Econometric Evaluation of Impact of Education Quality on Economic Growth in Azerbaijan

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ABSTRACT

The article is dedicated to study of the impact of the quality of education on the economic growth in Azerbaijan. The quality index of education has been selected for two levels: a) up to higher education; b) higher school and post higher school. The indicator of average score (if available) that an applicant obtained in the current year on the country in student admission to the higher schools as a quality index of education in the country at the pre-higher education is offered as an alternative to the number of upper grades (10-12) in the secondary education. In the higher and post-higher education level, the number of articles printed on basic science and engineering per million people in Azerbaijan, and indexed on the Web of Science is taken as a quality index of education. Semi-linear type regression equations were made to assess the dependence of the indicators characterizing economic development.

Keywords

average score, research publications, GDP, salary, profit

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Introduction

Achieving economic growth is one of the main functions of the state, but one is not the only indicator of development. GDP distribution and redistribution, social inequality, poverty, and some indicators of ecology and natural environment are among the key components of achieving decent living standards for the country's population. It is no coincidence that the Millennium Development Goals (MDGs) set out in recent years by the United Nations Development Program have focused on achieving sustainable development. However, achieving economic growth in each country has not lost its importance as one of the main indicators of socio-economic development of the country. Most economic factors, including economic, social, political, demographic, natural environment and resources, affect economic growth, including GDP growth. The role of education and its attitudes in these factors is significant. In this regard, the assessment of the impact of the education quality on the economic growth is actual problem.

The average score obtained by the applicant on the country in admission to higher schools is taken as one of the quality indices of education. The distribution law of the points obtained by the applicants in the admission exams to higher schools was tested in the article of (Yagubov et al., 2018), and it was determined that it is not subject to normal distribution, and the distribution of the mean point is asymmetric to the right. It was concluded by the statistical analysis that the quality of education in the secondary schools is lower than normal. The role of education in development of society, including the role of economic growth, was studied in the article of (Muradov A., Hasanli Y., Musayeva F., 2019), the relationship between incomes of population and education level in Azerbaijan was econometrically

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assessed and it was determined that there was an extreme offer of work force of secondary education without professional ability and this causes this group of employees to work in low-income businesses. As well as, the optimization issue has also been solved and it was found that the average duration of education giving maximum to the level of the GDP per capita in Azerbaijan should be 11.7 years, while the current term is 10.7 years (among the population above 25 years old). In the article of (Hasanli Y., 2014), Marx's repetitive and extensive recycling scheme was modified in the system of modern market relations and the exchange process between natural resources and non-natural resources studied and it was concluded that the exploitation of natural resources results in formation of extra money. And the extra money increases the demand to end product, not only the intermediate product of the non-oil sector, import extends, unilateral development appear that adversely affect sustainable development, human capital, including education and its quality. In the article of (Hasanli Y., 2013), the CES production function parameters in Azerbaijan were evaluated by the non-linear small squares method and it was concluded that the competitiveness in the labor market is lack for full capitalization of existing fixed assets (capital) as the mutual replacement elasticity of capital and labor was smaller. In the article of (Muradov A., 2017), the role of university education in economic development is studied, mentioning the increased demand for university education, and the possibilities of ensuring managerial, financial and academically sustainable universities in Azerbaijan, and enhancing their management, academic, financial and institutional freedoms to improve the quality of university education were investigated. In the articles of (Hasanli Y., 2017) and (Suleymanov E. et al 2018), connection of the effective administration of the economy and its correct answer to questions before it with education and its quality was researched in the example of the Azerbaijan economy. In the article of (Gylfason T., 2001), having studied the dynamics of economic development of countries rich in natural resources, it was determined that the share of public costs allocated to education in the GDP and the duration of general secondary education depend on the share of natural capital in the national wealth. So that, the natural capital compresses human capital, diminishes the quality of education, and thereby reduces the rate of economic development. There is a view accepted in the Western literature (see, for example, (Todaro M. and Smith, 2015), (Jin and Jin, 2013)), the main driving force of economic development in the developed countries was human capital more than physical capital. Usually, the elasticity ratio of GDP in the Kobb-Douglas production function of the countries is generally higher than the elastic factor of the capital. On the other hand, the elasticity ration of the GDP in industrially developed countries for labour is higher than those in countries rich with resources.

