Sain, K. ve Bozkurt, K. (2023). "The Effect of Education and Health as Fundamentals of Human Capital on Global Competition: A Panel Data Analysis on OECD Countries", Eskişehir Osmangazi Üniversitesi İİBF Dergisi, 18(3), 766 – 791.
Doi: 10.17153/oguiibf.1278550

Başvuru: 06.04.2023 Kabul: 06.06.2023 *Araştırma Makalesi/Research Article*

The Effect of Education and Health as Fundamentals of Human Capital on Global Competition: A Panel Data Analysis on OECD Countries

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Beşerî Sermaye Temel Unsurları Olarak Eğitim ve Sağlığın Küresel Rekabete Etkisi: OECD Ülkeleri Üzerine Bir Panel Veri Analizi

Öz

Bu çalışmanın amacı, Ekonomik İşbirliği ve Kalkınma Örgütü (OECD) ülkelerinde beşeri sermaye temel unsurları olarak eğitim ve sağlığın küresel rekabete etkisini Granger Panel Nedensellik Testi ile analiz etmektir. Çalışmanın uygulama kısmında Dünya Ekonomik Forumu (World Economic Forum [WEF]), Dünya Bankası (World Bank [WB]), Birleşmiş Milletler Eğitim, Bilim ve Kültür Örgütü (United Nations Educational, Scientific and Cultural Organization [UNESCO]) ve Dünya Sağlık Örgütü (World Health Organization [WHO]) veri tabanların elde edilen veriler ile 2004-2018 dönemini kapsayan ve sağlıklı verilerine ulaşılan 18 OECD ülkesi için panel veri seti kurulmuştur. Analiz sonucunda beşerî sermaye temel unsurları olarak eğitim ve sağlığı temsil eden her bir değişken ile küresel rekabet arasında kısa dönem için bir ilişkinin olduğu tespit edilmiştir. Westernlund (2007) Panel Eşbütünleşme testi sonuçlarına bakıldığında ise h1 ve h2 değişkeni hariç diğer tüm değişkenler ile gci; yani küresel rekabet endeksi değişkeni arasında uzun dönemli bir ilişkini olduğu görülmektedir.

Anahtar Kelimeler: Beşerî Sermaye, Eğitim, Sağlık, Küresel Rekabet, OECD, Türkiye, Panel Veri Analizi

JEL Kodları: I20, F12, C23

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Abstract

The aim of the current study is to analyze the effect of education and health as the main elements of human capital on global competition in Organization for Economic Co-operation and Development (OECD) countries using the Granger Panel Causality Test. Accordingly, in the application part of the study, with the data obtained from the World Economic Forum (WEF), the World Bank (WB), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Health Organization (WHO) databases, a panel data set was established for 18 OECD countries for which healthy data could be reached for the period of 2004-2018. As a result of the analysis, a causality relationship was determined between each variable representing education and health as the basic elements of human capital and the global competition for short term. When the results of the Westerlund (2007) panel cointegration test were examined, it was seen that there is a long-term relationship between the Global Competitiveness Index (gci) variable and all the other variables except for variables h1 and h2.

Keywords: Human Capital, Education, Health, Global Competition, OECD, Turkey, Panel Data Analysis

JEL Codes: I20, F12, C23

Araştırma ve Yayın Etiği Beyanı	Bu çalışma bilimsel araştırma ve yayın etiği kurallarına uygun olarak hazırlanmıştır.
Yazarların Makaleye Olan Katkıları	Yazarların makaleye olan katkıları eşittir.
Çıkar Beyanı	Yazarlar açısından ya da üçüncü taraflar açısından çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

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1. Introduction

The competition between limited companies, sectors and countries on limited goods and services in the past has reached such a dimension that involves the whole globe/world with the effect of technological developments. In particular, the increase in international goods, services and human mobility, the elimination of agreements limiting international trade or the stretching of their terms, the increasing economic integration of the world, the increase in liberalization, deregulation and privatization tendencies have brought competition to the global arena.

The main condition for gaining competitive power in the international arena is to correctly identify the factors affecting global competition and to successfully put into practice rational strategies, policies and practices that can respond to the emerging needs. The main factors that affect and shape today's global competitive environment are knowledge, technology, innovation, research and development (R&D) and qualified manpower, that is, human capital. In this connection, countries that can offer products and services based on advanced technology with high added value and which are in demand in global markets have gained a central position in global competition.

When the studies on global competition are reviewed, the main emphasis is seen to be put on information, technology, innovation, R&D, exchange rate, domestic-foreign trade volume and import-export balance as the factors affecting the global competition. Studies on the effect of human capital on global competition have been very limited. In these limited studies, education has been emphasized as the main element of human capital and health has been left in the background. However, health is a prerequisite for individuals to receive education, to acquire the knowledge, skills and abilities needed in the education process, to transform these gains into social and economic benefits and to actively participate in the production process. For this reason, as far as human capital is concerned, education and health which have a mutual causality relationship should be evaluated together.

On the other hand, when the literature on human capital is reviewed, it is seen that the majority of the studies are aimed at revealing the effect of human capital on economic growth and development. However, human capital affects global competition as much as economic growth and development. In fact, it is qualified and healthy manpower, that is, human capital, that transforms knowledge into advanced technology and innovations with high added value. In the current study, which is thought to contribute to the literature, the effect of education and health as the elements of human capital on global competition in OECD countries between the years 2004 and 2018 was analyzed using Dumitrescu and Hurlin (2012) Granger Panel Causality tests and Westerlund (2007) Panel Cointegration Tests. In this direction, some suggestions were put forward on the effect of education and health as the elements of human capital on global competition in OECD countries.

There are many factors that affect a country's global competitiveness. The current study focused on two factors affecting global competition: Education and health as basic elements of human capital. OECD countries were chosen as the universe of the study. However, during the data collection process, reliable and uninterrupted data could be reached for only 18 OECD countries. Since data before 2004 for global competition and 2018 data for education and health could not be reached, the period of the study was determined as 2004-2018. These are among the limitations of the study. Extending the time span and increasing the number of countries in the study group, depending on the available data, will ensure more

accurate and reliable results in future research on the subject. In addition, depending on the availability of data, the number of variables related to education and health as the elements of human capital can be increased.

2. Historical Development Process of the Concept of Human Capital

After World War II, especially with the effect of technological developments, the development gap between countries widened more. This has made it important to determine the factors that foster the development of countries. Until the 1960s, when Classical Economic Theories dominated, the main factor determining the development of countries was thought to be economic growth and development. On the other hand, basic production factors (natural resources, physical capital, labour/muscle power and entrepreneur) were pointed out as the factors determining the economic growth and development of countries.

Studies conducted in the 1960s and later revealed that these factors were insufficient to explain the economic growth and development of countries. The results of many researchers, especially those of Schultz (1960) and Denison (1962), supported this situation. This has brought the Neo-Classical Growth Theories, which were dominant especially between the years 1960 and 1980, to the fore in the explanation of social and economic conditions.

In the study conducted by Schultz (1960), the reasons for the economic growth experienced in the USA during the 1900-1957 period were tried to be explained. In the study, it was stated that the outputs in the economy are more than the inputs, that this surplus of output cannot be explained by traditional production factors such as natural resources/land, physical capital and labour and the amount of said surplus can be explained by another production factor that has not been sufficiently emphasized. Schultz explained 36% to 70% of the surplus amount in the mentioned economic growth with a production factor which he expressed as human capital.

In the study conducted by Denison (1962), the economic growth experienced in the USA during the 1929-1960 period and the factors affecting this economic growth were tried to be determined. In the study, the annual growth rate was determined to be 2.93%. Denison stated that labour and capital, two of the traditional factors of production, had a 0.92% effect and human capital had a 2% effect on this growth rate.

