The Effect of Education on Economic Growth in Jordan: 
An Econometric Study (1976 – 2007) "The Modified Version"

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ABSTRACT

The main aim of this study was to examine the effect of education on economic growth in Jordan over the period 1976-2007. Co-integration analysis was adopted with five variables: Real Gross National Product (RGNP), Capital (K), Labor (L), Expenditure on Education (EDU), and Technology (T). Two unit root tests (Dickey-Fuller Test and Philips-Perron Test) have been employed to test the integration order of the five variables. The Johansen Co-integration Test is mainly used. Furthermore, for the purpose of supporting the results, the dynamic relationships among the variables are explained through presenting the variance decomposition of log (RGNP). The empirical results support the main hypothesis of this study that education affects positively economic growth in Jordan. Even though that the most important effect on economic growth is for education, the other three explanatory variables affect also, positively, the economic growth; yet their effect is relatively less important than the effect of education.

Keywords: Education, Economic Growth, Co-integration Analysis.

INTRODUCTION

The effect of education on economic development and economic growth has been highly discussed and analyzed by economists and pedagogues, who all agree on the existence of this effect. The question about whether spending on education is consumption or investment, was largely raised since Adam Smith in his famous work, "Wealth of Nations (1776) in which, he compared between investment in machines and investment in human capital.

Recently, the interested in national accounts, who are considered as pro-Keynesian school, consider spending on education as consumption that contribute to national income only by wages and salaries of personal engaged in the educational sector. By contrast, the opposite view, consider spending on education as investment since education contributes directly to economic development through the skills of labor force acquired by education. However, the pro-Keynesian economists have moderated their point of view to consider that spending on education is consumption, whereas spending on training is investment.

Anyway, many studies focus on education as the main form of human capital, e.g., Romer (1990), Barro(1991), Stevens and Weale(2003) who argued that: " if spending on education delivers returns of some sort, in much the same way as spending on fixed capital, then it is sensible to talk of investing in human capital as the counterpart to investing in fixed capital. The process of education can be analyzed as an investment decision".

Hence, we can say that whether spending on education is consumption or investment, it contributes positively to national output, but investment contributes much more on economic growth than consumption given the effect of the investment multiplier.

In Jordan, the focus on education and human capital is the main concern of development policies implemented by the Jordanian state given the lack of natural resources in the country. The slogan of these policies declared by the highest level of authority is "human capital is the most appreciated resource in our country".

Nobody denies the positive effect of education on social and economic development and economic growth in the kingdom. This effect manifests through the relatively high skills and qualifications of the Jordanian labor force acquired by education, and through the

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remittances transferred by the high skilled Jordanian laborers working abroad especially in the Gulf Countries.

The main concern of this study is how to estimate this effect in Jordan? In an attempt to answer this question, we suggest two basic reasons for assuming some effect of education on economic growth in Jordan. The first one is the important improvement of standards of living in the country over the last five decades, particularly since 1975. This improvement could be expressed by the increase of the real per capita income, the progress of health care, and the spillovers of education manifested in: the consumption behavior, the decline in family size, and the participation of women in the labor force, etc.

The second reason is the belief that the incomes persons can command depend on their level of education. Poor education results in unskilled labor force and unemployment and by consequent, low levels of income, and this may have serious negative effect on economic growth. If educated people earn more than those without education, shouldn't the same be true for countries? If not, the rate of change of output per hour worked in a country ought to depend on the educational attainment of the labor force.

Objective and Importance of the Study:
This study aimed at investigating the effect of education on economic growth in Jordan over the period (1976-2007). The empirical aim of the study is to reach some conclusions and recommendations that may serve as an incentive for decision makers to pay more attention to education. The main hypothesis of the study is that education has a positive effect on economic growth in the country.

The importance of this study arises from the fact that nontraditional econometrical techniques, in particular time-series techniques for investigating this effect have been applied. This study attempts to shed light on this effect by using this technique.

