The quality of higher education and its funding in countries with different levels of socio-economic development

Olha Hryhorash (Ukraine), Dmytro Bocharov (Ukraine), Maxim Korneyev (Ukraine), Tatyana Rudyanova (Ukraine), Tetiana Hryhorash (Ukraine)

Olha Hryhorash, Dmytro Bocharov, Maxim Korneyev, Tatyana Rudyanova, Tetiana Hryhorash, 2022

Olha Hryhorash, Ph.D., Associate Professor, Department of Finance, Banking and Insurance, University of Customs and Finance, Ukraine.

Dmytro Bocharov, Ph.D., Rector, University of Customs and Finance, Ukraine.

Maxim Korneyev, Doctor of Economics, Professor, Department of International Economic Relations and Regional Studies, University of Customs and Finance, Ukraine. (Corresponding author)

Tatyana Rudyanova, Ph.D., Associate Professor, Department of Computer Science and Software Engineering, University of Customs and Finance, Ukraine.

Tetiana Hryhorash, Senior Lecturer, Department of Finance, Banking and Insurance, University of Customs and Finance, Ukraine.

Abstract

Higher education institutions train professional and scientific personnel. Therefore, the quality of higher education and its funding are vital for training highly qualified specialists. This study analyzes the annual volume of expenses (investments) per student in groups of countries, divided according to their socio-economic development, and competitiveness of higher education. The division of countries into groups is based on simultaneous compliance with the criteria for the quality of higher education and the level of social and economic development. The Ward's clustering method was applied. The analysis was conducted based on data from 32 OECD countries and partner countries.

The paper found a significant direct correlation between the level of competitiveness of higher education and the amount of its funding per student (R = 0.895). At the same time, a significant direct correlation was revealed between the level of competitiveness of higher education and the human development index (R = 0.787) and the global competitiveness index (R = 0.888). Finally, a significant direct correlation between the amount of expenditures and the level of competitiveness of higher education was found only in the cluster with the highest indicators of socio-economic development (R_s = 0.707). In other clusters, the correlation is weak or weakly inverse.

Keywords: higher education, investment, cost efficiency, cluster analysis

JEL Classification: H52, I22, I25

Received on: 7th of July, 2022

Accepted on: 5th of September, 2022

Published on:

Introduction

Education provides the skills of perception and assimilation of information and shapes the population's cultural level. In addition, higher education is the basis of staff training in different spheres of activity. Accordingly, the quality of higher education affects the quality of specialists' training, which provides socio-economic growth and increases the country's competitiveness and the population's living standard. At the same time, education quality competitiveness is ensured particularly by a sufficient level of funding. Therefore, the expenditure on higher education is determined by several factors, including state policy and budgetary opportunities, based on socio-economic development.

An important issue is the analysis of the relationship among indicators of socio-economic development of countries, education quality, and amount of higher education funding. In particular, with significant amounts of higher education funding, some countries also show high indicators of higher education competitiveness (e.g., Great Britain). On the contrary, countries with lower education expenditures (e.g., Denmark and Finland) show the same high indicators of higher education quality. At the same time, some countries have a small amount of funding but do not show the lowest indicators of higher education competitiveness (e.g., Greece and Ukraine) (U21, 2020; OECD, 2021).

Therefore, there is a necessity to classify countries according to the level of socio-economic development and assess the level of higher education funding within the obtained clusters.

1. Literature review

Education is one of the tools of human capital in every country. The usefulness of higher education is considered at the micro and macro level. The micro-level means that education seekers receive some benefits compared to those who do not have or have a lower level of higher education. Some benefits are the opportunity to hold better positions, higher salaries, or privileges of social mobility (Özsoy, 2008). In particular, in Germany higher wages have those employees, who has vocational training or higher education (Popova, 2021). The availability of higher education by profession is one of the key indicators for assessing the efficiency of the industry as a whole in European countries (Polyakov, 2020). Indeed, according to calculations in EU countries, each additional year of education provides an 8% wage increase (Harmon et al., 2001). The quality of

higher education is considered by educational policymakers as compliance with state educational standards, and by higher education applicants as compliance with the requirements of the labor market (Vardanyan, 2017).

The macro level assesses the usefulness of higher education for the economic growth of the country and the impact of human capital. Thus, an increase in the share of college graduates in the United States by one percent contributes to an increase in labor productivity and production by 0.5-0.6 percentage points (Moretti, 2004). In addition to the impact on the general level of economic growth, higher education has an impact on certain spheres of social life. In particular, Artyukhov et al (2021) analyze the role of the state in higher education funding in order to improve its quality, ensure the exchange of SDGs 4 technologies and expand opportunities for the implementation of SDGs 7 based on the preparation of energy efficiency specialists, and Kyrychenko et al (2021) analyze the interrelation between the implementation of the "green university" concept and the formation of a health-preserving environment in higher education institutions as components of sustainable public health.

As the primary customer of qualified personnel, the state is interested in funding it at all levels. It has been proven that due to the creation of innovative ecosystems of the university, there is an improvement of human capital, the activation of cooperation between science, education, business and state structures in the field of research and innovation (Gontareva, 2022). An important issue of training specialists is the need for them in the labor market. Vasilyeva et al (2018) proposes a model based on the assessment of demand and supply for the relevant category of labor in the by types of economic activity in order to optimize the higher education funding. Also, the system of monitoring the effectiveness of the educational system in Ukraine from the point of view of financial resources management needs separate consideration, this can be based on models of the efficiency of the banking system (Bukhtiarova, 2020).

Also, world practice proves the effectiveness of small business activities based on the latest technologies and cooperation with scientists, which contributes to the socio-economic development of the country, but in Ukraine such cooperation is at the stage of formation (Hryhorash, 2018), and as a result of the consequences of Covid-19, such cooperation has also become more difficult for start-ups of universities around the world (Moskovicz, 2021).

