















“Analysis of trends in the structure of higher education market of European countries”

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ANALYSIS OF TRENDS IN THE STRUCTURE OF HIGHER EDUCATION MARKET OF EUROPEAN COUNTRIES

Abstract

The structure of the higher education market in 2012–2021 in 38 European countries was analyzed using concentration levels and Herfindahl-Hirschman indices based on the number of higher education institutions and their share in the QS World University Rankings, and the number of students. This market in 2021 has a low concentration: the 3 countries with the largest number of higher education institutions (Germany, Ukraine, France) covered about 36% of the market in total; the 3 countries with the largest number of universities in the QS (United Kingdom, Germany, Italy) – 5%; the 3 countries with the largest number of students (Germany, France, United Kingdom) – 37%; and the 3 countries with the largest number of foreign students (United Kingdom, Germany, France) – 5%. Using parametric and non-parametric comparison tests, it was found that although the number of higher education institutions and students does not generally depend on the population's income level, the number of universities ranked in the QS and foreign students does. The correlation analysis revealed that GDP and GNI, population, and separately the employment and unemployment rates (for ranked universities and foreign students) are important factors that determine the uneven structure of the higher education market. The identified factors formed the basis for clustering countries using Ward's hierarchical method, which revealed the clear existence of 3 clusters: the smallest of them accumulates the 4 largest European economies with the most ranked universities; the largest (24 countries) is quite diverse, which indicates relatively equal opportunities in the market and its unification.

Keywords

tertiary education, university, QS World University Rankings, concentration ratio, Herfindahl-Hirschman Index, cluster, classification by income

JEL Classification

I20, I23, I25

INTRODUCTION

The global higher education market is undergoing a complex transformation driven by the heterogeneous impact of globalization, migration challenges, demographic shifts, and rapid technological progress. In this dynamic environment, higher education is becoming not only a place of knowledge transfer but also a center for solving societal problems, contributing to scientific research, and achieving the Sustainable Development Goals, technology development, and innovation.

The COVID-19 pandemic has significantly changed the landscape of higher education, necessitating a deep and long-term restructuring of higher education institutions' strategies (UNESCO, 2022). For the first time in history, universities have been forced to quickly rethink their learning methods, teaching and management, research, and international mobility. According to UNESCO (2021), one of the key aspects of university adaptation during the pandemic was the massive forced transition to online learning in pure or hybrid form, which led

to increased inequality among socially vulnerable groups of students, worsened educational and scientific outcomes, and caused changes in international student flows (UNESCO, 2022). Nevertheless, these events have become a booster of the rapid digitalization of the educational process, leading to the development of innovative technologies and new teaching and research methods.

Currently, universities are becoming catalysts for the creation of a single educational and research network space in Europe (European Commission, 2020a, 2020b). This involves establishing mechanisms to promote and strengthen various forms of transnational cooperation between higher education institutions and thus changing the structure of the higher education market. In this regard, the study of the peculiarities of the European higher education market plays a crucial role in forming a competitive and innovative educational space. It is also useful for identifying levers and incentives for influence.

1. LITERATURE REVIEW AND HYPOTHESES

The higher education market and its structure have been shaped and transformed throughout the entire period of its existence in accordance with the requirements of its time. In particular, after the Second World War, there was a rapid increase in the number of higher education institutions and students around the world, which was the result not only of the economic recovery in the postwar period but also of the growing public awareness of the role of education as an important factor in social progress and national welfare. The postwar years also marked the beginning of government support and investment in the higher education system, which stimulated its large-scale expansion and laid the foundations for modern higher education market models (Heffernan, 2024).

Universities have become not only centers of knowledge dissemination and creation (Engwall, 2020), but also active participants in the economy, influencing employment, innovation development, and labor mobility. In particular, Gondauri et al. (2024), Yehorova and Drozd (2024), and Vasylieva and Kasyanenko (2013), Mukhtarova et al. (2024), Dobrovolska et al. (2023b, 2023c) analyze the factors of increasing a country's innovative and socio-economic development through the development of the higher education sector. Eleyan (2020), Syaiful (2020), and Didenko et al. (2022) study factors of strengthening the competitiveness of higher education institutions in such conditions. Kuzior et al. (2022b) and Andrei et al. (2023), Tleuberdinova et al. (2024) prove the positive

relationship between higher education and the achievement of sustainable development goals.

Assaad et al. (2018), Taweel (2020), Mujtaba and Lawrence (2024), and Andrei et al. (2021) emphasize the importance of the interaction between the higher education system and the labor market. These works consider how market needs affect the formation of educational programs and whether they ensure that the educational achievements of the student meet market requirements. Particular attention is paid to the analysis of the development of skills that students acquire during their studies and their relevance to the modern labor market (Oswald-Egg & Renold, 2021). Dobrovolska et al. (2023a) note a positive relationship between certain indicators of higher education and the processes of knowledge creation, impact, and dissemination, which play a key role in the development of the knowledge society. Manfreda-Foley (2024), Semiv et al. (2024) investigate the relationship between the activities of educational institutions and migration processes in the country.

Studying the number of universities in the structure of the higher education market is important for understanding trends and dynamics in this area. Valero and Van Reenen (2019) prove that the growth in the number of universities or their expansion has a positive effect on the economic growth of a region and its geographically neighboring areas, measured by GDP per capita. Similar conclusions are drawn by Agasisti and Bertolotti (2022), who also prove the existence of a positive relationship on the example of European countries.

Studying the dynamics of student flows allows us

to better understand how demographic changes, economic development, and government policies on higher education funding affect the structure of the higher education market (Declercq & Verboven, 2015). The study by Maneejuk and Yamaka (2021) also confirms the impact of higher education enrollment on economic growth in ASEAN-5 countries.