The article of (Hanushek and Woessmann, 2007) provides a summary of the impact of the quality of education on economic growth. The article of (Bosworth and Collins, 2007) shows that it was determined as a result of inter-country comparison for 34 countries in the years 1975-2003 that high GDP on the country negatively affects the average annual growth rate of the GDP per capita and, the relative increase in pupils of 10-11-12 grades relative to the base year of 1975 affects positively and the number of articles per million person is also positive. The article of (Fernández-González et al., 2016) is dedicated to the PISA assessment allowing comparing the quality of secondary education in the countries. The quality of secondary education in Azerbaijan is studied in the article (Shabanov and Guliyev, 2017), and the impact of the quality of higher education of innovations in the article of (Hasanli and Shabanov, 2018).

The key question in this article is to analyze the dependence of a number of economic development indicators on the quality of education for Azerbaijan. For this purpose,

appropriate econometric models for average annual growth rate of GDP per capita, economic benefits and average monthly salary indices were built.

The regression equation of dependence of the result (explained) indicator on explanatory indicators was studied in the study and parameters are based on statistical data for 2000-2017 and econometrically evaluated by the Least Squares Method in the Eviews Econometrics Software Package.

Explained variable (dependent, result or endogenous variable) - average annual growth rate of GDP per capita

Explaining variables (quality factors that affect the conclusion or freely, exogenous variables)
1) The average statistical score collected by the applicants;
2) Number of articles per million person indexed on the Web of Science database and related to basic sciences and engineering.

Based on the basic statistical characteristics and relevant tests of the econometric model, the conditions of Gauss - Markov were researched (Residual Diagnostics tests and other relevant tests), i.e., the model's adequacy level was determined.

The relevant data of the State Statistical Committee of Azerbaijan, the World Bank, and the State Examination Center were used in the study. Given the annual GDP growth rate per capita, the relevant data was collected to study the impact of the education quality indicators on the lower indices of GDP (income and wages). (See Appendix 1). Considering that admission to higher education institutions includes 11 years of secondary school education, 4-6 years of undergraduate and graduate education, may have a positive impact on economic growth after spending their years in building their career and gaining experience in the economy. From this point of view, these factors were included in the result model (with delay). An empirical and econometric analysis has revealed that the duration of this delay is 12 years. Azerbaijan in 1992-2018, about 100 thousand graduates annually gives the university entrance exams in a centralized manner. It is estimated that over one million people in Azerbaijan, which is a significant factor, have a certain impact on economic growth. Thus, the effect of this effect has been 2 years. This can be explained by the fact that the 2-year delay will have a positive impact on the annual GDP growth rate per person, and the implementation of the provisions and ideas set out in those articles will take about two years to come.

Method

The method of smallest squares is used in the study. The database is based on the official information of the SSC (State Statistical Committee) of AR (Azerbaijan Republic) and World Bank data. The report includes information on the GDP in Azerbaijan, economic profits, average monthly salary, average score obtained by students, and the number of articles per million persons. The present article means the articles referred to the basic science and engineering and indexed in scientific and bibliographic database of the Web of Science. The data covers the years 2000-2017. The GDP deflator and consumer price index for Azerbaijan were used to process primary data. The built-in models were implemented in the Eviews9 econometric application software package.

Three models were proposed to investigate the dependence of economic indicators on the quality of education. The first one of them describes the dependence of the average annual growth rate of the GDP on the average score and the number of articles. The specification of the proper regression equation is as follows:

$$GR0017 = C(1) + C(2)*LOG(AVERAGESCORE(-12)) + C(3)*LOG(QE\_SCI(-2)) + \varepsilon$$
(1)

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The approach proposed in the article of Bosworth and Collins (2003) was used in building this model. Thus, the specification in their article is as follows:

$$GR7503 = \beta1 + \beta2 lnGDP75 + \beta3 SEC75 + \beta4 lnQE + \varepsilon \quad (2)$$

Where GR7503 variable is for the average annual growth rate of the GDP, lnGDP75 variable for the amount of the GDP in the values of the year 1975 in the logarithmic scale, SEC75 variable for the relative number of the pupils of 10-12th grades in relation to the year 1975, and ln QE for the education quality in the logarithmic scale. Where the second explanatory variable characterizes the education quality in the secondary education level, and the third explanatory variable expresses the number of articles per million persons on the country in basic science and engineering, that is, the education quality in higher and post-higher education step. And ε characterizes the normal and or asymptomatic normally distributed random quantity. We replaced the SEC variable that we offered in the model (1) with the Average Score variable. Because the SEC variable is a quantitative indicator more than the quality indicator. Our proposed Average Score variable shows the average score obtained by an applicant for admission to higher schools across the country. It should be noted that the admission to higher school in Azerbaijan has been carried out on the test system by the State Examination Center (former State Student Admission Commission) in a centralized form since 1992. Approximately 100 thousand applicants participate in test exams for admission to higher schools taking exams. According to the law of great numbers of mathematical statistics, the average score obtained by 100 thousand applicants may be considered acceptable as a quality indicator of secondary education in the country. Therefore, we consider that the specification (1) can be considered as a more advanced one for the countries where the average score obtained by the applicant in the admission exams for the higher schools in country.

The proposed second regression equation describes the regression relationship between the economic benefits and the education quality in the country.

$$\ln(Profit) = C(1) + C(2)*QE\_SCI(-1) + \varepsilon \quad (3)$$

Where ln(Profit) variable is for the economic profit in the country in the values of the year 2017, QE_SCİ (-1) variable for the number of articles per million persons in the country with delay of 1 year in relation with the current year.

Our offered third regression equation describes salary and the number of articles and GDP.

$$\ln(Salary) = C(1) + C(2)*QE\_SCI(-3) + C(3)*\ln(GDP) \quad (4)$$

Where ln(Salary) variable is for the average salary in the country in values of the year of 2017, QE_SCI (-3) variable for the number of articles per million persons with delay of 3 years in relation with the current year, and GDP variable for the GDP in the values of the year 2017.

Findings

The Table 1 describes the main econometric characteristics of our proposed (1) regression equation.

Table 1. Basic econometric characteristics of the dependence of the average annual growth rate per capita on the education quality

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.013410	0.003268	-4.104018	0.0262
Log(average score(-12))	0.001770	0.000615	2.877190	0.0637
Log(qe sci(-2))	0.001093	0.000226	4.835269	0.0169

Note: The dependent variable is the growth rate of GDP per capita.

As seen from the Table 1, the average annual growth rate of the GDP in Azerbaijan in the years 2000-2017 is the monotone function in respect of the average score and the number of articles. So that, an increase of 1 per cent of the average score with the 12-year delay in the admission to higher schools across the country increases the average annual rate of GDP per capita by 0.0000177. Increase of the number of articles in the country by 1% with 2-year delay increases the explanatory variable by 0.00001093. Relevant delays may be explained by the fact that an applicant admitted to a higher school has an impact of statistical importance on the average annual growth rate of the GDP per capita in 12 years upon he/she obtains experience in 6 year after studying for 4-6 years in higher school and is admitted the higher school. And the 2-year delay in the number of articles shows that the article has a positive impact on the average annual GDP growth rate after 2

years from the time it is written, published and indexed. The Table 1 shows that all coefficients are statistically significant with at least 90% reliability.
Let's compare the result obtained in Table 1 with those in the article of Jang C. Jin and Lawrence Jin. (2013). One of the main findings in their article is as follows.

$$GR7503 = 17{,}001 - 2{,}093 \ln GDP75 + 0{,}031 SEC75 + 0{,}820 \ln QE\_SC\dot{I} + \varepsilon \qquad (5)$$