Considering the expenditure on education in general and higher education in particular as a public investment, the government is interested in the return on invested capital, which does not always have a material substance. It is noted that higher education is a key resource for the development of any country, which has a short-term and long-term impact on the country and regions,

creating the social and technological capital (Saúde et al., 2015). It has been empirically confirmed that there is a significant positive relationship between the indicators of state funding of higher and secondary education per pupil/student and the productivity of countries (Nazukova, 2020).

For instance, China's rapid economic growth over the past 30 years has been attributed to investment in human capital. After the Third National Conference on Education in 1999 and the implementation of China's Education Development Plan in the 21st Century, higher education began to expand (Ahmad & Ng, 2014). Bouhajeb et al. (2018) indicated that a 1% increase in research expenditures increases 0.854% economic growth, a 1% increase in education expenditures increases 2.862% economic growth, and a 1% increase in patent application increases 0.075% economic growth in the long run. On the other hand, state interventions as international mergers and acquisitions have an impact on the financial indicators of higher education institutions (Frederick, 2020).

The existence of a positive relationship between the level of education and economic growth is confirmed using the examples of India (Kotásková et al., 2018), Taiwan (Lin, 2004), and Libya (Mahmoud & Alsanousi, 2017). Moreover, there is a positive relationship between GDP and the number of higher education graduates in Romania (Mariana, 2015). At the same time, it is noted that the impact of higher education on economic growth is more substantial when countries are closer to advanced technologies (Vandenbussche et al., 2006). It was also confirmed that education costs significantly change the distribution of countries according to the level of readiness for digitalization (Vorontsova, 2021), and a model for optimizing the costs of the education system throughout life was developed (Vorontsova, 2018).

Based on the considered sources, it is concluded that, in general, studies confirm the existence of a relationship between higher education and socio-economic growth. Thus, this paper aims to analyze the relationship between higher education funding and its quality in OECD countries and partner countries according to the level of their socio-economic development.

The views of scientists regarding the relationship between the quality of higher education and economic growth can be conditionally divided into two groups. First, many authors emphasize that higher education is one of the critical factors in ensuring the country's competitiveness and sustainable development. Therefore, as a sufficient level of funding ensures the quality of higher education, it needs significant investments. On the other hand, another group of scientists believes that there is no causal relationship between higher education funding and the level of socio-economic development. On the contrary, the level of socio-economic development determines the amount of higher education expenditures and ensures its competitiveness.

The first approach is presented by Verner (2011). Based on the analysis of the U21 rating, it

was concluded that an increase in education spending or spending on research and development contributes to the growth of the state's competitiveness (human development index). Williams (2017) noted that the worst national systems are those with low levels of public funding and significant public control of institutions.

Satsyk (2015) assessed universities in 50 countries of the world. The study showed that higher education funding directly affects the quality of higher education and the number of world-class universities (included in international rankings). The cluster analysis results determined the optimal amount of public and private expenditures per student using PPPs.

Based on the analysis of European countries, in which the share of public expenditure on education is at least 11%, a direct relationship between the amount of expenditure per student and the index of higher education quality of the QS World University Rankings system was established; however, costs are not the key factor that affects the quality score (Hryhorash, 2020).

The statement about the relationship between the competitiveness of the state and the quality of higher education is substantiated by Keser (2015). The analysis was based on the indicators of the global competitiveness index and the higher education and training index in Europe and the Middle East. It was found that in 2014, the leaders in the quality rating of higher education were Finland, Netherlands, and Belgium; these countries are presented in the top ten of 144 countries according to the GCI index. In countries of the Middle East, the United Arab Emirates tops the ranking on the quality of higher education; the UAE government claims that knowledge is the most critical factor in global competition.

Chentukov et al. (2021) used a correlation-regression analysis to confirm the presence of a significant direct correlation between the index of competitiveness of higher education (according to the data of Universitas 21) and the global competitiveness index (GCI). Furthermore, the strongest correlation was found between indicators in countries with an average level of competitiveness, and the lowest – in countries with a low level of competitiveness.

Antonyuk et al. (2017) found a significant direct correlation ($R = 0.92$) between the global innovation index and the competitiveness index of national higher education systems. At the same time, high quality of higher education and school (tertiary) enrollment is observed in countries with a high level of economic development: the USA, Great Britain, Switzerland, Germany, Australia, and Japan. Conversely, higher education funding per student is insufficient in countries with low economic development.

A study by Kuzkin et al. (2019) confirms that education is the main factor, which provides the the economic growth in countries with a level of income below the average. And based on an analysis

of the internal system of higher education in Ukraine Mazurkiewicz et al (2017) recommends to implement the experience of Poland to improve the system of internal quality assurance to Ukrainian higher education institutions.

Considering the second approach, West (2012) reviews studies of higher education in the United States made by groups of scientists (2000–2010). It indicated an increase in higher education funding in the United States while reducing the share of American students in the total number of higher education recipients. At the same time, the United States maintains its position as an economic leader. Therefore, the study refutes the thesis about the impact of education on the country's competitiveness and confirms the cause-effect relationship between economic growth and the quality of education, particularly in higher education.

The analysis made by Macerinskiene and Vaiksnoraite (2006) finds only weak evidence that higher education contributes to economic growth. It is suggested that countries with rapid economic growth and welfare can invest more in education than countries with slow economic growth.

Sannikova et al. (2021) presented standpoint theses about the lack of a direct relationship between the quality of higher education and the level of economic development. It is confirmed by the weak relationship between the positions in the world university rankings and the positions in the overall global rankings and digital competitiveness rankings. The weakness of the statistical relationship between high positions in the world rankings of competitiveness and low positions in the rankings of universities at the same time may indicate the import of intellectual capital. On the other hand, the high quality of education with a low level of competitiveness may indicate the outflow of intellectual capital.