However, in the context of the globalization of higher education and growing competition between institutions, universities face new challenges, focusing on improving the quality of educational and research services rather than increasing their quantity (Hauptman Komotar, 2020). The processes of internationalization (Rana et al., 2022; Kuzior et al., 2022a) and digitalization are considered to be significant factors that have influenced such changes, which have significantly expanded access to education, stimulating student mobility flows and made it more flexible. Researchers pay considerable attention to the impact of digitalization processes on the higher education sector (Samusevych et al., 2021), the transformation of the structure of the higher education market and competition in it in the context of digitalization (Altmann et al., 2018; Al-Imarah & Shields, 2019), the conditions for universities to adapt to online learning (Novikova et al., 2022; Pozovna et al., 2023; Kim et al., 2022), the use of digital technologies in the pedagogical process (Melnik et al., 2023; Ninassi & Burrell, 2023), the impact of new technologies such as artificial intelligence (Radianti et al., 2021), blockchain (Bhavana & Vijayalakshmi, 2022; Ogunleye et al., 2023), virtual reality (Onopriienko et al., 2023) on the transformation of higher education markets.

Such qualitative changes are reflected in the positioning of universities in various international rankings. In particular, numerous studies have focused on strengthening the competitiveness of universities to take leading positions in such rankings (Estrada-Real & Cantu-Ortiz, 2022; Dowsett, 2020). These international rankings, such as QS World University Rankings, Times Higher Education (THE), and others, play a key role in determining the position of universities on the world stage and influence their attractiveness to students, researchers, and investors

(Rybiński & Wodecki, 2022). Despite some criticism of the methodology and evaluation criteria, in particular, for an overemphasis on research and citation indicators, the rankings remain an authoritative guide for various stakeholder groups.

As Kwiek (2013) notes, most European countries are transforming the basic role of universities. These changes involve strengthening the financial self-sufficiency of public universities, rethinking student fees in the context of equal access to higher education, enhancing academic entrepreneurship, and attracting additional non-state funds. Yu et al. (2023, 2024) investigated the peculiarities of the distribution of financial resources between higher education institutions. As a result, universities are under great pressure from society and government agencies to ensure a high level of response to modern challenges.

Consideration of this problem in the regional context shows different trends: modern higher education in the United States has become a collection of segmented markets, each with its own limitations and logic of functioning, in particular in terms of pricing (Zemsky & Shaman, 2017), while in Europe the emphasis is placed on creating common unified standards and joining efforts to ensure the unity of higher education, in particular the creation of a single educational space (Gapinski, 2010; Highman, 2017). On the other hand, new governance models are emerging in the European educational space, which emphasize the strategic autonomy of higher education institutions and, accordingly, the idea of competitiveness and strategic differentiation (Bonaccorsi, 2014).

Therefore, it can be argued that universities need evidence-based recommendations that could help them better understand the market context and competitive conditions in which they operate and serve as a basis for developing and harmonizing policies aimed at increasing access to higher education, optimizing resource allocation, and improving the quality of education in different countries. The EU candidate countries need a deeper understanding of the convergence trends of European education areas.

The purpose of this study is to analyze the structure of the European higher education market and identify the factors that determine its differentiation and formation of regional clusters.

Given the above, the main hypotheses of this study are:

- H1: *The structure of the higher education market in European countries depends on the income level of a country.*
- H2: *The structure of the higher education market in European countries depends on the economic conditions in a country.*
- H3: *The structure of the higher education market in European countries depends on demographic factors.*

2. METHODOLOGY

The input data of the study were indicators characterizing the structure of the higher education market in the countries, particularly through the perspective of universities and students, as well as socio-economic and demographic factors of the countries' development for 2012–2021 (the latest available data). As a result, an array of input data was formed, presented in Table 1. The information

bases for collecting indicators were the European Tertiary Education Register (ETER), Eurostat, World Development Indicators by the World Bank, QS, and the State Statistics Service of Ukraine.

The study sample includes 38 countries located in Europe, some of which (28) are EU members and the rest are their development and cooperation partners according to Eurostat data, with information for the selected time period being freely available in the listed databases. For further research, these countries are classified according to the World Bank's atlas method (World Bank, n.d.), which includes low (L), lower-middle (LM), upper-middle (UM), and high-income (H) countries. The list and abbreviations are provided in Appendix A. For ease of analysis, all countries are divided into two groups: high-income (1) and lower- and upper-middle (0), as only one country is classified as lower-middle.

All calculations and data processing were performed using MS Excel and STATA/SE 11.1 software.

The following indicators were used to assess concentration in the higher education market: concentration level and Herfindahl-Hirschman indices (absolute and normalized). They determine the share of a market or industry in a certain period of time, and have an absolute or relative measurement (Brezina, 1994; Fendeková & Fendek, 1997).

Table 1. Characteristics of the research input data set

Indicator	Unit of measurement	Symbolic designation	Database
Number of higher education institutions in the country	un.	hei	European Tertiary Education Register (ETER), State Statistics Service of Ukraine
Number of higher education institutions included in the QS World University Rankings	un.	hei_qs	QS
Students enrolled in tertiary education	number of persons	stud	Eurostat, State Statistics Service of Ukraine
Foreign students enrolled in tertiary education	number of persons	stud_for	
Population on 1 January	number of persons	popul	
Population aged 15-24 years	number of persons	popul1524	
Population density	number of persons per sq. km	density	World Bank, Eurostat, State Statistics Service of Ukraine
GDP (constant 2015 USD)	USD	gdp	
GDP per capita (constant 2015 USD)	USD	gdppc	
GNI (constant 2015 USD)	USD	gni	
GNI per capita (constant 2015 USD)	USD	gnipc	
Employment to population ratio, 15+, total (modeled ILO estimate)	%	empl	
Unemployment, total (modeled ILO estimate)	% of labor force	unempl	

Concentration Ratio (CR) is an index that determines the market share held by market participants (traditionally a certain number of leading market participants), taking into account their performance indicators (e.g., production or service results, assets or liabilities, etc.) The traditional formula for calculating the concentration level is presented in the form of formula (1), but in this study, it is proposed to calculate it using formula (2). This involves assessing the concentration of each participant in the higher education market (for example, by the number of institutions, students, etc.).

$$CR = \sum_{i=1}^n Y_i, \tag{1}$$

$$CR_i = \frac{X_i}{X}, \tag{2}$$

where Y_i is the market share of participant i ; N is a certain number of leading market participants (3, 5, 1, etc.); X_i is a performance indicator of an individual market participant; X is the total performance of all market participants.

