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# Education and Economic Growth in Iran: A Meta-Analysis

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***Abstract***

This is the first meta-analysis for the effect of education on economic growth in Iran and represents some evidence exclusively with regard to effect size. The purpose of this paper is to provide a clear and unified picture of the impact of education on Iran's economic growth by combining different studies. This study undertakes a meta-analysis based on a sample of 57 studies with the period of coverage 2000-2021 and applies the Stouffer's method to present *p*-values. After separating the patterns into two logarithmic and non-logarithmic formats, as well as classifying the variables of education and obtaining the least significant probabilities of their coefficients, the effect of education is investigated. The study indicates that the three indicators of education such as secondary enrollment rate, the share of trained employees in the total number of employees, and the ratio of students to the total population have a positive and significant effect on economic growth, so that their increase by one percent will cause economic growth by respectively 0.28, 0.19 and 0.84 percent. Therefore, the government should pay special attention to investing in secondary education and targeting employment for high school graduates in the labor market and avoid over-investing in higher education.

***Highlights***

- So far, no meta-analysis has been published on the relationship between education and economic growth for Iran.
- This meta-analysis is based on all related articles published in journals and presented at conferences.
- Among the different levels of schooling, secondary education is more important for economic growth.

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## 1. Introduction

Identifying a deficiency in explanation of economic growth at the middle of 20th century notified the economists to discern a factor that is known "human capital". In Schultz's viewpoint, "it is *human* because it is embodied in man, and it is *capital* because it is a source of future satisfactions, or of future earnings, or of both" (Schultz, 1971). Such notion caused education as a flow of investment to be entered to economic literature. Since the introduction of this concept, much definitions, discussions and analyses regarding human capital have been provided, but the role of various types of human capital in economic performance, exclusively growth of output, has a longer history than other issues. Of course, the oldness of this view is longer and is found in Marshall (1895) who interpreted the education as national investment and wrote: "the most valuable of all capital is that invested in human beings" (Marshall, 1895). Thus, the advent of a new conception of capital brought about a noticeable evolution in economic growth models which are truly propounded as "the human investment revolution in economic thought" (Bowman, 1966). This new approach depressed the classic models of growth which were dominate on economic literature in the bulk of last century and opened a vivid and realistic horizon for economic theorists and researchers.

Afterwards, economists considered knowledge as a kind of human capital and put it into the economic growth models. This led to the inclusion of technical progress into the growth literature because technical progress in production occurs merely by accumulation of knowledge. Solow (1957) was the first who modeled this concept and made a basis for many prospective theoretical and empirical studies. The presented models after Solow's seminal work were exogenous because they involved the rate of technical progress as a given or exogenous parameter. Analysts tried to explain the growth of per capita output and succeeded somewhat. Those models contained production functions not comprising human capital directly, but took into account knowledge through the allocation of a part of physical capital and labor to knowledge production. In 1980s, technical progress emerged in growth models as a concept which is own affected by domestic changes of economy. This achievement led to the emergence of new growth theories or endogenous growth models in economic analysis. Romer (1986) was the flagman of these new topics. He spoke for first time regarding endogenous technical change and inserted knowledge as an input into the production function while he considered increasing marginal productivity of knowledge. Accordingly, Romer showed that the growth rate can be increasing in long-run and, thus, it is possible that great nations grow faster than those small.

Attention to the role of human capital at the second half of 1980s shifted minds from economic to human development. Recent notion, human development, has been defined as "the process of enlarging people's choices" (UNDP, 1990; Ranis et al. 2000) because the main aim of development is to bring about an environment for people to live longer, healthier and creative

(UNDP, 1990). After that change of view, economic development no longer is purely treated as economic growth, but comprises human dimensions. For decades, the UN has introduced human development index in its annual development report as a mixture of per capita income, health and education and observes the status of nations on the basis of this criterion every year. In line with this procedure, a variety of education indicators have been used in empirical studies and extensive evidence has been provided with regard to the relationship between education and economic growth around the world.

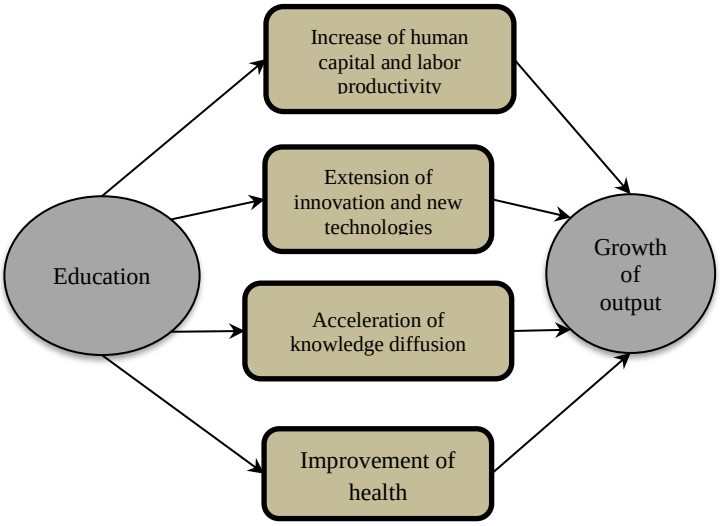


***Figure 1. The Mechanisms of the Impact of Education on Economic Growth***
***Source:*** *Author's compilation*

Following these theoretical advances, three main mechanisms were identified for the impact of education on economic growth. First, education increases human capital in the workforce, thereby the productivity of labor increases in the production process. Second, education fosters innovation and the invention of new technologies that result in product growth. Third, education accelerates the dissemination of knowledge necessary for information processing and the use of technologies (Agasisti & Bertoletti, 2020; Habibi & Zabardast, 2020; Hanushek & Woessmann, 2020). Forth, Health is another form of human capital that can be considered as a factor of economic growth because it leads to the improvement of labor force productivity. But based on human capital literature, there is a complementary relationship between education and health (Becker, 2007). In other words, education itself is an effective factor on health. Therefore, education indirectly leads to economic growth through improving health in society. Figure 1 illustrates this mechanism.