After this introduction, the plan of the study consists of five parts. In the second part, a brief historical overview of the educational system will be presented, the literature review and previous studies in part three, data and methodology in part four, the estimation methods and results in part five, and finally, the concluding remarks and recommendations in the last part.

The Educational System: An Overview
When the Emirate of Transjordan was created, in the 1920s, its educational system was simple and limited. There were only twenty five schools in the Emirate run by religious institutions.

Since the establishment of the kingdom in 1952, a great emphasis on education was given by the Jordanian state at the highest level. Already, by 1983, enrollment rate in the primary level (grades 1-9), has attained more than 90%. Actually, this rate reached 100%.

At the secondary level, the enrolment rate has risen from 50.6% in 1975, to 65.8% in 1990, and to 90% in the 2000s. Concerning the enrolment rate at the tertiary level, it has risen dramatically over the last four decades; it was only 9.3% in 1975 jumped to 21% in 1980, to 26% in 1990, and to up to 40% of the age group begins education at this level during the 2000s. 243,000 students (4% of population), were enrolled in the higher education in the year 2009/2010. Jordan has many universities compared to its population; the average is one university per 250,000 inhabitants. Accordingly, Jordan ranges at the third position among the MENA countries.

The numbers of schools, teachers, and students at the Pre-University level, have dramatically risen also since 1950 as it is shown in table No.1 below.

<table>
<thead>
<tr>
<th>Years</th>
<th>1950</th>
<th>1974</th>
<th>1992</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of schools</td>
<td>382</td>
<td>1,961</td>
<td>3,716</td>
<td>6,000</td>
</tr>
<tr>
<td>No. of teachers</td>
<td>1454</td>
<td>15,991</td>
<td>48,910</td>
<td>103,000</td>
</tr>
<tr>
<td>No. of students</td>
<td>61,425</td>
<td>497,125</td>
<td>1,142,433</td>
<td>1,600,000</td>
</tr>
</tbody>
</table>


Table(1) shows that between 1950 and 2010, the number of schools has doubled about (16) times, the number of teachers about (71) times, and the number of students (26) times. These figures may signify the
improvement of the quality of this level of education where the student/teacher ratio has declined from 42.27 in 1950, to only 15.53 in the scholar year 2009/2010.

The literacy rate affects positively economic and social development as many researches and studies confirm. This rate has strongly progressed in Jordan since 1952 when it was only the third of the total population aged above 15 years to rise to About (92%) in 2009 as table (2) below shows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>N.A.</td>
<td>N.A.</td>
<td>33</td>
</tr>
<tr>
<td>1996</td>
<td>N.A.</td>
<td>N.A.</td>
<td>85</td>
</tr>
<tr>
<td>2000</td>
<td>94</td>
<td>82.5</td>
<td>89</td>
</tr>
<tr>
<td>2005</td>
<td>95</td>
<td>87.0</td>
<td>91</td>
</tr>
<tr>
<td>2007</td>
<td>96</td>
<td>88.4</td>
<td>92</td>
</tr>
</tbody>
</table>

Source: MOE, Statistical Bulletins for Different Years, Amman, Jordan. Note: N.A.: Not Available

The large increase of enrolled students at all educational levels requires a proportional increase in public and private expenditure on education. Public expenditure on education constitutes on the average about (6%) of the GNP in the country. The surveys and studies that investigate the size of private expenditure on education are almost missing in Jordan. Nevertheless, a survey conducted by the author about this subject revealed that the private expenditure on all levels of education constitute on the average about (5%) of the GNP (Bader, Khasawneh, and Malawi, 1994). Hence, the total expenditure on education (private and public) constitutes around (11%) of GNP. This percentage does not include the foregone opportunity cost.

Expenditure on education and literacy rate are almost used in the studies for the purpose of estimating the effect of education on economic growth and development since these two variables may express the quantitative and qualitative aspects of the educational process. However, in this study, expenditure on education is used as the principal explanatory variable in the statistical analysis.

Review of Related Literature

The effect of education on economic growth was early estimated by Schultz (1961) and Denison (1962, 1964, 1967, 1974, 1979, 1984, and 1985). In his study in the USA, Schultz found that education is responsible for about (50%) of the increase in labor income during the period 1929-1957, this income constitutes the big portion of national output when we measure this output by using the income approach using cross-sectional survey data for the USA. Denison concluded that the relative contribution of education to economic growth is ascribed to the increase in the quality of the labor force. This estimated contribution amounted to 19.7% of economic growth rate for the period 1929-1948, to 14.5% for the period 1948-1973, and to 49.2% for the period 1973-1982.

After that, several studies have appeared extending Denison's first study (1962). One of these studies was conducted by Denison himself (1967), in which, he estimated the contribution of education to economic growth rate for nine European countries over the period 1950-1962. He found that this contribution varies from only 2% in Germany to 13% in UK and Belgium and, to 15% in USA for the same period.

Hicks (1980), in his study about the relationship between the growth, literacy taken as a measure of educational development, and the life expectancy in (83) developing countries during the period 1960-1977, found that the twelve countries who have the highest growth rates have the highest levels of literacy and life expectancy.

Hicks (1987) attributed the effect of education on economic growth to its positive effect on the productivity of the labor force in different ways, including general education and training.

Investment in education accelerates economic growth, but the opposite may occurs also; that is the conclusion of Robinson and Vaizy (1966) study about the contribution of education to economic growth. The authors interrogate whether the developed countries are rich because they are better educated or they are better educated because they are rich? They added, that no simple answer, but one can
say that the effect is reciprocal.

Martin Weale (1993) argues that social returns to investment in human capital could be compared with those of physical capital so as to give a basis for the allocation of resources between the two types of investment.

In their cross section analysis based on an estimation of aggregate production function for (51) countries based on data at 10-years time intervals between 1960 and 2000, E. Jamison, D. Jamison and Hanushek (2007), found a strong impact of education quality on growth rates of national income.

According to Foster (1985), research in the USA has led to the conclusion that historically over 40% of the growth of per capita income in that country could be attributed to educational investment in people. The author pointed out; also that education affects positively development through spillovers expressed by its effects on political stability and the limitation of the growth of population in developing countries.

Investigating the relationship between the enrollment rate and per capita GDP, was examined by Stevens & Weale (1983), in a study on a number of developed countries in addition to South Korea and Brazil. The study concluded that a 1% increase in the enrollment rate raises GDP by 0.35%. The authors added also, that this rate rises in less well-educated populations.

In his study about the sources of productivity, McMahon (2000) concluded that the major sources of growth in the USA are education, increasing returns to scale, and Research and Development (R & D). Concerning the education, the author pointed out that educational improvement in the labor force account for about 0.5% as direct contribution of education to the growth rate of aggregate output, or about one-third of residual Total Factor Productivity (TFP).

The relationship between literacy and per capita GNP was examined by Bowman and Anderson (1963), who looked first of all, at literacy rates in 1950 and GNP per capita in 1955 measured in the U.S. dollars in eighty three countries. They found a positive relationship between these two variables in the less developed and developed countries.

In Australia, the contribution of education to growth in per capita real GDP over the period 1969-2003 was analyzed by Matsushita, Abu Siddique, and Giles (2007), who found that 31% of the annual growth rate of per capita real GDP in that country was attributed to education. The share of higher education in this contribution was 16% and the remainder (15%) was contributed by the vocational education, training and technical and further education enrollments.

In a study about the same subject in India, Self and Grabowski (2004), concluded that primary education has a strong causal impact on growth, with more limited evidence of such an impact for secondary education. They added that, the evidence is quite compelling that it is female education at all levels, that has potential for generating economic growth.

In his paper investigating the effect of education and the role of technical progress on economic growth in Taiwan over the period 1965-2003, Lin (2003), revealed that education has a positive and significant effect on growth, but the role of technical progress does not appear to be extraordinary important.

Many other studies in developing countries reached similar conclusions in affirming the existence of positive relationship between education and growth.

Among these studies we can mention: Pereira and Miguel (2010) in their study on Portugal who pointed out also, that investment in education does not significantly crowd-out physical investment and average years of schooling semi-elasticities have comparable magnitude across primary and secondary education.

Burchi (2006), in his study about the role of education in socio-economic development in the rural areas in developing countries, demonstrated that increasing children's school attendance by 100% can reduce food insecurity by approximately 19%, therefore, he recommended governments and donors to focus their attention (and investment) on the educational sector.

Finally, and in the developing counties also, precisely in China; Li and Huang (2009) confirmed in a relevant study, that both education and health (human capital) investment have positive effect on economic growth. Their study has shown that educational stock quality has a strong correlation with economic growth.

In the Arab countries, there are very limited studies about this subject. One of these studies conducted by Almaliki & Ben Obeid (2000) in Saudi Arabia in which they concluded that an increase of educational expenditure by 1% leads to a 0.1% increase of non-oil real GDP in the short run, and to 0.36% in the long run.

A report of the World Bank about the educational sector in the MENA countries has focused on the relationship between education and economic growth and
has considered education as an essential condition for economic growth. Finally, Mazur (1979) reported that in Jordan the relative contribution of the residual factor to output growth over the period 1959/60-1965/66 ranged between 17-31% of the average growth rate for this period which is 7%.

Data and Methodology

The empirical works about the impact of education on economic growth in developing countries are limited, especially in Jordan where the educational system is developed in comparison with most of the Arab and developing countries. Hence, it seems fair to examine the effect of this system on economic growth in Jordan.

The growth accounting methodology is employed in this study. Denison's general approach will be used; by utilizing the econometric techniques to estimate the impact of education and the other explanatory factors on economic growth in Jordan over the period 1976-2007.

The basic formula of the neoclassical production function which was used by Matsushita (2006) to measure the contribution of education to growth in per capita real GDP in Australia over the period 1969-2003, is:

\[ Y_t = F (A_t, K_t, L_t). \]

Where:

- \( Y_t \): real GDP,
- \( A_t \): Technology,
- \( K_t \): Capital, and
- \( L_t \): Labor.

In this study we add education abbreviated by (Edu) to this formula as a fourth explanatory variable, so the formula becomes:

\[ Y_t = F (A_t, K_t, L_t, E_Du_t) \]

The formula used in this study is:

\[ RGNP_t = F (K_t, L_t, Edut, T_t) \quad \ldots (1) \]

Where:

- \( RGNP_t \): output level or real GNP in year t.
- \( T_t \): Level of technology in year t.
- \( K_t \): Level of capital in year t.
- \( L_t \): Level of labor in year t.
- \( E_Du_t \): Expenditure on education in year t.

The main hypothesis of this study as mentioned above, implies a positive effect of education on economic growth proxied by \( RGNP_t \).

For investigating this effect, four explanatory variables have been employed:

1- **Real Gross National Product (RGNP):**

Real GNP has increased from JD 3117.4 million in 1976 to JD 12060.89 million in 2007, in 2006 prices. This signifies that it has doubled about four times over the period of study with an average annual growth rate of 4.36%.

2- **National Capital:**

Real national capital was estimated during the period 1976-2007 by using the Incremental Capital Output Ratio (ICOR) method which was used before by many researchers: (hmaidaat & Hazaymeh, 1995, Talafhah, 1989, Hammad, 1986, and Bader, 2006).

The following equation is used for this purpose:

\[
\text{ICOR} = \frac{\sum \text{Real Net Capital Formation (1976 – 2007)}}{\text{RGNP 2007} - \text{RGNP 1976}} \quad \ldots (2)
\]

Where:

- \( \text{ICOR} \): Incremental Capital Output Ratio
- \( \text{RGNP} \): Real Gross National Product.

By using this formula, this ratio for the period of study is found to be:

\[
\text{ICOR} = \frac{36184.34}{8943.49} = 4.04588589
\]

For each year over the period of the study, the capital is estimated by adding the Real Net Capital Formation in a given year to the capital of the previous year.