The Herfindahl-Hirschman Index (HHI) is an indicator that takes into account the distribution of market share among all market participants. It is calculated using the formula (Brezina et al., 2014):

$$HHI = \sum_{k=1}^N (Y_k)^2, \tag{3}$$

where N is a total number of market participants; is a normalized Herfindahl-Hirschman index (NHHI), which ranges from $1/n$ to 1:

$$NHHI = \frac{HHI - \frac{1}{n}}{1 - \frac{1}{n}}. \tag{4}$$

The obtained values should be interpreted as follows (Brezina et al., 2014):

- 1) $HHI = 0$ denotes a minimal concentration. This indicates that the market is very competitive and the market share is divided among many small players;
- 2) $0 < HHI < 0.1$ denotes a low level of concentration. The market is still considered to be com-

petitive, with some level of concentration, but not so high as to cause significant recordable concentration effects;

- 3) $0.1 < HHI < 0.18$ denotes a medium level of concentration. The market may have a certain degree of concentration, indicating the presence of large players, but competition may still be high;
- 4) $HHI > 0.18$ denotes a high level of concentration. The market is considered to be concentrated and there is a large player or several large players with significant market shares. This may affect the level of competition and market efficiency.

The similarity of the calculated indicators of concentration of the higher education market by various features and the analysis of the unevenness of this market were checked using parametric and non-parametric comparison tests (Table 2), which allow us to take into account the diversity of data and their features, which will ensure a more objective interpretation of the results. Their essence is to determine whether statistically significant differences exist between the means, medians, or other indicators of two dependent or independent groups or objects (Hoskin, 2012).

The factors that determine the differentiation of concentration levels of the higher education market in European countries were identified using correlation analysis (building a correlation matrix) and graphical analysis of these dependencies by constructing scatter diagrams. To improve the quality of the results, the data were normalized by logarithmization.

To identify regional patterns in the higher education market in Europe, the hierarchical Ward clustering method was used to group objects based on mutual distances or similarities between them. This method first calculates the distances between objects and combines them into clusters, gradually combining similar objects into larger groups (Backhaus et al., 2023). Additionally, the Ward method allows you to visualize the hierarchy of groups in the clustering process using dendrograms, which helps to understand the structure of similarities among objects. The Duda-Hart meth-

Table 2. Characteristics of parametric and non-parametric comparison tests

Characteristic	Parametric tests	Non-parametric tests
The dependent sample groups	Paired t test	Wilcoxon signed-rank test; Sign test
The independent sample groups	Two-sample t test	Two-sample Wilcoxon rank-sum (Mann-Whitney) test; Median test; Two-sample Kolmogorov-Smirnov test; Kruskal-Wallis equality-of-populations rank test

od (Duda & Hart, 2000) was used as a criterion for determining the optimal number of clusters, which allows us to estimate the number of clusters by analyzing how quickly the variation between groups decreases with an increase in the number of clusters.

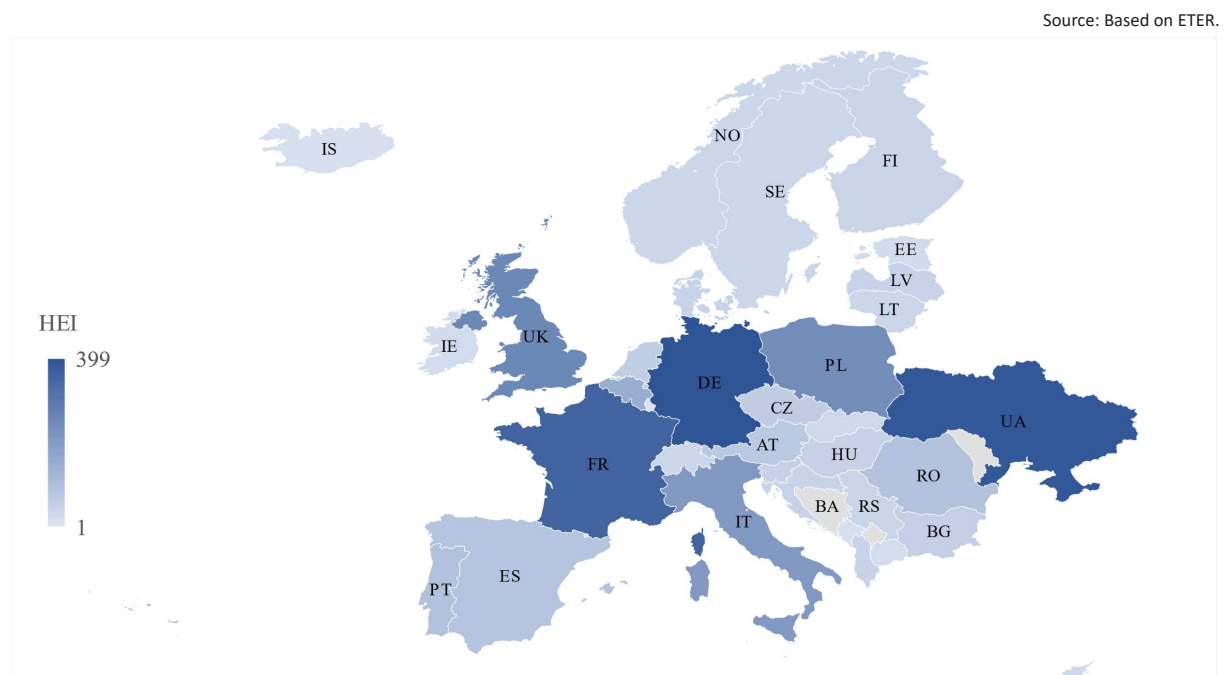
3. RESULTS AND DISCUSSION

3.1. Generalized analysis of the structure of the higher education market in Europe

The cross-country analysis showed that the number of higher education institutions among the selected 38 European countries varies significantly, as shown in Figure 1. In 2021, there were more than 2,900 universities (approximately 19% of