Synchronicity of theoretical achievements and practical experiences in some countries caused that education to be proposed as an influential factor on growth of output in many researches. Striking growth in East Asia by 1990s is the best example. Hong Kong, Singapore, Taiwan and South Korea were the newly industrialized countries at that time and were named as Four Tigers (Page, 1994) or Four Little Dragons (Liu, 1994) duo to their drastic growth in economy (industry) whereat this event was known as a miracle (McCord, 1989; Lucas, 1993; The World Bank, 1993). Between 1960s and 1990s, the average growth rate of real GDP in these countries was 6-9 percent (Liu, 1994) and they were able to reduce the gap of standard living between them and advanced economies. But, what was the cause of this rapid and stable economic change? Besides cultural factors including Confucius religion (McCord, 1989), it is said that the export-oriented policy was an important reason. Here, it is shed light on the role of investment in education. Huge and purposeful investment in education trained skilled manpower that resulted in the manufacture of industrial and technological products that could compete in foreign markets. For example, after World War II, the South Korean government implemented an education development strategy commensurate with the stages of economic development, in which it first pursued the goal of eliminating illiteracy by establishing a basic education system and the spread of primary education. Finally, in the 1990s, it implemented a strategy to expand higher education, establish a system of lifelong learning, and decentralize education (Mehrbani & Jamalipour, 2011). It was such educational planning that efficient investment in education, with greater reliance on higher education, made it possible to increase total factor productivity and knowledge accumulation, and significantly contributed to Korea's economic growth (Choi, 2010). South Korea's economy grew by an average of 7.6 percent annually from 1965 to 2015. Studies have shown that one of the reasons for this significant growth has been the improvement of human resources. For example, statistics show that the 0.5 percent annual growth in South Korea's GDP over the past three decades has been due to the growth of human capital (Han & Lee, 2020). The success of South Korea was so dramatic that the recommendation to follow the "South Korean model" was similar to the advice to a basketball player to follow the "Michael Jordan model" (Lucas, 1993). There is also some evidence that the role of education in Taiwan's economic growth has been even greater than in South Korea (Lee et al., 1994). Overall, educational progress was a common feature of all four East Asian countries. Apart from these four East Asian countries, India has also been successful in promoting human capital, so that this factor has had a significant impact on long-term productivity growth (Ghosh & Parab, 2021). Also, Zhang & Wang (2021) observed the strong positive effect of human capital on the growth of China's economy and saw it as consistent with the theory of human capital.

Since then, this successful experience has attracted the attention of other Asian countries including Iran to invest in education. In this regard, the Iranian

government invested in the quantity of education so that the share of education in total government spending increased from 18.3% in 1991 to 21.1% in 2018. Also, the government increased the share of higher education in total educational expenditures from 19.3% in 2001 to 28.2% in 2018. In addition, quality indicators of education improved, for example, the pupil-teacher ratio in primary education decreased from 31.3 in 1991 to 28.5 in 2017 (The World Bank, 2021). Also in higher education, the number of students per 100,000 of population in the academic year 2004-2005 was equal to 3138, but increased to 3805 in 2020-2021. In addition, the ratio of student to faculty member decreased from 15.6 in 2000-2001 to 12.5 in 2016-2017 (IRPHE, 2021).

Iranian researchers have also been active in analyzing the effect of education on economic growth and have conducted various experimental studies for Iran. It is natural to expect that Iranian studies have been conducted with a time lag compared to foreign studies because the development of general and higher education in Iran has been delayed and it takes some time to see the effects and consequences of education to the extent that be statistically testable. Therefore, according to a review of studies that will be presented in detail in later sections, the first empirical study was published in 2000. The main purpose of this article is to provide a comprehensive review of these studies to identify their various dimensions such as strengths and weaknesses and the main results and useful guidelines for Iran. In this regard, some new studies provide evidence of the positive and strong effect of education on Iran's economic growth. For example, Moeini & Daei-Karimzadeh (2021) analyzed the effect of labor force education in the health sector on economic growth in Iran. Their findings indicated the positive impact of public education, labor force education in the health sector, and labor force education in the Ministry of Science. Qorbani et al. (2020) investigated the effect of human capital and business environment on the economic growth of 30 provinces of Iran using panel data. The results showed that human capital has a positive and significant effect on economic growth, but its effect is greater than other variables. Also, Nonejad & Ghatee (2020) estimated the impact of human capital (the share of highly educated workers as an indicator of human capital) on the GDP in Iran's economy in the period after the revolution. The results showed that increasing human capital significantly increases Iran's GDP. In addition, there are other studies that provide similar results, although some studies based on different criteria indicate a weak effect of education.

Therefore, the innovation of this research is that, for the first time, it presents a comprehensive study of all the researches conducted in the field of the effect of education on Iran's economic growth and familiarizes the researchers with its details. This work creates a general impression of the main topic for the relevant researchers. This work will be a suitable source for studying the impact and position of human capital and education in the economic performance of a society and will meet the needs of researchers to some extent.

However, this article seeks to answer the questions of whether the expansion of education in Iran has contributed to economic growth and which educational factors have such an effect? The approach used is meta-analysis method. For this aim, in the next section, the research method will be introduced. Then, the empirical evidence from the published studies will be reviewed and appropriate analyzes will be provided. The last section will be devoted to summarizing and concluding the topics.

