladaique 2018; Hlavacek and Bal-Domanska 2016).

The economic development of EU member states is also strongly influenced by global trends and stages of the world economic cycle, so it is very difficult to quantify and separate the impacts of macroeconomic economic trends and the impacts result-

ing from EU membership (Janský and Kolcunová 2017; Szeiner et al. 2020). Therefore, as we stated in the introduction, since the accession of post-communist countries to the EU, their economic situation has improved, but we cannot just identify it with their EU membership – we also have to consider global trends in the background. Because of this, we decided to record the results of the economic development of eleven countries of the former socialist bloc (Estonia, Lithuania, Latvia, Poland, Slovakia, the Czech Republic, Hungary, Slovenia, Romania, Bulgaria, Croatia), which are linked by the fact that they are EU member states.

Our role is to pay attention to several indicators of economic development. Our overview is based on calculating the initial situation of each national economy in the year of accession to the EU and the form it acquired during the membership of the EU. The first thematic area of our review focuses on the aggregate macroeconomic indicators GDP, GDP per capita, Actual individual consumption expressed (real expenditure in PPS), and Purchasing power adjusted GDP per capita (real expenditure per capita in PPS). In order to avoid warnings and objections that the comparison is not adequate, we decided to include selected relative indicators that relativize the aggregate data. The second thematic area compares the development of the GINI Index and Nominal labour productivity per person employed (EU = 100).

Our research sample comprises all post-communist countries that are members of the EU. In 2004 (the so-called great enlargement), a total of ten countries joined the EU, including eight countries of the former socialist bloc: Estonia, Lithuania, Latvia, Poland, Slovakia, the Czech Republic, Hungary and Slovenia. The next round of EU enlargement to the south-east in 2007 meant membership for Romania and Bulgaria. So far, the last EU member state to have joined the EU – and join the post-communist countries – was Croatia in 2013.

Data and methods

The aim of our contribution is to point out the differentiated economic development of post-communist countries in the EU between 2004 and 2019 based on selected macroeconomic variables and indicators. Differentiated development contributed to increasing initial disparities between countries. Due to the monitoring of macroeconomic variables associated with GDP and other economic and economic indicators, we recorded different levels of progress of the post-communist EU countries. The selected quantities in our article are not selected at random; they are a selection that helps us achieve the set goal of the paper.

GDP and its modifications (per capita conversion, real GDP or the aggregate value of GDP) have a very important position for our article. GDP is an indicator of a nation's economic situation. It reflects the total value of all goods and services produced less the value of goods and services used for intermediate consumption in their production. GDP at purchaser's prices is the sum of gross value added by all

resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for the depreciation of fabricated assets or the depletion and degradation of natural resources. Data are in current euros. Euros figures for GDP are converted from domestic currencies using single year official exchange rates.

GDP per capita in Purchasing Power Standards (PPS) is another indicator we monitor. It is a measure of economic activity and is defined as the value of all goods and services produced less the value of any goods or services used in their creation. The volume index of GDP per capita in PPS is expressed in relation to the European Union average, set to equal 100. If the index of a country is higher than 100, this country's level of GDP per head is higher than the EU average and vice versa. Basic figures are expressed in PPS, i.e. a common currency that eliminates the differences in price levels between countries allowing meaningful volume comparisons of GDP between countries.

Information on net earnings (net pay taken home, in absolute figures) and related tax-benefit rates (in %) complements gross earnings data regarding disposable earnings. The transition from gross to net earnings requires the deduction of income taxes and employee's social security contributions from the gross amounts and the addition of family allowances, if appropriate. The amount of these components, and, therefore, the ratio of net to gross earnings, depends on the individual situation. Several different family situations are considered, all referring to an average worker. The data refer to an average worker at the national level for different illustrative cases, defined on the basis of marital status (single vs. married), number of workers (only in the case of couples), number of dependent children, and level of gross earnings expressed as a percentage of the average earnings of an average worker (AW). In the article, we operate with single person data without children earning 50% of the average earning.

The economic progress of post-communist countries in the EU is partly documented by actual individual consumption expressed as real expenditure in PPS. Actual individual consumption (AIC) refers to all goods and services consumed by households. It encompasses consumer goods and services purchased directly by households, as well as services provided by non-profit institutions and the government for individual consumption (e.g., health and education services). In international comparisons, the term is usually preferred over the narrower concept of household consumption, because the latter is influenced by the extent to which non-profit institutions and general government act as service providers. Although GDP per capita is an important and widely used indicator of countries" level of economic welfare, consumption per capita may be more useful for comparing the relative welfare of consumers across various countries.

Real expenditures are expenditures in national currency converted to PPS using PPPs. They are thus denominated in PPS. "Real expenditure" or "expenditure in PPS" refers to an expenditure aggregate, for instance, GDP or actual individual consumption, which has been converted to a common, technical currency, PPS) and a com-

mon price level using PPPs. Purchasing power parities (PPP) scaled to the sum of expenditures of the EU Member States expressed in euro. This means that the PPP of one particular country indicates how many units of national currency one would need in that country in order to maintain the purchasing power of one euro in the EU. This conversion results in a set of data that is comparable across countries and expresses the relative volume underlying each country's expenditure. If the real expenditure on, for instance, GDP is divided by the number of inhabitants in each country, the resulting real expenditure per inhabitant can be used as an indicator of the relative standard of living of the inhabitants of each country.

Thanks to the GINI index, we recorded the different income distribution in post-communist EU countries. The Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus, a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality. In general, the following formula is used to calculate the GINI index:

$$GINI\ index = \frac{\mathrm{A}}{(\mathrm{A}+\mathrm{B})} \tag{1}$$

where:

- A = is the area above the Lorenz Curve,
- B = is the area below the Lorenz Curve.

Nominal labour productivity per person employed expresses labour productivity per person employed and hour worked (EÚ = 100). Labour productivity per person employed and hour worked) GDP per person employed is intended to give an overall impression of the productivity of national economies expressed in relation to the European Union average Please note that "persons employed" does not distinguish between full-time and part-time employment. Labour productivity per hour worked is calculated as real output per unit of labour input (measured by the total number of hours worked). Measuring labour productivity per hour worked provides a better picture of productivity developments in the economy than labour productivity per person employed, as it eliminates differences in the full-time/part-time composition of the workforce across countries and years.

The most important source of data and materials for our research was the Eurostat database. In this online and freely accessible database, we monitored the set of information from National accounts and Products Datasets. The completion and verification of these primary data from Eurostat were based on databases of international organi-

zations, i.e. OECD and World Bank (especially in the area of the GINI index, nominal labour productivity per person employed and aggregate GDP).

Evaluating and interpreting the results of the analysis, we focused on determining, identifying and comparing the limit values of individual countries. It is the threshold (max and min) values that are the focus of our interest. They capture the initial situation in the year of accession of post-communist countries to the EU and compare it with the final level in 2019. Thanks to this, we can model the initial economic and economic situation to the EU and compare the resulting values of the monitored variables in 2019. The result of this procedure will be the opportunity to identify the diverse expansion of post-communist countries, their uneven economic progress and the growth of initial differences.

Results and discussion

Almost two decades have passed since the first countries of the former socialist bloc joined the EU.

On the one hand, all post-communist countries in the EU have improved economically, but on the other, this improvement is not proportionate and certainly is not even at all. Since the accession, a situation has developed in which some countries (Poland, the Czech Republic, Romania) are progressing economically faster (increasing GDP) and others are lagging significantly behind. The GDP of these "lagging" countries is gradually growing every year, although the growth is only slow and gradual. This results in a situation where imaginary economic scissors are opening more and more. Therefore, since 2004, post-communist countries have benefited from their membership to varying degrees, which creates room for widening economic disparities between their national economies.

A similar development, when the disparities between the economies of individual post-communist EU countries are deepening, can be illustrated by several more examples. The widening economic scissors and the increase in disparities can be traced, for example, to the development of annual net earnings, real GDP per capita, purchasing power parities or real expenditure per capita in PPS.

In the case of annual net earnings (a single person without children earning 50% of the average earning), the initial difference between the absolute maximum value (Slovenia €4271.2) and the absolute minimum value (Latvia €1211.6) was €3059.6 in 2004. By 2019, this difference between the highest (Estonia €7937.7) and lowest value (Bulgaria €3015.1) had increased to €4922.6. Since the accession of post-communist countries to the EU after 2019, the inequality of their absolute limit values in net annual income has increased by another €1862.9.

We reach a similar conclusion when monitoring the absolute limit values of GDP per capita. When the post-communist countries joined the EU, the difference between the maximum (Slovenia) and the minimum (Poland) was €8730. In the following years, the inequality between the highest and lowest GDP per capita increased

and in the year after, the difference was €13,860 (the highest in Slovenia and the lowest in Bulgaria).

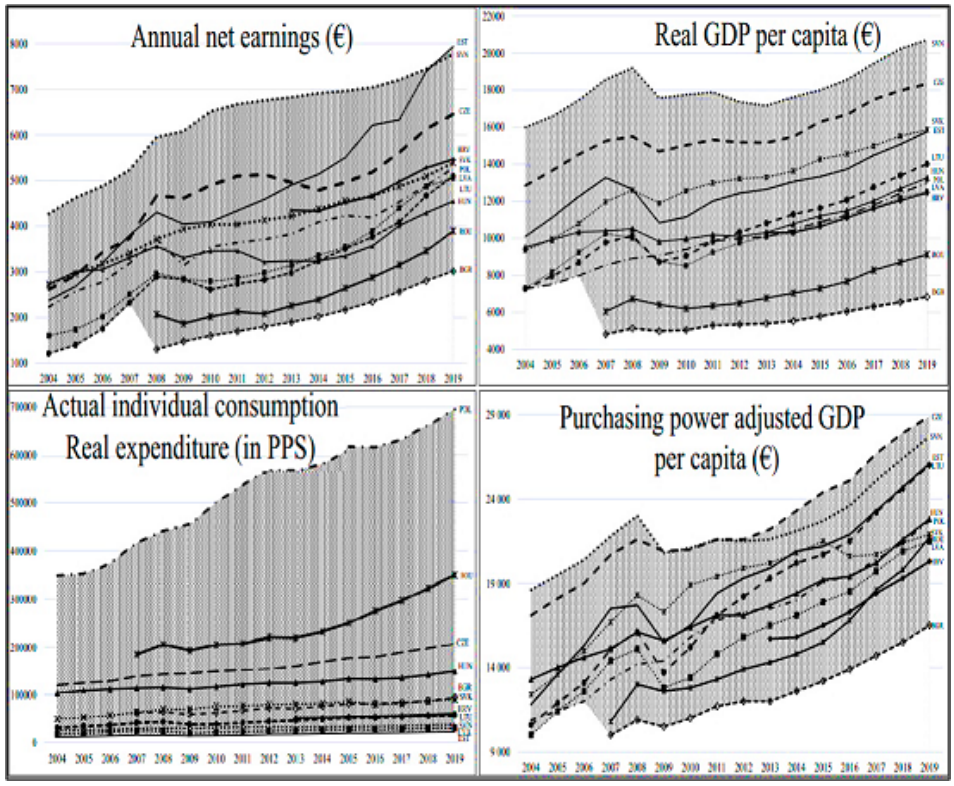

Chart 1. Economic indicators in post-communist EU countries, 2004–2019
Source: own processing based on Eurostat (2020) and World Bank data (2020).

During the first year of the post-communist countries' membership of the EU, the difference between their maximum (Poland) and minimum (Estonia) individual consumption (expressed in real expenditure in PPS) was €335,787. In 2004, the difference between the absolute maximum and minimum level of individual consumption expressed as real expenditure in PPS was more than €337,000. By 2019, this difference between the absolute values of the post-communist countries in the EU had doubled, representing a difference of €691,909.

The lowest level of purchasing power expressed as GDP per capita (PPS) in the first year of EU membership was reported by Latvia (2004) and Bulgaria (2007). The initial difference in the level of purchasing power expressed as GDP per capita (PPS) in 2004 was €8600. When comparing the absolute maximum (Czech Republic) and minimum (Estonia) value of purchasing power in 2019, we recorded an increase to €12,400. When comparing the values from the border years of purchasing power expressed as GDP per capita, the difference increased by almost half.

Using these examples, we want to demonstrate our claim that all EU countries have improved economically since the accession of the post-communist countries, but this improvement is not uniform. In addition, countries have emerged that have developed more rapidly economically since their accession and others in which progress has not been so significant. This opens the scissors of inequality on the economic level. It also applies to the post-communist countries in the EU, where we are seeing blocs of countries benefiting more from their EU membership and countries that are lagging. Although lagging countries have also improved since joining, we certainly could not call them premiums in this regard, and therefore the economic disparities between the post-communist economies are widening.

In addition, we can identify areas in which individual post-communist EU countries have experienced stagnation or decline since their accession. One such example is the GINI index. The GINI index expresses the degree to which the distribution of income among individuals or households in an economy deviates from a perfectly even distribution. A GINI index with a value of 0 thus represents perfect equality, while 100 represents perfect inequality.

The lower the values of the GINI index, the greater the equality of income distribution, and as the index increases, so does the inequality in income distribution. The initial values of the GINI index of post-communist countries upon accession to the EU were different. Among the post-communist countries from the great enlargement of the EU in 2004, the GINI index was between 37.9 (Poland) and 24.8 (Slovakia). Only slightly higher values of the GINI index upon accession to the EU were reported by Romania (38.3); the other acceding countries from 2007 and 2013 declared a GINI index at 35.3 (Bulgaria) and 30.9 (Croatia).

Comparing and analysing the annual height of the GINI index of post-communist countries since EU accession brings us three basic findings. First, it should be mentioned that the absolute inequality in the values of the GINI index is gradually increasing. In the long-term time horizon of 2004–2019, we record an increase in the initial disparity between the absolute limit values from 13.8 to 18.0. This leads us to the further finding that, for the post-communist countries in the EU, there are some that have improved income distribution and reduced income inequality. These countries include the Czech Republic, Slovakia and Slovenia, which have achieved the best average income distribution rate of all post-communist countries during their 16 years of EU membership. In addition to these premium countries in reducing income inequality, other post-communist countries have shown an improvement in their GINI index since joining the EU, including Estonia, Hungary, Poland and Romania. Two post-communist EU countries show a very slight decline or rather stagnation of the GINI index. Latvia and Croatia have reduced their income disparities only minimally, and the positive change is no more than 1.7 points. The third finding is that there are post-communist countries in the EU whose GINI index has increased since their accession, and thus declare an increase in income inequality among their citizens. Income inequality has increased by 0.5 points in Lithuania since 2004 and by

5.5 points in Bulgaria. At the same time, the GINI index in Bulgaria has risen to 40.8, which is clearly the highest declared value of income inequality among all post-communist EU countries. The development of the GINI index in Bulgaria and Lithuania has had the opposite trend to all other post-communist countries, where it is continuously declining.

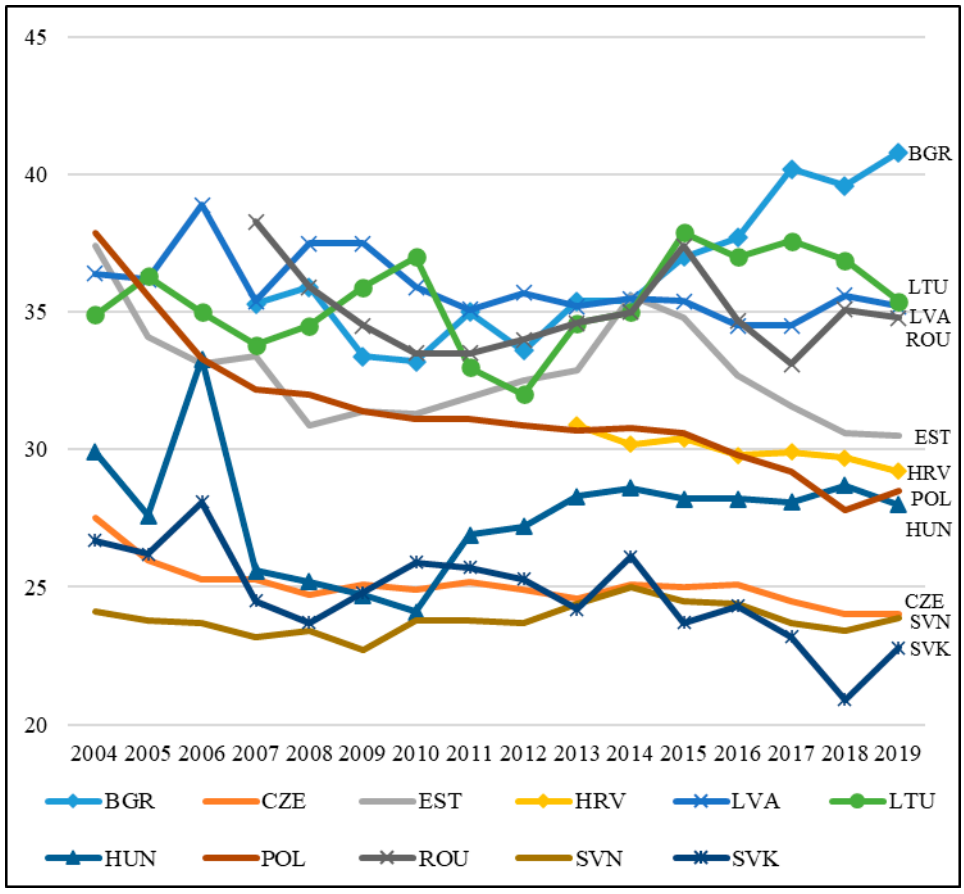

Chart 2. GINI Index in post-communist EU countries, 2004–2019
Source: own processing based on Eurostat (2020).

One of the other indicators that broaden the view of the economies of post-communist countries since their accession to the EU is nominal labour productivity per person employed, expressed in labour productivity per person employed and hour worked.

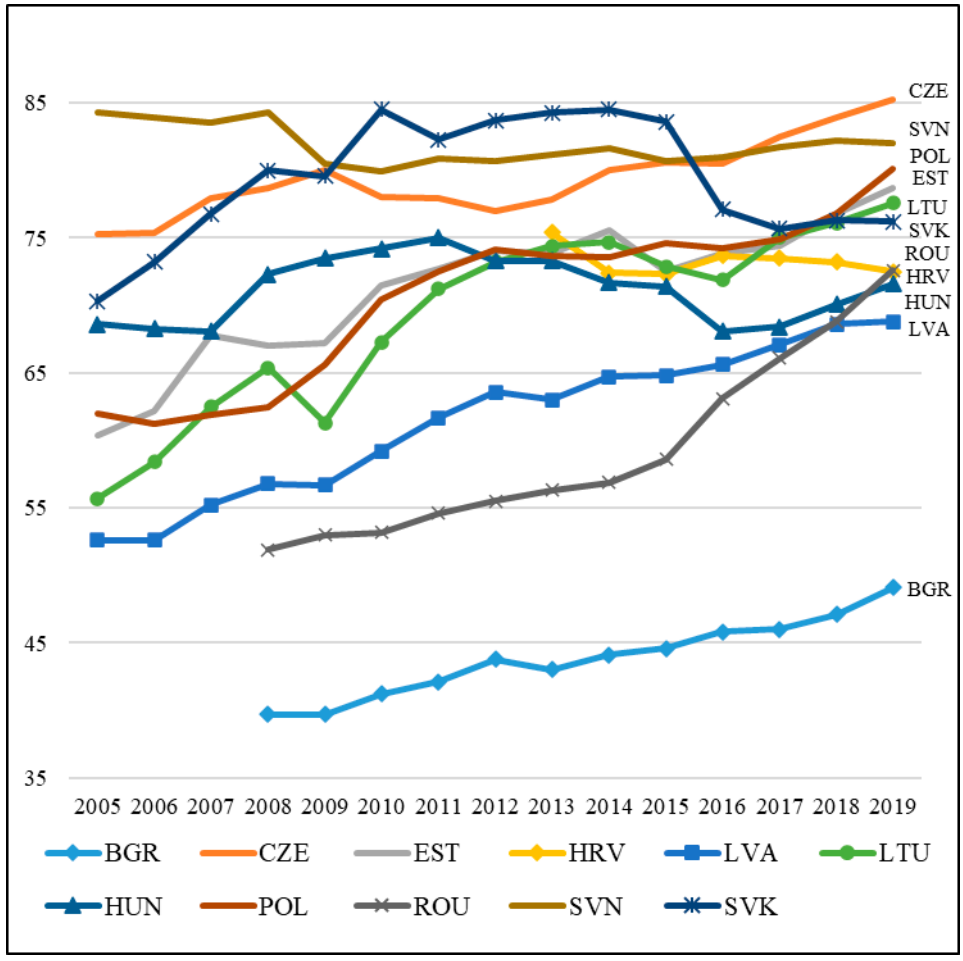

Chart 3. Nominal labour productivity per person employed (EÚ = 100)
Source: own processing based on Eurostat (2020).

Most post-communist countries have gradually caught up with the average EU level of nominal labour productivity per person employed since joining the EU. During their membership in the EU, several countries (Romania, Lithuania) increased their nominal labour productivity per person employed by more than 20 points. Meanwhile, Estonia, Latvia and Poland increased their nominal labour productivity per person employed and approached the EU average by 18.3 – 16.2 points. We also recorded a less progressive increase in the Czech Republic (+10) and Bulgaria (+9.4). Slovakia and Hungary also show a minimum increase of 5.9 – 3 points and an approach to the EU average during their membership. Significantly, the value of nominal labour productivity per person employed in two post-communist countries decreased compared to the EU average, i.e. Croatia and Slovenia, where from 2005 to 2019, the value decreased compared to the EU average by –2.3 and –2.9 points, respectively. This creates a situation where the vast

majority increase nominal labour productivity per person employed and approaches the EU average at different speeds, but there are also two post-communist countries that have seen a decline compared to the EU average since joining the EU.

For this reason, it is necessary to look at economic development very sensitively and to understand the partial economic indicators of post-communist countries in the EU. It cannot be said unequivocally that the economic situation of all post-communist countries has improved since joining the EU because the economies of post-communist countries are also showing a deterioration in some economic indicators. In support of our claim, we have cited examples of the GINI index and Nominal labour productivity per person employed (EU = 100), which show that the initial values of several of the new Member States had deteriorated by 2019.

Conclusion

The article presented the development of the situation in the post-communist countries of the Eastern bloc after 2004. The economic development of individual countries was significantly influenced by several internal and external influences. In our paper, we compared countries in terms of several economic indicators and pointed out the different developments of economies of individual countries after accession to the EU. The reasons for the different developments lie in a number of factors that influence the actors of public policies in individual countries, as well as various economic measures. Several external factors also contribute to various developments, and it is also necessary to realize that the initial state of EU accession shows particular economic values, but it is also necessary to take into account the trend of these economic indicators before EU accession. The predispositions of the economy to grow, the orientation of the economy, the degree of its diversification, as well as various fiscal policies contribute to the different pace of selected economic indicators.

Several significant findings could be considered the added value of the article. These findings are based on the presentation of the results of the analysis of selected macroeconomic indicators. Individual macroeconomic indicators of the economic development of selected countries point to differentiation and, in several cases, show an increase in differences. All countries in our research sample grew in terms of GDP per capita. On the other hand, it should be noted that in this important macroeconomic indicator, countries have been successful. The current gap between the countries with the highest and lowest GPD per capita is higher than in 2004. The Baltic States, Romania and Poland show the most progressive GDP per capita growth compared to the EU average. The title of our article speaks of countries that are more progressively moving towards the European average in terms of economic indicators and, conversely, a group of countries that have even worsened their numbers in several indicators.

The main finding is that since the accession of the post-communist countries to the EU in 2004, their mutual differences have increased, and a more significant eco-

nomic disproportion is emerging. We can see the "leading" post-communist countries, which have very quickly established themselves in the common market and can use the economic benefits of the EU more effectively.

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Integracja krajów postkomunistycznych z UE – liderzy i przegrani?

Wskaźniki ekonomiczne nowych państw członkowskich UE, które przystąpiły do UE po 2004 roku, są generalnie pozytywne. W niniejszym artykule przeanalizowano i zinterpretowano wyniki rozwoju gospodarczego 11 nowych państw członkowskich z byłego bloku wschodniego. Zestaw poszczególnych wskaźników ekonomicznych daje stosunkowo realistyczny obraz różnic rozwojowych między poszczególnymi krajami postkomunistycznymi. W artykule wskazano na kilka czynników, które tworzą dwie zasadnicze grupy krajów różniące się pod względem kształtowania się wskaźników ekonomicznych: bardziej zaawansowana grupa krajów, które w większości wykazują postęp w procesie osiągania średniej unijnej, oraz mniej zaawansowaną grupę, której tempo konwergencji jest znacznie wolniejsze.

Słowa kluczowe: gospodarka, rozwój, różnice, kraje postkomunistyczne, UE

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Digitalization's Effect on the Sectoral Structure Change in the Economy: a Comparative Analysis of Ukraine and Selected Countries

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Abstract

This article examines the impact of digital transformation on changes in the sectoral structure of Ukraine's economy, other post-communist countries, and countries with highly developed economies. Firstly, we estimate the structural changes and differences in the sectoral model by gross value-added and sectoral employment model by country using Ryabtsev's index. Secondly, we calculated the forecast of changes in the researched economies' sectoral structures for 2021 and 2025 using discrete Markov processes. The forecasts made it possible to determine the direction of socio-economic progress of highly developed and post-communist countries. Thirdly, assuming that the development of ICT technologies caused the sectoral changes identified as a result of the assessment, we analyzed available level ratings of the digital transformation of the selected economies and named global trends in ICT. Finally, we determined the impact of the ICT index on the substantiality of sectoral changes in the economies of post-communist countries and countries with highly developed economies. The study results allowed us to conclude that digital technology development affects the economy's structural changes indirectly due to the reallocation of labor resources from one sector to another. The article substantiates the need to

improve the economy's sectoral model by adding industries related exclusively to the digital economy.

Keywords: the sectoral structure of the economy, digital transformation, Markov chains, gross value added, the sectoral structure of employment

JEL: O11, O33, O57

Introduction

The world is changing. These changes are primarily related to the generation, transmission, storage, management, and analysis of information, making it the most critical production resource today. Countless information flows structure the modern world, changing people's consciousness and vital activity forms. Digital technologies, which have become one of the most powerful drivers of the world's economy, are changing society's development paradigm. They reduce economic growth dependency on the country's natural resources, able-bodied population, fixed capital and other extensive factors of influence.

A paradigm shift determines a society's transition to an entirely new development level, which is associated with the economic system's digital transformation. These processes were confirmed by Hilbert and Lopez, to some extent, who stated that a significant part of technological memory (94% in 2007) is already in digital format (Hilbert and Lopez 2011). In turn, the number and volume of individual elements of material production (buildings, structures, bank equipment) are being reduced the non-digital economy becomes digital. Nevertheless, the development of information technology does not abolish material production, nor does it reduce the role of industry and agriculture. However, most people begin to create, collect, store, process, and disseminate information rather than participate in direct production.

The purpose of this article is to determine the impact of digital transformation on structural changes and differences in sectoral models of the economy of Ukraine, other post-communist countries, and countries with highly developed economies. Firstly, we analyzed scientific views on the economy's sectoral structures (Fisher 1939; Clark 1940; Fourastié 1949) to achieve this goal. Secondly, we built a basic sectoral model[1] of the national economy that considers modern standards of sectoral classifi-

1 Note: By the basic sector model, we understand a five-sector model where 1) the primary sector includes agriculture, forestry, fisheries, mining and activities of households; 2) the secondary sector includes manufacturing and construction; 3) the tertiary includes electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation activities, wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage; 4) the quaternary includes accommodation and food service activities, Information and communication, financial and insurance activities, real estate activities, administrative and support service activities, other service activities; 5) the quinary includes professional, scientific and technical activities, public administration and defence, compulsory social security, education, human health

cation of the economic activities (ISIC, United Nations) and assesses structural changes and differences in the selected countries economies by technological criteria.

The article's starting point is the assumption that digitalization is one of the most significant factors that influence sectoral structural changes in the economy of countries of any level of development (both in terms of gross value added and employment). On the one hand, digital technologies contribute to the development of services by opening global markets. On the other hand, the digital transformation is causing widespread automatization of production and a significant reduction in employment, especially in the economy's primary and secondary sectors.

There has been empirical research of national economic structures from 2001 to 2019 in post-communist countries, which transitioned from an administrative command economy to a market economy. On the one hand, this group of countries can be called homogeneous. Some of them were formed after the collapse of communist federations in the late 1980s, such as Czechoslovakia, the Soviet Union, Yugoslavia. On the other hand, the former communist countries differ in the starting opportunities for implementing reforms, the pace and nature of their performance, and the results. Therefore, countries with transformational economies should be explored in three groups:

1. a group of countries characterized by the short existence of a planned economy (by historical standards) – about 40 years, and in a less rigid version than the USSR. These countries are members of the EU and are de jure equated to developed economies (Poland, Hungary, Slovakia, Czech Republic);
2. countries that have recently obtained EU membership. Furthermore, they are characterized by the long-term existence of an administrative-command system (Bulgaria, Romania);
3. countries characterized by the long-term administrative-command system for more than 70 years in its most rigid variant (Ukraine, Russia, Belarus, Georgia).

In addition to the post-communist countries, this study will place significant emphasis on the leading countries by different evaluation criteria, in particular: in terms of GDP – the USA, China, Japan, Germany, Great Britain, France; GDP per capita – Luxembourg, Norway, Switzerland; the global HDI rating – Australia. Most of these countries are at the forefront of post-industrial processes, and they serve as a transition model for post-industrial economic development for many countries worldwide.

and social work activities, arts, entertainment and recreation, activities of extraterritorial organizations and bodies.

Sectoral shifts in the economy of post-communist countries and countries with highly developed economies

The reflection of the qualitative development level of the economic system is carried out by covering the national economy's sectoral structure by the type of economic activity. An efficient sectoral structure of the economy should be consistent with a socially-oriented model of a market economy and be based on competitive advantages in the global division of labor and the economic advantages of international integration. An efficient sectoral structure of the economy thus guarantees the independence and dynamic development of any country (Bilotserkivets and Kryuchkova 2007).

The sectoral analysis of world GDP in general and in the chosen countries, in particular, allows us to note that the primary sector of the economy has 5.5% of the world's GDP structure. From 2001–2019, Romania has been the leader in the economy (2001 – 32.2%, 2019 – 21.2%), followed by Bulgaria (2001 – 25.8%, 2019 – 19.2%) and Ukraine (2001 – 20.3%, 2019 – 18.3%). At the same time, most countries with highly developed economies, except for Norway, had indicators of the primary sector of the economy in 2019 that fluctuated between 0.57% and 3.24%, showing a downward trend. The same indicators in Norway (2001 – 24.7%, 2019 – 17.7%) break the usual conclusions that the primary sector of the economy is most typical for countries with weak economies.

The secondary sector of the economy accounts for 27.9% of world GDP. This sector forms a major part of GDP, which develops areas such as defense, health, and education for improving society. However, this sector consumes energy and pollutes the environment the most. The leader in the secondary sector of the economy, according to the latest available data as of 2019, was held by China – 38.6% of GDP, followed by the Czech Republic – 30.7%, and Slovakia – 29.5%.

The tertiary, quaternary, and quinary sectors of the economy are the flagship of economic development, with 66.6% of world GDP. They are typical for developed countries, where time, knowledge, and potential are used to increase efficiency, productivity, and sustainability. Thus, in 2019, the share of services sectors in the GDP of highly developed countries that we studied fluctuated from 54.5% (China) to 87.8% (Luxembourg), with a tendency to constant growth. The service sector in all groups of countries (especially in the quaternary and quinary sectors of the economy) has growing against the background of a steady, albeit moderate in quantitative terms, trend of relative decline in the role of the industrial sector.

Ukraine has also demonstrated an impressive relative compression of the industrial sector (Heyets et al. 2011). It entered state independence and market transition with a relatively respectable industrial sector – 45% of GDP . However, it reduced industry's role in the economy, decreasing to 16.47%, the global average in 2019. The main result of transformational changes in Ukraine over the past two decades can be considered the formation of a multisectoral structure of the post-industrial economy with a respectable share of services in GDP (65.2%).

Our research considers it necessary to assess structural changes and differences to determine transformation processes in the previously defined economic systems. For this purpose, we can use some indices, particularly the Herfindahl-Hirschman index, the entropy index, the relative concentration index, the market share dispersion index, Gatev's integral coefficient of structural differences, and Salai and Ryabatsev's indices of structural shifts. They all have advantages and disadvantages. The Herfindahl-Hirschman index is traditionally used to measure business concentration in a particular market, but it is incomparable for structures with different elements. The entropy index is the inverse of the concentration (the higher its value, the lower the concentration of sellers in the market) but is used much less frequently. The dispersion of market shares is a rough analog of the indices mentioned above and is used as a supplementary method. There are no clearly defined boundaries to interpret the relative concentration index. The Gatev coefficient, the Salai index, and the Ryabtsev index are the most accurate and convenient tools for solving the goal defined in the study. They consider the size of the population, the number of groups, and the different contributions of those groups to the total volume of the studied feature (Kramarev 2017).

However, to assess further the significance of structural changes in the sectoral structure of national economic systems, we used the Ryabtsev index for several reasons. Firstly, the Salai and Gatev indices cannot be calculated if the share of the sector of the economy is zero. Secondly, the Ryabtsev index has a scale for assessing the significance of structural differences.

Empirical research of the structural changes in the sectoral structure for the periods 2001–2017 and 2001–2019 based on the Ryabtsev index allows us to conclude that there are structural changes in most national economic systems, which have to be studied (Table 1).

Table 1. The substantiality of structural differences by the Gross value added[2] of Ukraine and selected countries

Group	Country	Ryabtsev index 2001/2017	Ryabtsev index 2001/2019	Interpretation of the index
I	USA	0.047	0.051	An extremely low level of differences (0.031–0.070)
	Japan	0.035	0.099	
	Switzerland	0.050	0.029	
	France	0.054	0.058	
	Hungary	0.034	0.036	
	Slovakia	0.052	0.133	
	Australia	0.059	0.073	
	UK	0.067	0.060	
	Czech Republic	0.042	0.059	

2 Gross Value Added (GVA) provides a monetary value for the amount of goods and services that have been produced in a country, minus the cost of all inputs and raw materials that are directly attributable to that production.

Group	Country	Ryabtsev index 2001/2017	Ryabtsev index 2001/2019	Interpretation of the index
II	China	0.108	0.133	Low level of differences in structures (0.071–0.150)
	Luxembourg	0.080	0.077	
	Norway	0.101	0.116	
	Bulgaria	0.102	0.100	
	Ukraine	0.092	0.108	
	Belarus	0.132	0.293	
III	Romania	0.157	0.163	A significant level of differences (0.151–0.300)
	Russia	0.243	0.236	
	Georgia	0.199	0.302	
IV	Germany	0.021	0.013	Identity of structures (0.000–0.030)
	Poland	0.025	0.031	

Source: calculated and generated by the authors based on Data of Value added and its components for the period 2001–2019, available at OECD Statistics (n.d.); Eurostat (2019); State Statistics Service of Ukraine (2019); Federal State Statistics Service (2019); National Bureau of Statistics of China (2019); National Statistical Committee of the Republic of Belarus (2019); National Statistics Office of Georgia (2020).

According to the calculations given in Table 1, the most significant changes in the economy's sectoral structure by gross value added for the period 2001–2017 took place in Romania, Russia, and Georgia. During the period 2001–2019, Belarus joined these countries. At the same time, Ukraine is in the group of countries with a low level of structural differences, showing a tendency to grow the Ryabtsev index from 0.092 (2001–2017) to 0.108 (2001–2019).

The current structural transformation of highly developed countries economies is based on innovation and changing social needs through the priority development of those industries that determine the transition from an industrial to a post-industrial society. Accelerated development of the services sector and the relative reduction of the manufacturing sector's role have led to a gradual decline in employment in the secondary and a significant increase in the global economy's quaternary and quinary sectors. Moreover, it is characterized by the constant enrichment of new services. Thus, various national employment structures are formed to transfer workers from production branches to service sectors. In particular, highly developed countries, except China, created an "information" model of employment structure characterized by priority services. For example, in the USA, 80.49% of the economically active population worked in the service sector in 2019, in the UK – 83.52%, France – 81.17%, Luxembourg – 80.46%.

A more detailed analysis of Ukraine's distribution dynamics of employed population by economic sector from 2001 to 2019 showed a steady increase in the share of the employed population in the service sector from 52.91% to 62.8%. In general, the structure of the employed population by sector of the Ukrainian economy indicates the spread of the services sector in the system of social production, which fully reflects the trends of highly developed countries. By type of economic activity within

the services sector, almost 22.93% of employees worked in the areas of redistributing the value of GDP (wholesale and retail trade), 6.03% – in transport, warehousing, postal and courier activities, 5.9% – health care and the provision of social assistance. Education employed 8.4% of the economically active population aged 15–70 years. In addition, the number of people employed in information and telecommunications services in 2019 amounted to 1.7% of the services sector's total employment.

The Ryabtsev index determines the substantiality of structural changes in the sectoral structure of employment of the population of both groups of countries for the periods 2001–2017 and 2001–2019 (Table 2).

According to the calculations, most countries, including Ukraine, show a low difference in employment structure (Ryabtsev index 0.108 and 0.106 in 2001–2017 and 2001–2019, respectively). The most substantial changes in the sectoral employment structure occurred in Romania and China (the latest available data is for 2017). It is worth noting that Romania has also undergone a significant structural transformation in gross value added together with such countries as Georgia and Russia. At the same time, these countries showed a significant increase in GDP per capita. The most significant result can be observed in China, where GDP per capita increased over 7.32 times in 2001–2017 (latest available data), Romania – 7.67 times, Russia – 5.47 times, and Georgia – 5.86 times in 2001–2019.

Table 2. The substantiality of sectoral differences in the structure of employment in Ukraine and selected countries

Group	Country	Ryabtsev index 2001/2017	Ryabtsev index 2001/2019	Interpretation of the index
I	USA	0.053	0.058	An extremely low level of differences (0.031–0.070)
	Norway	0.042	0.053	
	Australia	0.065	0.072	
	Germany	0.068	0.061	
	France	0.050	0.049	
	UK	0.067	0.073	
	Slovakia	0.056	0.058	
	Czech Republic	0.038	0.046	
II	Japan	0.088	0.110	Low level of differences in structures (0.071–0.150)
	Luxembourg	0.105	0.110	
	Switzerland	0.093	0.089	
	Poland	0.115	0.125	
	Hungary	0.135	0.086	
	Bulgaria	0.084	0.105	
	Ukraine	0.108	0.106	
	Russia	0.120	0.147	
	Belarus	0.112	0.099	
	Georgia	0.137	0.405	

Group	Country	Ryabtsev index 2001/2017	Ryabtsev index 2001/2019	Interpretation of the index
III	Romania	0.238	0.195	A significant level of differences (0.151–0.300)
IV	China	0.614	–	A very significant level of differences in structures (0.501–0.700)

Source: calculated and generated by the authors based on Data of Labor input by activity for the period 2001–2019, available at OECD Statistics (n.d.); Eurostat (2019); State Statistics Service of Ukraine (2019); Federal State Statistics Service (2019); National Bureau of Statistics of China (2019); National Statistical Committee of the Republic of Belarus (2019); National Statistics Office of Georgia (2020).

Forecasting sectoral changes in post-communist economies and highly developed countries based on Markov chains theory

The theory of discrete Markov processes, i.e., Markov chains theory, was chosen as a mathematical tool for predicting structural changes (Meyn and Tweedie 2005). A random process with discrete states has a Markov property (aftereffect property) if, for any moment, the characteristics of the process are determined only by the state of the random process at a given time and do not depend on how the system behaved in the past.

Markov chain theory allows us to consider a change in the structure of a set as a stochastic process determined by two main characteristics: a stochastic vector of the initial state of a random process $X(t_0)$ and a stochastic matrix that determines the probability of process transition in one step $P=\left(P_{ij}, i, j=\overline{1,n}\right)$. Each element of this matrix P_{ij} is equal to the probability that in one step, the system will move from state S_i to state S_j. The order of the matrix n is equal to the number of states in which the system under study can be. The formula determines the probability of the system at time t in the appropriate form:

$$X(t)=X(t-1)\times P, \tag{1}$$

$X(t)=\left\{X_1^t, X_2^t, \ldots, X_j^t, \ldots, X_m^t\right\}$ – a vector that determines the probability of finding an object in the range of m states at time t; $X(t-1)$ is the corresponding probability vector for the previous step.

In the study of structural changes, the vectors' elements $X(t)$ and $X(t-1)$ were defined as relative values of the structure that reflect the nature of the distribution of objects by individual groups, namely the relevant sectors of the economy. If the structure of the phenomenon in the base period is known, it is necessary to predict the pop-

ulation's structure in subsequent periods. Thus, the main task of the theory is to estimate the transition matrix of the Markov chain.

1. The auxiliary matrix P' is formed, and the elements of the main diagonal are calculated by the formula:

$$P'_{ij} = \min\left\{S_i^0, S_i^1\right\},\ i = 1, \ldots, m. \tag{2}$$

where S_0, S_1 – are the vectors of the population structure in the previous and subsequent periods under the condition $\sum_{i=1}^{m} S_i^0 = \sum_{i=1}^{m} S_i^1 = 1$, while the elements remain unused of the previous structure of size $\Delta i = S_i^0 - P'_{ii}, i = 1, \ldots, m,$ and also elements of the following structure $\varepsilon_j = S_j^0 - P'_{jj}, i = 1, \ldots, m$. The distribution of Δi is made in proportion to the needs of columns ε_s, that is $P'_{ij} = \Delta i \frac{\varepsilon_j}{\sum_j \varepsilon_j}, i, j = 1, \ldots, m.$

2. The elements of the transition probability matrix are calculated:

$$P_{ij} = \frac{P'_{ij}}{S_i^0}, i, j = 1, \ldots, m. \tag{3}$$

The calculations that resulted from the forecast of sectoral shifts in the economies of Ukraine and the other selected countries by gross value added and employment for 2021 and for 2025 are presented in Tables 3–5. Given the forecast of sectoral shifts, we found the direction of the countries" socio-economic progress for the period 2001 to 2025.

The forecast data on the sectoral structure by the gross value added of highly developed countries, shown in Table 3, give grounds to expect the current structural change trends, significantly decreasing the pre-industrial sector's share while increasing its post-industrial sector. Simultaneously, for the period from 2001 to 2025, there is a growth of these countries" industrial economies. We assume that such trends are characteristic of increasing ICT development in production, leading to the reallocation of labor resources to other sectors due to the automation of easily algorithmic business processes, leading to increased ROI and increased investment attractiveness.

Ukraine, as well as most of the studied countries, is characterized by tendencies to increase the post-industrial sector while reducing the pre-industrial and industrial sectors of the economy for the period from 2019 to 2025 (Table 4). It indicates a progressive type of economic development.