higher education institutions worldwide), the largest number of which was observed in Germany (399), Ukraine (386), and France (355). Instead, the smallest number of higher education institutions is concentrated in Andorra (1), Liechtenstein (2), and Luxembourg (3). In the time dimension, all European countries in the sample showed an average increase in their number in 2021 compared to 2012 by 7.0%.

At the same time, the number of universities included in the QS World University Rankings varies significantly among European countries (Figure 2). For example, the largest number in 2021 is recorded in the United Kingdom – 84 universities are included in the ranking in 2021, which is 32.8% of all institutions in this country; Germany – 45 (11.3% of its higher education institutions), Italy (17.3%). Instead, Ireland



Note: * Gray areas are countries for which data are not available.

Figure 1. Comparison of the number of higher education institutions among European countries in 2021

Source: Based on ETER, QS World University Rankings.

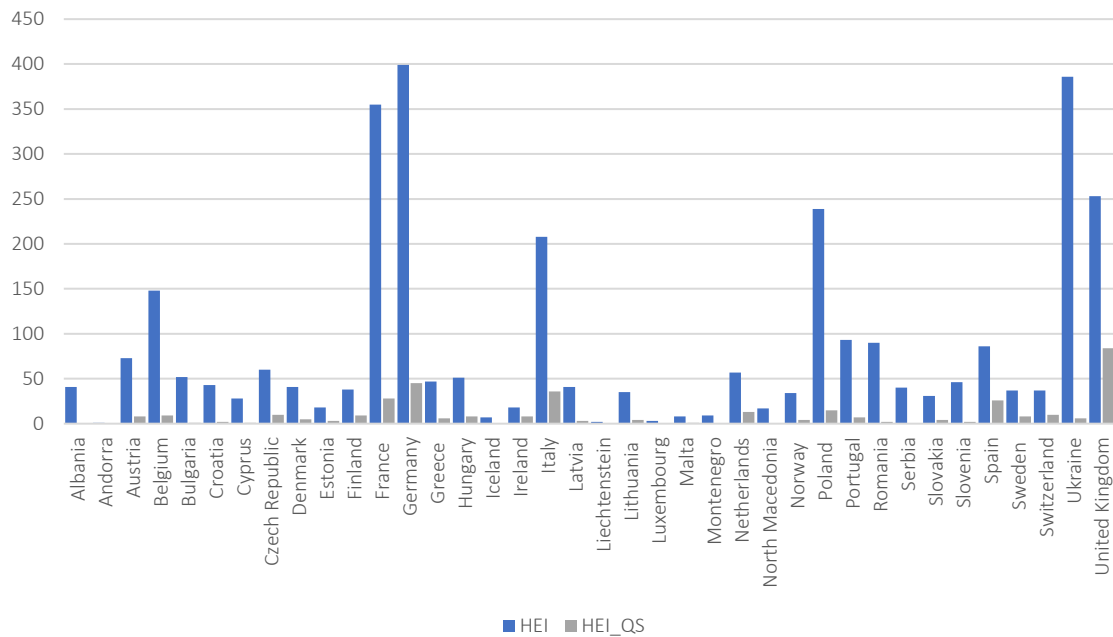


Figure 2. Comparison of the number and share of higher education institutions in the QS World University Rankings among European countries in 2021

(44.4% or 8 out of 18 institutions in the country are ranked) and Spain (30.2% or 26 out of 28 institutions) have high percentages. The following universities received the highest rankings in 2021:

- University of Oxford (United Kingdom) ranked 5th;
- Swiss Federal Institute of Technology Zurich, ETHZ (Switzerland) ranked 6th;

Source: Based on Eurostat.