Hamdan et al. (2020) analyzed the data from Saudi Arabia. They concluded that economic growth determines the amount of higher education expenditure, while no correlation between investment in higher education and economic growth has been found. Similarly, Lopez-Leyva and Rhoades (2016) found that in a group of Asian countries (Japan, Hong Kong, Singapore, and Korea), there is a direct correlation between the indicators of the global competitiveness index and the competitiveness of higher education systems (except Japan). On the other hand, the countries of the Latin American group (Argentina, Brazil, Chile, and Mexico) have much lower indicators of the global competitiveness index than the Asian group and have a weak correlation between competitiveness and the quality of higher education.

In the context of some contradictions about the impact of higher education funding on its quality and the contribution of higher education to economic growth, there is a need for a detailed analysis. Namely, it is critical to assess the relationship between the amount of funding and the

competitiveness of higher education in countries with different levels of socio-economic development. Therefore, the objective of this paper is to assess the relationship between the amount of funding and the quality of higher education in countries with different levels of socio-economic development.

2. Methodology

The study is based on the analysis of the correlation between the level of socio-economic development and expenditures on higher education. For this purpose, countries were grouped using the most abstract indicators that objectively characterize their socio-economic development. They are the human development index (HDI) as a social component, the global competitiveness index (GCI) as an economic component, and an indicator of the quality of the higher education system (U21). The indicator of financial support for higher education is the total expenditure on educational institutions per full-time equivalent student in equivalent USD converted using PPPs.

For the correct data comparison, the study used the indicators of only those countries represented in three ratings (HDI, GCI, and U21) and simultaneously had data on higher education expenditures. Therefore, 32 OECD countries and partner countries came to the focus of the study. In addition, data on expenditures per student in Ukraine were also calculated.

The correlation-regression analysis was used to assess the contribution of higher education expenditures on the competitiveness of higher education and the socio-economic development of countries. It is assumed that the amount of expenditures per full-time student in dollar equivalent using PPPs is related to the indicator of quality (competitiveness) of the U21 higher education system. Therefore, the study does not use the data of Luxembourg as the country with the extreme (highest) amount of higher education expenditure.

The grouping of countries by the level of socio-economic development was carried out using IBM SPSS Statistics based on Ward's clustering method with the Squared Euclidean distance; the standardization of variables was carried out based on Z-scores.

3. Results

The results of statistics calculations for series using the least squares method are presented in Table 1.

Table 1. Correlation between the amount of higher education expenditures, the quality of higher education, and economic and social development

Source: Authors' elaboration based on OECD (2021), WEF (2018), UNDP (2018), State Treasury Service of Ukraine (2018).

У References інші роки 2022 і 2020

Indicator	Higher education expenditures and the quality of higher education (U21)	Quality of higher education (U21) and Human Development Index (HDI)	Quality of higher education (U21) and Global Competitiveness Index (CGI)
R	0.895	0.787	0.888
R^2	0.8016	0.6193	0.7889
$F_{(0,05;1;30)}$	4.17	4.17	4.17
F_{emp}	121.2	48.81	112.1
$t_{(0,05;30)}$	2.04	2.04	2.04
t_1	11.0	6.9	10.6
t_0	11.7	29.3	15.2

Table 1 shows a significant direct correlation between the quality of education and the amount of expenditures per student (R = 0.895). Determination factor R^2 = 80.16%. The model is adequate to the observational evidence $F_{emp} = 121.2 > F_{(0,05;1;30)} = 4.17$ and has significant regression parameters $t_1 = 11.0$, $t_0 = 11.7 > t_{(0,05;30)} = 2.04$. That is, the amount of higher education expenditures is a significant factor in the quality of higher education. Among the represented countries, the lowest indicators of the quality of higher education are shown by Mexico (40.3) and Turkey (44.0) (Ukraine – 47.4); the highest indicators are shown by the United States of America (100.0), Great Britain (82.6), Sweden (82.4), and Denmark (81.7).

The next step is devoted to the relationship between the quality of higher education and human development (social component). The highest indicators of the human development index are shown by Norway (0.956), Ireland (0.951), and Germany (0.946), and the lowest by Ukraine (0.774) and Mexico (0.776). There is a significant direct correlation (R = 0.787) between the quality of higher education and the human development index. Determination factor R^2 = 61.93%. The model is adequate to the observational evidence $F_{emp} = 48.81 > F_{(0,05;1;30)} = 4.17$ and has significant regression parameters $t_1 = 6.9$, $t_0 = 29.3 > t_{(0,05;30)} = 2.04$. That is, the quality of higher education contributes to human development.

The analysis of the relationship between the quality of higher education and competitiveness (economic component) has shown a significant direct correlation between the quality of higher education and the global competitiveness index (R = 0.888). Determination factor R^2 = 78.89%. The model is adequate to the observational evidence $F_{emp} = 112.1 > F_{(0,05;1;30)} = 4.17$ and has significant regression parameters $t_1 = 10.6$, $t_0 = 15.2 > t_{(0,05;30)} = 2.04$. This means that the quality of higher education significantly contributes to (participates in) global competitiveness. Greece (4.0) and Ukraine (4.1) had the lowest indexes in 2018, and the USA (5.9) had the highest.

For the cluster analysis of the distribution of countries by the quality of higher education and the level of socio-economic development, the following indicators are used: the quality of higher education, the human development index, and the global competitiveness index.

Based on Ward's method, 5 clusters were identified according to the level of socio-economic development and the quality of higher education (Table 2).

Table 2. Clustering of countries by level of socio-economic development in 2018

Source: Processed by authors in IBM SPSS Statistics.

Cluster	Country
1	United States, United Kingdom, Sweden, Norway, Canada, Netherlands, Australia, Belgium, Austria, Denmark, Germany, Finland, New Zealand, and Ireland
2	Japan, France, Israel, and Korea
3	Czech Republic, Slovenia, Spain, Italy, and Poland
4	Hungary, Slovak Republic, Portugal, Turkey, Russian Federation, Chile, and Greece
5	Mexico and Ukraine

The values of the indicators within clusters are presented in Table 3.