Table 3. Forecast of sectoral changes of gross value added of highly developed countries

Sectoral structure, %		2001	2019	*change 01/19*	2021F	2025F	*change 19/25*	*change 01/25*
USA								
Pre-industrial sector	(S1)	2.45	2.48	*0.03*	2.52	2.58	*0.10*	*0.13*
Industrial sector	(S2)	19.16	15.65	*–3.51*	14.19	12.94	*–2.70*	*–6.22*
Post-industrial sector	(S3)	16.51	15.05	*3.48*	14.38	13.74	*1.34*	*4.82*
	(S4)	33.24	36.08		36.74	37.32		
	(S5)	28.65	30.74		31.53	32.16		
Norway								
Pre-industrial sector	(S1)	24.71	17.70	*–7.01*	15.14	13.24	*–4.46*	*–11.46*
Industrial sector	(S2)	14.20	13.75	*–0.45*	13.50	13.23	*–0.51*	*–0.96*
Post-industrial sector	(S3)	18.90	16.03	*7.46*	14.78	13.66	*4.97*	*12.43*
	(S4)	18.50	22.94		24.69	26.10		
	(S5)	23.69	29.58		31.89	33.77		
Luxembourg								
Pre-industrial sector	(S1)	1.12	0.58	*–0.54*	0.42	0.32	*–0.26*	*–0.80*
Industrial sector	(S2)	16.42	11.58	*–4.84*	9.96	9.01	*–2.57*	*–7.42*
Post-industrial sector	(S3)	16.76	14.74	*5.38*	13.82	12.96	*2.83*	*8.22*
	(S4)	45.84	46.43		46.25	45.74		
	(S5)	19.86	26.67		29.54	31.97		
Japan								
Pre-industrial sector	(S1)	1.49	1.01	*–0.48*	0.84	0.69	*–0.32*	*–0.80*
Industrial sector	(S2)	27.68	24.16	*–3.52*	22.58	21.11	*–3.06*	*–6.57*
Post-industrial sector	(S3)	21.59	19.69	*3.99*	18.81	18.00	*3.38*	*7.37*
	(S4)	24.39	21.69		20.50	19.47		
	(S5)	24.85	33.44		37.27	40.73		
China								
Pre-industrial sector	(S1)	14.20	6.90	*–7.30*	5.60	5.23	*–1.68*	*–12.92*
Industrial sector	(S2)	44.90	38.59	*–6.31*	35.84	33.42	*–5.17*	*–11.48*
Post-industrial sector	(S3)	16.60	16.90	*13.70*	16.85	16.72	*6.93*	*20.63*
	(S4)	8.90	16.50		20.79	24.13		
	(S5)	15.30	21.10		20.95	20.58		

Source: calculated and generated by the authors.

Table 4. Forecast of sectoral shifts by gross value added of the post-communist economies

Sectoral structure, %		2001	2019	*change 01/19*	2021F	2025F	*change 19/25*	*change 01/25*
Ukraine								
Pre-industrial sector	(S1)	20.26	18.37	*–1.89*	17.52	17.15	*–1.22*	*–3.11*
Industrial sector	(S2)	22.63	16.47	*–6.16*	14.06	12.02	*–4.45*	*–10.61*
Post-industrial sector	(S3)	29.03	26.96	*8.04*	25.99	25.09	*5.68*	*13.72*
	(S4)	13.68	18.67		20.71	22.27		
	(S5)	14.40	19.53		21.71	23.47		

Sectoral structure, %		2001	2019	*change 01/19*	2021F	2025F	*change 19/25*	*change 01/25*
Hungary								
Pre-industrial sector	(S1)	5.93	4.34	*–1.59*	3.81	3.56	*–0.77*	*–2.37*
Industrial sector	(S2)	27.60	26.39	*–1.21*	25.81	25.30	*–1.09*	*–2.29*
Post-industrial sector	(S3)	19.53	18.92	*2.80*	18.61	18.29	*1.86*	*4.67*
	(S4)	23.30	25.96		27.04	27.85		
	(S5)	23.65	24.40		24.72	24.99		
Czech Republic								
Pre-industrial sector	(S1)	4.83	2.75	*–2.08*	2.11	1.68	*–1.07*	*–3.16*
Industrial sector	(S2)	31.91	30.67	*–1.24*	30.07	29.49	*–1.18*	*–2.42*
Post-industrial sector	(S3)	22.91	20.10	*3.32*	18.83	17.65	*2.26*	*5.58*
	(S4)	21.24	24.75		26.17	27.40		
	(S5)	19.10	20.76		22.81	23.78		

Source: calculated and generated by the authors.

According to Furastier, the profound modification of the sectoral structure of employment is due to the dominance of the consumption factor, which explains the significant growth of the tertiary, quaternary, and quinary sectors in the "service society". This society's optimal structure (Krasil'nikov 2005) can be achieved when about 85% of the employed population will be in these sectors, 10% in the secondary, and 5% in the primary.

Table 5. Forecast of sectoral changes in the employment of highly developed and post-communist economies, %

Country	S1			S2			S3+S4+S5		
	2001	2019	2025	2001	2019	2025	2001	2019	2025
Ukraine	20.77	18.10	16.38	26.32	19.10	13.89	52.91	62.80	69.73
Hungary	7.15	4.27	2.76	30.83	26.59	23.18	62.03	69.14	74.06
Czech Republic	5.89	3.67	2.42	35.82	33.99	32.28	58.28	62.34	65.29
Japan	5.83	3.83	2.52	27.88	22.74	18.77	66.29	73.43	78.71
China	53.19	4.03	1.40	50.85	41.25	43.80	28.17	54.72	54.25
Norway	5.74	4.55	3.61	17.17	16.46	15.79	77.09	78.98	80.58
USA	2.53	2.50	2.46	20.56	17.00	14.47	76.90	80.50	82.98
Luxembourg	3.24	2.09	1.35	23.16	17.60	13.37	73.61	80.31	85.28
Optimal	5			10			85		

Source: calculated and generated by the authors.

Trends in sectoral employment changes are similar for both highly developed countries and those with economies in transformation. They are characterized by a decrease in the share of employment in the economy's primary and secondary sectors, and an increase in the share of employment in the service sectors (tertiary, quaternary, and quinary). As it can be seen from Table 3, Luxembourg, the USA, and Norway are among the countries which are the closest to the optimal "consumer society" employment structure in 2025.

Digital transformation as a factor in changing the sectoral structure of the economy

Digital transformation is exceptional in its speed and scale, which calls into question traditional thinking about the most effective way of organizing economic and social activities. The Internet and public platforms are able to provide a wide range of networking activities that serve common interests. As a result, markets, non-market transactions, and interactions between people are gaining new scale. Instead of a binary choice between public and private, digitalization involves gradations, hybrids, and options. In contrast to the stable and embedded architectures of the physical world or, in this regard, the developed institutions of advanced economies, digital transformation makes it possible to continuously fine-tune access, control, participation, and functioning.

According to the transformational concept of transition states, the nature of digital transformation processes, which acts as a qualitative leap or a civilizational shift, interrupts the slow evolutionary development. Researchers pay attention to the emergence of so-called bifurcation points (changes), suggesting branching and the emergence of alternative pathways. This tendency, discovered by Bell (1973), significantly enriches and deepens Marx's single-line determinism theory. Given its findings, multiline determinism provides a multi-vector principle of transformation that involves the critical factors of technology, property, politics, and culture. All of them are of great value as an independent factor of determinism.

The state of transition involves extraordinary contradictions, which affect the struggle of old and new phenomena. This pattern is determined by when the "victory" of new elements over "old" occurs, transforming a mixed transitional and unstable state into a new, organically stable system, which then becomes stable. There are trends in new quality development during this period, which are differently refracted in national economies, depending on each country's position in the world classification.

The transformation process ends with the transition to a new qualitative development stage, which sooner or later affects all countries. It usually begins in developed countries. The reason for the economic system's transformation is that it creates living conditions for the population with such a volume and structure of social production that domestic needs are met. Economists have always focused on general theoretical and practical problems of consumption: the place of consumption in social reproduction, the relationship with social production, the impact of consumption on social reproduction, factors of change, nature, the features and scale of consumption, and consumer behavior.

The digital transformation of the economy occurs in waves, in line with technological progress and the spread of innovation. The first wave of digital transformation is related to introducing and integrating those technologies that are now considered "mature". Such technologies include management information systems that automate data processing used to monitor and report on the results of the object of management.

They also include telecommunication technologies, particularly broadband (stationary, mobile) and voice telecommunications (stationary, mobile), which provide remote access to information.

The second wave of digital transformation determines the spread of the Internet and its respective platforms (search engines, markets), which allow businesses and consumers to interact in the delivery and distribution of products. Finally, the third wave is characterized by the development of advanced technologies, such as big data analytics, the Internet of Things, robotics, sensors, and artificial intelligence. They were designed to improve information processing and decision-making, and to automatize easy-to-algorithm tasks for businesses and governments. These newest technologies are usually not considered separately but are integrated into the mature technologies of the first and second waves.

Each wave of digital transformation has a set of social and economic consequences. Thus, technological innovations of the first wave, such as computers, broadband access, and mobile communications, began their formation between 1950 and 1975. The development of these technologies occurred between 1960 and 2000, and the socio-economic consequences became evident between 1990 and 2010. Second-wave technological innovations, such as Internet platforms and cloud computing, began their formation rapidly between 1970 and 1990, and development in 1995. It continues today. The first socio-economic effects began to emerge in 2005 and continue to this day (Katz 2017). Technological innovations of the third wave, particularly the Internet of Things, robotics, artificial intelligence, and machine learning, began their formation in 1980. Their usage dates back to 2010, and their socio-economic consequences should be expected no earlier than 2020. Thus, given that none of the processes is yet complete and in their infancy, the study of economic and social impacts may or may not be supported by forecasts based on past impacts.

The most apparent result of these three waves of digitalization is the development of the digital economy. According to Schwab (2016), the digital economy is an innovative, dynamic economy based on the active introduction of information and communication technologies in all economic activities and spheres of society. A characteristic feature of the digital economy is its connection with the on-demand economy, which involves not selling goods and services but gaining access to them when needed. Moreover, orders are received online and executed offline. The advantages of on-demand economics include the high speed of obtaining the necessary service or product, lower costs for consumers by reducing the number of intermediaries, and simplified access for suppliers of goods and services to users.

The International Organization for Economic Cooperation and Development (OECD) and scientist Thomas Massenburg have identified three main components of the digital economy:

1. Fundamental innovations (semiconductors, microprocessors), essential technologies (computers, telecommunications devices) and stimulating infrastructure (Internet and telecommunications networks);

2. Digital and information technology services based on raw digital technologies, including digital platforms, mobile applications and electronic payment systems;
3. The digital economy includes a broad range of activities where digital products and services are used, particularly e-commerce. This digital economy component should also include new activities or business models which are transformed due to digital technologies (Bukht and Heeks 2017).

These features distinguish the digital economy from previous stages of economic development and society and the digital sector from other sectors and industries of the modern economy where there are specific, unique laws. These unique laws include the law of network effect (Metcalfe's law) and the law of reverse pricing (Hilder's law). In the initial stages of the development of the digital economy, the improvements in machinery, technology, and the quality of products were invariably accompanied by a rise in price and a relative decrease in profit.

Hilder suggested, and empirical research confirmed that as computer capacity increases, expands, and improves network structures, there is an absolute and relative decrease in prices for information and communication technologies. The same decrease per unit of information is close to zero. According to the network effect, the value of networks for users depends on their number. As the participants of the network interact exponentially, a synergistic effect begins. It is expressed in improving customer service, increasing access to a variety of information, and expanding spatial boundaries. The result is that geographical remoteness loses its significance.

In view of the structural changes in the world economy, which is characterized as post-industrial, it is essential to assess the extent of digital transformation (Pohl and Santarius 2020). It is worth noting that information and communication technologies become an essential component of the methodology of global indexes. Such global indexes include the knowledge economy index, the Global Competitiveness Index, the Global Competitiveness Index 4.0, the Innovation Development Index, the Information and Communication Technology Development Index, the Digital Economy and Society Index, the Digital Evolution Index (Chakravorti and Chaturvedi 2017), the World Digital Competitiveness Index, the Network Readiness Index, and the BCG[3] e-Intensity index representing the level of digitalization of the economy. Therefore, a review of the last aspect allows us to identify three long-term trends in global ICT development.

The first is the increasing availability of communication services in general. A decade after the World Summit on the Information Society (WSIS) in 2005, there was a rise in mobile cellular telephony, leading to its almost complete penetration in developed and developing countries.

The second long-term trend is the growth of broadband services with a speed of 256 Kbps and above. From 2007 to 2019, subscriptions to fixed broadband networks in-

3 BCG – Boston Consulting Group.

creased by 183%. In addition, active mobile broadband subscriptions grew extremely fast, from 4.0 subscriptions per 100 population in 2007 to approximately 56.4 per 100 people in 2019. Available bandwidth has also increased rapidly, especially in developed countries. This growth in broadband has led to much wider and more efficient usage of the Internet and growth in advanced services.

The third trend is the predominance of mobile services over landlines. Today, mobile cellular subscriptions make up more than 90% of voice subscriptions, and in the least developed countries – more than 98%. The number of landline subscriptions has been steadily declining in recent years as a growing number of people have opted for mobile and landline access. Mobile subscriptions also dominate the broadband market, accounting for just over 80% of broadband subscriptions worldwide (although this was accompanied by an increase in fixed broadband penetration).

But the key question we need to answer in this section is whether digitalization actually leads to the development of the service economy. The contribution of the ICT sector to this development differs between countries. Manufacturing grows fast in China's ICT sector. At the same time, in other countries such as Switzerland, Norway, or Russia (Suslov 2019), the value added from ICT goods has remained roughly constant while the value added in ICT services has risen (Eurostat 2019). One possible reason for this difference is the relocation of manufacturing, for example, to China (OECD 2019).

If we look at the share of ICT services in the overall ICT sector, they made up the lion's share in 2014, with 73.1% compared to 26.9% of ICT manufacturing (Lange et al. 2020). More importantly, its share rose in basically all selected countries with data available from 2001 to 2017.

Therefore, the development within the ICT sector fosters the development of the service economy. However, this does not conclusively ascertain whether digitalization also fosters tertiarization in the rest of the economy.

Interconnection between digital transformation and sectoral changes in the economy

An essential step in this study is to determine the degree of impact of digital transformation on structural changes in the economy. We used the classical Spearman rank correlation coefficient and Kendall coefficient.

The correlation is determined based on empirical data such as the Ryabtsev's index on gross value added and employment (Table 2–3), as well as the ICT Development Index developed by the International Telecommunication Union (ITU), which is a measure of the country's economic readiness for digital transformation (Figure 1).

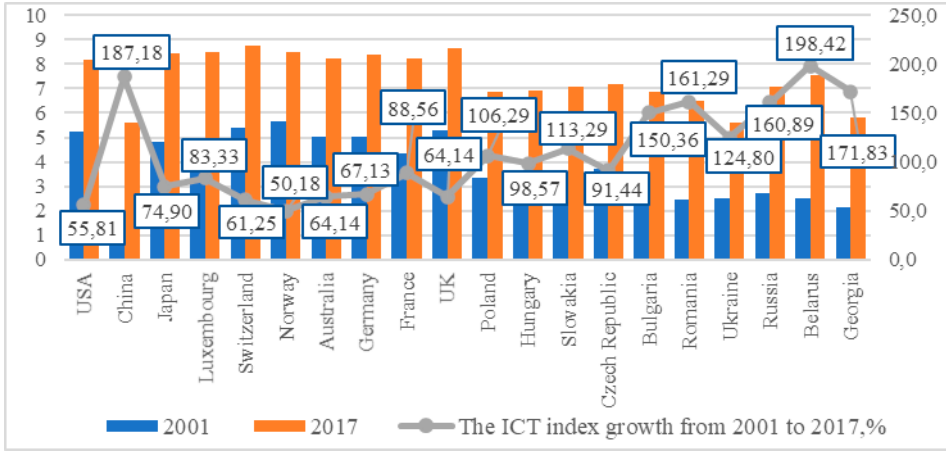


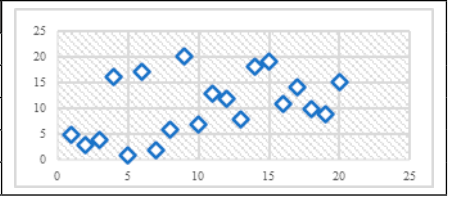
Figure 1. The ICT index growth of selected countries for the period from 2001 to 2017
Source: calculated and generated by the authors based on *Measuring the Information Society Report* 2017.

The choice of the ICT Development Index (IDI) is because, unlike other indices, the way it is calculated did not change during the study period.

The ratio between the data sets of Ryabtsev's index in terms of gross value added and the increase in ICT development with data available from 2001 to 2017 determined based on Spearman's and Kendall's coefficients is not statistically significant (Table 6).

Table 6. Correlation coefficients and criteria of their significance for a pair of values: Ryabtsev index on gross value added; ICT index growth, %

Values of coefficients	
The Spearman's rank coefficient	0,44
The Critical Point of the Student's-t	*0,52*
The Kendall rank correlation coefficient	0,31
The critical point of the Laplace function	*0,32*
Observations	20



Source: calculated and generated by the authors.

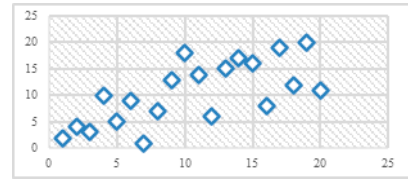
Such conclusions are based on the reliability of Spearman's and Kendall's rank correlation coefficients (Valz's and Thompson 1994; Gaißer and Schmid 2010), which was performed using the Student's t-test at the number of degrees of freedom n–2 = 18 and the critical point of the Laplace function. However, if we calculate the Spearman coefficient for the group of post-communist countries, we get p = 0.84 (for the critical point, p = 0.52). It indicates a high degree of closeness of the relationship (on the Chaddock scale) between the studied data sets. A similar conclusion can be made based on calculating the Kendall coefficient, where the value of the indicator is $\tau = 0.64$ (for critical point $\tau = 0.49$). This allows us to conclude that the greater the growth

of the ICT index for the period 2001–2017, the more significant the structural shifts in gross value added for this group of countries.

The closest interconnection, which confirms the Spearman and Kendall criteria, is between the data of the Ryabtsev index on the level of employment and the growth of the ICT development index (Table 7). It follows that ICT development has a more significant impact on the structure of employment than on the structure of value-added, which is fair, as digital technologies lead to a redistribution of labor from the primary and secondary sectors to services.

Table 7. Correlation coefficients and criteria of their significance for a pair of values: Ryabtsev index by employment; ICT index growth, %

Values of coefficients	
The Spearman's rank coefficient	0,69
The Critical Point of the Student's-t	*0,42*
The Kendall rank correlation coefficient	0,53
The critical point of the Laplace function	*0,32*
Observations	20

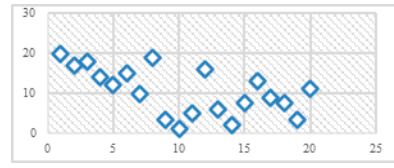


Source: calculated and generated by the authors.

It is interesting to study the interconnection between the Ryabtsev index by employment rate and the ICT index as of 2017. Calculations obtained in Excel demonstrate a statistically significant interconnection between this pair of values, and the value of the Spearman coefficient is equal to –0.57 (Table 8).

Table 8. Correlation coefficients and criteria of their significance for a pair of values: Ryabtsev index by employment; ICT Development Index, 2017

Values of coefficients	
The Spearman's rank coefficient	–0,57
The Critical Point of the Student's-t	*0,47*
The Kendall rank correlation coefficient	–0,37
The critical point of the Laplace function	*0,32*
Observations	20



Source: calculated and generated by the authors.

Evaluating the reliability of the rank correlation coefficient, which was performed using the Student's t-test criterion at the number of degrees of freedom n–2 = 18, found the coefficient to be reliable. A negative Spearman value indicates the direction of the relationship between the variables. Less significant structural changes are characteristic of countries with a high ICT development index.

Basic sectoral model of the economy in terms of digital transformation

Forecast data on the sectoral structure of gross value added give grounds to expect the continuation of existing trends in structural changes. Significantly reducing the share of the pre-industrial sector while increasing it in the post-industrial sector generally indicates progressive economic development in most countries except Ukraine. Trends in sectoral employment are similar both for highly developed countries and countries with economies in transformation. However, only highly developed countries will have a structure close to the optimal employment structure in Forestier's "consumer society" in 2025.

The empirical evidence discussed earlier highlights the relationship between digital transformation and sectoral shifts in the economy. On the one hand, the calculations indicate the extremely low significance of the interconnection between digital transformation and sectoral changes in gross value added. On the other hand, this relationship is significant between digital transformation and sectoral changes in employment. Moreover, the relationship between the Ryabtsev Index and the ICT Development Index as of 2017 is evidence that if the level of ICT development (post-communist countries and communist China, which was included in the group of highly developed countries as one of the leaders the world's largest GDP) is lower, the sectoral changes in the structure of employment are more significant. All this suggests that the digital transformation does not directly but indirectly affect the change in the sectoral structure of the economy through the redistribution of labor resources and productivity growth due to the widespread use of ICT technologies.

However, it can be assumed that the low correlation between these variables is a consequence of the inconsistency of the modern five-sector model of the economy with the conditions of widespread digital transformation, where the reflection of the digital economy is fragmentary. The modern basic model based on existing standards of economic sectoral classification considers, on the one hand, fundamental information technologies and stimulating infrastructure (the core of the digital economy), and on the other, the digital economy. It embidies the formation of new business models that are transformed by digital technologies in all sectors of the economy, without exception.

However, this model does not fully reflect the range of services based on basic digital technologies (including digital platforms, mobile applications, and electronic payment systems) and a wide range of new activities using digital goods and services.

Given the above, it is important to transform the basic sectoral model of the economy, which reflects the development of the digital economy. The author's vision of such a model is shown in Figure 2.

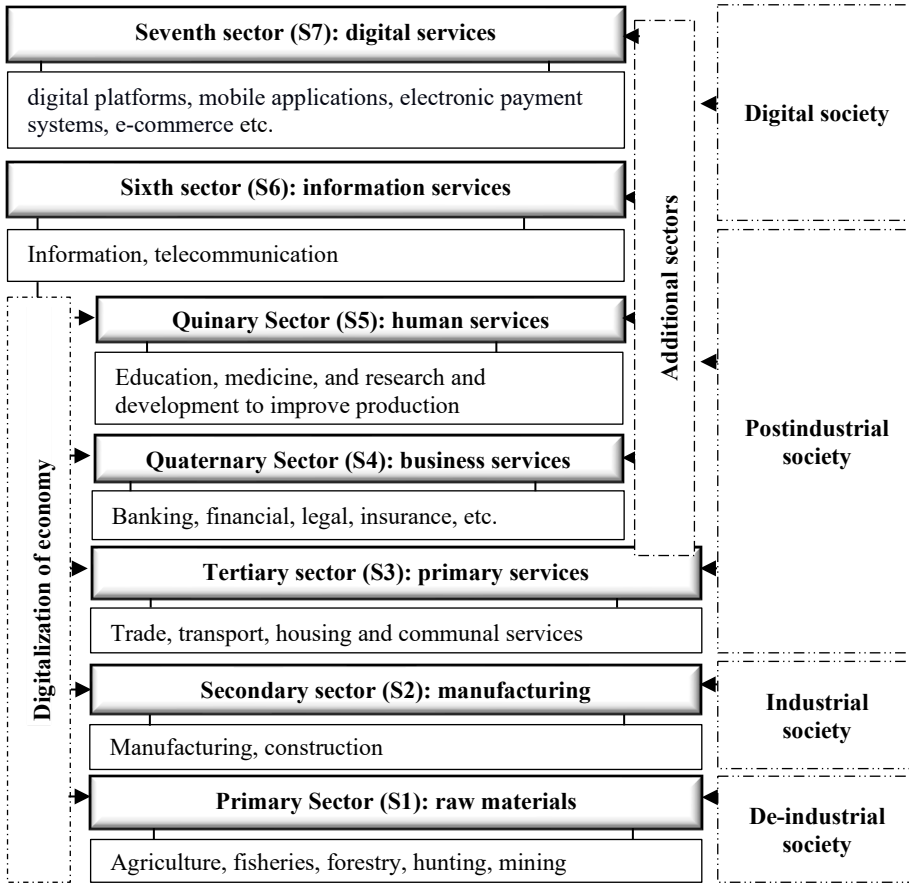


Figure 2. Basic sectoral model of the national economy in terms of digital transformation
Source: generated by the authors.

The improved structural and logical scheme of the economy's basic sectoral model considers the digital economy's wave-like development as the most obvious result of the digital transformation. This approach allows us to assess the qualitative level of its development from the standpoint of the consequences of digital transformation based on the decomposition of the economy.

Conclusion

The purpose of this article was to explore the impact of digital transformation on structural changes and differences of sectoral models of the economy of Ukraine, other post-communist countries, and countries with highly developed economies. We as-

sumed that the significance of sectoral changes in the economy depends on the level of digital transformation. To confirm the scientific hypothesis:

1. The sectoral structure of Ukraine's economy was analyzed in terms of gross value added and employment in comparison with other countries, which were conditionally divided into two groups: highly developed and post-communist countries.
2. Using the Ryabtsev index, the significance of structural changes in gross value added and employment for the period 2001–2019 was determined.
3. The forecast data of the sectoral structure of airborne forces and employment of Ukraine and other countries subject to research were determined, which allowed us to identify the type of economic development (progressive or regressive).
4. To determine the position of Ukraine in the world economic system, indices such as the index of the knowledge economy, the global competitiveness index, and the index of innovative development were analyzed, where information and communication technologies (ICT) became an important component of the study. At the same time, Ukraine was assessed through the prism of indices for measuring digital development, in particular, the ICT development index, the network readiness index, and the global digital competitiveness index. However, the dynamic analysis of most interstate indices was limited due to changes in the system of indicators and periods of their evaluation and research. The only index whose methodology did not change between 2001 and 2017 was the ICT development index, which was used in further research.
5. Based on the Ryabtsev index on gross value added and employment and the growth of the ICT development index for the period 2001–2017, using Spearman's and Kendall's rankings, it was found that ICT development has a significant impact only on changes in the employment structure. In general, the research results indicate the indirect effect of digital transformation on the significance of structural changes in gross value added through redistribution of labor resources and labor productivity, which only partially confirms the previously defined hypothesis. However, it can be assumed that the low correlation between variables is a consequence of the inconsistency of the five-sector model of the economy with modern development realities, and therefore it needs some transformations.

However, this study is not without limitations. The main limitation is the small sample size and the method of selecting and assigning countries to a particular group. For example, classifying China as a highly developed country by only one criterion is not justified. Because China's data do not match the averages in selected countries, they are often in the statistical release zone, which worsens the key parameters of regression-correlation analysis.

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Wpływ cyfryzacji na zmianę struktury sektorowej gospodarki: analiza porównawcza Ukrainy i wybranych krajów

Artykuł analizuje wpływ transformacji cyfrowej na zmiany w strukturze sektorowej gospodarki Ukrainy, innych krajów postkomunistycznych oraz krajów o gospodarkach wysoko rozwiniętych. Po pierwsze, oszacowano wielkość zmian strukturalnych i różnice w modelu sektorowym według wartości dodanej brutto i sektorowego modelu zatrudnienia według kraju przy użyciu wskaźnika Riabcewa. Po drugie, opracowano prognozę zmian w strukturach sektorowych badanych gospodarek na lata 2021 i 2025 wykorzystując dyskretne procesy Markowa. Prognozy pozwoliły określić kierunek

postępu społeczno-gospodarczego krajów wysoko rozwiniętych i postkomunistycznych. Po trzecie, zakładając, że rozwój technologii ICT spowodował zidentyfikowane w wyniku oceny zmiany sektorowe, przeanalizowano dostępne oceny poziomu transformacji cyfrowej wybranych gospodarek i przedstawiono światowe trendy w ICT. Wreszcie, określono wpływ indeksu ICT na istotność zmian sektorowych w gospodarkach krajów postkomunistycznych oraz krajów o gospodarkach wysoko rozwiniętych. Wyniki badania pozwoliły na stwierdzenie, że rozwój technologii cyfrowych wpływa pośrednio na zmiany strukturalne gospodarki poprzez realokację zasobów pracy z jednego sektora do drugiego. Artykuł uzasadnia potrzebę doskonalenia modelu sektorowego gospodarki poprzez dodanie branż związanych wyłącznie z gospodarką cyfrową.

Słowa kluczowe: struktura sektorowa etsonomii, transformacja cyfrowa, łańcuchy Markowa, wartość dodana brutto, struktura sektorowa wdrożenia

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The Bayesian Method in Estimating Polish and German Industry Betas. A Comparative Analysis of the Risk between the Main Economic Sectors from 2001–2020

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Abstract

This paper examines the long-term dependence between the Polish and German stock markets in terms of industry beta risk estimates according to the Capital Asset Pricing Model (CAPM). The main objective of this research is to compare the Polish and German beta parameters of five Polish and three German sector indices using the Bayesian methodology in the period 2001–2020. The study has two detailed aims. First, to develop a modified, Bayesian approach (SBETA model) that generates significantly more precise beta than the traditional model. Second, to compare the results of different time-varying industry betas in the Polish and German economies, giving a simple investment recommendation, i.e., which sector could be classified as aggressive or defensive.

The betas were time-varying in both markets but less persistent in the German industries, which seems characteristic of an advanced economy. The Banking sector betas were the highest in both markets, implying the aggressive nature of that industry in the last twenty years. For the Polish market industry, the betas of Construction, IT, Food and Drinks, and Telecom were classified as defensive. For the German economy, the Technologies (IT) sector was also classified as aggressive, but Telecom

was defensive. The results give a valuable insight into the systematic risk levels in Poland and Germany, reflecting the investors' learning process and indicating that Polish Banking and German technologies outperformed the market in the last twenty years.

Keywords: industry beta, CAPM, Bayesian method, Markov Chain Monte Carlo, Polish Stock Market, German Stock Market

JEL: C11, G10, G11, G15

Introduction

In finance, risk estimation is crucial for all market practitioners when investing in the stock market and researchers dealing with portfolio theory. Estimating risk is taken into consideration because a stock's profitability goes together with the appropriate risk level. The estimates of the beta parameter have various applications in finance, but they are extremely important both for portfolio managers, to build investment strategies, and individual investors. From a portfolio management perspective, risk estimation based on the beta parameter is crucial for building effective hedging strategies, asset pricing, and performance assessment. Various methods of risk estimation have been carried out in highly developed economies, mostly the US, as well as emerging markets in Europe and Asia.

The main aim of this study is to estimate the industry beta coefficient of five Polish and three German sectors over a long period in different economic conditions. The research compares these countries' stock markets in terms of industry beta risk estimates. The German market has an influential role in emerging European stock market movements due to their significant investment flows in Central and Eastern Europe. Banking, Construction, IT, Food and Drinks, and Telecom represent the main divisions of the Polish economy, and for Germany, it is Banking, Technologies (IT), and Telecom. The detailed aims of the study are: 1) to develop a modified Bayesian approach to estimate a beta parameter that is variable in time and that generates significantly more appropriate estimates and 2) to compare the results of different time-varying industry betas in the Polish and German economies and give a simple investment recommendation of which sector could be classified as aggressive or defensive over a long period, regardless of the economic cycle. We believe that our study demonstrates the usefulness of the beta coefficient as a proper measure of risk when building investment strategies on international markets. The Bayesian method of beta estimation reflects investors' learning process, and, therefore, our industry betas are highly precise relative to the competing traditional method.

This paper is organized as follows. Section 2 presents the literature review and the current state of research. Section 3 describes the research sample. Section 4 develops the model. Section 5 describes the results, and Section 6 concludes the paper. The Appendix provides details.

Literature review

The Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965), and Mossin (1966) describes the relationship between the expected return and risk of investing in a security. The Security Market Line (SML) represents the relationship between risk (beta parameter) and expected return; therefore, the beta can be viewed as a measure of systematic risk. According to CAPM, the beta should be the only source of excess returns in market equilibrium. Investors using beta assume that it is invariant over time. However, it might be unstable for many reasons, for example, a change in the company's strategy or capital structure, or microeconomic factors such as a change in its dividend policy or financial leverage. Such instances may influence beta stability over time. As a consequence, beta variability over time has been empirically examined worldwide, e.g., the American market (Fabozzi and Francis 1978), the European market (Wells 1994; Chaveau and Maillet 1998), Central and Eastern Europe (Dębski, Feder-Sempach, Szczepocki 2020), and the Polish market (Dębski, Feder-Sempach, and Świderski 2015, 2016; Wdowiński 2004).

An influential study was carried out on US industry portfolios by Jostova and Philipov (2005), who analyzed a mean-reverting stochastic process for beta estimation. They demonstrated that stochastic beta (SBETA) estimates outperform competing beta estimates and produce superior beta forecasts. Stochastic beta estimates reduce hedging errors by up to 30% compared to OLS, and they provide much stronger support for the conditional CAPM. They can also be useful when dealing with asset pricing anomalies such as the size, book-to-market, and idiosyncratic volatility effects in a cross-section of stock returns.

Some research has also been conducted on the German stock market. Ebner and Neumann (2005) estimated the time-varying betas of 48 stock returns, rejecting the traditional market model with strong evidence of beta instability. Lewellen and Nagel (2006) studied time-variation in risk and expected returns by using Conditional CAPM. They showed that betas vary considerably over time, with relatively high-frequency changes from year to year, but not enough to generate significant unconditional pricing errors. It suggests that conditional CAPM performs nearly as poorly as the unconditional CAPM.

Another interesting study was done on European stock markets by Mergner and Bulla (2008), who investigated the time-varying betas of 18 pan-European sectors in the period 1987–2005 using weekly data. The outcome of the study showed that the random walk process in connection with the Kalman filter was the best at describing and forecasting the time-varying industry systematic risk in a European market.

Central and Eastern Europe industry stock exchange data were commonly used to describe the behavior of CAPM beta to estimate the systematic risk of selected industries. Kurach and Stelmach (2014) studied five industry indices from the Warsaw Stock

Exchange and demonstrated that using the Kalman filter for beta estimation better shows an image of changing expectations about systematic risk.

Another study of the time-varying systematic risk of beta was made by Będowska-Sójka (2017), who investigated various approaches to assessing systematic risk on the Polish capital market from 2001–2015 using data from the Banking and IT sectors. The beta was estimated in a few different approaches: two Multivariate GARCH model specifications, Dynamic Conditional Correlation (DCC) (Engle 2002) and BEKK (Engle and Kroner 1995) models, the Kalman filter technique, and the estimates from linear regression models. The results showed that unobserved component beta together with beta from the DCC model have higher predictive accuracy than beta from the BEKK model or static beta. What was really interesting was the positive correlation of beta within the industry and the negative correlation of beta for stocks from different sectors. Będowska-Sójka stated that beta coefficients were more accurate for stocks from the banking sector than the IT sector.

Lastly, Cepeda-Cuervo et al. (2016) showed how to fit beta regression models applying the Bayesian method, while French (2016) compared time-varying betas and a traditional constant beta model for five ASEAN countries and US sectors. Similar research was conducted by Tsuji (2017) on international CAPM time-varying betas from the Asia Pacific and Japanese stock markets, and by Elshqirat and Sharifzadeh (2018) on the Jordanian Stock Exchange. Recent research with the Bayesian method was presented by Phuoc and Pham (2020), who indicated that CAPM using the non-parametric Bayes estimator is superior to the parametric Bayes estimator; consequently, the non-parametric estimator should be used in the asset pricing model.

Research sample

We apply our framework to Polish and German industry portfolios in a long run of 20 years. The research sample consists of five industry indices listed on the Warsaw Stock Exchange: WIG-Banking, WIG-Construction, WIG-IT, WIG-Food and Drinks, and WIG-Telecom, and three industry indices listed on German Exchanges: PRM-Banking, PRM-Technologies (IT), and PRM-Telecom, which represent the main divisions of the economy (if the industry index did not have enough 20-year time series data, we dropped it). As a risk-free rate, we took one-year Polish and German treasury bills yield, as it is consistent with the CAPM (Sharpe 1964; Lintner 1965; Mossin 1966; Fama and French 1993). We collected the closing prices of eight industry indices from the Polish and German markets. The WIG and DAX COMPOSIT indices were used as a proxy. The industry indices were collected beginning from the first trading day of January 2001 to the first trading day of January 2021, which gives 1044 weekly observations. We took all the industry indices with full time series available in the Refinitiv EIKON database. No data were interpolated, and the stock exchange time series were complete. The Polish and German T-bills yields were collected

beginning from December 2001 for the Polish market and May 2003 for the German, using the database. Missing time series data were interpolated.

Based on these prices, the logarithmic weekly rates of return were calculated as $R_{it} = \ln P_{it} - \ln P_{it-1}$, where R_{it} is the logarithmic rate of return on the i-th index at time t, and P_{it} is the price of the i-th index at time t. The rates of return on industry indices were calculated without dividends. For each industry, we received 1043 observations of return in the period 2001–2020 (20 years). Data were obtained from the Refinitiv EIKON database, and all tables are labeled with the RIC (Reuters Instrument Code). They formed the basis for the present research. Figure 1 presents the time series of the WIG and DAX index.

Figure 1. Time series of WIG and DAX index, 2001–2020
Source: own elaboration based on Refinitiv EIKON data.

The model and estimation method

We estimated CAPM with time-varying market risk premia, using the model based on the SBETA proposed by Jostova and Philipov (2005). The stochastic beta approach requires the model to be written in the form of two equations – the empirical market model and one that describes the dynamics of the time-varying beta. For this paper, we consider the following version of the market model

$$R_{it} - R_{ft} = \alpha + \beta_t \left(R_{Mt} - R_{ft} \right) + \varepsilon_{it}, \quad \varepsilon_{it} \sim N\left(0, \sigma_\varepsilon^2\right) \tag{1}$$

where R_{it} is the logarithmic return on portfolio i, R_{Mt} is the logarithmic return on the market portfolio, and R_{ft} is the logarithmic return on the risk-free asset. Here, α is the proportion of the excess return on considered portfolio[1] i that is left unexplained by the portfolio's systematic exposure, β_t is sensitivity to movements of market excess returns, and σ_ε^2 is the variance of the market model error term. Although α, β_t, and σ_ε^2 should have i subscripts to denote that they differ across portfolios, we omit them for ease of notation.

The form of the second equation depends on the form of the stochastic process that the beta parameter is assumed to follow. There are a few propositions: random walk (Faff et al. 2000; Ebner and Neumann 2005; Das and Ghoshal 2010; Będowska-Sójka 2017), autoregressive model of order 1 with the mean reversion (Faff et al. 2000; Jostova and Philipov 2005; Kurach and Stelmach 2014), the autoregressive–moving-average (ARMA) model (Yao and Gao 2004), and random coefficient (Faff et al. 2000; Ebner and Neumann 2005). The most popular specification is the random walk of the beta parameter. However, the random walk assumption means that the beta parameter is not stationary, which seems contrary to the fact that portfolio excess returns are a linear combination of parameters and market excess returns (equation (1)), and empirical research shows that both portfolio and market returns are typically stationary (see, for example, Dębski et al. (2018)). Jostova and Philipov (2005) also present an economic argument for the mean reversion of beta: the theoretical models of the business life cycle of Berk et al. (1999) and Gomes et al. (2003) imply that "beta reverts to its long-term mean over a period of time consistent with the business cycle." They support their claim with the empirical findings of Zhang (2005) and Petkova and Zhang (2005).
We decided to follow the arguments of Jostova and Philipov (2005) and use the autoregressive process with the mean reversion of the form

$$\beta_t = \mu + \phi\left(\beta_{t-1} - \mu\right) + \eta_{it}, \quad \eta_{it} \sim \quad N\left(0, \sigma_\eta^2\right) \tag{2}$$

where: μ is a long-term level of beta, ϕ is a persistence parameter, and σ_η^2 is the variance of the conditional beta. We assume that $|\phi| < 1$ to ensure stationarity of the beta process. Again, μ, ϕ, σ_η^2 should all have I subscripts, but we omit them for simplicity. All three parameters of the mean-reverting autoregressive process can be used to obtain the unconditional mean and variance of the beta (Jostova and Philipov 2005)

$$E\left(\beta_t\right) = \frac{\mu\left(1-\phi\right)}{1-\phi} = \mu, \tag{3}$$

1 Our study assumes that α≠0, in contrast to the model of Jostova and Philipov (2005), who examined the US market.

$$Var(\beta_t) = \frac{\sigma_\eta^2}{1-\phi^2}. \tag{4}$$

This formulation of the data generating process for the beta parameter also has the theoretical advantage of being the generalization of many other processes. When the persistence parameter ϕ is equal to zero, one obtains a beta process with no persistence and perfect mean reversion. This is the random coefficient assumption. By contrast, when μ is equal to zero, the beta-generating process simply becomes an autoregressive process of order 1. Additionally, in the limiting case of $\phi \to 1$, the autoregressive process becomes a random walk.

Based on equation (2), the market model may be rewritten in the form of a conditional normal distribution

$$R_{it} - R_{ft} \mid R_{Mt} - R_{ft} \sim N\left(\alpha + \beta_t\left(R_{Mt} - R_{ft}\right), \sigma_\varepsilon^2\right) \tag{5}$$

The beta-generating process (equations (3)) may also be rewritten in the form of a conditional normal distribution

$$\beta_t \mid \beta_{t-1} \sim N\left(\mu + \phi\left(\beta_{t-1} - \mu\right), \sigma_\eta^2\right) \tag{6}$$

Therefore, the likelihood of the model may be written as

$$\begin{aligned} L\left(\alpha, \mu, \phi, \sigma_\varepsilon^2, \sigma_\eta^2 \mid R_{it}, R_{Mt}, R_{ft}\right) \sim & \prod_{t=1}^{T} N\left(\alpha + \beta_t\left(R_{Mt} - R_{ft}\right), \sigma_\varepsilon^2\right) \\ & \times \prod_{t=1}^{T} N\left(\mu + \phi\left(\beta_{t-1} - \mu\right), \sigma_\eta^2\right) \end{aligned} \tag{7}$$

The joint posterior distribution of the parameter set $\theta = \left(\alpha, \mu, \phi, \sigma_\varepsilon^2, \sigma_\eta^2\right)$ is, by the Bayes theorem, proportional to the product of the joint prior distribution and the likelihood function

$$p\left(\theta \mid R_{it}, R_{Mt}, R_{ft}\right) \propto p(\theta) L\left(\theta \mid R_{it}, R_{Mt}, R_{ft}\right) \tag{8}$$

Regarding the prior distribution $p(\theta)$, we assume prior' independence of all parameters. For the α parameter, we use a normal prior with mean 0 and standard deviation 10. Typically, the value of parameter α is close to 0. For the long-term mean parameter μ, we use a normal prior with mean 1 and standard deviation 10. The value of 1 is often referred to as the "grand mean of all betas" (Blume 1976). We set $\phi = 2\tilde{\phi} - 1$ and specify a Beta (20,1.5) prior for $\tilde{\phi}$, which has a mean of 0.93 and a standard deviation of 0.055. For the parameters σ_ε and σ_η, we use Inverse-Gamma (2.5,0.025), which has a mean of 0.167 and a standard deviation of 0.024. The priors follow typical specifications of basic stochastic volatility models with a mean re-

version of log-volatility (see Kim et al. 1998; Yu 2004) and are slightly different from the priors used by Jostova and Philipov (2005).