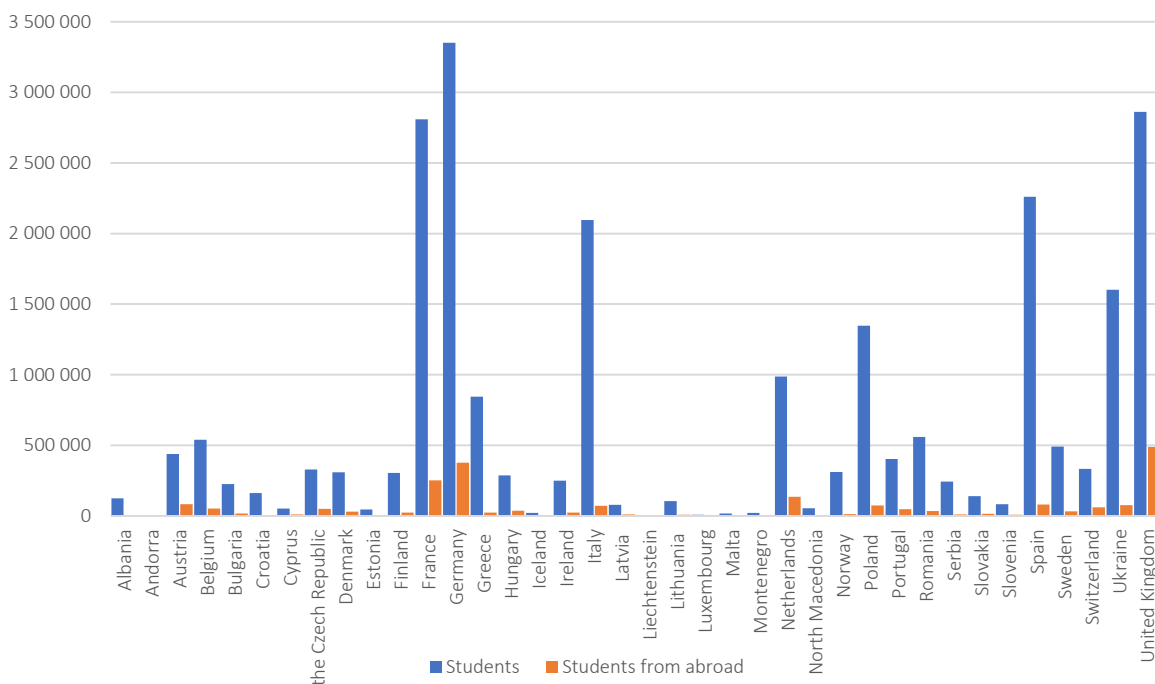


Figure 3. Comparison of the number and share of higher education students in the population among European countries in 2021

- University of Cambridge (United Kingdom) ranked 7th;
- Imperial College London (United Kingdom) ranked 8th;
- University College London (United Kingdom) ranked 10th.

Another important indicator that characterizes the structure of the higher education market is the number of students enrolled in higher education institutions, as well as the share of foreign students (Figure 3). In total, more than 21 million students were enrolled in the 38 European countries analyzed in 2021, of which more than 1.5 million were foreign students. The largest number of students is observed in Germany (with 11.2% of foreign students), France (9% of foreign students), and the UK (17.1%, respectively). It is worth noting that a fairly high number of foreign students is observed in Liechtenstein, Luxembourg, and Cyprus.

3.2. Analysis of concentration in higher education markets in Europe

Assuming that the European space is homogeneous and accessible to students without significant barriers to movement, the distribution of higher education institutions can be viewed as one that should provide equal access to educational services in each region. This provides the basis for calculating the concentration levels in the higher education markets among European countries, as it allows us to assess whether this distribution is close to an ideal uniform state or is concentrated around certain regions and centers. For this purpose, this study used the concentration levels of the number of higher education institutions (CRhei) and the number of higher education

institutions included in the QS World University Rankings (CRhei_qs), as well as the Herfindahl-Hirschman index (HHI) and its normalized index (NHHI) for the analyzed European countries (the results are shown in Table 3).

The results showed that, in general, the European higher education market has a low concentration level of the number of universities, with levels varying from country to country. Dynamic analysis revealed that in 2021, Germany (12.6%), Ukraine (12.2%), and France (11.1%) had the highest concentration levels in terms of the number of higher education institutions, which together cover more than 35% of the market. It is worth noting that the largest five players (with the United Kingdom and Poland in addition to the previously mentioned) concentrate more than 51% of higher education institutions in Europe, and their share remained relatively stable during the analyzed period.

On the other hand, the concentration of universities included in the QS ranking shows a higher growth rate. The top five countries, which cover more than 6.9% of the market, are the United Kingdom, Germany, Italy, France, and Spain. This may indicate a strengthening of individual universities' positions in international rankings and, thus, an increase in the competitiveness of some countries in the global educational arena.

The results of a similar calculation of the concentration indicators by the number of all (CRstud) and foreign students (CRstud_for) are shown in Table 4. In particular, in 2021, Germany (13.9%), the United Kingdom (11.8%), France (11.65%), Spain (9.38%), and Italy (8.7%) covered more than 50% of all students in the European higher education market, and the indicator has increased over time. The share of international students

Table 3. Comparison of indicators of concentration in higher education markets among European countries: university dimension

Code	conc_hei, %			Abs. increase Δ, %	conc_hei_qs, %			Abs. increase Δ, %
	2012	2016	2021		2012	2016	2021	
CR3, %	35.56	34.06	35.94	0.38	4.45	4.31	5.20	0.75
CR5, %	50.67	51.50	51.45	0.78	5.80	5.39	6.90	1.10
HHI, un.	0.07	0.07	0.07	0.00	0.00	0.00	0.00	0.00
NHHI, un.	0.04	0.04	0.05	0.01	0.00	0.00	0.00	0.00

Table 4. Comparison of concentration indicators in higher education markets among European countries: student dimension

Code	C_stud, %			Abs. increase Δ, %	C_stud_for, %			Abs. increase Δ, %
	2012	2016	2021		2012	2016	2021	
CR3, %	32.52	35.22	37.43	4.91	4.01	4.11	4.64	0.63
CR5, %	51.06	52.08	55.51	4.45	4.74	4.92	5.54	0.80
HHI, un.	0.07	0.07	0.08	0.01	0.12	0.11	0.11	0.00
NHHI, un.	0.05	0.05	0.05	0.00	0.10	0.09	0.08	0.00

increased slightly between 2012 and 2021, with the largest concentration in the United Kingdom, Germany, and France. The classical and normalized Herfindahl-Hirschman index remained almost unchanged in 2020 compared to 2012.

The obtained indices were tested for similarity using parametric and non-parametric comparison tests (the results are shown in Table 4). The null hypothesis is the assumption that the distributions are identical with equal means or medians. According to the results of the tests, the null hypothesis for the levels of concentration by the number of higher education institutions and students, as well as for the number of institutions included in the QS ranking and foreign students was rejected.

3.3. Identification of factors that determine the uneven structure of the higher education market in European countries and form regional clusters

Within the framework of the first hypothesis, it is assumed that the structure of the higher education market in European countries is uneven, depending on the country's income level (the World

Bank Atlas classification was chosen as a criterion). The use of a number of parametric and non-parametric comparison tests allowed us to obtain the following results (Table 6). The number of higher education institutions and students enrolled in them does not depend on the economic well-being of the population, but for the number of universities in the QS ranking and foreign students, the assumption is confirmed. This can be explained by the fact that universities from higher economic developed countries have more resources to invest in research, improve educational infrastructure, and international promotion, which makes them more attractive to foreign students and increases their positions in international rankings.