From the results obtained in these studies (Denison, 1962; Schultz, 1960) on the effect of human capital on economic growth, contrary to the previous general acceptance, it became clear that the basic production factors such as natural resources, physical capital and labour are not sufficient in the economic growth and development of countries and thus in their catching up with the levels of developed countries. The positioning of the concept of human capital as one of the factors of production, which had not been emphasized enough on economic growth and development before, made it necessary to re-determine and define the basic production factors and accelerated the studies to understand the concept of human capital and its effect.

There are many reasons why the concept of human capital had not been sufficiently emphasized until the 1960s, when Neo-Classical Growth Theories showed their influence. These reasons can be briefly listed as follows:

1. Education and health services were not widespread until the 1960s,
2. Widespread use of muscle power in production,
3. There was no qualitative difference between the units of labour,
4. Discussions of moral value that could be started as a result of considering human as a type of capital,
5. The idea that human capital was not a factor that could be measured directly and it would be difficult to determine its economic effects,
6. The conservative attitude of economists towards capital (Mathur, 1999; OECD, 1998; Schultz, 1971; Tuna and Yumuşak, 2002).

However, both the inability to explain the developments in the economic field with the basic production factors and the understanding of the determining role of human capital in the rapid economic growth and development of countries such as Germany and Japan after World War II made it necessary to focus on the concept of human capital (Gümüş, 2004).

Many arguments advocated in Neo-Classical Growth Theories which maintained their influence until the 1980s such as human capital's being considered only as a production factor (Gökçen, 2006), productivity changes in human capital's not being taken into account (Ercan, 2002), technological development and population growth's being considered as external variables, the idea that capital has a decreasing return, the convergence hypothesis claiming that the growth gap between developed and undeveloped countries will decrease over time (Taban and Kar, 2006), giving importance to quantitative growth (Yaylalı and Lebe, 2011) have brought about discussions in the economics literature. This paved the way for the Endogenous Growth Theory, which emerged after the 1980s, to take its place in the economics literature.

According to the Endogenous Growth Theories, which came to the forefront with the studies of Romer (1986) and Lucas (1988), economic growth and development emerge endogenously as a result of the interaction of the production factors in the economic process with each other (Ercan, 2002; Tunalı and Yılmaz, 2016; Yaylalı and Lebe, 2011). In these theories, contrary to the Neo-Classical Growth Theories, it is argued that knowledge and technology create positive externalities, that each information revealed creates a starting point for the next and that knowledge provides increasing returns in the production process in the long run (Odyakmaz, 2000). In Endogenous Growth Theories, human capital (Jones, 1996; Lucas, 1988), technological development and Research and Development activities (Aghion and Howitt, 1992; Grossman and Helpman, 1991; Romer, 1990), public investments (Barro, 1990), physical capital investments and learning by doing (D'Autume and Michel, 1993; Rebelo, 1991; Romer, 1986) have been brought to the fore.

Thus, with Endogenous Growth Theories, knowledge, technology, Research and Development activities and human capital, which is the source of their formation and development, have come to the fore as the main determinants of the economic growth and development processes of countries. In addition, the importance of human capital in today's information societies, where factors of classical production such as physical capital, natural resources and unqualified labour (brute muscle power) are losing importance, instead of

them, information, technology, innovation and Research and Development activities are gaining importance.

It is possible to give many examples that will confirm the value that Endogenous Growth Theories ascribe to knowledge, technology, Research and Development and human capital. In fact, despite having natural resources, physical capital and large labour supply, there are many countries that fall behind in economic growth and development and cannot reach the level of developed countries. If the economic growth and development of countries depended on rich natural resources and large labour supply, oil-rich countries such as Iraq, Saudi Arabia and Libya and countries with large labour supplies such as China, India, Pakistan and Bangladesh could have been the richest and most developed countries of the world (Berkman, 2008). On the other hand, countries such as Japan and Germany, which do not have natural resources such as oil, were expected to lag behind in terms of their social and economic conditions. However, these countries have been able to achieve a central position in the world economically and technologically with their successful growth and development (Seçgin, 2008). It is possible to see the same situation in Asian countries such as South Korea, Singapore, Hong Kong, Taiwan and Thailand. Although these countries are insufficient in terms of natural resources, they have been able to keep up with developed countries by accomplishing their rapid economic growth and development (Becker, 1994).

The common characteristics of the countries that have achieved a central position in the international arena by rapidly accomplishing their economic growth and development despite their insufficient natural resources are that they have achieved the integrity in the information-technology-innovation chain, that they have attached importance to the technology clusters formed by the university-industry-state cooperation and that they have understood the vital importance of R&D activities for the sustainability of their accomplishments.

Countries that have realized the importance of qualified manpower needed for the emergence and functioning of science, technology, innovation and R&D activities have also realized the importance of education and health, so they have increased their investments in these areas. Natural resources, physical capital and labour based on muscle power are not sufficient for the growth and development of countries in the 21st century. Moreover, there is a need for qualified and healthy individuals who have the necessary qualifications to be a source for the correct, effective and effective use of these factors (natural resources, physical capital and labour based on muscle strength).

3. Human Capital

Many different definitions of human capital have been made in the literature. According to Schultz (1961), one of the pioneers who formed the theoretical construct of the concept of human capital, human capital is the knowledge and skills acquired through education. Thurow (1970) considered it as an individual's skill, ability and knowledge for productivity. OECD (2001) defines it as the sum of knowledge, skills and other similar qualities that are possessed by the workforce to contribute to increasing personal, social and economic welfare. According to WEF (2017), it is the sum of the skills and abilities possessed by individuals in a country to be used in the production process. According to WB (2020), it is the knowledge, skills and health accumulated by people during their lifetime. According to Awan (2012), it is the sum of competences, knowledge and personal characteristics that are vital for generating economic value. According to Keskin (2011), besides the knowledge and skills acquired by individuals

through education, their physical and mental health is also extremely important. Similarly, according to Eser and Ekiz Gökmen (2009) and Durusoy (2007), besides knowledge and skills, physical and mental resilience is also important.

In the most general sense, human capital refers to qualified and healthy manpower competent enough to respond to the conditions, needs and expectations of the period, to improve the efficiency of production factors and to increase individual and social welfare.

4. Two Elements of Human Capital: Education and Health

In the development of human capital as a qualified and healthy human power, education plays the most important role. In the most basic sense, education is the process of imparting various knowledge, skills and abilities to learners by taking into account the needs of learners and society and the conditions of the period in which they live. The knowledge and abilities gained through education make great contributions to the creation of qualified, productive and healthy human capital.

Another basic element of human capital is health. Health, in the most general sense, is a state of physiological, psychological, mental and social well-being. Health is a prerequisite for individuals to receive education, to acquire the knowledge, skills and abilities needed in the education process, to transform these gains into social and economic benefits and to actively participate in the production process. Without health, it is not possible to talk about a qualified education and human capital. Likewise, it is not possible to talk about individual and social awareness of health without a qualified education. The fact that education and health are in a mutual causality relationship has led countries to regulate and develop health activities along with education in order to feed, improve and nurture their human capital.

Many reports have been prepared that reveal the human capital status of countries. And some of them are important in that they provide comprehensive information on the human capital status of countries and provide international measurements/data:

- Global Human Capital Index prepared by WEF (2017) based on variables such as education status, rate of participation in labour force, unemployment rate, underemployment rate, quality of education, improving the workforce through education and productive knowledge performance,
- Human Development Report 2019, prepared by the United Nations Development Program (UNDP) (2019) based on the variables of average years of education, expected years of education, life expectancy at birth and per capita income: Beyond Income, Beyond Averages, Beyond Today: Inequalities in Human Development in the 21st Century,
- The Human Capital Index 2020 Update, prepared by the WB (2020) to measure the human capital that children born today can expect to acquire by age 18, and to determine how current education and health status will shape the productivity of the next generation of workers: Human Capital in a Time of Covid-19.