Table 3. The values of the indicators within clusters in 2018

Source: Processed by authors in IBM SPSS Statistics.

Ward method		HDI	GCI	U21	Expenditures per student
1	Mid value	0.937	5.4	78.1	22,481
	Number of countries	14	14	14	14
	Standard deviation	0.010	.2	8.3	–
	Minimum	0.921	5.2	64.8	17,151
	Maximum	0.956	5.9	100.0	34,035
2	Mid value	0.911	5.3	63.7	15,088.5
	Number of countries	4	4	4	4
	Standard deviation	0.009	.2	4.7	–
	Minimum	0.898	5.1	58.0	11,289
	Maximum	0.917	5.5	68.5	19,309
3	Mid value	0.896	4.6	54.1	13,500.6
	Number of countries	5	5	5	5
	Standard deviation	0.014	.1	1.9	–
	Minimum	0.877	4.5	51.3	11,191
	Maximum	0.912	4.8	56.2	16,147
4	Mid value	0.848	4.4	49.3	9,853.8
	Number of countries	7	7	7	7
	Standard deviation	0.022	.2	3.7	–

	Minimum	0.817	4.0	44.0	10,008
	Maximum	0.881	4.7	56.4	9,024
5	Mid value	0.775	4.3	43.9	–
	Number of countries	2	2	2	2
	Standard deviation	0.001	.2	5.0	–
	Minimum	0.774	4.1	40.3	1,611
	Maximum	0.776	4.4	47.4	7,907

Considering the average, maximum, and minimum of the indicators by clusters, it is noted that the mid value of the indicator U21 in the first cluster significantly exceeds the mid value of the second cluster (78.1 compared with 63.7). The human development index also has a significant advantage (0.937 compared with 0.911). On the other hand, the indicator of global competitiveness does not differ significantly in the first and second clusters (mid values are 5.4 and 5.3). In the third, fourth, and fifth clusters, no significant fluctuations of the mid values of indicators by clusters were found.

The range of expenditures per student within the clusters is presented graphically in Figure 1.

Source: Processed by authors in IBM SPSS Statistics.

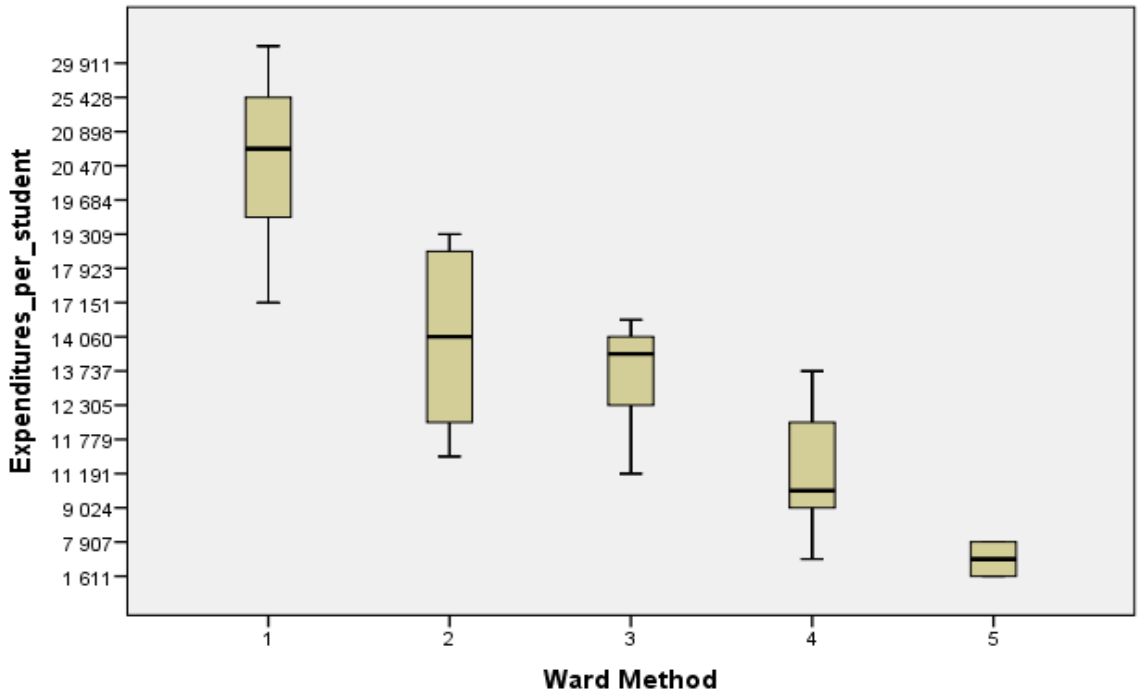

Figure 1. The range of expenditures per student within the clusters in 2018

In general, the amount of expenditures per student in the first cluster range from USD 17,151 to USD 34,035, with a mid value of 22,481 dollars. That is, the amount of expenditure per student in

Ireland is twice as much as per student in the USA. On the other hand, Great Britain, Sweden, Norway, and Canada have above-average amounts of spending. Next, 4 countries form the second cluster; the mid value of expenditures for the cluster is 15,089 dollars, with the maximum value of Japan (USD 19,309) and the minimum value of Korea (USD 11,289). In the third cluster, 5 countries are grouped; the maximum values of expenditures and the average values of the cluster are almost the same as the indicators of the second cluster. Next, the fourth cluster consists of 7 countries; the average amount of higher education spending per cluster is 9,854 dollars. Together with Mexico, Ukraine is in cluster 5 and spends five times fewer expenditures per student (USD 1,611) than Mexico (USD 7,907).

Similar calculations were carried out for the countries in previous years. Countries were grouped according to the criterion of socio-economic development into 5 clusters. Despite the lack of statistical data for some countries in 2014 (Canada, Denmark, and Greece), they are presented in the analysis of 2015–2018. The dynamics of the countries clustering by the level of socio-economic development in 2014–2018 is presented in Table 4.

