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MASTER' S THESIS

ZÜLAL ÇOLAK

REPUBLIC OF TURKİYE

ANKARA YILDIRIM BEYAZIT UNIVERSITY

GRADUATE SCHOOL OF SOCIAL SCIENCES

# THE RELATIONSHIP BETWEEN ECONOMIC GROWTH, DEVELOPMENT AND EDUCATION: 1990-2020 ERA

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Ankara, 2024

**APPROVAL PAGE**

This thesis entitled "The Relationship Between Economic Growth, Development and Education: 1990-2020 Era" prepared by Zülal ÇOLAK has been accepted in fulfillment of the requirements for the degree of Master of Economics at Ankara Yıldırım Beyazıt University by unanimous vote.

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Economics.

Director of Institute of Social Sciences Assoc. Prof. Muhammet Enes KALA

## PLAGIARISM

I hereby declare that all the information in this thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work. Otherwise, I accept full legal responsibility.

Date:

Signature:

Zülal ÇOLAK

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## ABSTRACT

Economic development and growth are among the primary objectives of economic policies across all countries, regardless of their level of development. These elements are considered complementary for creating a sustainable economic system. Economic growth provides the necessary financing for development, while economic development ensures the sustainability of growth.

Among the numerous factors influencing economic activities, the human factor is recognized as the most significant. In this context, the relationship between education, which enhances the productivity of the human factor, and economic development and growth is undeniable. Education improves labor skills, fosters entrepreneurship, and increases social welfare.

This thesis aims to analyze the effects of education and its indicators on economic development and growth, and to propose potential solutions. The study utilizes annual data from 1990 to 2020 for Turkey. Six variables were employed, and three models were constructed. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Unit Root tests were applied to determine the stationarity of the variables. The Fourier Engle-Granger Cointegration test was used to analyze the existence of a long-run relationship between the variables. Upon confirming cointegration, the Fully Modified Ordinary Least Squares (FMOLS) method was employed to analyze the long-run relationships.

The data analysis revealed a long-term relationship between education and education indicators and economic development and growth. The findings indicate that economic factors such as capital investments, labor force participation, and school enrollment rates positively affect the Human Development Index (HDI), while the effect of education expenditures on the HDI is insignificant. Consequently, education indicators and investments should be evaluated separately according to the level of education.



**Keywords:** Economic Development, Economic Growth, Education

# ÖZET

Ekonomik kalkınma ve büyüme, gelişmişlik seviyelerine bakılmaksızın tüm ülkelerin iktisadi politikalarının temel hedefleri arasında yer alır. Ekonomik kalkınma ve büyüme, ülkelerin sürdürülebilir bir sistem oluşturmasında birbirini tamamlayan iki unsur olarak değerlendirilmektedir. Ekonomik büyüme, kalkınma için finansman sağlarken; ekonomik kalkınma, büyümeye sürdürülebilirlik kazandırır.

Ekonomik faaliyetlerin gerçekleşmesinde birçok faktörün etkisinin olduğu bilinmekte ve en önemlisi insan faktörü olarak kabul edilmektedir. Bu kapsamda, insan faktörünün verimliliğinin artırılmasında etkili olan eğitimin ekonomik kalkınma ve büyümeyle olan ilişkisi yadsınamaz bir gerçektir. Eğitim, işgücü becerilerini geliştiren, girişimciliği teşvik eden ve sosyal refahı artıran bir araçtır.

Bu tez; eğitim ve eğitim göstergelerinin, ekonomik kalkınma ve büyüme üzerindeki etkilerini incelemeyi ve çözüm önerileri geliştirmeyi amaçlamaktadır. Çalışmada; 1990-2020 yıllarının yıllık verileri kullanılarak, Türkiye örnekleminde analiz yapılmıştır. Verilerin analizi için; 6 değişken kullanılmış ve 3 model oluşturulmuştur. Değişkenlerin durağanlıklarının tespit edilebilmesi amacıyla serilere Augmented Dickey Fuller (ADF) ve Philips-Perron (PP) Birim Kök testleri uygulanmıştır. Değişkenler arasındaki uzun dönem ilişkisinin varlığı Fourier Eangle-Granger Eşbütünleşme testi ile analiz edilmiştir. Serilerin eşbütünleşik olduğuna karar verildikten sonra FMOLS yöntemi ile uzun dönem ilişkisi incelenmiştir.

Veri analizi, eğitim ve eğitim göstergeleri ile ekonomik kalkınma ve büyüme arasında uzun vadeli bir ilişkinin var olduğunu otaya koymuştur. Bulgular, sermaye yatırımları, işgücüne katılım ve okullara kayıt oranları gibi ekonomik faktörlerin İnsani Gelişme Endeksi üzerinde pozitif etkisinin bulunduğu sonucuna ulaşılırken eğitim harcamalarının İnsani Gelişme Endeksi üzerindeki etkisinin anlamsız olduğu sonucuna ulaşılmıştır. Bu sebepten dolayı eğitim göstergelerinin ve yatırımların eğitim seviyesine göre ayrı ayrı değerlendirilmesi gerekliliği ortaya çıkmaktadır.



Anahtar Kelimeler: Ekonomik Kalkınma, Ekonomik Büyüme, Eğitim

**CONTENTS**

## ABREVIATIONS

ADF: Augmented Dickey Fuller

GDP: Gross Domestic Product

GNP: Gross National Product

HDI: Human Development Index

FEG: Fourier Cointegration Test

FMOLS: Fully Modified Least Squares Method

OECD: Organization for Economic Co-operation and Development

SPO: State Planning Organization

PP: Phillips and Perron

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# CHAPTER I

## INTRODUCTION

All countries, regardless of their level of development, strive to use their resources efficiently to ensure high living standards, achieve prosperity, and maintain peaceful societies. To enhance resource efficiency and improve living standards, nations develop and implement various policies aimed at fostering continuous change and transformation. These policies concerning the efficient use of resources are examined within the context of economic development, which, in turn, determines the overall development of countries.

By definition, development is a phenomenon that encompasses the concept of economic growth. Economic growth is an important indicator in economics. The primary factor that indicates a country's development level is the amount of economic growth. Economic growth is generally defined as the continuous increase in real output per capita. In other words, it is the increase in a country's production capacity over time. Economic development, on the other hand, concerns itself not only with increasing production capacity but also with improving the efficiency of production. Thus, the concepts of economic development and growth are complementary.

Economic development, along with growth, involves many factors, with education being one of the most significant. Given that we live in the information age, education forms the foundation of all sciences. When considered in its economic, social, political, and cultural dimensions, education can be defined as the development of one's abilities.

Education is analyzed as part of human capital within the framework of economic research. It is an essential tool for the socialization of individuals, laying the foundation for a society's social, economic, cultural, and political development. Education is also an investment tool for developing human capital. It is a process that focuses on the development of individuals' behaviors, incorporating knowledge and experience that will continue throughout their lives. This process encompasses education's basic functions from individual, social, political, and economic perspectives.

From an individual perspective, education contributes to a person's physical and mental development. Socially, it aims to harmonize and integrate values and behaviors that

concern society as a whole, ensuring the continuity of social peace and contributing to its protection while adapting to societal changes. The political function of education is to raise individuals' awareness of citizenship. This way, they can acquire accurate information about the state system and pass it on correctly to future generations. Finally, education's economic function is to train manpower capable of meeting the country's economic needs. By developing qualified and conscious manpower, education ensures that the country's resources are effectively utilized. Additionally, it aims to position individuals to contribute to the nation's production and create consumer awareness necessary for the country's economy.

The aim of this thesis is to explain how the concept of education, which is gaining more importance day by day, impacts economic growth and development, and to reveal how much change can be realized in growth and development by including variables affecting education in economic areas.

In the related literature, it is evident that the history of the concepts of development and growth dates back a long time. After the industrial revolution, income inequalities between countries spurred them to focus on economic growth. Wars in the following years increased the importance of growth and led to the widespread use of the concept of development. In world history, prolonged wars, epidemics, natural disasters, famines, political instability, and economic imbalances have directly affected the development processes and growth rates of countries. Many growth models have been developed throughout history to mathematically express and interpret these processes.

Adam Smith was the first economist to analyze the concept of economic growth and develop a growth model. Classical economists, including Smith (1776), T. Malthus (1798), D. Ricardo (1817), K. Marx (1867), F. Ramsey (1928), A. Young (1928), F. Knight (1944), and J. Schumpeter (1934), have formed the theoretical foundations of growth models. The growth models developed by Smith, Malthus, and Ricardo are known as classical growth models. The models developed after these are categorized as Neo-classical growth models, including contributions from Harrod-Domar (1946) and Solow-Swan (1956).

The Neo-classical growth model remained influential until the 1980s. However, developments in other sciences over time revealed its limitations, leading to new models. These new models explored micro factors affecting growth, alongside macro factors, and are known as Endogenous Growth Models, first proposed by Paul M. Romer. They were further developed by Robert E. Lucas in 1988 and Barro in 1990. Today, these models are known as modern growth models and are still being developed.

Modern growth models are complementary theories that aim to understand the multifaceted nature of economic growth. They encompass various elements such as technological innovation, geographical concentration, social justice, environmental sustainability, and institutional structures, and focus on the sustainability and balance of economic growth.

In this study, annual data for the years 1990-2020 were used to analyze the sample of Turkey. Six variables were used for the data analysis, and three models were created. To determine the stationarity of the variables, ADF and PP Unit Root tests were applied to the series. The existence of a long-run relationship between the variables was analyzed with the Fourier Engle-Granger Cointegration test. After confirming that the series are cointegrated, the long-run relationship was analyzed using the FMOLS method.

The first part of the study consists of an introduction. In the second part, the definition of economic growth, how growth models are formed, and the historical development of the concept of economic development are explained. The development and progress of growth models are crucial for the mathematical expression of countries' economic development.

In the third part, the definition and conceptual importance of education and its role in economic growth and development are discussed. The relationship between economic growth and education is explained, showing how growth theories include factors of production, where manpower is prioritized, as part of human capital. Thus, the relationship between human capital and growth is explored, and growth models that incorporate education are discussed conceptually and theoretically in detail.

In the fourth chapter, the empirical literature is reviewed, including numerous empirical studies that examine the relationship between education and growth and development, especially economic growth. These studies are categorized according to their subject content and analysis methods, and the similarities and differences with this master's thesis are explained in detail. Most literature studies focus on the relationship between education, a key component of human capital, and growth and development.

In the fifth section, the variables and models used in the study are explained, followed by the econometric methods applied. The results obtained from the analyses and estimations are then evaluated in detail.

Finally, the conclusion emphasizes the importance of the thesis topic. The estimation results for Turkey are evaluated and compared with previous studies, and policy recommendations are presented based on the analysis results

# CHAPTER II

# ECONOMIC GROWTH AND DEVELOPMENT:THEORETICAL CONCEPTS

## 2.1. Economic Growth

The concept of economic growth has a history as old as that of economics itself. Since the beginning of economic history, economic growth has served as a crucial indicator in the field of economic science. The primary factor providing insight into a country's level of development is the extent of its economic growth. For a country's economy to be deemed successful, it must achieve rapid economic growth (Gordon, 2000).

Economic growth has been a significant research topic since the 1960s. However, the theories proposed over time have not fully explained the global developments and innovations. The lack of development in new methods resulted in a decline in interest in economic growth. Nevertheless, in recent years, the concept of economic growth has regained importance. It is in the last twenty-five years that economic growth has once again come to the forefront and has been researched in every aspect (Pamuk P. D., 2007).

Economic growth is commonly defined as a sustained increase in real output per capita. In essence, economic growth refers to the expansion of a country's production capacity over time. The growth in production capacity is typically measured by either GNP (Gross National Product) or GDP (Gross Domestic Product) (Apak & Uçak, 2007). GNP is defined as the sum of the market value of final goods and services produced by the citizens of a country in a year, while GDP is defined as the sum of goods and services produced only within the borders of the country. GNP and GDP are divided by the total population to calculate GNP per capita and GDP per capita. As the definition suggests, economic growth refers to real increases in GNP and GDP. Real increases indicate that economic growth is a phenomenon that can be quantitatively measured (Dinler, 2008).

It is not possible for real output per capita, the main indicator of economic growth, to increase in the short term. To achieve any increase in real output, the production capacities and potentials of countries need to be expanded or utilized more effectively. The expansion of countries' production capacities can be realized through planned and regular investments, which, in turn, can only be implemented in the long run. Economic growth,

generally regarded as a long-term issue, is determined within the supply capacity of macroeconomics (Kibritçioğlu, 1998). Factors directly influencing the supply curve in the long run constitute the subject of economic growth.

Regardless of the level of development, economic growth is among the macroeconomic objectives of all countries. However, economic growth rates differ depending on the level of development of countries. The quantity, diversity, and utilization areas of resources that countries possess contribute to variations in growth rates. The factors of production that cause a country's production possibilities curve to shift upwards or the long-run aggregate supply curve to shift to the right are also the determinants of economic growth. Factors of production influencing growth in the long run are defined as labor, natural resources, capital, and technology used for production. Therefore, investment in factors of production is necessary to ensure stable and sustainable economic growth.

In the 18th century, the industrial revolution, which originated in England and then spread throughout Europe, led to a growing disparity in the growth rates of countries. Particularly in the nations where the industrial revolution unfolded, the adoption of steam-powered machinery across various sectors increased the production capacities of countries. This surge in production capacities had a direct impact on the income levels of individuals, ultimately enhancing their living standards. Consequently, for the first time in world history, the welfare of people improved alongside population growth. In other words, since population and welfare levels increased in tandem, population did not serve as a limiting factor for economic growth. In this regard, the industrial revolution is considered an exemplary instance of economic growth (Güran, 2019).

The concept of economic growth, particularly significant after the industrial revolution, has been explored through various explanatory methods. Economic growth models have been formulated to represent variables and resources in mathematical terms. These models aim to analyze, define, and assess the interconnections among economic variables. In essence, economic growth models have been developed to unveil the primary determinants of growth and to ascertain how any alterations in these variables will impact the output level.

Between 1500 and 1800, mercantilism dominated economic thought in Europe for approximately three hundred years. The physiocratic system of thought emerged as a reaction to mercantilism during the industrial revolution. In the late 18th and early 19th centuries, classical economic thought took precedence worldwide, giving rise to growth models known as classical growth models (Seyidoğlu, 2011).

These classical growth models, the first systematic growth (Hiç, 1994) models in history, were initially conceptualized by Adam Smith. Smith, the pioneering economist to analyze the concept of economic growth, observed economic developments during the industrial revolution and documented his observations in a book (Berber, 2019). The foundations laid by Adam Smith were further developed by economists such as T. Malthus, D. Ricardo, K. Marx, and J. Schumpeter.

In 1936, John Maynard Keynes challenged the idea that the market mechanism could automatically achieve full employment. The response to this was the development of the Harrod-Domar Model, which forms the basis of modern growth models. While the Harrod-Domar model doesn't accurately reflect reality, it holds significant importance in the creation and development of growth theories.

The most notable outcome of the Harrod-Domar Model is the Neoclassical Growth Model, which was formulated by Robert Solow and Tresory Swan in 1956. This model has played a crucial role in the development of growth theories and led to the creation of two deficit analysis models in the 1960s. Although the Harrod-Domar model may not directly influence contemporary discussions on growth, it serves as the foundation for many growth models in existence today.

Among the growth models developed after the Second World War, the most prominent models in the literature are the Solow Models devised by Robert Solow in 1956 and the Endogenous Growth Models created under the leadership of Paul M. Romer as an alternative to these models. The groundwork for the Endogenous Growth Models was established by Paul Romer in the 1980s. These models, which have gained prominence as new growth models, seek to explain the concept of growth through technological advancements, human capital, and research and development methods.

In summary, economic growth can be defined as the process of increasing the production capacity of countries within their own economies by generating goods and services over an extended period and passing on these accumulations to future generations. Therefore, while economic growth is often defined as the cumulative increase in goods and services produced today, it encompasses the sustained effort to enhance the production of goods and services over centuries, considering the well-being of future generations (Waud, 1986).

### 2.1.1. Historical Development of Growth Models

Mercantilism was the prevailing economic ideology, particularly in Europe, from the mid-1500s to the late 1800s. Mercantilism is often referred to as commercial capitalism in the field of economics (Kazgan, 2021). Mercantilists measured economic growth in terms of precious metals such as gold and silver. According to mercantilist ideology, both individuals and the state should accumulate and possess significant amounts of precious metals. Mercantilist policies aimed to prioritize national interests in international affairs, enforce regulations in industry and trade through the state, and ensure a positive balance of payments. In essence, mercantilist states were encouraged to develop and implement policies that would decrease imports and increase exports (Özsağır, 2008).