## 2. Literature Review

These are steps that were traversed in the bulk of studies regarding the relationship between education and economic growth in Iran. Table 1 summarizes the main features of reviewed studies. In the following, other information will be provided in general.

As we can see in table 1, these studies vary widely in terms of time period, independent variables, and education indicators. A prominent feature in most of these studies is the use of education quantity indicators, while quality indicators have not received much attention. Researchers have used very different production functions and regression models, and this has led to the estimated coefficients being unique and there being large differences between them. In addition, the diversity in the use of education indicators has resulted in a range of coefficients with different sizes and signs, and, therefore, the effect size cannot be calculated simultaneously for all indicators. Therefore, we have to calculate the effect size separately for the education variables. Examining the effect of education variables contains interesting points. These variables did not have the same effect in terms of sign and significance of the estimated coefficient. For example, educational expenditures in most cases showed a negative (statistically significant) or positive (statistically insignificant) effect.

***Table 1. Summary of Studies***

| *Researcher(s) (year)* | *Period* | *Independent Variables* | *Indicator of Education (sign of effect)* |
|---|---|---|---|
| Emadzadeh et al. (2000) | 1966-1992 | capital, labor, trend. | years of schooling (+) expenditures of education (+) |
| Shah Abadi (2001) | 1968-1999 | capital, labor, R&D, revolution. | number of employees with HE degree (+) |
| Tari & Arzromchilar (2002) | 1963-1998 | capital, export of oil, inflation, growth of population. | expenditures of education (+) |
| Yavari & Sa'adat (2002) | 1959-2001 | — | ratio of graduates to total labor (+) |
| Shah Abadi (2002) | 1959-2001 | capital, import, | number of educated employees (+) |

| | | | |
|---|---|---|---|
| | | interest rate. | |
| Salehi (2002) | 1966-1996 | capital,<br>war,<br>trend. | primary enrolment rate (+)<br>secondary enrolment rate (+)<br>tertiary enrolment rate (+)<br>years of schooling (+)<br>expenditures of HE (+)<br>budget of education (−)<br>employees with HE degree (+) |
| Olfati& Babaei (2002) | 1959-1999 | investment,<br>inflation,<br>budget. | number of primary students (−)<br>number of secondary students (+)<br>number of HE students (+) |
| Dargahi & Ghadiri (2003) | 1969-1996 | growth of investment,<br>growth of social security expenditures,<br>growth of R&D expenditures,<br>growth of productivity. | secondary enrolment rate (+) |
| Sadeghi & Emadzadeh (2004) | 1966-2001 | capital,<br>labor. | years of schooling (+)<br>expenditures of HE (+) |
| Nili& Nafisi (2204) | 1966-2000 | capital,<br>Gini coefficient,<br>war,<br>revolution. | years of schooling (+) |
| Komijani & Memarnejad (2004) | 1958-1999 | capital,<br>labor,<br>inflation,<br>export,<br>revolution. | employees with HE degree (+) |
| Pourfaraj (2005) | 1979-2001 | capital,<br>inflation,<br>growth of population,<br>government expenditures. | expenditures of education (+) |
| Dejpasand (2005) | 1974-2001 | capital,<br>labor,<br>trade openness.<br>export of oil and gas, | employees with HE degree (+) |
| Taghavi & Mohamadi (2006) | 1959-2002 | investment,<br>growth of population,<br>war,<br>revolution. | years of schooling (+)<br>literacy rate (+) |
| Elmi & Jamshidnezhad (2007) | 1972-2003 | capital,<br>oil shock. | years of schooling (+) |
| Mohammadi (2007) | 1976-2000 | investment,<br>growth of labor. | ratio of students to employees (−)<br>literacy rate (+)<br>secondary enrolment rate (+) |

| | | | |
|---|---|---|---|
| Rahm n ani & Amiri (2007) | 2000-2003 | investment,<br>trust,<br>initial GDP. | ratio of HE students to population (+) |
| Houshmand et al. (2008) | 1978-2006 | capital,<br>active population,<br>export. | years of schooling (+) |
| Fadaee Khorasgani (2008) | 1959-2005 | investment,<br>labor,<br>R&D expenditures<br>inflation,<br>war,<br>revolution. | number of employees with HE degree (+) |
| Zarra Nezhad & Ansari (2009) | 1974-2004 | GDP | expenditures of HE (+) |
| Falihi (2009) | 1966-2001 | capital | years of schooling (+) |
| Emadzadeh et al. (2009) | 1966-2006 | capital,<br>labor,<br>social capital. | years of schooling (+) |
| Motafakker Azad et al. (2009) | 1967-2005 | capital,<br>labor. | years of schooling (+)<br>number of secondary students (+) |
| Hoseini et al. (2009) | 1978-2004 | capital,<br>export,<br>oil and gas revenue,<br>government expenditures,<br>inflation,<br>war. | ratio of employees with HE degree to total labor (+) |
| Rabiei (2009) | 1968-2004 | capital,<br>labor,<br>import,<br>R&D. | tertiary enrolment rate (+) |
| Abdoli & Varahrami (2009) | 1978-2007 | capital,<br>labor. | years of schooling (+) |
| Hozhabr Kiani & Rahimzade (2010) | 1971-2006 | public and private investment. | number of employees with HE degree (+) |
| Behboudi & Amiri (2010) | 1967-2007 | capital,<br>data infrastructure,<br>institutional regime. | literacy rate (+) |
| Almasi et al. (2010) | 1971-2005 | capital,<br>government debt,<br>war,<br>revolution. | ratio of HE students to total employees (+) |
| Almasi et al. (2011) | 1971-2005 | capital,<br>government debt,<br>war,<br>revolution. | ratio of HE students to total employees (+) |
| Heidari et al. (2011) | 1971-2007 | capital,<br>oil shock,<br>war,<br>trend. | ratio of employees with HE degree to total labor (+) |
| Akbarian & Famkar (2011) | 1974-2005 | population density,<br>income inequality. | expenditures of education (−) |
| Barghandan et al. (2011) | 1974-2007 | capital, | number of employees with HE |