We use the open-source Bayesian software STAN, which interfaces with the R by RStan package (Stan Development Team 2020). STAN implements an efficient estimation of posterior probability using the No-U-Turn Sampler (NUTS). This sampler is the Markov chain Monte Carlo (MCMC) algorithm that avoids random walk behavior, and thus it is less prone to the correlation of parameters that impede many MCMC methods. NUTS is an extension of the Hamiltonian Monte Carlo (HMC) algorithm proposed by Hoffman and Gelman (2014). Two other popular open-source Bayesian programs, BUGS and JAGS, perform MCMC, updating one scalar parameter at a time. STAN moves in the entire space of all the parameters using NUTS, thus avoiding some difficulties that occur with one dimension at a time sampling in high dimensions. In all the presented results, we used a burn-in period of 5,000 iterations and a follow-up period of 20,000 iterations.

Results

The results show empirical evidence of the behavior of industry betas for the five Polish and three German industrial sectors. We evaluate the degree of time variation, persistence, and volatility exhibited by industry beta parameters over a twenty-year period (2001–2020, weekly data). The long time series of data suggests that betas respond to macroeconomic variables of the Polish and German economies and global risk factors arriving randomly on the international financial market. It means that the stochastic process of beta is implied, and our research captures a wide variety of economic events in the 20 years.

Polish industry betas

Table 1 summarizes the estimation results for the SBETA parameters for each Polish industry. i.e., Banking, Construction, IT, Food and Drinks, and Telecom.

The Banking sector has average systematic risk, a long-term beta μ level of 1.060, and a persistence parameter ϕ of 0.939. It means that the Banking sector in Poland can be classified as aggressive, and with a beta greater than 1, it tends to be more volatile than the whole Polish stock market. Compared to other Polish sectors, Banking should be chosen by investors who are willing to take on more risk or when an upward trend is forecast in the long run. The persistence parameter of 0.939 is close to unity, meaning that the Banking beta does not revert to a long-term mean for a long period. It can be affected by frequent and dynamic events, such as changing economic conditions or company structures. Additionally, the Banking industry in Poland has a positive alpha parameter, i.e., 0.152, indicating a higher risk-adjusted return. It means that this sector outperformed the market.

The Construction sector has average systematic risk, a long-term beta μ level of 0.910, and a persistence parameter ϕ of 0.986. It means that the Construction sector can be classified as defensive; with a beta less than 1 but more than 0, it tends to be less volatile than the market. This sector should be chosen by investors who are more risk-averse. The persistence parameter of 0.986 is also close to unity, so it means that the Construction beta is highly persistent (the strength of the long-term mean reversion is very weak).

The IT sector has average systematic risk, a long-term beta μ level of 0.916, and a persistence parameter ϕ of 0.386. The IT sector can also be classified as defensive, with a beta smaller than 1; however, the persistence is low, at 0.386, so the strength of long-term mean reversion is high.

The Food and Drinks sector has average systematic risk, a long-term beta μ level of 0.909, and a persistence parameter ϕ of 0.988. It means that this sector can be classified as defensive and less volatile than the market. The very high persistence parameter of 0.988 also means that the Food and Drinks beta is highly persistent.

The last sector, Telecom, has average systematic risk, a long-term beta μ level of 0.996, and a persistence parameter ϕ of 0.975; therefore, it is classified as defensive, less volatile than the market, and the beta is highly persistent.

Looking at Table 1 and Figure 2, one can compare the volatility of beta based on the σ_η parameter. The highest value is observed in the IT sector, which has a more jagged line. Four out of the five sectors have smooth graphs. There is also a clearly visible difference between WIG.IT, with low persistence, and the rest of sector which has higher persistence. After shocks, the beta of WIG.IT quickly returns to the long-term mean, whereas the betas of the other sectors persist far from the long-term mean for quite a long time.

Table 1. Summary of the posterior distribution for the model parameters – Polish industries

	Parameter	Mean	Standard error of the mean	Standard deviation	Quantiles				
					5%	25%	50%	75%	95%
WIG.BANKS	α	0.152	0.001	0.063	0.048	0.109	0.152	0.194	0.254
	ϕ	0.939	0.003	0.026	0.840	0.926	0.953	0.971	0.988
	μ	1.060	0.001	0.032	1.001	1.045	1.064	1.081	1.104
	σ_ε	1.641	0.002	0.039	1.577	1.614	1.640	1.667	1.705
	σ_η	0.035	0.002	0.014	0.020	0.026	0.032	0.040	0.062
WIG.CONSTRUCTION	α	–0.177	0.001	0.076	–0.303	–0.229	–0.178	–0.126	–0.053
	ϕ	0.986	0.001	0.005	0.965	0.982	0.989	0.993	0.997
	μ	0.910	0.000	0.043	0.841	0.881	0.908	0.937	0.983
	σ_ε	2.432	0.001	0.054	2.344	2.395	2.431	2.467	2.523
	σ_η	0.024	0.001	0.008	0.013	0.018	0.023	0.029	0.040

	Parameter	Mean	Standard error of the mean	Standard deviation	Quantiles				
					5%	25%	50%	75%	95%
WIG.IT	α	−0.179	0.001	0.070	−0.293	−0.227	−0.179	−0.132	−0.064
	ϕ	0.386	0.003	0.062	0.189	0.301	0.383	0.469	0.594
	μ	0.916	0.000	0.023	0.878	0.901	0.916	0.931	0.953
	σ_ε	2.030	0.002	0.067	1.923	1.984	2.029	2.074	2.142
	σ_η	0.217	0.002	0.026	0.172	0.200	0.218	0.234	0.257
WIG.FOOD &DRINKS	α	−0.310	0.001	0.077	−0.436	−0.363	−0.311	−0.258	−0.182
	ϕ	0.988	0.001	0.006	0.967	0.985	0.992	0.996	0.999
	μ	0.909	0.001	0.054	0.828	0.870	0.905	0.944	1.002
	σ_ε	2.542	0.000	0.057	2.450	2.503	2.541	2.579	2.639
	σ_η	0.024	0.001	0.008	0.014	0.018	0.022	0.027	0.038
WIG.TELECOM	α	−0.151	0.001	0.082	−0.285	−0.205	−0.151	−0.098	−0.015
	ϕ	0.975	0.001	0.010	0.938	0.966	0.979	0.989	0.996
	μ	0.996	0.003	0.053	0.919	0.959	0.991	1.029	1.091
	σ_ε	3.030	0.001	0.068	2.920	2.985	3.029	3.075	3.143
	σ_η	0.033	0.002	0.013	0.017	0.024	0.031	0.040	0.058

Source: own elaboration.

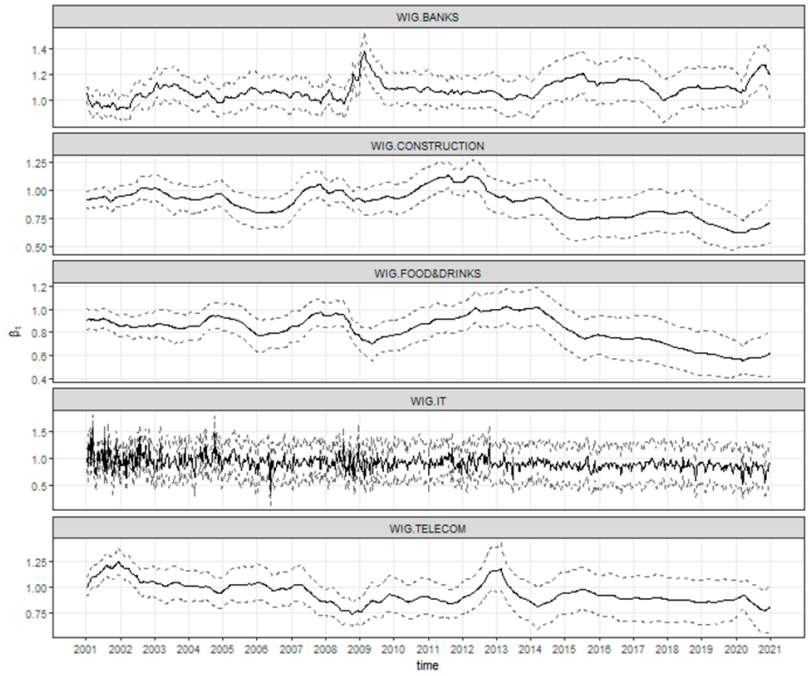

Figure 2. The posterior mean of β_{it} (thick line) with two thin dashed lines representing the 90% Bayesian posterior interval. Polish industries, weekly data from January 2001 to December 2020
Source: own elaboration based on Refinitiv EIKON data.

German industry betas

Table 2 summarizes the estimation results for the SBETA parameters for each German industry – Banking, Technologies (IT), and Telecom.

Table 2. Summary of the posterior distribution for the model parameters – German industries

Index	Parameter	Mean	Standard error of the mean	Standard deviation	Quantiles				
					5%	25%	50%	75%	95%
PRM.BANKS	α	–0.080	0.000	0.071	–0.196	–0.128	–0.080	–0.032	0.038
	ϕ	0.452	0.002	0.044	0.306	0.392	0.453	0.513	0.596
	μ	1.225	0.000	0.040	1.158	1.198	1.226	1.252	1.290
	σ_ε	2.801	0.002	0.086	2.662	2.742	2.799	2.858	2.944
	σ_η	0.472	0.002	0.050	0.389	0.437	0.472	0.506	0.555
PRM.TECHN	α	0.112	0.000	0.071	–0.005	0.064	0.112	0.161	0.230
	ϕ	0.605	0.013	0.084	0.295	0.499	0.625	0.726	0.856
	μ	1.221	0.001	0.037	1.160	1.197	1.222	1.246	1.281
	σ_ε	2.975	0.009	0.090	2.829	2.914	2.972	3.035	3.123
	σ_η	0.243	0.013	0.074	0.110	0.197	0.247	0.292	0.362
PRM.TELE-COM	α	–0.091	0.000	0.066	–0.198	–0.136	–0.091	–0.046	0.017
	ϕ	0.561	0.002	0.042	0.418	0.507	0.564	0.618	0.693
	μ	0.868	0.000	0.038	0.806	0.843	0.868	0.894	0.931
	σ_ε	2.401	0.002	0.072	2.284	2.351	2.400	2.449	2.520
	σ_η	0.393	0.003	0.044	0.318	0.364	0.393	0.422	0.465

Source: own elaboration.

The Banking sector has average systematic risk, a long-term beta μ of 1.225, and a persistence parameter ϕ of 0.452. It means that the Banking sector in Germany can also be classified as aggressive. It tends to be more volatile than the whole German stock market; therefore, it should be interesting to investors who take on more risk. The persistence parameter of 0.452 means that the strength of long-term mean reversion is high.

The Technologies (IT) sector has average systematic risk, a long-term beta μ level of 1.221, and a persistence parameter ϕ of 0.605. It is also classified as aggressive for low-risk averse investors, with average persistence. Similar to the Banking industry in Poland, German Technologies has a positive alpha parameter of 0.112, indicating a higher risk-adjusted return. It means that this sector outperformed the market.

The last analyzed German industry is Telecom. With a long-term beta μ of 0.868 and a persistence parameter ϕ of 0.561, the Telecom sector can be classified as defensive and less volatile than the market, and with moderate persistence.

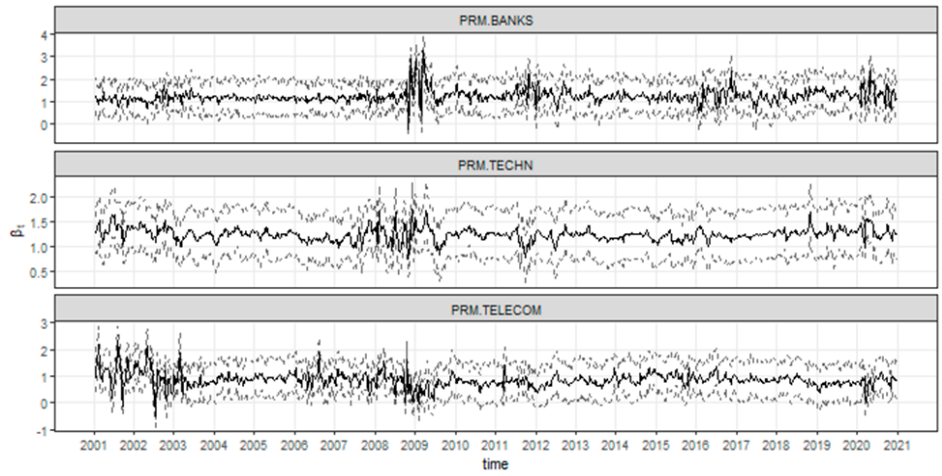

Figure 3. The posterior mean of β_{it} (thick line) with two thin dashed lines representing the 90% Bayesian posterior interval. The German industries, weekly data from January 2001 to December 2020
Source: own elaboration based on Refinitiv EIKON data.

Looking at Table 2 and Figure 3, one can compare the volatility of beta based on the ση parameter. The highest value is observed for the Banking sector, which has a more jagged line, but the differences are small, and all lines look different than for Poland. According to the persistence parameter, the beta of the Banking sector has the highest strength of mean-reversion. However, all sectors are less persistent than the Polish sectors (with the exception of WIG.IT)

Conclusions

The overall research objective was to examine the long-term dependence between the Polish and German stock markets in terms of industry risk estimates according to CAPM. The main aim of this article was to compare industry beta parameters of five Polish and three German sector indices using Jostova and Philipov's (2005) Bayesian methodology SBETA model in a long run. The novelty, in terms of Bayesian modeling, lies in the use of the No-U-Turn Sampler (NUTS) via open-source Bayesian software STAN. This Markov chain Monte Carlo sampler is very efficient because it is able to produce high-dimensional proposals that are accepted with high probability. The empirical investigation of Polish and German industries over the past 20 years provides evidence that betas are time-varying in both markets but less persistent in the German industries. Only one of the five Polish sectors had a beta with low persistence that quickly reverted to the long-term mean. In general, the German industry betas

showed a lower level of persistence in comparison with the Polish ones, which is usually observable in more advanced markets.

Comparing the level of risk, the Banking sector betas were the highest in both the Polish and German markets, implying the aggressive nature of that industry in the last twenty years. For the Polish market, the industry betas of the Construction, IT, Food and Drinks, and Telecom sectors were classified as defensive, but with betas more than 0.9 but less than 1, close to the market index. Looking at the German economy, the Technologies (IT) sector was also classified as aggressive, but Telecom was defensive. Comparing the volatility of industry betas in both markets, it is visible that German industries were more volatile, and the graphs of the beta parameters were more jagged than the Polish ones.

When comparing the alpha levels, the banking sector in Poland and Technologies (IT) in Germany outperformed the market by having positive results. This finding can be explained by the idiosyncrasy of the Polish and German economies. In the last twenty years, banking has been seen as a leading sector in Poland, with a high influx of foreign capital, while Germany is the world leader in technology and innovation.

To conclude, we showed that this modeling approach has several advantages. The first advantage of the SBETA model is its ability to separate and measure the beta characteristics in the long run and ensure that investors get highly desired investment recommendations based on a solid methodology. The comparison of different time-varying industry betas in the Polish and German economies gives some insights into the level of systematic risk and how it is perceived by investors. These findings indicate that the application of the SBETA model is associated with research impact and added value to international investors and portfolio managers.

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Oszacowaniach polskich i niemieckich współczynników beta z użyciem metody bayesowskiej – porównanie dla głównych indeksów sektorowych w latach 2001–2020

Celem artykułu jest porównanie długookresowych zależności w poziomie branżowego ryzyka systematycznego, mierzonego współczynnikiem beta, na polskim i niemieckim rynku giełdowym. Poziom ryzyka został oszacowany dla pięciu sektorów polskich i trzech niemieckich na podstawie modelu CAPM z wykorzystaniem metody bayesowskiej w okresie 2001–2020. Cele szczegółowe artykułu to rozwinięcie i udoskonalenie nowego podejścia bayesowkiego (model SBETA) do szacowania poziomu ryzyka i porównanie wielkości współczynnika beta zmiennego w czasie na obu rynkach wraz z prostą rekomendacją inwestycyjną, tj. sektor agresywny lub defensywny.

Wyniki wskazują, że współczynniki beta niemieckich sektorów miały niższy poziom persystencji, co jest charakterystyczne dla rynków rozwiniętych. Sektor bankowy okazał się najbardziej agresywny, najwyższy poziom bety, zarówno na polskim i niemieckim rynku giełdowym. Polskie indeksy sektorowe budownictwo, IT, artykuły spożywcze i telekomunikacja zostały zakwalifikowane do defensywnych. Niemieckie indeksy, Technologiczny (IT) został zakwalifikowany do agresywnych ale telekomunikacja do defensywnych. Na podstawie obliczeń wskazano, że polski sektor bankowy i niemiecki technologiczny przyniosły wyższe dochody niż cały rynek w analizowanym okresie. Wyniki mają bardzo duże znaczenie dla oceny poziomu ryzyka systematycznego na polskiej i niemieckiej giełdzie papierów wartościowych i dają jasne rekomendacje inwestorom międzynarodowym.

Słowa kluczowe: beta sektorowa, CAPM, metoda bayesowska, symulacja Monte Carlo, Polska, Niemcy

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The Immigration Policy of the European Union: Challenges and Prospects Conclusions for Poland

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Abstract

The paper aims to characterize and evaluate the immigration policy of the European Union in the context of the challenges posed by regular and irregular migration processes on a global and regional scale. The EU policy is in line with the United Nations (UN) initiatives aimed at international cooperation in solving migration problems. The provisions of the treaties share powers in EU immigration policy between its institutions and member states. The harmonization of activities in this area is carried out through the implementation of directives adopted at various times and related to limited areas of immigration policy, hence its fragmented nature. The 2015 migration crisis posed new challenges to the EU's immigration policy and revealed conflicts of interest between individual member states. Nevertheless, the EU is taking steps to build a comprehensive approach to migration, asylum, integration, and border management (*The New Pact on Migration and Asylum*). The diverse position in terms of the balance of migration flows of the EU as a whole (a net importer of labor) and individual member states (e.g., Poland – a net exporter of labor and recipient of circular migration) affects the approach to migration issues and the acceptance of the proposed solutions in the area of migration policy.

Keywords: migration, European Union, the EU immigration policy, Poland, circular migration

JEL: F02, F15, F22

Introduction

There are long-term tendencies towards strengthening migration processes in the global economy. The same is true in relations between the European Union (EU) and third countries. At the same time, the liberalization of labor markets within the EU stimulates labor flows among the member states. Although the reasons for migration flows and their economic, social, and political consequences for countries of origin and destination have been thoroughly discussed, attempts to establish global and regional migration policies have been analyzed to a lesser extent. Therefore, it justifies examining these issues further.

Although there are no binding global regulations that underlie international movements of people/labor force, the UN has attempted to formulate standards and norms related to migration. The EU is also attempting to establish a legal migration framework in relations with third countries, while a framework for inclusive social policy has been created to improve the situation of migrants.

This paper aims to characterize and assess the EU's immigration policy in the context of challenges arising from regular and irregular migration into the grouping. The more detailed research tasks in the paper are as follows:

- to present the results of international cooperation to manage migration flows in the world economy, with particular reference to UN initiatives (*Global Compact on Refugees* and *Global Compact for Safe, Orderly, and Regular Migration*),
- to examine changes in legal regulations on migration at the EU level and their impact on re-shaping EU immigration policy,
- to assess the activities undertaken by EU institutions to solve problems caused by regular and irregular migration,
- to discuss some conflicts of interests among the member states regarding irregular migration,
- to assess the consequences of migration flows from and to Poland for its economy, with particular reference to circular migration.

The UN documents and the official information on the EU immigration policy and independent analyses are used as references in the paper. The International Organization for Migration (IOM), EUROSTAT, and national statistics databases are used to analyze and evaluate the migration flows at the global level and between the EU and third countries.

The UN Global Compact for Migration

Global migration is intensifying, as evidenced by the increasing number of international migrants, estimated at 272 million in 2019. The number of refugees also increased. It was estimated at 25.9 million people worldwide in 2019, which meant an almost twofold increase compared to 2000. Moreover, 3.9 million people were stateless

(IOM 2019, p. 10). Although migrants represent a small fraction of the world's population, i.e., 3.5%, both absolute and relative values indicate that the scale of this phenomenon increased significantly in the last half-century. The total number of migrants in the world economy in 1970 was 84.5 million, which accounted for 2.3% of the global population (IOM 2019, p. 10). Compared with the scale of migration in 1970, the total number of international migrants in 2019 increased more than threefold.

The geographical structure of migration by region of residence indicates that in 2019, 61% of the total number of migrants resided in two regions of the world economy, i.e., Asia and Europe, with 84 and 82 million, respectively. North America was in third place, with 22% of the total number of migrants, i.e., 59 million (IOM 2019, p. 24).

The acceleration of migration in the global economy is closely related to violent events around the world (conflicts, severe disruptions to political and economic stability, economic crises), but also long-term trends that result from demographic changes, economic development, advanced communication technologies, and transport availability.

In the context of the migration that emerged with unprecedented intensity, the UN attempted to comprehensively regulate international movements of people. On September 19, 2016, the UN General Assembly adopted the *New York Declaration on Refugees and Migrants*, which launched international cooperation to manage migration (UN 2016; EP 2019; Kugiel 2018; IOM 2019a). Two separate negotiation processes were started in connection with the Declaration. As a result, two agreements – the *Global Compact for Refugees* and the *Global Compact for Safe, Orderly, and Regular Migration* – were adopted in 2018.

The *Global Compact on Migration* is the first-ever UN agreement on a common approach to international migration and its various dimensions. It is based on common values such as state sovereignty, responsibility-sharing, non-discrimination, and human rights. At the same time, Agreement signatories agree that a cooperative approach to migration is needed to optimize the overall benefits of migration while addressing the risks and challenges of migration for individuals and communities in countries of origin, transit, and destination. However, the *Global Compact on Migration* is not legally binding, does not restrict national policies, and does not replace national migration controls. Reaching this agreement is perceived as an important step in establishing a multilateral regime on migration and the first stage of the "internationalization" of migration policy. This process was supported institutionally by transforming the *International Organization for Migration* (IOM) into a UN agency (EP 2019, pp. 4, 11).

The agreement contains 23 goals that can be divided into three groups: (1) specific goals and goals directly related to migration, (2) goals concerning specific but contested issues, (3) broad and aspirational goals (IOM 2019, p. 298). The first group includes widely accepted goals, such as data collection and research, the ethical employment of migrants, facilitating the transfer of funds to the migrants' country of origin, and preventing trafficking in human beings. The second group objectives – contest-

ed – included a wider opening up of legal migration paths, coordinated and integrated border management, using detention as a last resort, ensuring migrants' access to essential services, investing in skills development, mutual recognition of qualifications, and facilitating returns and reintegration. The third group includes, i.a., reducing the negative forces that cause migration, eliminating all forms of discrimination, and taking measures for full social inclusion and cohesion (IOM 2019, p. 298).

Not all UN member states accepted the *Global Compact for Migration*. While still negotiating the agreement, i.e., in 2017, the US withdrew from its initial commitments, adopting a more protectionist approach regarding border management. President Trump's administration found the agreement to be incompatible with US sovereignty. Other countries also did not sign the agreement at the Marrakesh conference. This group includes 10 EU Member States, including Poland (EP 2019, p. 3).

The European Parliament, in its resolution of April 18, 2018, strongly endorsed the objectives of the *New York Declaration on Refugees and Migrants*. The draft refugee agreement and its approach to the problem were welcomed. Concerning the *Global Compact for Safe, Regulated and Legal Migration,* the European Parliament insisted on "*...the need for the EU Member States to demonstrate unity and to speak with one voice in support of an international human rights-based regime for managing migration*" (EP 2019a, par. 29), among other things.

The confrontation of the European Parliament's position with the approach of many EU member states to accession to the agreement shows that managing migration at the supranational level is a problematic issue.

The European Union as a grouping played an essential role in preparing the *Global Compact on Migration*, formulating six priorities that were broadly adopted in the final text of the agreement. They read as follows (EP 2019, pp. 7–8):

- upholding the human rights of all migrants and protecting migrants in vulnerable situations,
- addressing the drivers of migration, including climate change impacts, natural disasters, and man-made crises,
- connecting migration with development, including remittances and the portability of earned benefits,
- promoting international governance of migration, including through effective cooperation on return, readmission, integration, and reintegration,
- addressing irregular migration, including trafficking in human beings and smuggling of migrants, and promoting border management,
- promoting regular pathways.

The European Union strongly emphasized the link between these priorities and the *2030 Agenda for Sustainable Development* – SDG) (EP 2019a; EC 2019). The immigration policy of the European Union also reflected these priorities.

The International Organization for Migration (IOM) makes recommendations on national policies for the social inclusion of migrants, stressing that specific issues cannot be resolved globally. However, the IOM recognizes that with increasing mi-

gration over the last 50 years, the diversification of the migrants' countries of origin, their socio-economic differentiation, and the differences in the causes of migration, the cohesion of the societies of countries that receive migrants has become a challenge for them (IOM 2019, pp. 185–206). In the *Global Compact for Safe, Regulated and Legal Migration*, the social inclusion of migrants and social cohesion is one of the central goals (Goal 16) confirmed by the acceding countries. This issue is raised similarly by the *Global Compact on Refugees* (IOM 2019, p. 186).

The IOM recommendations concerning the policy of the social inclusion of migrants by host countries are as follows (IOM, p. 206):

- Applying a holistic approach to the social inclusion policy should improve its effectiveness; usually, high importance is attached to policies aimed at including migrants in the labor market, but different policy areas are interdependent, and the effects in different areas may interact.
- Not applying restrictive policies in migration management (e.g., high language requirements on entry), as this may have opposite effects, e.g., in family reunification.
- Local actors (local authorities) play an important role in social inclusion; their role should be strengthened when shaping national social inclusion policies.

Immigration policy within the European Union

The specifics of the EU immigration policy result, on the one hand, from the legal conditions defined by the treaties, and on the other, from the changing approach to the real flows of people/labor in the global economy and relations with third countries. The declared goal of the EU in this area is to create a far-reaching and extensive policy based on solidarity, with a balanced approach to the issue of regular and irregular immigration (EP 2021, p. 1).

Treaty basis

The legal basis for the immigration policy is the provisions of the *Treaty on the Functioning of the European Union* (TFEU) – Art. 79 and Art. 80 (TFEU 2012). The EU has the power under the Treaties to develop a common immigration policy to manage migration flows effectively. This policy applies both to third-country nationals legally residing in the member states and to irregular migration. The EU is committed to ensuring that legal immigrants have the same rights and obligations as EU citizens. Its policy also aims to prevent irregular migration and human trafficking (Art. 79 TFEU). The European Parliament and the Council create the means of achieving these objectives through the ordinary legislative procedure.

The EU does not have exclusive competencies in immigration policy – it shares them with the member states (TFEU 2012; EP 2021, pp. 1–2). The EU's competencies

concern establishing the conditions of the entry and residence of legal immigrants, including family reunification procedures and the freedom of movement and to live in the other member states. However, member states have the right to determine the allowed number of third-country immigrants seeking employment or self-employment in their markets. The EU can offer incentives and support to member countries to promote the integration of legal immigrants from third countries. However, EU law does not contain any regulations concerning the harmonization of the laws and regulations of the member states in this respect.

Regarding irregular migration, the EU takes measures to prevent and reduce such flows and has the right to conclude agreements with third countries on the readmission of irregular migrants who do not fulfill the conditions for entry or stay in EU member states (EP 2021).

The TFEU also empowers the EU to develop a common policy in the fields of asylum, subsidiary protection, and temporary protection aimed at granting appropriate status to every third-country national in need of international protection (TFEU Art. 78). This policy must follow the Geneva Convention of July 28, 1951, and the Protocol of January 31, 1967, relating to the status of refugees, and other relevant treaties. If one or more member states find themselves in an emergency related to the sudden influx of third-country nationals, they may receive temporary measures, granted by the Council based at the request of the Commission, after consulting the European Parliament (TFEU Art. 78.3).

The Treaty of Lisbon creates the legal framework for the EU's policy on border control, asylum, and immigration. This policy applies the principle of solidarity and fair sharing of responsibility between the member states, also in the area of finance (Art. 80). Adopting the above provisions in the Treaty of Lisbon has institutional implications, i.e., the above-mentioned co-legislation of the Parliament and the Council and the full jurisdiction of the Court of Justice concerning the sphere of immigration and asylum (EP 2021, p. 2).

Implementation of the EU immigration policy

The implementation of the assumptions of the EU immigration policy required action at the EU level. As part of these activities, the *Global Approach to Migration and Mobility* (GAMM) was adopted in 2011, setting out a general framework for the EU's relations with third countries in migration and asylum policy (EC 2011). The EU has taken many initiatives that tackle the problem of migration in neighborly relations, for example, with African countries. GAMM addressed four issues: regular immigration and mobility, irregular migration and trafficking in human beings, international protection and asylum policy, and maximizing the development impact of migration and mobility (EC 2011, p. 6). Regarding the latter area, the EU formulated priorities that indicated that the grouping would strive to mitigate the brain drain from developing countries and reduce the cost of transferring wages to immigrants' home countries,

among others. At the same time, the EU saw immigration in the context of the new *Europe 2020* strategy as a means of enhancing the development of the EU economy by replenishing the workforce that is declining there (due to population aging) and using a new pool of skilled workers. The *Directive on the conditions of entry and residence of third-country nationals for highly qualified employment* had already been adopted (Council Directive 2009/50/EC).

Another action of the EU was that it adopted strategic guidelines for EU legislative and operational planning in the area of "freedom, security, and justice" for the period 2014–2020. The guidelines emphasized the need for a holistic approach to migration to make the best use of regular migration, offer protection to those who need it, combat irregular migration, and effectively manage borders (EP 2021, p. 2).

In response to the unprecedented migration crisis in 2015, the Commission published the *European Agenda on Migration,* proposing immediate countermeasures and measures to be taken in the coming years to manage all aspects of immigration more effectively (EC 2015). The *European Agenda for Migration* introduced the idea of relocating refugees/immigrants throughout the European Union and supporting this process financially (EC 2015, pp. 5–6), which was a reactive solution in the face of the failure of destination countries to cope with the flood of migrants.

The assessment of the immediate effects of implementing the *European Agenda for Migration* shows that it fulfilled its task concerning the crisis and stopping irregular immigration to the EU. After the stream of irregular migration reached over 1.8 million people in 2015, it dropped to 150,000 in 2018 and then decreased in 2019 by a further 5%, reaching 141,700 (EC 2019a; EC 2019b). The EU institutions used a range of instruments to tackle the current problems. They included an innovative approach to partnerships with third countries, an agreement with Turkey, providing protection and support to millions of refugees in third countries, creating a new *European Border and Coast Guard Agency,* and allocating significant funds (over EUR 10 billion) to migrants and border protection (EC 2019a).

At the same time, third countries, including Turkey, critically assess the actions taken by the EU to deal with the refugee crisis. There is a discrepancy between the normative principles of EU policy, such as solidarity and burden-sharing, and the actual practice in this area (Eylemer, Söylemez 2020, pp. 315–342).

In the medium and long term, in addition to reducing incentives for irregular immigration, border management, and the development of a more assertive common asylum policy, in *the European Agenda for Migration,* the Commission proposed establishing a new policy for regular immigration and a revision of the "Blue card", which concerns the immigration of highly qualified people (EC 2021, p. 3). The *Agenda* emphasizes the needs of the EU in terms of the inflow of labor from third countries, indicating that Europe is competing with other economies for workers with the required skills. It is estimated that without migration, the EU working-age population will decline by 17.5 million in the coming decade (EC 2015, p. 17). Migration is an increasingly important way to improve the EU's welfare system's sustainability and ensure sustained economic growth.

Regarding regular migration, the EU developed legal solutions (directives) concerning the opening of legal channels for migration. In addition to the above-mentioned *Directive on the conditions of entry and residence of third-country nationals for highly qualified employment*, several directives have been adopted to organize and standardize the situation of immigrants living in the EU. These were directives *on the right to family reunification* (2003/86/EC), *long-term residents* (2003/109/EC), *single permit* (2011/98/EU), *intra-corporate transfers of workers* (2014/66/EU), *seasonal workers* (2014/36/EU), *the conditions of entry and residence of third-country nationals for the purposes of research, studies, training, voluntary service, pupil exchange schemes or educational projects and au pairing* (2016/801/EU). In 2016, the European Commission also adopted a new action plan to integrate migrants from third countries (EP 2019, pp. 9–10).

The directives mentioned above harmonize the member states' approaches to individual areas of immigration policy concerning legal migration. However, there are potential gaps in these regulations and their maladjustment to the current needs of the EU. It applies in particular to the problems that appear at various stages of the migration process (e.g., obtaining entry visas), a lack of regulation of the conditions of access to the EU labor market for certain categories of third-country nationals important for its economy (e.g., seasonal workers with low or medium qualifications, job seekers, service providers). As a result of sharing competencies in immigration policy with the member states, these gaps are covered by national regulations. However, this causes the fragmentation of the EU immigration policy, which is the price paid for the gradual Europeanization in this very sensitive sphere (EC 2019c, pp. 100–101).

According to official assessments, the EU immigration policy pursues the main goals formulated at the 1999 Tampere European Council summit and included in the Lisbon Treaty. In implementing this policy, an additional goal emerged, i.e., attracting third-country nationals to the EU economy, according to its needs, to strengthen the competitiveness and economic growth of the EU (EC 2019c, p. 100). However, scientists' assessments indicate that the EU policy reveals two specific phenomena concerning granting rights to legal migrants, i.e., granting "restrictive rights" to third-country nationals and "politics of categorization" (Mourão Permoser 2017). "Restrictive rights" mean that member rights are, in principle, guaranteed to third-country nationals but under restrictive conditions. On the other hand, "the politics of categorization" refers to the political construction of different categories of migrants who are subject to the influence of different regimes in terms of the rights granted. These phenomena make it possible to extend rights to non-EU citizens. However, they create new dividing lines and mechanisms of exclusion.

Following the actions taken so far, the European Commission published in September 2020 The *New Pact on Migration and Asylum*, aiming to construct a comprehensive approach to migration, asylum, integration, and border management (EC 2020, p. 3). It expresses the desire to regulate migration in a long-term perspective while respecting European values and international law. The pragmatic dimension is about reducing the problem of unsafe routes and irregular immigration routes and promoting

permanent and safe legal migration routes for people who need protection. The *New Pact on Migration and Asylum* proposes a holistic approach to migration and asylum, emphasizing the need to create more effective procedures and capture a new balance between responsibility and solidarity among member states. The importance of enhanced cooperation on migration with partners outside the EU is also stressed. The *New Pact* proposal is also subject to critical evaluation from various viewpoints (Carrera and Geddes 2021).

Characteristics of people/labor flows in relations between the European Union and third countries

In an integration grouping, such as the EU, flows of people/labor within the grouping result from having achieved an advanced stage of integration – the single European market, which implements the free movement of people/employees. On the other hand, migrations and labor flows in relations with third countries result from many factors, including political ones. The EU member states accept migrants from other member states and third countries. In the latter case, they are both regular and irregular migrants.

According to Eurostat, the total number of people living in EU countries without citizenship of any EU member state was 23 million on January 1, 2020, and accounted for 5.1% of the EU population. Also, 13.5 million people in the EU had citizenship of other member states (Eurostat 2021). In the geographical structure of the EU, residents born outside the EU by country of origin, Australia and Switzerland had the largest share (29.7% each), followed by Canada (21.3%), Norway (15.6%), Great Britain[1] (14%), the USA (13.6%) and Russia (8%). The reasons indicated for the migration of people with residence permits to the EU are family reasons (38%), work (17%), asylum (9%), education (4%), and other (32%) (Eurostat 2019, pp. 2–3). The EU member states with the largest number of immigrants, in absolute terms, as of 1.01.2020, were Germany (10.4 million), Spain (5.2 million), France (5.1 million), and Italy (5.0 million). Altogether, non-EU citizens living in these four countries represented 71% of the total number of immigrants in the EU (Eurostat 2021, p. 9).

The importance of immigrants for the EU labor market is confirmed by the number of non-EU citizens employed and their share in the population aged 20–64. In 2019, it was 8.8 million people, which accounted for 4.6% of this population. At the same time, the average employment rate in the working-age population is higher among EU citizens (73.8%) than non-EU citizens (60%) (Eurostat 2019, p. 3). On the other hand, the employment structure (job/occupation) does not reflect expectations regarding attracting higher-skilled immigrants to the EU labor market. There is an

1 In the revised EU statistics on migration for 2018–2019, Great Britain is already treated as a third country.

over-representation of immigrants in jobs that require lower qualifications (cleaners and helpers, personal service workers, personal care workers, building workers, food preparation assistants). In the case of jobs/professions requiring high qualifications, there is an under-representation of non-EU citizens (teaching professionals, business and administration associate professionals, market-oriented skilled agricultural workers) (Eurostat 2019, pp. 4–5).

In response to the unprecedented influx of migrants and refugees experienced in 2015, the European Union is making numerous efforts to open up legal channels for migration and prevent illegal crossings of the EU borders. The scale of the problem is illustrated by the data on irregular migration in 2014–2019 (see Figure 1), which followed various routes from Africa, the Middle East, and Asia, mainly through the Mediterranean Sea and the Balkan route (EP 2019, p. 9).

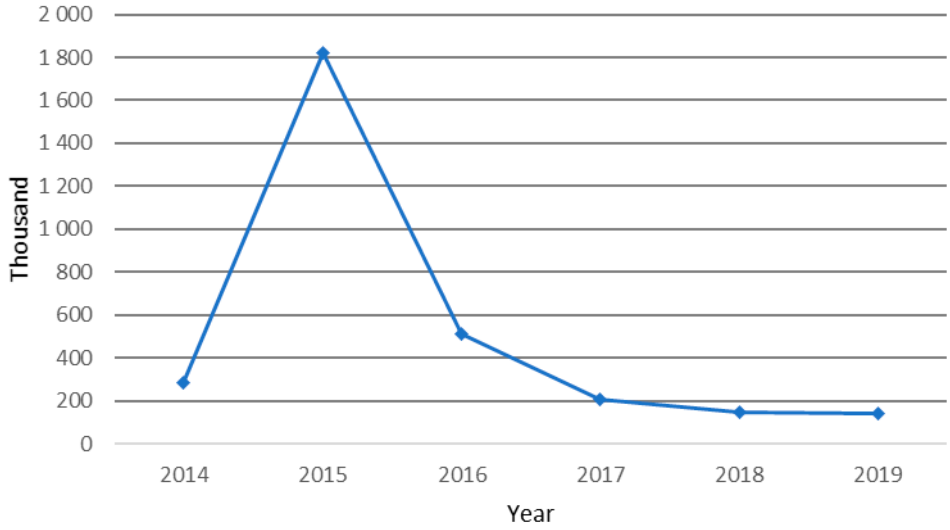

Figure 1. Irregular migration to the EU, 2014–2019, thousand people
Source: European Parliament, EPRS, J. Apap, *A Global Compact on Migration. Placing Rights at the Heart of Migration Management*, January 2019, p. 9; Communication from the Commission to the European Parliament, the European Council and the Council, Progress Report on the Implementation of the European Agenda on Migration, COM (2019) 481 final, Brussels, 16.10.2019, p. 1; *Statistics on migration to Europe*, European Commission, https://ec.europa.eu/info/strategy/priorities-20192024/promoting-our-european-way-life/statistics-migration-europe_en (accessed: 11.03.2021) and own elaboration.

The above data show that measures taken by the EU in cooperation with other countries resulted in a reduction in the number of illegal/irregular crossings of the EU borders. The experience of the past migration crisis made the EU strive to develop mechanisms that would help it better deal with possible crises. It is reflected in the above-mentioned *New Pact on Migration and Asylum*.

Migrations and flows of labor between Poland and the European Union member states and third countries

Evolution of legal conditions

Establishing the free movement of people/labor between Poland and the European Communities/European Union was a sensitive issue. At the stage of association, under the *Europe Agreement*, Polish citizens legally employed in the EU member states at that time were guaranteed non-discrimination in terms of working conditions, remuneration, or dismissal, similarly to their family members. However, the possibility of Polish citizens obtaining the right to work was decided by individual member states, making their decisions dependent on the situation in their labor markets. The flows of labor in mutual relations were limited by bilateral agreements (Kawecka-Wyrzykowska 1997, pp. 409–415).

At the stage of negotiating Poland's membership agreement with the EU, the negotiating area on the free movement of people proved to be one of the most difficult. At the request of the European Union, a seven-year transitional period was established in the 2 + 3 + 2 formula, limiting the right of Polish citizens and the citizens of eight new member states (EU–8) to work in the EU (EC 2011a). The EU–15 Member States were allowed to open their labor markets at any stage of the transition period until all restrictions were lifted. Typically, the member states that restricted access to their labor markets applied work permit schemes.

Among the EU–15 member states, Ireland, Great Britain, and Sweden declared their will to liberalize the labor market from Poland's accession to the EU, i.e., from May 1, 2004. Poland was allowed to apply the reciprocity clause during the transitional period, which meant that it could take similar measures restricting access to its labor market as applied by the member states. It made use of this option during the first stage. During the transitional period, citizens of the newly admitted member states, including Poland, could enjoy priority access to the labor markets of the EU member states over citizens of third countries.

During the second stage, i.e., between 2006 and 2009, Polish workers gained increasing access to labor markets in another eight member states. At that time, Poland lifted the restrictions on the basis of the reciprocity clause. During the last two years of the transition period, only two EU–15 countries, i.e., Austria and Germany, continued to apply significant restrictions on access to their labor markets. On May 1, 2011, the last restrictions on access to the labor market for EU–8 citizens were lifted (EC 2011a).

During the transition period, the inflow of workers from the EU–8 countries to Ireland and the United Kingdom increased from 1 million in 2004 to 2.3 million in 2010. However, this number was low in the European Commission's opinion, compared to the 19 million non-EU citizens living in the EU–15 countries (EC 2011a, p. 2).

Flows of people/labor in relations with European Union member states

The gradual establishment of the freedom of movement of people/labor within the European Union determined migration directions from Poland. Estimates of migration from Poland for a temporary stay abroad indicate that over 83% of the total number of migrants stayed in the European Union countries at the end of 2019 (GUS 2020 and own calculations).