To test the second and third hypotheses, a correlation matrix was constructed that examines the relationship between the concentration of universities in countries, as well as students enrolled in them, and a number of socio-economic and demographic factors of country development (Figure 3).

As a result, the second hypothesis was confirmed, since the structure of the higher education market in European countries depends on the economic conditions in the country. In particular, a high positive correlation with GDP and GNI was found. It is worth noting that the relationship with the

Table 5. Comparison of similarity of concentration indicators in higher education markets among European countries

Tests	conc_hei vs conc_hei_qs	conc_stud vs conc_stud_for	conc_hei vs conc_stud
Paired t test	Mean diff = 0.024 t = 15.534 Pr(T > t) = 0.000	Mean diff = 0.026 t = 14.381 Pr(T > t) = 0.000	Mean diff = 0.000 t = 0.012 Pr(T > t) = 0.990
Wilcoxon signed-rank test	z = 16.884 Prob > z = 0.000 Exact prob = 0.000	z = 16.657 Prob > z = 0.000 Exact prob = 0.000	z = 5.031 Prob > z = 0.0000 Exact prob = 0.0000
Sign test	Pr(#positive ≥ 371 or #negative ≥ 371) = min(1, 2*Binomial(n = 371, x ≥ 371, p = 0.5)) = 0.0000	Pr(#positive ≥ 349 or #negative ≥ 349) = min(1, 2*Binomial(n = 350, x ≥ 349, p = 0.5)) = 0.0000	Pr(#positive ≥ 244 or #negative ≥ 244) = min(1, 2*Binomial(n = 347, x ≥ 244, p = 0.5)) = 0.0000

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The null hypothesis that the distributions are identical is rejected

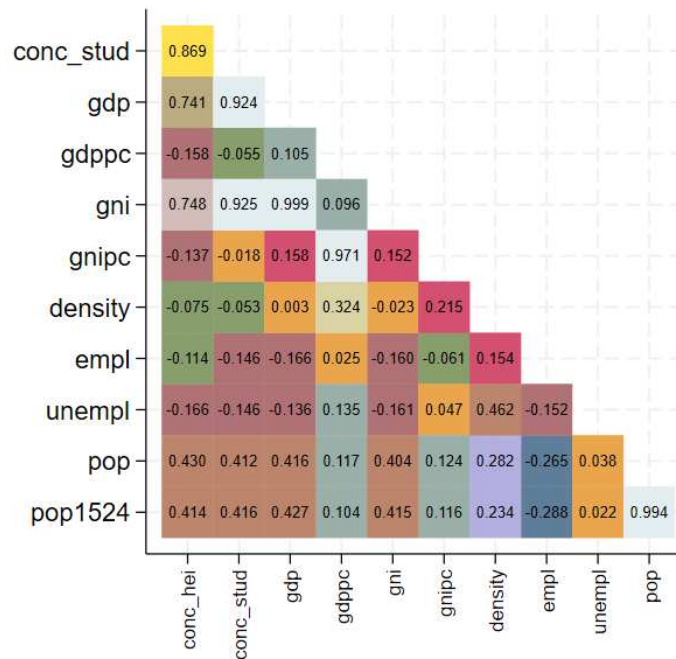


Figure 4. Correlation matrix on the relationship between the structure of the higher education market in European countries and socio-economic and demographic factors

Table 6. Analysis of the uneven concentration of the higher education market in European countries depending on a country’s income level

Tests	conc_hei	conc_hei_qs	conc_stud	conc_stud_for
Two-sample t test	Mean diff = 0.001 t = -0.317 Pr(T > t) = 0.751	Mean diff = -0.003 t = -4.922 Pr(T > t) = 0.000	Mean diff = -0.008 t = -1.609 Pr(T > t) = 0.109	Mean diff = -0.002 t = -3.108 Pr(T > t) = 0.002
Two-sample Wilcoxon rank-sum (Mann-Whitney) test	z = 0.622 Prob > z = 0.534	z = -7.708 Prob > z = 0.000	z = -1.278 Prob > z = 0.201	z = -3.240 Prob > z = 0.001
Median test	Pearson chi2(1) = 0.0437 Pr = 0.834	Pearson chi2(1) = 47.251 Pr = 0.000	Pearson chi2(1) = 14.356 Pr = 0.000	Pearson chi2(1) = 11.780 Pr = 0.001
Two-sample Kolmogorov-Smirnov test	D = 0.158 p-value = 0.115	D = 0.474 p-value = 0.000	D = 0.259 p-value = 0.001	D = 0.214 p-value = 0.011
Kruskal-Wallis equality-of-populations rank test	chi2(1) = 0.386 Prob = 0.534	chi2(1) = 55.434 Prob = 0.000	chi2(1) = 1.629 Prob = 0.202	chi2(1) = 9.520 Prob = 0.002

indicator of concentration in terms of the number of students in a country is stronger. The third hypothesis is also confirmed, as demographic factors such as the number of population and young people among them have a moderate impact on the structure of the higher education market.

Taking into account the previously confirmed first hypothesis about the uneven concentration of the higher education market in European countries depending on the level of income of the country, the correlation matrices for the number of universities included in the QS ranking and foreign students were built in two groups (Table 7).