| | | | |
|---|---|---|---|
| | | labor,<br>export,<br>war,<br>revolution. | degree (+) |
| Jozarian (2012) | 1959-2003 | capital,<br>labor. | years of schooling (+) |
| Mehregan et al. (2012a) | 1967-2007 | capital,<br>social capital. | ratio of students to total population (+) |
| Mehregan et al. (2012b) | 1959-2007 | investment,<br>war,<br>revolution. | literacy rate (+) |
| Samadi et al. (2012) | 1971-2008 | social capital. | years of schooling |
| Aghaei et al. (2013) | 2000-2008 | capital,<br>labor. | growth rate of HE graduates (+) |
| Shahbazi & Hasani (2013) | 1996-2007 | capital. | share of literate employees (+) |
| Arabi & Kazemi (2014) | 1971-2011 | health,<br>oil shock,<br>war | — |
| Jahangard & Shishvani (2014) | 1976-2006 | capital,<br>labor. | ratio of employees with HE degree to total labor (+) |
| Farshadfar et al. (2014) | 2001-2006 | investment,<br>labor,<br>growth of population,<br>climate. | number of HE graduates (+) |
| Naderi (2014) | 1959-2010 | investment,<br>national saving,<br>jump of oil revenue. | ratio of students to total population (+)<br>years of schooling (+) |
| Azarbayejani et al.(2014) | 1959-2006 | trade liberalization. | years of schooling (+) |
| Taghvayi & Khosravi (2015) | 1978-2013 | capital. | government expenditures of education (−)<br>literacy rate (+) |
| Mirzayi & Banouei (2015) | 2000-2011 | growth of investment,<br>high & medium technology. | skilled labor (+) |
| Kia & Arsalanbod (2015) | 2001-2012 | capital,<br>labor. | number of HE graduates (+) |
| Akbar Mousavi et al. (2015) | 1966-2010 | capital | years of schooling by labor (+,−) |
| Naderi (2016) | 1959-2010 | investment,<br>national saving,<br>jump of oil revenue. | ratio of students to total population (+)<br>years of schooling (+) |
| Ebrahimi & Arshadi (2016) | 1979-2010 | labor. | literacy rate (+)<br>number of secondary students (+)<br>number of schools (+) |
| Sabetqadam & Zareyee (2017) | 1981-2015 | investment. | primary enrolment rate (+) |
| Kimiagari et al. (2017) | 1992-2013 | budget deficit,<br>non-oil export. | — |
| Farajzadeh et al. (2017) | 1974-2012 | capital, | literacy rate (+) |

| | | | |
|---|---|---|---|
| | | labor,<br>social capital,<br>natural resources. | primary enrolment rate (+)<br>number of HE students (+) |
| Dehghan Shabani & Shahnazi (2017) | 2001-2011 | capital,<br>industrial concentration,<br>cost of transportation. | years of schooling by labor (+) |
| Asadzadeh et al. (2017) | 2001-2014 | inflation,<br>interest rate,<br>female participation,<br>trade openness. | ratio of female HE students to total female population (+) |
| Ghiasi et al. (2018) | 2005-2015 | capital,<br>mortality rate,<br>fertility rate,<br>life expectancy,<br>health expenditures. | household education expenditures (+) |
| Ahmadzadeh & Nasri (2018) | 2006-2012 | telephone lines,<br>highways length,<br>electricity production,<br>government health expenditures. | government education expenditures (−) |
| Aleemran & Aleemrann (2019) | 1998-2015 | investment,<br>labor. | ratio of female HE students to total students (+) |
| Kamali Dehkordi et al. (2019) | 2001-2011 | capital,<br>social capital,<br>growth of population. | number of HE students (+) |
| Nonejad & Ghatee (2020) | 1978-2015 | labor productivity | share of employees with HE degree (+) |
| Mirzayi et al. (2020) | 2006-2015 | capital,<br>health,<br>budget,<br>skill. | — |
| Qorbani et al. (2020) | 2009-2015 | capital,<br>rank of business environment. | number of HE graduates (+) |
| Moeini & Daei-Karimzadeh (2021) | 1991-2019 | investment,<br>export,<br>trade openness. | number of school graduates (+)<br>number of medicine graduates (+)<br>number of non-medicine graduates (+) |

*Note: HE= Higher Education. Source: Author's compilation*
***Source:*** *Author's compilation*

## 3. Methodology

The analytical approach here is the meta-analysis method. Meta-analysis is the most effective way to clarify conflicting results in a set of experimental works and has distinct benefits compared to qualitative studies (Sohrabifard, 2007). Meta-analyses systematically review articles that have already been

written on a particular topic by systematically reviewing resources for finding, evaluating, combining, and, if necessary, statistically summarizing (Rezaeian, 2006). In meta-analysis research, the researcher by recording the characteristics and mass findings of researches prepares them for statistical methods in the form of quantitative concepts (Mohammadi et al., 2012). In other words, meta-analysis is "analysis of analyses". It is a statistical analysis for a large set of results of individual studies with the aim of consolidating and integrating findings. The meta-analyst's observations are the means, standard deviation and statistical test results (Kulik & Kulik, 1988). Therefore, with regard to the publication of a significant number of empirical studies on the impact of education on Iran's economic growth on the one hand and the lack of meta-analysis in this field, it is appropriate to conduct a meta-analysis to increase the richness of texts. The main advantage of this method is that by combination of past research, dispersed and inconsistent results of the research become more accurate and logical (Mohammadi et al., 2012). Therefore, the meta-analysis is a laborious and accurate study, and at the same time it will be more practical than individual studies because each study is limited to the time period, selected variables and specific estimation methods, but a meta-analysis exceeds this and provides more comprehensive conclusions.