Figure 2 shows general trends in emigration from Poland between 2004 and 2019. Due to the changing research methodology and the availability of data on migration, it presents estimated data on the number of people staying abroad at the end of a given year.

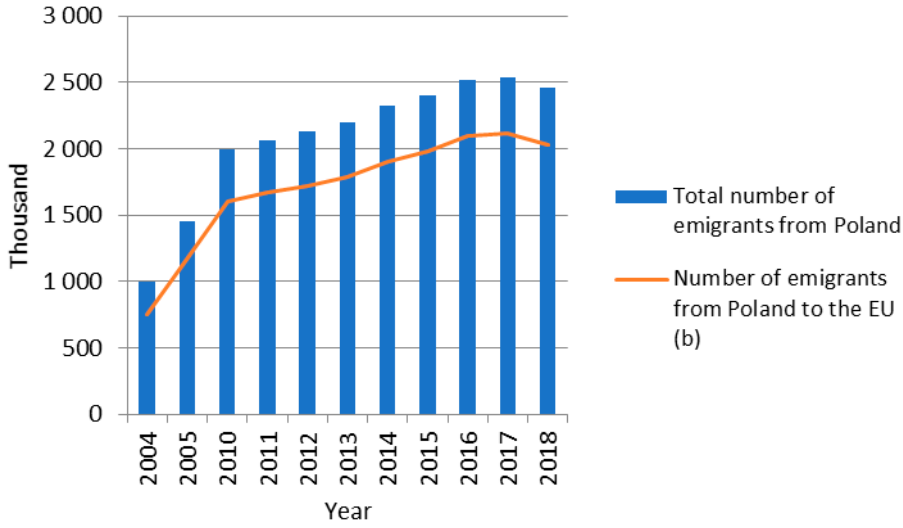

Figure 2. Estimated number of emigrants from Poland for temporary stay, 2004–2019[a)], thousand people

[a)] The data concern the number of people staying abroad temporarily:
for 2004–2005 – longer than 2 months,
for 2010–2019 – longer than 3 months.
[b)] For 2004–2005 – 24 countries, for 2010–2012 – 26 countries.

Source: *Informacja o rozmiarach i kierunkach czasowej emigracji z Polski w latach 2004–2019*, 19.11.2020, https://stat.gov.pl/obszary-tematyczne/ludnosc/migracje-zagraniczne-ludnosci/informacja-o-rozmiarach-i-kierunkach-czasowej-emigracji-z-polski-w-latach-2004-2019,2,13.html (accessed: 31.03.2021) and own elaboration.

According to Statistics Poland (GUS) data, the estimated number of Polish emigrants at the end of 2019 was 2,415,000, including 2,008,000 living in the EU. Compared to 2018, the total number of emigrants decreased by 40,000. (GUS 2020, p. 1). The main motive for emigration was the desire to work in the target countries, as indicated by household surveys.

The main target countries for emigration from Poland in 2019 were Germany (35% of all Polish emigrants in the EU), Great Britain (34%), the Netherlands (6%), and Ireland (6%). The majority of people who reported going abroad in population registration offices in 2019 were aged 30–39. Ten years earlier, these were people aged 20–29 (GUS 2020, p. 2). The data on the qualifications of emigrants from Poland refer to the years 2011–2013. Still, they indicate a general trend: people migrating from Poland were relatively well educated, i.e., secondary education. Compared to the entire Polish population, there was an overrepresentation of people with secondary and higher education among migrants (PARP 2019).

Immigration to Poland

Poland is also a destination country for immigrants from EU member states and third countries. The number of foreigners who had valid documents entitling them to stay in Poland in 2020 was 453,100 (UDSC 2021). Over 60% of foreigners had documents authorizing them to stay temporarily. The structure of immigrants by country of origin shows the dominance of one neighboring country, i.e., Ukraine, from which came 242,200 people, i.e., 53.5% of immigrants included in the statistics. Figure 3 shows the number of immigrants in the top ten on the list of immigrants' countries of origin in 2020.

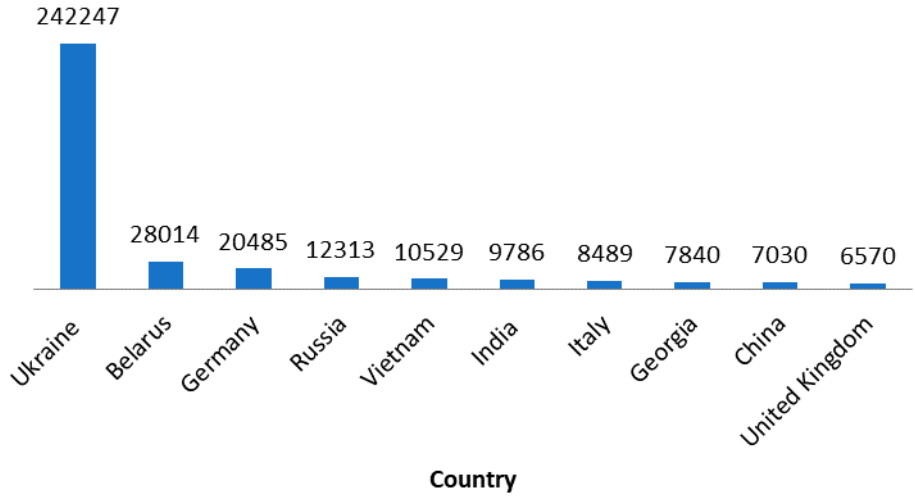

Figure 3. Immigration to Poland by country of origin, 2020
Source: Statistics-Poland-Valid documents-Tabular data-Year–2020, https://migracje.gov.pl/en/statistics/scope/poland/type/statuses/view/tables/year/2020/ (accessed: 8.04.2021).

The influx of immigrants from other neighboring countries of Poland should be noted – from Belarus (28,000), Germany (20,500), and Russia (12,300). Slightly smaller numbers of immigrants also came from Asia, i.e., from Vietnam (10,500) and India (9,800).

However, the above data do not fully reflect the size of the foreign labor supply for the Polish economy. The Ministry of Family and Social Policy estimates that in 2018 Poland received 1.1 million people with declarations of Polish entities to offer them jobs.[2] If we include those who received work permits or seasonal work permits (almost 450,000), 1.4–1.5 million people were able to come to work in Poland throughout the year (Kowalski, Osiecki, and Cedro 2019). It is estimated that a maximum of 1.5 to 2 million foreign workers live in Poland each year. They go to their home countries for a few months and then return to Poland. The average annual number is about half lower than the estimations (Osiecki and Grajewski 2019). This type of migration is sometimes called circular migration (EMN 2011), and the Social Insurance Institution (ZUS) data on employee insurance shows fluctuations due to the seasonality of employment and the method of registering employees from abroad (Osiecki and Grajewski 2019).

The official data on emigration and immigration and additional estimates of people living in Poland seasonally/circularly allow us to conclude that Poland remains a net exporter of labor. Regarding the qualifications of the labor force flowing out of Poland and flowing into Poland, the balance for the Polish economy remains negative.

The reception of refugees by Poland is a separate issue. According to official statistics, 1,310 people had refugee status, 1,448 were granted subsidiary protection, 1,428 were granted a stay for humanitarian reasons, and 217 were given tolerated stay status in 2020 (UDSC 2021a). The number of refugees coming into Poland has dramatically changed as a result of the war in Ukraine. Over 2 million refugees from this country entered Poland within one month (UNHCR 2022). Between 2015 and 2017, Poland transferred PLN 67.7 million for humanitarian aid in the Middle East (to Syria, Lebanon, Jordan, and Iraq). In 2015, it transferred contributions of PLN 4 million to the budget of the Office of the United Nations High Commissioner for Refugees (UNHCR) in response to the deteriorating situation of Syrian refugees. It transferred the same amount to the United Nations World Food Program (MSWiA 2019, p. 64).

In the light of public opinion polls, the attitude of Polish society to the issue of immigration is similar to the attitudes of societies in other Eastern European EU member states, and does not cause concern (Bulut 2019, pp. 773–789). The approach of Western European societies, on the other hand, is shaped by concerns about the threats that immigration poses to their economic and cultural interests.

2 It refers to citizens of Armenia, Belarus, Georgia, Moldova, Russia and Ukraine.

Conclusion

The added value of this paper can be attributed to the characteristics of setting up the EU immigration policy in the context of the efforts undertaken at the global level to tackle the migration problems. In addition, the paper shows potential conflicts of interest between the EU institutions and the Member States in this field.

International flows of people/labor are not subject to unified, standardized regulations at the global level. Nevertheless, attempts are being made to introduce some norms and standards. They are binding for countries only to a limited extent. However, countries that have acceded to the UN agreements are expected to achieve the goals set.

Data on the movement of people/labor on a global scale indicate a long-term intensification of migration in the global economy. The acceleration of migration is related to violent events around the world but also to economic and demographic factors, changes in world transport, and climate change. Labor flows on a global scale are not liberalized, and on an international scale, they are liberalized only to a limited extent, under the conditions defined by host countries.

The 2015 migration crisis, which brought about an unprecedented influx of migrants and refugees to the EU, created new challenges for the EU's immigration policy. The EU stepped up efforts at the group level to build a common immigration policy to manage migration flows effectively. This policy applies both to third-country nationals who legally reside in the Member States and to irregular migration. In implementing this policy, an additional goal emerged, i.e., to attract third-country citizens to the EU economy according to its needs. It should strengthen the competitiveness and economic growth of the EU. The grouping is a net importer of labor in external relations.

Immigration policy competencies are shared between the EU institutions and the member states. Harmonizing activities in this area is carried out through the implementation of directives adopted at various times and related to limited areas of immigration policy. Hence, its fragmented character is still maintained. Nevertheless, the EU is taking steps to build a comprehensive approach to migration, asylum, integration, and border management (*The New Pact on Migration and Asylum*).

Immigration from third countries and how it is regulated remain a highly sensitive issue in relations between EU institutions and member states and among the member states. It is evidenced by the non-accession of some countries to the *Global Compact for Safe, Regulated and Legal Migration* (UN), despite the calls of the European Parliament, and the lack of consent of some member states to the forced reallocation of refugees/migrants during the migration crisis.

The case study of Poland shows that in the period of the integration with the European Union, Poland joined the international flow of production factors, including labor. The liberalization of capital flows in relations with the European Union took place earlier than the liberalization of labor flows. It was beneficial for Poland to gradually liberalize capital flows with more developed and competitive partners. However,

postponing the liberalization of labor flows meant the accumulation of negative phenomena in the labor market.

Thirty years after the start of the socio-political transformation and seventeen years of membership of the EU, Poland's position in international flows of production factors remains unbalanced. Poland is still a net exporter of the labor force. It will probably move towards a deepening of the imbalance due to the consequences of the SARS-CoV-2 pandemic (difficulties with the inflow of seasonal workers). The balance of qualifications of workers migrating from Poland and the qualifications of incoming immigrants, mostly seasonal workers, seems to be unfavorable. The migration of relatively young people from Poland also contributes to the deepening of negative trends in the demographic structure of society.

As Poland faced serious problems with irregular migration at the border with Belarus in 2021, there is a growing need to build a comprehensive immigration policy at the EU level.ł

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Polityka imigracyjna Unii Europejskiej: wyzwania i perspektywy. Wnioski dla Polski

Celem artykułu jest charakterystyka i ocena polityki imigracyjnej Unii Europejskiej w kontekście wyzwań, jakie niosą ze sobą regularne i nieregularne procesy migracyjne w skali globalnej i regionalnej. Polityka UE wpisuje się w inicjatywy ONZ ukierunkowane na międzynarodową współpracę w rozwiązywaniu problemów migracyjnych. Kompetencje w zakresie polityki imigracyjnej UE, na mocy postanowień traktatowych są dzielone między jej instytucje i kraje członkowskie. Harmonizacja działań w tej sferze dokonuje się przez implementację dyrektyw, które przyjmowane były w różnych okresach i odnosiły się do ograniczonych obszarów polityki imigracyjnej, stąd jej fragmentaryczny charakter. Kryzys migracyjny z 2015 r. postawił przed polityką imigracyjną UE nowe wyzwania i ujawnił sprzeczności interesów między poszczególnymi krajami członkowskimi. Tym niemniej UE podejmuje działania w celu skonstruowania kompleksowego podejścia do migracji, azylu, integracji i zarządzania granicami (Nowy Pakt o migracji i azylu 2020). Zróżnicowana pozycja pod względem bilansu przepływów migracyjnych UE jako całości (importer netto siły roboczej) i jej poszczególnych krajów członkowskich (przykład Polski jako eksportera netto siły roboczej i odbiorcy migracji cyrkularnej) rzutuje na podejście do kwestii migracyjnych oraz na akceptację proponowanych rozwiązań w sferze polityki migracyjnej.

Słowa kluczowe: migracje, Unia Europejska, polityka imigracyjna UE, Polska, migracja cyrkularna

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Selected Aspects of European Integration of the Visegrad Group Countries

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Abstract

This paper analyzes the membership of the Visegrad Group countries (the Czech Republic, Poland, Slovakia, and Hungary) in the European Union (EU). It presents the parallel process of fundamental systemic transformation and integration with the EU in the analyzed countries. Their integration path is shown, starting from the association with the European Communities, a transitional period to membership, through adjustments to the requirements related to EU accession and membership. A comparative analysis of the main macroeconomic indicators, trade development, and the inflow of foreign direct investment showed that the adopted measures and the membership of these countries in the EU positively impacted their overall socio-economic development, in particular in the context of modernizing and restructuring their economies, which ultimately translated into the civilizational leap of the analyzed countries.

Keywords: Visegrad Group, European Union, association, membership

JEL: 013

Introduction

The systemic transformation that began in the late 1980s and early 1990s in most countries of Central and Eastern Europe (CEE) led to the initiation of enlargement of the then European Communities (EC). A significant evolution characterized the development of mutual relations between the CEE countries and the European Union (EU).[1] It was determined by political factors and the European continent's ideological division into two antagonistic blocs. The deepening of the European integration

1 Formal relations began with the European Communities, the European Union has been operating since the entry into force of the Treaty on the EU, i.e., from November 1, 1993.

process and the political division of Europe were the main sources of the relatively poor development of mutual relations between the CEE and EC countries. However, economic ties between them, in particular, trade with some member states (e.g., West Germany), were always characterized by a significant asymmetric intensity. The EC share in, e.g., Polish exports, amounted to approx. 25%, while Poland's share in total EC exports was less than 1%. These indicators for Czechoslovakia and Hungary were similar. The importance of the EC for these countries as a trading partner was immeasurably greater than their importance for the EC. In 1992, the exports of these countries to the EC markets accounted for approx. 53% of their total exports, while imports from the EC accounted for approx. 47% of their total imports; EC exports to these countries amounted to 1.3% of the total EC exports, while the share of their imports in total EC imports was 1.2%. (Gorzelak, Jałowiecki, Kukliński, and Zienkowski 1995, p. 21). The scale of cooperation between the CEE countries and the EC was determined by both their level of economic development and the systemic, political, and institutional conditions. Economic ties with the EC relied on institutional arrangements in the relationships between the EC and the Council for Mutual Economic Assistance and the lack of mutual recognition of the two groups in the international scene.

This paper aims at demonstrating that the EU membership of the Visegrad Group countries was not only a beneficial step but also a necessary one, in particular for the modernization of their economies, building civil society and a democratic rule of law, as well as social and economic development, which all together led to the economies of these countries being classified as highly developed. Without actions undertaken in the name of EU integration, the Visegrad Group countries would not have had an opportunity to experience such a significant advancement.

The official opening of diplomatic relations between the CEE countries and the EC took place in 1988 through trade and economic cooperation agreements with the EC.[2] Under these agreements, the EC removed quantitative restrictions on specific products and extended the generalized system of preferences on these countries.

The commencement of systemic transformation in the CEE countries posed a challenge for the EC in providing aid to these countries and sharing the EC's more than 40 years of integration experience. The success of the transformation of these countries depended on extensive cooperation with the EC and other highly developed countries.

In February 1991, the presidents of Poland, Czechoslovakia, and Hungary signed a joint declaration in Visegrad, defining the goals and conditions for cooperation. The Visegrad Triangle was established to deepen the cooperation in building democratic state structures and a market economy. In the initial phase, it concerned, in particular, the accession to the EU and NATO. After the dissolution of Czechoslovakia in December 1992,[3] the Visegrad Group (V4) was established as an informal associ-

2 Hungary concluded the agreement on September 26, 1988, Poland on September 19, 1989, Czechoslovakia on March 23, 1990.

3 From January 1, 1993, two independent countries functioned: the Czech Republic and Slovakia.

ation of 4 countries: the Czech Republic, Poland, Slovakia, and Hungary. They were linked by proximity, similar geopolitical conditions, and shared history, tradition, culture, and values.

Association agreements as a transitional stage to membership

In January 1990, in the European Parliament, Jacques Delors[4] proposed that the interested CEE countries conclude association agreements. They would "create an institutional framework for genuine dialogue and joint political and economic activities, extending cooperation in the field of technology, science, protection environment, trade and finance (...)" (Le Monde Diplomatique 1990).

The associative formula of EC ties with third countries provided in Art. 238 of the EC Treaty then in force could take various forms. Association agreements were concluded unanimously by the Council after obtaining an absolute majority of the European Parliament (Barav and Philip 1993, p. 6). Generally speaking, a country that was associated with the EC was more than a third country. Although it had institutional links with the EC bodies, it was not a member state and did not participate in the EC decision-making process.

Some CEE countries expressed their readiness to conclude agreements on association and the commencement of negotiations, indicating at the same time that their goal was to obtain membership of the EC (Mizsei and Rudka 1995, p. 60). At that time, it was not unanimously accepted by the member states. It was pointed out that their accession would not take place quickly, and it would not be an easy process, for various reasons (Weidebfeld and Janning 1993, p. 195). First, there was an ongoing dilemma in the EU – enlargement or deepening of the EU.[5] The positions of individual member states varied considerably.[6] Three positions could be distinguished among the member states regarding the inclusion of the CEE countries in the EU (Nyssen 1996, p. 18). The first group (Great Britain and, to a lesser extent, Denmark) wanted the associated countries to be admitted as soon as possible, hoping to weaken the process of EU deepening. The second group included countries that opposed quick accession. One of them was France, afraid that EU enlargement would cause Germany to maintain its dominant political position within the European Union, resulting from its former political, economic, cultural, and historical ties with the CEE countries. Countries such as Spain, Greece, and Portugal believed that the new countries would become serious competitors for structural funds. Belgium believed that enlargement would

4 The then president of the European Commission.

5 At that time, the ratification of the Treaty on the EU took place, which provided for the creation of an economic, monetary and political union.

6 It should be emphasized that the decision to admit new members is taken unanimously.

seriously weaken the process of deepening the EU. The third group (Germany, Italy, and the Netherlands) opted for enlargement, which, in their opinion, would not threaten the deepening (Nyssen 1996, p. 18).

Another reason was the very low level of economic development of the CEE countries and the need for a deep systemic transformation and the necessary complex and costly adaptation measures (Błaszczyk 1994, pp. 116–119). Finally, the macroeconomic situation of these countries also differed significantly (Nyssen 1996, p. 20).[7] For the above reasons, the EU did not agree to include "automatic membership" in the preamble of the agreement. It stated that, in the meantime, extensive cooperation was possible, but accession was a distant perspective (Nyssen 1996, p. 17).

Numerous analyses related to the development opportunities of the Visegrad Group countries indicated their huge economic backwardness compared to even moderately developed EU member states of the time, as shown in the table below. In an optimistic scenario of growth amounting to 5% per year, these countries would reach 75% of the average EU income in 20 years.

Table 1. Years needed for the most developed CEE countries to reach 75% of the average EU income

Country	3% growth	4% growth	5% growth
Czech Republic	28	21	14
Hungary	35	26	18
Poland	44	33	22
Slovakia	51	39	26
Visegrád Group	40	30	20

Source: R. Baldwin, *Towards an Integrated Europe*, CEPR, London 1994.

Association agreements, called Europe Agreements, with Hungary, Poland, and Czechoslovakia, were signed on December 16, 1991, in Brussels, and the European Parliament gave its consent for the first two countries on September 16, 1992 (Constantinesco, Kovar, and Simon 1995, p. 773).[8] The Czech Republic and Slovakia signed association agreements on October 4, 1993. Agreements with Poland and Hungary entered into force on February 1, 1994, with the Czech Republic and Slovakia on February 1, 1995. The negotiation process was not easy for many reasons.[9] Many negotiated issues were just emerging in the economy and politics of these countries, both in the real and regulatory spheres. They included, among others, demonopolization of the economy, restructuring and modernization, building a market econo-

7 For example, Poland recorded huge debt and inflation; Hungary also had serious debt, but inflation was at an acceptable level; in Czechoslovakia, the situation was quite different – a balanced budget and virtually no inflation.

8 In the case of Czechoslovakia, the consent of the European Parliament, taking into account its collapse, was issued on April 5, 1993.

9 For example, it was not possible to negotiate the provisions regarding financial protocols (as was the case with, e.g., Malta or Cyprus), under which the EU would undertake to provide financial assistance on a multi-annual basis.

my and the rule of law, customs tariffs, norms and standards, and competition rules (Weidebfeld and Janning 1993, pp. 188–191).

Nevertheless, despite the lack of an EU declaration to admit the CEE countries to the community, it treated the Europe Agreements as a transitional stage towards full EU membership, which was emphasized by the V4 countries within the framework of their cooperation. Indeed, the association agreements constituted an essential legal basis for shaping mutual relations (Mizsei and Rudka 1995, p. 8), regulating trade relations, competition rules, and cooperation in such areas as industry, environment, transport, and customs.

The V4 countries indicated many factors that influenced their decision to join the EU. Among the political factors, it included the guarantee of the irreversibility of the transformation process, the possibility of becoming a member of a large political, economic and social grouping, and gaining influence on decisions taken on the international forum of global importance. The socio-economic factors included, i.a., access to the Single Internal Market, new technologies and innovations, accelerated economic growth, modernization of the economy, and access to European funds.

In June 1993, at the Copenhagen summit, the European Council decided on the possibility of associated countries acceding to the EU after meeting certain conditions, the so-called Copenhagen criteria. Despite their general nature, they played an important role in integrating these countries with the EU. Based on these criteria, the European Commission prepared an opinion on the official accession applications submitted by these countries. The Commission reported annually on the progress made by these countries towards membership in the EU every year beginning in 1998. Between 1994 and 1996, following the decision made at the Copenhagen summit, the V4 countries officially applied to join the EU.[10]

The first political steps taken by the EU to implement the decisions of the Copenhagen summit were at the Essen European Council in December 1994. As a result, the pre-accession strategy was adopted along with a proposal to prepare a White Paper containing the scope of necessary legal adjustments to the internal single market rules.[11] The White Paper was adopted at the Cannes Summit in June 1995. The next summit, held in Madrid in December 1995, adopted a recommendation that the European Commission prepare an opinion on membership applications and analyze the financial consequences of enlargement and its impact on EU policies.

The results of the work of the European Commission – the opinions and the Agenda 2000 draft, presented at the summit in July 1997 – made it possible to decide at the Luxembourg summit in December of the same year to open accession negotiations with the Czech Republic, Cyprus, Estonia, Poland, Slovenia, and Hungary.[12] Official ac-

10 Hungary officially applied to join the EU on March 31, 1994, Poland – April 5, 1994, Slovakia – June 27, 1995, the Czech Republic – January 22, 1996.

11 The single internal market was completed on January 1, 1994.

12 The decision to start negotiations with Slovakia was made two years later, at the Helsinki summit in December 1999.

cession negotiations with the Czech Republic, Poland, and Hungary started in March 1998,[13] while actual negotiations took place in November 1998, and in February 2000 with Slovakia.

The process of enlarging the European Union

The EU enlargement was an extremely important but very complex and multifaceted process, which the EU had never carried out before. On the one hand, never before had the Union faced such a huge challenge as integrating countries that differed so much from the EU Member States in terms of their social and economic development, and political, legal, and institutional systems. On the other hand, the candidate countries had never carried out such a profound and total transformation alongside a comprehensive integration process. It took a great deal of determination from all parties to successfully achieve the enlargement.

The EU carried out this process both in the real and regulatory spheres, starting with trade and cooperation agreements, association agreements, adoption of the Copenhagen criteria, pre-accession strategies, annual reports on the progress of candidate countries towards membership. It ended with the Danish diplomacy strategy "from Copenhagen to Copenhagen" to conclude accession negotiations at the summit in Copenhagen on December 13, 2002. The European Commission played an essential role in the accession process as it was determined to help the candidate countries meet the membership requirements.[14]

The EU wanted the CEE countries to accede to the EU on favorable terms. First of all, it was believed that enlargement should strengthen the EU. It would be stronger if they acted together, not separately. It was emphasized that after enlargement, in its new form, it would become more competitive in the world market and play a more significant political role on an international scale. The candidate countries also made great efforts to implement the fundamental political and economic transformation and social activities in parallel with activities aimed at full integration with the EU. Furthermore, the collapse of the former Soviet market, which resulted in a significant limitation of sales opportunities, was significant. Along with the commencement of the systemic transformation, the V4 countries began the adjustment processes for successive integration with the EU. The implementation of the association agreements was a very important step in the integration process. Although the preamble to the agreements only confirmed that the ultimate goal of these countries was accession to the EC, and that the association would help to facilitate this, they treated association cooperation as a transitional step towards full membership.

13 In the 5 + 1 formula in the form of bilateral intergovernmental conferences.

14 Its role was to initiate and organize the entire process within the Union.

The Europe Agreements negotiated by the V4 were undoubtedly the most comprehensive and meaningful. They regulated mutual relations with the largest grouping in the world, which, from the 1990s, also became the main cooperation partner. The agreements influenced almost all areas of socio-economic life. The most visible effects were observed in trade (in January 2002, a free trade area for industrial products was established between Poland and the EU, based on the Interim Agreement under the Europe Agreement, and with Hungary) (Nyssen 1996, p. 23).[15]

For many different reasons, it was extremely difficult to estimate the development of economic relations between the V4 countries and the EU. Firstly, the development of these relations was determined by the solutions adopted in the Europe Agreements, in particular, those concerning the liberalization of mutual trade, with many restrictions concerning agricultural products. There were also mutual relations and developing cooperation within the Visegrad Group, especially after the dissolution of Czechoslovakia, although this was not always successful.[16] Secondly, the volume of trade was influenced by many factors, apart from liberalization, especially those arising from the systemic transformation carried out in these countries and the profound structural changes and modernization of their economies. The cooperation between the parties, which developed within the association, had a significant impact on the dynamics of the economic growth of the V4 countries. It was estimated that Poland's economic growth rate, which resulted from implementing the Association Agreement reached, its highest level, i.e., 0.5–0.6% annually, between 1992 and 1997 (Kawecka-Wyrzykowska 1998, p. 17). Trade liberalization caused positive and negative effects, such as a significant increase in unemployment or the closure of unprofitable branches of industry. The negative effects resulted from modernizing and restructuring the backward national economy.

The implementation of the Europe Agreements and the parallel adjustment activities became the framework for the transformation of the V4 economies, and a point of reference for constructing a market economy, the rule of law, and democracy.[17] The implementation of the agreements ensured both economic stability and transparency of the economic system. It created a solid and stable environment, attracting foreign investment. Between 1989 and 2012, its value in Poland exceeded USD 185 billion, in the Czech Republic – over USD 99 billion, in Hungary – over USD 90 billion,

15 The Interim Agreement did not apply to the Czech Republic and Slovakia, the renegotiations of the association agreement with the Czech Republic and Slovakia (after the dissolution of Czechoslovakia) followed the redefinition of the EC trade policy with respect to the CSCE partners (now OSCE), consisting in including human rights dispositions in the agreements and market economy (these provisions do not appear in the agreements with Poland and Hungary, which were concluded before the introduction of the new doctrine).

16 The Czech Republic initially intended to go its own way towards integration with the EU, which was much more developed after the dissolution of Czechoslovakia, http://www.nbp.pl/publikacje/nms/nms_07_14.pdf (accessed: 12.02.2021).

17 Meanwhile, the V4 countries joined the OECD: the Czech Republic in 1995, Hungary and Poland in 1996, Slovakia in 2000; in 1995, they joined the WTO.

and in Slovakia – over USD 47 billion.[18] It was partly the result of implementing the association agreements concerning, i.a., customs, capital movements, and harmonizing the laws of these countries with Community law. The implementation of the agreements and the integration process was supported by financial aid granted by the EU under the PHARE program,[19] which proved to be important, especially in the initial phase of the economic, political, and institutional transformation.

Summing up, the Europe Agreements were undoubtedly an important tool for deepening and expanding cooperation between the parties. However, they also proved to be a vital instrument in preparing the economies, legal systems, administrations, and societies of the V4 countries for integration with the EU. These preparations were undoubtedly a huge challenge, as they touched almost every area of socio-economic life.

The problems faced by the V4 countries in preparing for EU membership were similar.[20] The most important tasks to be performed by the candidate countries included strengthening administrative structures and the efficient implementation of the law, promoting structural changes and restructuring in the economy, fighting corruption, and creating a favorable environment for the development and operation of firms, especially small and medium-sized enterprises.

Eventually, the accession negotiations were concluded in Athens on April 16, 2003, with the accession treaty, which governed membership conditions.[21] The negotiations concerned many areas, such as environmental protection, competition policy, agriculture, the free movement of people, services, goods and capital, transport policy, taxes, social policy and employment, energy, telecommunications and information technology, company law, finance, and budget. In many negotiated areas, transition periods were foreseen – in areas such as competition policy, free movement of capital, or the environment at the request of the V4 countries (Tendera-Właszczuk 2006, pp. 8–10, 19), agriculture (Tendera-Właszczuk 2006, pp. 11–15) or the free movement of people at the initiative of the EU. There was also a broad debate on the effects of integration. Ultimately, in the referenda held, the citizens of the V4 countries voted in favor of EU membership. The results are presented in the table below. The highest acceptance of accession to the EU was recorded in Slovakia, then in Hungary, while in Poland and the Czech Republic, the acceptance rate was similar.

18 https://ssl-kolegia.sgh.waw.pl/pl/KES/czasopisma/kwartalnik/Documents/KES17DK.pdf (accessed: 12.01.2021).

19 In December 1989, the EC Council of Ministers legally sanctioned the functioning of the PHARE program. Since 1990, it has provided significant financial support. Initially, aid focused on supporting systemic changes, then the process of integration with the EC.

20 Negocjacje członkowskie. Polska na drodze do Unii Europejskiej, Chancellery of the Prime Minister, Warsaw 1999, p. 73.

21 Traktat o przystąpieniu Republiki Czeskiej, Estonii, Cypru, Łotwy, Litwy, Węgier, Malty, Polski, Słowenii i Słowacji (the Treaty of Accession of the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia), OJ L236 of 23.09.2003.

Table 2. Results of referenda in the V4 countries on EU membership

Country	Date	Turnout	In favor	Against
Poland	7/8.06.2003	58.8%	77.45%	22.55%
Czech Republic	15/16.06.2003	55.21%	77.33%	22.67%
Slovakia	16/17.05.2003	52.12%	92.46%	6.20%
Hungary	12.04.2003	45.65%	83.76%	16.24%

Source: https://encyklopedia.interia.pl/slownik-ue/news-referendum-akcesyjne,nld,2112785 (accessed: 16.02.2021).

Governments, NGOs, research and development centers, schools, and political parties were involved in debates on the effects of integration for both the V4 and the European Union. The main doubts concerned the costs and benefits of these countries' EU membership (Inotai 1996, pp. 79–83). It was pointed out that generally speaking, the benefits would be greater than the costs incurred, although initially, they might not be too noticeable.

The benefits of enlargement for the then member states and the Union itself were also analyzed. For example, for Germany, the EU enlargement would have a positive effect on the economy, increasing GDP growth by about 0.4% (Błaszczyk 2004, p. 166). Other analyses prepared by the member states' institutions and commissioned by the European Commission also emphasized the positive effects of enlargement both for the member states and the Union as an actor in international economic relations. Kok emphasized that "enlargement may act as a catalyst in solving certain problems in Europe" (Kok 2003, p. 86). He also added that "if we want the Union to function better, we must adopt the appropriate attitudes. We should leave our national approach: small and large countries, old and new members, rich and poor regions – we are all Europeans" (Kok 2003, p. 86).

May 1, 2004 – the day the EU was enlarged by ten new countries, including the V4 countries – symbolizes the reunification of two parts of the European continent. It is the realization of the dream of one of the fathers of Europe, Robert Schuman, who said in 1963: "We must make Europe not only in the interest of the free countries, but also to be able to welcome the peoples of the East who, freed from the subjection that they have suffered until now, will ask to join us and request our moral support."[22]

The reorientation of the Visegrad Group countries' foreign policies and the commencement of a multifaceted, costly, and challenging transformation process, parallel with the integration process, were dictated by numerous and multiple factors. Among the political reasons for the decision to join the EU especially worth mentioning are the guarantee of the irreversibility of the commencement of the system transformation process, anchoring among democratic societies, and the possibility of taking part in making international-level decisions that have a global impact. The economic factors include access to the large EU internal market, modern technologies, and innovations allowing for the acceleration of economic growth and modernization of the na-

22 Translation: G. Avery, *Robert Schuman on Hungary and Europe*, https://cadmus.eui.eu/handle/1814/14315 (accessed: 16.04.2021).

tional economy. It also allowed access to structural funds to support socio-economic development, including the fight against unemployment and social exclusion, the restructuring of the agri-food economy, and issues related to public finance discipline. The opening of borders and the freedom to move or study abroad also played an important role in making decisions about joining the EU.

Assessment of the V4 countries' membership of the European Union

May 2020 marked the 16th anniversary of the Visegrad Group countries' membership of the EU, which is sufficient to assess the achievement of their transformation and integration goals. There is no doubt that the outcomes are positive. While preparing for and adjusting to integration with the EU, it was not easy to estimate the integration costs and benefits. The process involved numerous activities in many areas and depended on various factors. The overall effect also depended on their readiness to meet the requirements that resulted from membership, including, e.g., preparing enterprises from the V4 countries to participate in the single internal market (ensuring full freedom of movement of people, services, capital, and goods) or the ability to absorb structural funds. Nevertheless, membership created conditions for accelerating economic growth and the gradual closing of the development gap between the V4 countries and the EU member states. The accession to the area of the four freedoms was conducive to modernizing and restructuring these countries' economies.

When summarizing the V4 countries' membership of the EU, it can be stated that they made a significant civilizational leap. Their importance on the international scale increased not only in the area of economic but also political and international security.

When Poland initiated the transformation and integration process, its GDP per capita ratio was approx. 35% of the EU average. Table 3 shows the development of this indicator in the period 1990–2019. The data show that the integration process in the V4 countries resulted in an increase in GDP per capita in all countries, the most in Poland – more than twice. In 2000, the GDP per capita of the analyzed countries was 48.5% of the average EU–15 level, while in 2019, this had increased to 78% of the average EU–28 level.

Table 3. GDP per capita in the V4 countries in the period 1990–2019 in relation to the EU average (%)

Country	1990	1995	2000	2005	2010	2012	2016	2019
Poland	35	37	42	46	57	60	69	73
Czech Republic	73	66	62	72	73	72	89	93
Slovakia	58	41	43	55	66	68	73	73

Country	1990	1995	2000	2005	2010	2012	2016	2019
Hungary	54	44	47	57	59	60	69	73

Source: own elaboration based on: http://www.pte.pl/kongres/referaty/Matkowski%20Zbigniew,%20Pr%C3%B3chniak%20Mariusz,%20Rapacki%20Ryszard/Matkowski%20Zbigniew,%20Pr%C3%B3chniak%20Mariusz,%20Rapacki%20Ryszard%20-%20SCENARIUSZE%20REALNEJ%20KONWERGENCJI%20W%20UNII%20EUROPEJSKIEJ%20-KRAJE%20E%C5%9AW%20A%20U.pdf (accessed: 21.02.2021); https://ec.europa.eu/eurostat/databrowser/view/tec00114/default/table?lang=en (accessed: 21.02.2021).

The employment structure also changed significantly. The total employment in individual sectors of the economy of the Visegrad Group countries compared to the EU in 1992 reflected the state of their social and economic development at that time (Table 4).

Table 4. Employment structure in the V4 and EU countries in 1992 (%)

Branch of economy	V4 countries	EU
Agriculture	24.1	2
Industry	35.9	31.6
Services	40	66.4

Source: http://www.euroreg.uw.edu.pl/dane/web_euroreg_publications_files/4021/europa_rodkowa_2005._perspektywy_rozwoju.pdf (accessed: 25.02.2021).

The table below illustrates the employment structure in individual V4 countries. At the beginning of the 1990s, most people were employed in agriculture (especially in Poland), while the service sector was poorly developed. The accession of these countries to the EU fundamentally changed the analyzed indicators. Employment in agriculture decreased significantly while employment in services increased in all countries.

Table 5. Changes in the employment structure in the V4 countries (in %)

	Czech Republic (1992)	Poland (1990)	Slovakia (1992)	Hungary (1992)	Czech Republic (2017)	Poland (2015)	Slovakia (2017)	Hungary (2017)
Agriculture	8.3	30.4	12.0	13.5	2.0	11.6	4.0	7.1
Industry	46.0	34.0	43.3	34.5	38	30.3	39	29.7
Services	45.7	35.6	44.7	51.8	60.0	57.9	56.9	63.2

Source: own elaboration based on: https://www.paih.gov.pl/files/?id_plik=34144 (accessed: 26.02.2021), https://pl.wikipedia.org/wiki/Gospodarka_S%%82oC5wacji (accessed: 26.02.2021).

There was a significant increase in trade within the EU and gradually with third countries. The structure of foreign trade changed significantly. In the initial period of transformation, the exports of the discussed countries were dominated by raw materials and agri-food products, in imports dominated machinery and equipment. Moreover, the markets of the V4 countries became much more important as EU trading partners. From 1993–2004, the total exports of Poland, Slovakia, and the Czech Republic increased fivefold and, in the case of Hungary – sixfold. There was also a five-

fold increase in their import (Wysokińska 2006). The share of sensitive products (coal, steel, textiles, and agricultural products) in exports decreased significantly. Very high growth was recorded in high-tech sectors, especially in Hungary (the share doubled in 2004 compared to 1994) and the Czech Republic, but less in Poland and Slovakia (although Slovakia achieved a very positive result in 2004) (Wysokińska 2006). The value of the V4 countries' exports to the EU between 1995 and 2019 increased more than 19 times, and the value of imports more than 16 times (Visegrad Group 2020, p. 6).

In recent years, the European Union has been the main trading partner for all countries in the group. In 2018, the trade of the Czech Republic with the EU member states accounted for 84% of Czech exports (32% went to Germany, 8% to Slovakia, and 6% to Poland). In terms of imports, 76% came from the EU member states (29% from Germany, 9% from Poland, and 6% from Slovakia).[23]

In the case of Poland, the EU member states accounted for 80% of its exports (28% went to Germany, and 6% to the Czech Republic and France each). In imports, 69% came from the EU member states (27% from Germany, 6% from the Netherlands, and 5% from Italy).[24]

In Slovakia's trade, 86% of its exports went to EU member states (22% to Germany, 12% to the Czech Republic, and 8% to Poland). Eighty percent of imports came from the EU member states (20% from Germany, 16% from the Czech Republic, and 10% from Austria).[25]

For Hungary, the situation was very similar. Trade with the EU member states accounted for 82% of exports (27% went to Germany and 5% to Romania, Austria, Italy, and Slovakia). Seventy-five percent of imports came from the EU member states (Germany – 25%, Austria – 6%, Poland and the Netherlands – 5%).[26] The above data show that the most important trading partners for all the V4 countries, both in exports and imports, were the EU countries, especially Germany.

The share of the V4 countries in global value chains (GVCs) also increased. The degree of involvement of individual countries in GVCs between 2004 and 2014 indicates that in Poland, it grew to 59%. Higher rates were recorded for the Czech Republic, Slovakia, and Hungary – 70% (Ambroziak and Błaszuk-Zawiła 2020, pp. 43–45).

The inflow of foreign investment should be noted, which occurred due to accession and preparations for it. In all the V4 countries, an increase in the value of the inflow

23 https://europa.eu/european-union/about-eu/countries/member-countries/Bohemia_en (accessed: 27.02.2021); 3% of the Czech exports went to the USA and Russia; in imports, 8% came from China and 2% from the USA.

24 https://europa.eu/european-union/about-eu/countries/member-countries/poland_pl (accessed: 27.02.2021), Poland's exports to Russia and the USA accounted for 3% of Polish exports; in imports, 8% came from China and 7% from Russia.

25 https://europa.eu/european-union/about-eu/countries/member-countries/slovakia_en (accessed: 27.02.2021), Slovakia's exports to the USA amounted to 3%, to Russia and China – 2%, in imports, 5% came from Russia and South Korea.

26 https://europa.eu/european-union/about-eu/countries/member-countries/hungary_en (accessed: 27.02.2021), Hungarian exports to the USA and Ukraine accounted for 2% each, while imports from China accounted for 6% and from Russia – 5%.

of foreign direct investment (FDI) was observed. The accumulated FDI value in all analyzed countries reached high values, denoted in billions of USD. It exceeded USD 240 billion in Poland and over USD 170 billion in the Czech Republic. Foreign investment stock in individual countries is presented in the table below.

Table 6. FDI stock in the V4 countries in 2000–2019 (in million USD)

Country/year	2000	2010	2019
Czech Republic	21,644	128,504	170,682
Poland	33,477	18,7602	23,6506
Slovakia	6,970	50,328	59,750
Hungary	22,870	91,015	97,841

Source: UNCTAD, World Investment Report 2020, Geneva 2020, Annex, p. 242, https://unctad.org/system/files/official-document/wir2020_en.pdf (accessed 10.03.2021).

It is also worth paying attention to the positive growth trend of the V4 countries' foreign investments. For example, the cumulative value of Polish FDI in 2019 reached almost USD 24 billion. Among the 20 countries – directions of Polish foreign investments, there are the V4 countries: the Czech Republic in the sixth position, Hungary – the seventh, and Slovakia in the ninth position.[27] The table below presents the increase in foreign investments of the V4 countries.

Table 7. Cumulative value of the V4 countries' foreign investments, 2000–2019 (in million USD)

Country/year	2000	2010	2019
Czech Republic	738	14,923	45,364
Poland	268	16,407	24,835
Slovakia	555	3,457	4,727
Hungary	1,280	23,612	33,732

Source: UNCTAD, World Investment Report 2020, Geneva 2020, Annex, p. 242, https://unctad.org/system/files/official-document/wir2020_en.pdf (accessed 10.03.2021).

Membership of the Visegrad Group countries also contributed to an increase in the competitiveness and innovation of their economies.[28] Their development was primarily supported by transfers from the EU budget, particularly from the Structural Funds. Cohesion policy financial transfers proved crucial to the EU's investment policy, which provided 8.5% of government investment in the EU (Seventh Report on Economic, Social and Territorial Cohesion 2017). And in the analyzed countries (net beneficiaries of the cohesion policy), this value was significantly higher. In Poland, it is over 60%, in Hungary – almost 55%, Slovakia – 54%, and the Czech Republic – over 40% (Seventh Report on economic, social and territorial cohesion 2017).