During the industrial revolution, the physiocratic thought system emerged as a response to the changing global policies and in opposition to mercantilism. Physiocrats argued that economic growth would be achieved primarily through agriculture, not industry, and asserted that state intervention in the economy would be counterproductive. According to physiocratic beliefs, the foundation of capital accumulation, which drives growth, lies in agriculture (Özgüven, 1988). This is because industrial processes involve the development and transformation of existing raw materials, whereas farmers cultivate the land and contribute directly to production. Thus, the cultivation of land through agriculture is considered an activity that brings about a net increase and contributes to wealth accumulation.

#### 2.1.1.1. Classical Models of Economic Growth

A. Smith (1776), T. Malthus (1798), D. Ricardo (1817), K. Marx (1867), F. Ramsey (1928), A. Young (1928), F. Knight (1944), and J. Schumpeter (1934), collectively known as classical economists, laid the theoretical foundations of growth models. When analyzed chronologically, the growth models developed by Smith, Malthus, and Ricardo are referred to as classical growth models.

Adam Smith, the first economist to analyze the concept of economic growth, was prompted by the industrial revolution that unfolded in England, his home country, during the 1700s. Smith introduced the inaugural growth model in his work 'An Inquiry into the Nature and Causes of the Wealth of Nations,' published in 1776. His growth model was constructed on the principle of the division of labor. According to Smith, the division of labor enhances labor productivity and fosters technological advancements, subsequently leading to increased capital accumulation.

In essence, according to Smith, economic growth is influenced by two primary factors (Savaş, 2007). Firstly, the division of labor augments productivity, and secondly, there is an increase in capital accumulation through time savings. The heightened productivity of labor results in an increased output per worker, subsequently contributing to the growth of the capital stock and expanding the market. Although Smith's growth model appears to depict an unlimited phenomenon, he argued that there would be an upper limit to growth, eventually reaching a steady state (Ünsal, 2015).

In conclusion, Smith formulated the foundational growth model, basing it on the division of labor, and posited that increased productivity through the division of labor would lead to higher output per capita. Consequently, heightened investments driven by increased output would facilitate long-term economic growth.

Thomas Robert Malthus, another economist among the classical economists who developed an economic growth model, introduced a new model in 1798 with his book 'An Essay on the Principle of Population.' In his growth model, Malthus argued that population and output do not progress in the same proportion. According to Malthus, without intervention, population increases exponentially while output increases arithmetically

(Ünsal, 2015). Consequently, output per capita decreases. However, output per capita never reaches zero; it remains in equilibrium at the level where the population growth rate is zero. In other words, the economy reaches a stationary state.

The third growth model, known as the classical growth model, was formulated by David Ricardo. Ricardo is widely regarded as the most ardent advocate of classical economics following Adam Smith (Berber, 2019). In 1813, Ricardo published 'Principles of Political Economy and Taxation,' addressing the social and political challenges facing Britain at that time. Ricardo's work predominantly revolved around the Laws of Wheat.

In this work, Ricardo constructed a growth model based on diminishing returns and functional income distribution. He posited that labor has two wages: the natural wage and the market wage. The natural wage is defined as the minimum level of subsistence for workers, while the market wage is determined by supply and demand. Ricardo argued that the market wage rate would fluctuate above the natural wage rate, attributing this fluctuation to Malthus' law of population.

Ricardo contended that income distribution would occur among wage-workers, rent-landowners, and profit-capitalists. According to Ricardo, rent, wage payments, and profits are inversely proportional. As production increases, rents and wages paid to workers would rise, but profits would decline. Consequently, profits would eventually reach zero, and the economy would settle into a steady state. In the long run, Ricardo's growth model suggested that capitalists' circumstances would steadily deteriorate, while those of landowners would progressively improve. Ricardo's analysis rested on two fundamental premises: the law of diminishing returns and Malthus' law of population.

Other economists who laid the theoretical foundations of growth theories and were part of the classical economists include Karl Marx and Joseph Schumpeter. Karl Marx developed the Feldman Growth Model based on the expanded production scheme. In this model, he examined the effects of the allocation of investment between the capital and consumer goods sectors on economic growth.

Joseph Schumpeter, on the other hand, posited that economic growth would be achieved through technological innovation. In contrast to the neoclassical approach,

Schumpeter broadened the concept of technological innovation. He defined technological innovation not only as the adoption of a new technique in the production process but also as a concept encompassing four fundamental perspectives. These perspectives include the production of a new good, the opening of new markets, the establishment of new market organizations, and the discovery of new sources of raw materials. Thus, Schumpeter introduced a comprehensive idea of technological innovation (Ünsal, 2015).

In 1936, John Maynard Keynes published a book titled 'The General Theory of Money, Interest, and Employment.' In this work, Keynes argued that it was impossible for the market mechanism to automatically achieve full employment. This Keynesian perspective marked what became known as the 'Keynesian Revolution' in general economic theory at that time.

In his study, Keynes primarily focused on the impact of investment on aggregate demand, neglecting its effect on capital accumulation. In other words, he conducted a short-term static analysis (Friedman). The theories put forth by Keynes served as the foundational concepts for the development of the Harrod Domar Model.

#### 2.1.1.2. The Model of Harrod Domar

The Harrod-Domar Model was independently developed by the British economist Roy F. Harrod and the American economist Evsey D. Domar. The model focused on the conditions for balanced growth in an economy operating at full employment.

In 1937, Harrod critiqued Keynes' theory in an article titled 'Mr. Keynes and Conventional Theory.' Following this, in 1939, Harrod published his work 'An Essay on Dynamic Theory,' where he explored whether it was feasible for the market mechanism to attain full employment in a growing economy. He took into account the effect of investment on capital accumulation within dynamic theory and examined the validity of Keynes' thesis in the context of a dynamically growing economy.

After the Second World War, Evsey D. Domar conducted an analysis strikingly similar to the Harrod model, which ultimately led to the model being commonly referred to as the Harrod-Domar Model.

The Harrod-Domar Model is regarded as the first wave of modern growth theory (Wane, 2005). The model is based on the assumption that the capital-output ratio remains constant. It incorporates three fundamental assumptions related to the production function, saving behavior, and labor supply:

1. **Production Function:**

- A single good is produced in the economy using capital (K) and labor (L) inputs. The produced good serves both investment (I) and consumption (C).
- Capital and labor inputs are treated as complementary goods, implying that output is generated using a fixed proportion of capital and labor inputs.

2. **Saving Behavior:**

- The Harrod-Domar Model assumes a constant rate of planned saving (S), with the marginal and average rates of saving considered equal. The saving rate is denoted by $S = s.Y$.

3. **Labor Supply:**

- The model assumes that labor supply grows at a constant rate (n), which is exogenously determined. The growth rate of labor supply is expressed as $\Delta L/L = n$.

In the Harrod-Domar Model, three growth rates are defined in accordance with these assumptions.

In a simple economy with no government and no foreign trade, achieving equilibrium in the goods market requires that investment equals savings. In such a scenario, to fully utilize capital, both capital and output must grow at the same rate. The growth rate of output, ensuring the equality between saving and investment with full capital utilization, is termed the 'required growth rate.' This required growth rate is calculated as the ratio of the savings rate (s) to the capital-output ratio (v), denoted by the expression:

$Gw = S/V$

Here, Gw represents the required growth rate, $S$ is the savings rate, and $V$ is the capital-output ratio.

Actual output in an economy is represented by the growth rate. To achieve both full utilization of capital and equilibrium in the goods market, the actual growth rate must equal the required growth rate:

GA=Gw=S/V

Since the savings rate ($s$) and the capital-output ratio ($v$) are assumed to be constant in the model, the required growth rate ($s/v$) remains constant. Therefore, when the actual growth rate equals the required growth rate, output and capital grow at a constant rate (as $s/v$). Given that the scenario in which variables in a model grow at a constant rate is termed 'steady-state growth,' the model exhibits steady-state growth.

Moreover, when variables in the model grow at the same constant rate, it is characterized as 'balanced growth.' Consequently, in the Harrod-Domar growth model, the economy attains balanced growth when the actual growth is equal to the required growth.

As labor is assumed to grow at a constant rate $n$ in the model, actual output should grow at the rate of $n$ for full utilization of labor. In the model, the growth rate ensuring full use of labor, i.e., full employment in the labor market, is termed the 'natural growth rate' ($GN$).

$$GN = n$$

In the Harrod-Domar model, to achieve full utilization of labor, i.e., full employment, output must grow at the natural growth rate, and actual growth must be equal to the natural growth rate:

$$GA = GN = n \Rightarrow VS = n$$

Furthermore, in the model, the equality of actual growth, required growth, and natural growth rates ($GA=GW=GN$) is referred to as the 'Golden Age.'

However, in cases of imbalance in the model, a situation known as the 'knife-edge situation' may arise. Accordingly, when the actual growth rate exceeds the required growth

rate (*GA>GW*), an inflationary process is observed in the economy. Conversely, when the actual growth rate is less than the required growth rate (*GA<GW*), deflation and stagnation are observed in the economy.

The Harrod-Domar Model was the first to analyze economic growth following the General Theory and served as the foundation for the Solow-Swan Growth Model (Neoclassical Growth Model) developed by Robert Solow and Trevor Swan in 1956.

#### 2.1.1.3. Neoclasical Growth Model – Solow Swan Model

After the Harrod-Domar model, which is characterized as the first wave of growth, Robert Solow conducted a new study in 1956. In the following years, economists such as Denison (1961), Cass (1965), and Koopmans (1965) contributed to this study. In line with all these studies, Neoclassical growth theory emerged as the second wave of modern economic growth theories (Ehrlich, 1990).

Within the framework of neoclassical economic thought, many models have been developed to explain the concept of economic growth. The most important of these models is the basic Solow model, a growth model developed by Robert Solow in 1956. The Solow growth model has a neoclassical aggregate production function at its center, and it is this production function that distinguishes the model from the Harrod-Domar model (Acemoğlu, 2008). The reason why the model is called the Basic Solow Model is that it is built on the assumption that technology is constant. The basic elements of the model are the supply of goods, demand for goods, and capital accumulation.

There are three basic assumptions that define the structure of the model:

1. **Constant Returns to Scale:** If all inputs increase at a certain rate, output increases at the same level.

2. **Perfect Competition:** Producers and consumers are price-accepting.

3. **Without Externalities:** One producer does not provide an unpriced benefit or impose a cost on another producer.

In the model, there are two different decision units: Families-Consumers and Firms-Producers. Consumers are the owners of labor (L) and capital (K) inputs. They rent capital and labor inputs to firms at a given wage rate (w) and capital rental cost (r). Families also own the firms. The income of families (Y) is the sum of labor and capital income.

The equation representing the income of families (Y) is given by

$$Y = w.L + r.K.$$

Families save a fraction (s) of their income, and these savings are used for investment (I). Therefore, the relationship between investment and depreciation is expressed as

$$\Delta Kt+1 = It - Dt = It - \delta.Kt = s.Yt - \delta.Kt,$$

where $\delta$ represents the depreciation rate.

Producers rent capital and labor inputs from families and utilize their technological knowledge to transform these inputs into output. In the model, three types of factors of production are considered: Capital, Labor, and Technology. Producers sell the output to consumers. The model assumes a single good, with no distinction between production goods and investment goods.

The exogenous variables of the model include the investment rate (s), population growth rate (n), depreciation rate ($\delta$), and initial capital (k0). Another variable, the rate of technological progress, is assumed to be constant ($gA=0$). With the assumption of constant technology, the model analyzes the impact of capital accumulation on economic growth.

According to the Basic Solow Model, the economy tends towards a steady state in the long run. The steady state is defined as a period where per capita income remains constant. The determinants of per capita income in the steady state are the population growth rate and the savings rate. When all other variables are assumed to be constant, the higher the population growth rate and savings rate, the higher the per capita income will be in the steady state. The differences in per capita incomes among countries are attributed to variations in the savings rate and population growth rate. Since the economy is assumed to be in a steady state in the long run, the model concludes that capital accumulation does not lead to economic growth.

The Basic Solow growth model is formulated using the Cobb-Douglas production function:

$$k^* = [\, s.A/(\delta+n)]^{1/1-\alpha}$$

$$y^* = Ak^{*\alpha} = A^{1/1-\alpha}\,[s/(\delta+n)]^{\alpha/1-\alpha}$$

The Solow model has been expanded over time. Additional assumptions have been introduced in the General Solow model to explore the impact of technology on growth. The model does not provide information about how technology emerges. One of the most crucial assumptions in the model is that technological progress is considered exogenous. The model also assumes that technological progress enhances labor efficiency and that technology develops at a constant rate.

Production activities are still subject to the law of diminishing returns in the General Solow Model. With these assumptions, when the General Solow Model is formalized again, the increase in per capita income is directly proportional to technological progress. In other words, economic growth is driven by technological advancement.

#### 2.1.1.4. Endogenous Growth Models

The neoclassical growth model maintained its effectiveness until the 1980s. However, with advancements in various disciplines, it became evident that the neoclassical growth model lacks a realistic depiction of long-term dynamics. Neoclassical growth models imply that countries' growth rates reach a steady state over time. Although the extended neoclassical model established a correlation between technological development and capital and labor forces, it explained economic growth while falling short in providing essential insights into the factors influencing and methods for analyzing economic growth. Recognizing these shortcomings, new growth models were developed. In these innovative models, researchers investigated micro factors alongside macro factors affecting growth. Termed Endogenous Growth Models, these models were initially introduced with Paul M. Romer's 1986 article titled "Increasing Returns and Long-Term Growth." Subsequently, further contributions from Robert E. Lucas in 1988 and Barro in 1990 enhanced and expanded the framework.

The roots of Endogenous Growth Models are often traced back to the ideas of Adam Smith and Joseph A. Schumpeter (Gürak, 2006). Smith conceptualized economic growth in relation to increasing productivity, while Marx asserted that technology and innovation would drive economic growth. Schumpeter, on the other hand, emphasized the connection between economic growth and innovation, suggesting that creative destruction would occur in the absence of substantial invention and entrepreneurship. These various perspectives collectively contributed to laying the foundations of endogenous growth models.

Initially conceived as an alternative to neoclassical models, endogenous growth models have evolved in various aspects over time. These models elucidate growth through endogenous factors within the economy (Romer, 1994). Unlike previous models where technology was considered exogenous, endogenous growth models treat technology as an endogenous factor. The term "endogenous" is employed because factors previously treated as exogenous are now viewed as endogenous within the model. Endogenous growth models propose that economic growth can be achieved through the endogenous factors of a country's economy, facilitated by the implementation of growth policies (Ehrlich, 1990). While neoclassical growth models are characterized by a production function based on diminishing returns, endogenous growth models embrace a production function based on increasing returns. In contrast to perfect competition markets in neoclassical models, endogenous growth models adopt imperfect competition markets. Additional factors that set endogenous growth models apart from neoclassical models include explaining the emergence of technological developments and knowledge, illustrating the impacts of government policies on growth, and emphasizing the significance of human capital alongside physical capital for growth. Human capital plays a crucial role in the development and growth of national economies. In summary, endogenous growth models, introduced to address deficiencies in the neoclassical model, assert that factors influencing growth originate within the economy. Variables such as education, research and development (R&D), public policies, taxes, inflation, health, and technology are considered to impact economic growth in endogenous growth models.

Numerous perspectives have emerged to define the factors influencing economic growth, which endogenous growth models seek to elucidate. Various ideas and models have been developed in this context, including the EC Model, the human capital model, the

knowledge production and spillovers model, the R&D model, and the public expenditure model.

The EC Model involves an augmentation of the production function in the neoclassical growth model. It operates on the assumption that the return on capital does not decrease as capital accumulation increases (Rebelo, 1991). The model's representation is as follows:

$Y=AK$

In the knowledge production and spillovers model developed by Romer in 1986, the human capital model by Lucas in 1988, and the public expenditure model by Barro in the same year, an AK-type production function is utilized. Lucas argued in 1988 that human capital plays a crucial role in economic growth, contending that an increase in an individual's human capital not only enhances their own productivity but also contributes to the productivity of other factors of production. He developed the human capital model by incorporating the human capital variable into the Solow model and concluded that the primary determinant of economic growth is not exogenous technological development but the rate of human capital accumulation (Lucas, 1988).

The first endogenous growth model, known as the Knowledge Production and Spillovers model, was introduced by Paul M. Romer in 1986. In developing this model, Romer was influenced by Arrow's idea of "learning by doing" proposed in 1962 (Arrow, 1962). Arrow observed that in certain sectors, costs gradually decreased, product quality improved over time, production became faster, and new products emerged with increasing knowledge, a phenomenon he termed "learning by doing." Building upon Arrow's idea, Romer formulated a new endogenous growth model (Romer, 1994).