With this description of the research method, the raw data on education and economic growth, as well as other control variables for regression estimation, will not be used through conventional econometric methods in this research, but a sample of studies related to the subject matter and their main characteristics are examined and interpreted. The sample of the research is articles published in journals or presented at conferences. Therefore, it focuses on Iranian studies, whether they are published inside the country and outside. Nevertheless, this research can be a comprehensive and suitable source for researchers interested in doing research on the effect of human capital (education) on economic growth.

The sources to find relevant studies include some domestic and international bases such as Scientific Information Database (SID), Magiran, Noor Specialized Magazines Website (Noormags), Civilica and Elsevier. In addition to these scientific databases, the references of reviewed studies have been investigated also. The focus of searches was on those studies that relate to the effect of education on economic growth directly and indirectly. Therefore, some studies which explore the determinants of growth other than education as pivotal issue have been included in sample while education is another independent variable in empirical models and its effect is estimated.

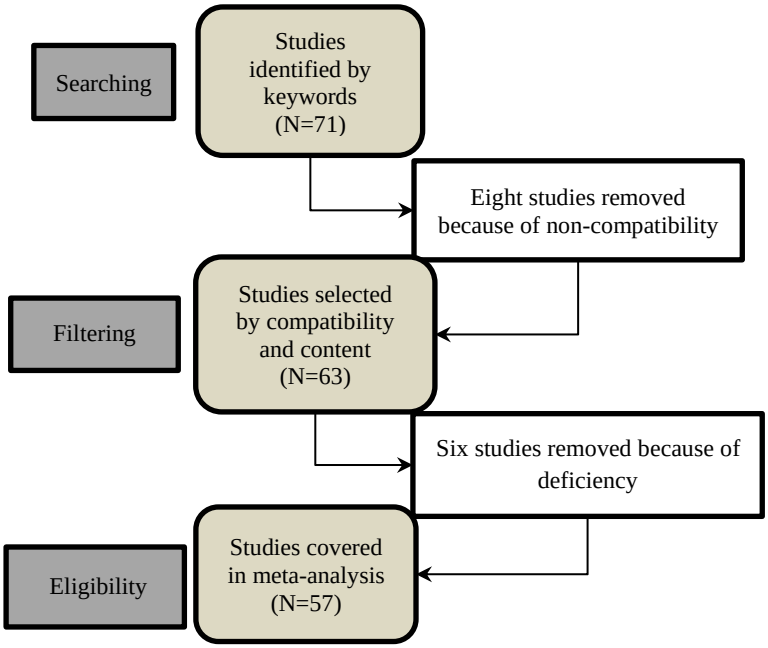


***Figure 2. PRISMA Flow Diagram for Selection Process***
***Source:*** *Author's compilation*

In the initial search, 71 relevant articles were found. A number of studies have been found that are relevant to the current topic but for some reason cannot be used in the sample. First, there have been a number of studies on the impact of human capital (education) on labor productivity or total factor productivity (TFP). Second, some studies have analyzed the effect of education on specific sectors, such as agriculture or services. Third, some researchers had developed a composite index for human capital, including education, and tested the effect of this index on economic growth. Fourth, there are studies that examine the effect of education on a sample of several countries including Iran that the evidence for Iran cannot be identified separately. Fifth, others did not contain empirical study, or the method of empirical study in some of them was not econometrics. Therefore, in the filtering step, 8 articles were considered irrelevant and 6 articles lacked basic information which were excluded from the sample. Figure 2, which is a PRISMA flow diagram, shows the selection process for meta-analysis. This process was derived from Page et al. (2021).

Meta-analysis is performed in various approaches and includes a variety of methods and criteria. In order to achieve a single finding of many studies and to observe the effect of a variable like education on economic growth, the statistical test is required. In other words, the test is also done in meta-analysis, and to do this, using a statistic is compulsory. A test statistic belongs to Fisher

(1932). Fisher's method requires the researcher to take the natural logarithm of the one-tailed *p* value of each study in a set and to multiply the value by -2 (Kulik & Kulik, 1988). Obviously, this method needs to know the all *p* values while a great many of current reviewed studies have not reported these information. So, it is here used the Stouffer's method that is a prevalent approach to combined probabilities. This method requires the analyst to add standard deviations (*z* values) associated with obtained *p* values and then divide the sum by the square root of the number (*n*) of studies being combined (ibid: 6):

$$Z_c = \frac{\sum z}{\sqrt{n}} \quad (1)$$

According to equation (1), coefficients, t-statistic and estimated standard deviation are used to test the significance of the effect of different variables of education on economic growth index. The information obtained in this way will be reported separately for different indicators of education.

## 4. Results & Discussion

The review of the studies shows that the following stages comprise the common characteristics of almost all studies:

- Theoretical explanation of the problem based on the model of production function,
- Introducing the main and control variables,
- Introducing the regression equation,
- Specifying the time span,
- Referring to data centers,
- Entering data into the statistical software,
- Performing diagnostic tests,
- Fitting the regression equation,
- Interpretation of results on the basis of the test statistic,
- Conclusion.