27 https://www.pwc.pl/pl/media/2020/2020-12-03-ranking-kierunkow-ekspansji-raport-pwc.html (accessed: 28.02.2021).

28 In *Global Competitiveness Report* in 2019, out of 141 countries, the Czech Republic was 32nd, Poland 37th, Slovakia 42nd and Hungary 47th. World Economic Forum 2018 The Global Competitiveness Report, http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf (accessed: 10.03.2021).

From 2004–2019, over EUR 327 billion flowed from the EU budget to the countries of the Visegrad Group, the most was within the cohesion policy – over EUR 207 billion, and the common agricultural policy – over EUR 102 billion. The surplus of the transfer of funds from the EU budget for 2000–2019 amounted to almost EUR 240 billion (Grupa Wyszehradzka 2021, p. 12).

Projects co-financed from the EU structural funds have significantly helped modernize the V4 economies. They made it possible to improve infrastructure, build highways, develop modern railways, and fight unemployment and social exclusion. They also contributed to the modernization and restructuring of agriculture and the development of rural areas. According to the HDI, all V4 countries are classified as very highly developed countries of the world.[29]

The positive assessment of their membership is reflected in support of the V4 citizens for the presence of these countries in the EU. In 2017, 88% of Poles, 82% of Hungarians, 74% of Slovaks, and 56% of Czechs declared their support for EU membership. Definitely against EU membership were 3% of people in Poland and Hungary, 8% in Slovakia, and 17% in the Czech Republic (CBOS 2017, p. 6).

Conclusion

The above analysis shows that the complex and costly actions undertaken by the Visegrad Group countries to achieve their goals concerning both the deep systemic transformation and integration with the EU were effective and beneficial. However, this does not mean that no further actions should be taken to make the economies of the V4 countries more competitive and innovative in the European and global markets. This will undoubtedly be facilitated by EU membership and deeper European integration. The region is currently the sixth economic power and the third consumer market in Europe. We can say that today, the Union is needed as never before – the main goals that inspired the commencement of the European integration process are still valid. The EU should be perceived as central uniting Europe, especially in the face of challenges resulting from its internal problems and the progressive globalization of the modern world. Partially giving up sovereignty in certain economic matters led to mutual economic dependencies between the member states in the integration process. Simultaneously, new methods of cooperation were established that replaced classic intergovernmental negotiations with a decision-making process carried out by supranational institutions.

The integration of the Visegrad Group countries with European structures is a reflection of ideas that were at the foundations of the European project. The founding fathers of the European Community wanted to build a European community based on solidarity and the commonality of goals, a Europe that would ensure the accom-

29 https://pl.wikipedia.org/wiki/Lista_pa%C5%84st w_%C5%9Bwiata_wed%C5%82ug_wska%C5%BAnika_rozwoju_spo%C5%82ecznego#Kraje_bardzo_wysoko_rozwini%C4%99te (accessed: 15. 03.2021).

plishment of national interests and observe fundamental values in cooperation. The enlargement of the European Union with the V4 countries embodies all of their aspirations. It put an end to the division of Europe into two rival blocks and gave these new member states an opportunity to catch up with their western counterparts. The latter, in turn, was possible thanks to the solidarity of the old member states, who agreed to allocate huge funds to help the V4 countries (and not only them) to modernize their physical infrastructure and economy. Without this solidarity, the process would have been much lengthier, if possible at all. From this point of view, the EU membership of Visegrad Group countries is no doubt a success story.

Today, the Visegrad Group countries, which have gained a lot from becoming EU members, should focus future efforts on improving the European architecture and strive to strengthen the community method that pursues national and common interests of the member states on an international scale.

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Kraje Grupy Wyszehradzkiej w procesie integracji europejskiej: wybrane aspekty

Niniejszy artykuł poddaje analizie członkostwo krajów Grupy Wyszehradzkiej (Czech, Polski, Słowacji i Węgier) w Unii Europejskiej. Przedstawiono realizowany w badanych krajach równolegle proces fundamentalnej transformacji ustrojowej i integracji z UE. Wskazano ich drogę począwszy od stowarzyszenia ze Wspólnotami Europejskimi, jako okresu przejściowego do uzyskania członkostwa, podjęcia działań dostosowawczych do wymogów członkostwa i akcesji do UE. Analiza porównawcza głównych wskaźników makroekonomicznych, rozwoju handlu czy napływ bezpośrednich inwestycji zagranicznych, pokazała, że podjęte działania i członkostwo tych krajów w Unii Europejskiej miało pozytywny wpływ na ich ogólny rozwój społeczno-gospodarczy, w szczególności w kontekście modernizacji i restrukturyzacji ich gospodarek, co ostatecznie przełożyło się na realizację przez badane kraje skoku cywilizacyjnego.

Słowa kluczowe: Grupa Wyszehradzka, Unia Europejska, stowarzyszenie, członkostwo

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Assessing the Effectiveness of Selected European Innovation Systems

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Abstract

The growing importance of innovation in the modern economy has revived the interest of economic sciences in studies on the mechanisms that govern innovation and its impact on economic development. This growth of interest induced the concept of the national system of innovation (NSI), which occupies an important place in the innovation policy of all developed market economies. The economic literature distinguishes various typologies of innovation systems. The aim of the article is to assess the effectiveness of the system of European integration, the socio-democratic system, and the mutated system, measured by the level of innovation of the economies that belong to these systems, in 2014 and 2019. The article analyzes the literature on the subject of innovation systems. The method of linear ordering, which makes it possible to build a synthetic measure calculated using the Hellwig method, is used to assess the effectiveness of innovation systems. The article formulates a research hypothesis that the most effective innovation systems are the socio-democratic system and the system of European integration. This hypothesis has been positively verified.

Keywords: innovation, national innovation system, innovation ranking

JEL: O30, O31, O43

Introduction

The growing importance of innovation in the modern economy has revived the interest of economic sciences in studies on the mechanisms that govern innovation and its impact on economic development. This growth of interest induced the concept of the national system of innovation (NSI), which occupies an important place in the innovation policy of all developed market economies. The economic literature distinguishes various typologies of innovation systems, one of which is the classification that includes the market system, the European integration system, the socio-democratic system, the meso corporative system, and the mutated system (Godinho, Mendonca and Pereira 2003; Okoń-Horodyńska 1998, p. 81; Weresa 2014, pp. 66–70).

The article aims to assess the effectiveness of innovation systems, measured by the level of innovation of the economies that belong to these systems, in 2014 and 2019. Due to the scarcity of data, the study covers three European systems, the system of European integration, the socio-democratic system, and the mutated system. The article analyzes the literature on the subject of innovation systems. Multidimensional statistical analysis was used to assess the effectiveness of innovation systems – this is the method of linear ordering that makes it possible to build a synthetic measure calculated using the Hellwig method. The article hypothesizes that the most effective innovation systems are the socio-democratic system and the system of European integration. This hypothesis has been positively verified.

The concept and classification of the national innovation system

The concept of the national innovation system (NIS) became the subject of in-depth research and studies in the late 1980s and early 1990s (Vonortas 2009, p. 174). The works of Freeman (1992), Nelson and Rosenberg (1993), Patel and Pavitt (1994), Edquist (1997), and Lundvall (1992) were the milestones in the development of this concept.

The emergence of the NIS is inextricably linked with the thesis adopted by the above-mentioned economists that the innovation or innovative capacity of the economy should be analyzed in the context of the economic, institutional, and cultural conditions that are specific to a given national economy.

Various definitions of the NIS exist in the economic literature. One of the most frequently cited is from Lundvall, who defines it as an arrangement of production, scientific and technical subsystems, institutional solutions, and the relationships between them, which affect the level of innovation in the economy (Lundvall 1992, pp. 12–20). An NIS defined in this way can, according to Lundvall, be analyzed from a narrow and broad perspective. In the narrow sense, it covers all institutions in the research and development sphere, such as universities, research institutes (private and pub-

lic), and the research and development units of enterprises. On the other hand, from a broad perspective, an NIS includes various participants that represent individual subsystems of the structure of a given economy, including, primarily, universities, research and development institutions, industrial enterprises, financial and marketing institutions, and public institutions (Lundvall 1992, pp. 12–15).

The literature on the subject distinguishes several NIS models (Okoń-Horodyńska 1998, p. 81; Weresa 2014, pp. 66–70):

- The first category is the free-market system, which occurs mainly in Anglo-Saxon economies (e.g., the USA, Great Britain, Canada, and Australia). These economies are characterized by the importance of the education system, in which emphasis is placed on the development of life sciences (mainly medicine, biology, and biochemistry), a flexible labor market, industry specialization, which involves supporting high technology fields (pharmaceutical and space industries, and biological sciences), an efficiently operating financial sector that actively participates in building the NIS, and enterprises that focus their innovative activities within their own organizations.
- The second model involves the system of European integration. It is characterized by a focus on developing the exact sciences and is oriented towards supporting the chemical and machine industries. The education system and research and development play an important role in its development. It is mainly based on the public sector and synchronizing the following activities: promoting economic growth, active methods of counteracting unemployment, care for social welfare, and intensive innovation policy. The system of European integration occurs in France, Germany, Belgium, the Netherlands, and Italy.
- The third model, the socio-democratic system, includes Scandinavian countries (Finland, Sweden, and Norway). Especially important are the internationalization of research and development, technological specialization in the development of industries based on the intensive use of raw materials, R&D financed primarily from private funds, the implementation of modern production methods, implementation of high education standards, supported by significant expenses, especially from the budget state, and education at the university level.
- The fourth model is the Japanese innovation system, called meso corporative, due to the high degree of sectoral specialization. It is characterized by the dynamic management of technologies, a flexible and mobile labor market, concentrating research at the level of applied research, primarily in the field of engineering sciences, high efficiency of applied research, significant industry specialization, and a strong connection with the NISs of other countries through foreign trade.
- The fifth model is an innovation system created in economies that were once in the process of systemic transformation, known as a mutated or changing (mutant). These economies had to face a significant challenge, i.e., to develop institutions that would enable the creation of international cooperation under condi-

tions that were favorable to domestic entities. This system includes the economies of Estonia, the Czech Republic, Hungary, and Poland.

Due to the lack of data, the next subchapter will assess the effectiveness of three European innovation systems, i.e., the socio-democratic system, the European integration system, and the mutated system.

Research methodology

To evaluate the effectiveness of the selected European innovation systems, multidimensional statistical analysis was used, specifically the method of linear ordering to determine the Hellwig synthetic measure. This measure replaces a large set of features of the studied objects with one aggregated variable (Krakowiak-Ball 2005, p. 71), and it makes it possible to compare the general level of innovation between countries and rank them in terms of the development of this particular field. Nevertheless, the study begins by properly selecting the diagnostic variables, i.e., variables that significantly characterize the examined, complex, and multidimensional phenomenon.

In this study, reference is made to the methodological proposals contained in the Oslo Manual 2018 (*Podręcznik Oslo 2018* 2020, pp. 63–64), which result from the joint work of Eurostat and OECD. Following the Oslo methodology, 13 variables, potential indicators of innovation, were included in the input data set. The set of potential diagnostic variables is presented in Table 1. All potential indicators that describe innovation were treated as stimulants, i.e., variables whose increasing values have a positive impact on the studied phenomenon.

Table 1. A set of potential diagnostic indicators of innovation

Symbol	Innovation index
X1	R&D expenditure in euro per capita – all sectors
X2	R&D expenditure in euro per capita – business enterprise sector
X3	R&D expenditure in euro per capita – government sector
X4	R&D expenditure in euro per capita – higher education sector
X5	High-tech patent applications to the EPO per million inhabitants
X6	EU trademark applications per million population
X7	Students in tertiary education by age group as % of corresponding age population
X8	Total high-tech trade in million euro as % of total (imports)
X9	R&D personnel as % of the labor force
X10	High-tech exports as % of total exports
X11	Employment in knowledge-intensive activities as % of total employment
X12	Product or process innovative enterprises engaged in cooperation as % of innovative enterprises
X13	Triadic patent families per million inhabitants

Source: Eurostat, Database by theme: Science, Technology, Digital Society; Education and Training, accessed: January 20, 2021.

In the first step, the usefulness of the indicators for the analysis was assessed using descriptive statistics. At this stage, there is a transition from a set of acceptable indicators, determined based on substantive and formal premises, to a set of diagnostic indicators (Panek 2009, pp. 20–21).

The next stage of the preliminary data analysis involves assessing the correlation of potential diagnostic indicators. Of the many methods to reduce and select diagnostic variables due to their informational potential, the parametric Hellwig method is used (Panek 2009, pp. 20–21). It is based on Pearson's linear correlation coefficient matrix and removes features that are strongly correlated with the others, usually at a level greater than 0.9 (which was also the level adopted in this study). Therefore, as a result of the correlation analysis for countries of the European integration system, the following variables were removed from further analysis: x1, x5, and x7, for 2014, and x1, x11, and x13, for 2019. For countries of the socio-democratic system, the following variables were removed: x1, x2, x3, x6, x8, x9, x12, and x13 for 2014, and x2, x3, x4, x8, x9, x10, x12, and x13 for 2019. On the other hand, for countries of the mutated system, x2, x4, x6, x9, x12, and x13 for 2014, and x1, x2, x8, x11, and x13 for 2019 were removed. Thus, the variables shown in Table 2 were used in the multivariate statistical analysis.

Table 2. Diagnostic indicators of the level of innovation for countries of the three innovation systems in 2014 and 2019

	Countries of the European integration system	Countries of the socio-democratic system	Countries of mutated system
	Variables used in multidimensional statistical analysis		
2014	x2, x3, x4, x6, x8, x9, x10, x11, x12, x13	x4, x5, x7, x10, x11	x1, x3, x5, x7, x8, x10, x11
2019	x2, x3, x4, x5, x6, x7 x8, x9, x10, x12	x1, x5, x6, x7, x11	x3, x4, x5, x6, x7, x9, x10, x12

Source: author's own compilation.

The basic stages of linear ordering using the Hellwig measure are as follows (Bąk 2013, p. 57):

- Determining the nature of variables (stimulants, destimulants, nominants). A variable is a stimulant if its growth positively influences the assessment of the subject. A variable is a destimulant if its decreasing values have a positive effect on the object's assessment. A nominant is a variable whose values have a positive effect on the object up to a certain point, and when this threshold is exceeded, it adversely affects the assessment of the object.
- Standardization of variables.
- Calculating the pattern coordinates: $z_{0j} = \begin{cases} \max\limits_{i} \{z_{ij}\} \text{ for stimulants} \\ \min\limits_{i} \{z_{ij}\} \textit{ for destimulants} \end{cases}$.

– Calculating the distance from the pattern: $d_{i0} = \sqrt{\sum_{j=1}^{m}\left(z_{ij} - z_{0j}\right)^2}$.

– Determining the value of the measure of economic development: q_i (usually $q_i \in [0;1]$). – $q_i = 1 - \frac{d_{i0}}{d_0}$,

where: $d_0 = \overline{d}_0 + 2s_d$, $\overline{d}_0 = \frac{1}{n}\sum_{i=1}^{n} d_{i0}$, $s_d = \sqrt{\sum_{i=1}^{n}\left(d_{i0} - \overline{d}_0\right)^2}$.

The method used will make it possible to assess the level of innovation and build innovation rankings of countries that belong to different innovation systems. The pllord package operating in the R environment was used for linear ordering (Bąk 2013, p. 58).

Analysis of the effectiveness of selected European innovation systems

The article analyzes the effectiveness of the three selected European innovation systems, i.e., the European integration system, the socio-democratic system, and the mutated system, in 2014 and 2019. First, the focus was on presenting the average values of diagnostic indicators that describe the level of economic innovation in countries of the three innovation systems, as well as on the assessment of the diversity of these variables in the analyzed countries.

Table 3. Average values of diagnostic variables and coefficients of variation for three innovation systems for 2014 and 2019

Variable	Year	Countries of the European integration system		Countries of the socio-democratic system		Countries of the mutated system	
		Mean	Coefficient of variation (%)	Mean	Coefficient of variation (%)	Mean	Coefficient of variation (%)
X1	2014	820.3	39.8	1290.1	7	189.7	38.5
	2019	970.2	39.9	1381.7	11.4	256	32
X2	2014	439	34.9	811	13.5	102.8	40.7
	2019	614	35.7	861	18.7	153.3	32.8
X3	2014	93	36.6	116	49.5	30.3	45.6
	2019	96.5	44.5	117	51	30	70.8

Variable	Year	Countries of the European integration system		Countries of the socio-democratic system		Countries of the mutated system	
		Mean	Coefficient of variation (%)	Mean	Coefficient of variation (%)	Mean	Coefficient of variation (%)
X4	2014	172	29.7	358	16.9	55.3	57.3
	2019	192	30.6	393.7	20.9	70.4	51.4
X5	2014	28.7	41.8	56.8	53.4	4.6	75.4
	2019	27	38.8	51.2	54.8	3.3	47.8
X6	2014	174	27.5	156	42.2	45.8	45.7
	2019	200.2	27.5	209.7	43.8	72.3	66.1
X7	2014	22.6	68.1	0.73	42.1	2.5	60.8
	2019	24.5	67.5	0.53	23.4	2.5	64.9
X8	2014	11.1	18.9	10.5	29.8	12.4	10.4
	2019	11.3	4.5	10.9	25.2	12.1	11.7
X9	2014	2	13.3	2.8	44.3	1.4	25.6
	2019	2.2	10.7	2.6	41.5	1.6	20.6
X10	2014	14	38.1	7.6	53.1	13.5	24
	2019	15	35.8	6.9	48	13.4	27.6
X11	2014	38	7.9	40.4	6.8	32.1	5.8
	2019	38	8.9	41.2	7	32	4.9
X12	2014	29.7	35.5	36.4	11.3	38.2	11.6
	2019	31.5	40.9	31.1	11.8	37.6	12.4
X13	2014	26.3	44.9	24.9	46.6	1.45	34.8
	2019	18.1	62.9	9.7	57.9	0.81	35

Source: author's own compilation based on Eurostat, Database by theme: Science, Technology, Digital Society; Education and Training (accessed: 20.01.2021).

As can be seen from Table 3, the highest average values of most diagnostic indicators are recorded by countries of the socio-democratic system. Only for two variables – x7 and x10 – are the highest average values shown by countries of the European integration system. Similarly, the highest mean values of the two diagnostic indicators – x8, x12 – are recorded by the countries of the mutated system.

Among the three analyzed innovation systems, the countries of the European integration system are the least diversified in terms of the development of diagnostic variables (for all variables, except x7, the coefficients of variation are below 45%). With regard to the presented indicators, the countries of the socio-democratic system are slightly more diversified. Several indicators (x3, x5, x10, x13) are characterized by above-average variation (over 45%). The economies of the mutated system are the most diversified – 5 variables (x3, x4, x5, x6, x7) are characterized by strong variation (over 45%).

The results of the linear ordering using the Hellwig method for 2014 (divided by innovation system) are presented in Figure 1.

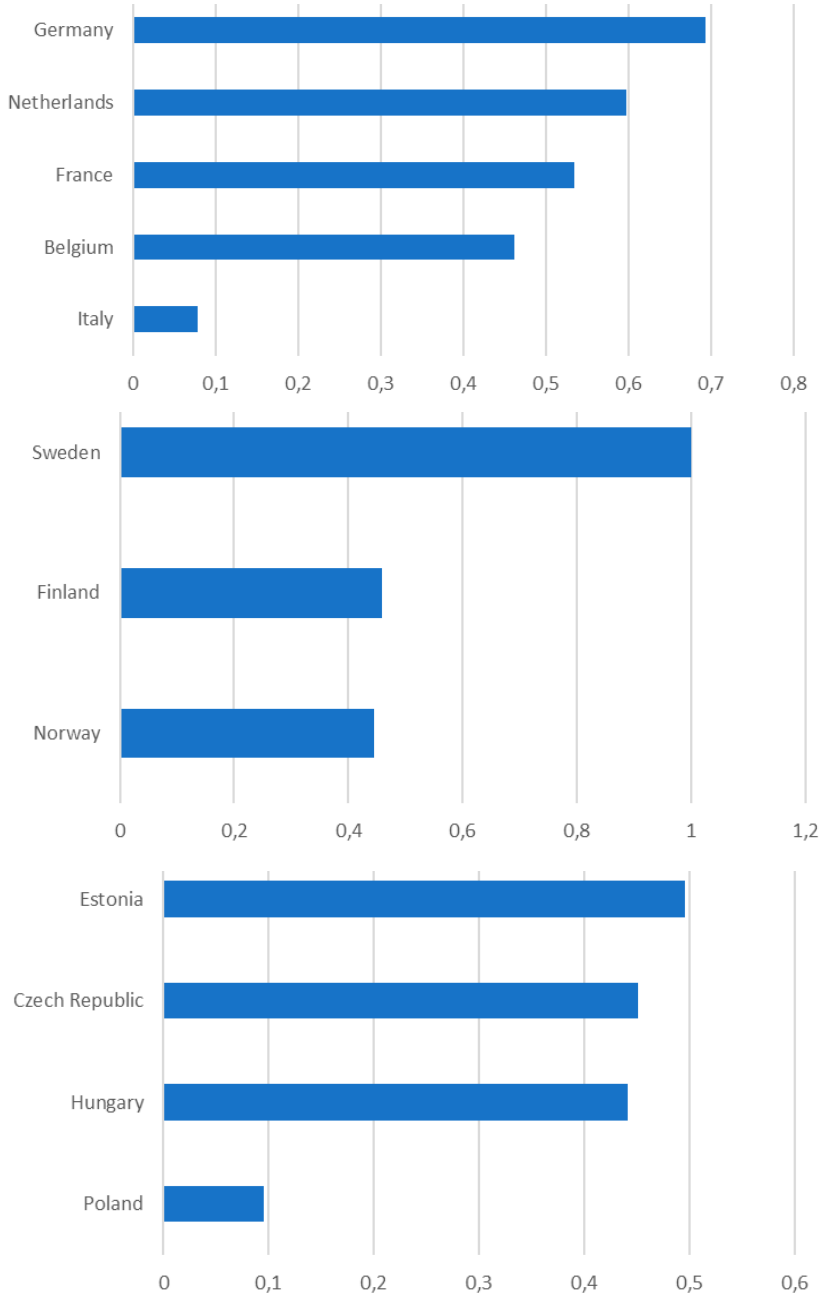
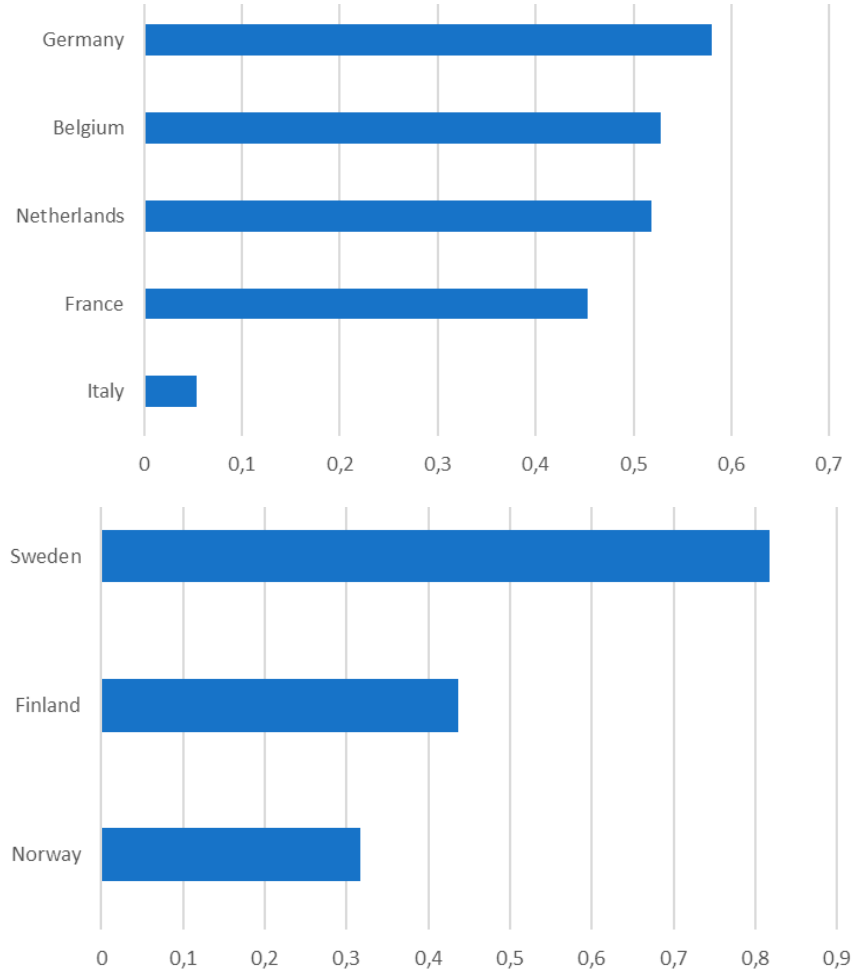


Figure 1. The results of the linear ordering of countries of the three innovation systems in 2014 using the Hellwig method (divided by innovation system)
Source: author's own study in the pllord package (R environment) based on Eurostat, Database by theme: Science, Technology, Digital Society; Education and Training (accessed: 20.01.2021).

As shown by the data in Figure 1, according to the synthetic Hellwig measure, in 2014, the highest level of innovation in the group of countries of the European integration system was achieved by Germany (0.69), and the lowest by Italy (0.07). In the socio-democratic innovation system, Sweden ranked the highest (1), while Finland the lowest (0.44). Among the countries from the mutated system, the highest level of innovation was recorded in Estonia (0.49) and the lowest in Poland (0.09).

The results of the Hellwig linear ordering for 2019 (divided by innovation system) are presented in Figure 2.



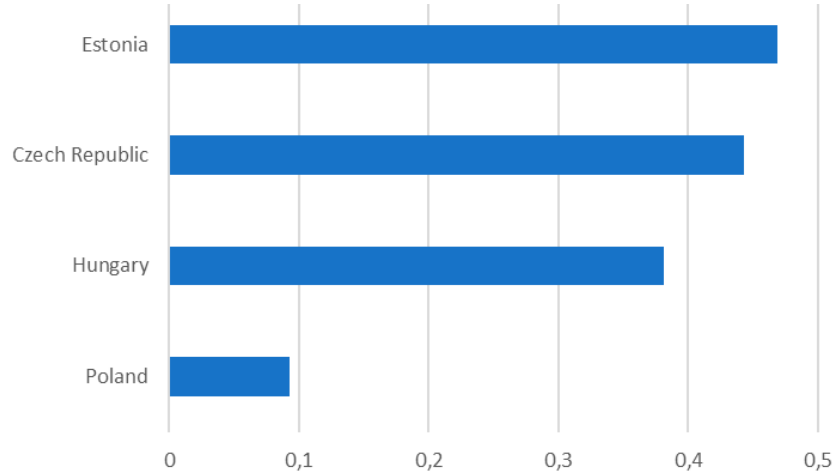


Figure 2. Results of the linear ordering of countries of the three innovation systems, using the Hellwig method, in 2019 (division by innovation system)
Source: author's own study in the pllord package (R environment) based on Eurostat, Database by theme: Science, Technology, Digital Society; Education and Training (accessed: 20.01.2021).

Based on the data in Figure 2, in 2019, in the group of countries from the European integration system, the highest level of innovation was shown by Germany (0.58), followed by Belgium (0.52), the Netherlands (0.51), France (0.45), and Italy (0.05). Among the countries from the socio-democratic system, Sweden was ranked the highest (0.81), and Norway the lowest (0.44). In the group of countries from the mutated innovation system, the highest level of innovation was again shown by Estonia (0.47), followed by the Czech Republic (0.44), Hungary (0.38), and Poland (0.09).

Summarizing the results of the analysis so far, between 2014 and 2019, the highest position in the European integration system in terms of the level of innovation, measured by the Hellwig synthetic index, was occupied by Germany, and the lowest by Italy. In the socio-democratic system, during the entire period of the analysis, Sweden ranked the highest, although Finland was the lowest in 2014, and Norway in 2019. On the other hand, in the mutated system, in both years, Estonia ranked the highest in terms of the level of innovation, and Poland the lowest. These results are presented in Table 4.

Table 4. Countries with the highest and lowest positions according to the synthetic Hellwig index in the years 2014 and 2019 in the three innovation systems

Innovation system	System of European integration		Socio-democratic system		Mutated system	
Year	2014	2019	2014	2019	2014	2019
Top position in terms of Hellwig synthetic innovation index	Germany	Germany	Sweden	Sweden	Estonia	Estonia
The lowest position in terms of Hellwig synthetic indicator of innovation	Italy	Italy	Finland	Norway	Poland	Poland

Source: author's own compilation based on Eurostat, Database by themes: Science, Technology, Digital Society; Education and Training (accessed: 20.01.2021).

The next part of the analysis focuses on assessing the level of innovation in all countries, without dividing them into particular groups (i.e., innovation system).

Figure 3 presents the results of the linear ordering of countries by the Hellwig method in 2014 without dividing them into groups.

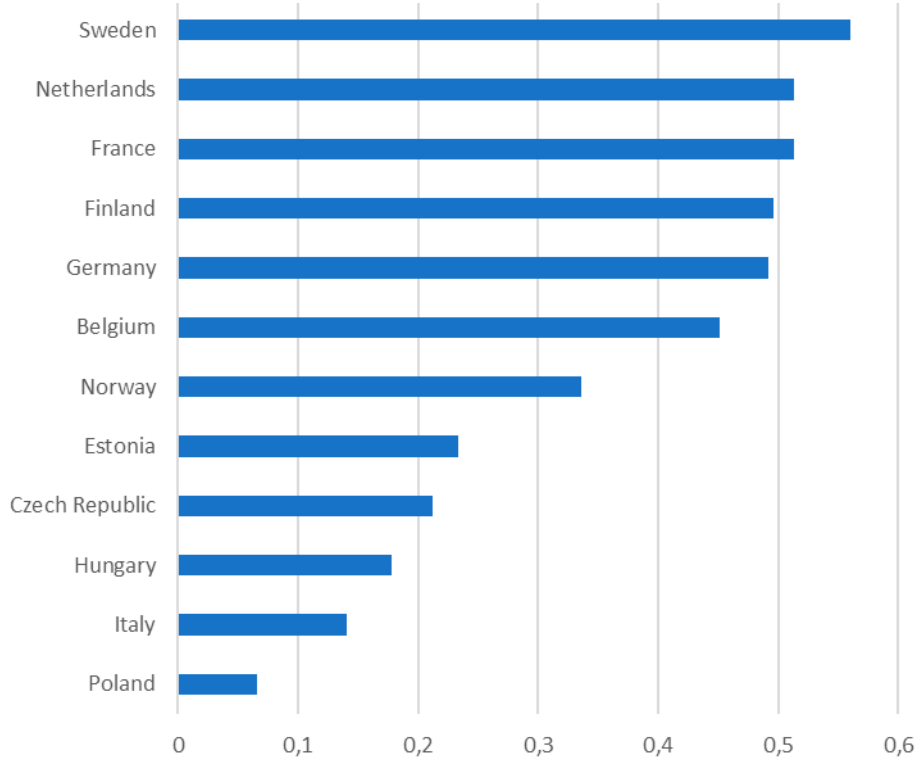


Figure 3. Results of the linear ordering of all countries in 2014 using the Hellwig method without dividing them into groups (i.e., by innovation system)
Source: author's own study in the pllord package (R environment) based on Eurostat, Database by theme: Science, Technology, Digital Society; Education and Training (accessed: 20.01.2021).

As shown by the data in Figure 3, in 2014, the highest level of innovation was reported by Sweden (0.56), the Netherlands (0.51), France (0.51), Finland (0.50), and Germany (0.49), i.e., countries from the system of European integration and socio-democratic system. Countries from the mutated system (Estonia, the Czech Republic, Hungary, and Poland) and Italy ranked lower. Poland was again the last in terms of the level of innovation, measured using the Hellwig method.

Figure 4 presents the results of the linear ordering of all countries using the Hellwig method in 2019 without grouping them.

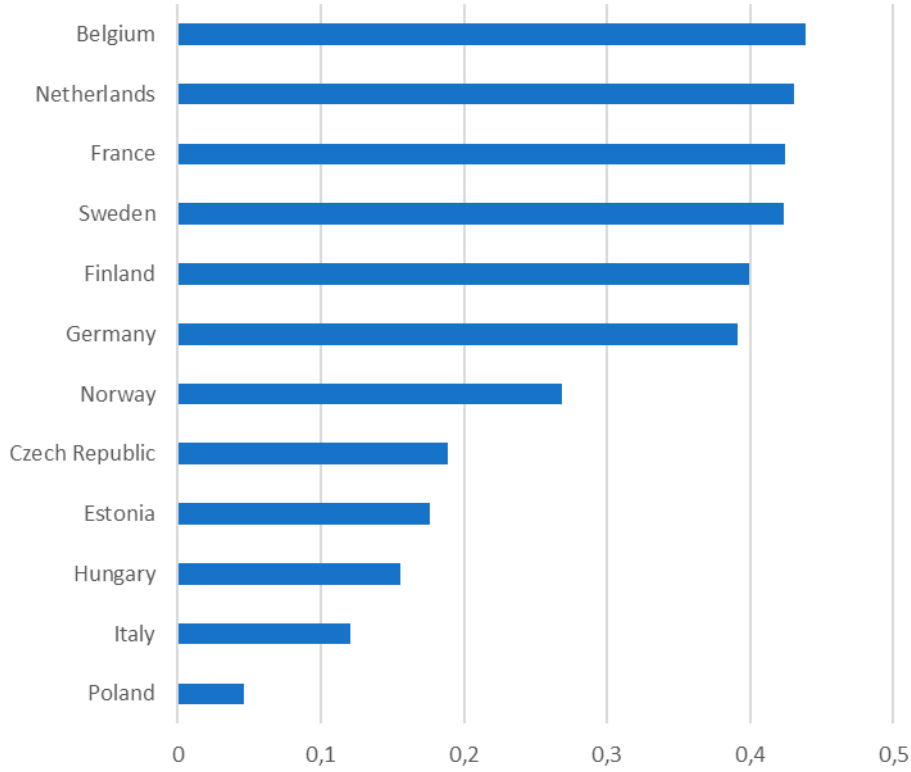


Figure 4. Results of the linear ordering of all countries using the Hellwig method in 2019 without grouping them (i.e., by innovation system)
Source: author's own study in the pllord package (R environment) based on Eurostat, Database by themes: Science, Technology, Digital Society; Education and Training (accessed: 20.01.2021).

The results of linear ordering using the Hellwig method (Figure 4) indicate that the countries of the European integration and socio-democratic systems, i.e., Belgium (0.44), the Netherlands (0.43), France (0.42), Sweden (0.42), and Finland (0.39), were characterized by the highest level of innovation in 2019 while a lower level of innovation was recorded, as in previous years, by countries from the mutated system, i.e., the Czech Republic (0.19), Estonia (0.18), Hungary (0.16), and Poland (0.05). Italy, from the European integration system, was last but one (0.12).

Table 5 shows the countries with the highest and the lowest levels of innovation in 2014 and 2019, measured using the Hellwig method.

Table 5. Countries with the highest and the lowest levels of innovation in the years [between] in 2014 and 2019, measured using the Hellwig method

Year	2014	2019
Country with the highest level of innovation, measured by the Hellwig method	Sweden (socio-democratic system)	Belgium (European integration system)
Country with the lowest level of innovation, measured by the Hellwig method	Poland (mutated system)	Poland (mutated system)

Source: author's own compilation.

Conclusions

As can be seen from the considerations on the selected European innovation systems, in 2014 and 2019, the highest level of innovation was demonstrated by countries of the socio-democratic innovation system and the European integration system. It can therefore be concluded that the hypothesis formulated in the introduction to the article has been positively verified.

Particularly noteworthy is the high position in the innovation rankings of the Swedish and German economies. The success of the Swedish innovation system is based on a coherent and long-term strategy aimed at increasing the innovativeness of the economy through investments in education, human capital, and R&D. The Swedish innovation system is characterized by the internationalization of scientific research, industrial orientation towards technological and innovative activity, rapid adaptation of new techniques, and high expenditure on education (Prystrom 2012, p. 504). The policy of creating clusters and tax incentives for R&D plays a vital role in it.

On the other hand, the main source of the success of the German innovation system is the equally consistent policy of supporting the innovation of the economy, based on three pillars (Gorynia-Pfeffer 2012, p. 218): (a) improving the conditions for the development of innovation by simplifying the taxation system, reducing tax burdens, and reducing bureaucratic procedures, (b) promoting innovative behavior by providing financial aid, and (c) improving the education and learning system in order to create highly qualified human resources.

As for the Belgian innovation system, it is headed by a government that operates through federal and local authorities and administrative bodies. Financial support flows directly into the research sector from these organizations. At the same time, the R&D sector is supported by industry and international institutions (Szajt 2009, p. 23).

The results of the analysis also indicate distant positions in the rankings of innovativeness of economies belonging to the mutated system. Nevertheless, Estonia occupies the highest position in this group in terms of economic innovation (Wojtowicz and Mikos 2012, p. 169). After gaining independence in 1991, the country began to implement the "Tiger's Jump" policy, which involved technological development, investments in the Internet infrastructure, and incentives for foreigners to open a business.[1] Estonia's success was possible thanks to high social capital, based on mutual trust, trust in state institutions, as well as openness to foreign citizens. It is also based on an efficiently functioning and friendly institutional environment.[2]

In the group of countries from the mutated innovation system, Poland has the lowest position in the rankings of economic innovativeness presented in the article, as well as in other rankings.[3] There is no doubt that this is due to the ineffectiveness of the innovation policy pursued in Poland. The lack of a long-term strategy to increase the level of innovation in the economy (Dworak 2012, p. 219), which would combine the achievements of various governments, is the fundamental weakness of this policy. The dependence of many elements of the Polish innovation system on the public finance sector is another drawback.[4] The structure of scientific research is also unfavorable from the point of view of increasing innovation – in Poland, applied research, i.e., research that is "closer to the market", has too low a share in the overall structure of research. The lack of permanent connections between entities from the scientific and research sphere and the sphere of enterprises has also been disturbing for years,[5] which results from the shortages of social capital and the lack of appropriate state support for such cooperation.

1 Estonia focuses primarily on supporting foreigners to create innovative start-ups, the availability of administrative and government services via the Internet, e.g., electronic cards for residents have been introduced, which are proof of social security insurance. (Najważniejsze wiadomości-Estonia-kolebka innowacji i kraj o rozwiniętej infrastrukturze sieciowej 2019).

2 The elements of this environment include clear laws, little bureaucracy, and simplified rules for establishing enterprises (e-Residence program). (Najważniejsze wiadomości-Estonia-kolebka innowacji i kraj o rozwiniętej infrastrukturze sieciowej 2019).

3 In the rankings of the European Innovation Scoreboard, Global Competitiveness Report, and Global Innovation Index, Poland occupies a distant position. (Dworak, Grzelak 2020, pp. 38–50).

4 This relationship is evidenced by the fact that approx. 80% of Polish R&D potential, measured by the number of research and development employees, is employed in the state sector, i.e., approx. 80% of "scientific production" is generated outside enterprises – a reverse proportion than in highly developed countries. It is also worth adding that about 60% of financial expenditure on research and development comes from the state budget and EU funds, while the share of enterprises in this financing is about 30%. This does not mean that state expenditures should decrease – on the contrary, they should increase and be the driving force for R&D expenditures from enterprises, but enterprises expenditures should grow faster than state expenditures, also thanks to easier access to capital at all stages of implementation of R&D projects (Jasiński 2018, p. 235).

5 Almost 80% of Polish innovations are based on ideas and solutions developed in enterprises, which is because Polish companies use the achievements of scientific units only to a small extent. Because of this, Polish technical innovations represent a relatively low level of modernity. (Jasiński 2018, p. 235).

Summing up the considerations, the countries that hold high positions in the rankings of economic innovation owe this advance to the synergy of several factors, i.e., the implementation of an appropriate state policy, based on supporting R&D and education (Roszko-Wójtowicz and Grzelak 2020, p. 658; Roszko-Wójtowicz, Grzelak, and Laskowska 2019, p. 720), the development of an efficient and friendly institutional environment, as well as launching social capital, conducive to the development of creativity and ability to cooperate. Regarding the Polish economy, it is therefore necessary to try to reconstruct the current model of supporting the development of innovation.

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Ocena efektywności wybranych europejskich systemów innowacji

Wzrost znaczenia aktywności innowacyjnej we współczesnej gospodarce ożywił zainteresowanie nauk ekonomicznych studiami dotyczącymi mechanizmów rządzących procesami innowacyjnymi i wpływu innowacji na rozwój gospodarczy. Na fali wzrostu tego zainteresowania powstała koncepcja narodowego systemu innowacji (NSI), która zajmuje ważne miejsce w polityce innowacyjnej wszystkich rozwiniętych gospodarek rynkowych. W literaturze ekonomicznej wyodrębnia się różne typologie systemów innowacji. Celem artykułu jest ocena efektywności systemu integracji europejskiej, systemu społeczno-demokratycznego i systemu zmutowanego, mierzonej poziomem innowacyjności gospodarek należących do tych systemów, w latach 2014 i 2019.

W artykule dokonano analizy literatury przedmiotu poświęconej systemom innowacji; do oceny efektywności systemów innowacji wykorzystano metodę wielowymiarowej analizy statystycznej – metodę porządkowania liniowego, pozwalającą na zbudowanie miernika syntetycznego Hellwiga. W artykule sformułowano hipotezę badawczą zakładającą, że najbardziej efektywnymi systemami innowacji są system społeczno-demokratyczny i system integracji europejskiej. Hipoteza ta została zweryfikowana pozytywnie.

Słowa kluczowe: innowacja, narodowy system innowacji, ranking innowacyjności

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Integrated Evaluation of Innovative Development of the New EU Member States and Other EU Countries

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Abstract

This study investigates the problem of estimating various aspects and qualitative features of innovative development. A new methodological approach to comprehensively assessing the polystructural nature of modern innovative development in the new EU member states and other EU countries is proposed, which allows us to identify growth points and promising areas to increase their innovative development. Aspects such as information adaptability, innovative orientation, and synergetic efficiency are considered. The analysis is based on a logical evaluation of indicators that characterize science, technology, and the digital society in accordance with the data presented in the public domain, from which the main indicators that characterize these three aspects of the EU's innovative development were selected. According to the algorithm of the matrix method for the new EU member states and other EU countries, the maximum (reference) value was chosen for each indicator and the coefficient

of compliance with the reference value of a particular indicator was calculated. As a result, integrated indicators of assessing information adaptability, innovative orientation, and synergetic efficiency and the integrated indicator of innovative development of the EU countries were calculated, which allowed us to rate them. The innovative development of the economies of the EU countries differs significantly in some indicators and aspects. The assessment and comparison of innovative development at the national level depends on many factors but is primarily determined by public policy and national priorities of a particular country. That is why a promising direction of increasing the innovative development of all EU countries should be, first of all, the further development of their mutual exchange of technologies based on the existing integration scientific and technical potential.