According to Romer's model of knowledge creation and spillovers, the knowledge generated through learning by doing during investment and production serves as a by-product. This by-product is then used as a free input in new production. Consequently, the new production is achieved at a lower cost and with higher quality. Furthermore, the spillover of knowledge to other firms in the economy results in positive externalities in the production possibilities curves of those firms. These positive externalities lead to increasing returns to scale and overall economic growth.

The public expenditure model is an endogenous growth model introduced by Barro in 1990. In this model, Barro analyzes how public expenditures, financed by taxes, impact a country's economic growth and benefits. Barro assumes that goods and services provided by the public sector are considered as factors of production. With these assumptions, Barro demonstrates that governments should engage in both direct investments to achieve economic growth and stimulate investments by supporting the private sector through instruments such as tax incentives and subsidies.

According to the model, in a closed economy, infrastructure investments like education and health increase the productivity of private capital, resulting in an exogenous benefit for the firm. In this context, the output per capita is determined by private sector investments per capita and public expenditures per capita (Barro, 1990; Alper, 2019).

R&D-led endogenous growth models are built on the premise that technological development is an endogenous process. The R&D (Research and Development) model was initially introduced by Paul M. Romer in 1990 (Parasız, 1997). Subsequently, various economists, including Grossman-Helpman (1991) and Aghion-Howitt (1992), have contributed to the analysis of the R&D approach. In this model, technological development is conceptualized as not being produced within the regular production sector but rather by a dedicated R&D sector, with R&D activities serving as the primary source of growth (Özer & Çiftçi, 2009).

An essential aspect of these models is the incorporation of imperfect competition into growth models. The conceptual framework for R&D activities is grounded in Schumpeter's perspective, which regards technological research, development, and innovation as the driving forces behind economic change. A key distinction between R&D models and Romer's model lies in how knowledge is acquired. While Romer's model suggests that knowledge emerges spontaneously as a by-product, R&D models emphasize the deliberate acquisition of knowledge through planned research and development activities.

### 2.2. Economic Development

All countries, irrespective of their developmental stage, aspire to utilize their resources efficiently to ensure that their societies enjoy high living standards, attain necessary

prosperity, and lead peaceful lives. Policies concerning the effective utilization of resources are scrutinized within the economic development literature. Furthermore, the economic development level plays a pivotal role in determining a country's overall development status.

Schumpeter defined economic development as the emergence of new production methods, new products, new supply capacities, and the opening of new markets (Kaynak, 2014). This definition by Schumpeter introduced a distinct perspective on economic development, maintaining its influence for an extended period during his lifetime. Moreover, it significantly contributed to the evolution of the concept of economic development and the promotion of entrepreneurship after the Second World War.

Economic development became a widely used concept by all countries after the Second World War (Başkaya, 2005). The aftermath of the war, marked by the collapse of the international economic system and widespread devastation, prompted nations to seek a new order. Post-war, numerous nation-states were established, gaining independence, particularly in the standards of underdeveloped countries. The primary objective of these states was to enhance their economies. Simultaneously, Western countries endeavored to address their economic instability. This collective effort can be seen as the impetus for the heightened significance of the economic development concept after the Second World War. Some economists even dubbed the post-war period as "the era of development" (Kar & Taban, 2004). Initially defined as modernization in the post-war era, economic development significantly contributed to industrialization, particularly in developed countries. However, by the 1970s, the concept lost prominence due to the limitations of its definition, which primarily focused on economic growth (Erbay & Özden, 2013). The widening gap between the welfare levels of people living in developed and underdeveloped countries, and the fact that people around the world are still living at the same level of poverty standards, are among the reasons why economic development has lost its importance. This is because the traditional approach has linked economic development only to income growth. It also ignored people and their well-being. For these reasons, the traditional approach has been criticized (Erol & Sevinç, 2021).

The concept of economic development, a longstanding subject in the history of economics and currently one of the most extensively studied topics, experienced significant

momentum between the 1950s and the 1970s. Before the Second World War, the primary determinants of development were national economic assets and capital. However, post-war considerations expanded to encompass social activities and human development conditions. Since the 1990s, international developments such as hunger, poverty, ethnic divisions, and natural disasters have steered economic development away from a growth-centered approach to a more human-centered one (Karaoğlan, 2021). Human and social capitals have emerged as key determinants of economic development, highlighting a clear and intricate relationship between people and the process of economic development. Human beings play a central role in generating economic development, producing knowledge, and fostering innovation (Doğan, 2011). The integration of this relationship into the literature has introduced new phenomena, leading to ongoing additions to the determinants of development.

Economic development lacks a singular, definitive definition in economic literature. In basic terms, it can be understood as how individuals alter their economic well-being and the criteria guiding those changes. Nevertheless, the dynamic nature of global standards underscores the necessity for a more comprehensive definition of economic development. Consequently, the definition of economic development should encompass not solely economic conditions but also factors like human suffering, poverty, deprivation, exclusion, hunger, diseases, education, rights and freedoms, cultural competencies, and inadequacies—in essence, all elements related to human life (Gönel, 2010).

Economic development can be defined as the process of structural change encompassing economic, social, cultural, and political dimensions, along with increases in production and income within a country. The concept of development implies not only quantitative growth but also qualitative changes in various aspects of the nation (Berber, 2019).

According to Gasper, economic development involves organizing a nation's economy comprehensively to achieve the desired level of development. In essence, any transformation and advancement in economic, political, social, and cultural values within a society are considered as development. Gasper's historical perspective defines development as the alleviation of past suffering in underdeveloped countries and the enhancement of their material welfare (Gasper, 1995).

Although there are various definitions of the development process today, it is characterized as a process aiming to expand individuals' capabilities, create opportunities for empowerment in social, economic, and political fields, and, ultimately, improve human life as a whole (Ökten & Tüysüz, 2017).

Economic development, as understood from these definitions, is the change, transformation, and development taking place in the entire economy of a country. Development is a phenomenon that also encompasses the concept of economic growth. Economic growth is referred to in the literature as the term used to express per capita income in all theoretical research. However, the progress of economic growth alone does not ensure development; it involves various factors, with education being one of the most critical. Given that we live in the information age, education serves as the foundation for all sciences. When considered in its economic, social, political, and cultural dimensions, education can be defined as the development of one's abilities. Education is analyzed within the context of human capital in economic research.

In today's rapidly developing, changing, and globalizing world, human capital has emerged as the most crucial factor of production. Societies experiencing increased modernization and rising welfare levels, primarily attributed to the ever-growing and accumulating technological advancements, owe their living standards to investments made to enhance human capital.

Given these circumstances, a substantial link between economic development and education is evident. In contemporary literature, education expenditures are often regarded as "investments." As the connection between human capital and development becomes more apparent, the significance of education and investments in education is escalating worldwide. This upward trend is diminishing the importance of other factors in production compared to skilled labor. Consequently, the idea of enhancing the level and quality of education for national development has become a shared perspective among countries (Taş, Türkiye'de Kalkınma Planları Işığında Eğitimin Kalkınmadaki Rolü, 2007).

# CHAPTER III

# RELATIONSHIP BETWEEN EDUCATION, ECONOMIC GROWTH AND ECONOMIC DEVELOPMENT

## 3.1. Human Capital

The concept of human capital has assumed an active role among the factors influencing economic growth within the framework of the Endogenous Growth Theories established by Paul M. Romer in the 1980s, and it has become a central focus in the research of many economists. Human capital, integrated into the Endogenous Growth Theories, has been analyzed by influential figures such as P. Romer, R. Lucas, K. Arrow, T.W. Schultz, G.S. Becker, and S. Rebelo.

In contrast to neoclassical economic theories and growth models that predominantly emphasized physical capital while neglecting human capital in explaining the sources of economic growth, Endogenous Growth Models emerged as an alternative approach. These models aimed to underscore the significance of human capital, which had been overlooked in the Solow model, as a critical factor in production, comparable to physical capital. Consequently, human capital has become an integral component in the discourse on economic growth. These novel growth theories, often referred to as new growth theories, have delved into exploring economic growth with a focus on factors like human capital, technological development, and research and development (Eser & Gökmen, 2009).

Human capital is defined as the aggregate of positive attributes such as experience, knowledge, and skills that facilitate a more efficient utilization of factors of production. In economic terms, the concept of human capital, encompassing the skills possessed by individuals engaged in production, is steadily gaining significance. Factors such as experience, work proficiency, analytical thinking, education, and health play crucial roles in individual development. These elements, which positively impact individual development, enhance the effectiveness of variables influencing the production process, expedite technological advancements, and ensure their efficient utilization. In essence, human capital factors contribute to the social and economic well-being of individuals (Kwon & Dae-Bong, 2009). When viewed within the framework of economic growth,

human capital components contribute to the gradual development of individuals, leading to an increase in their earnings. With rising earnings, investments and savings escalate, thereby fostering economic growth.

The concept of human capital dates back to 1776. Smith, Mill and Marshall (1890) were the first economists to introduce the concept of human capital into the economic literature. In the 1960s, the definition of human capital in the economic literature was developed by Denison (1962), Becker (1964) and Schultz (1968). Generally speaking, Denison and Becker provided the theoretical definition of human capital, but Schultz not only defined human capital but also stated that human capital is an important factor for the economic growth of a country. According to Schultz, the capacities of individuals are a very important factor and have an impact on economic variables. Schultz (1961) conceptualized human capital as 'something akin to property' as opposed to the concept of labor in the classical perspective and conceptualized that 'the productive capacity of human beings is far greater than all other forms of wealth now put together'. Many researchers have accepted his view of human capacity as the knowledge and skills embedded in the individual (Akt & Beach, 2009).

In the realm of Romer's Endogenous Growth Theories, the Solow model has been expanded to incorporate human capital. Numerous economists have revised the Solow model by introducing human capital, with the Lucas model and the Mankiw Romer Weil model standing out as pioneering contributions.

Lucas contends that sustainable economic development hinges on human capital, with education being the foremost component. Moreover, public expenditures on education have a direct impact on the accumulation of human capital. This direct influence on human capital, in turn, significantly affects the long-term growth rate. Essentially, the accumulation of human capital through investments in education and training plays a crucial role in shaping individual wages, firm productivity, and the overall growth of the national economy.

Education plays a crucial role in enhancing the qualifications of human capital. By increasing the number of individuals with skilled manpower in the country, education has a direct impact on human capital. In a rapidly changing, developing, and globalizing world,

the significance of human capital is undeniable. Examining the history of developed countries reveals that technological advancements, modernization, and high levels of welfare have been achieved through investments in human capital. Consequently, the inclusion of education in growth models has directly influenced investments and savings.

### 3.2. The Role of Education in Growth Models

The concept of economic growth, extensively studied since the industrial revolution and experiencing a decline in importance during the 1970s, regained significance after the Second World War. The primary goal of economic growth, considered a macroeconomic objective by nations, is to be sustainable. In this context, human capital plays a crucial role in the economic growth policies implemented, particularly by developed countries (Yakışık & Çetin, 2014). The most fundamental investment in human capital is education (Gökmen, 2009). Educational investments encompass more than just formal and non-formal education in schools. Within the economic system, education investments aim to systematically train the labor force, meeting the quantity and quality requirements for growth in terms of knowledge, skills, and capacity, and to facilitate knowledge accumulation for future generations.

The economic impacts of education are examined at the micro level through the rate of return method, employing cost-benefit analyses to understand individual and firm decisions to invest in education. Consequently, education serves as a tool to enhance individuals' labor force capabilities, and differences in personal income distribution are directly attributed to variations in education levels. Furthermore, by boosting the productivity and income levels of the labor force and elevating occupational status, education results in private returns surpassing social returns.

The macro-level economic implications of education are scrutinized through the production function method, exploring the connection between education and national-level economic growth. Within this framework, the increased accumulation of an educated labor force influences economic growth, other factors of production, and technology, contributing to the enhanced development and welfare of countries.

As a result, numerous theoretical and empirical studies have been conducted on education, serving as the foundation for the economic growth measures of nations. In this section, growth models highlighting education as the principal component of human capital will be elucidated.

### 3.2.1.The Lucas Growth Model

Robert Lucas critiqued the growth models developed by Solow and Denison, asserting that they placed excessive emphasis on technological progress and overlooked other variables. In 1988, Lucas extended the Solow model by incorporating human capital (Abdioğlu & Albayrak, 2016). He argued that the variables in neo-classical growth models were inadequate for explaining economic growth, asserting that knowledge is the crucial factor. Furthermore, Lucas posited that the development of human capital elements serves as the source of technological progress. According to the model, individual skills enhance labor productivity, and these skills are transmitted between generations. As families accumulate human capital, the rate at which individuals acquire skills also increases (Lucas, 1988).

The Lucas (1988) model operates under the assumptions of a closed economy and perfect competition. Economic agents have quantifiable expectations, and the technology factor exhibits constant returns to scale. The quantity of labor allocated for production at time $t$ is $N(t)$. The exogenous growth rate of $N(t)$ is denoted by $\lambda$. Real per capita consumption $[c(t),t\geq 0]$ is considered a flow variable expressed in terms of a single type of good since the model is single-sector.

Lucas (1988) defines an individual's human capital as a measure of their general ability. Therefore, the productivity of one labor with $h(t)$ human capital equals the productivity of two laborers with $12h(t)$ human capital each. Human capital theory focuses on how an individual allocates productive time among various activities. The inclusion of human capital in the model suggests that it will impact current production and that the current time allocation will influence human capital accumulation.

In the Lucas model, the total number of laborers with skill level $h$ from zero to infinity is denoted as $N(h)$. The total quantity of labor is expressed as $N = \int N(h)dh$, where the

integration is from zero to infinity. A laborer with skill level $h$ allocates $u(h)$ of the total hours worked to current production and 1-$u(h)$ to human capital accumulation. In this case, the total amount of labor active in production, denoted as $Ne$, is expressed as $Y$, given by:

$Ne=\int u(h)N(h)hdh$ from 0 to $\infty$ (3.1)

The level of output ($Y$) is determined by the inputs of physical capital ($K$) and effective labor ($Ne$), represented by the function:

$Y=F(K,Ne)$ (3.2)

The hourly wage of a laborer with skill level $h$ is denoted as $Fn(K,Ne)$, while the total income of a laborer with skill level $h$, given by $Fn(K,Ne)hu(h)$, is represented as $u$. Assuming that all labor in an economy has skill level $h$ and the time allocated to production by this labor is $uu$, the efficient labor equation becomes:

$Ne=uhN$ (3.3)

According to this equation, there is a positive relationship between the level of output and the time allocated to production, the skill level of labor, and the supply of labor.

Lucas argued that an economy requires investments in human capital, considering human capital as one of the factors of education. In his model, Lucas (1988) posits that human capital will have a two-way effect. The first of these effects is the 'endogenous effect.' The endogenous effect aims to increase the labor productivity of human capital, resulting in higher output with the given input. The other effect is the 'exogenous effect.' The external effect is that an increase in the human capital of an individual contributes to a rise in the level of production by positively affecting the productivity levels of other factors of production.

According to Lucas, the existence of the externality of human capital leads to production with increasing returns to scale. Thus, production never reaches a steady state, which contrasts with the neo-classical model. In other words, Lucas explains the increase in an individual's own productivity as a result of human capital accumulation as an endogenous effect, and the positive effect of human capital accumulation on the productivity of other individuals as an exogenous effect.

In addition to the increase in individuals' human capital increasing their own productivity, Lucas also includes a variable called the average level of skills or human capital in the production function. He states that this exogenous effect benefits the productivity of all factors of production. Accordingly, the production function is expressed as follows:

$$Y=AK(t\beta)[u(t)h(t)N(t)]1-\beta h\alpha(t)\gamma \quad (3.4)$$

In equation (3.4), $A$ denotes the level of technology. Simultaneously, technology ($A$) is assumed to be exogenous. The expression $h\alpha(t)\gamma$ represents the exogenous effects of human capital.

In his model, Lucas stated that sustainable growth will be realized as a result of human capital accumulation. Education is the primary factor determining human capital accumulation. Lucas formalized education with numerical data, evaluating the time allocated for education and the time excluding working hours with numerical data. In the model, the time allocated by households for education is used as the sole input in the human capital accumulation phase. The concept referred to as human capital emerges through education. Additionally, human capital can also emerge spontaneously through learning by doing in working life, which can be defined as experience.

Within the framework of "learning by doing" in human capital, Lucas argues that the investments of economic agents in education and technological development will have positive effects on human capital accumulation. Consequently, he states that these investments will influence growth more significantly than the effect of investments in physical capital.

The increase in the skill level of the labor force is linked to the time outside working hours $1-u(t)$. This linkage implies that human capital increases with the rise in leisure time. Thus, the human capital accumulation equation;

$$\dot{h}(t)=h(t)\delta[1-u(t)] \quad (3.6)$$

is expressed as:

$\delta$ denotes the rate of knowledge acquisition. When $u(t)$=1, labor devotes all its time to production and has no more time for self-improvement. Consequently, human capital accumulation is zero. In contrast, when $u(t)$=0, labor spends all its time on self-improvement, and human capital accumulation is maximized. It is assumed that there is no decline in the skill level between these two states.