Table 4. Countries clustering by the level of socio-economic development in 2014–2018

Source: Processed by authors in IBM SPSS Statistics based on data of Education at a Glance (OECD, 2017, 2018, 2019, 2020, 2021).

Country	2014	2015	2016	2017	2018
Australia	1	2	2	2	1
Austria	2	2	2	3	1
Belgium	2	2	2	3	1
Canada		4	3	2	1
Chile	5	5	5	4	4
Czech Republic	3	3	4	4	3
Denmark		4	3	2	1
Finland	1	1	1	2	1
France	2	2	2	3	2
Germany	2	2	2	3	1
Greece		3	5	4	4
Hungary	4	3	2	4	4
Ireland	2	2	2	3	1
Israel	2	2	2	3	2
Italy	3	3	4	4	3
Japan	2	2	2	3	2
Korea	2	2	2	3	2
Mexico	5	5	5	5	5
Netherlands	1	1	1	2	1
New Zealand	2	2	2	3	1
Norway	1	2	2	3	1

Poland	3	3	4	4	3
Portugal	3	3	4	4	4
Russian Federation	4	5	5	5	4
Slovak Republic	4	3	5	4	4
Slovenia	3	3	4	4	3
Spain	3	3	4	4	3
Sweden	1	1	1	2	1
Turkey	5	5	5	5	4
Ukraine	5	5	5	5	5
United Kingdom	1	1	1	2	1
United States	1	1	1	1	1

According to Table 4, the USA was the absolute leader in socio-economic development during 2014–2018. In addition, during 2014–2018, except for 2017, Finland, the Netherlands, Sweden, and Great Britain were in the first cluster. The second cluster also has a stable structure, represented by Japan, France, Israel, and Korea (except for 2017). During 2015–2017, it also included Australia, which moved to the first cluster in 2018. Finally, the structure of the fifth cluster was stable during 2014–2016: Chile, Mexico, Turkey, and Ukraine. However, Chile moved from the fifth to the fourth cluster in 2017, and Turkey did so in 2018.

The analysis of the relationship between the amount of higher education expenditures and the quality of higher education within the clusters is presented in Figure 2. However, since the number of observations in clusters 2-3 is small (4 and 5), it is not enough to objectively assess this relationship. Thus, the data of clusters 2 and 3 were combined.

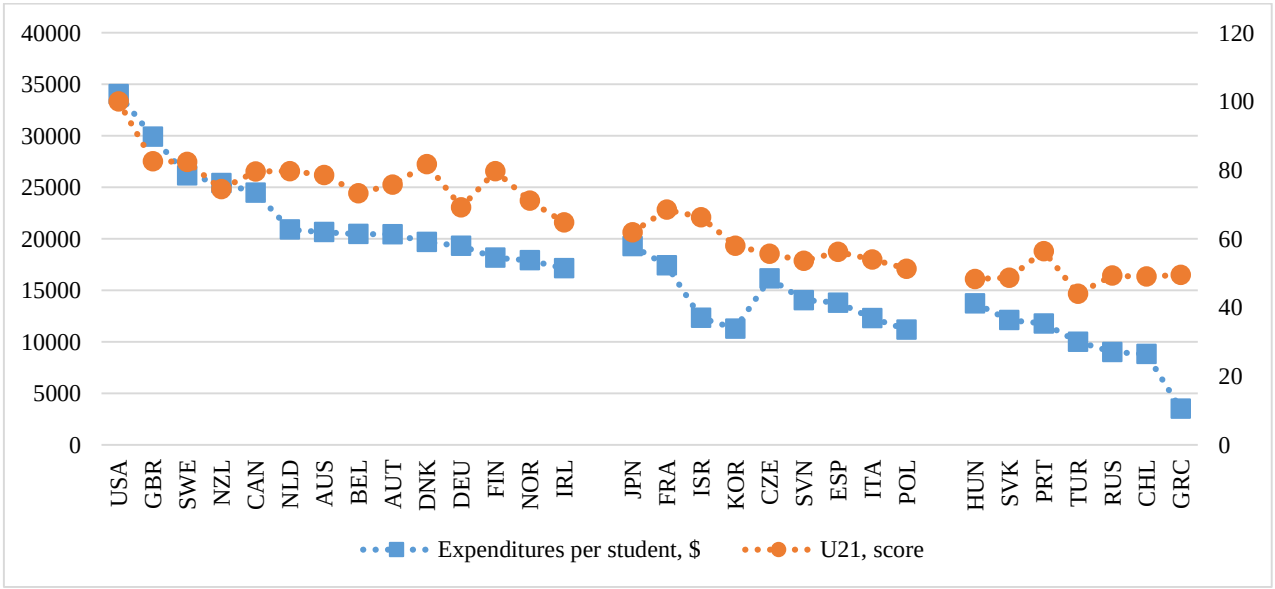

Figure 2. The relationship between the amount of higher education expenditures and the quality of higher education within clusters

Figure 2 shows that indicators of higher education expenditures in the countries of cluster 1 correspond to indicators of the quality of higher education. The higher amount of expenditures, the higher quality of higher education in general. The exceptions are Denmark and Finland; their indicators of educational competitiveness are above the average value for the cluster, while spending on higher education per student is lower than the average value for the cluster. Therefore, Finland is excluded from the statistical series.

In 2-3 clusters, the graphs that describe the amount of expenditures and the quality of higher education are not parallel. An example of "falling out" is Israel: it has a high indicator of the quality of higher education, but the amount of expenditures per student is less than the cluster average, so the indicators of Israel are excluded from the statistical series. The relationship between indicators of the quality of higher education and expenditures per student is not apparent. Thus, it will be tested using correlation analysis.