***Table 2. General Properties of Studies***

| | Feature of Study | % | % (total) |
|---|---|---|---|
| Submission | Journal | 89 | 100 |
| | Conference | 11 | |
| Type of Specification | Logarithmic | 66 | 100 |
| | Non-Logarithmic | 34 | |
| Subject | Main | 82 | 100 |
| | Subordinate | 18 | |
| Level of Analysis | National | 81 | 100 |
| | State | 19 | |

***Source:*** *Author's findings*

These studies differ in terms of how they are presented and disseminated, how empirical models are specified, the central theme, and the level of research.

Table 2 contains information about these properties. Evidently, most of the researches have been published in scientific journals. Perhaps one reason is that the privilege of publishing an article in a journal is greater than the privilege of presenting it at a conference. Another feature is that the most of estimated empirical models are logarithmic (approximately one-third). This feature makes the obtained coefficients express the elasticity of economic growth to the education index. Additionally, in 82% of cases, the effect of education has been the main (direct) subject of research. In other cases, education is present as a control variable in the growth pattern. Finally, in most studies, national data have been used and in the rest of the studies, provincial data have been utilized.

Figure 3 displays the frequency of studies over time. Evidently, the number of studies has an upward trend with a slight slope. This shows that the tendency to research the impact of education on economic growth has increased over time as government attention to education has changed and the demand for education, especially higher education, has intensified. Another feature that has made a difference between the studies is the use of various indicators for economic growth as dependent variable. Figure 4 shows the types of these indicators along with the share of each. It is observed that the GDP level is used more than other indicators, followed by the GDP growth rate.

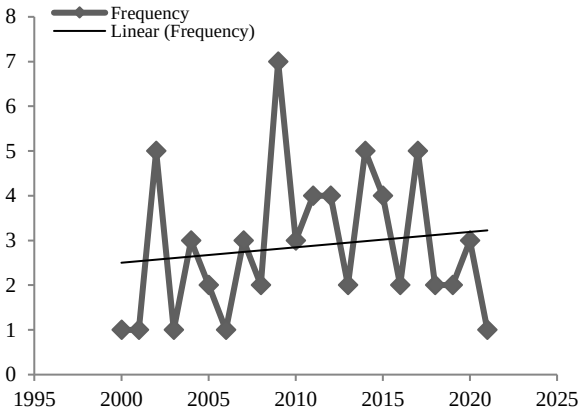


***Figure 3. Frequency of Studies over Time***
***Source:*** *Author's findings*

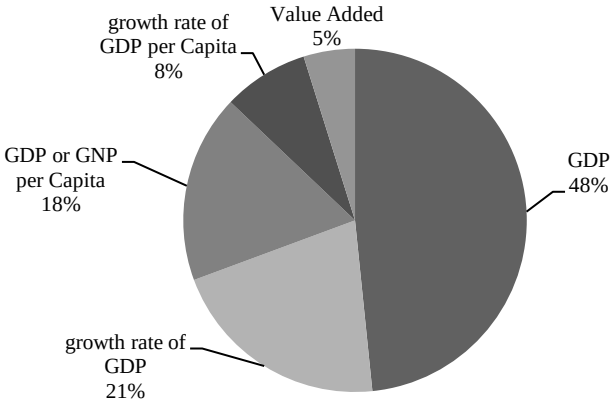


***Figure 4. Types of Dependent Variable***
***Source:*** *Author's findings*

In addition, it is useful to examine the types and number of education indicators. By aggregating similar indicators and classifying them, it was found that 9 major indicators have been used in researches, which figure 5 shows their frequency. The number of years of schooling has been the most frequent indicator. Perhaps one reason is the ease and prevalence of using this index. But an important point about education indicators is that most of them refer to the quantity of education and the quality indicators are not used much. This indicates an important gap in empirical studies. With this description of the dependent and independent variables, it is better to look at the estimation method.