The results showed that for European countries with lower and upper middle-income levels, the structure of the higher education market in terms of the number of universities included in the QS ranking depends on GDP and GNI (moderately), population (strongly), its density (moderately), and unemployment and employment (moderately). In contrast, no statistically significant linear relationship with the labor market was found for high-income countries. A similar relationship is confirmed for markets with different numbers of foreign students. It is also worth noting that in European countries with lower and upper middle-income levels, there is a positive moderate rela-

Table 7. Correlation between the structure of the higher education market in European countries and socio-economic and demographic factors depending on a country’s income level

Factors	<i>conc_hei_qs</i>		<i>conc_stud_for</i>	
	0	1	0	1
gdp	0.497	0.900	0.363	0.922
gdppc	-0.276	0.022	-0.321	0.066
gni	0.624	0.889	0.495	0.919
gnipc	-0.276	0.057	-0.330	0.119
density	0.626	-0.066	0.492	-0.056
empl	0.253	-0.190	0.245	-0.140
unempl	-0.488	-0.054	-0.433	-0.154
pop	0.825	0.411	0.846	0.412
pop1524	0.775	0.446	0.777	0.438

tionship with population density, as densely populated countries create more favorable conditions for the development of leading educational institutions that are in demand among both local and foreign students. In other words, in lower-income countries, universities may be more dependent on the economic situation, as limited resources may encourage governments and institutions to concentrate resources to increase competitiveness. Highly developed countries have better infrastructure and stable funding for education, so changes in unemployment or employment rates do not have a significant impact on the number of universities included in the QS rankings. All this shows that the second and third hypotheses are confirmed.

The identified patterns are the basis for clustering European countries according to the structure of their higher education market, taking into account demographic and socio-economic features. The use of hierarchical clustering by the Ward method allowed us to obtain the dendrogram shown in Figure 4. Visually, we can clearly see three main clusters. This number was also confirmed using the Dood-Hart method $Je(2)/Je(1)$ (the test results are given in Appendix B).

The data presented in Table 8 show an uneven distribution of countries. The table does not show all the indicators that were used in the clustering, but only some of them, which allows us to identify the reasons for the division of clus-

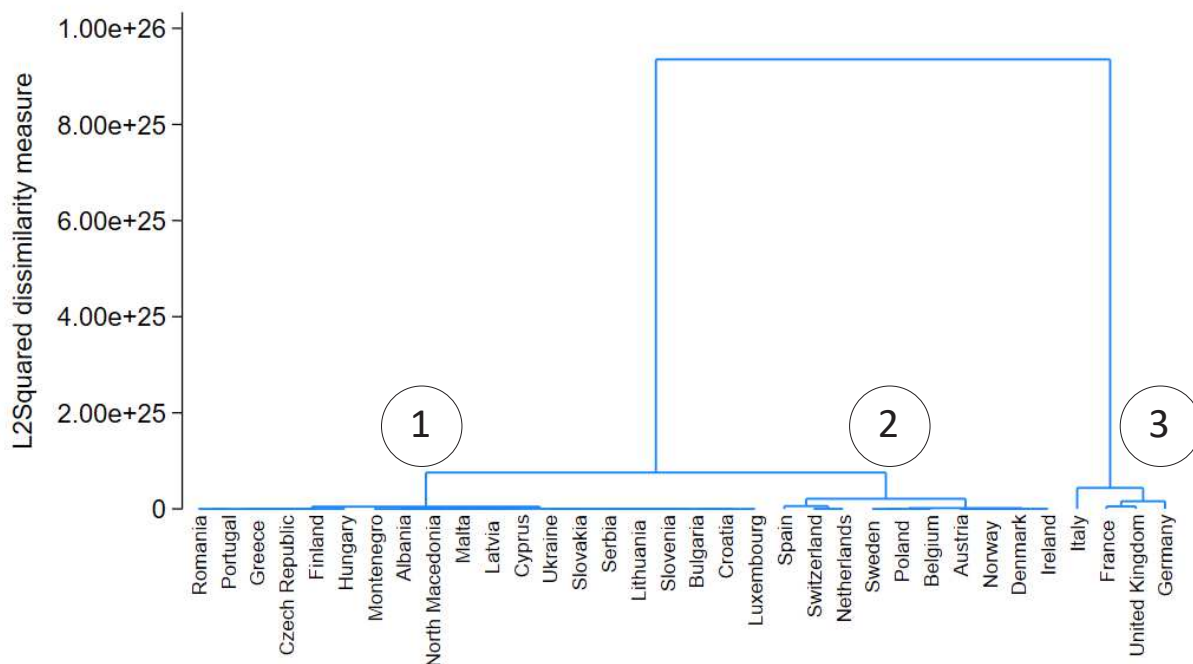


Figure 5. Clustering of the higher education market structure in European countries

Table 8. Statistical analysis of clusters of European countries by the level of concentration of higher education institutions

Cluster	Freq. n	Percent	Stat.	conc_hei_qs	conc_stud_for	gdp	gni	pop
1	24	63.16	Mean	0.001	0.001	83.10	78.60	10.70
			SD	0.001	0.001	84.90	81.10	17.10
2	10	26.32	Mean	0.004	0.002	645.00	609.00	16.20
			SD	0.002	0.002	291.00	284.00	18.40
3	4	10.53	Mean	0.015	0.012	2 860.00	2 830.00	40.70
			SD	0.008	0.007	725.00	747.00	40.30
Total	38	100.00	Mean	0.005	0.004	523.00	508.00	15.30
			SD	0.005	0.004	888.00	880.00	21.90
Cluster 1				Cluster 2			Cluster 3	
Romania, Montenegro, Albania, Ukraine, Serbia, Bulgaria, North Macedonia, Latvia, Greece, Portugal, Andorra, Iceland, Malta, Hungary, Slovakia, Finland, Estonia, Lithuania, Croatia, Cyprus, Czech Republic, Luxembourg, Liechtenstein, Slovenia				Spain, Sweden, Austria, Switzerland, Belgium, Netherlands, Poland, Denmark, Ireland, Norway			Italy, France, United Kingdom, Germany	

ters. In particular, the largest number of countries is accumulated in clusters 1 (24 countries) and 2 (10 countries). The smallest list of countries is included in the third cluster, which consists of the 4 largest European economies – Italy, France, the United Kingdom, and Germany. The average GDP and national income here are significantly higher than in other clusters, and the concentration of QS universities and foreign students is the highest. The second cluster includes countries with a large concentration of ranked universities and attractive to foreign students, which is supported by the stability of their economies. The clustering results also confirm previous assumptions that the uneven concentration of the higher education market in European countries depends on the country’s income level and other economic and demographic conditions. However, it is worth noting that the first and second clusters are milestones of the same branch, which indicates the gradual unification of the European educational space.