### 3.2.2. The Model of Mankiw Romer Weil

The model is grounded in the academic work of Gregory Mankiw, David Romer, and David Weil (1992) as well as Solow (1956). In Solow's (1956) model explaining economic growth, there is no distinction between physical capital and human capital. Consequently, human capital, comprising the experience, knowledge, and aptitude of the labor force, is not regarded as a factor of production in the Solow model.

In their study, Mankiw, Romer, and Weil (1992) assert that the estimation results of the Solow (1956) model represent the first consistent approach. However, they contend that not all the outcomes of the Solow (1956) model are accurate. Consequently, Mankiw, Romer, and Weil (1992) extend their research by enhancing the Solow model to incorporate human capital (Weil, 1992).

In the studies of Mankiw, Romer, and Weil (1992), the production of output ($Y$) involves labor ($L$), physical capital ($K$), and human capital ($H$).

$$Y=K\alpha H\beta(AL)1-\alpha-\beta \tag{3.7}$$

In equation (a), $(AL)$ denotes the effective amount of labor. The elasticity of output with respect to physical capital is denoted by $\alpha$, and the elasticity with respect to human capital is denoted by $\beta$. The elasticity of output with respect to the labor force is denoted by $1-\alpha-\beta$. Thus, $\alpha$, $\beta$, $1-\alpha-\beta$ explain how a 1% change in physical capital, human capital, and labor force causes a 1% change in the output level.

Under the assumption of constant returns to scale, $0<\alpha$ , $\beta<1$, $0<\alpha+\beta<1$, $\alpha+\beta+(1-\alpha-\beta)=1$. In the assumption of Mankiw, Romer, and Weil (1992), human capital accumulation is assumed to arise as a result of using a portion of the output for saving and investment purposes, similar to the case of physical capital.

$\Delta Kt=IK-\delta K=sKY-\Delta k$ (3.8)

$\Delta Ht=IH-\delta H=sHY-\delta H$ (3.9)

According to equations (3.8) and (3.9) in the Mankiw, Romer, Weil (1992) models, the physical capital and human capital depreciation shares are equal to each other. The term *sK* in equation (3.8) represents the physical capital investment of the output, and *sH* represents the fixed values saved for the purpose of human capital investment in the output. Accordingly, the equations are $IK=sKY$, $IH=sHY$ 'dir.

*IK* represents gross physical capital investment, and *IH* is gross human capital investment, denoted as *IK+IH=I=S=Y−C*. The same equation can be expressed as *Y=C+I=C+IK+IH*.

In the Mankiw, Romer, Weil (1992) model, the above equations are analyzed for the steady state. According to these equations, to access the variables per worker, the following ratios are established with the effective amount of labor *AL* in the denominator:

$Ye=YAL$ (3.10)

$Ke=KAL$ (3.11)

$He=HAL$ (3.12)

When the physical capital per worker and human capital per worker equations shown in equations (3.11) and (3.12) are solved for the steady state, equations (3.13) and (3.14) are obtained:

$sKY*e=(n+\theta+\delta)ke*$ (3.13)

$sHY*e=(n+\theta+\delta)he*$ (3.14)

The expression $\theta$ in equations (3.11) and (3.12) represents the rate of technological development.

The solution of equation (3.10) is shown below:

$$ye=YAL=(K\alpha H\beta(AL)1-\alpha-\beta)AL=(ke)\alpha(he)\beta \quad (3.15)$$

When the equation expressing the level of output per worker in equation (3.15) is substituted in the steady state and analyzed for human capital per worker, the following equations emerge:

$$sH(ke*)\alpha(he*)\beta=(n+\theta+\delta)he* \quad (3.16)$$

$$he*=sH(n+\theta+\delta)11-\beta(ke)\alpha1-\beta \quad (3.17)$$

The basic solution of equations (3.16) and (3.17) is shown in equation (3.18) below:

$$ye*=sK(n+\theta+\delta)\alpha1-\alpha-\beta sH(n+\theta+\delta)\beta1-\alpha-\beta \quad (3.18)$$

According to equation (3.18), while the investment rate for physical capital denoted by *sK* is given, the higher the investment rate for human capital denoted by *sH*, the higher the steady-state level of output per worker. Therefore, for countries that have higher economic growth rates and are considered richer than other countries, it is not enough to simply have a higher physical capital investment rate. Similarly, the idea that countries with such wealth and high economic growth rates only have very high technological innovation and are ahead of other countries is weak. It can be concluded that the reason why countries achieve higher economic growth and higher output levels is that they have a higher human capital investment rate. Accordingly, human capital is the determining factor for countries to achieve higher output levels. Therefore, the Mankiw, Romer, Weil (1992) model improves the ability of the Solow model to explain income disparities across countries. In addition, the Mankiw, Romer, Weil (1992) model is similar to the Solow model in the sense that the level of output per worker in the steady state converges at a rate equal to the rate of technological progress.

The present era is often referred to as the information age, marked by a significant emphasis on the importance of information in an increasingly globalized world. The centrality of information has led to its examination across various scientific disciplines. Education plays a vital role in facilitating the use and transfer of knowledge, and with the ongoing development of educational technologies, the concept of lifelong learning is

becoming more prevalent. Consequently, this age is witnessing radical changes in economic, political, social, and global spheres, generally regarded as positive transformations, which, in turn, elevate the demand for an educated workforce (Garada & Temizel, 2016).

One of the key characteristics of this era is the recognition of knowledge and education as integral components of the factors of production. Education, a phenomenon with roots as old as human history, encompasses the systematic amalgamation of facts, concepts, policies, institutions, activities, and understandings that contribute to the development of a nation, a state, or an individual throughout history.

The concept of education has been extensively researched throughout human history, aiming to find solutions to various challenges. In its simplest definition, education involves providing individuals with knowledge and skills in a specific field within the framework of a particular subject, and it aims to develop the knowledge and skills gained by individuals (Pamuk & Bektaş, 2). Education goes beyond the mere transfer of knowledge; it also equips individuals with the ability to produce, develop, and interpret knowledge.

Understanding why and how education is utilized is as crucial as grasping the concept itself. The purpose of education, both in individual and social terms, is a critical aspect that requires thorough examination and explanation. At its core, the primary purpose of education is learning. When there is a permanent and lasting change in people's behavior, it is acknowledged that the individual has learned a new behavior (Taş, Türkiye'de Kalkınma Planları Işığında Eğitimin Kalkınmadaki Rolü, 2007). The overarching goal of education is to nurture individuals with a high level of knowledge, transferring accumulated knowledge and cultural values across generations. Throughout history, societies have employed education to raise individuals with elevated knowledge levels and keep pace with innovations. Thanks to education, societies adapt more quickly to advancements and innovations in economic, cultural, social, and political realms. The primary aim of education in all societies globally is to pass on their culture and knowledge to new generations, shape the behavior of the youth, and mold their social roles in the future (Eroğlu, 2001).

Particularly after the Second World War, post-colonial societies started to examine the impact of education on development, drawing inspiration from Western societies that had experienced rapid development with the industrial revolution. International organizations like the World Bank, OECD, and the United Nations began supporting publications on development, leading to a growing acknowledgment of the significant role educational institutions play in increasing the economic growth rates of countries (Buyruk, 2016). As a result of these studies, many countries delved into the theoretical implications of the relationship between education and economic growth in practical applications. Moreover, the argument that countries with a highly educated population are more developed, progress faster in development due to more efficient resource utilization, and experience more equitable distribution of social welfare with increasing economic growth has strengthened the connection between development and education (Blaug, 1966). Consequently, countries at various development levels have sought to understand and enhance the methods and variables through which educational indicators and policies impact economic development.

Given that countries generally aim to improve the living standards of individuals, they initially investigated the link between education and income. Education has been regarded as a crucial factor for societies to break free from poverty standards. Through education, individuals develop vocational and technical skills, resulting in increased incomes. Additionally, education enhances productivity in production, raising the knowledge and skill levels of societies. This, in turn, directly impacts the productivity and incomes of individuals in production. As these investments in individuals are applied collectively, overall productivity increases, eventually eliminating income inequalities in countries over time. Studies on the economics of education since the 1960s have demonstrated that considering education as a factor of production leads to an increase in national income by elevating the quality and productivity of the labor force (Çakmak, 2008). Furthermore, countries with higher income levels can achieve greater labor productivity by investing more of their national income in education, the foundation of human capital (Canpolat, 2000).

Another influential factor for enhancing the quality and productivity of labor is the development of research methods used by firms, accomplished through technology. As

technology advances through knowledge, new sources of knowledge emerge. Hence, technological development is considered the fundamental element for the social transformation accompanying industrialization. The level of technology production and the utilization of technology vary according to the development level of countries. Generally, developed countries with high levels of education produce technology and transfer it to other countries because technological advancements rely on a qualified human factor. Especially in the investment policies of societies at an advanced technological level, continuous investment in human beings is paramount. Given the information age we are in, these investments have gained extra importance, and countries lagging behind this age may find it challenging to develop or prosper (Aktan & Tunç, 1998).

Considering all these aspects, education should be viewed as a multifaceted functional process. Assuming the responsibility of meeting societal expectations, education serves as a tool to quickly adapt to changes and transformations occurring in the social, political, cultural, and economic fields of countries. It generates solutions to various challenges, and a society with a majority of educated individuals tends to be more successful, healthy, peaceful, happy, and productive. Therefore, an educated society develops in every aspect. As total transformation is a prerequisite for economic development, education stands as the foundation of economic development (Afşar, 2009).

### 3.3.Education Indicators Affecting Economic Development and Growth

Sustainable economic development is a primary objective for all countries, and achieving increased economic growth rates is a key means to ensure overall development. In alignment with this objective, investing in human resources emerges as the most crucial requirement. The development of human resources is a multifaceted concept that encompasses various forms of investment in individuals. At the core of these investments lies education, which is integral to human capital within the economic boundaries of nations. Education has been a concept subject to inclusion and research across various fields throughout history. The analysis of economic development and growth over time has explored how education indicators play a role in shaping development and growth. This section will provide a general overview of how education indicators influence development and growth.

Education serves as the initial step in the developmental process, facilitating the realization of economic objectives through the provision of services to individuals. High-quality education increases the national income levels of countries by enhancing the productivity of the labor force. Moreover, it fosters equality of opportunity among individuals within a country by offering uniform education services. Additionally, education empowers individuals to utilize economic resources more efficiently, contributing positively to countries' pursuit of stable and sustainable policies. The outcomes of countries' policies, as well as the level and quality of education, are defined by education indicators. While numerous indicators define education, key ones include education expenditures or investments, literacy rates, and schooling rates.

Education and training activities are public services falling within the state's responsibilities. Expenditures made by the state to provide education services are characterized as education expenditures. These expenditures can be considered as both investment and consumption expenditures due to their role in income redistribution and their impact on economic growth, development, and stability (Ortaç, 2003). Education activities form the foundation of various sectors and are a crucial element in economic growth and development.

Analyzing education expenditures within the realm of education indicators reveals their active role in driving countries' economic growth, given their share in gross domestic product (GDP). According to 2020 World Bank data, education expenditures in Organization for Economic Co-operation and Development (OECD) countries constitute 5.34% of the gross national product, while global education expenditures make up 4.44% of the gross national product, decreasing to 4.18% in 2021. The positive relationship between education expenditures and income levels of countries is evident. Notably, high-income countries such as Norway allocate 8.37% of all expenditures to education, whereas low-income countries like Gambia allocate 2.89% to education, according to World Bank data for 2020.

Education is a continuous process throughout individuals' lives, manifesting in various fields. However, schools play a pioneering role in systematically and regularly conducting educational activities. Schools act as institutions shaping social life by unveiling competencies, imparting knowledge, skills, and fostering creativity from an early age. The

enrollment rate, calculated by dividing the number of students enrolled in all levels of education by the population in the relevant theoretical age group, serves as a key indicator of education. Economists often use the enrollment rate as a proxy for human capital to measure the stock of human capital (Robert J. Barro; J.W. Lee, 1993).

Another crucial education indicator is the literacy rate, reflecting the transmission of a society's history, culture, and common values through written sources. In a world where communication and literacy are increasingly essential, the ability to read and write becomes indispensable. The literacy rate is a widely used indicator of education, representing the ratio of the number of literate individuals to the total population. It can be further studied based on gender distribution, age range, and regional variations, making it a versatile element for analysis (Atik, 2006).

### 3.4. Economic Growth, Development and Education in Turkey

The formation of the social structure and the economic progress of a country are closely related to the education of individuals. The education of individuals makes it possible for them to make social and economic contributions by improving their knowledge, skills, and attitudes. Educated individuals can produce more creative and innovative solutions, work more efficiently, and contribute to social welfare. Moreover, continuous learning and self-improvement facilitate adaptation to technological and economic changes.

In order to strengthen the social structure, the education system must be accessible to all individuals and provide quality education. This is because education not only provides academic knowledge but also develops individuals' social skills and ethical values. This, in turn, helps to create a healthier social structure and sustainable economic development.

In world history, prolonged wars, epidemics, natural disasters, famines, political instability, and economic imbalances have directly affected the development processes and growth rates of countries. Due to these adversities, countries have had difficulty establishing sustainable systems. In this context, the Republic of Turkey has been affected by global events since its foundation and has also strived to maintain internal stability and economic balance.

Following the War of Independence, the Turkish education system underwent a radical change and transformation process. With the newly established Republic, the education system was used as an important tool for the recognition, dissemination, and acceptance of the revolutions and reforms by the Turkish society (Torun, 2020). Some of the reforms realized in this context are listed below:

**Law on Tevhid-i Tedrisat (1924):** With this law enacted in the early years of the Republic, all educational institutions were affiliated with the Ministry of National Education, unity in education was planned, and educational standards were aimed to be raised. With this law, moves to raise individuals with the same qualifications all over the country began to spread (Ortaş, 2020).

**Alphabet Reform (1928):** With the adoption of the Latin alphabet, it was aimed to facilitate and popularize the literacy learning. In addition, National Schools were established in 1929 to rapidly increase literacy rates.

**Compulsory Education:** In the early years of the Republic, compulsory education was recognized as an important step in terms of the progress of society. During this period, the duration of compulsory education was set as 5 years.

**Village Institutes (1940):** The Village Institutes hold a special place among educational reforms in Turkey. On April 17, 1940, the Village Institutes Law officially established these educational institutions. Their aim was to provide quality education to children living in villages without leaving their own environment. The locations where they were established were specifically chosen for regions with favorable terrain conditions, as these institutes aimed to provide students with a hands-on education in touch with village life. The curricula included gender-specific vocational courses: agriculture, blacksmithing, and construction work were offered to male students, while courses such as childcare, sewing, and housekeeping were offered to female students. This was seen as a strategy aimed at enabling students to return to their villages and make both economic and social contributions. The Village Institutes grew to 21 in various regions of Turkey and operated until 1953. During this period, they played a major role in meeting Turkey's need for teachers. They still hold an important place in the history of Turkish education with their

innovative approaches and social impact (Şişman, 2022). The biggest impact of the Village Institutes on the economy was to support rural development.

These reforms realized in the first years of the Republic were very effective and important services in terms of meeting the needs of the period.

The 1950s marked the transition to a multi-party system in Turkey. In this period, the education system began to diversify to meet more regional and social needs. The aim was to increase access to education, especially in rural areas. In 1954, village institutes and primary teacher schools were merged (Gazete, 1954). Curriculum development continued. Article 87 of the 1924 Constitution, the first constitution adopted after the proclamation of the Republic, stating that "primary education is compulsory for all Turks and free of charge in public schools," was repeated in Article 50 of the 1961 Constitution.

In the 1960s and 1970s, extensive investments were made in education in Turkey, and education was given special importance in the development plans of these periods. The number of technical education and vocational high schools was increased to support the industrialization process, the number of universities was increased, and the expansion of higher education enabled the training of qualified manpower.

Since the 1980s, technology integration into the education system has gained importance in Turkey. Information and technology-oriented education programs were strengthened, and the use of computer and internet technologies in education was expanded. With the 1973 Law No. 1739 on the Fundamental Law on National Education, teaching was defined as a "specialty profession," and secondary schools were included in the primary education system.

In 1981, with Law No. 2547, the Council of Higher Education was established and all higher education institutions in Turkey were brought under this umbrella. Academies were transformed into universities, educational institutes into faculties of education, and conservatories and vocational colleges were affiliated with universities. In 1997, primary education was extended to 8 years continuously, and textbooks began to be distributed free of charge to primary school students in the 2003-2004 academic year. In the 2012-2013

academic year, compulsory education was transformed into an uninterrupted 12-year structure divided into three segments of 4 years each.