Keywords: innovative development, information adaptability, innovative orientation, synergetic efficiency, integrated indicator of innovative development

JEL: F15, F55, K23, O32, O33, P51

Introduction

In the modern scientific and technological paradigm of global economic development, the driving forces of economic growth in the 21st century are the effective implementation of human, scientific, technical, financial, infrastructural, and managerial resources. The emergence of a new, sixth technological system contributes to the importance of innovative development for countries and regions around the world. Therefore, it is natural that new technology, science, and innovation in general, which today determine not only social development, but also the direction of evolution of mankind as a whole has a growing influence on the economic growth.

However, the parameters of this process are not fully understood. The process can include the speed of processing information, communicative mobility, the availability of new technologies, as well as the ability of the state to generate and effectively commercialize innovative ideas, technologies, and institutions.

Therefore, if we consider the methodological aspects of this problem, the focus should be on the fact that modern innovative development has a polystructural nature, due to the three most important aspects: information adaptability, innovative orientation and synergetic efficiency. Information adaptability is people's ability to perceive and analyze the flow of information and, on this basis, predict and implement technological changes in accordance with the level of motivation, preferences, and desires to maximize the usefulness of activities to increase profits from new technologies. Innovative orientation is the fundamental direction of economic development. It determines the relevant trend in society in which many of the results of activities are invested in the future by creating conditions to develop and commercialize education, science, and technology. Synergetic efficiency is the most important determinant of in-

novative development, as it makes it possible to obtain revenues from the development, commercialization, and implementation of new technologies.

All this seriously complicates the issue of assessing the innovative development of countries in a globalized world. The innovative achievements of a national economy are quite difficult to capture in single indicators because it is impossible to reflect and quantify the full range of innovations used within one country. And if they could be quantified, the lack of reliable data makes it impossible to comprehensively analyze them. Therefore, there is a problem of choosing and quantitatively interpreting such indicators, especially when it comes to countries of different levels of development that are members of the same integration association, e.g., Central and Eastern European Countries (CEECs), including the new EU member states such as Bulgaria, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Croatia, the Czech Republic, and Estonia, and other EU countries. In this sense, the purpose of the article is to calculate integrated indicators that will take into account the general condition of the new EU member states and allow a rating assessment of their innovative development compared to other EU countries.

Literature review

Currently, the innovative development of different countries are assessed in the context of world rankings by individual factors. Europe needs to adapt to tactical growth factors nowadays – to the technological innovation and to achieving the desideratum of the Union (Rădoi and Șerban 2019, p. 35). The success of regional development is highly dependent on the ability of human resources in districts to innovate district government organizations (Badrudin and Hale 2019, p. 986). Thus, the issues of evaluating innovative development are considered by the US Council on Competitiveness, the European Institute of Business Management (INSEAD), the Institute of Management Development (IMD), the Economist Intelligence Unit (EIU), and the World Economic Forum (WEF), in compiling indexes of global competitiveness of different countries.

According to the analysis, there are many methods to assess a country's innovative development, including the Technology Achievement Index (TAI) (United Nations 2019), The Global Innovation Index (GII), introduced by the European Institute of Business Administration (INSEAD, WIPO 2019), The Good Country Index, developed by Anholt (USA), with the help of Hovers (The Good Country 2019), The Knowledge Economic Index, developed by the World Bank (The World Bank 2019), the European Innovation Scoreboard, developed in the Netherlands (European Commission 2019), structural analysis of the innovative activity of the territory, proposed by Kortov (Kortov 2004), and The Information and Communication Technology Opportunity Index (ICT-OI) (World Information Society Report 2007).

There are also widespread methods of calculating indexes, which can be used to draw conclusions about the innovative development of countries, e.g., the method of calculating the index infostate – an index used to measure the Digital Divide, proposed by Orbicom, the International Network of UNESCO Chairs in Communications (UNESCO 2019), The Information and Communication Technology Development Index (IDI) calculation method is based on the International Telecommunication Union (ITU) method and includes three sub-indexes: ease of access, use and practical skills (International Telecommunication Union 2019c); methodology for calculating the Information Society Index (ISI), which includes 15 indicators grouped into four categories: computers, telecommunications, Internet, social development of society (IDC 2018); method of calculating the Digital Access Index (DAI), which includes four groups of indicators: infrastructure, accessibility, knowledge and quality, the actual use of ICT (International Telecommunication Union 2019a); E-Readiness Index (ERI) or Digital Economy Ranking (DER) calculation method, which contains six components: connection infrastructure and technologies; business environment; social and cultural environment; legal environment; public policy and strategy; acceptance by society and business, developed by the EIU (World Economic Forum 2019a)); methodology for calculating the E-Government Development Index (EGDI), which includes three groups of indicators: the degree of coverage and quality of Internet services, the level of development of ICT infrastructure, human capital (UN Department of Economic and Social Development 2019); Methodology for calculating the Networked Readiness Index (NRI), calculated by WEF and INSEAD based on statistics from the UN and other organizations, as well as the results of the annual survey of managers on 68 parameters, combined into three groups: environment, state, business and civil society use of ICT, use of ICT by the state, business and civil society (World Economic Forum 2019b); Digital Opportunity Index (DOI) calculation method based on the calculation of three sub-indexes: capability, infrastructure and use (International Telecommunication Union 2019b); ICT Diffusion Index (ICT-DI) calculation method based on two groups of indicators: communication (number of Internet hosts, personal computers, telephone lines and mobile subscribers per capita) and access (number of Internet users, adult literacy, cost of local call and GDP per capita) (International Telecommunication Union 2019d).

The shift of techno-socio-economic paradigm in the information age is associated with a shift in the character of innovation (Cantwell 2017; Filippetti et al. 2017; Castellani 2018). Thus, analyzing the work of scientists (Awate et al. 2015; Belderbos et al. 2016; Dovgal and Goncharenko 2019, 2015; Giannini et al. 2019; Cassetta et al. 2020; DeGrazia et al. 2020; Goncharenko et al. 2020; Ortiz and Fumás 2020), we can note the lack of a unified approach to assessing the innovative development of countries. There is also no generally accepted direction for calculating an indicator that would reflect the full diversity of this process. Existing methods of calculating indexes reflect the current practice in statistical accounting for one or more aspects of the analysis of innovative development, but they cannot characterize all manifesta-

tions of such a complex phenomenon. This is a deterrent in applied economic research of innovative development around the world and leads to difficulties when attempting to provide a prognostic assessment of the situation in this direction.

Existing realities require a comprehensive assessment of the qualitative features of innovative development and its aspects. The main problem is the need for a rational choice from the entire existing list of possible indicators of the most significant, informative determinants for a comprehensive study of the essence of innovative development and being able to apply these indicators practically. This issue is relevant today, as regulating the economy in the current trends of globalization and regionalization requires real assessment tools when choosing the appropriate strategic priorities for countries' development.

The solution to this scientific problem is of particular importance for the countries of the European Union (EU), which has traditionally occupied a leading position in the world in many indicators of innovative development. In addition to the level of technological development of the country, its innovation policy also depends on additional factors, such as the exchange of best practices, technological development path dependence, and civilizational and cultural peculiarities of national innovation systems (Jablonski 2018, p. 28). However, recently, the innovative level of other countries and regions of the world, mainly in Southeast Asia, allows them to compete successfully with European countries in terms of innovation development (European Union 2015).

Today, various methods and models are intensely adopted in the development of business management systems (Karmanov et al. 2020, p. 346). In this regard, there is a need to develop a methodological approach to comprehensively assess the polystructural nature of modern innovative development in the EU countries, taking into account its aspects such as information adaptability, innovative orientation, and synergetic efficiency, which make it possible to identify growth points and promising areas to improve their innovative development. Therefore, the purpose of this article is to develop an integrated indicator of innovative development of the EU, which will take into account the general state of the EU countries and allow a rating assessment of their innovative development in the EU economic system.

Data and methodology

To calculate the integrated indicator for assessing the innovative development of the new EU member states and other EU countries, taking information adaptability, innovative orientation and synergetic efficiency, the following methodology is proposed by the authors: 1) forming a hypothesis about the impact of factors that characterize the level of innovation development; 2) assessing factors and estimating their integrated indicators by EU countries; 3) calculating the integrated indicator of the EU countries innovative development. Schematically, the methodology can be seen in Figure 1.

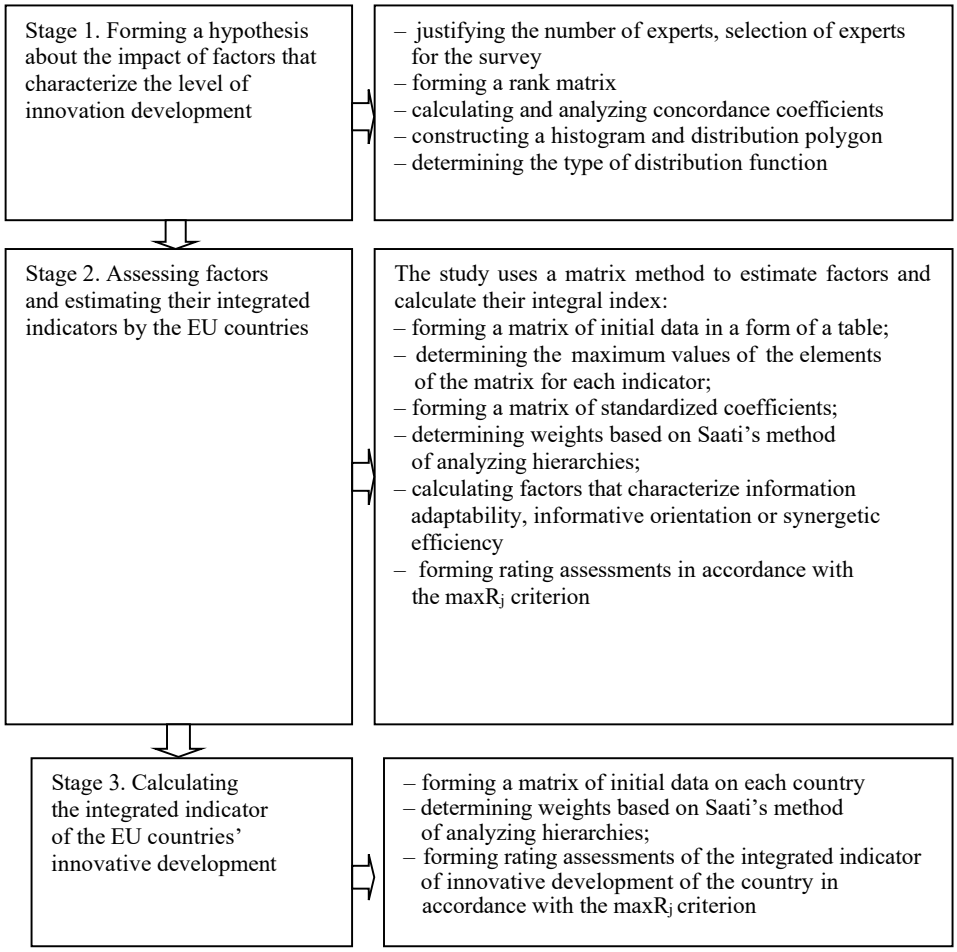

Figure 1. The sequence of calculating the integrated indicator of innovative development of the EU
Source: author's elaboration.

To increase the objectivity of the assessment of factors that characterize the level of innovation development, we proposed applying the algorithm of a priori analysis based on the analysis of experts' points of view. The information obtained a priori is processed using the methods of rank correlation. The algorithm for conducting a priori analysis based on the method of expert evaluations includes blocks: forming a rank matrix; calculating and analyzing concordance coefficients; constructing a histogram; determining the type of distribution function.

The concordance coefficient is calculated by the formula (Shmoylova 2008):

$$W = \frac{12 \cdot S}{m^2 \cdot (n^3 - n)} = \frac{12}{m^2 \cdot \left(n^3 - n\right)} \left(\sum_{j=1}^{m} \left(\sum_{i=1}^{n} a_{ij} - \frac{\sum_{j=1}^{m} \sum_{i=1}^{n} a_{ij}}{n} \right)^2 \right) \quad (1)$$

where a_{ij} – is the rank of the i-th factor in the j-th specialist; m – is the number of specialists; n – is the number of factors.

The study uses correlation analysis to check the results, a comparative assessment, and the possibility of excluding some factors. According to statistics, a matrix of pairwise correlation coefficients is formed, which determines the degree of connection of each of the factor-features (x) with the resultant factor (y) and with each other.

The correlation coefficient is calculated by the formula (Shmoylova 2008):

$$r_j = \frac{\sum x_j \cdot y_i - \frac{\sum x_j \cdot \sum y_j}{m}}{\sqrt{\left(\sum x_j{}^2 - \frac{\left(\sum x_j \right)^2}{m} \right) \left(\sum y_j{}^2 - \frac{\left(\sum y_j^2 \right)}{m} \right)}} \quad (2)$$

where x – is the value of the factor-sign; y_j – is the value of the productive factor; m – is the value of the statistical ensemble.

Pearson's t-test is used to assess the significance of the correlation of coefficient r. This determines the actual value of criterion t (Shmoylova 2008):

$$t_r = r \cdot \sqrt{\frac{m-2}{1-r^2}} \quad (3)$$

The system of indicators for assessing the degree of investment attractiveness of objects will include indicators for which the correlation coefficient r is considered significant, that is, the opinion of experts on this indicator is confirmed. Thus, a list of indicators that characterize information adaptability, innovative orientation, or synergetic efficiency is formed.

The content of the second stage is comparing individual objects of analysis and choosing the most promising among them.

In the course of the comparative analysis, we propose using methods of multidimensional analysis, in particular the matrix method. When assessing a country's level of innovative development in accordance with the selected three determinants, the matrix makes it possible consider the level of significance of each indicator, increasing the accuracy of the assessment (Shmoylova 2008).

The rating is determined by the formula (Malitskiy and Solovev 2006):

$$R_j = \sum_{i=1}^{n} k_i \cdot x_{ij} \tag{4}$$

where k_i – is the weighting factor determined by experts based on the method of analysis of hierarchies for the i-th indicator; x_{ij} – standardized coefficient of the i-th indicator of the j-th country.

Weights during the calculation of the integrated indicator are determined based on Saati's (1993) method of analysis of hierarchies, which is based on a hierarchical procedure for evaluating alternatives. To record the result of comparing a pair of alternatives, the scale presented in Table 1 is used. Similarly, the significance of the calculated integrated indicators is assessed according to the established aspects of the level of innovative development.

Table 1. Scale for evaluating the results of comparing alternatives

Scores	Characteristics of similarity of alternatives
1	Equivalence
3	Moderate advantage
5	Strong advantage
7	A very strong advantage
9	The highest advantage
2, 4, 6, 8	Intermediate values

Source: compiled by the authors based on data derived from (Saati 1993).

The index method is used to calculate the integrated indicator of innovative development of the countries. According to the value of the integrated indicators calculated in the previous stage, the general indicator of innovative development of the country is calculated, according to which the EU countries are ranked.

Empirical results

According to the first stage of the evaluation, based on the logical analysis of indicators that characterize science, technology, and digital society in accordance with the data 2007–2020 presented in the public domain, the main indicators were selected. These indicators characterize information adaptability, innovative orientation, and the synergetic efficiency of innovative development of the EU countries and are grouped by three aspects of analysis (Annex 1).

According to the presented sequence, we obtained a priori information on the degree of influence of each of the assessed indicators. The methods of rank correlation based on expert surveys were used. The results were summarized in a table – a matrix

of ranks to identify the main factors of information adaptability, innovative orientation and synergetic efficiency.

The analysis of the rank matrixes showed that experts' assessments of the degree of influence that factors have on the innovative development differ slightly. By our calculation, the concordance coefficients at an estimation of factors of innovative development regarding information adaptability is 0.69, for innovative orientation – 0.73, and for synergetic efficiency is 0.83. Therefore, with a probability of 0.95, it can be argued that the consensus of experts is not accidental.

The group of factors that will be included in the further study for each aspect of the analysis is summarized in Table 2.

Table 2. The factors that characterize the innovative development of the EU countries are singled out as a result of the priori expert analysis

Aspects of innovative development	The name of the factor
Indicators for assessing information adaptability	High-tech patent applications to the European Patent Office (EPO) (X1)
	Broadband penetration rate (X31)
	Patent applications to the EPO for the priority year (X3)
	Frequency of mobile Internet use (X16)
	Expenditure on information technology, in millions of Euros and % of GDP (X29)
	Internet use and activity (X24)
	Enterprises – Internet access level (X18)
	Market share in telecommunications (X30)
	Fixed broadband connection, market share (X25)
Indicators for evaluating innovation orientation	Total turnover due to innovative products according to NACE (X13)
	Expenditure on research and development (BERD) of enterprises in the ICT sector, in % of total R&D expenditure on NACE activities (X30)
	R&D expenditures at national and regional levels (X1)
	Innovation in high technology (CIS 2008, CIS 2010, CIS 2012), EU Member States and individual countries (X27)
	Number of scientific and technical staff at national and regional levels (X6)
	Venture capital investment HTEC (X22)
	Total internal costs for R&D by type of activity
	Number of enterprises with innovative activity (X9)
Indicators for assessing synergetic efficiency	Total government budget expenditures on research and development (GBAORD), in % of the total state budget
	R&D costs per patent
	GNP growth of the state due to high-tech industries

Source: author's.

For the selected factors, matrixes of pairwise correlation coefficients were compiled for each aspect of the analysis, confirming their significance with the help of corre-

lation coefficients. Thus, a system of indicators that characterize the innovative development of the new EU member states and other EU countries in three aspects was formed.

Based on the system of indicators, at the next stage, matrixes of initial data to calculate the integrated indicator of innovative development regarding information adaptability, innovative orientation and synergetic efficiency were formed.

Based on the algorithm of the matrix method, for each indicator, the maximum value was chosen and the coefficient of compliance was calculated with the reference value of a particular indicator.

At the next stage, we assessed the level of significance of indicators that characterize information adaptability, innovative orientation and synergistic efficiency by the method of hierarchy levels.

The results of calculatng the integrated indicator of innovative development and its aspects (integrated indicators for assessing information adaptability, innovative orientation and synergetic efficiency) are presented in Table 3.

Table 3. Integrated assessment of innovative development of the new EU member states and other EU countries and its aspects, 2019

	An integrated indicator of information adaptability	An integrated indicator of innovation orientation	Integral indicator of synergetic efficiency	An integrated indicator of innovative development
Belgium	0.17171138	0.084140778	0.3106522	0.19005295
Bulgaria	0.0763596	0.003908588	0.1024535	0.06132269
Czech Republic	0.04637599	0.022038094	0.4604155	0.17911792
Denmark	0.08802018	0.071208356	0.3013829	0.15501561
Germany	0.96057348	0.769633288	0.9293509	0.88694753
Estonia	0.0755352	0.001964972	0.226657	0.10263845
Ireland	0.07784342	0.013088213	0.0913327	0.06106056
Greece	0.10666103	0.009113942	0.2764979	0.13221503
Spain	0.19365445	0.101947282	0.3362231	0.21186443
France	0.65528756	0.40885517	0.4092773	0.49032137
Croatia	0.29322782	0.003007053	0.1701116	0.15559545
Italy	0.05602372	0.159471703	0.5272793	0.25038844
Latvia	0.05220141	0.000564598	0.0766133	0.04346129
Lithuania	0.03574048	0.001923421	0.1615178	0.06734515
Luxembourg	0.15239839	0.005891607	0.1747653	0.1116559
Hungary	0.27583997	0.017765122	0.144205	0.14591938
Netherlands	0.20327514	0.116619676	0.560755	0.29622198
Austria	0.17252061	0.084611167	0.5091282	0.25795709
Poland	0.05518047	0.032485992	0.2109227	0.10064366
Portugal	0.05465951	0.023281419	0.4833499	0.19005948
Romania	0.02467962	0.006025889	0.2237742	0.08621604
Slovenia	0.0624881	0.007680435	0.132872	0.0683321

	An integrated indicator of information adaptability	An integrated indicator of innovation orientation	Integral indicator of synergetic efficiency	An integrated indicator of innovative development
Slovakia	0.15432816	0.004812195	0.1137611	0.0911951
Finland	0.25866374	0.05433714	0.2120396	0.17538375
Sweden	0.6286747	0.107681421	0.2561006	0.33007172
Weighting factor	0.33	0.33	0.34	

Source: own calculations.

Thus, according to the criteria for maximizing the integrated indicator of innovative development, the general rating of the EU countries can be presented (Table 4).

Table 4. Ranking of the EU countries on the integrated indicator of innovative development, 2019

Country	An integrated indicator of innovative development	Ranking
Germany	0.88694753	1
France	0.49032137	2
Sweden	0.33007172	3
Netherlands	0.29622198	4
Austria	0.25795709	5
Italy	0.25038844	6
Spain	0.21186443	7
Portugal	0.19005948	8
Belgium	0.19005295	9
Czech Republic	0.17911792	10
Finland	0.17538375	11
Croatia	0.15559545	12
Denmark	0.15501561	13
Hungary	0.14591938	14
Greece	0.13221503	15
Luxembourg	0.1116559	16
Estonia	0.10263845	17
Poland	0.10064366	18
Slovakia	0.0911951	19
Romania	0.08621604	20
Slovenia	0.0683321	21
Lithuania	0.06734515	22
Bulgaria	0.06132269	23
Ireland	0.06106056	24
Latvia	0.04346129	25

Source: own calculations.

Conclusions

Summarizing the results of calculations of the integrated indicator of innovative development and its aspects of the new EU member states and other EU countries, we can conclude that the innovative development of EU economies differs significantly in individual indicators of information adaptability, innovative orientation, and synergetic efficiency.

First, in terms of information adaptability indicators such as high-tech patent applications to the European Patent Office (EPO), speed of penetration in the broadband network, patent applications to the EPO by priority year, information technology costs, and frequency of mobile Internet use, the leaders of innovative development are Germany, France, the Netherlands, and Sweden, which indicates the dynamic spread of information technology and, on this basis, future technological changes in economic development. Among the CEECs, the new EU member states of Croatia, Hungary, and Slovakia achieved the best results in these indicators, even ahead of such highly developed countries as Italy and Portugal. This corresponds to their development strategies, which set a course for the introduction of modern information technologies, creating the necessary infrastructure, and motivating the population to expand their use in their activities.

Secondly, by indicator of innovation orientation (total turnover due to innovative products, the number of developments in the ICT sector, R&D expenditures, innovations in high technology, the number of scientific and technical staff, the volume of venture investment in R&D, total domestic R&D expenditures, and the number of enterprises with innovative activities) the leading role among was played by Germany, France, Italy, and Spain, which is a consequence of a purposeful state policy on the creation and dissemination of innovations. Poland, the Czech Republic, and Hungary, as expected, became leaders among the new EU member states. They show the greatest rates of innovative economic renewal, primarily through awareness of its importance, as well as significant investment in education, science and technology development, and greenfield investment.

Third, in terms of total government budget expenditures on research and development (GBAORD), R&D expenditures on one patent, and the growth of state GDP due to high-tech industries that characterize synergetic efficiency, Germany, Austria, Sweden, Portugal, Denmark, Italy, and the Netherlands are ahead, as is the Czech Republic (the first of the CEECs), which indicates the gradual awareness of the importance of innovation in the economic development of most European member states.

Thus, as a result of the study, it can be noted that Germany is a leader in innovative development in the European economic system, as its integrated indicator of innovative development is significantly higher than in all other countries. France, which, according to the calculations, is second in the ranking, lags behind the values of the integrated indicator of Germany by 0.396 points. The Czech Republic's 10th place in the overall ranking (the first place among the new EU member states)

is quite logical, in our opinion. It reflects the results of the country's recent structural reforms and economic modernization, due in part to a significant inflow of foreign investment. For the vast majority of CEECs, their low rating is evidence of the direct relationship between innovation development and economic development indicators, despite the fact that they are all members of the same integration association. Therefore, to ensure the technological development of the new EU member states today, it is necessary to focus on those areas of activity where it is advisable to combine the technology of "Industry 4.0" with Smart TEMP factors (Technology, Environment, Manufacturing, Products), which creates sustainable demand in new markets and value for consumers.

As for the practical results of the study, a comprehensive assessment of the polystructural nature of modern innovative development in the new EU member states and other EU countries, taking into account aspects such as information adaptability, innovative orientation, and synergetic efficiency, allows us to identify growth points and promising areas to increase their innovation. Assessing and comparing innovative development at the national level depends on many factors, but it is primarily determined by the public policy and national priorities of a particular country. That is why, in our opinion, the further development of their mutual exchange of technologies based on the existing integration of scientific and technical potential should be perspective directions to increase the innovative development in all EU countries.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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Annex 1. Indicators for assessing the innovative development of countries

Indicators for assessing information adaptability	Indicators for assessing innovative orientation	Indicators for assessing synergetic efficiency
High-tech patent applications to the European Patent Office (EPO) for the priority year	Expenditures on research at the national and regional levels	The total amount of GBAORD, in % of the total state budget
Biotechnological patent applications to the EPO for the priority year	Total internal R&D expenditures by the type of activity	Total trade in high-tech trade, in millions of Euros and % of total
Patent applications to the EPO for the priority year	Total costs for research and development (GER) by industry and type of research	Percentage of the ICT sector in GDP
High-tech patent applications to the EPO for the priority year (pat_ep_ntec)	Expenditures on research and development of enterprises (BERD) by type of economic activity and source of funding	Growth rates of 20% or more (since 2008, NACE Rev. 2)
ICT patent applications to the EPO for the priority year (pat_ep_nict)	Total internal R&D expenditure (GER) by efficiency sectors and NUTS 2 regions	GNP growth of the state due to high-tech industries
Biotechnological patent applications to the EPO for the priority year (pat_ep_nbio)	Number of scientific and technical staff at the national and regional levels	Number of patents per employee in R&D
Nanotechnology patent applications to the EPO for the priority year (pat_ep_nnano)	Total volume of scientific and technical staff and researchers by field of effectiveness, in % of total labor force and total employment and by sex	R&D costs per patent
Radio navigation with the help of patent applications for satellite communication to the EPO for the priority year (pat_ep_nrns)	The total number of GBAORD by financing method	
Patent applications for energy technologies to the EPO for the priority year (pat_ep_nrg)	Number of enterprises with innovative activity	
Application of energy technologies under the Patent Cooperation Treaty (PTA), which is intended for the EPO for the priority year (pat_ep_nrgpct)	Number of enterprises with innovative activity by size class	
Registered trademarks of the European Union (EUTM) per 1 billion GDP (ipr_tr_gdp)	Number of enterprises with innovative activity in the production sector by technology sectors	
Registered trademarks of the European Union (EUTM), per 1 million population (ipr_tr_pop)	The level of export intensity of innovative firms by size class	

Indicators for assessing information adaptability	Indicators for assessing innovative orientation	Indicators for assessing synergetic efficiency
Applications completed for registration of one or more Community (CD) designs up to the year of approval (ipr_da)	Circulation due to innovative products, according to NACE	
Community Programs (CD) (ipr_da_tot)	Intensity of innovation for NACE	
Financial activities via the Internet	The number of innovative enterprises, taking into account the importance of goals for NACE	
Frequency of mobile internet use	Factors that hinder innovative enterprises due to a serious delay of projects by class size	
Computer and Internet at enterprises	Number of innovative enterprises supported by the government to NACE	
Businesses – the level of access to the Internet	Products and technological innovations that hinder innovation	
Activities on the Internet – enterprises		
Integration of internal business processes	Organizational and marketing innovations	
Enterprises working in the field of ICT/IT specialists	Extremely important consequences of organizational innovations	
Single Digital Market – Promoting e-commerce for businesses	Venture capital investments in the HTEC sector	
Businesses connected to a broadband connection	Venture capital investment at the development stage	
Internet use and business activity	Employment in technology and spheres of knowledge at the National level in terms of education	
Fixed broadband connection – market share	HRST operates by categories, age, and activity of NACE	
Mobile communication – incomes	R&D expenditures in high technology industries	
Telecommunication services: investments (isoc_tc_inv)	Innovation in high technology (CIS 2008, CIS 2010, CIS 2012), EU Member States and separate countries	
Telecommunication services: circulation (isoc_tc_tur)	Personal qualities of doctoral students	
Expenditures on information technology in millions of euros and % of GDP (isoc_tc_ite)	Employment of doctoral students	

Indicators for assessing information adaptability	Indicators for assessing innovative orientation	Indicators for assessing synergetic efficiency
Market share in telecommunications (isoc_tc_msht)	Expenditure on research and development (BERD) of enterprises in the ICT sector, in % of total R&D expenditure on NACE activities	
Broadband connections penetration rate (isoc_tc_broad)	R&D staff in ICT sector, in % of total R&D for NACE	

Source: compiled by the authors based on data derived from World Information Society Report (2007), IDC (2018), International Telecommunication Union (2018), European Commission (2019), INSEAD, WIPO (2019), International Telecommunication Union (2019a, 2019b, 2019c, 2019d), The Economist Intelligence Unit (2019), The Good Country (2019), The World Bank (2019), UNCTAD (2019), UN Department of Economic and Social Development (2019), UNESCO (2019), United Nations (2019), World Economic Forum (2019a, 2019b), CIA World Factbook (2020), Destatis (2020), Eurostat (2020).

Zintegrowana ocena innowacyjnego rozwoju nowych państw członkowskich UE i innych krajów UE

W niniejszym opracowaniu poruszono problem szacowania różnych aspektów i cech jakościowych rozwoju innowacyjnego. Zaproponowano nowe podejście metodologiczne do kompleksowej oceny polistrukturalnego charakteru nowoczesnego rozwoju innowacyjnego w nowych państwach członkowskich UE i pozostałych państwach członkowskich UE. To pozwoliło na identyfikację punktów wzrostu i obiecujących obszarów umożliwiających zwiększanie ich innowacyjnego rozwoju. Przeanalizowano takie aspekty jak zdolność do absorpcji informacji, innowacyjna orientacja i efektywność synergii. Analiza opiera się na logicznej ocenie wskaźników charakteryzujących naukę, technologię i społeczeństwo cyfrowe w oparciu o dane dostępne publicznie, z których wybrano główne wskaźniki charakteryzujące te trzy aspekty innowacyjnego rozwoju UE. Według algorytmu metody macierzowej dla nowych państw członkowskich UE i pozostałych państw UE dla każdego wskaźnika wybrano wartość maksymalną (referencyjną) i obliczono współczynnik zgodności z wartością referencyjną danego wskaźnika. W efekcie obliczono zintegrowane wskaźniki oceny zdolności do absorpcji informacji, innowacyjnej orientacji i efektywności synergii oraz zintegrowany wskaźnik rozwoju innowacyjnego krajów UE, co pozwoliło na ich ocenę. Innowacyjny rozwój gospodarek krajów UE różni się znacznie w odniesieniu do niektórych wskaźników i aspektów. Ocena i porównanie rozwoju innowacyjnego na poziomie krajowym zależą od wielu czynników, ale są determinowane przede wszystkim polityką państwa i priorytetami danego kraju. Dlatego obiecującym kierunkiem zwiększania innowacyjności wszystkich krajów UE powinien być przede wszystkim dalszy rozwój wzajemnej wymiany technologii w oparciu o istniejący naukowo-techniczny potencjał integracji.

Słowa kluczowe: rozwój innowacyjny, zdolność do absorpcji informacji, innowacyjna orientacja, efektywność synergii, zintegrowany wskaźnik rozwoju innowacyjnego

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Integration of Ukraine to the Global Value Chains

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Abstract

The article considers the theoretical and methodological approaches to global value chains when measuring international trade. Global trends in the modern development of international trade are analysed, and the main challenges of international trade policy for Ukraine are characterised. It is established that the modern structure of the Ukrainian economy was formed under the influence of external factors. The authors propose that, over time, the influence of the global economy on the dynamics and structure of the Ukrainian economy will continually intensify. The prospects of Ukraine's integration into global value chains are examined, and the authors found that the structure of Ukrainian exports of goods coincides with the structure of world exports only partially. Ukrainian export of goods is characterised by a low share of highly processed industrial products and a high share of low value-added products, in particular, basic metals and agriculture and food industry products. The export of domestic high-tech goods is constantly decreasing compared to developed countries, and its share in the world export of high-tech goods is insignificant. To ensure the acceleration of GDP growth in Ukraine, it is important not only to increase exports, but also to increase the export of high-tech goods.

Keywords: international trade, integration, global value chains, export, import, high-tech goods

JEL: F15, F20, F29

Introduction

The characteristic feature of the stage of development of the current world economy is the existence of global production chains, which are the international trade in intermediate goods. A global value chain (GVC) is a sequence of interrelated types of activities on added value creation, located on at least two continents, or within two trading blocks, ensuring the production of a good or a service, from the idea for its creation to its delivery to the final consumer (Antras 2020; Yaroshuk and Ochrimenko 2020).

Global trade increasingly includes exports of parts, components, subsystems and services within the GVC and its associated production networks. This has led to a growing specialisation of companies related to specific tasks when producing final goods and services and an increase in international trade between different industry sectors. There has also been a dramatic increase in the international movement of goods between different structures of transnational corporations as a result of an active detailed, nodal distribution of labour. Consequently, this process has triggered rapid development in international production and supply chains. Undoubtedly, GVC is a positive product of globalisation, as it allows almost all countries to be included in the global economy, in turn, contributing to their socio-economic development.

As production systems become decentralised, fragmented and more specialised, new market opportunities arise for all types of companies, including small and medium-sized enterprises, to enter global markets and shift to export activity. It is more efficient through the specialisation.

GVCs provide significant opportunities for countries to expand exports. They allow enterprises to concentrate on specific components or activities where they have a competitive advantage, such as low cost or high quality. They can also develop and implement effective strategies for processing raw materials where they are already competitive. This could include processing cotton into textile yarn, fabric into clothing, round wood into furniture products, or supplying certain agricultural raw materials or semi-finished products. There are, therefore, many opportunities for co-operation – one has to know how to find them and occupy a niche in the market.

Within the GVC, higher-level buyers can provide access to know-how in technology, management, marketing, intermediate resources, and loans. However, to be competitive in the world of international business, enterprises must change the concept of their development and base it primarily on the efficiency of the entire GVC, i.e., the main goal of their activities should be to achieve systemic efficiency, not only their own.

Thus, the concept of a global value chain, based on the concept of value added,[1] allows us to research the different sectors of the world economy, studying their structure and the dynamics of participation of various economic entities involved in the production process. This approach is a useful tool for analysing global economic trends, as it allows us to track all the links between the different parts of geographically fragmented international production, determine the role of each participant and predict the consequences for a given country.

Both developed and developing countries participate in GVC. However, their level of involvement, positions in the stages of the production processes, the nature of activities and relationships with the other participants in GVC can differ significantly. A key role in organising fragmented international production is played by transnational corporations, whose countries of origin are mainly developed. When locating the distinct stages of the production process in different countries, they gain certain advantages due to the local differences in production costs, infrastructure, marketing, logistics, trade and investment regimes, and so on. Participating in GVCs can have both positive and negative effects for the recipient countries. It is of particular importance for the least developed countries, where effective involvement in global production processes is a prerequisite for national economic growth and overcoming unemployment and poverty. Therefore, it is vital for all countries to research the GVC and identify the prospects for participation in them. It is of particular importance for developing the countries' own economic strategy.

This article aims to provide a systematic analysis of trade activities and a rationale for promising areas to facilitate the integration of Ukraine's high-tech industries into global value chains.

The theoretical and methodological basis of the research consists of scientific work and methodological research of leading Ukrainian and foreign scientists. The research on scientific problems related to Ukraine's integration into global value chains was conducted using critical and scientific analysis, methods of scientific generalisation and systematisation, mathematical statistics and graphical tools, and analysis of the Ukrainian and international external economic activity dynamics. The results, conclusions and recommendations are substantiated based on an integrated approach.

Theoretical concepts for measuring global value chains in international trade

The concept of the value chain was introduced by Porter in the context of the competitive advantages research. His fundamental works (Porter 1985, 1990) provide two important principles for the value chain concept. First, it distinguishes between the stag-

1 Value added is the value that the firm has added to the purchased raw materials and materials with its factors of production, i.e., it is the firm's net contribution to the creation of the commodity.

es of the production process, in particular, input logistics for supply, the activities of the firm, output logistics, and sales and auxiliary services. Secondly, he investigated how value is created in a multiple links system (Porter 1990). From these two perspectives, Porter lays down the basic theory, which explains why certain enterprises are efficient. In his view, the performance of enterprises depends on how they manage their delivery links, how they are included in the overall structure of the value chain, and how well they are organised and able to maintain competitiveness in the entire chain. Consequently, the development of an enterprise and an industry is determined by, among other factors, the industrial structure and organisation.

Based on empirical research in the garment, footwear and automotive industries, Gereffi et al. (2001) developed the concept of global value chains. They paid attention to the value chain governance structures and the conditions for suppliers to participate and modernise their industries as value chains become more open to trade and foreign direct investment. Modernisation methods include product modernisation, process modernisation, functional modernisation and cross-sectoral modernisation. One of the main arguments often put forward in discussions about the GVC is that certain global players are powerful enough to impose contractual terms. Suppliers whose products are easier to produce or whom major buyers can substitute, and producers who depend on suppliers of complex modern resources and technologies that are difficult to buy abroad, are generally forced to accept the imposed contractual terms. Consequently, the major players maintain a greater share of the value added through ownership of well-established brands, proprietary technologies, or access to exclusive information in various raw material and product markets.

Freeman (1987) and Nelson and Winter (1982) demonstrated that the competitiveness of a national industry is based on the structure and efficiency indicators of national innovation systems. Striking examples include the automotive and information technology industries in Japan (Freeman 1987). The approach based on innovation systems is not directly related to the study of value chains. Nevertheless, it assumes that access to knowledge and technology, and thus systemic competitiveness, depends on enterprises' access to innovation, and accordingly on the engagement of actors in value chains, which entails technological modernisation, research, development and training. Those who cannot keep up with the technological developments can benefit from the investments of previous innovators, copying, adapting and improving innovations for their own purposes.

A useful theoretical analysis of the formation of global value chains is considered in the works of Antràs, Garicano, and Rossi-Hansberg (2008), and others. Grossman and Rossi-Hansberg (2012) suggested the term "trade in tasks", which characterises the distribution of production functions into separate pieces. They created the model of a fragmented production where every country fulfils one function in the production and sale of the good.

An important problem in keeping track of economic statistics is assessing the contribution of each country's value added to the total value added in international trade

flows. As experts argue, international trade statistics today most often provide a distorted picture of trade's impact on the economy: "...what you see is not what you get". This is related to the globalisation of production and reflects that the value of products that cross borders several times for further processing is accordingly being accounted several times (Maurer and Degain 2010). UNCTAD estimates that about 28% of world exports are intermediate goods that have been included several times in the value of exports at different stages of production in different countries. This problem, in turn, generates new problems, namely that it is impossible to estimate real imbalances in trade between countries, real exchange rates, and to make a realistic assessment of other important international trade indicators and aspects of international economic relations. For this reason, research into the measurement of global value chains in international trade is being carried out today mainly in two directions: 1) "cleaning up" the trade statistics from double counting, isolating value added flows; 2) decomposing the aggregate trade flows into components according to the national origin and purpose of value added (Motorin and Prychodko 2015).

The fragmentation of production processes through international co-operation has led to the emergence of borderless production systems. They exist in the form of sequential chains or complex networks, which can be global, regional or involving only two countries. Because of this, an objective question arises, as to how to isolate the contribution of each country involved in the production of value-added products. There are three main approaches to address this task. The first is based on the fact that research is conducted either on specific products or on individual export-oriented enterprises. However, when using this approach in the research process, it is difficult to trace the entire chain of intermediate suppliers. The second approach is based on estimating the international trade in goods of intermediate demand. However, this approach leaves domestic transactions in these goods outside the scope of the study, which may significantly distort the results of the estimates. The third approach is based on developing "cost-output" tables and their international modification, where cross-border trade flows are decomposed into components similar to transactions between the industries and final consumers within the domestic economy. This is the most appropriate approach, but it also has disadvantages in terms of the quality of international statistics and the possibility to isolate the user's import by consuming industries (Daudin, Rifflart, and Schweisguth 2011). According to the Organisation for Economic Co-operation and Development (OECD 2013), this issue is both relevant and requires the development of new trade statistics to complement existing ones. The very nature of the problem requires a coordinated international approach to build a database and methodology based on official statistics that are widely accepted and approved.

In general, studying GVC involves analysing the following elements: the structure of the "cost-output" system, which describes the process of converting raw materials into final products; geographical features of the processes distribution within the framework of GVC; management structure, which shows how the control and man-

agement of GVC is carried out; the institutional environment where the GVC is located (Maruschak 2017, p. 31).

Quantitative indicators that characterise the scale, depth and length of the chain, as well as the level of participation and relative positions of countries in the chain, are important when studying GVCs. One way of assessing such participation, which was developed earlier in the academic literature, is to calculate the share of vertical specialisation, which can be interpreted as the import component of export. At the same time, the value of imported components used in the production of export products and the value of export added abroad are differrent concepts, since imports may include the value added in the domestic economy. The international "cost-output" matrix developed by the OECD allows the calculation of the value added that is returned to the domestic economy as part of foreign components. Based on this matrix, a global "cost-output" database has been created. It includes annual international inter-industry "cost-output" matrices covering 55 countries – 34 OECD countries and 21 non-member countries, as well as a separate category of "other countries of the world" (Kravcova 2016, p. 41). Ukraine is not included in the list of countries. Thus, a synthesis of existing ideas, methodologies and approaches to analysing global value chains and forming a comprehensive theoretical approach to their study is relevant.

Global trends in the modern development of international trade and trade policy: challenges for Ukraine

The Ukrainian economy is quite open in terms of the goods and services export ratio to GDP, although it does not among the most open economies in the world. In general, the openness of Ukraine's economy in terms of the foreign trade to GDP ratio exceeds the world average. Under such conditions, Ukraine's economic development depends significantly on the state of the world economic situation, including the dynamics and scale of changes taking place.

In turn, the dynamics, content and scope of international economic interactions today are determined by global development trends, which reflect profound transformations in almost all the spheres of society, and the speed of the relevant changes is constantly increasing. In this context the following processes are particularly important (IER 2016, p. 11): the digitalisation of all spheres of life; technological innovations; increasing interdependence between firms, countries, markets and geographical regions; "rebalancing" the world economy; globalisation, which significantly changes the business environment, regardless of its size and degree of internationalisation; the intensive and dynamic development of international system to regulate economic relations, which includes international economic organisations, international agreements, consultations, etc.; the growing importance of healthcare in the economy. The COVID–19 crisis also raised the issue of international trade security, as restrictions on internation-

al value chains may have contributed to economic downturns during the crisis (Fortunato 2020; GTIPA 2021). In general, these processes affect the nature and features of international economic co-operation in one way or another.