This study’s results indicate minor differences in the structure of the higher education market in the studied European countries. On the one hand, this is in line with the findings of Teichler (2008) regarding the growing debate in the European education space on the feasibility of moving from moderate vertical diversity of higher education institutions to more extreme forms, especially in the quest to compete on a

global scale, which contributes to the strengthening of diversification processes. On the other hand, the results of our study, obtained as a result of the clustering of European countries, partially confirm the trends of unification of the higher education market, which were empirically formalized earlier on the example of the Czech Republic (Sekerák, & Valeš, 2023), France and Italy (Dobbins, 2017), etc.

The patterns identified in this study are consistent with the findings of Carpentier (2021), who examined the peculiarities of the transformation of the higher education system through the prism of the processes of sectoral diversification, differentiation/convergence, and social (in)equality, which are particularly exacerbated during socio-economic crises.

Also, this study’s findings can be considered a logical continuation of the study by Bertoletti et al. (2022), who empirically proved, using the example of 29 European countries in 2014–2016, that certain characteristics of higher education systems (size of higher education institutions, internationalization of students, and research performance) affect regional economic development. Similar conclusions were reached by Agasisti et al. (2022), who considered the concentration of higher education institutions as a prerequisite for economic growth for 284 European regions from 2000–2017.

CONCLUSION

This study aims to analyze the structure of the higher education market in Europe and identify the factors that determine its differentiation and form regional clusters. For this purpose, the study analyzes the number of higher education institutions and their share in the QS World University Rankings, as well as the number of students in them, including foreign students, for 38 European countries from 2012 to 2021.

A generalized analysis of the distribution of higher education institutions among European countries has shown that their number differs significantly in the analyzed countries. In general terms, the European higher education market has a low concentration, with the largest three countries (Germany, Ukraine, and France) covering only 36% of the market in 2021 by number of educational institutions. Regarding the number of universities ranked in the QS World University Rankings, the leaders are the United Kingdom, Germany, and Italy, which account for only 5% of all European higher education institutions. The growth rate of the number of higher education institutions in 2012–2020 averaged 7.0%. The calculated absolute and normalized Herfindahl-Hirschman index remained at less than 0.1 during the analyzed period, confirming the previous conclusions about the low concentration level.

A similar analysis of the distribution of students in European higher education institutions revealed similar trends, with Germany (11.2% of foreign students), France (9% of foreign students), and the UK (17.1%) being the leaders. The calculated concentration levels for them also amount to 37% (the three countries with the largest number of students) and 5% (the three countries with the largest number of foreign students), respectively, which supports the assumption of low market concentration.

Based on a number of parametric and non-parametric comparison tests, it is proved that the number of higher education institutions and students enrolled in them does not depend on the country's economic well-being, but the dependence exists for the number of universities in the QS ranking and foreign students.

The correlation analysis revealed that the structure of the higher education market in European countries depends on the country's economic conditions, particularly a high positive correlation with GDP and GNI and demographic factors (population and youth in particular). In addition, it was found that for European countries with lower and upper middle-income levels, in addition to the previous factors, the number of universities included in the QS ranking and the number of foreign students depend on the level of employment and unemployment in the country (inverse).

The obtained results became the basis for selecting indicators for clustering European countries, which was carried out in the paper using the hierarchical Ward method. As a result, the existence of three clusters in terms of concentration of the higher education market has been identified, the formation of which is determined by demographic and socio-economic features.

The results obtained can serve as important information for making future strategic decisions in the field of higher education, especially in the context of infrastructure development and financing of educational institutions, curricula development and adaptation, marketing strategies, etc.

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APPENDIX A

Table A1. List of countries included in the sample

Country	Code	WB group	Country	Code	WB group
European Union countries					
Austria	AT	H	Italy	IT	H
Belgium	BE	H	Latvia	LV	H
Bulgaria	BG	UM	Lithuania	LT	H
Croatia	HR	H	Luxembourg	LU	H
Cyprus	CY	H	Malta	MT	H
Czech Republic	CZ	H	Montenegro	ME	UM
Denmark	DK	H	Netherlands	NL	H
Estonia	EE	H	Poland	PL	H
Finland	FI	H	Portugal	PT	H
France	FR	H	Romania	RO	UM
Germany	DE	H	Slovak Republic	SK	H
Greece	EL	H	Slovenia	SI	H
Hungary	HU	H	Spain	ES	H
Ireland	IE	H	Sweden	SE	H
Partner countries on development and cooperation					
Albania	AL	UM	Norway	NO	H
Andorra	AD	H	Serbia	RS	UM
Iceland	IS	H	Switzerland	CH	H
Liechtenstein	LI	H	Ukraine	UA	LM
North Macedonia	MK	UM	United Kingdom	UK	H

APPENDIX B

Table B1. Results of the Dood-Hart test for determining the optimal number of clusters

Number of clusters	Duda/Hart	
	$Je(2)/3e(l)$	Pseudo T-squared
1	0.1584	169.98
2	0.3177	60.15
3	0.3268	4.12
4	0.2868	19.89
5	0.2482	3.03
6	0.0476	20.03
7	0.0000	–
8	0.1298	120.72
9	0.2593	14.28
10	0.2813	30.65
11	0.0000	–
12	0.3848	3.20
13	0.1067	8.37
14	0.3132	8.77
15	0.1738	4.75