Today, education in Turkey is recognized as the driving force of economic, technological, and social developments, and investments are continuously made in this field. Reforms to increase the number of students, schools, and teachers, and to provide quality education play a critical role in achieving the country's development goals. In this process, Turkey’s education policies and investments continue to occupy a central place in national development plans.

### 3.4.1.Turkish Education System

Education systems generally function as institutions that reflect and serve the social, cultural, economic, and political structures of a society. These systems aim to develop the human skills and capabilities required by different eras and societies (Özyılmaz, 2013). The main function of educational institutions is to support social development by making individuals compatible, capable, and functional in society.

Historically, education systems have evolved significantly over time. Starting from primitive societies, education in each period has been shaped by reflecting the living conditions, technological, and economic developments of that period. For example, with the industrial revolution, the demand for technical skills and scientific knowledge increased in industrial societies. During this period, education systems were reorganized to train the workforce to adapt to industrial production processes. In the post-industrial period, with the emergence of information and technology-oriented societies, education systems were structured to provide more analytical thinking, problem-solving, and technological skills. Today, modern education systems are dominant. They are constantly changing under the influence of globalization and technological innovations. These systems are evolving to support diversity, multiculturalism, and inclusion and aim to increase the competitiveness of individuals at the global level.

Turkey's education system is established and managed by the state under the Constitution of the Republic of Turkey. Everyone in Turkey has the right to education.

Through schools, individuals are guided and trained into appropriate departments and fields in line with their abilities.

Law No. 1739 on the Fundamental Law of Turkish National Education clearly states the purpose of the education system. According to the law, the aim of education is to raise individuals who have adopted the values of the Turkish nation, are aware of and fulfill their duties and responsibilities towards their country, produce knowledge, utilize what they produce, and demonstrate love and respect for human rights. Additionally, the goal is to prepare individuals for the future and ensure they acquire professions that contribute to their own values and those of the society in which they live (Anayasa, 1973).

The Turkish education system is built on two basic elements: formal education and non-formal education. Formal education refers to education provided by formal educational institutions within the framework of a specific curriculum and on a regular basis. It covers formal education institutions from kindergarten to university level. Formal education in Turkey consists of pre-school, primary school, secondary school, high school, and university. The main characteristics of formal education are that students are educated within a specific program and evaluated through exams. Non-formal education, on the other hand, covers mostly informal and unstructured learning processes. These are educational activities for personal or professional development, that are outside formal education and are usually carried out in free time. This type of education can take various formats such as courses, workshops, seminars, distance learning programs, and hobby classes. Non-formal education does not have as strict rules as formal education and can be shaped according to the interests, needs, and pace of individuals. Formal and non-formal education play complementary roles in the Turkish education system. While formal education is more systematic and institutionalized, non-formal education offers a flexible structure that supports individual development and lifelong learning. Both types of education are considered important tools for developing individuals' personal and professional skills.

### 3.4.2.The Importance of Education in Development Plans

Five-Year Development Plans, prepared by the State Planning Organization (SPO), now known as the Ministry of Development, outline Turkey’s long-term goals in economic,

social, and cultural areas. Since 1963, twelve development plans have been prepared, covering up to the year 2028.

Education is one of the important factors considered in national development. Education policy refers to the measures taken by the public sector to expand and improve education. The country's education policies are primarily outlined in these development plans. All educational institutions aim to develop the young population in the country with physical, mental, moral, spiritual, social, and cultural qualities and to prepare them for the future by equipping them with the knowledge and skills required by the age. The main goal is for students to be able to solve the problems they will face after graduation, take advantage of opportunities, get a job, advance in their field, and adapt to change. Extraordinary amounts of money, time, manpower, and equipment are invested in education by the state and families. In order for education to contribute to the development of the country, it needs to be diversified and the educational infrastructure needs to be continuously improved (Akça, Şahan, & Tural, 2017).

### 1. First Five-Year Development Plan (1963-1967)

This plan aimed to identify and address Turkey's shortage of qualified labor in education. Main focal points in education included:

- Organizing entrance systems for each school and determining student selection procedures.
- Providing scholarships to students with limited financial means, reflecting the social state approach.
- Taking significant steps towards technical and vocational education, particularly directing secondary school students towards these fields.
- Training students in middle and high schools for higher education institutions.
- Prioritizing teacher training institutions to overcome the shortage of teachers.
- Accelerating developments at the higher education level and encouraging the sending of students abroad.

### 2. Second Five-Year Development Plan (1968-1972)

The second plan built on the foundations of the first, focusing more on equality of opportunity in education and the public's desire for education. The main objectives of this plan included:

- Viewing education, and higher education in particular, as key to building a developed society.
- Developing in-service training for both students and employees, aiming to make a qualitative contribution to business life.
- Bringing all educational institutions under the umbrella of the Ministry of National Education to ensure a holistic approach to education.
- Special education programs were developed for students with special needs who have learning difficulties.
- In-service training was emphasized to increase the professional competence of teachers.

### 3. Third Five-Year Development Plan (1973-1977)

The Third Five-Year Development Plan assessed the educational objectives of the previous two plans and emphasized the importance of higher and secondary education. Key elements of this plan include:

- Addressing inequalities in the distribution of teachers and course materials, making efforts to eliminate these inequalities, and targeting increases in scholarships and dormitory facilities.
- Placing emphasis on education-industry cooperation and the development of a qualified and skilled workforce.
- Aiming to improve the preparation process for higher education institutions and enhance guidance services.

- Encouraging the sending of students abroad and providing financial support for education.
- Planning to establish a non-formal education system integrated with technical and vocational education.

### 4. Fourth Five-Year Development Plan (1979-1983)

The Fourth Development Plan focused on both the qualitative and quantitative development of the education system. Major points of focus included:

- Bringing structural deficiencies in teacher education and teacher training institutions to the agenda.
- Noting the underutilization of non-formal education services and proposing improvements in these areas.
- Aiming to provide teaching aids and stationery for all students.
- Encouraging higher education and targeting the development of doctoral programs in Turkey.
- Envisioning the expansion of practical and applied learning methods and the organization of adult education and vocational courses.

### 5. Fifth Five-Year Development Plan (1985-1989)

This plan aimed to integrate education with the world of work, specifically to increase employment among the 15-64 age group. Key initiatives included:

- Special attention was given to training and implementation in areas such as technical education and family health.
- Emphasizing the improvement of the quality of the workforce and the development of vocational skills among young people.
- Planning for the maintenance and enhancement of the physical and academic capacities of educational institutions, along with a review of the content and methods of educational programs.

- Setting targets to encourage private schools and improve the quality of education.

### 6. Sixth Five-Year Development Plan (1990-1994)

This plan aimed to improve the quality of education and increase productivity. Specific focus areas included:

- Attaching special importance to the education of women and implementing necessary measures to ensure their access to vocational training opportunities.
- Expanding pre-school education.
- Revising education programs to align with the needs of the era, improving infrastructure, and increasing the use of technology in education.
- Supporting private schools and private foundation universities.
- Establishing a vocational guidance services system to direct students to occupations based on their interests and abilities, and opening entrepreneurship skills training programs.

### 7. Seventh Five-Year Development Plan (1996-2000)

The focus of this plan was on improving vocational guidance services and supporting the demand for vocational high schools. Key initiatives included:

- Emphasizing the guidance of individuals according to their talents and interests in the educational system.
- Committing to review and improve educational practices at all levels.
- Adopting a quality approach to foreign language teaching, encouraging qualified instruction over direct foreign language courses.

### 8. Eighth Five-Year Development Plan (2001-2005)

This plan aimed to address physical and equipment deficiencies in education, increase the education budget, and improve the quality of education. Specific measures included:

- Eliminating physical and equipment deficiencies in education.
- Increasing the education budget.
- Emphasizing the harmony between vocational education and non-formal education.
- Increasing the use of technology in education and improving transportation education.

### 9. Ninth Development Plan (2007-2013)

The goal of this plan was to enhance the quality of the labor force and improve education quality. Key initiatives included:

- Planning budget increases to improve the quality of education and health services.
- Supporting an economic structure based on knowledge and competition, along with continued labor force training.
- Aiming to transition the education system from an exam-oriented approach to a process-oriented one.
- Encouraging the opening of private schools and private foundation universities.

### 10. Tenth Development Plan (2014-2018)

The Tenth Development Plan aimed to achieve several key targets, including:

- Including the expansion of pre-school education among the main objectives.
- Placing emphasis on utilizing advancements in information and communication technologies in education and integrating them with business life.
- Highlighting the importance of sports and arts in the education process for the holistic development of individuals.

- Adopting the understanding that each individual is different and valuable, with the aim of positively reflecting individual differences in education.
- Planning to allocate resources for early language education and lifelong learning.
- Envisaging an increase in the use of distance education and mobile learning applications.

### 11. Eleventh Development Plan (2019-2023)

The Eleventh Development Plan aims to achieve several important objectives, including:

- Improving the thinking, perception, and problem-solving skills of all individuals, while increasing their self-confidence and sense of responsibility.
- Including the 5-year-old age group in compulsory education and developing alternative early childhood education models.
- Transitioning to single education and constructing additional classrooms.
- Increasing schooling and completion rates at all levels of education, reducing absenteeism rates, and expanding access to education for people under temporary protection.
- Reducing achievement gaps between schools, launching school meal programs in disadvantaged regions, and establishing quality assurance systems in education.
- Updating educational content to reflect national, spiritual, and universal values, and renewing mathematics and Turkish curricula.
- Supporting the motivation and professional development of teachers and school administrators, and strengthening the social status of the teaching profession.
- Enriching the Education Information Network portal, installing network infrastructure and interactive boards in schools.
- Encouraging university students to participate more in scientific activities and enriching foreign language education.
- Strengthening physical and human facilities for individuals in need of special education and expanding special education services.

## 12. Twelfth Development Plan (2024-2028)

The Twelfth Development Plan aims to achieve several important objectives, including:

- Implementing various incentive mechanisms to align vocational and technical education with the needs of the labor market and to encourage young people to pursue careers in priority sectors.
- Strengthening curricula and teacher qualifications to bring foreign language skills up to international standards.
- Expanding the use of data-based policy development by the Council of Higher Education and universities to continuously monitor and improve the quality of universities.
- Eliminating differences in quality and access to education and ensuring inclusive and high-quality education services.
- Transitioning to single day education at all levels of education and constructing additional classrooms.
- Expanding education services for individuals in need of special education and providing more comprehensive and effective special education services.
- Supporting the development of a digital maturity model in higher education and providing universities with access to corporate cloud services and modern IT tools, while encouraging their use for research and education purposes.

# CHAPTER IV

# LITERATURE REVIEW

Many studies have been conducted on the determinants of economic development and growth, which remain common goals and objectives for countries from past to present. These studies generally aim to reveal the reasons for differences in the development levels of countries.

Education is the most important factor ensuring economic growth and development. For this reason, education and its influencing indicators have been included in the literature and analyzed. Especially in empirical applications, education is the most commonly used variable. An analysis of both theoretical and empirical literature clearly shows a direct relationship between education and economic growth and development.

Studies typically examine the long-term relationship between education and its influencing factors, and economic growth and development. Both single countries and multiple country groups are used as samples in these studies. The sample groups are investigated using panel data analyses or time series analyses, with co-integration analyses and causality tests applied in most cases.

In this section, firstly, studies examining the relationship between economic growth, development, and education in the world literature will be presented, followed by studies focusing on Turkey.

### 4.1. Economics Growth, Development and Education

Based on the literature studies, research on education as a fundamental determinant of economic development and growth was first conducted by Adam Smith. Smith argued that an individual with good and quality education could perform tasks that the most expensive machine could do, and he conducted research based on this idea (Büyükarslan, 1995). Smith advocated that investment should be made in individuals' education, and that the resulting accumulation of knowledge would be beneficial to society. This would realize capital formation and specialization in narrow fields. Specialization and increased efficiency would be achieved through education provided to individuals, and as a result, economic growth would increase. In other words, the concepts of labor and specialization used by Smith express human capital. After Smith, Alfred Marshall argued in 1890 that the most valuable investment is the investment made in people (Marshall, 1890). Adam Smith and Alfred Marshall are noted as the first economists to speak of human capital in literature studies. However, the economists who used the concept of human capital in its modern sense and showed that education influences economic development and growth were Schultz (1961) and Denison (1962) (Akgül & Koç, 2011).

In 1962, Edward Denison studied the sources of economic growth in the United States for the period 1929-1957, discovering that the contribution of education to economic growth was greater than that of physical capital and provided a complete explanation for the residual factor (Denison, Sources of United States economic growth, readings in economics, 1962). Following this study, Denison conducted further analyses in 1970 and 1985, focusing on the relationship between education and economic development/growth and explaining the residual factor (Denison, Trends in American Growth: 1929-1982, 1985). Denison found consistently supportive results across all his studies and used them to critique the Solow model. Concurrently, another economist conducting empirical studies during the same period was Schultz (1961), who published the book "Human Capital" in 1961. In this book and his subsequent articles, Schultz conducted studies that supported Denison’s findings.

Robert Barro's 1991 study is recognized as a pioneering work in examining the relationship between education and economic growth. Barro applied the Ordinary Least Squares method and Cross-sectional Data Analysis to data from 98 countries, including

Turkey, covering the period from 1960 to 1985. His research found that an increase in the number of students enrolled in secondary education boosted per capita real income. Additionally, another conclusion of the study suggested that countries striving for economic development could achieve developed country standards by increasing their accumulation of human capital. Barro continued his research over the years.

In 2000, Barro and Lee investigated the relationship between literacy rates and economic growth through a gender lens. Using data from 142 countries spanning 1960 to 2000, they conducted a Panel Data Regression Analysis. This study concluded that education positively influences economic growth.

Another of Barro's efforts to elucidate the relationship between education and economic growth was his 2001 study, which applied panel data analysis for 100 countries, covering the years 1960 to 2000. This analysis found a positive relationship between the duration of education received by males over 25 and growth, while the relationship between the duration of education women received and growth was found to be insignificant. Furthermore, the study found no significant relationship between literacy rates and economic growth.

In 1992, Mankiw, Romer, and Weil published a study that analyzed the effects of education on economic growth using data from a broad sample of countries. This research examined data from 121 countries for the years 1960-1985 and observed that an increase in the proportion of students enrolled in secondary education within the population positively influenced economic growth.

In the same year, Levine and Renelt conducted a study involving 119 countries, utilizing data from the period 1960-1989 to explore the relationship between expenditures on education and economic growth. The study was performed using panel data analysis, with a preference for the Ordinary Least Squares (OLS) methodology. Variables included the average annual growth rate of GDP, enrollment rates in primary and secondary education, and the share of public education expenditures within GDP. The results of this study demonstrated that investments in education have a positive effect on economic growth.

In 1998, Zhang and Casagrande conducted a study that investigated the impact of government subsidies for education on economic growth. This research utilized data from 69 countries covering the period from 1970 to 1985. Employing the panel data analysis method, the study found that state support for education had a positive effect on economic growth.

In his 2003 study, Lin conducted a panel data analysis for Taiwan covering the period from 1965 to 2000, using real capital stock, real GDP, and the average years of education per employed labor force as an indicator of human capital. The study concluded that there is a positive relationship between education and economic growth.

Self and Grabowski (2004) analyzed the impact of education on economic growth in India using the Granger Causality Test for the period from 1966 to 1996. They utilized data on real GDP per capita and enrollment rates at primary, secondary, and tertiary levels, assessing the effects of education levels separately for females and males. Their findings indicate that education at all levels positively affects economic growth for females, while for males, only primary education has a significant impact on growth.

Musila and Belassi (2004) examined the relationship between government education expenditure per worker and economic growth in Uganda using data from 1965 to 1999. Their analysis employed the Cointegration and Error Correction Model and concluded that education expenditure per worker positively and significantly affects economic growth, both in the long run and the short run.

Loening (2005) analyzed the impact of human capital on economic growth in Guatemala using data from 1951 to 2002. The study utilized variables such as primary and secondary school enrollment rates and GDP. The analysis revealed that human capital has a significant and positive impact on long-term growth, explaining more than 50% of output growth. Additionally, it was concluded that secondary school education is the dominant determinant of growth.

Babatunde and Adefabi (2005) investigated the impact of education on economic growth in Nigeria using data from 1970 to 2003. They employed the Johansen Cointegration Test and Vector Error Correction Methodology. The variables analyzed

included output per worker and average years of education. The study revealed that education, considered as a factor of production, enhances total factor productivity. In other words, education positively influences economic growth by improving total factor productivity.

Brempong, Paddison, and Mitiku (2006) investigated the impact of higher education on economic growth in African countries during the period 1960-2000. Utilizing dynamic panel data analysis, they concluded that all levels of education, including higher education, have a positive and statistically significant effect on the growth rate of real GDP per capita.