As for the international trade in goods and services directly, today, experts highlight several important qualitative changes (IER 2016, p. 13–14): the increase in the number of regional agreements; the search for agreements on trade in goods that until recently were not allocated to a separate group (i.e., so-called environmentally friendly goods); the search for agreements to deepen or complement the acting agreements within the WTO framework; the rapid development of technology has significantly reduced transport, communication and the other costs; the liberalisation of cross-border movement of goods, services, capital and labour; the dynamic development of international trade in technologies and high-tech goods, which are the material embodiment of new technologies; the development of e-commerce is a factor that determines today the dynamics and structure of international trade in general and the peculiarities of export-import operations in particular.

The current structure of the Ukrainian economy has been shaped by external factors. This means that the government and businesses must react promptly and appropriately to new global economic and political challenges. At the same time, the development of the domestic market as an alternative to international markets is virtually impossible today without exploiting the opportunities offered by the global market for goods, services, capital and labour.

In fact, the main goal of export development should ultimately be to secure employment and income, and to increase the efficiency of national production. In a substantial sense, exports and export promotion policies should become a factor and a tool for modernising Ukraine's economy. In other words, it is a question of making the presence of Ukrainian producers and service providers a factor in the country's economic development.

Identifying the prospects for Ukraine's integration into global value chains

The leading long-term trend in the development of Ukrainian exports is a decrease in the share of CIS countries and a simultaneous increase in the share of EU countries (Figure 1).

This reorientation is primarily due to global economic processes and structural changes in international markets. The mode of goods or services supply and the particularities of the market structure also influence the geographical structure.

In 2019, the share of exports of goods and services to CIS countries decreased by 12.3 percentage points compared to the same period in 2010. At the same time, the share of exports of goods and services to the EU increased from 25.8% in 2010

to 37.3% in 2019. The share of exports of goods and services to other countries increased by 0.4 percentage points over the same period.
When analysing the exports of goods separately, a similar trend can be observed. In particular, the share of exports to CIS countries in 2019 was 13.5%, which was 22.9 percentage points less compared to 2010. The share of Ukrainian goods exports to the EU increased by almost 1.3 times over the period 2010–2019, and to other countries by 2.6 percentage points.

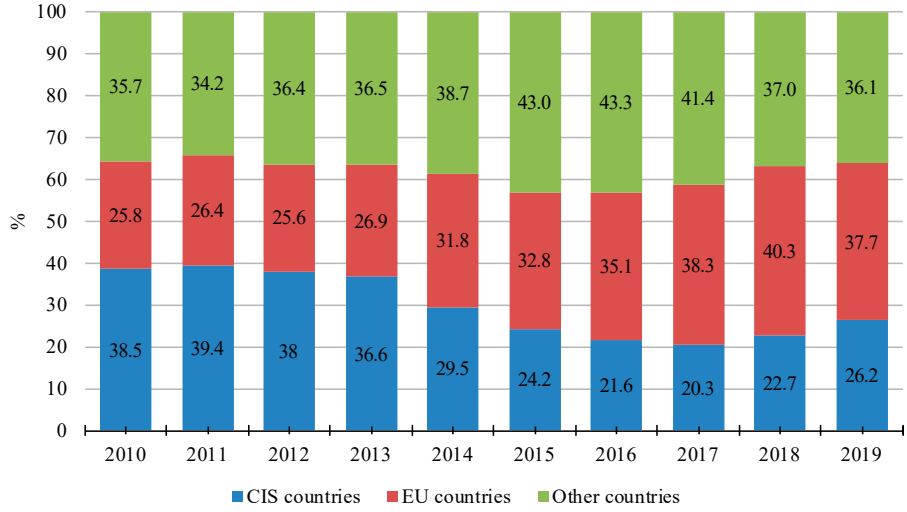

Figure 1. Geographical structure of exports of goods and services from Ukraine, 2010–2019 years, (%)
Source: calculated according to the data of State Statistics Service of Ukraine.[2]

In 2019, the share of services exports to CIS countries decreased by 5.9 percentage points compared to the same period in 2010. The share of services exports to EU countries increased from 27.4% to 28.6% during 2010–2019. The share of services exports to other countries increased by 4.7 percentage points over the same period.

The structure of exports of goods and services of any country is shaped both by the international demand for the corresponding goods and services and by the level and specifics of the national economic development. The structure of Ukrainian exports of goods partially coincides with the structure of world exports.

While electrical machinery (on average 13.3%), mechanical machines, nuclear boilers (on average 11.6%), and vehicles (on average 7.7%) dominated world exports in the period 2010–2019, the share of electrical machinery in Ukrainian exports during the same period was on average 5.3%, i.e., 2.5 times less than the world average. The share of mechanical machines and nuclear boilers (4.9% on average) is 2.4 times

2 Ukraine's Foreign Trade in Goods and Services in 2014. State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua); Ukraine's Foreign Trade in Goods and Services in 2018. State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua). Geographical structure of Ukraine's foreign trade in goods in 2018–2019 (retrieved from http://www.ukrstat.gov.ua) (accessed: 24.12.2021).

smaller, while he share of vehicles (0.6% on average) is 12.8 times smaller. At the same time, the share of Ukrainian exports of base metals and their products is high (18.3% on average in 2010–2019), which is 8.3 times more than the world total.

A significant share of Ukrainian exports during the period 2010–2019 was of products of plant origin, which ranged from 4.8% in 2010 to 19.3% in 2019, which is 20.8 times higher on average than the global indicator. Ukrainian fats and oils accounted for an average of 7.8% of domestic exports during 2010–2019. Overall, the growth rate of Ukrainian exports of agricultural, food and ore products outpaced the global rate, indicating fairly stable global demand and the resilience of these sectors to crises in the economy.

The above shows that Ukrainian exports are characterised by a low share of highly processed industrial products and a high share of low value-added products, in particular, metallurgical products, agriculture, and food industry products. At the same time, Ukraine holds leading positions in the world in terms of certain goods exports. In particular, the share of Ukrainian grain exports increased from 4.8% in 2010 to 19.3 in 2019, the share of fat and vegetable oil exports increased from 5.1% to 9.5%, and ore from 5.0% to 7.2%.

There were 20 main partner countries in 2010–2019, which accounted for between 68.5% in 2010 and 70% in 2019 of domestic exports (Table 1).

During 2010–2019, the structure of Ukrainian services exports was strongly dominated by transport services (62.5% on average), telecommunication, computer and information services (11.5% on average), services in the processing of material resources (10.5% on average) and business services (8.0% on average).

Table 1. The main partner countries in the export of goods, 2011–2019, (%)

Country	2011	2012	2013	2014	2015	2016	2017	2018	2019
Austria	0.9	0.8	0.9	1.0	0.9	1.0	1.2	1.2	1.2
Belarus	2.8	3.3	3.1	3.0	2.3	2.5	2.6	2.8	3.1
China	3.2	2.6	4.3	5.0	6.3	5.0	4.7	4.6	4.0
Czech Republic	1.2	1.0	1.3	1.4	1.4	1.5	1.7	1.9	1.8
Egypt	2.0	4.2	4.4	5.3	5.5	6.2	4.2	3.3	4.5
Germany	2.6	2.4	2.5	3.0	3.5	3.9	4.1	4.7	4.8
Hungary	2.0	2.2	2.5	2.8	2.4	2.9	3.1	3.5	3.1
India	3.3	3.3	3.1	3.4	3.8	5.2	5.1	4.6	4.0
Iran	1.6	1.7	1.3	1.3	1.4	1.9	1.3	0.9	1.2
Israel	0.7	1.2	1.1	1.1	1.6	1.3	1.4	1.2	1.2
Italy	4.4	3.6	3.7	4.6	5.2	5.3	5.7	5.6	4.8
Moldova	1.3	1.2	1.4	1.4	1.4	1.3	1.6	1.7	1.5
Netherlands	1.2	1.2	1.7	2.1	2.4	2.7	3.9	3.4	3.7
Poland	1.2	3.7	4.1	4.9	5.2	6.1	6.3	6.9	6.6
Romania	1.4	0.8	0.9	1.1	1.5	2.0	1.9	2.0	2.0
Russia	29.0	25.6	23.7	18.2	12.7	9.9	9.1	7.7	6.5
Slovakia	1.2	1.0	1.2	1.2	1.2	1.3	1.5	1.8	1.4

Country	2011	2012	2013	2014	2015	2016	2017	2018	2019
Spain	1.4	2.2	1.6	2.2	2.7	2.8	2.9	2.9	3.0
Turkey	5.5	5.4	6.0	6.6	7.3	5.6	5.8	5.0	5.2
United States of America	1.6	1.5	1.4	1.2	1.3	1.2	1.9	2.3	2.0

Source: calculated according to the data of State Statistics Service of Ukraine.[3]

Although the average share of exports of domestic transport services is 3 times higher than the global average, their share in the global structure was only 0.7%. The share of domestic exports of telecommunication, computer and information services in the global structure of these services exports was 0.3% during 2010–2019. The share of domestic exports of services in the processing of material resources was on average 5.0 times higher than the global average. At the same time, the share of domestic exports of business services was on average 2.6 times lower than the global average. Also, the average share of domestic exports of travel-related services in the global structure of services exports is quite low – only 0.02% of their global exports.

Analysis of the domestic economy export orientation shows that between 2013 and 2019, on average, about 19.6% of goods and services produced in Ukraine were exported (Table 2). The metallurgy industry was the most export-oriented during this period – its export quota averaged 63.4%.

The following sectors of the domestic economy also have significant export shares: machinery and equipment production – 59.1%, on average; computer programming – 50.3%, on average; metal ore mining – 47.4%, on average; electrical equipment production – 45.6%, on average; transport and warehousing – 36.5%, on average; timber and paper production – 32.5%; postal and courier operations – 32.1%, on average; agriculture, forestry and fishing – 28.8%, on average. The lowest export quota between 2013 and 2019 was in the provision of public administration services and education – on average 0.1% and 0.4%, respectively, which are predominantly domestically oriented.

Table2. Export orientation of the national economy sectors, 2013–2019, (%) (share of export in the total output of the industry)

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Total	***19.9***	***22.9***	***21.0***	***19.6***	***19.3***	***18.1***	***16.7***
Manufacture of basic metals	66.7	71.4	69.8	60.4	59.8	60.4	55.5
Mining of metal ores	44.5	50.4	53.5	45.6	47.5	44.7	45.4
Computer programming	41.6	50.7	58.6	53.3	52.8	51.1	44.3
Postal and courier activities	0.0	20.3	37.2	32.2	44.6	51.9	38.6
Manufacture of machinery and equipment, not elsewhere classified	71.7	86.8	70.8	54.0	48.8	43.7	38.1
Manufacture of electrical equipment	65.8	59.0	42.7	38.0	37.9	38.1	37.4
Agriculture, forestry and fishing	23.1	28.1	29.0	29.1	30.3	27.9	34.3

3 Ukraine's Foreign Trade in Goods and Services in 2014; 2016; 2018; 2019. State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 25.12.2021).

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Manufacture of wood, paper	31.9	35.0	33.5	32.2	33.5	32.4	28.7
Transport, warehousing	32.3	44.0	38.7	41.1	38.3	32.7	28.5
Manufacture of chemicals	57.9	59.9	33.8	26.8	27.3	29.0	22.3
Manufacture of food products	25.7	30.8	23.0	24.5	25.2	23.8	22.2
Research and development	27.5	28.6	34.7	31.1	29.7	19.2	21.8
Manufacture of other transport equipment	40.6	42.5	35.6	31.4	13.6	13.6	21.6
Manufacture of furniture	30.6	33.8	28.8	26.4	25.8	23.3	20.7
Manufacture of textiles	70.9	52.4	19.1	18.8	21.1	21.7	19.5
Manufacture of motor vehicles	65.3	49.8	18.8	17.6	15.6	17.0	16.0
Manufacture of computers	69.2	64.2	25.6	21.1	17.8	15.4	14.9
Manufacture of rubber and plastic products	19.0	19.4	14.3	13.2	14.4	14.7	14.2
Manufacture of fabricated metal products	25.4	33.7	24.3	18.9	18.4	16.5	14.1
Other services	16.6	14.9	16.3	14.8	12.1	13.9	12.8
Legal and accounting activities	13.1	18.1	20.0	15.8	13.7	15.9	11.4
Advertising	8.7	9.6	10.9	10.0	11.5	9.3	9.7
Accommodation and catering	54.4	22.0	14.2	13.5	14.3	12.4	9.4
Manufacture of refined petroleum products	28.6	24.5	7.0	6.2	7.1	7.7	8.4
Administrative services	6.6	11.8	12.3	10.3	10.7	9.5	8.0
Arts, sports, entertainment and recreation	13.1	7.5	8.6	8.9	10.8	8.4	7.5
Manufacture of other non-metallic mineral products	12.6	14.6	11.7	9.2	9.0	8.8	7.2
Manufacture of basic pharmaceutical products	19.0	19.9	7.6	7.5	7.7	7.5	6.5
Telecommunications	14.3	16.5	18.7	15.1	12.6	11.0	6.0
Water supply	3.5	3.6	4.0	4.0	4.2	3.9	3.4
Manufacture of coke and coke products	13.8	11.0	5.9	4.5	4.6	4.2	3.1
Oil and gas extraction	7.0	6.0	3.2	2.7	3.4	3.0	2.9
Electricity supply	4.1	4.6	4.2	2.2	2.8	3.0	2.9
Publishing	3.4	4.3	4.2	3.3	2.8	3.5	3.0
Financial and insurance activities	3.3	2.5	4.2	2.7	2.1	2.5	2.3
Construction	1.3	1.5	3.2	1.8	0.7	0.9	0.5
Real estate activities	1.8	0.6	0.3	0.6	0.6	0.5	0.5
Healthcare	0.7	0.4	0.4	0.5	0.4	0.4	0.4
Public administration and defence	0.3	0.3	0.6	0.5	0.5	0.2	0.2
Education	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Mining of coal	11.7	20.3	2.7	1.9	3.2	0.2	0.0

Source: calculated according to the data of State Statistics Service of Ukraine.[4]

Analysing trade in terms of value added allows an assessment of exports in a dimension comparable to GDP, and hence a better understanding of the role of exports in the structure of the national economy.

Comparing exports in terms of gross output and value added shows that during 2013–2019, the share of services was traditionally lower (34.3% of output against

4 Input-Output table for 2013–2019 (at consumer prices). State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 26.12.2021).

37.8% of value added), while the share of manufacturing was on average higher (65.7% of output against 62.2% of value added) (see Table 3 & Table 4).

Table 3. Share in value added export by industry, 2013–2019, (%)

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Agriculture, forestry and fishing	15.8	18.9	24.7	25.5	24.1	23.7	26.8
Mining of coal and lignite	1.4	1.0	0.1	0.1	0.2	0.0	0.0
Extraction of crude petroleum and natural gas	0.7	0.6	0.5	0.6	0.7	0.7	0.6
Mining of metal ores	9.2	9.0	8.0	7.1	8.7	8.8	9.2
Manufacture of food products; beverages and tobacco products	6.1	7.3	6.1	7.0	6.9	6.2	5.8
Manufacture of textiles, wearing apparel, leather and related products	2.5	1.7	0.7	0.8	0.9	1.0	0.9
Manufacture of wood, paper, printing and reproduction	1.6	1.8	1.9	2.0	2.1	2.2	1.9
Manufacture of coke	0.2	0.1	0.1	0.1	0.1	0.1	0.0
Manufacture of refined petroleum products	0.4	0.4	0.1	0.1	0.1	0.1	0.1
Manufacture of chemicals and chemical products	1.7	1.5	1.0	0.7	0.6	0.7	0.5
Manufacture of basic pharmaceutical products and pharmaceuticals	0.3	0.4	0.2	0.2	0.2	0.2	0.2
Manufacture of rubber and plastic products	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Manufacture of other non-metallic mineral products	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Manufacture of basic metals	5.9	10.3	9.5	8.7	9.1	9.8	7.2
Manufacture of fabricated metal products, except machinery and equipment	0.8	0.8	0.7	0.6	0.6	0.7	0.6
Manufacture of computer, electronic and optical products	0.8	0.6	0.2	0.3	0.2	0.2	0.2
Manufacture of electrical equipment	2.2	1.7	1.1	1.0	1.1	1.3	1.1
Manufacture of machinery and equipment, not elsewhere classified	4.6	4.2	3.3	2.9	2.6	2.4	2.2
Manufacture of motor vehicles, trailers and semi-trailers	1.0	0.7	0.2	0.2	0.2	0.3	0.2
Manufacture of other transport equipment	4.3	2.1	1.4	1.2	0.7	0.6	1.0
Manufacture of furniture; other goods; repair and installation of machinery and equipment	1.9	1.8	1.6	1.6	1.8	1.7	1.8
Electricity, gas, steam and air conditioning supply	0.9	0.9	0.8	0.5	0.6	0.8	0.8
Water supply; sewerage, waste management and remediation activities	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Construction	0.3	0.2	0.4	0.3	0.1	0.2	0.1

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Transport, warehousing	17.9	18.1	18.1	19.7	18.8	17.2	16.3
Postal and courier activities	0.0	0.2	0.4	0.4	0.4	0.5	0.4
Accommodation and catering	3.3	0.9	0.6	0.7	0.7	0.7	0.7
Publishing	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Telecommunications	1.8	1.6	1.9	1.4	1.1	1.0	0.5
Computer programming, consultancy, and information service activities	3.8	5.0	7.8	8.5	9.3	10.7	12.2
Financial and insurance activities	1.2	0.8	1.0	0.6	0.5	0.6	0.6
Real estate operations	0.9	0.2	0.2	0.3	0.3	0.3	0.3
Legal and accounting activities	1.5	1.4	1.6	1.5	1.5	1.9	2.0
Research and development	1.6	1.5	1.7	1.3	1.3	1.0	0.9
Advertising and market research	0.7	0.6	0.8	0.8	0.8	0.9	0.9
Administrative and support service activities	0.6	0.9	0.9	1.0	1.0	1.1	1.1
Public administration and defence; compulsory social security	0.1	0.1	0.2	0.2	0.2	0.1	0.1
Education	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Healthcare and social work	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Arts, sports, entertainment and recreation	0.9	0.4	0.4	0.4	0.5	0.4	0.4
Other services	1.2	0.9	0.8	0.8	0.7	0.9	1.1
Total	41.9	41.2	33.9	33.6	33.9	33.9	34.8

Source: calculated according to the data of State Statistics Service of Ukraine.[5]

Table 4. Share in gross output export by industry, 2013–2019, (%)

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Agriculture, forestry and fishing	15.8	18.9	21.3	21.8	20.3	19.9	23.0
Mining of coal and lignite	1.4	1.0	0.1	0.1	0.2	0.0	0.0
Extraction of crude petroleum and natural gas	0.7	0.6	0.5	0.5	0.7	0.6	0.5
Mining of metal ores	9.2	9.0	6.8	6.0	7.1	7.3	7.7
Manufacture of food products; beverages and tobacco products	6.1	7.3	11.2	13.8	14.8	13.9	12.9
Manufacture of textiles, wearing apparel, leather and related products	2.5	1.7	1.3	1.4	1.5	1.6	1.5
Manufacture of wood, paper, printing and reproduction	1.6	1.8	2.0	2.1	2.2	2.3	2.0
Manufacture of coke	0.2	0.1	0.1	0.0	0.1	0.0	0.0
Manufacture of refined petroleum products	0.4	0.4	0.6	0.5	0.6	0.6	0.6

5 Input-Output table for 2013–2019 (at consumer prices). State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 26.12.2021).

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Manufacture of chemicals and chemical products	1.7	1.5	2.0	1.3	1.4	1.5	1.1
Manufacture of basic pharmaceutical products and pharmaceuticals	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Manufacture of rubber and plastic products	0.4	0.3	0.4	0.4	0.4	0.4	0.3
Manufacture of other non-metallic mineral products	0.5	0.4	0.5	0.4	0.4	0.5	0.4
Manufacture of basic metals	5.9	10.3	8.2	7.7	7.6	8.2	6.2
Manufacture of fabricated metal products, except machinery and equipment	0.8	0.8	0.8	0.6	0.7	0.7	0.6
Manufacture of computer, electronic and optical products	0.8	0.6	0.6	0.6	0.6	0.5	0.5
Manufacture of electrical equipment	2.2	1.7	1.5	1.3	1.7	1.8	1.7
Manufacture of machinery and equipment, not elsewhere classified	4.6	4.2	3.7	3.1	3.0	2.8	2.6
Manufacture of motor vehicles, trailers and semi-trailers	1.0	0.7	1.0	1.1	0.7	0.9	0.8
Manufacture of other transport equipment	4.3	2.1	1.3	1.2	0.7	0.8	1.3
Manufacture of furniture; other goods; repair and installation of machinery and equipment	1.9	1.8	1.7	1.7	1.9	1.8	1.9
Electricity, gas, steam and air conditioning supply	0.9	0.9	0.8	0.5	0.6	0.7	0.7
Water supply; sewerage, waste management and remediation activities	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Construction	0.3	0.2	0.4	0.3	0.1	0.2	0.1
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.2	0.2	0.2	0.1	0.2	0.2	0.2
Transport, warehousing	17.9	18.1	16.3	17.2	16.2	15.0	14.3
Postal and courier activities	0.0	0.2	0.4	0.3	0.4	0.4	0.4
Accommodation and catering	3.3	0.9	0.6	0.6	0.6	0.7	0.6
Publishing	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Telecommunications	1.8	1.6	1.9	1.4	1.1	1.0	0.5
Computer programming, consultancy, and information service activities	3.8	5.0	6.6	7.2	7.8	9.0	10.4
Financial and insurance activities	1.2	0.8	0.9	0.5	0.4	0.5	0.5
Real estate operations	0.9	0.2	0.1	0.2	0.2	0.3	0.2
Legal and accounting activities	1.5	1.4	1.3	1.3	1.3	1.6	1.7
Research and development	1.6	1.5	1.5	1.1	1.1	0.9	0.8
Advertising and market research	0.7	0.6	0.7	0.7	0.7	0.8	0.8
Administrative and support service activities	0.6	0.9	0.9	0.9	0.9	1.0	1.0
Public administration and defence; compulsory social security	0.1	0.1	0.2	0.2	0.2	0.1	0.1

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Education	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Healthcare and social work	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Arts, sports, entertainment and recreation	0.9	0.4	0.3	0.3	0.4	0.3	0.3
Other services	1.2	0.9	0.7	0.7	0.6	0.8	0.9
Total	41.9	41.2	39.9	39.7	40.1	40.0	40.5

Source: calculated according to the data of State Statistics Service of Ukraine.[6]

Among the branches of the processing industry where the average share in exports of output prevailed over the average share in exports of value added during 2013–2019, we can see the following:

- manufacture of food products; beverages and tobacco products – 11.5% and 6.5% respectively;
- manufacture of machinery and equipment not included in other groups – 3.4 and 3.2%, respectively;
- manufacture of furniture, other products, and installation of machinery and equipment – 1.8 and 1.7% respectively;
- manufacture of electrical equipment – 1.7 and 1.4%, respectively;
- manufacture of textiles, clothing, leather and other materials – 1.6 and 1.2%, respectively;
- manufacture of chemicals and chemical products – 1.5 and 0.9%, respectively;
- manufacture of refined petroleum products 0.5 and 0.2%, respectively.

The processing industries where the average share in exports of value added prevailed over the average share in exports of gross output during the period include:

- agriculture, forestry and fisheries – 22.8% of value added against 20.2% of gross output;
- extractive industry – 8.6% of value added against 7.6% of gross output.

In the services sector, the sectors in which the average share of value added exports between 2013 and 2019 prevailed over the average share of gross output exports are: transport, warehousing (18.0% and 16.4%, respectively); computer programming, consulting and information services (8.2% and 7.1%, respectively); activities in the areas of law and accounting, head office activities, management consulting, architectural and engineering activities, technical testing and research (1.6% and 1.5%, respectively); research, scientific and technical activities (1.3% and 1.2%, respectively); temporary accommodation and catering (1.1% and 1.0%, respectively); administrative and support services activities (0.9% and 0.8%, respectively); provision of other services (0.9% and 0.8%, respectively); other services (0.9% and 0.8%, respectively); advertising and market research, veterinary activities (0.8% and 0.7%, respectively); financial and insurance activities (0.7% and 0.6%, respectively); art, sport, entertainment

6 Input-Output table for 2013–2019 (at consumer prices). State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 26.12.2021).

and recreation (0.5% and 0.4%, respectively); real estate transactions (0.3% and 0.2%, respectively).

Among these industries, the two sectors with the highest average share of value added exports were transport and warehousing (18.0%) and computer programming, consulting and information services (8.2%).

In order to ensure accelerated GDP growth, it is important not just to increase exports, but to increase exports of goods and services that provide higher value added growth. In terms of this indicator, the most important export sectors are agriculture, forestry and fisheries (on average 22.8% of exports in value added); transport and warehousing (on average 18% of exports in value added) and computer programming, consulting and information services (on average 8.2% of exports in value added). The products of the metallurgical industry (on average 8.6% in exports of value added) and food, beverage and tobacco production (on average 6.5% in exports of value added) should also be added to this list.

During 2013–2019, the content of imported raw materials in export products averaged 19.6% (Table 5). That is exactly the indicator that shows the level of the economy's integration into global value chains.

Table 5. The content of imported raw materials and components in export products by sector, 2013–2019, (%)

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Agriculture, forestry and fishing	23.1	28.1	29.0	29.1	30.3	27.9	34.3
Mining of coal and lignite	11.7	20.3	2.7	1.9	3.2	0.2	0.0
Extraction of crude petroleum and natural gas	7.0	6.0	3.2	2.7	3.4	3.0	2.9
Mining of metal ores	44.5	50.4	53.5	45.6	47.5	44.7	45.4
Manufacture of food products; beverages and tobacco products	25.7	30.8	23.0	24.5	25.2	23.8	22.2
Manufacture of textiles, wearing apparel, leather and related products	70.9	52.4	19.1	18.8	21.1	21.7	19.5
Manufacture of wood, paper, printing and reproduction	31.9	35.0	33.5	32.2	33.5	32.4	28.7
Manufacture of coke	13.8	11.0	5.9	4.5	4.6	4.2	3.1
Manufacture of refined petroleum products	28.6	24.5	7.0	6.2	7.1	7.7	8.4
Manufacture of chemicals and chemical products	57.9	59.9	33.8	26.8	27.3	29.0	22.3
Manufacture of basic pharmaceutical products and pharmaceuticals	19.0	19.9	7.6	7.5	7.7	7.5	6.5
Manufacture of rubber and plastic products	19.0	19.4	14.3	13.2	14.4	14.7	14.2
Manufacture of other non-metallic mineral products	12.6	14.6	11.7	9.2	9.0	8.8	7.2
Manufacture of basic metals	66.7	71.4	69.8	60.4	59.8	60.4	55.5
Manufacture of fabricated metal products, except machinery and equipment	25.4	33.7	24.3	18.9	18.4	16.5	14.1

Type of economic activity	2013	2014	2015	2016	2017	2018	2019
Manufacture of computer, electronic and optical products	69.2	64.2	25.6	21.1	17.8	15.4	14.9
Manufacture of electrical equipment	65.8	59.0	42.7	38.0	37.9	38.1	37.4
Manufacture of machinery and equipment, not elsewhere classified	71.7	86.8	70.8	54.0	48.8	43.7	38.1
Manufacture of motor vehicles, trailers and semi-trailers	65.3	49.8	18.8	17.6	15.6	17.0	16.0
Manufacture of other transport equipment	40.6	42.5	35.6	31.4	13.6	13.6	21.6
Manufacture of furniture; other goods; repair and installation of machinery and equipment	30.6	33.8	28.8	26.4	25.8	23.3	20.7
Electricity, gas, steam and air conditioning supply	4.1	4.6	4.2	2.2	2.8	3.0	2.9
Water supply; sewerage, waste management and remediation activities	3.5	3.6	4.0	4.0	4.2	3.9	3.4
Construction	1.3	1.5	3.2	1.8	0.7	0.9	0.5
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Transport, warehousing	32.3	44.0	38.7	41.1	38.3	32.7	28.5
Postal and courier activities	0.0	20.3	37.2	32.2	44.6	51.9	38.6
Accommodation and catering	54.4	22.0	14.2	13.5	14.3	12.4	9.4
Publishing	3.4	4.3	4.2	3.3	2.8	3.5	3.0
Telecommunications	14.3	16.5	18.7	15.1	12.6	11.0	6.0
Computer programming, consultancy, and information service activities	41.6	50.7	58.6	53.3	52.8	51.1	44.3
Financial and insurance activities	3.3	2.5	4.2	2.7	2.1	2.5	2.3
Real estate operations	1.8	0.6	0.3	0.6	0.6	0.5	0.5
Legal and accounting activities	13.1	18.1	20.0	15.8	13.7	15.9	11.4
Research and development	27.5	28.6	34.7	31.1	29.7	19.2	21.8
Advertising and market research	8.7	9.6	10.9	10.0	11.5	9.3	9.7
Administrative and support service activities	6.6	11.8	12.3	10.3	10.7	9.5	8.0
Public administration and defence; compulsory social security	0.3	0.3	0.6	0.5	0.5	0.2	0.2
Education	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Healthcare and social work	0.7	0.4	0.4	0.5	0.4	0.4	0.4
Arts, sports, entertainment and recreation	13.1	7.5	8.6	8.9	10.8	8.4	7.5
Other services	16.6	14.9	16.3	14.8	12.1	13.9	12.8
Total	***19.9***	***22.9***	***21.0***	***19.6***	***19.3***	***18.1***	***16.7***

Source: calculated according to the data of State Statistics Service of Ukraine.[7]

The reorientation of the Ukrainian economy is increasingly a question of reducing foreign trade in commodities and focusing on exports in high-tech goods. This trend

7 Input-Output table for 2013–2019 (at consumer prices). State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 26.12.2021).

will contribute to building Ukraine's export capacity and ensuring an innovative model of national economic development.

Officially, Ukraine does not have a list of high-tech goods in accordance with the UCCFT. Consequently, there is a problem in calculating a single correct value for the volume of high-tech products export. This causes difficulties in determining this indicator and also generates different values for its share in the structure of exports in goods. This situation arises because the Ukrainian legislation equates knowledge-intensive technology with high technology, but not all of them are as such.

The Secretariat of the OECD developed the Standard International Trade Classification based on the product approach, according to which, the following groups of goods are classified as high-tech: aerospace products; computer and office equipment; electronics and telecommunications; pharmaceutical products; scientific instruments; electrical machinery and equipment; chemical products; non-electrical machinery and equipment.

Analysis of foreign trade in high-tech goods in Ukraine in 2010–2019 shows that the export of groups of goods that are partly or fully classified as high-tech is significantly lower than their import (Figure 2; Figure 3).

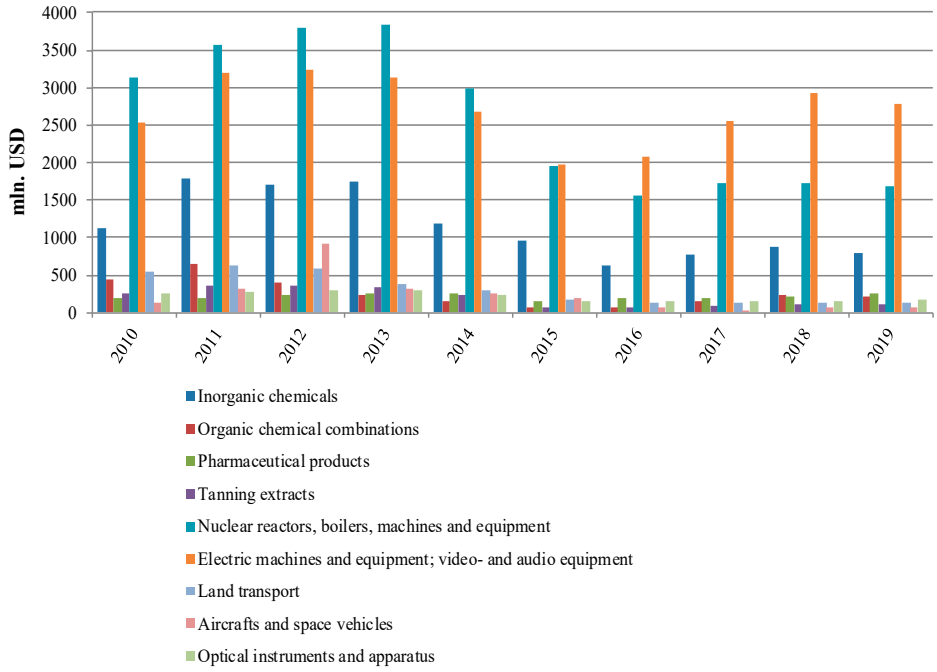

Figure 2. Volumes of certain groups of goods export, 2010–2019 years
Source: calculated according to the data of State Statistics Service of Ukraine.[8]

8 Ukraine's Foreign Trade in Goods and Services in 2010–2019. State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 28.12.2021).

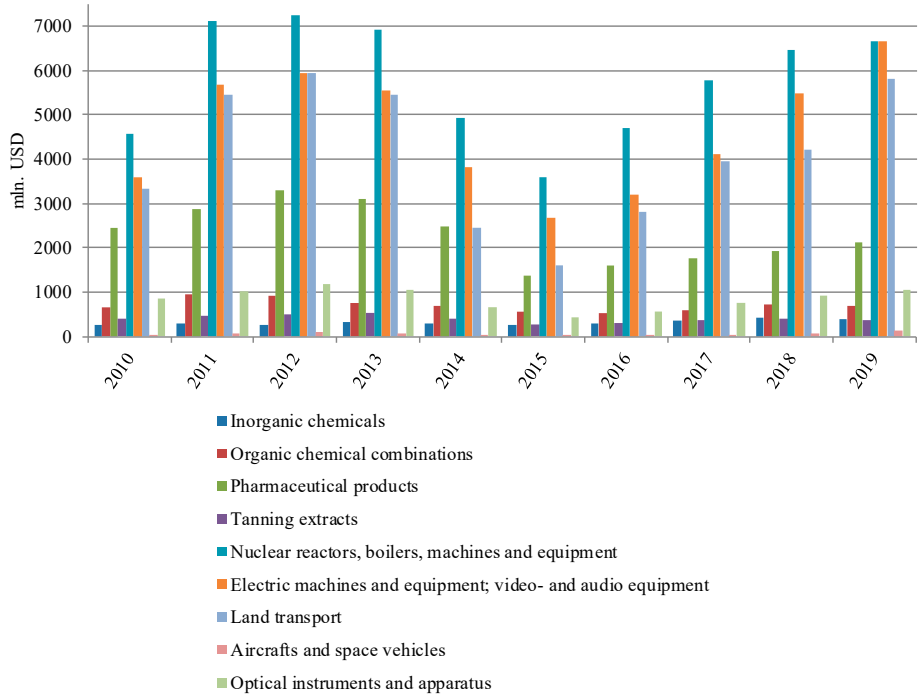

Figure 3. Volumes of certain groups of goods import, 2010–2019 years
Source: calculated according to the data of State Statistics Service of Ukraine.[9]

The balance of these groups of goods was negative from 2010–2019. The share of knowledge-intensive exports during this period averaged 15.4% of the total exports of goods, while the share of imports was almost 34.0%. A more detailed analysis of the structure of Ukrainian exports and imports of high-tech goods between 2010 and 2019 shows that only goods from the "Products of inorganic chemistry" group had a positive balance, and, prior to 2017, goods from the "Aircraft and space vehicles" group.

In the structure of exports, between 2010 and 2019, the largest share was taken by groups of domestic goods such as "Electrical machinery and equipment; video and audio equipment" – an average of 5.4% of total domestic goods exports; "Reactors, boilers, machinery, equipment" – an average of 4.9% of total domestic goods exports, and "Products of inorganic chemistry" – an average of 2.2% of total domestic goods exports.

In the structure of high-tech imports during 2010–2019, the largest share belonged to the group "Reactors, boilers, machinery, equipment" – on average 30.4% of total imports of high-tech goods. Also, a fairly high share of high-tech imports in the total structure of imports belongs to such groups as "Electrical machinery and equipment; video

9 Ukraine's Foreign Trade in Goods and Services in 2010–2019. State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 28.12.2021).

and audio equipment" – an average of 24.2% to the total imports of high-tech goods; "Land vehicles" – an average of 20.7% to the total imports of high-tech goods; "Pharmaceutical products" – an average of 12.1% to the total imports of high-tech goods; "Organic chemical compounds" – 3.8% to the total imports of high-tech goods.

Overall, as Figure 2 and Figure 3 show, from 2010–2019, foreign trade in high-tech goods was characterised by a low share in total exports and a significant negative balance.

Analysing the foreign trade in high-tech goods based on knowledge-intensive products in dynamics, one can see that by 2012, there was an increase in the volume of foreign trade in high-tech goods. However, from 2014–2015, the volume of foreign trade in high-tech goods decreased by more than 2.2 times. Only since 2016 has been an increase (Figure 4).

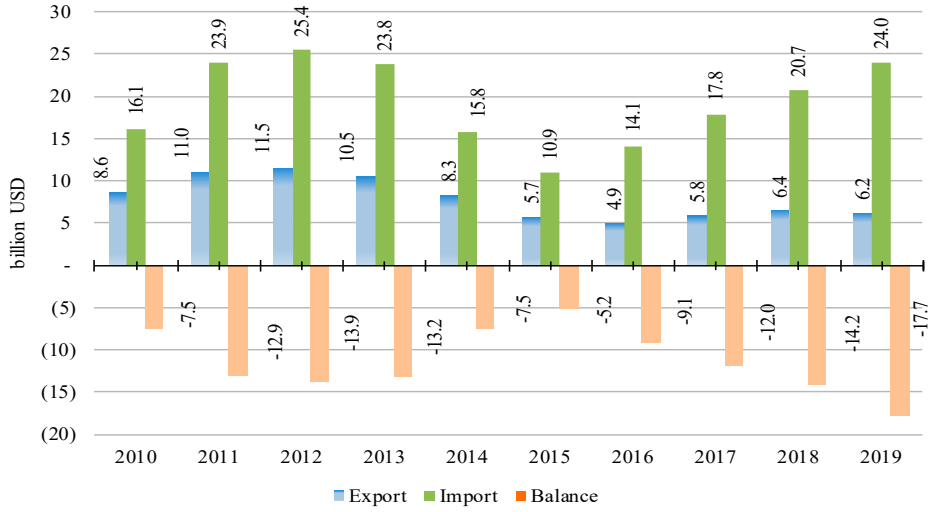

Figure 4. Dynamics of foreign trade in high-tech goods of Ukraine, 2010–2019 years, USD billion
Source: calculated according to the data of State Statistics Service of Ukraine.[10]

Compared to developed countries, the dynamics of Ukraine's high-tech goods exports over the period 2010–2019 show an annual decrease in its share (Figure 5). In particular, the share of high-tech goods exports in the total structure of Ukraine's exports decreased by 3.4 p.p. in 2019 compared to 2010, amounting to 13.4%. This is the lowest figure among the countries represented, as the share of high-tech goods exports in the total export structure of the USA, China, Japan and Germany exceeds 50%. Note that the US, China, Japan, Germany and Poland together accounted for between 33.4% and 60.1% of global exports of high-tech goods during 2010–2019.

10 Ukraine's Foreign Trade in Goods and Services in 2010–2019. State Statistics Service of Ukraine (retrieved from http://www.ukrstat.gov.ua) (accessed: 28.12.2021).

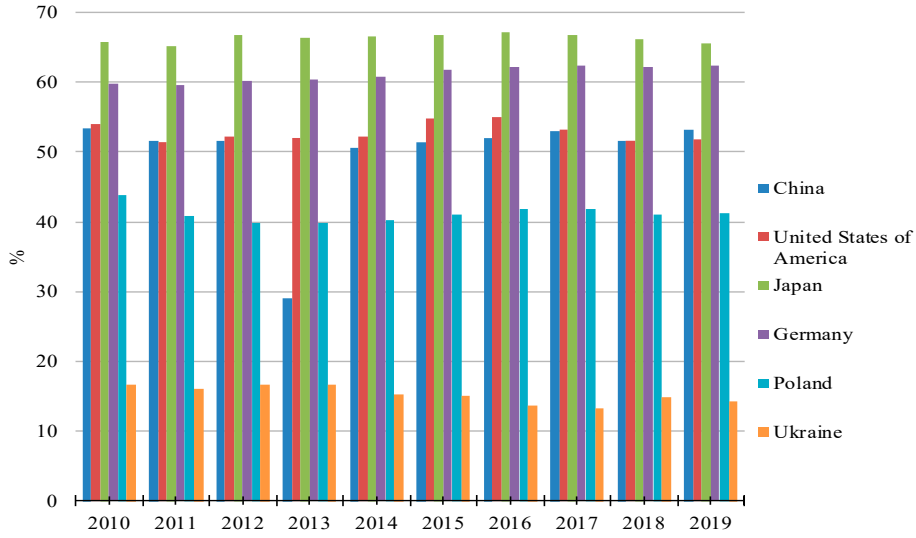

Figure 5. The share of high-tech goods exports in total exports of developed countries and Ukraine, 2010–2019 years %
Source: compiled and calculated according to the data.[11]

This is primarily due to the social, political and economic situation in the country, as well as the shutdown of a number of strategic production facilities and the loss of control over the part of the state's territory as a result of military aggression by the Russian Federation.

Figure 5 also shows that, despite its potential in the high-tech sphere, Ukraine remains dependent on imported high-tech goods.

Compared to developed countries, the dynamics of Ukraine's export in high-tech goods in 2010–2019 shows an annual decrease in its share (Figure 6).

11 Trade statistics for international business development. ITC. URL: https://www.trademap.org/tradestat/Product_SelProduct_TS.aspx (accessed: 4.01.2022).