In all the three reports, it can be seen that the leading countries in the human capital index rankings (such as Sweden, Norway, Finland, Denmark, USA, Germany, Singapore, Canada, Australia, the United Kingdom) are high-income economies. Being aware of the fact that the resources spent on quality education and health are investments, these countries have allocated a significant part of their economic power to education and health investments, aiming to train people in skill-intensive fields/occupations that require qualified labour. On the other hand, it is seen that countries that do not/cannot allocate the necessary resources to education and health (such as Pakistan, Nigeria, Chad, Iraq, Afghanistan, Egypt, Tajikistan, Zambia, Yemen, Algeria) are at the bottom of the index rankings. It has been observed that these countries cannot create the needed human capital, and accordingly, they cannot reveal high value-added knowledge, technology and innovations, and as a result, they remain as foreign-dependent economies. However, countries that attach importance to human capital formation and development by allocating the necessary resources to education and health have succeeded in being among high-income economies by completing their economic growth and development processes in a shorter time.

5. Education and Health as a Human Capital Aspect in Global Competitiveness

WEF conducts various measurements and analyses through the Global Competitiveness Index, which has been developed to reveal the global competitiveness of countries by WEF. It publishes the findings resulting from measurements and analyses in the Global Competitiveness Reports on a regular basis every year. In these reports, it is possible to reach the world rankings and scores regarding the global competitiveness of countries. In addition, in these reports, it is possible to see the strengths and weaknesses of countries in the variables that determine the global competitiveness of each country and the comparison of these variables across countries.

As of 2018, WEF has developed the Global Competitiveness Index 4.0 with an approach based on the dynamics (flexibility, agility, innovation ecosystem and human-oriented approach) required by the 4th Industrial Revolution. In this new index, human capital is seen as one of the main factors affecting the competitiveness of countries. Human capital has been attempted to be determined on the basis of the general skill level and health status of the workforce. The overall skill level of the workforce as a factor affecting global competitiveness is addressed together with its sub-components; average years of education, scope of staff training, quality of vocational education, skills of graduates, digital skills among the population, ease of finding qualified personnel, school life expectancy, critical thinking in teaching and teacher-student ratio in primary education. Health is addressed together with its sub-component of healthy life expectancy (WEF, 2018).

5.1. Skills

One of the most fundamental factors determining the competitiveness of a country in the global arena is the general skill level of the workforce. What determines the general skill level of the workforce is the quantity and quality of education. Education plays a dominant role in equipping the workforce with the necessary skills and competences (UNDP, 2019; WB, 2020 WEF, 2018). In its most general sense, education is the process of imparting various knowledge, skills, abilities, attitudes and behaviours to individuals, taking into account their needs as well as the conditions of the era in which they live. In the process of education, knowledge, skills, abilities, attitudes and behaviours are imparted to individuals in a planned, systematic and organized manner in line with pre-determined objectives with the expectation

of generating qualified, productive, dynamic and healthy human capital. Human capital as an educational output is a critical factor for a country's economic growth, competitiveness and social welfare (Altay and Pazarlıoğlu, 2007; Czajkowski, 2014; Reda, 2012; Weresa, 2017). Education is a powerful tool that helps people develop their skills, think innovatively and realize their potential. A good education system contributes to the general development of society by making people well-equipped, knowledgeable and analytical, critical, reflective and creative thinkers.

5.2. Health

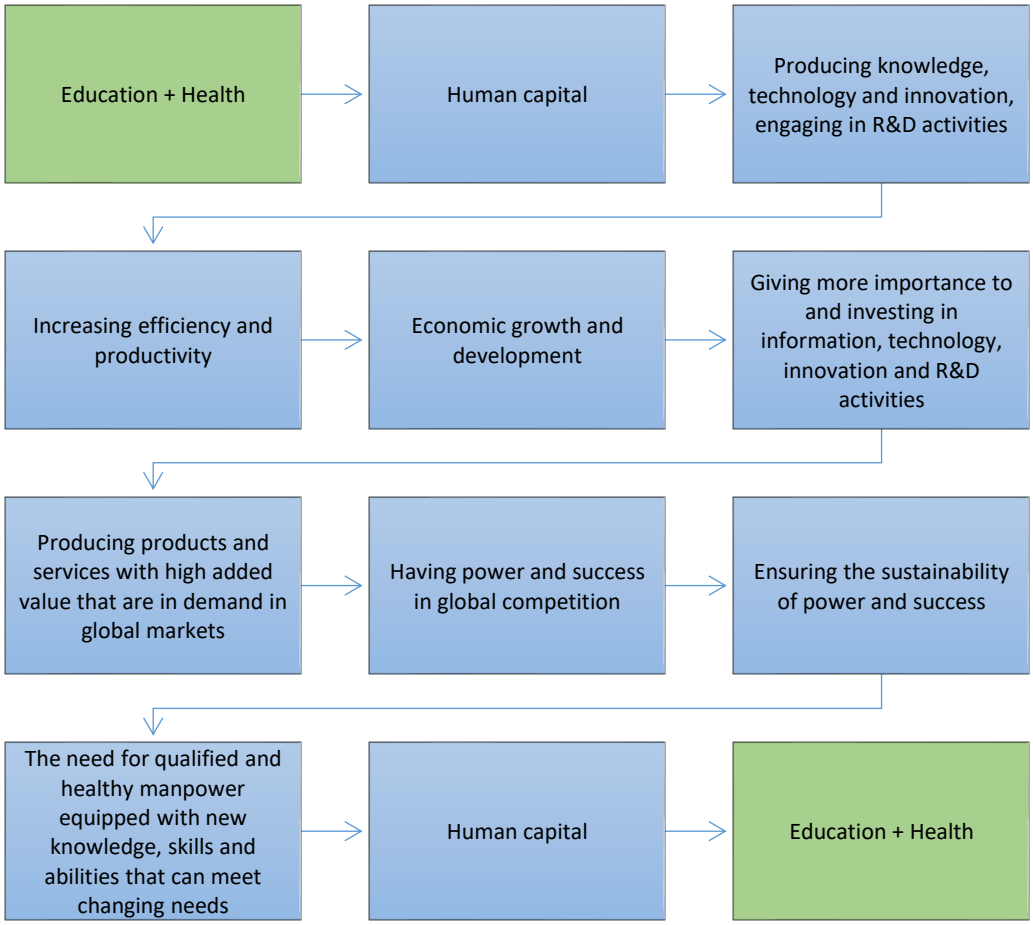
Health is an indispensable element for a country's labour productivity, efficiency and creativity and therefore its competitiveness. Healthy individuals have better physical and mental abilities, they are more productive and creative than those who are not healthy (WEF, 2018). The fact that healthy individuals can be educated better and benefit from education investments for a longer period of time reveals that health should be given importance as well as education (Becker, 1994; Bloom and Canning, 2003; Öz et al., 2008). On the other hand, increasing healthcare expenditures of countries nourish the human capital stock over the years in a cyclical manner by preserving the individuals' working capacity and enhance their labour force participation and life expectancy (Becker, 1994; Berkman, 2008; Herrin, 2000; Kelly, 1997). Long life expectancy, on the other hand, positively influences individuals' capital accumulation decisions throughout their lives, as they have the expectation of returns from investments. This situation has a positive impact on economic growth and global competitiveness. Moreover, health is a prerequisite for individuals to receive education, acquire the knowledge, skills and abilities needed in the education process, transform these gains into social and economic benefits and actively participate in the production process.