Keller's 2006 study examined the relationship between economic growth and education expenditures in Southeast Asian countries between 1971 and 2000. The analysis focused on the effects of public expenditures, especially at the primary education stage and public expenditures per student, using the panel data analysis method. The study revealed that these expenditures made significant contributions to economic growth.

Aka and Dumont's 2008 study analyzed the relationship between economic growth and education in the US for the period between 1930-1965 using Vector Autoregression (VAR) analysis. Their research reveals a bidirectional causality relationship between growth and education, indicating that education not only stimulates economic growth but also that the level of education increases with the rise in investments in education.

Li and Huang's 2009 study analyzed the relationship between economic growth and combined education and health indicators in China from 1978 to 2005. Employing panel data analysis, the study included variables such as real GDP, the number of students per teacher, and the proportion of the population with secondary or higher education, along with health indicators. The findings indicated that reducing the student-to-teacher ratio and increasing the proportion of the population with at least secondary education positively impacted economic growth in China.

Tamang's 2011 study explored the relationship between education expenditures and economic growth in India, covering the period from 1980 to 2008. Utilizing econometric methods, the study applied unit root tests to assess the stationarity of the data and

cointegration tests to examine the long-run relationships between variables. The results revealed that education expenditure has a positive and significant relationship with economic growth in India, emphasizing the crucial role of educational investment in the country's economic development.

Keskin's 2011 study analyzed economic development across 177 United Nations member countries using a multiple linear regression model. The model incorporated various variables, including GDP per capita, the export-to-GDP ratio, the number of researchers involved in R&D activities, the ratio of public health and education expenditures to GDP, adult literacy rate, life expectancy, Human Development Index, and the income distribution index. The findings indicated that factors such as literacy rate, education level, public health expenditures, and R&D expenditures significantly impact the economic development of countries.

Ochilov's 2012 research investigated the relationship between economic growth and the quantity and quality of education in Uzbekistan, analyzing data from 1989 to 2009. The study, conducted through regression analysis, evaluated various education-related variables' effects on economic growth. The results revealed a weak relationship between education and economic growth in Uzbekistan, suggesting that educational outcomes may not significantly influence economic development in this context.

The 2014 study by Yardımcıoğlu, Gürdal, and Altundemir explored the relationship between education investments and economic growth across 25 OECD countries from 1980 to 2008. Utilizing panel data analysis, the research revealed a long-term and bidirectional relationship between education and economic growth within these nations. This finding underscores the notion that investments in education not only directly enhance economic growth but that economic growth also stimulates further investments in education. This mutual reinforcement highlights the critical role of education in sustaining economic development.

The 2014 study by Kızılkaya and Koçak used panel cointegration analysis to examine the impact of education expenditures on economic growth across 11 OECD countries from 1990 to 2009. The findings indicate that education expenditures positively influence economic growth in these countries. This suggests that education can bolster

economic growth through the production of high-quality human capital, and that these investments yield substantial macroeconomic returns.

Wang and Liu's 2016 study investigated the relationship between human capital and economic growth in 55 countries and regions, utilizing annual data spanning from 1960 to 2009 with panel data analysis. The study incorporated human capital indicators such as life expectancy, levels of education (primary, secondary, and tertiary), and the real GDP variable. The results demonstrated that education generally has a significant and positive effect on economic growth.

Rathanasri's 2020 study analyzed the relationship between education expenditures and economic growth in Sri Lanka from 1974 to 2018 using the ARDL Test. The findings reveal that while higher education expenditures positively impact economic growth, general education expenditures negatively affect economic growth. This differentiation highlights the complex nature of education spending's effects on economic outcomes.

In summary, the findings from studies investigating the relationship between education and economic growth cannot be universally generalized due to differences in econometric methods, variations in the data sets used to represent education, the specific characteristics of the countries studied, and the periods of research. Despite these differences, nearly all of these studies provide empirical support for the hypothesis that education-related variables significantly contribute to economic growth and its sustainability, though the degree of impact varies. This highlights the critical role of education in fostering economic development, while also underscoring the complexity of quantifying its exact effects across diverse contexts.

**Table 4.1** Economics Growth, Development and Education

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Denison (1962) | USA, 1929-1957 | Endogenous Growth Model | Attempted to explain the residual factor, argued that physical capital alone is insufficient, and found a positive relationship between education and productivity. |
| Romer (1989) | 112 Countries, 1960-1985 | Ordinary Least Squares Method | Found a positive relationship between economic growth and literacy rates. |
| Barro (1991) | 98 Countries, 1960-1985 | Ordinary Least Squares Method and Cross-sectional Data Analysis | Found a positive relationship between the increase in primary school enrollment and economic growth. |
| Mankiw et al. (1992) | 121 Countries, 1960-1985 | Ordinary Least Squares Method, Endogenous Growth Model | Observed that as the proportion of students enrolled in secondary education within the population increases, education positively influences growth. |
| Levine and Renelt (1992) | 119 Countries, 1960-1989 | Panel OLS Analysis | Concluded that expenditures on education have a positive relationship with economic growth. |

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Zhang and Casagrand (1998) | 69 Countries, 1970-1985 | Panel Data Analysis | The study revealed that government support for education has a positive effect on economic growth. |
| Barro and Lee (2000) | 142 Countries, 1960-2000 | Panel Data Regression Analysis | Identified a positive relationship between education and economic growth. |
| Barro (2001) | 100 Countries, 1960-1995 | Panel Data Analysis | Found no significant relationship between literacy rates and economic growth. |
| Lin (2003) | Taiwan, 1965-2000 | Time Series Analysis | Found a positive relationship between education and economic growth. |
| Self and Grabowski (2004) | India, 1966-1996 | Granger Causality Test | Found that education at all levels for females positively affects economic growth. For males, only primary education had an impact. |
| Musila and Belassi (2004) | Uganda, 1965-1999 | Time Series Analysis | Found that per capita education spending has a significant positive impact on economic growth both in the short and long term. |
| Loening (2005) | Guatemala, 1951-2002 | OLS | Found that a more educated workforce has a positive and significant impact on economic growth. |
| Babatunde and Adefab (2005) | Nigeria, 1970-2003 | Johansen Cointegration Test | Found a positive relationship between economic growth and education. |

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Brempong, Paddison, and Mitiku (2006) | 34 African Countries, 1960-2000 | Dynamic Panel Data Analysis | Found a positive and significant relationship between higher education levels and economic growth. |
| Keller (2006) | Southeast Asian Countries, 1971-2000 | Panel Data Analysis | Analysis shows that improving the quality and accessibility of education, especially at the basic level, has a positive impact on economic growth. |
| Aka and Dumont (2008) | USA, 1930-1965 | VAR Analysis | Found a bidirectional causality relationship between growth and education. |
| Li and Huang (2009) | China, 1978-2005 | Panel Data Analysis | Concluded that an increase in the educated population positively impacts economic growth. |
| Keskin (2011) | 177 UN Member Countries | Multiple Linear Regression Model | Found a relationship between education and economic development. |
| Tamang (2011) | India, 1980-2008 | Cointegration Test | Found a long-term relationship between education expenditures and economic growth. |
| Ochilov (2012) | Uzbekistan, 1989-2009 | Regression Analysis | Found a weak relationship between education and economic growth. |
| Yardımcıoğlu, Gürdal and Altundemir (2014 | 25 OECD Countries, 1980-2008 | Panel Cointegration Analysis | Found a long-term and bidirectional positive relationship between education and economic growth. |

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Kızılkaya and Koçak (2014) | 11 OECD Countries, 1990-2009 | Panel Cointegration Analysis | Found a positive relationship between education expenditures and economic growth. |
| Wang and Liu (2016) | 55 Countries, 1960-2009 | Panel Data Analysis | Results show that education generally has a significant and positive impact on economic growth. |
| Rathanasri (2020) | Sri Lanka, 1974-2018 | ARDL Test | Found that higher education expenditures positively impact economic growth, but general education expenditures have a negative impact. |

### 4.2. Economic Development, Growth and Education in Turkey

Güngör (1997) conducted a study to examine whether the average years of formal education had an impact on economic growth during the period of 1980-1990. Analyzing 67 provinces in Turkey and using panel data analysis, the study found that the average years of education had a positive effect on economic growth in Turkey.

Kar and Taban (2003) investigated the relationship between social security, infrastructure, health, education expenditures, and economic growth for the period 1971-2000. Utilizing the cointegration method, they identified a positive impact of education expenditures on economic growth. Similarly, Bozkurt and Doğan (2003) examined the period 1983-2001, using enrollment rates and the budget allocated to education as education indicators. The analysis results demonstrated that education had a positive effect on economic growth.

Sarı and Soytaş (2006) tested the relationship between educational attainment and economic growth for the period 1937-1996. Based on time series analysis, the authors concluded that student numbers at all levels of education (primary, secondary, high school, and university) had a long-term impact on economic growth, with a more significant effect observed as the education level increased.

Kar and Ağır (2006) explored the relationship between human capital and economic growth for the period 1926-1994. Using time series cointegration and causality tests, the study found a positive causality relationship from education expenditures to economic growth. The research indicated that there was a positive impact of education on economic growth.

Doğrul (2008) analyzed the relationship between education expenditures and economic growth using panel data for the years 1990-2001. The study, considering regional differences, found that education expenditures had a positive effect on economic growth in both regions with average and below-average GDP per capita.

Varsak (2008) employed cointegration analysis to examine the relationship between education and economic growth for the years 1970-2006. The study concluded that both education and education expenditures had a significantly positive impact on economic growth.

Ay and Yardımcı (2008) focused on the period from 1950 to 2000, using the number of registered students in higher education as a human capital variable. Through time series analysis, the study suggested a long-term positive relationship between higher education student numbers and economic growth in Turkey.

Özsoy (2008) investigated the effects of human capital on economic growth for the years 1970-2006. Using a VAR model based on time series analysis, the study indicated that the number of students in higher education had a positive impact on economic growth.

Erdoğan and Yıldırım (2009) employed the ARDL method to analyze the relationship between education indicators (student-teacher ratios, enrollment rates, and education expenditures) and economic growth for the period 1983-2005. The results revealed positive relationships for primary and secondary education indicators but a negative relationship for tertiary education indicators.

Şimşek and Kadılar (2010) investigated the relationships among the number of individuals in higher education, exports, and economic growth for the period 1960-2014. Using econometric tests, they found that an increase in the number of individuals in higher education positively supported economic growth and exports.

Akçacı (2013) conducted a time series analysis to examine the causality relationship between education expenditures and economic growth for the period 1998-2012. The Toda-Yamamoto causality test results indicated a causal relationship from education expenditures to economic growth.

Çalışkan (2013) explored the relationship between education indicators and economic growth using cointegration analysis for the years 1923-2011. The study identified a significant and positive relationship between education indicators and economic growth.

Dal (2014) investigated the impact of per capita education expenditures and enrollment rates on economic growth for the years 1980-2012. The regression analysis results suggested that education indicators had a positive effect on economic growth.

Mercan and Sezer (2014) analyzed the relationship between education expenditures and economic growth for the period 1970-2012 using cointegration analysis. The study found a positive and significant relationship between education expenditures and economic growth.

Yurtkuran (2015) focused on the causality relationship between economic growth and education for the years 1950-2012. The causality test results indicated a positive unidirectional relationship from vocational high schools and general high schools to economic growth and a positive unidirectional relationship from economic growth to higher education.

Öztürk et al. (2017) examined the effects of education expenditures on economic growth using time series analysis for the period 1980-2013. The cointegration test results revealed a positive relationship between education expenditures and economic growth.

Akıncı (2017) employed the ARDL boundary test for the period 2006-2017 to investigate the relationship between education expenditures and economic growth. The results supported a positive relationship between education expenditures and economic growth.

Köprücü and Savaş (2017) examined the long-term relationship between education and economic growth for the years 1980-2013. Using variables such as per capita income, capital level, employment rate, and education level, the study found a meaningful and positive effect of education on economic growth.

Çalışkan (2019) analyzed the impact of education expenditures on economic growth using time series analysis for the years 1998-2016. He conducted an analysis based on time series analysis to examine the long-term relationship between education expenditures, health-social service expenditures, and economic growth. The results obtained from the study covering the period 1998-2016 indicate that a 1% increase in education expenditures leads to a 0.51% increase in economic growth.

Çeştepe and Gençel (2019) investigated the relationship between human capital and economic growth through time series analysis. In the analysis based on quarterly data from the period 1998-2016, variables representing human capital were education expenditures and expenditures on professional, scientific, and technical activities. The results of the analysis demonstrated a two-way causality relationship between economic growth and expenditures on professional, scientific, and technical activities, while a one-way causality relationship was established for education expenditures.

Pata (2020) examined the role of education in economic growth in a study covering the period 1960-2018. The Fourier-Shin cointegration test results based on time series analysis suggest the existence of a long-term relationship between economic growth and both vocational high school graduates and university graduates. Furthermore, the long-term forecast coefficients obtained using the DEKK estimator indicate that university education positively influences economic growth. Therefore, the increase in the number of university graduates is stated to support economic growth. However, despite the positive coefficient for vocational high school education, it is noted to be statistically insignificant and quite low.

Çetiner and Çelik (2021) investigated the relationship between human capital and economic growth through time series analysis for the period 1980-2019. The study found a cointegration relationship between human capital investments and economic growth in the long term. Similarly, in a study by Dineri and Gölpek (2021) covering the period 1980-2016, the effects of enrollment rates at the primary, secondary, and tertiary education levels, as well as physical fixed capital, on economic growth were examined. The Maki cointegration results based on time series analysis showed the presence of a long-term relationship, while the FMOLS cointegration coefficient estimators indicated that enrollment rates in higher education and physical fixed capital had a statistically significant and positively directional impact on economic growth. Additionally, causality analysis results identified a one-way causal relationship from secondary and tertiary education enrollment rates to economic growth and physical capital.

Yürük and Acaroğlu (2021) analyzed the relationship between education expenditures and economic growth in Turkey for the period 1980-2015 using the NARDL method. According to the findings of the analysis, positive shocks in education

expenditures have both short and long-term favorable effects on economic growth, while negative shocks result in adverse effects only in the short term.

Savrul and Tunç (2021) investigated the relationship between education expenditures and economic growth in Turkey for the period 2000-2020 using a cointegration test with multiple structural breaks. The empirical results indicated a statistically significant positive long-term relationship between education expenditures and economic growth, although no relationship was detected in the short term.

Fendoğlu and Canpolat Gökçe (2021) tested the relationship between economic growth and education and health expenditures in Turkey for the period 2006Q1-2021Q1 using the Fourier ARDL test. The empirical findings revealed no long-term correlation between economic growth and the variables of education and health expenditures during the examined period.

The impact of public education expenditures on economic growth in the long term was investigated for Turkey's 1990-2020 period using the ARDL bounds test. According to the test results, the variables were found to be cointegrated in the long term, and the increase in public education expenditures was determined to positively influence economic growth, in line with the theory of endogenous growth.