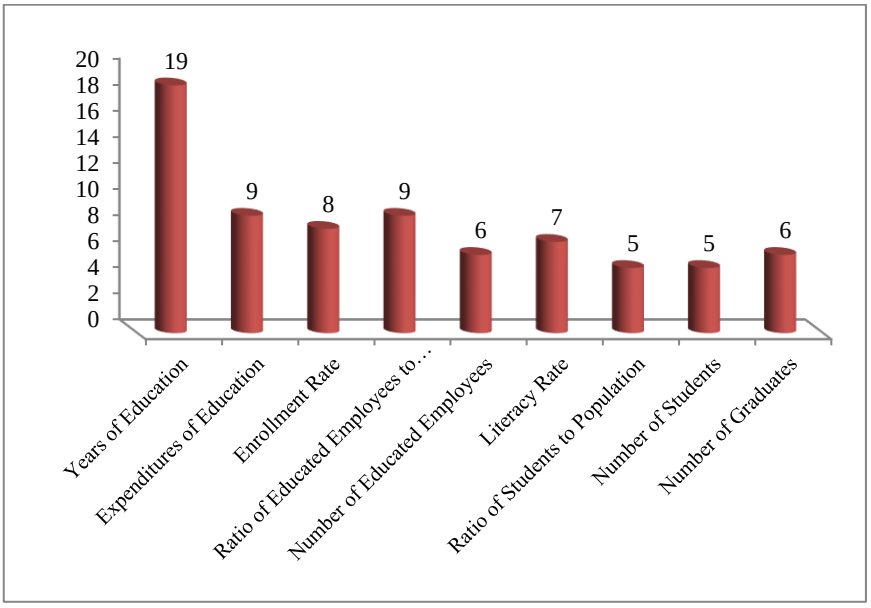


***Figure 5. Types and number of education indicators***
***Source:*** *Author's findings*

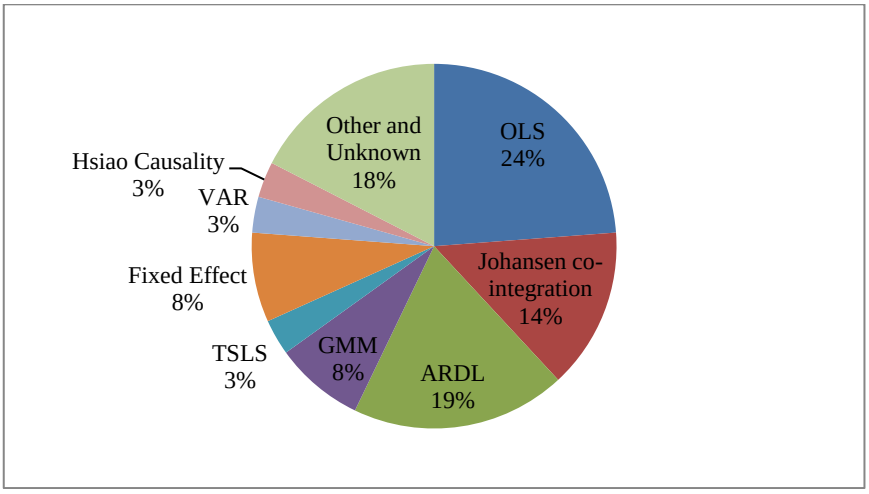


***Figure 6. Methods of Estimation***
***Source:*** *Author's findings*

Figure 6 shows that OLS is the most widely used method in estimating the effect of education on economic growth. However, a review of this reveals that OLS has been used most in early and older studies, and as we get closer to recent years, other estimation methods, especially ARDL, have been utilized.

The latter method has been mainly used in studies in which the level of GDP has been a dependent variable and therefore there has been the non-stationary problem. In cases where the units of analysis were provinces, the fixed effect method was used and in only one case was the random effect used for estimation. Also, a small number of studies have been devoted to the causality test, in which mainly the Hsiao causality method has been used. In other cases, the test method was either unclear or very few in number.

Another issue that needs to be addressed is the analysis of education at the school or university level. Researchers have focused on different levels of education in their researches. Some have only studied at the school level and some have only studied higher education. Some have taken a more holistic view of education and used indicators from both levels. In the rest of the studies, the researchers did not specify the level of education. Figure 7 reveals that the focus was more on higher education (40%). This shows that with the increase of government attention to higher education and the expansion of this sector, researchers' curiosity about its impact on the economy has also increased.

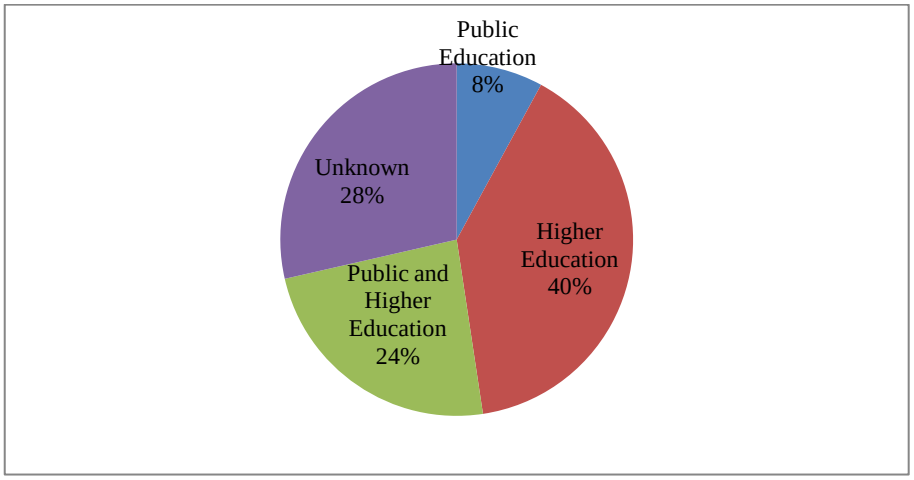


***Figure 7. Level of Analysis***
***Source:*** *Author's findings*

With regard to the manner of the specification of regression models, the reviewed studies are divided into two categories: logarithmic and non-logarithmic. Because the interpretation and size of the coefficients of these two types of patterns are different, their results are calculated and presented separately. Therefore, first in table 3, the average coefficients, standard deviations along with the significant level of coefficients for logarithmic patterns are reported separately by training indicators, and then in table 3 the same information about non-logarithmic models is presented.

***Table 3. Results of Logarithmic Models***

| Education Indicator | Mean of Coefficient | Mean of Standard Deviations | Stouffer's *p*-value |
|---|---|---|---|
| Years of Education | 0.5775 | 0.1588 | 0.6548 |
| Expenditures of Education | −2.98 | 0.251 | 0.615 |
| Enrollment Rate (primary) | 0.215 | 1.1691 | 2.0251 |
| Enrollment Rate (secondary) | 0.28* | 0.0316 | 0.032 |
| Enrollment Rate (university) | 0.44 | 0.1215 | 0.122 |
| Ratio of Educated Employees to Total of Employees | 0.1938** | 0.0353 | 0.0999 |
| Number of Educated Employees | 0.5645 | 0.1073 | 0.2146 |
| Literacy Rate | 633.29 | 109.304 | 189.3258 |
| Ratio of Students to Population | 0.843** | 0.0539 | 0.0763 |
| Number of Students | 0.3186 | 1.0591 | 2.3683 |
| Number of Graduates | 0.4519 | 0.1067 | 0.2615 |