Since the number of observations in the samples is small (14, 9, and 7), the non-parametric Spearman test was used for analysis. The results of the calculations are presented in Table 5.

Table 5. Correlation between indicators of the quality of higher education and expenditures per student within clusters

Source: Processed by authors in IBM SPSS Statistics.

Indicator	Cluster 1	Clusters 2-3	Cluster 4
R_s	0.706	0.619	–0.429
Significance of the regression parameters	0.05	0.102	0.337
Correlation (+/–)	+	–	–

According to the calculations, there is a significant direct relationship between the amount of expenditures per student and the quality of higher education only in cluster 1 (countries with a very high level of socio-economic development). It is also stated that there is no correlation between the indicators in clusters 2-3 and 4.

4. Discussion

As previously noticed in the literature review, existing studies have proven the existence of a relationship between the level of higher education funding and quality. Moreover, the relationships

between the amount of spending on education, research and development, and the state's competitiveness, between the index of competitiveness of higher education (according to Universitas 21), and the global index competitiveness (GCI) were also proved.

As a result of the study of 32 OECD countries and partner countries, a significant direct correlation between the amount of expenditure per student and the quality of higher education (competitiveness of higher education system) was confirmed. In addition, a significant direct correlation between the quality of higher education, the human development index, and the global competitiveness index was proved. This result confirms Verner (2011), Satsyk (2015), and Chentukov et al. (2021). However, it does not allow estimating the level of spending on higher education in countries with a high or low level of socio-economic development.

At the same time, the analysis showed certain disproportions in assessing the level of funding in countries with different levels of socio-economic development. In particular, the countries with the highest levels of social development (HDI) and economic development (GCI) are different. Moreover, these groups do not include those on the top of the Higher Education Competitiveness Rankings (QES). Unlike previous studies, the countries are divided so that three conditions are met simultaneously.

Based on the assumption that a significant amount of higher education funding ensures a high level of competitiveness of higher education and contributes to the socio-economic growth of the state, OECD countries and partner countries were grouped into 5 clusters according to the level of socio-economic development and quality of higher education. They are countries with a very high level of socio-economic development (14), countries with a high level (4), an average level (5), low (7), and very low level (2). As expected, Ukraine was related to cluster 5 together with Mexico.

The analysis of the relationship between higher education spending and competitiveness of higher education within the clusters showed a significant direct correlation between the indicators. It does not confirm that higher education is a driver of economic growth. However, it proves that when the quality of higher education is high, the socio-economic development level is also high. The perspective of further research is the analysis of higher education funding systems within clusters.

Conclusion

The analysis of the annual amount of expenditure (investments) per student in groups of countries, which were divided according to their socio-economic development and competitiveness of higher education, is done in this study. The findings revealed a significant direct correlation between the amount of higher education expenditures per student and the competitiveness of higher education in OECD countries. In addition, a strong direct correlation was found between the amount

of spending on higher education and the human development index, as well as the global competitiveness index.

Countries were grouped according to the level of socio-economic development and competitiveness of higher education. Within the clusters, an analysis of the relationship between the amount of higher education expenditures and the level of its quality was carried out. A significant direct correlation between the indicators was found only in the cluster with countries with the highest level of socio-economic development.

The lack of a significant correlation between the indicators in other clusters (in countries with a lower level of socio-economic development) can be explained by several reasons, in particular:

1. A low quality of higher education with a significant amount of expenses may indicate low efficiency of the higher education funding system (excessive expenses).
2. A high level of competitiveness of the education system with an insignificant level of funding may also be evidence of implementing new methods in the educational process or the involvement of other institutions to the training of specialists (practice, internship, etc.), or the recruit professionals, trained by other higher education systems (import of specialists).

Author contributions

Conceptualization: Olha Hryhorash, Dmytro Bocharov, Tetiana Hryhorash.

Data curation: Dmytro Bocharov, Maxim Korneyev, Tatyana Rudyanova.

Formal analysis: Dmytro Bocharov, Maxim Korneyev, Tatyana Rudyanova.

Funding acquisition: Olha Hryhorash, Tetiana Hryhorash.

Investigation: Olha Hryhorash, Dmytro Bocharov, Maxim Korneyev, Tatyana Rudyanova, Tetiana Hryhorash.

Methodology: Olha Hryhorash, Dmytro Bocharov.

Project administration: Olha Hryhorash.

Resources: Dmytro Bocharov, Maxim Korneyev, Tatyana Rudyanova, Tetiana Hryhorash.

Software: Olha Hryhorash, Dmytro Bocharov.

Supervision: Olha Hryhorash, Tatyana Rudyanova, Tetiana Hryhorash.

Validation: Dmytro Bocharov, Maxim Korneyev.

Visualization: Tatyana Rudyanova, Tetiana Hryhorash.

Writing – original draft: Olha Hryhorash, Dmytro Bocharov, Maxim Korneyev.

Writing – review & editing: Dmytro Bocharov, Maxim Korneyev, Tatyana Rudyanova, Tetiana Hryhorash.