It is possible to reveal the process through which education and health as elements of human capital affect the global competition as follows:

1. Education and health are keys to the formation and development of human capital.
2. Human capital makes it possible to produce information, technology and innovations.
3. Creating knowledge, technology and innovations and using them in the production process result in an increase in efficiency and productivity.
4. Increasing efficiency and productivity form the basis of economic growth and development.
5. Economic growth and development create the opportunity to give more importance to and invest in information, technology, innovation and R&D activities.
6. This importance and investments ensure the creation of products and services with high added value that are in demand in global markets.
7. This paves the way for power in global competition.

However, for the sustainability of the power and success achieved in global competition, the need for qualified and healthy manpower equipped with knowledge and skills necessary to adapt to the conditions of the rapidly changing and developing age must be met. A quality education and adequate and effective health services are prerequisites to meet this need. As can be seen, education and health as the elements of human capital are not only the cause but also the result of these returns. It is possible to show this situation as in Figure 1.

Figure 1: The Process Through Which Education and Healthy Affect the Global Competition as the Elements of Human Capital



Source: Created by the authors.

In short, human capital, which is considered to be the driving force of development, affects global competition by contributing to the development of information and technology and to R&D activities, by increasing efficiency and productivity and production of high value-added products and services, encouraging entrepreneurship and by fostering the development of new strategies and policies. According to Atik (2018), the fact that human capital is difficult to imitate and shows its effect clearly has made human capital the most vital element of competition on a global scale today.

Aware of the aforementioned importance and benefits of human capital, countries have tried to provide qualified, healthy, productive, efficient and entrepreneurial manpower by structuring their education and health policies according to the rapidly changing conditions and needs of the 21st century.

6. Indicators for Education, Health and Global Competitiveness in OECD Countries

The current study, which is conducted to analyze the effect of education and health on global competition as the basic elements of human capital, is based on the data on OECD countries. However, since reliable data for all the OECD countries could not be reached in the data collection process, 18 OECD countries for which healthy data could be reached from the population were selected as the sample. In Table 1, Table 2 and Table 3 below, the indicators related to education, health and global competition of the OECD countries in the sample are given.

Table 1: Indicators of Educational Status

	Public expenditure on education (as % of GDP)		**Gross enrolment rate in primary education**		**Gross enrolment rate in secondary education**		**Gross enrolment rate in higher education**	
Countries	**2004**	**2018**	**2004**	**2018**	**2004**	**2018**	**2004**	**2018**
Austria	5.3	5.36	100.72	103.32	99.52	99.96	63.04	86.69
Belgium	5.79	6.41	100.8	103.35	153.4	155.96	61.02	78.9
Czech Republic	3.99	3.85	98.59	100.51	95.4	102.3	43.73	63.77
Denmark	8.2	7.82	100.73	100.52	123.58	129.75	74.39	81.18
Estonia	4.87	4.97	99.68	97.67	100.08	116.65	66.18	70.37
Finland	6.15	6.38	98.78	100.21	110.73	154.82	89.51	90.26
Hungary	5.32	4.67	97.5	96.76	95.95	103.92	60.05	50.31
Ireland	4.48	3.51	102.96	101.03	109.4	154.91	58.92	77.28
Italy	4.38	4.04	102.06	101.25	99.01	101.35	62.24	64.29
Latvia	4.38	4.4	105.49	99.61	99.29	109.16	74.60	93.02
Norway	7.29	7.91	99.35	100.08	115.38	117.45	79.22	83.02
Portugal	5.04	5.02	118.56	106.83	95.06	120.83	55.65	65.66
Slovak Republic	4.1	3.94	97.74	99.71	92.56	91.36	35.98	45.37
Slovenia	5.64	4.78	98.99	102.06	97.18	114.49	72.36	77.11
Spain	4.15	4.21	103.05	101.99	113.83	126.18	66.09	91.11
Sweden	6.66	7.57	97.31	128.64	103.29	151.7	83.76	72.46
Turkey	**2.98**	**4.3**	**103.28**	**94.91**	**86.85**	**104.48**	**38.2**	**112.78**
United Kingdom	4.72	5.44	105.93	101	104.68	120.78	59.35	61.38
OECD Average	**5.19**	**5.25**	**101.75**	**102**	**105.28**	**120.89**	**63.57**	**75.83**

Source: WB, 2022a

Table 2: Indicators of Health Status

	Life expectancy at birth (in years)		Infant mortality rate (per 1000 live births)		Health expenditures (as % of GDP)		Number of doctors (per 1000 individuals)	
Countries	**2004**	**2018**	**2004**	**2018**	**2004**	**2018**	**2004**	**2018**
Austria	79	82	4	3	9.71	10.32	4.2	5.21
Belgium	79	82	4	3	9.37	10.76	2.85	3.11
Czech Republic	76	79	4	3	6.35	7.52	3.5	4.02
Denmark	77	81	4	3	9.01	10.07	3.22	4.22
Estonia	72	78	6	2	5.12	6.69	3.02	3.46
Finland	79	82	3	2	8.06	9.04	2.58	4.64
Hungary	73	76	7	4	7.77	6.55	3.33	3.41
Ireland	79	82	5	3	7.22	6.86	2.74	3.31
Italy	81	83	4	3	8.17	8.68	7.36	7.93
Latvia	72	75	9	4	6.22	6.19	2.89	3.3
Norway	80	83	3	2	8.82	10.02	3.43	4.78
Portugal	78	81	4	3	9.53	9.41	3.42	5.31
Slovak Republic	74	77	7	5	6.37	6.71	3.13	3.52
Slovenia	77	81	4	2	7.94	8.28	2.3	3.17
Spain	80	83	4	3	7.66	8.99	3.41	4.03
Sweden	80	83	3	2	8.13	10.94	3.37	4.33
Turkey	**72**	**77**	**24**	**9**	**4.91**	**4.12**	**1.44**	**1.81**
United Kingdom	79	81	5	4	8.39	9.90	4.66	5.62
OECD Average	**77,05**	**80.3**	**5.77**	**3.3**	**7.7**	**8.39**	**3.38**	**4.17**

Source: UNESCO, 2022; WB, 2022b; WHO, 2022

Table 3: Indicators for Global Competitiveness (2018)

	Global Competitiveness Index			
	2004	**2018**	**2004**	**2018**
Countries	**Score (1-7)**	**Score (0-100)**	**Ranking (within 104 countries)**	**Ranking (within 140 countries)**
Austria	5.2	76.3	17	22
Belgium	4.95	76.6	25	21
Czech Republic	4.55	71.2	40	29
Denmark	5.66	80.6	5	10
Estonia	5.08	70.8	20	32
Finland	5.95	80.3	1	11
Hungary	4.56	64.3	39	48
Ireland	4.9	75.7	30	23
Italy	4.27	70.8	47	31
Latvia	4.43	66.2	44	42
Norway	5.56	78.2	6	16
Portugal	4.96	70.2	24	34
Slovak Republic	4.43	66.8	43	41
Slovenia	4.75	69.6	33	35
Spain	5	74.2	23	26
Sweden	5.72	81.7	3	9
Turkey	**3.82**	**61.6**	**66**	**61**
United Kingdom	5.3	82	11	8
OECD Average	**4.94**	**73.17**	-	-

Source: WEF, 2022

Note: (The Global Competitiveness Index gave a score from 1 to 7 to the global competitiveness of countries until 2017. In 2018, the index was revised, and a scoring system ranging from 0 to 100 was implemented. This is the reason for the numerical difference between 2004 and 2018.)

When the indicators related to education, health and global competitiveness in the OECD countries included in the study are evaluated together, it is generally seen in countries with higher global competitiveness such as Sweden, Norway, Denmark, Finland, the United Kingdom, Belgium that;

- Public expenditure on education (as % of GDP) is higher,
- The gross enrolment rate in primary education is higher,
- Gross enrolment rate in secondary education is higher,
- Life expectancy at birth (in years) is longer,
- Infant mortality rate (per 1000 live births) is lower,
- Expenditure on healthcare (as % of GDP) is higher,
- The number of doctors (per 1000 individuals) is higher.