(s.e.)   (2,086) (0,279) (0,011) (0,211)   (5)

Where s.e. means standard error. The equation means that the increase of 1% in GDP in the values of the year 1975 reduces the average annual growth rate by 0.02093 points. The relative increase in the number of students of the upper grades (10-12) of the secondary school increased the average annual growth rate by 0.031 points in comparison with the year 1975. In our equation (1), the increase of 1% in the quality of secondary education has increased the average annual growth rate by 0,0000177 points with 12-year delay. Comparison of the relevant coefficients shows that the share of secondary education in the average annual growth rate per person in Azerbaijan is approximately 3 percent. When comparing the impact of the article on the growth rate of GDP per capita, we find that this impact is characterized by approximately 3 point weakness factor in Azerbaijan. The effect of higher and post-higher education era occurs with a 2-year delay compared to the current one. The comparative analysis shows that the requirements for the quality of education in the labor market of Azerbaijan cannot be considered to be high. We explain this by the fact that the economy of the country depends largely on oil.
The Table 2 shows the basic econometric characteristics of the model (3) we propose.

Table 2. Basic econometric statistics of dependence of economic profit on the article number

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.815204	0.128858	76.17051	0.0000
Qe sci(-1)	0.007462	0.002313	3.226809	0.0104

Note: The dependent variable is the economic profit in logarithmic scale.

As seen from the Table 2, the 1-point increase in the number of articles with a 1-year delay will increase the economic profit by 0.7462%. The coefficients of the equation are of statistic importance of 99% reliability.

The Table 3 describes the basic econometric characteristics of the third equation proposed by us.

Table 3. Basic econometric statistics of salary on the article number and GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.520383	0.545998	-2.784595	0.0212
Qe_sci(-3)	0.002546	0.000683	3.726073	0.0047
Log(gdp)	0.689046	0.051610	13.35090	0.0000

Note: The dependent variable is the salary in logarithmic scale.

As seen from the Table 3, 1-point increase of the article number with 3-year delay in relation with the current year increases salary by 0,2546%. And increase of 1% of the GDP increases salary by 0,689046%. According to the equation describing salary, we can say that in developed countries, usually increase of 1% of GDP increases salaries more than 1%. And as seen from our equation, it appears that this increase is 0,689%, which is less than 1%. We can explain this conclusion that production is more capital-intensive than being labor-intensive in Azerbaijan.

Results, Conclusions and Recommendations

We conclude from the established models that the quality of education has a positive impact on economic growth. We propose that as a quality index of the secondary education, the average score should be taken as an alternative to the variable of the number of pupils (SEC) enrolled in the grades of 10-12. Where the average score means the average score (if available) formed in the country in admission to the higher schools in the current academic year. We think that the appropriate average score will adequately characterize the quality of education in the secondary education compared to the SEC variable. Furthermore, positive dependence of the profit in economy that is one of the economic development factors on the quality of education in higher education level has been determined. Moreover, the salary per head in Azerbaijan has been found to be positively dependent on the quality of education in higher education level and GDP.

Finally, we would like to note that the dependence of the Azerbaijani economy on oil is one of the main factors that slow down its innovative economy. To alleviate this delay, we consider that raising the quality of education in the long term should be targeted at one of the top priority issues for Azerbaijan. By examining labor markets in the region and world, we can select such segments there that the experts of our country should be competitive in those segments. And on the base of this case, supporting the export of highly qualified specialists from Azerbaijan can also benefit the Azerbaijani economy. Export of experts to foreign

countries also has a positive impact on the country in addition to its negative effects as the brain drain. Thus, continuously interacting of these people with their homeland allows them to take advantage of chances for interest of their country in the first turn. Additionally, the opportunity of such professionals to return to their country after a certain period by improving their professionalism can also help them to benefit from their high-level skills for the country in the future. Work of the specialists that are citizens of the country may have a positive impact on newer independent countries not only from economic point, but also from diaspora activities.

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