References

1. Ahmad, A. R., & Ng, K.-S. (2020). Funding Higher Education: Analysis from the Context of Developing Country. *Vision 2020: Sustainable Growth, Economic Development, and Global Competitiveness – Proceedings of the 23rd International Business Information Management Association Conference.* Retrieved from https://www.academia.edu/7038298/Funding_Higher_Education_Analysis_from_the_Context_of_Developing_Country
2. Antonyuk, L., Ilnytskyy, D., Barabas, D., & Sandul, M. (2017). International competitive disposition of national higher education systems. *International Economic Policy, 27,* 7-38. Retrieved from http://iepjournal.com/journals_eng/27/2018_1_Antoniuk_Ilnytskyy_Barabas_Sandul.pdf
3. Artyukhov, A., Volk, I., Vasylieva, T., & Lyeonov, S. (2021). The role of the university in achieving SDGs 4 and 7: A Ukrainian case. *The E3S Web of Conferences*. https://doi.org/10.1051/e3sconf/202125004006
4. Bouhajeb, M., Mefteh H., & Ammar, B. R. (2018). Higher education and economic growth: The importance of innovation. *Atlantic Review of Economics, 1*(2). Retrieved from https://www.econstor.eu/handle/10419/213791
5. Bukhtiarova, A., Semenog, A., Razinkova, M., Nebaba, N., & Haber, J. A. (2020). Assessment of financial monitoring efficiency in the banking system of Ukraine. *Banks and Bank Systems, 15*(1), 98-106. https://doi.org/10.21511/bbs.15(1).2020.10
6. Chentukov, Yu., Omelchenko, V., Zakharova, O., & Nikolenko, T. (2021). Assessing the impact of higher education competitiveness on the level of socio-economic development of a country. *Problems and Perspectives in Management, 19*(2), 370-383. https://doi.org/10.21511/ppm.19(2).2021.30
7. Frederick, D. T., & Kasztelnik, K. (2020). An Analytical Study of Impact of International Merger and Acquisitions on the Financial Performance for Higher Education Institution in the United States. *Financial Markets, Institutions and Risks, 4*(4), 5-30. https://doi.org/10.21272/fmir.4(4).5-30.2020
8. Gontareva, I., Litvinov, O., Hrebennyk, N., Nebaba, N., Litvinova, V., & Chimshir, A. (2022). Improvement of the innovative ecosystem at universities. *Eastern-European Journal of Enterprise Technologies, 1*(13(115)), 59-68. https://doi.org/10.15587/1729-4061.2022.251799

9. Hamdan, A., Sarea, A., Khamis, R., & Anasweh, M. (2020). A causality analysis of the link between higher education and economic development: empirical evidence. *Heliyon, 6*(6), e04046. https://doi.org/10.1016/j.heliyon.2020.e04046
10. Harmon, C., Walker, I., & Westergaard-Nielsen, N. (2001). *Education and earnings in Europe: a cross country analysis of the returns to education.* Edward Elgar. Retrieved from https://www.e-elgar.com/shop/gbp/education-and-earnings-in-europe-9781840645309.html
11. Hryhorash, O., Chentsov, V., Nurgaliyeva, A., & Hryhorash, T. (2020). State funding of higher education as a factor of ensuring its quality: experience of the European countries. *Public and Municipal Finance, 9*(1), 60-69. https://doi.org/10.21511/pmf.09(1).2020.06
12. Hryhorash, O., Korneyev, M., Leheza, Y., Zolotukhina, L., & Hryhorash, T. (2018). The development of small business as a source of formation of local budget revenues in Ukraine. *Investment Management and Financial Innovations, 15*(1), 132-140. http://dx.doi.org/10.21511/imfi.15(1).2018.12
13. Keser, H. Y. (2015). Effect of Higher Education on Global Competitiveness: Reviews in Relation with European Countries and the Middle East Countries. *Annals – Economy Series, 1*(1), 58-68. Retrieved from https://www.utgjiu.ro/revista/ec/pdf/2015-01.Volumul%201/08_Hilal%20Yildirir.pdf
14. Kotásková, S. K., Procházka, P., Smutka, L., Maitah, M., Kuzmenko, E., Kopecká, M., & Hönig, V. (2018). The impact of education on economic growth: The case of India. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 66*(1), 253-262. https://doi.org/10.11118/actaun201866010253
15. Kuzkin, Y., Cherkashyna, T., Nebaba, N., & Kuchmacz, B. (2019). Economic growth of the country and national intellectual capital (evidence from the post-socialist countries of the central and eastern Europe). *Problems and Perspectives in Management, 17*(1), 348-359. http://dx.doi.org/10.21511/ppm.17(1).2019.30
16. Kyrychenko, K., Laznenko, D., & Reshetniak, Ya. (2021). Green University as an Element of Forming a Sustainable Public Health System. *Health Economics and Management Review, 2*(4), 21-26. https://doi.org/10.21272/hem.2021.4-02
17. Lin, T. C. (2004). The role of higher education in economic development: An empirical study of Taiwan case. *Journal of Asian Economics, 15*(2), 355-371. https://doi.org/10.1016/j.asieco.2004.02.006

18. Lopez-Leyva, S., & Rhoades, G. (2016). Country Competitiveness Relationship with Higher Education Indicators. *Journal of Technology Management & Innovation, 11*(4), 47-55. https://doi.org/10.4067/S0718-27242016000400007
19. Macerinskiene, I., & Vaiksnoraite, B. (2006). The role of higher education to economic development. *Vadyba. Management, 2*(11), 82-90. Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.556.3396&rep=rep1&type=pdf
20. Mahmoud, A., & Alsanousi, A. (2017). The effect of higher education quality on economic growth in Libya. *International Journal of Academic Research in Business and Social Sciences,* 7(3), 139-149. Retrieved from https://econpapers.repec.org/article/hurijarbs/v_3a7_3ay_3a2017_3ai_3a3_3ap_3a139-149.htm
21. Mariana, D. R. (2015). Education as a Determinant of the Economic Growth. The Case of Romania. *Procedia – Social and Behavioral Sciences, 197,* 404-412. https://doi.org/10.1016/j.sbspro.2015.07.156
22. Mazurkiewicz, M., Liuta, O., & Kyrychenko, K. (2017). Internal Quality Assurance System for the Higher Education: Experience of Ukraine and Poland. *Business Ethics and Leadership, 1*(4), 74-83. https://doi.org/10.21272/bel.1(4).74-83.2017
23. Moretti, E. (2004). Workers' Education, Spillovers and Productivity: Evidence from PlantLevel Production Functions. *American Economic Review, 94*(3), 656-690. https://doi.org/10.1257/0002828041464623
24. Moskovicz, A. (2021). Post-pandemic Scenario for University Startup Accelerators. *Financial Markets, Institutions and Risks, 5*(2), 52-57. https://doi.org/10.21272/fmir.5(2).52-57.2021
25. Nazukova, N. (2020). State funding of education as a factor of economic growth. *Economy and Forecasting, 2,* 97-119. https://doi.org/10.15407/eip2020.02.097
26. OECD. (2017). *Education at a Glance 2017: OECD Indicators.* Paris: OECD Publishing. http://dx.doi.org/10.1787/eag-2017-en
27. OECD. (2018). *Education at a Glance 2018: OECD Indicators*. Paris: OECD Publishing. http://dx.doi.org/10.1787/eag-2018-en
28. OECD. (2019). *Education at a Glance 2019: OECD Indicators*. Paris: OECD Publishing. https://doi.org/10.1787/f8d7880d-en
29. OECD. (2020). *Education at a Glance 2020: OECD Indicators*. Paris: OECD Publishing. https://doi.org/10.1787/69096873-en