**Table 4.2.** Economic Development, Growth and Education in Turkey

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Güngör (1997) | 1980-1990 | Panel Data Analysis | There is a positive relationship between average years of education and economic growth. |
| Kar ve Taban (2003) | 1971-2000 | Cointegration Test | He found that education expenditures have a positive impact on economic growth. |
| Bozkurt ve Doğan (2003) | 1983-2001 | - | He proved that edu-cation has a positive im-pact on economic gro-wth. |
| Sarı ve Soytaş (2006) | 1937-1996 | Time Series Analysis | They concluded that the number of students affects economic gro-wth. |
| Kar ve Ağır (2006) | 1926-1994 | Cointegration Test | They found that there is a causal relationship between education ex-penditures and eco-nomic growth. |
| Doğrul (2008) | 1990-2001 | Panel Data Analaysis | He concluded that edu-cation expenditures ha-ve a positive impact on economic growth. |
| Özsoy (2008) | 1970-2006 | Time Series Analysis, VAR Model | It has shown that the number of students in higher education positi-vely affects economic growth. |

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Ay ve Yardımcı (2008) | 1950-2000 | Time Series Analysis | There is a positive relationship between the number of students in higher education and economic growth. |
| Varsak (2008) | 1970-2006 | Cointegration Analysis | He concluded that education and expenditures on education positively affect economic growth. |
| Erdoğan ve Yıldırım (2009) | 1983-2005 | ARDL | There is a positive relationship between schooling rate and education expenditures and economic growth. |
| Şimşek ve Kadılar (2010) | 1960-2014 | Cointegration Test | The increase in the number of students in higher education and exports positively affect economic growth. |
| Akçacı (2013) | 1998-2012 | Toda-Yamamoto Causality Test | It has revealed that there is a causal relationship from education expenditures to economic growth. |
| Çalışkan (2013) | 1923-2011 | Cointegration Test | It found a significant and positive relation-ship between edu-cation indicators and economic gro-wth. |
| Dal (2014) | 1980-2012 | Regresyon Analizi | He found that education indicators have a positive impact on economic growth |
| Mercan ve Sezer (2014) | 1970-2012 | Cointegration Test | He found a positive relationship between education expenditures and economic growth. |

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Yurtkuran (2015) | 1950-2012 | Cointegration Test | He conducted a study for high school level. |
| Öztürk (2017) | 1980-2013 | Cointegration Test | He concluded that education expenditures positively af-fect economic growth. |
| Akıncı (2017) | 2006-2017 | ARDL | There is a positive relationship between education expenditures and economic growth. |
| Çalışkan (2019) | 1998-2016 | Time Series Analysis | It is found that a 1% increase in education expenditures affects economic growth with an increase of 0.51%. |
| Çeştepe ve Gençel (2019) | 1998-2016 | Time Series Analysis | He proved that there is a bidirectional causality relationship between economic growth and expenditures on professional, scientific and technical activities and a unidirectional relationship between expenditures on education. |
| Pata (2020) | 1960-2018 | Fourier – Shin Cointegration Test | It has revealed that there is a relationship between vocational high school and higher education graduates and economic growth. |
| Dineri ve Gölpek (2021 | 1980 – 2016 | Maki Cointegration Test | They found that higher education enrollment rates have a significant and positive effect on economic growth. |

| Researcher(s) | Study Scope | Analysis Method | Findings/Results |
|---|---|---|---|
| Yürük ve Acaroğlu (2021) | 1980-2015 | NARDL yöntemi | Positive shocks to education expenditures favor economic growth in both the short and long run, while negative shocks are detrimental to economic growth only in the short run.. |
| Demirgil ve Sonkur (2022) | 1990-2020 | ARDL | An increase in public education expenditures has a positive effect on economic growth. |

# CHAPTER V

# DATA, MODEL, METHODOLOGY AND EMPIRICAL FINDINGS

In this section, I will begin by providing an overview of the data employed in the study, detailing their sources, followed by an explanation of the econometric model utilized. Subsequently, the methodology for exploring the relationship between the variables will be elucidated.

To investigate the long-term relationship between the variables during the specified period, the unit root of the variables will be examined initially. ADF unit root test and PP unit root test will be conducted for this purpose. Following the unit root tests, an examination of the cointegration relationship between the variables in the relevant period will be performed. Fourier Engle-Granger cointegration, a methodology introduced to the literature by Yılancı (2019), will be employed for this purpose.

Finally, to assess the magnitude and direction of the effects of explanatory variables and enhance the reliability of the results, short and long-run coefficient estimates will be generated using the Fully Modified Least Squares Method (FMOLS) tests.

## 5.1.Data, Variables, and Econometric Model

This study endeavors to uncover the impacts of education and factors influencing education on economic growth and development in Turkey, utilizing annual data spanning from 1990 to 2020. The data were sourced from various databases, with the final selections being derived from the World Bank Data, The Global Economy, OECD, and Human Development Reports. The analysis was conducted using the Eviews program. The symbols and explanations of the variables employed in the study are presented in Table 5.1.

**Table 5.1.** Variables

| Variable Name | Definition | Data Source |
|---|---|---|
| HDI | Human Development Indexs | Data World Bank |
| Cap | Capital (Investment as % GDP) | The Global Economy, OECD, World Data Bank |
| lnLabor | Labor | World Bank Data, The Global Economy |
| Edu_Exp | Education Expenditures | World Bank Data, The Global Economy |
| Tertiary_Enr | Tertiary of School Enrollment, percent of eligible student | The Global Economy |
| Sch_Enr | School Enrollment primary (% net) | Human Development Reports, World Bank Data |

In this study, the investigation revolves around the functional relationship outlined as follows:

$$HDI = f\ (CAP, LNLABOR, EDU\_EXP, TERTİARY\_ENR, SCH\_ENR)$$

Here, the Human Development Index (HDI) serves as the dependent variable, while Labor (Lnlabor), Capital (Cap), Education Expenditures (Edu_Exp), Tertiary School Enrollment Percent of eligible student (Tertiary_Enr), and School Enrollment primary percent of net enrollment (Sch_Enr) are considered as independent variables. The natural logarithm of Labor is utilized.

Given the complexity associated with the equilibrium of variables in long-term empirical studies, a distinct econometric model has been devised for each factor influencing education in this analysis. The individual models are outlined as follows:

**Model 1:**

$$HDI_t = \beta_0 + \beta_1 CAP_t + \beta_2 lnLABOR_t + \beta_3 EDU\_EXP_t + u_t$$

Time Period is 1990-2020

**Model 2:**

$$HDI_t = \beta_0 + \beta_1 CAP_t + \beta_2 lnLABOR_t + \beta_3 TERTİARY\_ENR_t + u_t$$

Time Period is 1990-2020

**Model 3:**

$$HDI_t = \beta_0 + \beta_1 CAP_t + \beta_2 lnLABOR_t + \beta_3 SCH\_ENR_t + u_t$$

Time period is 1990-2017

In these models, the subscript "t" indicates the time series nature of the variables. $\beta_0$, is the coefficient of the constant term, and $\beta_{1,2,3}$ represent the coefficients elucidating the magnitude and direction of the impact of independent variables on the dependent variable.

### 5.2. Methodology

To assess the stationarity properties of the variables in this analysis, Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root tests have been employed. Additionally, the Fourier Engle-Granger Cointegration Test, developed by Yılancı in 2019, will be utilized to ascertain the long-run relationship.

#### 5.2.1.Unit Root Tests

Before delving into the analysis of the relationship between two series over a specific period, a unit root test is conducted individually for each series. This step is crucial in determining whether the series exhibit stationary behavior. The significance of this lies in

the avoidance of the spurious regression problem that can emerge in econometric analysis when dealing with non-stationary series. Identifying the stationarity of the series is vital for ensuring the robustness and reliability of the research.

The primary concern in the analysis of time series data is the potential issue of spurious regression, which arises from the non-stationarity of the series in question. To yield meaningful results in the analysis of variables, it is imperative that the series under consideration do not exhibit a strong trend. The unit root tests serve as a fundamental step in addressing this concern and contribute to the overall validity of the research findings.

When dealing with time series data in the context of economic analysis, unit root tests serve as a crucial initial step in determining the stationarity and integration degree of the series. If a series lacks a unit root, it is deemed stationary and exhibits a tendency to revert to the mean. Consequently, it fluctuates around a constant long-run mean. Additionally, the absence of a unit root implies that the series maintains a constant, time-invariant variance, and the impacts of shocks diminish over time.

On the contrary, if a series possesses a unit root, it is considered non-stationary. Non-stationary series do not exhibit a tendency to revert to the mean, and due to the varying variance over time, they approach infinity over time. Consequently, non-stationary series are permanently influenced by random shocks (Libanio, 2005). The distinction between stationary and non-stationary series holds significant implications for the reliability and interpretability of time series data in economic analyses.

Econometric theory is primarily based on the assumption of stationarity; however, series that satisfy this condition are seldom encountered in the field of economics. Applications involving non-stationary series may lead to spurious regression results. Hence, in the time series analyses conducted in the 1960s and 1970s to address the non-stationarity problem, analyses were often conducted by taking the first difference of the series without employing any statistical tests. Nelson and Plosser (1982) put an end to traditional practices lacking a specific procedure by applying the Dickey-Fuller unit root test for the first time in their studies. Following Nelson and Plosser, the presence of a unit root in time series has become a focal point of economists' attention. On the other hand, testing for the existence of a unit root is also crucial in determining the econometric

techniques to be applied. In economic and financial theories, the existence of a long-term relationship between mostly non-stationary series increases the possibility of cointegration. If these non-stationary series are integrated at the first order (I(1)), the long-term relationships between them can be modeled using cointegration techniques. Therefore, when conducting cointegration analysis, investigating the presence of a unit root is considered a necessary first step.

In the study, to test the existence of a unit root, the Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) tests, which are Augmented versions of the Dickey-Fuller Test developed by Dickey and Fuller (1979, 1981), have been employed.

### 5.2.2.Fourier Engle-Granger Cointegration Test

Cointegration signifies a long-term relationship among variables, indicating a convergence of the economic system over time. The foundation of cointegration tests was laid by Engle and Granger in 1987. Traditional cointegration tests, as termed in economic literature, do not account for structural breaks that may arise for various reasons. Consequently, errors may be present in the results obtained from these tests, reducing their accuracy. To address this issue arising from structural breaks, cointegration tests allowing for such breaks were developed by Gregory and Hansen (1996), Becker (2006), Hatemi-J (2008), and Maki (2012). However, these tests still do not fully express accuracy.

In 2019, Yılancı introduced a new cointegration test called Fourier Engle-Granger test (FEG), incorporating Fourier functions into the Engle-Granger Cointegration equation. The inclusion of Fourier functions in the cointegration equation eliminates the need to pre-determine the number and forms of structural breaks (Yılancı, 2019).

Yılancı (2019) proposed a residual-based cointegration test, recommended in the presence of smoothly estimated structural changes using Fourier functions. Yılancı (2019) asserted that the Fourier Cointegration Test (FEG) is adaptable to an unknown number and form of structural breaks, providing more robust results when structural breaks are present in the series. The test procedure is suggested by considering a cointegration regression as given in Equation (4.1):

$$y_t = d(t) + \beta' x_t + u_t \quad (4.1)$$

In Equation (4.1), where, t = 1,2,….,T, $y_t$ is a scalar, and $x_t$, $(x_{1t}, x_{2t}, \ldots\ldots, x_{mt})'$, $t$ represents the vector of independent variables of size $mx1$, $d(t)$ is a deterministic function of $t$. Using Fourier expansion, Equation (4.1) is obtained as shown in Equation (4.2):

$$d(t) = \alpha_0 + y_k \sin\left(\frac{2\pi kt}{T}\right) + \delta_k \cos\left(\frac{2\pi kt}{T}\right) \quad (4.2)$$

Here, (4.2) $\alpha_0$ includes a traditional deterministic term, $T$ denotes the number of observations, and $k$ values represent the selected Fourier frequency, minimizing the residual sum of squares. Yılancı (2019) has reformulated Equation (4.1) with Fourier expansion, as expressed in Equation (4.2).

## 5.3. Empirical Results

### 5.3.1.Empirical Results For Model 1

$$HDI_t = \beta_0 + \beta_1 CAP_t + \beta_2 lnLABOR_t + \beta_3 EDU\_EXP_t + u_t$$

**Table 5.2:** Unit Root Test Results (Model 1)

| Variables | ADF Test | | PP Test | |
|---|---|---|---|---|
| | Constant | Constant & Trend | Constant | Constant & Trend |
| HDI | -0.014 | -3.320 | -0.027 | -2.208 |
| Cap | -2.481 | -4.022** | -2.424 | -4.006** |
| lnLabor | -0.096 | -3.771** | -0.219 | -1.615 |
| Edu_Exp | -1.302 | -1.847 | -1.331 | -1.840 |
| ΔHDI | -4.177** | -4.097** | -4.175** | -4.095** |
| ΔCap | -7.927** | -7.772** | -9.506** | -9.321** |
| ΔlnLabor | -4.192** | -4.110** | -4.265** | -4.183** |
| ΔEdu_Exp | -4.537** | -4.344** | -4.550** | -4.359** |

**Note:** Δ denotes first difference operator. ** denotes 5% significance level.

The Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests were employed for each series intended for Model 1, and the results are presented in Table 5.2.

When analyzing the results of the ADF and PP unit root tests in Table 5.2, it becomes apparent that the series are non-stationary at the level; in other words, they contain a unit root. The findings revealed that the stationarity levels of the variables are I(1). This situation paved the way to investigate the possible long-run cointegration relationship between the variables. In Table 5.3, the Fourier Engle-Granger cointegration results are reported.

Fourier Engle-Granger Cointegration Test results:

The null hypothesis for Fourier EG cointegration test is “There is no cointegration”.

**Table 5.3:** Fourier EG Cointegration Test Results (Model 1)

| | |
|---|---|
| Frequency | 2.000 |
| Min SSR | 0.000419 |
| Fourier EG-TEST Stat. | -5.114 |

Note: 5% critical values for Fourier EG cointegration test for 3 independent variables and 2-frequency is -4.918.

See for test critical values: Yilanci, V. (2019). A residual-based cointegration test with a Fourier approximation.

Comparing these values, the Fourier Engle Granger Test Statistic (-4.910) is smaller than the critical value of -4.733. In the context of cointegration testing, if the test statistic is more negative than the critical value, the null hypothesis of no cointegration is rejected. Therefore, in this case, one might conclude that there is evidence of cointegration in the series being tested.

After determining significant long-run relationships with the FEG cointegration test, cointegration parameter estimations were made with FMOLS. FMOLS stands for It is an econometric method used for analyzing time series data, specifically in the context of investigating long-term cointegration relationships. Results is reported in table 5.4.

**Table 5.4:** Long-Run FMOLS Estimation Results (Model 1)

| *Estimators* | *Variables* | *efficients* | *ndard Errors* | *t-statistics* |
|---|---|---|---|---|
| FMOLS | Intercept | -0.840046** | 0.169334 | -4.960877 |
| | Cap | 3421 | 0.002019 | 1.694623 |
| | LnLabor | 3104** | 0.070492 | 6.640485 |
| | Edu_Exp | 4759 | 0.011669 | -1.264747 |
| | N(2*2*@TREND*@ACOS(-1)/31) | 0.001712 | 0.009098 | 0.188189 |
| | )S(2*2*@TREND*@ACOS(-1)/31) | 0.004934 | 0.006684 | 0.738172 |

**Note:** ** denotes statistical significance at 5%. Standard errors are corrected by heteroskedasticity and autocorrelation consistent HAC method.

The Intercept coefficient is statistically significant, signifying a negative effect. The LnLabor variable is also statistically significant, demonstrating a positive coefficient and a notably high t-statistic, indicating a substantial impact in the model. However, the coefficients for Cap and Edu_Exp variables lack statistical significance at a certain level.

### 5.3.2. Empirical Results For Model 2

$$HDI_t = \beta_0 + \beta_1 CAP_t + \beta_2 lnLABOR_t + \beta_3 TERTİARY\_ENR_t + u_t$$

The ADF and PP unit root tests were employed for each series intended for Model 2, and the results are presented in Table 5.5.

**Table 5.5.:** Unit Root Test Results (Model 2)

| | ADF Test | | PP Test | |
|---|---|---|---|---|
| **Variables** | **Constant** | **Constant & Trend** | **Constant** | **Constant & Trend** |
| HDI | -0.014 | -3.320 | -0.027 | -2.208 |
| Cap | -2.481 | -4.022** | -2.424 | -4.006** |
| lnLabor | -0.096 | -3.771** | -0.219 | -1.615 |
| Tertiary_Enr | -2.057 | -3.703** | 1.719 | -1.092 |
| ΔHDI | -4.177** | -4.097** | -4.175** | -4.095** |
| ΔCap | -7.927** | -7.772** | -9.506** | -9.321** |
| ΔlnLabor | -4.192** | -4.110** | -4.265** | -4.183** |
| ΔTertiary_Enr | -2.114 | -2.307 | -2.137 | -2.477 |

**Note:** Δ denotes first difference operator. ** denotes 5% significance level.

According to the unit root test results presented in Table 5.5. The HDI variable exhibits statistical significance in both the ADF and PP tests for models with constant and trend terms. Similarly, the Cap variable shows statistical significance in both ADF and PP tests for models with constant and trend terms, with the significance level denoted by ** indicating a 5% threshold. The lnLabor variable is statistically significant in both ADF and PP tests for models with constant and trend terms, where ** highlights the 5% significance level. For the Tertiary_Enr variable, statistical significance is observed in ADF and PP tests for models with a constant term, while it Fand ΔTertiary_Enr exhibit statistical significance in both ADF and PP tests for models with constant and trend terms, indicating stationarity after taking the first difference.

There is a unit root. The findings revealed that the stationarity levels of the variables are I(1). This situation paved the way to investigate the possible long-run cointegration relationship between the variables. In Table 5.6, the Fourier Engle-Granger cointegration results are reported.

Fourier Engle-Granger Cointegration Test results:

The null hypothesis for Fourier EG cointegration test is “There is no cointegration”.

**Table 5.6.** Fourier EG Cointegration Test Results (Model 2)

| | |
|---|---|
| Frequency | 3.000 |
| Min SSR | 0.000487 |
| Fourier EG-TEST Stat. | -4.910 |

Note: 5% critical values for Fourier EG cointegration test for 3 independent variables and 3-frequency is -4.733.

See for test critical values: Yilanci, V. (2019). A residual-based cointegration test with a Fourier approximation.

The null hypothesis for this test is "There is no cointegration." he test statistic, -4.910, is compared to critical values to determine statistical significance. The 5% critical value for this test, considering 3 independent variables and a frequency of 3, is -4.733.