However, it is not possible to make such an inference for the gross enrolment rate in higher education. It is seen that Turkey, Latvia and Spain, which lag behind other OECD countries in global competitiveness, have the highest rates of gross enrolment in higher education. The fact that the indicators related to education and health in OECD countries act together with the indicators related to global competitiveness has given rise to the question of whether education and health are related to global competitiveness.

In order to reveal statistically whether there is any relationship between the mentioned variables, in this study, the effect of education and health as the main elements of human capital on global competition in OECD countries was tried to be analyzed with the Panel Causality Test.

7. Literature Review

When the studies on global competition are reviewed, the main emphasis is seen to be put on information, technology, innovation, R&D, exchange rate, domestic-foreign trade volume and import-export balance as the factors affecting the global competition. On the other hand, when the literature on human capital is reviewed, it is seen that the majority of the studies are aimed at revealing the effect of human capital on economic growth and development. However, human capital affects global competition as much as economic growth and development. Indeed, human capital influences and shapes global competition in many ways by introducing high value-added products and services, by developing knowledge, technology and innovation, by engaging in R&D activities, by promoting entrepreneurship, by increasing efficiency and productivity and by developing rational strategy and policy against economic, ecological, social, cultural and political problems.

However, studies on the effect of human capital on global competition have been quite limited in the literature (Altay and Pazarlıoğlu, 2007; Czajkowski, 2014; İlkay, 2019; Krstić et al., 2020; Reda, 2012; Sart, 2018; Tijanic and Obadic, 2015; Weresa, 2017; Wyszkowska-Kuna, 2017). In these limited studies, education has been emphasized as the main element of human capital and health has been left in the background. However, health is a prerequisite for individuals to receive education, to acquire the knowledge, skills and abilities needed in the education process, to transform these gains into social and economic benefits and to actively participate in the production process. For this reason, as far as human capital is concerned, education and health which have a mutual causality relationship should be evaluated together. In addition, these studies were based on a limited number of variables related to education and health.

This study, as the representative variables, public expenditures on education (as % of GDP), gross enrolment rate in primary education, gross enrolment rate in secondary education and gross enrolment rate in higher education were used to reveal the state of education, life expectancy at birth (in years), infant mortality rate (per 1000 live births), health expenditures (as % of GDP) and number of doctors (per 1000 individuals) were used to reveal the state of health. Accordingly, in this study, the effect of education and health as the elements of human capital on global competition for 18 OECD countries, including Turkey, was analyzed using Dumitrescu and Hurlin (2012) Granger Panel Causality Test and Westerlund (2007) Panel Cointegration Test.

A summary of the relevant literature is given below:

Altay and Pazarlıoğlu (2007) analyzed the relationship between international competitiveness and human capital with an econometric approach (Spearman Rank Correlation and Regression). In the study that covers the period of 2000-2004, the countries that are in the top 51 in the international competitiveness ranking were examined. As a result, a positive correlation was found between education as an element of human capital and international competitiveness.

Reda (2012) analyzed the effects of labour force, education and innovation factors on international competition by using panel data analysis methods (fixed and random effects model). In the study that covers the period of 2005-2011, an analysis was conducted on 25 countries. As a result, a positive correlation was found between workforce, education, innovation and international competitiveness.

Czajkowski (2014) analyzed the effect of human capital and innovation on international competitiveness by using panel data analysis methods (Random Effects Model and Arellano RCM Estimator). In the study covering the period of 2000-2010, various countries divided into four different groups were examined. In the study, national innovation was used as an indicator of international competitiveness, the rate of enrolment in secondary education and the rate of participation of the highly educated workforce in the total workforce were used as indicators of human capital and Research and Development expenditures were used as an indicator of innovation. In the study, a negative correlation was found between human capital accumulation and international competitiveness in countries having a dynamic national innovation system.

Tijanic and Obadic (2015) analyzed the impact of interregional human capital stock differences on international competitiveness using panel data analysis methods (Fixed Effects Model and System GMM Method). In the research covering the period of 2000-2011, 22 EU member countries were examined. As a result of the application of the research, it has been determined that the differences in the human capital stock between regions affect the international competitiveness negatively.

Wyszkowska-Kuna (2017) analyzed the impact of interim demand and technological factors on international competitiveness using panel data analysis methods (Panel Unit Root and Panel Cointegration). In the research covering the period of 2000-2009, an examination was made on EU member countries. According to the application results of the research, it has been determined that only EU member countries with high income levels have international competitiveness in the field of knowledge-intensive business services. In addition, it has been determined that the domestic concentration of human capital,

knowledge-intensive business services and low labor wages positively affect the international competitiveness of the knowledge-intensive business services sector.

Weresa (2017) empirically analyzed how competitiveness developed in four Middle East European EU member states (Poland, Czechia, Slovakia and Hungary) for the period 2008-2015. In the research, innovation and human capital factors in shaping the competitiveness of these countries are emphasized. As a result of the analyzes made, it has been determined that there are four reasons why a new competitive model based on innovation and skills cannot be adopted in these countries. These are: (1) low level of R&D, (2) inefficient links between science and business, (3) barriers to knowledge diffusion and learning processes, and (4) insufficient development of digital skills. For this reason, it was stated that these countries should especially focus on innovation and human capital in order to achieve sustainable competitiveness.

Sart (2018) analyzed whether the global competitiveness of countries is affected by the level of global competitiveness of their higher education. In the study conducted on 138 countries, two of the non-parametric tests; Kruskal-Wallis and Mann-Whitney U tests, were applied using the data obtained from the WB-Global Competitiveness Index 2017-2018 Report. According to the application results of the study, as the level of global competition in higher education increases, the global competitiveness of countries also increases.

İlkay (2019) analyzed the extent to which human capital and macro and technological variables affect international competitiveness using panel data analysis methods on the basis of high-tech product exports. In the study covering the period of 1992-2014, a total of 14 G20 member countries, including Turkey, were examined. The findings obtained in the study are as follows: (1) While the variables of human capital index calculated on the basis of the total years of education, human development index and life expectancy at birth positively affect international competitiveness, the infant mortality rate variable affects it negatively. (2) There is a bidirectional causality relationship between international competitiveness and the variables of GDP per capita, human capital and life expectancy at birth.

Krstić et al. (2020) analyzed the relationship between higher education, competitiveness and sustainable development. In the correlation and regression analysis on the member states of EU and its candidates, a strong correlation was found between higher education, competitiveness and sustainable development.

8. Data Set and Method

In the application part of the study, with the data obtained from the WEF, WB, UNESCO and WHO databases, a panel dataset was constructed for 18 OECD countries for which healthy data could be reached for the period of 2004-2018. The countries included in the study are Austria, Belgium, The Czech Republic, Denmark, Estonia, Finland, Hungary, Ireland, Italy, Latvia, Norway, Portugal, The Slovak Republic, Slovenia, Spain, Sweden, Turkey and The United Kingdom. Logarithmic forms of the series were used in the analyses. Information on the variables which are used in the study is presented in Table 4.