3- **The labor (L):**

The labor is proxied by the compensation of employees. These compensations have jumped from JD 1104.55 million in year 1976 to 4092.56 million in year 2007 in real prices of 2006. The average annual growth rate of these compensations is 4.225%.

4- **Expenditure on education:**

These expenditures consist of all public expenditures incurred by all the public authorities, and the private expenditure incurred by the households (families).

The foregone opportunity cost is not considered in this study.

The total expenditure on education (Private + Public), at all levels, is estimated to constitute about (11%) of the GNP in Jordan as mentioned above. These expenditures have increased from JD 342.89 million in 1976 to JD 1267.14 million in 2007 in real prices of 2006. They have multiplied 3.7 times with an annual growth rate of 4.2%.

The expenditure on education is counted to express the quantitative and qualitative progress of the educational system.

5- **Technology:**

Technology is proxied by an arithmetic sequence over the period of the study. In other words we estimated the progress of technology from (1) in 1976 to (32) in 2007.
Central Bank of Jordan through its various statistical bulletins, and the Department of Statistics in Jordan.

The econometric analysis adopted in the study is based on the following model:

\[ \log (\text{RGNP}) = b_0 + b_1 \log (L) + b_2 \log (K) + b_3 \log (\text{EDU}) + b_4 \log (T) + u \]  

\[ \ldots \text{(3)} \]

Where:

- \( \text{RGNP} \) = Real Gross National Product.
- \( L \) = Labor proxied by the compensation of employees.
- \( K \) = Real Capital.
- \( \text{EDU} \) = education proxied by real public and private expenditure on education.
- \( T \) = technology proxied by arithmetic sequences, as mentioned above.
- \( u \) = measures the Random error term.

and, \( b_0, b_1, b_2, b_3, \) and \( b_4 \) are parameters to be estimated.

In order to test the hypothesis of the study, the researcher has employed the time series data analysis in general; the co-integration analysis in particular.

**Empirical results:**

**A- The Stationary Analysis:**

The integration order of the variables determines the appropriate approach of estimation. If all the variables are integrated of the same order, it is possible for these variables to be co-integrated, and the Ordinary Least Squares(OLS) approach can be adopted. Otherwise, the results of this approach could be misleading and other approaches of estimation should be applied.

For determining the order of integration of the variables, two tests were conducted:

1- **Augmented Dickey Fuller Test (ADFT):** which examines the hypothesis \( (p = 0) \) versus the hypothesis \( (p < 0) \) in the following formula:

\[ m \Delta \text{X}_t = \mu + \rho \text{X}_{t-1} + \alpha \sum \Delta \text{X}_{t-i} + \varepsilon_t \]  

\[ i=1 \]

In this test, the lagged difference terms are included where their number of lags is normally chosen empirically, i.e. enough terms could be included for obtaining serially independent error term in equation (4).

2- **The Phillips-Perron Unit Root Test (PPURT):**

This test is basically a test of the hypothesis \( \rho = 1 \) in the equation:

\[ \Delta \text{X}_t = \mu + \rho \text{X}_{t-1} + \varepsilon_t \]  

The equation is estimated by the OLS method and then the t-statistic of the \( \rho \) coefficient is corrected for autocorrelation in \( \varepsilon_t \).

**B- The integration order of the variables:**

The results of the two tests are displayed in table (3) below:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Augmented Dickey-Fuller Unit-Root-Test (ADFURT)</th>
<th>Phillips-Perron-Unit-Root-Test (PPURT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calculated value</td>
<td>1% Critical value</td>
</tr>
<tr>
<td>( \log(\text{RGNP}) )</td>
<td>-0.282</td>
<td>-3.666</td>
</tr>
<tr>
<td>( \Delta[\log(\text{RGNP})] )</td>
<td>-2.831</td>
<td>-3.675</td>
</tr>
<tr>
<td>( \Delta[\log(\text{RGNP},2)] )</td>
<td>-3.876</td>
<td>-3.685</td>
</tr>
<tr>
<td>( \log(K) )</td>
<td>-0.408</td>
<td>-3.666</td>
</tr>
<tr>
<td>( \Delta[\log(K)] )</td>
<td>-2.766</td>
<td>-3.675</td>
</tr>
<tr>
<td>( \Delta[\log(K,2)] )</td>
<td>-3.854</td>
<td>-3.685</td>
</tr>
<tr>
<td>( \log(L) )</td>
<td>-1.275</td>
<td>-3.666</td>
</tr>
<tr>
<td>( \Delta[\log(L)] )</td>
<td>-3.303</td>
<td>-3.675</td>
</tr>
<tr>
<td>( \Delta[\log(L,2)] )</td>
<td>-4.260</td>
<td>-3.685</td>
</tr>
<tr>
<td>( \log(\text{EDU}) )</td>
<td>-0.528</td>
<td>-3.666</td>
</tr>
<tr>
<td>( \Delta[\log(\text{EDU})] )</td>
<td>-2.938</td>
<td>-3.685</td>
</tr>
<tr>
<td>( \Delta[\log(\text{EDU},2)] )</td>
<td>-3.872</td>
<td>-3.685</td>
</tr>
<tr>
<td>( \Delta[\log(t)] )</td>
<td>-17.189</td>
<td>-3.675</td>
</tr>
<tr>
<td>( \Delta[\log(t,2)] )</td>
<td>-24.170</td>
<td>-3.685</td>
</tr>
</tbody>
</table>

**Notes:**

- \( D(X) \): the first difference of variable \( X \).
- \( D(X, 2) \): the second difference of variable \( X \).
ADFURT indicates that log (RGNP) and is integrated of order (2), i.e., 1(2) since the calculated value is higher than the critical values (all in absolute values) at 1% and 5% level of significance. By the same token, log (k), and log (EDU), are both 1(2) at 1% and 5% significance level, log (L) is 1(1) at 5% significance level. Finally log (T) is 1(0) at 1% and 5% level of significance.

Likewise, PPURT shows that log (RGNP), log (K), log (L), and log (EDU), are all 1(2) given that the calculated values are higher than the critical values at 1% and 5% significance level, whereas log (T) is 1(0) at 1% and 5% significance level.

Even though the results of two tests are not identical, the main point is that both tests show that all the variables are integrated of different orders, which implies that using the OLS method could lead to false results and other estimation methods should be used. Therefore, the researcher has adopted the co-integration analysis.

C- The Co-integration Analysis

This analysis aims to check if all variables are co-integrated, i.e., if a linear combination of these variables are stationary. If that is the case, regression on the levels of these variables would be meaningful and we do not miss any valuable long-term information (Gujarati, 1995).

The Johansen Co integration Test, which tests the assumption of linear deterministic trend in the data, is used for the purpose of this analysis.

The results of this analysis are shown in table (4) below:

Table (4): Johansen Co integration Test:

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>5 Percent Critical Value</th>
<th>1 Percent Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>None**</td>
<td>0.958388</td>
<td>131.4639</td>
<td>68.52</td>
<td>76.07</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.459744</td>
<td>36.08318</td>
<td>47.21</td>
<td>54.46</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.332597</td>
<td>17.61184</td>
<td>29.68</td>
<td>35.65</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.166631</td>
<td>5.480987</td>
<td>15.41</td>
<td>20.04</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.000421</td>
<td>0.012628</td>
<td>3.76</td>
<td>6.65</td>
</tr>
</tbody>
</table>

(**) denotes rejection of the hypothesis at the (1%) level Trace test indicate 1 co-integrating equation(s) at both 5% and 1% levels.

Consequently, we can suggest that these results are, in general in accordance with the economic theory, and could explain a very important part of the variation of Real Gross National Production in Jordan.

D- The-Variance- Decomposition:

In order to make the results more concrete, the researcher has investigated the dynamic short term relationship among the variables through decomposing the variance of RGNP.

Table (5) below reports the variance decomposition of log (RGNP) for different time periods:

Table (5): Variance Decomposition of log (RGNP) for Different Time Periods:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Variance Decomposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2005</td>
<td>0.5432</td>
</tr>
<tr>
<td>2005-2010</td>
<td>0.5347</td>
</tr>
<tr>
<td>2010-2015</td>
<td>0.5263</td>
</tr>
</tbody>
</table>

Where the standard errors are reported between brackets. The co-integrating equation produces the long-term relationship among the variables and shows that all the explanatory variables, i.e., log (L), log (K), Log (Edu), and log (t), have positive effect on Real Gross National Product, and they are highly significant. The main point in this study is the effect of education on economic growth in Jordan.

As the above equation shows, the contribution of education on the GNP is highly significant. This result is compatible with the results of many studies mentioned in the section devoted to the economic literature and previous studies.
Table (5): Variance Decomposition of Log (RGNP)

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E</th>
<th>Log (RGNP)</th>
<th>Log(K)</th>
<th>Log (L)</th>
<th>Log (Edu)</th>
<th>Log (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.064837</td>
<td>100.0000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>3</td>
<td>0.263312</td>
<td>11.21015</td>
<td>3.154110</td>
<td>22.69535</td>
<td>62.89012</td>
<td>0.050263</td>
</tr>
<tr>
<td>5</td>
<td>0.285698</td>
<td>9.929988</td>
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<td>19.91507</td>
<td>59.76059</td>
<td>0.142435</td>
</tr>
<tr>
<td>7</td>
<td>0.305153</td>
<td>14.16420</td>
<td>13.74267</td>
<td>17.46390</td>
<td>54.36288</td>
<td>0.266343</td>
</tr>
<tr>
<td>9</td>
<td>0.420002</td>
<td>28.71285</td>
<td>7.751833</td>
<td>22.68508</td>
<td>40.65338</td>
<td>0.196851</td>
</tr>
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</table>

The results displayed in table (5) indicate that education is responsible for explaining about 62.9% of the variation of RGNP after three time periods. This size of explanation reaches around 60% after five time periods, to 54.4%, and to 40.7% after seven, and nine time periods respectively.

On the other hand, innovations to log (K) were found to explain about 3.15% of the forecast error of RGNP after three time periods and this rate rises to 10.25% after five time periods, to 13.74% after seven time periods, but declines to 7.75% after nine time periods.

The innovations to log (L), explain about 22.70% of the variation of RGNP after three time periods, 19.92% after five time periods, 17.46% after seven time periods, and 22.69% after nine time periods.

Finally, the innovations to log (T) explain only 0.05% of the variation of RGNP after three time periods, this percentage rises to 0.14% after five time periods, 0.27% after seven time periods, and declines to about 0.20% after nine time periods.

Hence, it is clear from table (5), that log (EDU), has the greatest effect on log (RGNP), comparing to log (K), log (L), and to log (T). These results in the short term support the results of co-integrating equation mentioned above.

Finally, it is clear from table (5) also, that the four explanatory variables employed in this study explain about 85% of the changes of RGNP in Jordan.

Conclusions and Recommendations

The main concern of this study is to investigate the effect of the education proxied by the total expenditure on all levels of education, on economic growth proxied by the RGNP. For this purpose and for testing the hypothesis, the researcher examined five variables for stationary by applying the (ADFURT), and the (PPURT). The two tests confirmed that these variables are integrated of different orders, which implies that the researcher has adopted the co-integration analysis.

The results show that the education affects positively economic growth in Jordan and this effect is strongly significant. The other three explanatory variables (K, L, and T) have also a positive effect on economic growth, but the most important effect is for education, as the co-integration test and the variance decomposition test show.

Policy implications for the empirical results of this study suggest a number of recommendations:

1- Jordan should concentrate on investment in human resource development through education while also implementing reforms that are conducive to economic growth.

2- The improvement of the quality of education particularly through the concentration on the economics of knowledge and information technology.

3- The permanent development of the educational programs and curricula in order to satisfy the renewable needs of the labor market resulting from the rapid scientific and technological progress.

4- Increasing the government budget devoted to education at all levels, given the existence of positive relationship between expenditure on education and its quality.

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