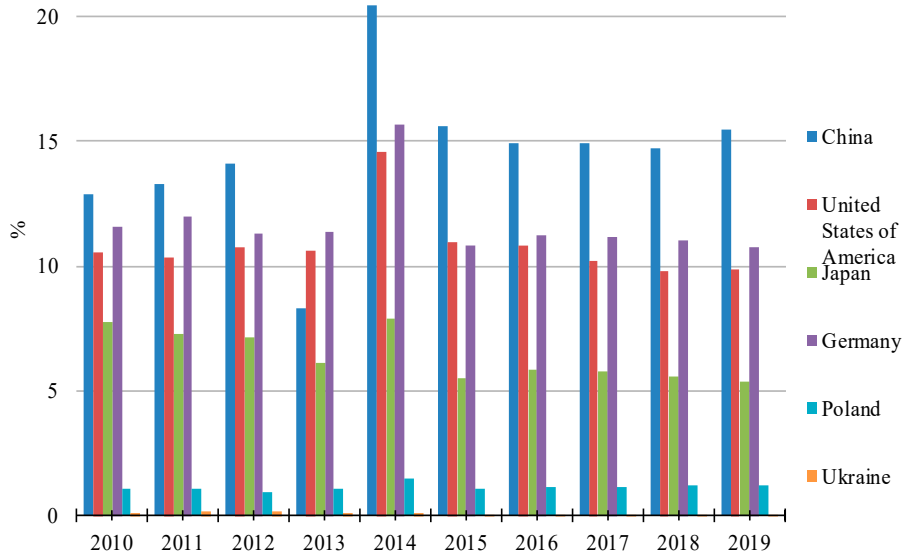

Figure 6. The share of high-tech goods exports in total exports of developed countries and Ukraine, 2010–2019 years %
Source: compiled and calculated according to the data.[12]

Conclusions

The concept of global value chains allows for a qualitatively new level of research into the functioning of the world economy, as well as the study of the essence and components of modern international commodity co-operation, production and technological potential of individual countries and their competitiveness. This concept is extremely important for Ukraine in the context of deepening the regional economic integration with the EU and other countries within the framework of bilateral and multilateral trade and economic agreements. Ukraine has held leading positions in the markets for non-precious metals and their products (an average of 18.3%), as well as in the markets for products of plant origin, whose share ranged from 4.8% in 2010 to 19.3% in 2019, an average of 20.8 times higher than the global indicator, etc. Overall, the growth rate of Ukrainian exports of agricultural, food and ore products is outpacing the global rate, which indicates fairly stable global demand and the resilience of these sectors to crises in the economy.

As the analysis shows, in order to ensure accelerated GDP growth, it is important for Ukraine to increase the exports of goods and services that provide higher value-added growth. In terms of this indicator, the most important export sectors are

12 Trade statistics for international business development. ITC. URL: https://www.trademap.org/tradestat/Product_SelProduct_TS.aspx (accessed: 4.01.2022).

agriculture, forestry and fisheries (an average of 22.8% in exports of value added); transport, warehousing (an average of 18%) and computer programming, consulting and information services (an average of 8.2%). Also, the products of the metallurgical industry (on average 8.6% in exports of value added) and the food, beverage and tobacco industry (on average 6.5%) should be added to this list.

The content of imported raw materials in export output indicates the level of Ukrainian economic integration into the global value chains. Between 2013 and 2019, this indicator averaged 19.6%. By sector, the highest content of imported raw materials and components was in the metallurgical industry and services in the area of computer programming, consulting and information services. This indicator is also high for the machinery and equipment industries; postal and courier services; metal ore mining, etc. From 2013–2019 education, healthcare, public administration and defence were the least dependent on imported raw materials and components.

Overall, Ukraine's export is concentrated, which increases its sensitivity to shocks. Consequently, its quantities and values can fluctuate substantially, as shown by the analysis. At the same time, increasing the share of goods with a high level of processing will increase the stability of export earnings.

In order to facilitate Ukraine's economic integration into global value-added chains, it is necessary to: create favourable conditions to attract investments in projects that involve the production of final high-tech goods; strengthen the protection of intellectual property rights to encourage the implementation of patent-protected production facilities in Ukraine; foster collaboration between science and business to encourage the innovation process. This, in turn, requires: improving the legal and regulatory framework; the implementation and monitoring of programmes for research and technical activities; intensifying the international integration of science, production and education; a mechanism to coordinate research and technical activities; an effective system for foreign investment attraction; technological support and security; the harmonisation and standardisation of trade procedures; updating the technical regulation system; ensuring integration with the information exchange system; bringing customs law into line with international standards; the insurance of export credits, agreements, and direct investments from Ukraine; a commitment to locate technological production in the host country by providing supplies to companies; investing in high-tech goods; concluding free trade agreements with countries that are promising for the development of Ukrainian export in high-tech goods; the introduction of international experience in creating special investment zones with favourable conditions for doing business; assistance in promoting knowledge-intensive and high-tech products on the world markets, etc.

Overall, the implementation of the proposed measures will allow national producers to actively seek and take advantage of opportunities for inclusion in GVCs. In addition, for Ukrainian enterprises to become intermediate and even final links in global value chains, political stability, the unwavering rule of law, the establishment of quality logistics infrastructure and effective tariff and customs regulation are also needed.

In our view, the clear and consistent implementation of the measures outlined above will create serious competitive advantages and allow Ukrainian high-tech companies to occupy the relevant niches in many regional and global value chains.

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Integracja Ukrainy z globalnymi łańcuchami wartości

W artykule rozważono teoretyczne i metodologiczne podejście do globalnych łańcuchów wartości w procesie pomiaru handlu międzynarodowego. Analizowane są światowe trendy w obecnym rozwoju handlu międzynarodowego oraz scharakteryzowano główne wyzwania międzynarodowej polityki handlowej dla Ukrainy. Stwierdzono, że nowoczesna struktura gospodarki ukraińskiej ukształtowała się pod wpływem czynników zewnętrznych. Autorzy zakładają, że z biegiem czasu wpływ gospodarki światowej na dynamikę i strukturę gospodarki ukraińskiej będzie się nasilał. Badane są perspektywy integracji Ukrainy z globalnymi łańcuchami wartości, a autorzy stwierdzili, że struktura ukraińskiego eksportu towarów tylko częściowo pokrywa się ze strukturą eksportu światowego. Ukraiński eksport towarów charakteryzuje się niskim udziałem wysoko przetworzonych produktów przemysłowych oraz wysokim udziałem produktów o niskiej wartości dodanej, w szczególności metali podstawowych oraz produktów przemysłu rolno-spożywczego. Eksport krajowych towarów high-tech stale spada w porównaniu z krajami rozwiniętymi, a jego udział w światowym eksporcie towarów high-tech jest znikomy. Aby zapewnić przyspieszenie wzrostu PKB na Ukrainie, ważne jest nie tylko zwiększenie eksportu, ale także zwiększenie eksportu towarów high-tech.

Słowa kluczowe: handel międzynarodowy, integracja, globalne łańcuchy wartości, eksport, import, towary high-tech

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International Determinants of Comprehensive Income Reporting by Groups – An Analytical and Comparative Study of Poland and Germany

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Abstract

The mainstream theoretical and empirical research presented in the study is a comparative analysis of comprehensive income reporting by groups listed in the Polish and German capital markets. The theoretical part of the article is dedicated to a scientific discussion on the determinants of the capital market and corporate governance in continental Europe and the so-called 'new governance', related to the convergence of financial reporting standards, including IFRSs, that oblige groups of entities to prepare consolidated statements of comprehensive income. It also assesses the relevance of comprehensive income to capital market players. The empirical part contains the results of comparative research on the format and structure of consolidated statements and the nomenclature of their components, as well as the findings from studies of the value relevance of comprehensive income for the WIG30 and DAX groups in 2009–2019.

Keywords: corporate governance, accounting standards, financial reporting, comprehensive income, Polish and German markets

JEL: G15, G38, M41, M52

Introduction

Research on the financial reporting of groups of entities in the international financial market is determined by the existing differences between countries, not only in accounting, but also in the established capital market and corporate governance models – either the continental or Anglo-Saxon one. In the former model, which developed in continental Europe, mostly in Germany but also in Poland, the level of disclosure is limited, with financial reporting more conservative, oriented towards meeting information needs, mainly of banks and tax authorities (Shleifer and Vishny 1997; Enriques and Volpin 2007). As regards the Anglo-Saxon model, primarily formed in the United Kingdom, the United States and Canada, it is characterised by strong subordination of disclosures to the needs of the capital market and shareholders (La Porta et al. 1999; Jacoby 2001). The specific characteristics of the capital market model and the adopted corporate governance model may determine the quality and usefulness of information reported by groups of entities.

The ongoing discussion on the necessary convergence of reporting standards, developed to ensure a high level of transparency and comparability of financial statements, may contribute to the increased efficiency of the Community capital market (Nestor and Thompson 2000; Chhillar and Lellapalli 2015). The convergence process takes place both on a European scale (the European Commission regulations) and at the international level, as tangibly reflected in the International Financial Reporting Standards (IFRSs) (IFRSs 2011). The implementation of IFRSs, including the category of comprehensive income, is believed to have quite significantly influenced investor expectations regarding the quality of financial reporting (Soderstrom and Sun 2007; Jermakowicz et al. 2007; Armstrong et al. 2010). As argued by opponents of international regulations, they have indeed increased the information quality of statements of comprehensive income for investors, but they have not considerably improved the cross-border comparability of data or their usefulness for capital markets (Barth et al. 2008; Devalle et al. 2010).

The article aims to undertake comparative theoretical and empirical research on the German and Polish capital markets in terms of the practices of reporting comprehensive income by groups of entities, with a special focus on the established capital market and corporate governance models, as well as on information policy regulations. The selection of the study sample comprising groups from the German and Polish capital markets was because both countries have similar corporate governance models and – importantly – the same international accounting regulations apply.

The objective of the paper is achieved by verifying two research hypotheses. One hypothesis is that disclosures relating to group statements of comprehensive income are much more extensive in the German capital market than in Poland. Similarly, the strategies pursued by German groups, in contrast to those of Polish corporations, are highly disciplined in terms of the uniform application of the format, structure and nomenclature of the consolidated statement of comprehensive income and its

components. The other hypothesis assumes that the German capital market is characterised by greater positive effects of the value relevance of presented comprehensive income for groups of entities in comparison with the Polish capital market. Therefore, it is assumed that the strategies of German groups reflect the high quality of the information policy pursued in connection with the application of corporate governance rules. As a result, the information contents of group statements of comprehensive income, while not excessive, should create satisfactory conditions for German capital market players to make investment decisions and contribute to increasing the market capitalisation of companies.

The research objective and adopted presumptions were verified on the basis of annual consolidated financial statements of selected groups listed on the stock exchanges in Frankfurt and Warsaw in 2009–2019 (the DAX and WIG30 indices, respectively). The empirical data for the study were retrieved from the Refinitiv (Thomson Reuters) database and from the websites of the corporations under analysis. The eleven-year period was selected as, in line with European Union legislation, starting from 1 January 2009, public companies in Germany and Poland became obliged to present their consolidated statements of comprehensive income in conformity with the IFRSs.

The capital market and corporate governance models in continental Europe

Basically, the literature distinguishes between two main capital market and corporate governance models: Anglo-Saxon and continental. In construction, they refer to two extreme concepts: the shareholder concept, based on external control by owners of enterprises, and the stakeholder concept, relying on control by various interest groups – creditors, banks, personnel, counterparties, society, etc. The Anglo-Saxon model, dominated by the idea of shareholder value maximisation (the shareholder model), also referred to as the capital market model (Jeffers 2005), mostly formed in the United Kingdom, the United States, Canada, Australia and New Zealand. As regards the continental model (the stakeholder model), accentuating the creation of value for all the stakeholders of an enterprise, it developed in continental Europe, especially in Germany, Austria, France, Belgium, Spain, Italy, Central European countries (also in Poland), even in Japan. In geographic terms, the Anglo-Saxon model is also called the Anglo-American one, whereas the continental model is called the German, continental-Japanese, or German-Japanese one (Shleifer and Vishny 1997; Enriques and Volpin 2007; Jerzemowska and Golec 2013).

Whereas the Anglo-Saxon concept is dominated by a liberal capital market model, significantly dispersed share ownership, and the shareholder's perspective (La Porta et al. 1999), in continental Europe, greater importance is attached to the institutional environment and capital interrelationships (Chhillar and Lellapalli 2015), with

a prevalent corporate social responsibility orientation (Camilleri 2017). Continental Europe applies a fundamentally different concept of business relationships, and the interest of owners (shareholders) is not the most important consideration (the institutional approach), in contrast to the Anglo-Saxon model. The model is largely based on European Union directives, but also with a strong influence of national laws (Jerzemowska 2019). Other differences concern the level of ownership concentration and the significance of the stock exchange. The German model is characterised by the lesser importance of the capital market (the stock exchange) and a higher degree of share ownership concentration than in the Anglo-Saxon model (Allen and Gale 2000). The dominant role is played by banks, as capital suppliers, by insurance companies, and – importantly – by groups of undertakings (Chhillar and Lellapalli 2015). An additional distinguishing feature of the German model is that an average of one-fourth of listed companies have a dominant shareholder (Mallin 2004).

Governance and management are also essentially different – based on a two-tier system where the shareholders, through a supervisory board or internal committees, have a significant influence on executive decision-making. A vital element of the German model is the strong position of employees and trade unions in supervisory bodies (Aguilera and Jackson 2010). With specific regulations in place, in companies that employ more than 2,000 people, as many as half of the seats must be occupied by employee representatives. As a result, the German model relies on co-decision (in German: *Mitbestimmung*) (Bühner 2001). Therefore, executives are accountable to a wider circle of stakeholders than only those oriented towards maximising shareholder value and, in extreme cases, the firm cannot carry out a merger or restructuring without the employees' approval.

As regards Poland, there are a number of similarities to the German model that result from Poland's socio-political transition, privatisations, and the country's integration into the European Union and implementation of the relevant directives. The above-mentioned similarities concern aspects such as the dominant role of majority shareholders (privatisation), the strong position of banks and pension institutions, employees' influence on business management (employee representation in bodies of state-owned companies) and the importance of groups of entities. It makes the Polish corporate governance system, modelled after French solutions, consistent with the continental version (Jerzemowska and Golec 2013).

Due to the existing country-specific differences, in both the legal order and institutional conditions, the convergence of corporate governance systems has been relatively slow despite the ongoing globalisation (Jacoby 2001; Nestor and Thompson 2000). Even the dominance of US corporations in globalisation has not contributed to the US style of corporate governance being adapted (Khana and Palepu 2004). Taking account of particular corporate governance characteristics determined locally (Weiner and Pepe 1999), it must be pointed out that they are largely different not only in concept but also in business organisation, the importance of the share market, the ownership structure and legal regulations (Aguilera and Jackson 2010).

Andrzejewski and Grabiński (2016) argue that the quality of corporate governance is a multidimensional issue and is difficult to estimate. The one aspect all the models have in common is the purpose to be fulfilled. First and foremost, a quality corporate governance system must counteract the adverse effects of the information asymmetry in the financial market (Grossman and Stiglitz 1980), e.g. by ensuring investors' access to cyclical company information that is as exhaustive as possible. Therefore, the quality of corporate governance concerns not only the independence and competence of supervisory board members but also the linkages between corporate governance tools and the financial reporting system (Cohen and Hanno 2000). The current debate on the quality of the corporate governance model has been about its suitability for corporate social responsibility (Camilleri 2017), more similar to the stakeholder rather than shareholder concept, but also about unifying good practices (Aluchna and Tomczyk 2018) and the convergence of reporting standards, which have been recommended for years (Aguilera and Jackson 2010). In particular, developing and promoting the application of uniform accounting standards should be the subject of projects implemented by specific countries and incorporated into international treaties.

The implementation of international regulations in Polish and German financial reporting

At the international level, 'new governance' is exemplified by the IFRSs (Aguilera and Jackson 2010), which, essentially, are supposed to not only replace national accounting standards, but also to take over the US GAAP. The impact of this 'new governance' is not trivial as, at present, more than 100 countries require or permit IFRS-based reporting, including Poland and Germany.

As regards legislative solutions, in Poland, the Accounting Act[1] should be applied first, while international regulations may be followed in the absence of specific provisions. In 2004, the Polish balance-sheet law was adapted to the EU Regulation on the application of IFRSs.[2] The Regulation in question authorised the Member States to specify entities permitted or required to apply the IFRS provisions in preparing their financial statements.

In Poland, the application of IFRSs in financial reporting is only mandatory for public limited liability companies whose securities are admitted to trading in a regulated market of any EU Member State and for banks whose securities are not traded in such a market (see Table 1). Furthermore, the obligation only applies to consolidated statements (i.e. to statements prepared by groups of entities).

1 The Accounting Act of 29 September 1994 (Journal of Laws 121, 591, as amended).

2 Regulation (EC) No. 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards (OJ L 243, 11.09.2002).

Table 1. IFRS application in terms of consolidated and separate financial statements in Poland (PL) and Germany (DE)

Type of companies	Consolidated financial statements				Separate financial statements			
	Required		Permitted		Required		Permitted	
	PL	DE	PL	DE	PL	DE	PL	DE
Listed companies whose securities are traded in a regulated market	X	X	–	–	–	–	X	–
Listed companies in the process of becoming listed in a regulated market	–	X	X	–	–	–	X	–
Listed companies that have filed for admission to public trading	–	–	X	X	–	–	X	–
Listed companies whose securities are traded in a non-regulated market	–	–	–	X	–	–	–	–
Banks whose securities are not traded in a regulated market	X	–	–	X	–	–	X	–
Unlisted companies	–	–	–	X	–	–	–	–
Subsidiaries of a group in which the parent or higher-level parent prepares consolidated statements in conformity with the IFRSs	–	–	X	–	–	–	X	–

Source: prepared by the authors based on the Accounting Act and Handelsgesetzbuch.

In Poland, IFRS-based consolidated financial statements may also be prepared by issuers who have or who intend to apply for admission to trading in a regulated market, as well as entities from groups where the parent company prepares consolidated statements in conformity with the IFRSs. Importantly, the Polish legislation permits the preparation of separate financial statements in accordance with international regulations, but it is a right rather than an obligation.

The main statutory act governing the functioning of enterprises and the principles of accounting in Germany is *Handelsgesetzbuch* (HGB),[3] amended – as in Poland – in 2004, for the purpose of harmonisation and standardisation in line with the IFRSs. In Germany, as in Poland, groups of entities must prepare consolidated financial statements based on the IFRSs and in compliance with the obligatory disclosures required under HGB at the same time. However, the requirement solely applies to groups listed in a regulated market.[4] In Germany, in contrast to Poland, the IFRS application is an option in non-regulated public securities markets. Moreover, the requirement to prepare group statements in conformity with the IFRSs additionally concerns issuers that have applied for admission to trading in a regulated market. However, there

3 Handelsgesetzbuch vom 10. Mai 1994, (BGBl. I S. 2565, 2567, as amended).

4 Regulated markets in Germany are as follows: Börse Berlin, Börse Berlin Second Regulated Market, Düsseldorfer Börse, Düsseldorfer Börse Quotrix, Börse Berlin Equiduct Trading, Börse Berlin Equiduct Trading Second Regulated Market, Frankfurter Wertpapierbörse, Hanseatische Wertpapierbörse Hamburg, Niedersächsische Börse Zu Hannover, Börse München, Börse München – Market Maker Munich, Baden-Württembergische Wertpapierbörse, European Energy Exchange, Frankfurter Wertpapierbörse Xetra, Eurex Deutschland, Tradegate Exchange.

are no special IFRS application requirements for certain groups, e.g. banks. As a rule, in Germany, the preparation of IFRS-based separate financial statements is prohibited, whether for listed or unlisted companies. It is only possible as an addition to financial statements prepared in accordance with HGB.

For years, both in Poland and Germany, financial statements prepared under national laws have been characterised by disclosures and layouts different from those contained in international regulations. For example, under the Accounting Act, micro- or small entities are allowed not to prepare a cash flow statement or a statement of changes in equity. But the requirement applies to groups, public limited liability companies, banks, investment funds, insurance undertakings, etc. Similarly, even though the German HGB is consistent with the IFRSs, in the case of separate statements, a cash flow statement and a statement of changes in equity are not required. However, the requirement does concern groups that prepare consolidated financial statements.

With regard to the profit and loss account (income statement), the provisions of HGB and the Accounting Act are similar to the IFRSs. However, they evidently lack a 'statement of comprehensive income', introduced by the EU Member States as a mandatory statement on 1 January 2009.[5] Therefore, the obligatory incorporation of this statement into the rules of preparing consolidated financial reports by groups of entities contributed to the inclusion of comprehensive income as an important economic and financial category to be evaluated by users of financial statements.

'Comprehensive income' (sometimes also referred to as 'all-inclusive income') was first formally defined in 1980 in a document published by the US Financial Accounting Standards Board (FASB 1980). According to those regulations, it was described as the change in equity (net assets) of an entity during a period from transactions and other events and circumstances from non-owner sources (Yen et al. 2007). In addition to net income, comprehensive income comprises other comprehensive income, including (MSSF 2011): (i) changes in revaluation surplus; (ii) actuarial gains and losses on defined employee benefit plans; (iii) the effective portion of gains and losses on hedging instruments in a cash flow hedge; (iv) gains and losses on remeasuring available-for-sale financial assets; (v) gains and losses arising from translating the financial statements of a foreign operation.

With regard to the statement of comprehensive income, the IFRS prescribes no recommended model layout. It only indicates several line items which must be included as a minimum for the reporting period. It is also non-specific about the format or internal structure of the statement of comprehensive income. Entities are mostly free to choose the terminology used, the method of presenting other comprehensive in-

5 In the EU, the international accounting standards were implemented on 18 December 2008. As a result, since 2009, entities preparing their financial statements in conformity with the IFRSs have been obliged to present a 'statement of profit or loss and other comprehensive income for the period'. Cf.: Commission Regulation (EC) No. 1274/2008 of 17 December 2008 amending Regulation (EC) No. 1126/2008 adopting certain international accounting standards in accordance with Regulation (EC) No. 1606/2002 of the European Parliament and of the Council as regards International Accounting Standard (IAS) 1 (OJ L 339, 18.12.2008).

come, recognising expenses and showing income tax on other comprehensive income. Entities that apply IFRSs may decide whether their expense and income items should be presented in a single statement of comprehensive income or in two statements: (i) a statement displaying components of profit or loss (separate income statement) and (ii) a second statement beginning with profit or loss and displaying components of other comprehensive income.

Therefore, it may be assumed that the format and structure of the statement of comprehensive income may vary widely between countries or even between groups of entities listed in the same capital market. But the comparison of the Polish and German markets seems to show that German corporations are characterised by greater discipline in applying the uniform format, structure and nomenclature of the statement of comprehensive income and its components, as submitted in our first research hypothesis.

Discussion on the relevance of comprehensive income to capital market players

Irrespective of the international and national requirements, recommendations and regulations concerning the format and structure of reporting comprehensive income, decades of discussion have taken place on its relevance to users of financial statements. The discourse on the substance of comprehensive income, particularly in comparison with net income, has been conducted by various authors for years; so far, however, it has not been unambiguously determined which of those categories is more value relevant. There is certainly agreement that the relationships between financial performance and market measures are more evident in advanced economies with the Anglo-Saxon rather than continental corporate governance model (Land and Lang 2002; Bhattacharya et al. 2003), i.e. the one used in Germany and Poland. However, there is no consensus about any specific financial performance category being a more accurate explanation of share prices and market trends, which may affect investors' assessments of the usefulness of reporting information in making investment decisions in the capital market.

One key argument against the usefulness of comprehensive income in investment decision-making is that it varies significantly, even the lack of stability in time (Sajnóg 2017). Furthermore, considering the research orientation towards verifying the hypothesis of the superiority of comprehensive income over net income in terms of value relevance for listed companies, as early as 1999, operating income was proven to have the strongest relationship with the rate of return on shares (equity return), followed by net income (profit or loss for the period). In contrast, the disclosure of comprehensive income had no significant information content (Cheng et al. 1993).

Table 2. Arguments of proponents of comprehensive income in selected capital markets

Authors	Capital market	Observations
Barth et al. (1996)	US	Some of the disclosed items of other comprehensive income are related to share prices.
Dhaliwal et al. (1999)	US	Gains (losses) on the measurement of short-term securities are value relevant.
Cahan et al. (2000)	New Zealand	Comprehensive income is more value relevant than net income.
Bloomfield (2002)	US	There is an interrelation between changes in gains (losses) on AFS securities and the volatility of share prices in the market.
Louis (2003)	US	Foreign translation adjustments are positively associated with market value.
Biddle and Choi (2006)	US	Comprehensive income is the most strongly related to equity returns, but net income is more relevant to executive compensation contracting.
Hodder et al. (2006)	US	Asset measurement at fair value is characterised by strong value relevance.
Kubota et al. (2006)	Japan	Comprehensive income is a better key indicator of company value relevance.
Chambers et al. (2007)	US	Components of OCI are value relevant for listed companies.
Kanagaretnam et al. (2009)	Canada	Comprehensive income is more strongly related to share prices and equity returns for listed companies than net income.
Nejad et al. (2014)	Malaysia	Particular components of other comprehensive income are closely associated with the share prices of listed firms.
Mironiuc et al. (2016)	Romania	There are significant relationships, of similar strength, between both indicators of financial performance (net income and comprehensive income) and share market pricing.

Source: prepared by the authors.

So far, the most extensive studies of the usefulness of comprehensive income for the capital market have been conducted in the United States. However, the study results have produced various arguments for both opponents and proponents of reporting comprehensive income in investment decision-making (see Tables 2 and 3).

Table 3. Arguments of opponents of comprehensive income in selected capital markets

Authors	Capital market	Observations
Cheng et al. (1993)	US	The disclosure of comprehensive income has no information content relevant to investors.
Smith and Tse (1998)	US	Net income is more associated with share prices than comprehensive income.
Dhaliwal et al. (1999)	US	Net income is more strongly related to market capitalisation than comprehensive income.

Authors	Capital market	Observations
O'Hanlon and Pope (1999)	United Kingdom	In contrast to comprehensive income, net income is more related to equity returns.
Brimble and Hodgson (2007)	Australia	Comprehensive income is characterised by a much weaker correlation with market capitalisation than net income.
Ernstberger (2008)	Germany	Comprehensive income provides investors with no significant information in explaining equity returns.
Dastgir et al. (2008)	Tehran	Comprehensive income is less strongly associated with the market capitalisation of listed companies than net income.
Păşcan (2014)	Romania	There is no significant value relevance of comprehensive income.

Source: prepared by the authors.

Studies conducted in other capital markets, e.g. in Canada (Kanagaretnam et al. 2009), the United Kingdom (O'Hanlon and Pope 1999), Germany (Ernstberger 2008), New Zealand (Cahan et al. 2000), Australia (Brimble and Hodgson 2007), Japan (Kubota et al. 2006), Tehran (Dastgir et al. 2008), Malaysia (Nejad et al. 2014) or Romania (Păşcan 2014) have produced equally ambiguous conclusions. On the one hand, comprehensive income does not provide investors with any information useful in explaining equity returns other than that recognised in profit or loss (net income); on the other hand, its components included in the structure of other comprehensive income show a significant relationship with share prices.

A global cross-sectional analysis was performed by Barton et al. (2010), who examined the value relevance of several types of accounting measures for nearly 20,000 companies from 46 countries in 1996–2005.[6] As determined by the authors, operating income was characterised by the greatest value relevance for the companies covered, whereas correlations with bottom line items reported in the income statement (net income or comprehensive income) were distinctly the weakest.

In this context, it becomes important to ascertain whether within the same continental corporate governance model, which functions in Germany and Poland, there are differences in the value relevance of comprehensive income for groups. We assume that strategies of German groups reflect higher information policy quality and – as a result – the German capital market shows greater value relevance of presented comprehensive income for groups compared to the Polish capital market. The above assumption is the substance of our second research hypothesis.

6 The largest number of observations concerned Japan (38,731 cases) and the United States (37,330 cases).

Methodology

For the purpose of verifying the first research hypothesis, the analysis covered consolidated statements of comprehensive income of listed companies included in the WIG30 and DAX indices[7] for 2009–2019. The research process comprised verifying the uniform application of the reporting version in terms of format and principles of presenting the consolidated statement of comprehensive income. Furthermore, in order to assess the relevance and usefulness of those categories for Polish and German capital market players, the nomenclature of both the statement and its components was examined for uniform application.

The usefulness of financial performance for the capital market was treated as the value relevance of the information contained in the financial statements (Ohlson, 1999). In accordance with the approach, a comparative analysis of such relationships was performed for groups included in the WIG30 and DAX indices. The study was oriented towards verifying the second research hypothesis.

The examination relied on the approach presented in the literature by authors such as Graham et al. (2005), Kanagaretnam et al. (2009) and Dechow et al. (2010), according to which the market value of an enterprise should be the function of its book value and financial performance (in this case, comprehensive income). The market value of an enterprise was usually adopted by the authors as the market capitalisation reflecting the market value of equity – MVE. Therefore, adequately, in our opinion, the book value of a company should be assumed to be the book value of equity – BVE.

To exclude any possible effects of the scale of business operations on a group's financial performance, comprehensive income was scaled according to total assets. That aspect tends to be pointed out in comparative analyses of companies (Bratten et al. 2016). As a consequence, the examination relied on returns on assets RoA(CI), calculated using comprehensive income.

Based on an analysis of the literature on the value relevance of various financial performance indicators (Dhaliwal et al. 1999; Bradshaw 2002; Asquith 2005; Yen et al. 2007; Barth et al. 2008), two additional control variables were used:

- DR – the debt ratio, calculated as the ratio of debt to equity, reflecting the problem of the capital structure of the companies covered,
- DIV – the dividend ratio, calculated as the ratio of dividend per share to the market share price, which may be related to a positive or negative capital market response to the dividend payout and thus contribute to increasing or decreasing the market capitalisation.

Taking into account the presented methodological approach, the authors formulated the following economic model version with one explained variable and four explanatory variables:

$$lnMVE_t = \propto_0 + \propto_1 \times lnBVE_t + \propto_2 \times RoA\left(CI\right)_t + \propto_3 \times DR_t + \propto_4 \times DIV_t + \mu_t$$

7 The selection of the two indices was due to the equal numbers of companies covered.

Since the applied research procedure involved the simultaneous use of different types of indicators, both relative values and absolute values of the variables under analysis, i.e. the market value of equity (MVE) and the book value of equity (BVE), the model included the natural logarithms of the two variables: lnMVE and lnBVE.[8] It is a frequently used method in empirical studies, including those that examine comprehensive income (Bratten et al. 2016).

The research procedure for analysing the value relevance of comprehensive income for groups included in the WIG30 and DAX indices comprised three stages. The first step involved calculating the main descriptive statistical measures for the variables under examination. Next, the authors examined the strength and nature of correlations between them; lastly, the leading research dimension was regression analysis. The data for the study were retrieved from the Refinitiv (Thomson Reuters) database and from the websites of the corporations under examination. The websites mostly served to obtain consolidated statements of comprehensive income.[9]

Research results

Analysis of the format and structure of presenting the statement of comprehensive income

As demonstrated by the analysis of 619 financial reports of groups obtained by the authors,[10] no uniform approach to presenting the consolidated statement of comprehensive income has been developed in Poland. The study identified versions of both single and two-document statements, with a marked prevalence of the latter type (see Table 4). Furthermore, not all entities used uniform versions of statements throughout the eleven-year period. In contrast, groups of entities in Germany were consistent in using the form of two statements published.

8 Such an approach should also be considered valid due to the fact of positive values of the variables MVE and BVE for which natural logarithms could be calculated.

9 Among the three databases available to us, i.e. those of Thomson Reuters, Notoria Serwis and Bloomberg, only the last one contained detailed information on statements of comprehensive income. However, serious data deficiencies and frequent errors forced the authors to manually gather numerical data.

10 To evaluate 30 DAX corporations and 30 WIG30 companies over the eleven-year period covered (2009–2019), 619 financial reports were obtained (for DAX – 303; for WIG30 – 316) out of the 660 possible statements. This was because some companies were newly established or became listed during the period in question; therefore, as non-public companies, they did not publish their financial statements on their websites for the whole period. That was the case for five DAX groups (COVESTRO, FRESENIUS MEDICAL CARE, LINDE, MERCK, RWE) and five WIG30 groups (DINO-PL, ENERGA, JSW, KRUK, PLAY).

Table 4. Discrepancy in the form and presentation of consolidated statements of comprehensive income

Characteristics		WIG30		DAX	
		Number of companies	Share	Number of companies	Share
Form of statement	Single statement	10	34%	0	0%
	Two statements	19	63%	30	100%
	Both forms	1	3%	0	0%
Presentation of tax	Information about the tax	23	77%	22	73%
	No information about the tax	7	23%	8	27%

Source: prepared by the authors.

An important aspect that differentiates the reporting practices of groups was the recognition of income tax. The majority of the groups in Poland presented information on 'income tax', but using two different terms: 'deferred tax' or 'income tax'. In Germany, not all groups of entities reported line items in a uniform manner, before or after tax (presenting no information on the tax). In addition, they used discrepant terms regarding the tax, namely 'deferred tax', 'income tax', 'tax effect', 'income tax effect', 'taxes on unrealised gains/losses'.

As demonstrated by the review of annual consolidated financial statements of the WIG30 and DAX groups, they tended to use the term 'consolidated statement of comprehensive income'. However, in all the cases of the Polish and German groups of entities, there were numerous non-uniform terms (see Table 5). The dominant term for the Polish groups was the 'Consolidated statement of profit or loss and other comprehensive income', whereas the German groups tended to use the title 'Consolidated statements of recognised income and expense'.

Table 5. Discrepancy in the nomenclature of consolidated statements of comprehensive income

Nomenclature	WIG30		DAX	
	Number of companies	Share	Number of companies	Share
Consolidated statement of comprehensive income	25	65.9%	26	66.5%
Consolidated statement of profit or loss and other comprehensive income	6	15.8%	–	–
Consolidated statement of other comprehensive income	2	5.3%	–	–
Statement of financial result and other comprehensive income	1	2.6%	–	–
Statement of the results and other total revenue	1	2.6%	–	–
Consolidated income statement	1	2.6%	–	–
Consolidated comprehensive income statement	1	2.6%	–	–
Consolidated statement of total comprehensive income	1	2.6%	–	–
Consolidated statements of recognised income and expense	–	–	6	15.3%

Nomenclature	WIG30		DAX	
	Number of companies	Share	Number of companies	Share
Consolidated statement of comprehensive income and expense	–	–	1	2.6%
Consolidated statements of income and comprehensive income	–	–	1	2.6%
Consolidated statements of income and expense recognised in equity	–	–	1	2.6%
Group statement of comprehensive income	–	–	1	2.6%
Statement of income and accumulated earnings	–	–	1	2.6%
Statement of comprehensive income of the … Group	–	–	1	2.6%
Statement of comprehensive income for the group	–	–	1	2.6%

Source: prepared by the authors.

Surprisingly, the analysed groups did not maintain uniform versions of the titles of comprehensive income and its components. Whereas the WIG30 groups referred to comprehensive income as 'Total comprehensive income' and 'Comprehensive income', the German groups proved to vary more widely in that regard (see Table 6).

Table 6. Discrepancy in the nomenclature of comprehensive income and other comprehensive income

Characteristics	WIG30		DAX	
	Number of companies	Share	Number of companies	Share
Nomenclature of comprehensive income				
Total comprehensive income	26	86.7%	25	73.6%
Comprehensive income	4	13.3%	4	11.8%
Total income and expense	–	–	3	8.8%
Profit or loss	–	–	1	2.9%
Total income and expense recognised in equity	–	–	1	2.9%
Nomenclature of other comprehensive income				
Other comprehensive income	29	96.7%	26	78.9%
Total other comprehensive income	1	3.3%	1	3.0%
Income and expense recognised directly in equity	–	–	3	9.1%
Income recognised directly in equity	–	–	1	3.0%
Gains/losses recognised immediately in equity	–	–	1	3.0%
Other profit	–	–	1	3.0%

Source: prepared by the authors.

A similar situation was found in the nomenclature of other comprehensive income. The WIG30 groups used roughly the same terms ('Other comprehensive income' or 'Total other comprehensive income'), whereas certain groups included in the German index applied more individualised nomenclature: 'Income and expense recognised directly in equity' or – enigmatically – 'Other profit'.

Usefulness of comprehensive income for the Polish and German capital markets

As shown by the empirical research results presented in Table 7, in the period under analysis, i.e. 2009–2019, the mean lnMVE values were 7.6 for the WIG30 and 10.07 for the DAX, with the respective median at 7.71 and 10.20. However, no significant differences in the variable were found between the Polish and German capital markets, as reflected in the minimum, maximum and standard deviation values. Similar conclusions can be drawn from analysing the lnBVE or DIV variables, although the dividend ratio was more differentiated among the WIG30 groups than those in the DAX index. At the same time, the analysis of the RoA(CI) and DR variables demonstrated significant differences. The return on assets varied more widely in time for the WIG30 groups than in the case of the DAX, as confirmed by the standard deviation values calculated. The debt ratio was found to be distinctly differentiated in Germany.

Table 7. Descriptive statistics

Statistic	Index	Variable				
		lnMVE	lnBVE	RoA(CI)	DR	DIV
Mean	WIG30	7.69	7.24	18.27	58.85	2.09
	DAX	10.07	9.41	3.92	112.72	2.73
Median	WIG30	7.71	7.60	13.82	41.90	1.24
	DAX	10.20	9.46	3.67	73.96	2.19
Maximum	WIG30	9.53	9.30	222.36	462.24	31.85
	DAX	11.87	11.71	18.59	693.60	8.90
Minimum	WIG30	2.19	–0.12	–119.07	0.00	0.00
	DAX	6.29	5.50	–12.37	0.00	0.00
Std. Dev.	WIG30	1.09	1.45	29.75	62.26	2.98
	DAX	0.98	1.18	4.00	114.03	1.71

Source: calculated by the authors.

Table 8. Correlation matrix

Variable	Index	Variable				
		lnMVE	lnBVE	RoA(CI)	DR	DIV
lnMVE	WIG30 DAX	1.000				
lnBVE	WIG30 DAX	0.798* 0.837*	1.000			
RoA(CI)	WIG30 DAX	–0.020 0.005	–0.249* –0.181*	1.000		
DR	WIG30 DAX	–0.191* 0.013	–0.262* 0.171*	–0.200* –0.418*	1.000	
DIV	WIG30 DAX	0.308* 0.294*	0.275* 0.431*	0.259* –0.226*	–0.216* 0.065	1.000

* represents statistical significance at the 0.05 level.
Source: calculated by the authors.

The matrix of correlation between the analysed variables, presented in Table 8, points to a positive and statistically significant relationship between the market value and the book value of equity in groups of entities listed in both Poland and Germany. A positive correlation was also found between the market value and the dividend ratio. A statistically significant – although negative – relationship was observed for the debt ratio, but only for the groups in Poland. Simultaneously, it was not possible to find a statistically significant relationship between comprehensive income (calibrated by the amount of group assets) and the market value. However, the return on assets, RoA(CI), proved to be negatively correlated with the book value of equity and the debt ratio. In the case of the dividend ratio, the examination produced different results for the WIG30 and DAX groups.

At the same time, with regard to the regression analysis of the market capitalisation, special emphasis must be placed on the directions of the influence of the two main variables, i.e. lnBVE and RoA(CI), on the lnMVE variable (see Table 9).

Table 9. Results of Panel Least Squares regression

Index	Dependent variable	Independent variable	Coefficient	t-Statistic	*p-value*	Adjusted R-squared
WIG30	lnMVE	lnBVE	0.643*	21.574	0.000	0.67
		RoA(CI)	0.007*	5.099	0.000	
		DR	0.001*	2.189	0.030	
		DIV	0.014	1.006	0.316	
DAX		lnBVE	0.745*	27.351	0.000	0.73
		RoA(CI)	0.029*	3.559	0.000	
		DR	–0.001*	–2.695	0.007	
		DIV	–0.035**	–1.862	0.064	

* and ** represent statistical significance at the 5% and 1% levels.
Source: calculated by the authors.

Both comprehensive income and the book value of equity had unambiguously positive effects on market capitalisation. But those effects, in both cases, appeared to be somewhat stronger for the DAX groups than for those included in the WIG30 index. The parameters for the variables concerned were statistically significant at the significance level of 0.05.

The independent variable with positive and statistically significant influence on the market value of the groups in Poland was the debt ratio, DR. In contrast, for the groups in Germany, a negative correlation of this variable was found, as in the case of the dividend ratio, DIV.

Summary

The study examined the practices of reporting comprehensive income by groups listed in the Polish and German capital markets. The results suggest that the strategies of German groups, in contrast to those of Polish corporations, are highly disciplined in terms of the uniform application of the format and structure of the statement of comprehensive income. The groups of entities in Poland used both single-statement and two-statement versions. On the other hand, the first research hypothesis cannot be considered valid as the DAX groups showed greater differentiation of the nomenclature applied to refer to the statement of comprehensive income and its components than those included in the WIG30 index. The results are consistent with the findings from prior analyses of the quality of presenting the statement of comprehensive income. Discrepancies and shortcomings can be observed in a number of markets (Thinggaard et al. 2006; Cimini 2013). Interestingly, executives of various entities present no components of other comprehensive income at all, mostly due to different business models; if they do, they tend to choose presentation formats which may or may not affect the entity's perception and market capitalisation (Bamber et al. 2010).

As suggested by the study, the comprehensive income reported has a positive effect on market capitalisation in both Poland and Germany, as it is value relevant. For the groups listed in Germany, whose reporting format is largely uniform (comprising two statements), the influence was more evident, which confirmed the second research hypothesis. Undoubtedly, however, the book value of equity must be considered the main determinant of the market value. The literature provides various dissimilar results in that regard (Turktas et al. 2003).

Overall, our findings suggest that listed companies should appreciate corporate governance standards and follow best practice codes and international recommendations, emphasizing the need to tie comprehensive income reporting to market expectations. Additionally, our study provides evidence that comprehensive income shows shareholders' wealth, and it is one of the key accounting and market-based performances which influence market value.

To recapitulate, it is possible to share the opinion expressed by Chambers et al. (2007): in practice, executives are required to ensure the transparency of companies' financial statements to influence their market pricing. Perhaps, as the information transparency of the statement of comprehensive income increases, one may expect, in time, the development of improved report formats, not so much on account of international regulations or national legislative measures, but as a result of a more professional executive approach to the disclosure policies of groups of entities.

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Międzynarodowe uwarunkowania raportowania wyników całkowitych grup kapitałowych – polsko-niemieckie studium analityczno-porównawcze

Wiodącym nurtem badań teoretyczno-empirycznych zaprezentowanych w opracowaniu stanowi porównawcza analiza raportowania wyników całkowitych grup kapitałowych notowanych na polskim i niemieckim rynku kapitałowym. Część teoretyczną artykułu poświęcono dyskusji naukowej wokół uwarunkowań rynku kapitałowego i nadzoru korporacyjnego w Europie kontynentalnej oraz tzw. „nowego ładu korporacyjnego" związanego z konwergencją standardów sprawozdawczości finansowej, w tym MSSF, które obligują grupy kapitałowe do sporządzania skonsolidowanego sprawozdania z wyniku całkowitego. Dokonano również oceny znaczenia wyniku całkowitego dla podmiotów rynku kapitałowego. W części empirycznej znajdują się wyniki komparatywnych badań nad formą i strukturą skonsolidowanego sprawozdania z wyniku całkowitego oraz nomenklaturą jego komponentów, a także badań wpływu wyniku całkowitego na wartość rynkową grup kapitałowych z indeksu WIG30 oraz DAX w latach 2009–2019.

Słowa kluczowe: nadzór korporacyjny, standardy rachunkowości, raportowanie finansowe, wynik całkowity, polski i niemiecki rynek

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