Table 4: Information on the Variables Used in the Study

Category	Variable	Abbreviation	Source
Global Competition	Global Competitiveness Index	gci	WEF
Education	Public expenditure on education (as % of GDP)	e1	WB
	Rate of gross enrolment in primary education	e2	WB
	Rate of gross enrolment in secondary education	e3	WB
	Rate of gross enrolment in higher education	e4	WB
Health	Life expectancy at birth (in years)	h1	UNESCO
	Rate of infant mortality (per 1000 live births)	h2	UNESCO
	Health expenditures (as % of GDP)	h3	WHO
	Number of doctors (per 1000 individuals)	h4	WB

In the current study, which aims to analyze the effect of education and health as the elements of human capital on global competition with the Granger Panel Causality Test, the Global Competitiveness Index (gci) was employed to reveal the status of global competition of 18 OECD countries included in the study, the variables of public expenditures on education (as % of GDP) (e1), rate of gross enrolment in primary education (e2), rate of gross enrolment in secondary education (e3) and rate of gross enrolment in higher education (e4) were used to reveal the status of education in these countries and the variables of life expectancy at birth (in years) (h1), rate of infant mortality (per 1000 live births) (h2), health expenditures (as % of GDP) (h3) and number of doctors (per 1000 individuals) (h4) were used to reveal the status of health in these countries. The study is grounded on the basic assumption that there may be a short-term causality relationship between each variable representing education and health as the basic elements of human capital and the Global Competitiveness Index. In this context, it was investigated whether there is a short-term causality relationship between each variable representing education and health as the basic elements of human capital and the Global Competitiveness Index, which represents global competition.

In addition, the long-term relationship between the global competitiveness index and education and health variables was examined. At this point, the panel cointegration test developed by Westernlund (2007) was used.

Within the scope of the analysis in the study, it was first investigated whether the series included cross sectional dependence, and at this point, Pesaran (2004) $CDLM_2$ test was used. Then, the Pesaran and Yamagata (2008) homogeneity test was performed. The test hypotheses are as follows.

H0: βi=β for all the is and H1: βi≠ βj (1)

($\widehat{\Delta}$) and ($\widetilde{\Delta}$ adj) are calculated as follows.

$$\widehat{\Delta} = \sqrt{N}\left(\frac{N^{-1}\hat{S}-k}{\sqrt{2k}}\right) \text{ ve } \widetilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\hat{S}-E(\tilde{Z}_{iT})}{\sqrt{Var(\tilde{Z}_{iT})}}\right) \quad (2)$$

Then, Pesaran's (2007) CADF panel unit root test was used. In the last stage, the Dumitrescu and Hurlin (2012) Panel Granger Causality Test was conducted. This test is performed against the null hypothesis that there is no causality relationship and the alternative hypothesis that there is a causality relationship in at least one cross section, and the following model is taken into account (Göktaş et al., 2018).

$$y_{it} = \propto_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

In Equation 3, $\beta_i = (\beta_i^{(1)}, \ldots\ldots, , \beta_i^{(K)})$. Wald statistics is employed to test the null hypothesis.

$$W_{N,T}^{Hnc} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T} \quad (4)$$

It was recommended by Dumitrescu and Hurlin (2012) to use the following standardized test statistics for small values of T.

$$\tilde{Z}_{N,T}^{Hnc} = \frac{\sqrt{N}[W_{N,T}^{Hnc} - \sum_{i=1}^{N} E(\widetilde{W}_{i,T})]}{\sqrt{\sum_{i=1}^{N} Var(\widetilde{W}_{i,T})}} \quad (5)$$

As a result of their simulations, Dumitrescu and Hurlin (2012) stated that $\tilde{Z}_{N,T}^{Hnc}$ test statistic gave very good results. They even emphasized that this test they developed can be applied for panels with unbalanced and heterogeneous lag lengths of the units. In this context, they stated that it would be appropriate to use the test statistic expressed in the equation (6) below instead of the test statistic expressed in the equation (5) (Bozkurt et al., 2021).

$$\tilde{Z}_{N,T}^{Hnc} = \frac{\sqrt{N}[W_{N,T}^{Hnc} - N^{-1} \sum_{i=1}^{N} E(\widetilde{W}_{i,T})]}{\sqrt{N^{-1} \sum_{i=1}^{N} Var(\widetilde{W}_{i,T})}} = \frac{\sqrt{N}\left[W_{N,T}^{Hnc} - N^{-1} \sum_{i=1}^{N} K_i \times \frac{(T_i - 2K_i - 1)}{(T_i - 2K_i - 3)}\right]}{\sqrt{N^{-1} \sum_{i=1}^{N} 2K_i \times \frac{(T_i - 2K_i - 1)^2 \times (T_i - K_i - 3)}{(T_i - 2K_i - 3)^2 \times (T_i - 2K_i - 5)}}} \quad (6)$$

On the other hand, Westerlund (2007) proposed four fundamental statistics based on the error correction model to address the limitations of the Pedroni (1999; 2004) panel cointegration test statistic. The error correction equation used by Westerlund (2007) is as follows.

$$\Delta Y_{i,t} = \delta_i d_t + \alpha_i Y_{i,t-1} \lambda_i x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{i,j} \Delta Y_{i,t-j} + \sum_{j=0}^{p_i} \lambda_{i,j} \Delta x_{i,t-j} + e_{i,t} \quad (7)$$

In the initial stage, on the basis of the above-given error correction equation, Westerlund (2007) calculates group average statistics under the null hypothesis of no cointegration for all cross-sections given below and alternative hypothesis of cointegration for some cross-sections.

$$G_\tau = \frac{1}{N} \sum_{i=1}^{N} \frac{\alpha_i}{st(\alpha_i)} \sim N(0,1) \quad (8)$$

$$G_\alpha = \frac{1}{N} \sum_{i=1}^{N} \frac{T\alpha_i}{\alpha_i(1)} \sim N(0,1) \quad (9)$$

$$H_o = \alpha_i = 0 ve\ H_A = \alpha_i < 0$$

In the second stage, Westerlund (2007) estimates the error correction equation given below with EKK to calculate panel statistics.

$$\Delta Y_{i,t} = \delta_i d_t + \lambda_i x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{i,j} \Delta Y_{i,t-j} + \sum_{j=0}^{p_i} \lambda_{i,j} \Delta x_{i,t-j} + e_t \quad (10)$$

$$Y_{i,t-1} = \delta_i d_t + \lambda_i x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{i,j} \Delta Y_{i,t-j} + \sum_{j=0}^{p_i} \lambda_{i,j} \Delta x_{i,t-j} + \varepsilon_t \quad (11)$$

After estimating the above equation, the error correction coefficient for the whole panel and the standard error of the error correction coefficient are calculated as follows, respectively.

$$st(\alpha_i) = \left[(\hat{S}_N^2) \sum_{i=1}^{N} \sum_{t=2}^{T} \tilde{Y}_{i,t-1}^2 \right]^{-1/2} \quad (12)$$

$$\alpha_i = \left[\sum_{i=1}^{N} \sum_{t=2}^{T} \tilde{Y}_{i,t-1}^2 \right]^{-1} \sum_{i=1}^{N} \sum_{t=2}^{T} \frac{1}{\alpha_i(1)} \tilde{Y}_{i,t-1} \Delta \tilde{Y}_{i,t} \quad (13)$$

$$\hat{S}_N^2 = \frac{1}{N} \sum_{i=1}^{N} \hat{S}_i^2$$

$$\Delta \tilde{Y}_{i,t} = \Delta Y_{i,t} - \delta_i d_t - \lambda_i x_{i,t-1} - \sum_{j=1}^{p_i} \alpha_{i,j} \Delta Y_{i,t-j} - \sum_{j=0}^{p_i} \lambda_{i,j} \Delta x_{i,t-j} \quad (14)$$

$$\Delta \tilde{Y}_{i,t} = \Delta Y_{i,t} - \delta_i d_t - \lambda_i x_{i,t-1} - \sum_{j=1}^{p_i} \alpha_{i,j} \Delta Y_{i,t-j} - \sum_{j=0}^{p_i} \lambda_{i,j} \Delta x_{i,t-j} \quad (15)$$

At this point, the panel cointegration statistics are calculated as follows under the null hypothesis that there is no cointegration for all cross-sections given below and the alternative hypothesis that there is cointegration for some cross-sections.

$$H_0 = \alpha_i = 0 ve \ H_A = \alpha_i < 0$$

$$P_\tau = \frac{\alpha}{st(\alpha)} \sim N(0,1) \quad (16)$$

$$P_\alpha = T\alpha \sim N(0,1) \quad (17)$$

9. Application Results

In the application part of the study, first, descriptive statistics were examined. Descriptive statistics for each series used in the study are given in Table 5.

Table 5: Descriptive Statistics

Variables	Number of Observations	Mean	Standard Error	Minimum	Maximum
gci	270	0.6842	0.0432	0.5658	0.7745
e1	270	0.7148	0.1061	0.3384	0.9324
e2	270	2.0092	0.0192	1.9692	2.1093
e3	270	2.0405	0.0642	1.9033	2.2146
e4	270	1.8375	0.0830	1.5560	2.0522
h1	270	1.8964	0.0167	1.8512	1.9190
h2	270	0.5783	0.2018	0.3010	1.3802
h3	270	0.9062	0.0995	0.6145	1.0393
h4	270	0.5581	0.1358	0.1611	0.9009

In the second stage of the application, it was tested whether the series in question included cross section dependence. To this end, the Pesaran $CDLM_2$ (2004) Test was employed. The test results are given in Table 6.

Table 6: Cross Sectional Dependence Test Results

Variables	$CDLM_2$	Probability Value
gci	276.05	0.0000
e1	203.27	0.0000
e2	270.59	0.0000
e3	378.99	0.0000
e4	293.23	0.0000
h1	545.55	0.0000
h2	409.94	0.0000
h3	328.05	0.0000
h4	421.49	0.0000

When Table 6 is examined, it can be concluded that the whole series group included cross sectional dependence, since the probability level obtained according to the Pesaran CDLM2 (2004) Test Statistic is lower than the 1% level of significance.

After the Pesaran CDLM2 (2004) Test, Blomquist and Westerlund (2013) slope heterogeneity test was applied to determine whether the model established for each country included slope heterogeneity. Here, the slope homogeneity null hypothesis was tested.

Table 7: Slope Heterogeneity Test

	Value
$\hat{\Delta}$	-3.521***
$\tilde{\Delta}_{adj}$	-9.086***

Note: *** denotes 1% level of significance.

In light of the results given in Table 7, the slope homogeneity null hypothesis is rejected and therefore the slope of the model is heterogeneous.

In the fourth stage of the application, since the cross section dependence was determined for all the series, it was examined whether the series were stationary by using the CADF Panel Unit Root Tests of Pesaran, which is one of the second generation unit root tests. The results are given in Table 8 below. The analysis revealed that all the variables, except for the h1 variable, were not stationary at the level. On the other hand, even though the series group gci, e1, e2, e3, e4, h2, h3 and h4 were not stationary at the level, when the one-lagged values of the series were taken into account, it was concluded that the series in question became stationary as one lagged, since the CADF tests were significant at 1%.

Table 8: Panel Unit Root Test (CADF)

Variables		Z[t-bar]	Probability Value
gci	At the level	-1.023	0.153
	At one lag	-10.066	0.000
e1	At the level	-1.427	0.077
	At one lag	-12.634	0.000
e2	At the level	2.108	0.982
	At one lag	-9.376	0.000
e3	At the level	1.198	0.885
	At one lag	-12.864	0.000
e4	At the level	-0.081	0.468
	At one lag	-3.779	0.000
h1	At the level	-5.065	0.000
h2	At the level	-2.125	0.017
	At one lag	-9.282	0.000
h3	At the level	0.596	0.724
	At one lag	-13.047	0.000
h4	At the level	-1.934	0.027
	At one lag	-11.791	0.000

Finally, Dumitrescu and Hurlin (2012) Panel Granger Causality Test was run to determine the causality relationship between gci and education and health-related variables (e1, e2, e3, e4, h1, h2, h3, h4). The results of the test are shown in Table 9.

Table 9: Granger Panel Causality Test Results

	1 Lag Length			2 Lag Length			3 Lag Length		
	$W_{N,T}^{Hnc}$	$Z_{N,T}^{Hnc}$	Z_{N}^{Hnc}	$W_{N,T}^{Hnc}$	$Z_{N,T}^{Hnc}$	Z_{N}^{Hnc}	$W_{N,T}^{Hnc}$	$Z_{N,T}^{Hnc}$	Z_{N}^{Hnc}
e1→gci	4.51	10.53***	6.75***	10.43	17.88***	8.73***	10.25	12.56***	2.22**
gci→e1	2.85	5.56***	3.35***	3.51	3.22***	0.95	5.07	3.58***	0.03
e2→gci	2.92	5.76***	3.48***	6.15	8.82***	3.92***	9.42	11.12***	1.87*
gci→e2	6.30	15.91***	10.43***	5.23	6.85***	2.88***	5.22	3.85***	0.09
e3→gci	1.52	1.58	0.62	6.73	10.05***	4.58***	45.84	74.20***	17.32***
gci→e3	6.06	15.20***	9.95***	2.88	1.87***	0.24	8.28	9.15***	1.39
e4→gci	6.57	16.73***	10.99***	13.21	23.80***	11.87***	28.41	44.02***	9.93***
gci→e4	22.40	64.22***	43.50***	7.90	12.52***	5.89***	7.02	6.97***	0.86
h1→gci	5.09	12.28***	7.94***	4.86	6.06***	2.46**	9.70	11.61***	1.99**
gci→h1	1.24	0.73	0.05	3.34	2.85***	0.76	6.96	6.86***	0.83
h2→gci	2.00	3.00***	1.59	3.54	3.27***	0.98	11.54	14.79***	2.77***
gci→h2	12.25	33.77***	22.66***	5.17	6.74***	2.82***	11.54	14.79***	2.77***
h3→gci	8.07	21.21***	14.06***	7.99	12.72***	5.99***	18.85	27.46***	5.87***
gci→h3	5.44	13.32***	8.66***	3.16	2.47***	0.56	17.59	25.28***	5.34***
h4→gci	3.04	6.14***	3.75***	12.14	21.51***	10.65***	33.68	53.14***	12.17***
gci→h4	17.46	49.39***	33.35***	3.94	4.12***	1.43	9.48	11.23***	1.90*

Note: *** shows 1%, ** shows 5% and * shows 10% level of significance.

As seen in Table 9, there is a bilateral causality relationship between each education variable except for the e3 variable and the gci variable. As for the e3 variable related to education, a causality relationship from gci to e3 was detected, while a causality relationship from e3 to gci could not be determined. On the other hand, it is seen that there is a bilateral causality relationship between the health variables of h3 and h4 and the gci variable. On the other hand, while a causality relationship from h1 to gci was detected, a causality relationship from gci to h1 could not be determined. On the other hand, while no causality relationship could be determined from h2 to gci, a causality relationship was determined from gci to h2.

The identified short-term causality relationships are summarized in Table 10 below.

Table 10: Summary of Short-term Relationships

	Variables	Findings (Causality)
Global Competitiveness Index (gci)	Public expenditure on education (as % of GDP) (e1)	**Finding 1** There is bilateral causality.
	Rate of gross enrolment in primary education (e2)	**Finding 2** There is bilateral causality.
	Rate of gross enrolment in secondary education (e3)	**Finding 3** There is only causality from gci to e3.
	Rate of gross enrolment in higher education (e4)	**Finding 4** There is bilateral causality.
	Life expectancy at birth (in years) (h1)	**Finding 5** There is only causality from h1 to gci.
	Infant mortality rate (per 1000 live births) (h2)	**Finding 6** There is only causality from gci to h2.
	Health expenditures (as % of GDP) (h3)	**Finding 7** There is bilateral causality.
	Number of doctors (per 1000 individuals) (h4)	**Finding 8** There is bilateral causality.

Finally, the results of panel cointegration test statistics developed by Westernlund (2007) to analyze whether there is a long-term relationship between the global competitiveness index and health and education variables are given in Table 11 below.

Table 11: Westerlund (2007) Panel Cointegration Test Results

Constant and Trend	Test Statistics			Probability Value
		Value	Z-value	
gci and e1	G-tau	-4.699	-13.868	0.000
	G-alpha	-18.074	-8.512	0.000
	P-tau	-12.804	-6.463	0.000
	P-alpha	-13.608	-8.554	0.000
gci and e2	G-tau	-3.377	-7.557	0.000
	G-alpha	-13.849	-5.204	0.000
	P-tau	-11.185	-4.866	0.000
	P-alpha	-9.773	-5.009	0.000
gci and e3	G-tau	-4.419	-12.531	0.000
	G-alpha	-11.468	-3.340	0.000
	P-tau	-15.995	-9.614	0.000
	P-alpha	-11.899	-6.974	0.000
gci and e4	G-tau	-3.329	-7.329	0.000
	G-alpha	-13.119	-4.633	0.000
	P-tau	-8.384	-2.100	0.018
	P-alpha	-8.848	-4.154	0.000
gci and h1	G-tau	-3.800	-9.576	0.000
	G-alpha	-14.188	-5.469	0.000
	P-tau	-5.287	0.957	0.831
	P-alpha	-6.237	-1.739	0.041
gci and h2	G-tau	-3.404	-7.689	0.000
	G-alpha	-10.660	-2.708	0.003
	P-tau	-6.405	-0.147	0.441
	P-alpha	-7.001	-2.446	0.007
gci and h3	G-tau	-3.463	-7.969	0.000
	G-alpha	-10.896	-2.892	0.002
	P-tau	-10.007	-3.703	0.000
	P-alpha	-10.189	-5.394	0.000
gci and h4	G-tau	-3.342	-7.391	0.000
	G-alpha	-11.798	-3.598	0.000
	P-tau	-10.228	-3.921	0.000
	P-alpha	-10.413	-5.601	0.000

Note: Regarding the Westerlund (2007) test, the number of antecedents and delays (k) was determined as 1

When the results of the Westerlund (2007) panel cointegration test are examined, it is seen that there is a long-term relationship between the Global Competitiveness Index (gci) variable and all the other variables except for variables h1 and h2.

10. Results and Suggestions

The competition between limited companies, sectors and countries on limited goods and services in the past has reached such a dimension that involves the whole globe/world with the effect of technological developments. In particular, the increase in international goods, services and human mobility, the elimination of agreements limiting international trade or the stretching of their terms, the increasing economic integration of the world, the increase in liberalization, deregulation and privatization tendencies have brought competition to the global arena.

The main condition for countries to gain competitive power and success in the international arena is to correctly identify the factors affecting global competition and to successfully put into practice rational strategies, policies and practices that can respond to the emerging needs. However, the fulfilment of these conditions depends on having qualified human power (i.e., human capital), the main actor in this process. In fact, it is the qualified manpower that will determine the elements that provide superiority in global competition, will correctly read the dynamics that shape global competition and will correctly identify the factors affecting global competition and implement rational strategies, policies and practices that can respond to the emerging needs.

Education and health are the two most fundamental factors that lead to the formation and development of human capital. The knowledge and abilities gained through education make great contributions to the creation of qualified, productive and healthy human capital. However, health is a prerequisite for individuals to receive education, to acquire the knowledge, skills and abilities needed in the education process, to transform these gains into social and economic benefits and to actively participate in the production process. Without health, it is not possible to talk about a quality education and human capital. Likewise, it is not possible to talk about individual and social awareness of health without a qualified education. The fact that education and health are in a mutual causality relationship has led countries to regulate and develop health activities along with education in order to feed, improve and nurture their human capital.

In the current study analysing the effect of education and health as the basic elements of human capital on global competition in the 18 OECD countries, including Turkey, by using the Granger Panel Causality Test, it was determined that each variable representing education (e1, e2, e3, e4) and health (h2, h3, h4) is in a causal relationship with the Global Competitiveness Index (gci). A bilateral causality relationship was determined between the e1 (public expenditure on education [as % of GDP]), e2 (rate of gross enrolment in primary education), e4 (rate of gross enrolment in higher education), h3 (health expenditures [as % of GDP]) and h4 (number of doctors [per 1000 individuals]) variables and gci (Global Competitiveness Index) variable. On the other hand, a unilateral causality relationship was detected from the gci (Global Competitiveness Index) variable to the e3 (rate of gross enrolment in secondary education) and h2 (rate of infant mortality [per 1000 live births]) variables and from the h1 (life expectancy at birth [in years]) variable to the gci (Global Competitiveness Index) variable. Moreover, when the results of the Westerlund (2007) panel cointegration test are examined, it is seen that there is a long-term relationship between the Global Competitiveness Index (gci) variable and all the other variables except for variables h1 and h2.

This result means that OECD countries which want to gain strength and success in global competition should strengthen education and health factors, which are the main driving forces of human capital, both qualitatively and quantitatively. Human capital consisted of a qualified and healthy manpower serves many important functions in adapting the economic, social, cultural and political atmosphere in the rapidly changing, transforming and developing world of the 21st century, in getting rid of the middle-income trap, in achieving sustainable economic growth and development and in achieving power and success in global competition. Human capital affect global competition by creating and developing knowledge, technology and innovation, by producing products and services based on advanced technology with high added value, by making R&D activities operational, by engaging in entrepreneurial activities, by developing rational strategies and policies that will guide progress and development.

As for Turkey, it is seen that the variables related to education, health and global competition are below the OECD average in all the variables except the rate of gross enrolment in higher education (112.78). In public expenditures on education (as % of GDP) (4.3), it ranks the sixth from the bottom and in the rate of gross enrolment in primary education (94.91) and in the rate of gross enrolment in secondary education (104.48), it ranks the sixth from the bottom. In health related variables, it ranks third from the bottom in life expectancy at birth (in years) (77), and it takes the first place with the highest rank of infant mortality (per 1000 live births) (9) and the last place with the lowest rate (4.12) in health expenditures (as % of GDP) and the last place with the lowest rate (1.81) in the number of doctors (per 1000 individuals). In the variable related to global competition (Global Competitiveness Index), it is in the last place among OECD countries.

Turkey, which aims to have power in a global competitive environment, should increase the budget allocated for education and health with an understanding that it will not sacrifice quality to quantity, increase the rate of enrolment in primary and secondary education, prolong life expectancy at birth and decrease the rate of infant mortality and increase the number of doctors. In this direction, with the awareness of the fact that the resources spent on qualified education and health are an investment, it should allocate a significant part of its economic power to education and health and world-class manpower should be trained in skill-intensive fields/occupations that require qualified labour. It should be ensured that the educated and healthy workforce is not allowed to fall into qualification conflicts and that they are employed in jobs that are suitable for their qualifications and specialization. In addition, the qualified workforce to be trained should be trained in sufficient number and quality by considering the supply-demand balance and kept in the country after being trained. Otherwise, training of qualified labour force above or below what is needed and losing the qualified labour force to other countries (especially developed countries) through brain drain will cause many economic, social, psychological and political problems in the social field and negatively affect global competition.

In short, both Turkey and OECD countries that have fallen behind in global competition can create and develop human capital with the education and health policies they will structure by taking into account the conditions and needs of the 21st century and they can use this power as a tool in accomplishing their sustainable economic growth and development, raising the level of social welfare and gaining power in global competition.

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