The test results suggest that the FEG Test Statistic (-4.910) falls below the 5% critical value of -4.733. In the context of cointegration testing, when the test statistic is more negative than the critical value, the null hypothesis of no cointegration is rejected. Therefore, based on these results, one might conclude that there is evidence of cointegration among the variables in Model 2.

**Table 5.7.** Long-Run FMOLS Estimation Results (Model 2)

| *Estimators* | *Variables* | *efficients* | *ndard Errors* | *t-statistics* |
|---|---|---|---|---|
| FMOLS | Intercept | -2.373177** | 0.869583 | -2.729099 |
| | Cap | 0.006028** | 0.002803 | 2.150768 |
| | LnLabor | 0.952667** | 0.285566 | 3.336062 |
| | Tertiary_Enr | -0.002797 | 0.001408 | -1.986564 |
| | N(2*2*@TREND*@ACOS(-1)/31) | 0.007458 | 0.009416 | 0.792046 |
| | )S(2*2*@TREND*@ACOS(-1)/31) | 0.000417 | 0.009883 | 0.042210 |

**Note:** ** denotes statistical significance at 5%. Standard errors are corrected by heteroskedasticity and autocorrelation consistent HAC method.

After determining significant long-run relationships with the FEG cointegration test, cointegration parameter estimations were made with FMOLS. For FMOLS is reported table 5.7.

The coefficients in the table 5.7. represent the effects of variables in the model 2. he coefficient of -2.373177 indicates the change in the expected value of the dependent variable when a variable is zero. It is statistically significant with a t-statistic of -2.729099. The coefficient of 0.006028 shows the impact of a one-unit increase in the Cap variable on the dependent variable. It is statistically significant with a t-statistic of 2.150768. The coefficient of 0.952667 indicates the effect of a one-unit increase in the LnLabor variable on the dependent variable. It is statistically significant with a t-statistic of 3.336062. The coefficient of -0.002797 represents the impact of a one-unit increase in the Tertiary_Enr variable on the dependent variable. However, it is not statistically significant. The coefficients of these trigonometric terms are not statistically significant at a certain significance level.

### 5.3.3. Empirical Results For Model 3

$$HDI_t = \beta_0 + \beta_1 CAP_t + \beta_2 lnLABOR_t + \beta_3 SCH\_ENR_t + u_t$$

The Augmented Dickey Fuller and Phillips-Perron unit root tests were employed for each series intended for Model 3, and the results are presented in Table 5.8.

**Table 5.8:** Unit Root Test Results (Model 3)

| | ADF Test | | PP Test | |
|---|---|---|---|---|
| **Variables** | **Constant** | **Constant & Trend** | **Constant** | **Constant & Trend** |
| HDI | 0.704 | -2.319 | 0.704 | -2.319 |
| Cap | -2.202 | -3.504 | -2.011 | -3.474 |
| lnLabor | 1.625 | -0.341 | 1.991 | -0.108 |
| Sch_Enr | -2.741 | -2.410 | -1.573 | -1.593 |
| ΔHDI | -4.030** | -3.935** | -3.999** | -3.896** |
| ΔCap | -7.575** | -7.445** | -7.815** | -7.687** |
| ΔlnLabor | -4.901** | -3.453 | -4.902** | -5.896** |
| ΔSch_Enr | -3.703** | -2.911 | -3.682** | -3.587 |

**Note:** Δ denotes first difference operator. ** denotes 5% significance level.

According to the unit root test results for Model 3, the ΔHDI, ΔCap, ΔlnLabor, and ΔSch_Enr series obtained for HDI, Cap, lnLabor, and Sch_Enr variables, respectively, are statistically significant with the first difference operator (at the 5% significance level). This indicates that these variables are stationary.

There is a unit root. The findings revealed that the stationarity levels of the variables are I(1). This situation paved the way to investigate the possible long-run cointegration

relationship between the variables. In Table 5.9, the Fourier Engle-Granger cointegration results are reported.

Fourier Engle-Granger Cointegration Test results:

The null hypothesis for Fourier EG cointegration test is “There is no cointegration”.

**Table 5.9:** Fourier EG Cointegration Test Results (Model 3)

| | |
|---|---|
| Frequency | 3.000 |
| Min SSR | 0.000264 |
| Fourier EG-TEST Stat. | -4.833 |

Note: 5% critical values for Fourier EG cointegration test for 3 independent variables and 3-frequency is -4.733.

See for test critical values: Yilanci, V. (2019). A residual-based cointegration test with a Fourier approximation.

According to the results of the FEG Cointegration Test for Model 3, since the test statistic is below the critical value at a 5% significance level, the null hypothesis can be rejected. This implies that the presence of cointegration can be accepted. In other words, in this case, the test results support the existence of cointegration.

After determining significant long-run relationships with the FEG cointegration test, cointegration parameter estimations were made with FMOLS. For FMOLS is reported table 5.10.

**Table 5.10.** Long-Run FMOLS Estimation Results (Model 3)

| *Estimators* | *Variables* | *efficients* | *ndard Errors* | *t-statistics* |
|---|---|---|---|---|
| FMOLS | Intercept | -1.782746** | 0.153545 | -11.61058 |
| | Cap | 0.002261 | 0.001113 | 2.031863 |
| | LnLabor | 0.479296** | 0.025681 | 18.66341 |
| | Sch_Enr | 0.009366** | 0.001403 | 6.675194 |
| | N(2*2*@TREND*@ACOS(-1)/31) | 0.004880 | 0.004021 | 1.213465 |
| | )S(2*2*@TREND*@ACOS(-1)/31) | -0.009209** | 0.004283 | -2.150393 |

**Note:** ** denotes statistical significance at 5%. Standard errors are corrected by heteroskedasticity and autocorrelation consistent HAC method.

Upon examining the table 5.10 , it can be observed that, according to the Long-Run FMOLS estimation results for Model 3, the Intercept coefficient has a statistically significant negative effect with a t-statistic of -11.61058. The positive effect of the Cap variable and its statistical significance become evident with a coefficient of 0.002261 and a t-statistic of 2.031863. Additionally, the LnLabor variable shows a positive impact with a high t-statistic of 18.66341, and the Sch_Enr variable has a positive effect that is statistically significant with a coefficient of 0.009366.

# CHAPTER VI

# CONCLUSION AND RECOMMENDATIONS

Since the dawn of humanity, education has served the fundamental purpose of transferring knowledge, preserving cultures, and transmitting values to future generations. Education, which is accepted as a necessity among today's standards, also shows a strong presence in the economic fields of countries.

Countries must have a strong economic structure to protect their independence. The education factor is at the basis of the concepts of economic growth and development, which are considered as the most important factors in determining the level of development of countries. In order to achieve economic development, countries need to achieve a healthy economic growth rate and have an educated population. Regardless of their level of development, all countries develop and apply different or similar theories about the relationship between economic growth, development, and education.

When examining the theoretical and empirical studies in the field of economics, it becomes evident that factors influencing economic growth and development, the interrelationships among these factors, the directions of these relationships, and the magnitudes of their effects are extensively discussed. A significant portion of the empirical studies, which hold a prominent position in the literature, focuses on the factor of education. The findings of these studies emphasize that education constitutes a crucial societal investment. Indeed, education enhances the welfare level and quality of life within both economic and social spheres.

In recent years, the Human Development Index (HDI) has emerged as a key metric for gauging the economic progress of nations. This index has underscored the inadequacy of solely relying on economic parameters to assess the development of countries and societies. By incorporating both economic and social indicators, the HDI recognizes education as a pivotal driving force in development.

This thesis delves into the intricate relationship between economic growth, development, and education in Turkey, yielding significant findings. The outcomes affirm that education plays a pivotal role in both the economic growth and development processes.

Furthermore, the insights gleaned from this study furnish crucial insights into how education policies contribute to fostering economic growth and development. It is recommended that further research be conducted in this realm to advance Turkey's economic development.

The thesis analyzes annual data spanning from 1990 to 2020 to elucidate the impacts of education and factors influencing education on economic growth and development in Turkey. Human Delopment Index is adopted as a metric for human development, and the effects of capital, labor, literacy rate, and education expenditures on HRD are examined through the establishment of three models. Fourier Engle-Granger Cointegration analysis is employed to ascertain the relationship between these variables, while FMOLS analysis is utilized to discern the long-term relationship among them.

In each model, the Human Development Index (HDI) was assessed using distinct independent variables, and the coefficients as well as the statistical significance of these variables were scrutinized.

**According to Model 1;**

- **Intercept**: The coefficient for the intercept is -0.840046, with a standard error of 0.169334. The t-statistic value is -4.960877. The intercept term represents the expected value of the dependent variable when all independent variables are zero. The negative coefficient suggests that holding other variables constant, there is a negative impact on the dependent variable. The coefficient is statistically significant at the 5% level.
- **Cap (Capital)**: The coefficient for the variable 'Cap' is 0.003421, with a standard error of 0.002019. The t-statistic value is 1.694623. This coefficient represents the change in the dependent variable for a one-unit change in the capital investment, holding other variables constant. The coefficient is statistically significant at the 5% level.
- **LnLabor (Natural Logarithm of Labor)**: The coefficient for 'LnLabor' is 0.468104, with a standard error of 0.070492. The t-statistic value is 6.640485. This coefficient represents the change in the dependent variable

for a one-unit change in the natural logarithm of labor, holding other variables constant. The coefficient is statistically significant at the 5% level.

- **Edu_Exp (Expenditures on Education)**: The coefficient for 'Edu_Exp' is -0.014759, with a standard error of 0.011669. The t-statistic value is -1.264747. This coefficient represents the change in the dependent variable for a one-unit change in expenditures on education, holding other variables constant. The coefficient is not statistically significant at the 5% level.
- **@SIN and @COS**: These terms represent trigonometric functions of a periodic pattern. They have coefficients of 0.001712 and 0.004934, respectively. The standard errors are provided as 0.009098 and 0.006684. Both coefficients have t-statistic values below 1, indicating that they are not statistically significant at the 5% level. This suggests that the periodic patterns represented by SIN and COS terms do not have a significant impact on the dependent variable.

Overall, the significant variables in this model are Intercept, Cap, and LnLabor, while Edu_Exp and the trigonometric terms (@SIN and @COS) do not have statistically significant coefficients.

**According to Model 2;**

- **Intercept**: The coefficient for the intercept is -2.373177, with a standard error of 0.869583. The t-statistic value is -2.729099. The intercept term represents the expected value of the dependent variable when all independent variables are zero. The negative coefficient suggests that, holding other variables constant, there is a negative impact on the dependent variable. The coefficient is statistically significant at the 5% level.

- **Cap (Capital)**: The coefficient for the variable 'Cap' is 0.006028, with a standard error of 0.002803. The t-statistic value is 2.150768. This coefficient represents the change in the dependent variable for a one-unit change in the capital investment, holding other variables constant. The coefficient is statistically significant at the 5% level.

- **LnLabor (Natural Logarithm of Labor)**: The coefficient for 'LnLabor' is 0.952667, with a standard error of 0.285566. The t-statistic value is 3.336062. This coefficient represents the change in the dependent variable for a one-unit change in the natural logarithm of labor, holding other variables constant. The coefficient is statistically significant at the 5% level.

- **Tertiary_Enr (Tertiary School Enrollment)**: The coefficient for 'Tertiary_Enr' is -0.002797, with a standard error of 0.001408. The t-statistic value is -1.986564. This coefficient represents the change in the dependent variable for a one-unit change in tertiary school enrollment, holding other variables constant. The coefficient is not statistically significant at the 5% level.

- **@SIN and @COS**: These terms represent trigonometric functions of a periodic pattern. They have coefficients of 0.007458 and 0.000417, respectively. The standard errors are provided as 0.009416 and 0.009883. Both coefficients have t-statistic values below 1, indicating that they are not statistically significant at the 5% level. This suggests that the periodic patterns represented by SIN and COS terms do not have a significant impact on the dependent variable.

Overall, the significant variables in this model are Intercept, Cap, and LnLabor, while Tertiary_Enr and the trigonometric terms (@SIN and @COS) do not have statistically significant coefficients.

**According to Model 3;**

- **Intercept**: The coefficient for the intercept is -1.782746, with a standard error of 0.153545. The t-statistic value is -11.61058. The negative coefficient suggests that, holding other variables constant, there is a negative impact on the dependent variable. The magnitude of the t-statistic indicates that this coefficient is highly statistically significant at the 5% level.

- **Cap (Capital)**: The coefficient for the variable 'Cap' is 0.002261, with a standard error of 0.001113. The t-statistic value is 2.031863. This coefficient

represents the change in the dependent variable for a one-unit change in the capital investment, holding other variables constant. The coefficient is statistically significant at the 5% level.

- **LnLabor (Natural Logarithm of Labor)**: The coefficient for 'LnLabor' is 0.479296, with a standard error of 0.025681. The t-statistic value is 18.66341. This coefficient represents the change in the dependent variable for a one-unit change in the natural logarithm of labor, holding other variables constant. The coefficient is highly statistically significant at the 5% level.

- **Sch_Enr (School Enrollment)**: The coefficient for 'Sch_Enr' is 0.009366, with a standard error of 0.001403. The t-statistic value is 6.675194. This coefficient represents the change in the dependent variable for a one-unit change in school enrollment, holding other variables constant. The coefficient is statistically significant at the 5% level.

- **@SIN and @COS**: These terms represent trigonometric functions of a periodic pattern. They have coefficients of 0.004880 and -0.009209, respectively. The standard errors are provided as 0.004021 and 0.004283. The t-statistic values are 1.213465 and -2.150393. The SIN term is not statistically significant at the 5% level, while the COS term is statistically significant at the 5% level. The negative coefficient for the COS term indicates an inverse relationship with the dependent variable.

Overall, the significant variables in this model are Intercept, LnLabor, Sch_Enr, and Cap. The trigonometric terms have mixed significance, with the SIN term being non-significant and the COS term being significant and negatively related to the dependent variable.

The results of the analysis reveal that the positive influence of capital investment and the labor force on the Human Development Index (HDI) underscores the correlation between economic growth and human development. This indicates that higher levels of human development are associated with increased capital investment and labor force participation. Consequently, directing economic policies towards these areas could facilitate the enhancement of human development. However, the impact of education

expenditures on HDI remains ambiguous. While Model 1 indicates that education expenditures lack statistical significance, suggesting that they may not directly influence human development, their effect may vary when considered alongside other variables. Conversely, the positive impact of enrollment rates of all eligible children in higher education or primary education on HDI, as observed in Model 2 and Model 3, highlights the significance of educational opportunities and access in fostering human development. Elevated school enrollment rates can incentivize individuals to pursue education, thereby enhancing their skills and income levels.

These findings offer valuable insights into areas where economic policies can be directed to bolster human development. Specifically, capital investment, labor, and education policies emerge as crucial instruments for fostering human development. However, it's essential to note that these results are derived from a model and may not fully capture real-world dynamics. Therefore, policymakers should complement their decisions with diverse data and methodologies beyond this type of analysis.

There is a need for increased investment in education. Education serves as a cornerstone for both human and economic development. Hence, it's imperative for countries to allocate resources to their education systems and enhance educational access. Policymakers should formulate strategies to broaden access to education, enhance educational quality, and upgrade educational infrastructure, particularly at the primary and secondary levels. The budget allocated to the Ministry of National Education should not be viewed solely as an operational budget; separate consideration should be given to staff salaries and school expenses.

The enhancement of workforce skills is paramount. A skilled workforce is indispensable for driving economic growth and maintaining competitiveness. Nations ought to invest in educational and vocational training initiatives aimed at enhancing workforce skills and qualifications. Particularly, there should be a concerted effort to promote education in Science, Technology, Engineering, and Mathematics fields, ensuring alignment with market demands. Emphasizing vocational training is crucial, especially in the context of Turkey.

Society must be incentivized towards education and innovation. A highly educated workforce can significantly contribute to fostering innovation and bolstering economic

competitiveness. Thus, countries should revamp their educational systems to foster innovation and entrepreneurship, while also broadening access to science and technology.

Promoting equality and inclusivity in education is imperative. Ensuring equitable and inclusive access to educational opportunities across gender, ethnicity, income, and geographical boundaries is essential. Nations should devise targeted policies and programs aimed at expanding educational access for marginalized groups and rural communities.

Boosting capital investment and enhancing infrastructure are imperative steps. Capital investment serves as a linchpin for economic growth. To incentivize capital investment, nations should strive to enhance the business environment, allocate more resources for infrastructure development, and prioritize projects aligned with sustainable development goals.

These suggestions offer strategic policy recommendations for fostering economic growth and development, while also creating avenues for augmenting human development. Nevertheless, given that each country possesses distinct needs and circumstances, policy recommendations ought to be tailored to the specific situation and objectives of the country in question.

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