***Source:*** *Author's findings*
*Note:* * significant in 5 percent, ** significant in 10 percent.

***Table 4. Results of Non-Logarithmic Models***

| Education Indicator | Mean of Coefficient | Mean of Standard Deviations | *p*-value |
|---|---|---|---|
| Years of Education | 0.812 | 0.442 | 0.442 |
| Expenditures of Education | 0.0226 | 0.2816 | 0.4878 |
| Enrollment Rate (secondary) | 1.1704 | 0.7244 | 1.0245 |
| Number of Academic Educated Employees | 0.5845 | 0.1209 | 0.171 |
| Literacy Rate | 4.91 | 2.0844 | 3.6104 |

***Source:*** *Author's findings*

According to the results in table 3, which contains the production elasticity of the 11 education indicators, three education indicators have a statistically significant effect: "the secondary enrollment rate", "the ratio of educated employees to total employees", and "the ratio of students to the total population". In line with many international studies that show the important role of secondary education in economic development, it is also observed that the higher the enrollment at the high school level, the more the economy will experience growth. This indicates that the Iranian economy does not only need basic education, but also a higher level of education is important to be able to meet the needs of industry and production. According to the coefficient of this variable, if "the secondary enrollment rate" increases by one percent, Iran's economy will grow by 0.28 percent. A comparison of Iran and other countries shows that, in 2017, the gross secondary enrollment rate in Iran was 86.3, in the Middle East and North Africa 80.4, in low and middle income countries 71.5, in OECD member countries 106.2, while the world average was 75.4 (The World Bank, 2021). This statistics show that the situation in Iran is better than many countries and regions except members of OECD and is even higher than the

global average. However, it seems that Iran is still far from the desired situation and the government should invest enough in this area.

But another important piece of evidence is the ineffectiveness of enrollment in higher education, although the coefficient of this variable is positive. While this finding is consistent with few evidence in other regions (Hamdan et al., 2020), but contradicts international evidence in European (Agasisti & Bertoletti, 2020) and African (Seetanah & Teeroovengadum, 2019) countries, Eurozone countries (Pegkas et al., 2020), developed and developing countries (Şerifoğlu and Güney, 2022), ASEAN countries (Maneejuk and Yamaka, 2021), OECD countries (Özdoğan Özbal, 2021) and the world at large (Valero & Van Reenen, 2019) and some case studies such as Spain (Canal Domínguez, 2021). We have earlier said that the Iranian government has increased the share of higher education in total education expenditures in the last three decades. According to our evidence and similar to China (Bai et al., 2020), this policy of government means inefficient budget allocation and a wasteful investment and is not, therefore, justified by economic logic. If the government is to achieve a higher rate of economic growth, it must avoid over-investment in higher education and focus on secondary education.

In addition, evidence shows that employing more educated people in production processes has a significant effect on economic growth, so that an increase of one percent of "educated employees to total employees" leads to economic growth by 0.19 percent. This finding confirms the guideline of human capital theory that education will improve labor productivity. The third variable is the "ratio of students to the total population", an increase of one percent of which leads to economic growth by 0.84 percent. In fact, increasing the number of students in schools and universities with a break of several years increases the number of skilled workers and improves labor productivity. One noteworthy point is that educational expenditure is the only variable that shows a negative effect. Although the coefficient of this variable is statistically insignificant, it shows that the allocation of funds by the government to the education sector at the same time is equivalent to not allocating resources to other productive sectors, and since the return of education appears in the long run, the negative effect of education expenditures will be apparent in the short term.

Table 4, which presents the results of non-logarithmic regressions, includes five education indicators, all of which have a statistically insignificant effect. Therefore, the effect of education cannot be judged on the basis of non-logarithmic models. Hence, these results suggest that to investigate the effect of education, logarithmic regression models are preferable to those non-logarithmic and provide better evidence.

## 5. Conclusion

Almost a decade after the advent of endogenous growth theory, researchers began studying the effect of education on Iran's economic growth, which resulted in the publication of dozens of articles in scientific journals and the

presentation of several papers at national and international conferences. The importance of the place of education and skills in today's dynamic economy, the need for a comprehensive study on this issue and also the feeling of a gap in research studies led to this meta-analysis. Existence of differences and variations in time periods, independent variables, specification method of models, estimation methods, indicators of education and economic growth have caused very different results and evidence and it is difficult to achieve a certain result. Different variables of education show different effects on economic growth. Some of them have a significant effect and some have a meaningless effect. Also, the sign of the coefficients was not the same. This scattered evidence weakens the applicability of the results and degrades their reliability. Thus, the vacancy of a meta-analysis on the relationship between education and economic growth in Iran is quite evident.

This study revealed different dimensions of the consequences of education and showed that education has different dimensions that are different from each other and their effects cannot be considered similar. Education has a wide variety of indicators, each of which has a specific feature. For example, quantitative indicators produce different impacts than qualitative indicators, whether in terms of sign, size of effect, or significance. Most of the used indicators measure the quantity of education and at the same time the types of these indicators do not show the same effect.

According to the results, secondary education is very important in Iran's economic growth and development. This suggests that investment and education policies of government should predominantly focus on this level of education, especially in less privileged areas that lack educational facilities at the high school level. And this is while the government has spent a lot of money in recent years to expand higher education. Therefore, it seems that the allocation of government education expenditures is not done in order to strengthen economic growth. Putting these together, we can see why the unemployment rate of university graduates in Iran is high. The structure of production in the Iranian economy needs more high school graduates and is facing a surplus of university graduates. This is the result of a mismatch between educational programs and economic growth policies. In addition, the labor market in Iran has also faced an increase in the supply of skilled and specialized labor, and since the employment of trained workers has a positive effect on the economy, it seems that targeting employment and reducing unemployment in Iran should be more focused on hiring graduates of schools and universities.

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All stages of the current article (study, methodology, data collection, analysis of results, and its revisions) were carried out by the sole author. The final version of the manuscript was reviewed and approved by author.

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The author declares no conflict of interest.

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