30. OECD. (2021). *Education at a Glance 2021: OECD Indicators*. Paris: OECD Publishing. https://doi.org/10.1787/b35a14e5-en
31. Özsoy, C. (2008). The Contribution of Higher Education to Economic Development. *8th Global Conference on Business & Economics.* Retrieved from https://www.academia.edu/773478/The_Contribution_of_Higher_Education_to_Economic_Development
32. Polyakov, M., Bilozubenko, V., Nebaba, N., Korneyev, M., & Saihak, Y. (2020). Analysis of asymmetry factors in the development of the EU tourism industry. *Innovative Marketing, 16*(4), 117-128. http://dx.doi.org/10.21511/im.16(4).2020.10
33. Popova, M. (2021). Wage Differentials And Educational Attainment In Germany. How Do Job Profiles Affect Earnings? *SocioEconomic Challenges, 5*(2), 5-25. https://doi.org/10.21272/sec.5(2).15-25.2021
34. Sannikova, I. N., Prikhodko, E. A., & Muhitdinov, A. A. (2021). Assessment of the universities impact on global competitiveness based on rankings. *1st International Conference on Environmental Sustainability Management and Green Technologies (ESMGT–2021)*. https://doi.org/10.1051/e3sconf/202129608009
35. Satsyk, V. (2015). U poshuku efektyvnoi stratehii rozvytku vyshchoi osvity v Ukraini (analiz mozhlyvostei ta obmezhuvalnykh faktoriv) [In search of an effective strategy for the development of higher education in Ukraine (analysis of opportunities and limiting factors)]. *Vyshcha osvita Ukrainy – Higher Education of Ukraine, 3,* 40-52. (In Ukrainian). Retrieved from http://nbuv.gov.ua/UJRN/vou_2015_3_8
36. Saúde, S., Borralho, C., Feria, I., & Lopes, S. (2015). The impact of Higher Education on socioeconomic and development dynamics: lessons from six study cases. *Investigaciones de Economía de la Educación, 10,* 887-905. Retrieved from https://repec.economicsofeducation.com/2015madrid/10-45.pdf
37. State Treasury Service of Ukraine. (2020). *Expenditures on the program classification of expenditures and lending of the state budget.* (In Ukrainian). Retrieved from http://www.treasury.gov.ua/
38. U21. (2020). *U21 Ranking of National Higher Education Systems.* Retrieved from https://universitas21.com/rankings
39. United National Development Programme (UNDP). (2022). *Human Development Index.* Retrieved from https://hdr.undp.org/en/content/human-development-index-hdi

40. Vandenbussche, J., Aghion, P., & Meghir, C. (2006). Growth, Distance to Frontier and Composition of Human Capital. *Journal of Economic Growth, 11*(2), 97-127. Retrieved from http://www.jstor.org/stable/40216090
41. Vardanyan, N. (2017). Education Quality Assessment from the Perspective of Stakeholders on the Example of Armenian Higher Education Institutions. *Business Ethics and Leadership, 1*(3), 93-97. https://doi.org/10.21272/bel.1(3).93-97.2017
42. Vasilyeva, T., Lyeonov, S., & Lopa, L. (2018). Forecasting Supply and Demand In the Regional Labor Market: In Search of Optimal Proportions of Financing Vocational Education Institutions In the Region. *SocioEconomic Challenges, 2*(1), 69-84. https://doi.org/10.21272/sec.2(1).69-84.2018
43. Verner, T. (2011). National Competitiveness and Expenditure on Education. *Research and Development Journal of Competitiveness, 2,* 3-10. Retrieved from https://www.cjournal.cz/files/53.pdf
44. Vorontsova, A., Lyeonov, S., Vasylieva, T., & Artyukhov, A. (2018). Innovations in the financing of lifelong learning system: expenditure optimization model. *Marketing and Management of Innovations, 2,* 218-231. http://doi.org/10.21272/mmi.2018.2-18
45. Vorontsova, A., Vasylieva, T., Lyeonov, S., Artyukhov, A., & Mayboroda, T. (2021). Education expenditures as a factor in bridging the gap at the level of digitalization. *Paper presented at the 2021 11th International Conference on Advanced Computer Information Technologies, ACIT 2021* (pp. 242-245). https://doi.org/10.1109/ACIT52158.2021.9548338
46. West, M. R. (2012). Education and Global Competitiveness. In K. Hassett (Ed.), *Rethinking Competitiveness.* Washington, DC: American Enterprise Institute Press. Retrieved from https://dash.harvard.edu/handle/1/9544459
47. Williams, R. (2017). Global: A Good National System of Higher Education: The Lessons of the U21 Rankings. In G. Mihut, P. G. Altbach, & H. D. Wit (Eds.), *Understanding Global Higher Education* (pp. 33-35). Rotterdam: SensePublishers. https://doi.org/10.1007/978-94-6351-044-8_7
48. World Economic Forum (WEF). (2018). *Global Competitiveness Index 2018*. Retrieved from https://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf