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BEŞERİ SERMAYE VE EKONOMİK BÜYÜME İLİŞKİSİNİN TEORİK VE AMPİRİK LİTERATÜRÜ[1]

THEORETICAL AND EMPIRICAL LITERATURE OF THE RELATIONSHIP BETWEEN HUMAN CAPITAL AND ECONOMIC GROWTH[2]

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Öz

Ekonomik performansın ve refah şartlarının en belirgin göstergelerinden biri olan iktisadi büyüme, hükümet politikalarına yol veren önemli bir parametredir. Bu nedenle iktisat literatürü tarafından birçok akademik araştırmaya konu olmuştur. Geçmişte büyümenin tamamıyla fiziksel kaynaklar sayesinde elde edildiği düşünülse de günümüzde büyümeye bilgi gibi maddi olmayan unsurlar kaynaklık etmektedir. Bilginin kullanımı ve temini için ise beceri ve tecrübe sahibi kişilerin varlığına ihtiyaç duyulmaktadır. Bu noktada Schultz (1961), bir ulusun sahip olduğu bilgi, beceri ve tecrübe sahibi insan stokunu beşeri sermaye olarak tanımlamıştır. İçsel büyüme teorileri çerçevesinde literatürde önemli yer tutan beşeri sermaye kavramı ekonomik büyümeyle ilişkilendirilmiştir. Ancak, yapılan çalışmalar çeşitli sonuçlar ortaya çıkarmış ve değişkenler arasındaki ilişki hakkında fikir birliğine ulaşılamamıştır. Bu nedenle bu çalışmada, beşeri sermaye ve ekonomik büyüme ilişkisine yönelik yapılan teorik ve ampirik bulguların bir araya getirilmesi hedeflenmiştir.

Anahtar Kelimeler: Beşeri Sermaye, Ekonomik Büyüme, Literatür Çalışması

JEL Sınıflaması: E24, J24, O15

Abstract

Economic growth, which is prominent indicators of economic performance and welfare conditions, is an important parameter that gives way to government policies. For this reason, it has been the subject of many academic studies by the economics literature. Although in the past it was thought that growth was achieved entirely through physical resources, today growth is based on intangible factors such as knowledge. For the use and supply of information, the presence of people with skills and experience is needed. At this point, Schultz (1961) defined the human stock of a nation with knowledge, skills and experience as human capital. The concept of human capital, which has an important place in the literature within the framework of endogenous growth theories, has been associated with economic growth. However, studies have revealed various results and no consensus has been reached about the relationship between the variables. Therefore, in this study, it is aimed to bring together the theoretical and empirical findings on the relationship between human capital and economic growth.

Keywords: Human Capital, Economic Growth, Literature Study

JEL Classification: E24, J24, O15

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1. Introduction

The concept of economic growth, which is one of the most important indicators of economic performance and welfare conditions in terms of macroeconomics, is one of the primary and final policy goals that countries focus on with importance. For this reason, the phenomenon of economic growth is among the most studied subjects in the economics literature. Since its emergence, the methodology of economics has been in an effort to explain the concept of economic growth and the factors that lead to economic growth according to the conditions of the period. The mercantilist system of thought suggested that economic growth and welfare increase would be possible by increasing the precious metal stock in the country. The Physiocrats formed their economic policies on the basis of the agricultural sector, with the thought that the economic growth would be realized by the increase in the amount of agricultural products. Classical economists tried to explain economic growth with capital accumulation, conversion of surplus value into investment, division of labor and specialization. The mainstream Neoclassical view of economics saw the developments in technology as the unexplained part of the increase in the factors of production and described external technological development as the source of economic growth. Later economists, adopted endogenous growth models, associated the concept of human capital with economic growth and introduced the concept of human capital to the economics literature.

Although economic growth was based entirely on physical assets in the past, today the main source of growth is intangible assets such as knowledge. Knowledge-based activities have become increasingly valuable both in national economies and in individual activities. Today, the progress in information technologies is felt in all working life. Powerful computers and connections are needed to accomplish all of this. But more importantly, people with skills and knowledge should be involved in order to realize the economic transformation (Keeley, 2007). At this point, Schultz (1961) defined the human stock of a nation with knowledge, skills and experience as human capital. According to the definition of the OECD (2023), human capital is; labor is known as productive wealth embodied in skills and knowledge. Today, the relationship between human capital and economic growth is a well-known fact. All the variables that help the development of human skills physically and mentally and affect the human capital stock are called human capital elements. Improvements made in these elements increase the potential of human capital and contribute to national economies both on an individual and national level.

Mankind has realized three important economic and social transformation processes throughout history. The history of humanity began its life as an agricultural society, then continued as an industrial society, and today the period has been passed the information society. All these periods had their own characteristics with the change of the economic structure, and each of them revealed a new understanding of production and management. The technological developments that have taken place have made great contributions to the living of these transition periods and the change of social life. While the "labor" factor was the most vital element of the production process for the agricultural society, "capital" was substituted for labor in the industrial society. In the later information society, however, labor and capital alone were not sufficient, and labor equipped with knowledge and skills as the basic production factor, namely "human capital", was seen as the most important factor of the production process (Karadeniz, Durusoy and Kose, 2007: 1-2).

Due to this importance of human capital, it has been the subject of many academic studies in the economics literature. This study is in the nature of a literature study. The study includes theoretical contributions and related definitions that are important on the relationship between human capital and economic growth. The factors that determine human capital and economic growth; return on human capital, individual earnings and return on education; the factors that determine the effective use of human capital; topics such as complementarity and comparison of human capital with other production factors and the historical process of human capital are discussed in the first part. After the first part, in which the theoretical literature on human capital is explained and finally empirical literature examining the relationship between economic growth and human capital is included in the study.

2. The Concept of Human Capital and Its Elements

The concept of human capital has been exposed to various definitions for different economic perspectives due to its importance in the literature. The definitions made have been expanded by keeping up with the changing world order. The first definition of the concept of human capital in the contemporary sense was made by the American Nobel Prize-winning economist Theodore W. Schultz (1961), the representative of the Chicago School. Later, Edward F. Denison (1962) and Gary S. Becker (1962) from the same school made additions to this definition.

Schultz (1961) defines the human stock of a nation with knowledge, skills and experience as human capital. According to Shultz, educated human stock is a special type of capital as it will be the source of future income and the size of the income to be earned will be realized according to the knowledge, experience, talent and education level of the labor. Since all these determinants will be acquired over time, human capital has the ability to accumulate and multiply. Human capital actually resembles nature and natural resources. When human beings are

born, they are dysfunctional like natural resources. However, just like natural resources, it becomes usable after certain transactions and gains the quality of capital. As a result, the investment made to improve the quality of labor transforms unskilled labor into capital (Schultz, 1961: 7). In addition to Schultz's explanations, Danison (1962) associated the increase in production that cannot be explained by the increase in capital and labor with the concept of human capital. He argued that this increase was due to the increased education level of labor. Becker (1962), on the other hand, draws attention to the fact that the main determinant of company success is the human factor, and thinks that the most successful companies are those that use human capital effectively, invest in their employees and provide them with a training environment.

OECD (2023) defines human capital as 'productive wealth embodied in labour, skills and knowledge'. According to the OECD (2001) report, human capital; It is the structure that allows the creation of personal, social and economic well-being by focusing on the knowledge, skills and competencies of individuals. According to Thurow (1970); human capital is an individual's productive ability, skills and knowledge. Goldin (2014) closely defines human capital as the stock of skills that labor has it. According to Goldin, human capital is also an indicator of the ability of individuals to generate income. Saxton (2000) defines human capital as the knowledge and abilities that workers acquire to increase their value in the labor market.

All the variables that help the development of human skills physically and mentally and affect the human capital stock are called human capital elements. Some resources are needed for the development of human capital. Improvements made in these elements increase the potential of human capital and contribute to national economies both on an individual and national level. When the economics literature is examined, it is concluded that factors such as education, health, population and brain drain are effective on human capital.

The most critical element in the process of increasing the knowledge and skills of labor and giving it a higher qualification is undoubtedly the investment in education. For this reason, investments in education appear as the most important factor in the development of human capital (Bowen, 1964: 183). For this reason, education indicators are used to represent human capital in most studies in the economics literature. These studies on education are in the nature of human capital studies. Education contributes to the development of human capital through three different channels. The most important way is for the individual to realize the formal education process such as primary school, high school and university education. The second way is learning by experience with on-the-job training and seminars. The third channel is self-development of the individual on a personal basis.

Another important human capital element is health. Health is a state of physical and mental well-being. Health is an important factor affecting human life and working life. Mushkin (1962) put forward the view that health, like education, has an impact on human capital for the first time in his work titled "Health as Investment". According to Mushkin (1962), health expenditures have important effects on economic growth and therefore health expenditures should be considered as investment expenditures. The health factor also affects the labor productivity of the individual. Individuals who are not healthy and have physical or mental problems cannot fully use their capacities in working life. Physically and mentally healthy individuals take an active role in the production process. Therefore, the development of human capital is positively affected in societies that have good access to health services and have a high level of general health (Aguayo-Rico et al., 2005, 1).

Another factor that helps the development of human capital stock in a country is brain drain, in other words, labor transfers. Brain drain generally refers to the transfer of skilled labor from underdeveloped and developing countries to developed countries that offer them better opportunities for socio-economic reasons. While the brain drain provides significant benefits for the countries receiving qualified migration, it creates consequences against the sending country.

Finally, the qualitative and quantitative demographic structure of a country also determines the economic efficiency of human capital. While what is meant by qualitative population here is the general education and health status of the population, characteristics such as population amount, population growth rate, age distribution and gender structure represent quantitative population conditions. Such population elements are extremely determinant in the development of human capital. While the young and dynamic population structure is more suitable for production, societies with high elderly population lose their production ability and are exposed to productivity losses over time (Yumuşak, 2008, 12).

3. Determinants of the Effective Use of Human Capital and the Income of Efficiency

There are certain specific conditions to the development of the human capital stock and its effective use in the real economy. In order to increase the quality of human capital, a healthy society with a high level of education is needed in economy. However, the fact that the said human capital can be considered effective can be achieved primarily by satisfying the individual in the field of physical opportunities and social relations. In this direction, it is important to determine the factors that increase the productivity of human capital. It is possible to divide these factors into two as material and intangible factors. Material factors can be exemplified as working environment

opportunities, wage level and compatibility of human capital with physical capital. On the other hand, intangible factors are the factors that affect the work belonging of labor, the compatibility of human capital with social capital, and the moral and social values of the society (Karagul, 2003, 84).

Ensuring the optimal level between physical and human capital is a critical condition for the workforce to work effectively and contribute more to the level of output. For this reason, the complementarity network with physical capital must be well established for the effectiveness of existing human capital. If this balance is not achieved, the human capital of the country remains idle and cannot be utilized well. Also, this situation brings with it some problems. In addition to the inability to provide economic efficiency, it also leads to the migration of qualified workforce to other economies that offer more suitable opportunities.

The share of labor in production is directly related to the efficiency of human capital. If the worker is not satisfied with the wage he receives for his labor, this will reduce the productivity in production. This prevents the active use of human capital. As a result, the wrong wage policies applied in underdeveloped and developing countries also cause the escape of a small number of trained labor force that develops under difficult conditions (Haque and Khan, 1997: 21).

In addition to the material gains obtained in return for the labor, the moral gains of the worker from his profession also affect the morale and motivation of that worker towards the work. Because profession is a factor that determines the position of individuals in social life rather than a source of livelihood, adds value to them and provides psychological satisfaction. For this reason, the satisfaction of the worker from his profession will contribute positively to his productivity in the workplace.

The return of the effective use of human capital can be examined in three parts in terms of individual, organization and society. The increase in productivity on an individual basis means the increase in the income of labor. Because many employers want to hire highly productive people to maximize their profits and are willing to pay higher salaries in return. From the perspective of the organization; High potential human capital contributes to the organization's more competitiveness and higher core competencies. Expert and trained personnel increase the profitability of the organization and contribute to its sustainability. Finally, the social aspect of human capital is a synthesis of both the individual and the organization. Democracy, human rights and political stability can be achieved more easily in educated and conscious societies. Such societies have high social awareness. Thus, the link between human capital and social awareness is based on a close interrelationship as a result of socio-political development (Kwon, 2009).

4. Human Capital and Individual Gains: The Return on Education

The impact of human capital on growth ultimately depends on the relationship between an individual's education and productivity. Since empirical macroeconomic growth studies, which are mostly used in the literature, have microeconomic foundations, micro-evidence on the effect of education on productivity needs to be analyzed. However, due to the difficulties of measuring variables on a micro basis, such as the cost of education, these studies are scarce in the literature. Labor economists often examine the link between education and productivity. Standard empirical approaches use variation in individuals' wages as the explanatory variable for education, age, experience, health, and other characteristics. The most popular specification is based on the work of Mincer (1974), which predominantly functions human capital.

Jacob Mincer, in his first study on human capital published in 1958, wondered why individuals with different levels of education earned different levels of earnings throughout their lives and focused on explaining this situation. The human capital model used in the first work is simple and includes earnings differences by education groups. The model was then expanded to address the differences in earnings between different age groups. As a result of the expansion, the equation that Mincer brought to the economics literature in 1974, showing the effect of an individual's additional education on individual earnings, is named as the Mincer earnings equation in the literature. In summary, the Mincer earnings equation expresses the positive relationship between personal education and the return obtained through education. It is argued that as a result of equality, personal productivity determines earnings. According to Mincer (1974), education affects individual earnings in increasing productivity. In addition, it was emphasized that the connection between the variables in the study was not a linear and simple relationship.

$$\ln W_s = \ln W_0 + rs \quad (1)$$

Equation 1, shows the Mincer equation. In the equation, W(s) represents the annual earnings of individuals with s years of education, and r represents the rate of return on education. The main result deduced from the equation; The amount of earnings obtained is directly proportional to the time allocated for education (Mincer, 1974, 11).

5. The First Foundations and Historical Process of the Concept of Human Capital

Considering the concept of human capital in the historical process, the first foundations of human capital in the primitive sense were laid by the mercantilist period thinker William Petty. William Petty attributes the size of a country and ruler not to the extent of the land and its military might, but to the number of people in industry and the arts. According to Petty, human resources are much more important than natural resources for economic growth. Because in order to be able to export higher capability must be combined with resources. William Petty carried out studies to measure the effect of labor on economic development and argued that labor was 3/5 more productive than natural resources and accumulated capital under the conditions of the period (Johnson, 1964, 25-27). According to Petty, wealth arise from the cooperation of labor and land. For this reason, "the father of wealth is labor and its mother is land". Petty, who defended the importance of education in the mercantilist period, draws attention to the importance of human capital in the primitive sense, although he does not fully define human capital.

Although it does not fully express the concept of human capital, the first classification was made by Adam Smith, the pioneer of classical economics doctrine. Smith (1776) divided the labor into two as skilled and unskilled while talking about the labor factor. According to Smith, skilled workers are employed in jobs appropriate to their knowledge and experience, while unskilled workers are employed in areas that do not require knowledge and skills. Phenomena such as division of labor and specialization refer to the knowledge, skills and abilities of labor. This directly coincides with the definitions made on human capital. Smith's words draw attention to the importance of human capital, although it is not fully named (Smith, 2006, 111);

"A man trained by spending a lot of time and effort for a job that requires extraordinary craftsmanship and dexterity can be compared to one of these expensive machines. It is necessary to expect that the task he has learned to perform will bring back to him all of the cost of his education, apart from the usual wages of ordinary labor, together with the usual profits of at least a capital of that value. Then, given the uncertain duration of human life and the sharper expiration date of the machine, it must also happen at a reasonable time. It is on this basis that the difference between the wages of skilled labor and ordinary labor rests.''

Karl Marx, one of the important names of socialism evaluated in the classical economics doctrine, contributed to some of Smith's ideas by supporting them. The following words of Marx also support Smith's idea of division of labor and specialization, drawing attention to the importance of human capital (Marx, 1977: 78);

"The true meaning of teaching and education for philanthropic economists is as follows: to train each worker in as many trades as possible so that when he is kicked out of one line of business because of the use of a new machine or any change in the division of labour, he may find work elsewhere as easily as possible.''

In addition, defending the labor theory of value, Marx states that the factor that determines the value of a good is labor, and therefore, the development of an individual's physical, mental and artistic creative abilities is "true wealth" and "the most productive power of society" (Nureyev, 2008: 129).

The first definition of the concept of human capital in the contemporary sense was made by the American Nobel Prize-winning economist Theodore W. Schultz (1961), the representative of the Chicago school. Later, Edward F. Denison (1962) and Gary S. Becker (1962) from the same school made additions to this concept. The theory of human capital, whose theoretical framework was drawn by Schultz (1961), has been studied by many economists with the development of endogenous growth theories. Important economists such as Romer (1989), Barro (1991) and Mankiw, Romer and Weil (1992) are among the pioneers in this field. As a result of these studies, human capital theory has been expanded and examined for many economies. The human capital theory, which has an important place in the economic literature thanks to the endogenous growth models, has brought a new perspective to the economic growth phenomenon.

In the economics literature, the pioneering of endogenous growth theories is the work of Paul Romer and Robert Lucas (Grossman and Helpman, 1994). Neoclassical theory, which advanced under the leadership of Solow in the 1950s, defined economic growth as a phenomenon that occurs due to external reasons, by linking growth to factors outside the economic system in the model. In the 1980s, developments in education, R&D activities and technological fields revealed the necessity of re-evaluation of the subject. Romer (1986) and Lucas (1988) pioneered endogenous growth models by reevaluating the concept of growth in this conjuncture. In these studies and in the later internal models, the phenomenon of capital includes both physical capital and human capital in the model together. For this reason, knowledge accumulation and human capital are at the forefront in addition to physical capital in endogenous growth models.

When examined in general, it is possible to divide endogenous growth models into two basic groups. The first group consists of endogenous growth models centered on knowledge and human capital. In this group, besides the importance of human capital on economic growth, factors such as learning by doing, dissemination of knowledge

and public investments are discussed (Arrow, 1962; Romer, 1986; Lucas, 1988; Barro, 1991; Rebelo, 1991; Mankiw, Romer, and Weil, 1992; Mulligan and Sala-i-Martin, 1993).

The endogenous growth theories, which center on knowledge and human capital, explain the benefit of knowledge to economic growth in two ways. The first way is the positive externality created by knowledge and technological progress. Regardless of the level of knowledge obtained, it can be used in various sectors and the information can be processed with various steps to provide efficiency. This contributes to the accumulation of knowledge over time. The other way is that knowledge increases the scale of production and offers increasing returns to scale. As information is used and disseminated, it increases efficiency. Thanks to these features, knowledge is distinguished from other production factors. Because information increases as it is shared, and the use of information in the production process does not consume information, on the contrary, it contributes more to production by increasing human capital.

Knowledge accumulation creates resources for productivity increases by increasing the equipment of human capital and contributes more to production. Increasing production, on the other hand, will increase the human capital stock in addition to the increase in capital stock according to endogenous growth models. Contrary to the neoclassical thought, the marginal productivity of physical capital will not decrease, and an increasing return to scale will be achieved thanks to the positive externality emitted by human capital. This will ensure the continuity of economic growth.

The other group consists of endogenous growth models centered on R&D activities. Among these models, Romer (1990), Grossman and Helpman (1991), Aghion and Howitt (1992) and Jones (1995) models are among the main works. These works generally explain the relationship between the profit motive and the technological progress and economic growth based on private sector R&D investments. The beginning of this school is based on the Romer (1990) model. In these studies, R&D investments are seen as the driving force of economic growth.

There are two main facts that distinguish R&D-centered endogenous growth theories from knowledge-based and human capital-centered endogenous growth theories. The first case; The first group of models argue that technical progress emerges as a result of physical capital accumulation and human capital accumulation, and that the information obtained will spread throughout the economy thanks to positive externalities in the market. The second group of models, on the other hand, argue that technological progress will be realized by a separate sector that carries out R&D studies. The second case is; In the first group models, as in the Solow model, perfect competition market conditions are valid, while in the second group, imperfect competition conditions must be met in order for the technology producing sector to survive. While the first group models can be used for all countries, it is meaningful to use these models more on developed economies, since the new technology production process is considered as a separate production activity in the second group models.

Joseph A. Schumpeter, one of the important economic thinkers, drew attention to the effects of research and development activities on economic growth. According to Schumpeter (1942), creating knowledge through R&D using modern technology is critical in gaining productive efficiencies that lead to sustainable economic growth. Romer's (1994) endogenous growth model, based on Schumpeter's work, showed that the productivity provided by technology and R&D contributed significantly to increasing economic growth. The study also states that developed countries tend to invest in innovation and technology, and thus they strengthen their production capacities (Nair, Pradhan and Arvin, 2020, 2).

Unlike perfectly competitive markets with fixed incomes to scale, which assume that the information put forward in the first group human capital-based endogenous growth theories is full, free and fast spreading, in the second group of R&D-based internal growth models; companies carry out R&D activities for profit maximization under the condition of imperfect competition where patent and intellectual property rights are valid, and thus, they provide more growth opportunities from the sector, obtaining increasing returns according to scale and ensuring the continuity of economic growth.

6. Empirical Literature Review on the Relationship between Human Capital and Economic Growth

The concept of human capital in the economics literature is an important research area that has been studied for many years. Human capital has been at the focal point for many years in the literature due to its great importance. In addition to the studies on the determinants of human capital, the effects of human capital on macroeconomic activities such as economic growth, economic development and social development have been examined in many academic studies. However, these studies differ because they serve different analytical purposes, are based on various economic approaches, the econometric methods used differ, and the analyzes have various regional and national samples. For this reason, various findings about the determinants of human capital and its relationship

with economic growth have been obtained in these studies, and a common consensus has not been reached in the economics literature.

Due to the various findings and different approaches used, there is great benefit in the classification of the literature examining the relationship between human capital and economic growth. In this context, Boarini, Mira d'Ercole and Liu (2012) developed two general approaches to the classification of human capital literature: indicators-based approach and monetary measures based approach. In this study, the classification made within the framework of the indicator-based approach used by was adopted Boarini, Mira d'Ercole and Liu (2012).

The indicator-based approach measures human capital through various indicators related to education. Because education is the most basic element and main component in the formation of human capital. Therefore, the increase in human capital stock is closely related to investment in education. In this approach, education indicators represent human capital. This indicator-based approach divides the literature among variables into quantitative studies (eg education level, average length of education) and quality based studies (eg class size, test score) (Le, Gibson and Oxley, 2005).

In this study, the literature examining the relationship between human capital and economic growth is primarily divided into two as quantitative-based studies and quality-based studies. Quality-based studies have been examined under a single heading because they do not occupy much space in the literature. Quantity-based studies, on the other hand, were evaluated separately as studies conducted on a national and regional basis. Since the literature is strong and the studies are very comprehensive, it will be useful to examine the empirical literature in tabular form. For this reason, analysis in tabular form was preferred in study. The relevant literature study is given in Table 1 below.

Quantity Assessment is generally based on various educational output indicators such as enrollment rate, literacy rate, and average years of education (Oxley, Le, & Gibson, 2008). Within the framework of this approach, many academic studies have been conducted in the literature to explain the relationship between education output indicators and various economic variables. The most important of these variables is economic growth, and in the early 1980s, the interest in human capital began to develop on the axis of economic growth. While some of the aforementioned studies concluded that human capital contributed positively to economic growth, others concluded that there was a negative relationship between the variables. In this study, studies with positive and negative results were brought together.

In the economic literature, quantity measurement methods are generally used in theoretical studies designed to calculate the growth rate at the international level. Quantitative indicators such as enrollment and achievement are relevant to education but may fail to indicate the quality of learning (Wößmann, 2003). In order to compare educational achievement in an international context, various cross-country tests were established in the mid-1960s. The most well-known tests applied to predict students' success are; TIMSS, PISA and PIRLS are tests. The PISA test includes math, science, reading, and problem solving. The PIRLS test is a test of primary school reading performance over a five-year cycle. The TIMSS test, evaluates the knowledge and skills of fourth and eighth grade students in the fields of mathematics and science (Hanushek and Woessmann, 2011).

Table 1. Empirical literature of the relationship between human capital and economic growth

Authors	Nations	Duration	Represented Variables	Approaches	Outcomes
A. QUANTİTY ASSESSMENT					
A.1. Studies on Multiple Country and Regional Basis					
Romer (1989)	112 countries	1960-1985	Literacy Rate	Cross Sectional Analysis	Human capital is a factor that will contribute to development of physical capital.
Barro(1991)	98 countries	1960-1985	Enrollment rate	Cross Sectional Analysis	The findings indicate that human capital and economic growth have positive connection.
Mankiw, Romer and Weil (1992)	Non-oil, intermediate and OECD countries	1960-1985	Enrollment rates in secondary education	Cross Sectional Analysis	As a result of the reform made by adding human capital to the classical Solow growth analysis, this model reveals more meaningful results.
Benhabib ve Spiegel (1994)	78 countries	1965-1985	Primary, secondary and higher education enrollment rates	Cross Sectional Analysis	The finding surprisingly show this; coefficient of variation in human capital is statistically negative and insignificant.
Barro ve Lee (1994)	More than 100 countries	1965-1985	Secondary education achievement rate and life expectancy	Panel Data Analysis	The findings show that education and health factors affect economic growth positively.
Islam (1995)	Non-oil, intermediate and OECD countries	1960-1985	Average duration of education in the total population over 25 years old	Panel OLS	According to the findings human capital has a negative and insignificant affect on growth.
Pritchett (1996)	The data set used from Barro and Lee (1994)	Barro and Lee (1994)	Average duration of education over 25 years old	Cross Section Analysis	In the study, it was concluded; increase of education standard didn't have a positive effect on the growth rate of output per worker.
Gemmell (1996)	98 countries	1960-1985	Education level data	Cross Section Analysis	According to the results, primary and secondary education level contributes significantly to income increase in low and middle-income countries.
Elias and Fernandez (2000)	24 Latin American countries	1965-1996	Primary, secondary and high school enrollment rates	Cross Section Analysis	For human capital, primary education ratio is highly significant and has a positive sign, while other proxy variables (middle school and high school) have negative signs.
Kalaizidakis et al. (2001)	93 countries	1960-1970	Average years of education	Traditional linear regression and semi-parametric partially linear regression models	While findings show this there isn't linear relationship between variables, they also revealed the existence of a nonlinear relationship.
Agiomirgionakis, Astreriou and Monastiriotis (2002)	93 countries	1960-1987	Enrollment rate	Panel data analysis	The results show that education contributes to growth.

Barro and Sala-i-Martin (2004)	72 countries 86 countries 83 countries	1965-1975 1975-1985 1985-1995	GDP per capita, education level, life expectancy, public spending, democracy, international openness, investment rate	Panel regression analysis	On the basis of educational attainment, human capital has positive effects on growth. Economic growth is positively dependent on the rule of law and international openness, and negatively on public spending and inflation. In addition, while growth increases with positive movements in the terms of trade, it decreases with increases in the fertility rate.
Gyimah-Brempong et al. (2006)	34 African countries	1960-2000	Average education years	Panel Data Analysis	In conclusion, all education levels contributes to growth in African countries.
Maasoumi, Racine and Stengos (2007)	OECD and non-OECD countries	1965-1995	Years of schooling	Non-parametric regression analysis and traditional linear regression model	While traditional parametric (linear) models revealed that human capital has an insignificant effect on economic growth, robust non-parametric (non-linear) model indicated the existence of a significant relationship between variables.
Baldacci et al. (2008)	118 countries	1971-2000	Sum of gross primary and secondary education enrollment rates	Panel data analysis	Health and education expenditures has an effect on growth. Economic growth is also positively affected by education and health capital.
Henderson (2010)	88 countries	1965-1995	Average years of education	Non-parametric regression analysis	Although most of the results found are compatible with the theory, according to Henderson (2010), the related issue needs further investigation.
Kesikoğlu and Öztürk (2013)	20 OECD countries	1999-2008	Education and health expenditures	Panel causality analysis	While the findings indicate the existence of a long-term relationship between variables, they also show a bi-directional causality relationship between education and health expenditures with growth.
Delgado, Henderson and Parmeter (2014)	84 countries	1970-1985	Average year of education data	Linear regression and non-parametric regression analysis	The results obtained show that the mean education period isn't statistically significant variable in the regressions.
Manga et al. (2015)	Turkey and BRICS countries	1995-2011	Enrollment rate	Panel cointegration analysis	The results show that human capital promoting growth.
Wang and Liu (2016)	55 countries	1960-2009	Average years of education	Panel regression analysis	While primary and secondary education have limited effects on economic growth, higher education affect is more significant.
Mandal, Batina and Chen (2018)	127 countries	1975-2010	Average years of education and life expectancy.	Panel system GMM	The results show that health is more effective than education on growth.
Intisar et al. (2020)	19 Asian countries	1985-2017	Gross secondary school enrollment	Kao and Fisher cointegration tests, FMOLS, DOLS	Trade openness and human capital are crucial to growth.

Agasisti and Bertoletti (2020)	284 European regions (NUTS 2)	2000-2017	Many explanatory variables were used, especially the number of universities.	Panel cointegration analysis	According to the findings universities have positive impact on regional development.
Nedić, Turanjanin and Cvetanović (2020)	EU countries	2000-2012	Graduates number	Panel regression analysis	The obtained results confirm negative relationship between variables
Oyinlola et al. (2021)	17 Sub-Saharan African Countries		Human Capital Index	Panel regression analysis	According to the findings human capital and innovation are positively related with economic growth.
Mabrouki (2022)	Scandinavian countries	1990-2019	education expenditure, life expectancy at birth	Westerlund (2007) Panel cointegration tests, Dumitrescu and Hurlin (2012) Granger causality tests	It shows that there is a stable long-term cointegration relationship between the variables.
Sultana, Dey and Tareque (2022)	141 countries (93 developing and 48 developed)	1980-2008	health and education indicators	GMM Methods	All aspects of human capital help sustain growth in developing and developed countries.
Adeleye, et al. (2022)	19 MENA countries	1980-2020	educational enrollment and life expectancy at birth	Panel Regression Analysis	Among the education indicators, it reveals that primary education has the highest impact, and that the strongest human capital indicator is the average life span. These results underscore the importance of both human capital measures and support the argument that neither education nor health is a perfect substitute for the other as human capital measures.
Abdellaoui (2023)	Maghreb countries, (Tunisia, Algeria and Morocco)	1996-2018	secondary school enrollment rates	GMM and S-GMM	Human capital is an important determinant of economic growth.
Leite and Cardoso (2023)	97 countries	1966-2015	democratization of education data	Panel regression analysis	Regarding human capital, the democratization of education plays a role on growth.
A.2. Country-Based Studies					
Lau et al. (1993)	Brazil	1970-1980	Avarage years of education	Cross-Section Analysis	Results show that additional year of formal education increases actual output about 20%.
In and Doucouliagos (1997)	USA	1949-1984	Human capital formation	Granger-causality analysis	According to the findings there is bidirectional causal relationship among human capital formation and private sector GDP.
Asteriou and Agiomirgianakis (2001)	Greece	1960-1994	Primary, secondary and higher education enrollment rates	Time series analysis	The obtained results indicate positive connection among variables.

Self and Grabowski (2003)	Japan		Average years of education	VAR Model Analysis	Various levels of education significant for growth
Ay and Yardımcı (2008)	Turkey	1950-2000	Number of students	VAR Model Analysis	According to the result higher education has a positive effect on growth.
Chi (2008)	China	1996-2004	Government expenditures on education and total social education expenditures	GMM Model	According to the finding human capital doesn't has direct effect on growth.
Pereira and Aubyn (2009)	Portugal	1960-2001	Average years of education	VAR model analysis	According to the findings, increasing education at all levels except higher education has a positive and significant effect on economic growth.
Adelakun (2011)	Nigeria	1986-2009	Education expenditures, health expenditures, enrollment numbers	Regression Analysis	In conclusion, the study confirms the strong relationship between variables.
Afzal et al. (2011)	Pakistan	1970-2009	Index of gross enrollment rate	ARDL, Toda-Yamamoto	Econometric results reveal the existence of a long-term cointegration relationship between the variables. In addition, the results of the analysis indicate the existence of feedback causality between all education levels and growth.
Frini and Muller (2012)	Tunisia	1963-2007	Primary, secondary and higher education data	Johansen cointegration analysis and VEC model	In the study, in which three education levels were evaluated together, in conclusion education supports growth.
Çalışkan et al. (2013)	Turkey	1923-2011	Student numbers	Johansen cointegration analysis	High school and higher education have significant and positive impact on growth.
Eigbiremolen and Anaduaka (2014)	Nigeria	1999-2012	Secondary education enrollment rate	Johansen Cointegration analysis	The results showed that, human capital development exhibits significant positive effects on the level of output, consistent with theory.
Chirwa and Odhiambo (2016)	Zambia	1970-2013	Total enrollment amount	ARDL bounds testing approach	According to the results, human capital is positively related to growth.
Pegkas and Tsamadias (2017),	Greece	1975-2012	Higher education enrollment rates	Cointegration, analysis	The results showed that, there is a long-run cointegration relationship among variables.
Neychava and Joensen (2019)	Iceland	2000-2015	High school and higher education achievement variables	OLS and DOLS	According to the results high school has positive impact on growth.
Han ve Lee (2020)	South Korea	1986-2017	Human capital calculated by creating micro-level datasets	Cross-section analysis	Human capital contributes significantly to growth for the Korean economy.
Pomi et al. (2021)	Bangladesh	2000-2019	Number of university students	VAR model analysis	The results showed that both human capital and physical capital contributes significantly to growth but their efficiencies are different.

Zhang and Wang (2021)	China 28 provinces	1985–2014	The proportion of the workforce that has completed high school	Panel data analysis	According to the findings, human capital generally have significant positive effects on growth.
Ghosh and Parab (2021)	India	1970-2017	Gross enrollment rate of secondary school	ARDL and NARDL models	According to the results, while R&D provides mixed evidence for economic growth, human capital plays an important role on growth.
Ha and Hgoc (2022)	Vietnam	1992-2017	Financial development	nonlinear ARDL	Financial development has an impact on human capital and is positively related.
Islam and Alam (2022)	Bangladesh	1990–2019	health and education expenditure	ARDL model and Toda-Yamamoto causality test	Expenditure on health influences economic growth rate positively in the long run, but not in the short-run, while government spending on education affects economic growth rate in the long run negatively, and in the short-run positively
Almutairi (2023)	Saudi Arabia	1990-2019	average years of schooling, tertiary education enrollment ratio and scholarships	ARDL model	Higher education enrollment rate and scholarships were found to be negatively and significantly associated with economic growth, and mean schooling time had a negative but insignificant relationship with growth. It is thought that the effect of oil is more than education.
Muhammed et al. (2023)	Nigeria	1988-2020	Human Development Index, Education Expenditure of Government, Health Expenditure of Government, Life Expectancy	Regression analysis	The study concluded that all variables are responsible for the growth. Education expenditure of government and health expenditure of government having the greatest influence.
Mengesha and Singh (2023)	Ethiopia	1980-2019	The secondary and tertiary educational attainments of the labor force and life expectancy	ARDL model and error correction mechanism	According to the results human capital has positive impact on growth.
B. QUALİTY ASSESSMENT					
Hanushek and Kimko (2000)	PISA 31 countries	1960-1990	Math and science test scores	Regression analysis	The quality of the workforce derived from international math and science test scores is strongly associated with growth.
Fertig and Wright (2004)	PISA 31 countries	2000 year	Class size reading performance	Cross-section OLS method	According to the results, it is significant at high clustering levels that include variables such as class size, individual, school district and geographical region.
Entorf and Minoiu (2005)	European and immigration countries	2000 year	Data on school performance, mastery of national languages, relevant migration	Cross Section OLS method	For all countries, the language spoken at home for students with a migrant background has been found to be a key to catch up.

			histories and intergenerational mobility		
Chen and Luoh (2010)	PISA ve TIMSS verileri	2003 year	Test scores	Regression analysis	According to the results, test scores aren't good indicators to explain income differences between countries.
Hanushek and Woessmann (2011)	OECD countries	2000 year	Quality tests	Regression analysis	They found that quality tests have an significant role in explaining the differences in human capital among countries.
Altınok and Kingdon (2012)	47 countries	2003 year	TIMSS data, student achievement (math and science scores), class size	Regression analysis	The findings show a statistically significant negative impact of class size in 14 countries.
Hanushek, Link and Woessmann (2013)	42 countries	2000-2009	PISA test scores	Panel data analysis	It has been concluded that giving more autonomy to schools has negative effects for underdeveloped and developing countries.
Serifoğlu (2020)	54 countries	1998-2012	Number of graduates from different faculties	System GMM	Health science graduates make a higher contribution to economic growth in developing countries, while agriculture and engineering graduates make a higher contribution to economic growth in developed countries.
Phillips and Rossi (2021)	37 countries	2002-2015	PISA test scores parental influence for immigrant students	Regression analysis	It has been concluded that parental influence plays an important role on education.
Kurt and Güvenek (2021)	European Union	2000-2010	Ratio of graduates from science, mathematics and technology fields, education expenditures, participation rate in education between the ages of 15-24	Dynamic Panel Data Analysis	The results show that, except for education expenditures, other education indicators have a positive effect on economic growth.

7. Conclusion

Determining the relationship between human capital and economic growth is important in terms of revealing the necessity of shifting investments to this area and using the existing human capital stock efficiently in countries with development problems. This study is in the nature of a literature study. The study includes theoretical and empirical contributions in the literature and also related definitions that are important on the relationship between human capital and economic growth. The concept of human capital in the economics literature that has been studied for many years. However, when literature is examined, the empirical results show difference. Among the main reasons for this situation, the results obtained differ due to the fact that the studies serve different analytical purposes, they are based on various economic approaches, the econometric methods used differ and the analyzes have various regional and national samples. For this reason, various findings were obtained about the determinants of human capital and its relationship with economic growth in these studies and a common consensus could not be reached in the economics literature.

As can be seen in the empirical literature, there are significant differences in the representation of the human capital variable. Many variables such as literacy rate; primary, secondary and higher education enrollment rates; success

rate in primary, secondary and higher education; average life expectancy; average education time; schooling rate; education and health expenditures; number of universities; number of students; number of graduates; class size; reading performance; math and science test scores have been used as indicators of human capital. Failure to determine a common variable to represent human capital also causes differences in results. However, the conclusion to be drawn from this study; It is necessary to represent human capital with educational indicators which is generally accepted also by the literature. The most critical element in the process of increasing the knowledge and skills of labor and giving it a higher qualification is undoubtedly the investment in education. Investments in education appear as the most important factor in the development of human capital. For this reason, education indicators are used to represent human capital in most studies in the economics literature. In studies where education indicators are accepted as representative of human capital, a strong and significant positive relationship was found between high human capital and economic growth.

Education has many contributions on the human capital of individuals and economic performance. Education provides an increase in productivity by improving the skills of the individual in terms of their profession. Education makes the workforce more prone to innovation and invention. In addition, it helps the workforce to adapt more easily to new inventions and inventions, allowing them to use machines more easily that require technical knowledge. Educated individuals can gain employment advantage in various sectors by easily adapting to changing business conditions. By providing training, learning by doing and specialization, it helps the worker to use the factors of production more effectively and positively affects the increase in production. Through education, knowledge and experience learned can be transferred to other generations. Continuity of useful information is ensured. Education enables individuals to gain entrepreneurship and turn to new initiatives. Factors such as productivity increase, new talents, specialization and entrepreneurship achieved through education accelerate economic growth by increasing production. For such reasons, in this study, it is recommended to policy makers to increase the importance given to human capital and to speed up education investments.

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