AN EMPIRICAL STUDY ON THE EFFECT OF EDUCATION ON LABOR PRODUCTIVITY

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Abstract

This study investigates the effect of education on labor productivity using data from the Jordanian economy. Jordan has the world's second-highest share of refugees in comparison to its population. This fact outlines the main challenges facing efforts to provide quality education to Jordanian citizens and refugees. This study shed light on the obstacles and challenges facing education in Jordan to serve as a wake-up call for decision-makers. The study employs the autoregressive distributed lag (ARDL) model bounds testing procedure developed by Pesaran, Shin, and Smith (2001), using data ranging from 1984 to 2018. The results showed that in the long run, education has a positive and statistically significant effect on labor productivity. Inversely, in the short run, education has a negative and statistically significant effect on labor productivity. The estimation results indicate that a 1% increase in education in the long run increases labor productivity by 1.15%, and a 1% increase in education in the short run decreases labor productivity by 1.25%. In addition, the study found that both labor share of capital and foreign direct investment (FDI), have a positive and significant effect on labor productivity. The study concluded with several recommendations.

Keywords: Education, Average Labor Productivity, Foreign Direct Investment, Education Index, Jordan

1. INTRODUCTION

Jordan has a clear shortage of natural resources. Economic growth in Jordan has continued to be sluggish throughout the last decades, and the labor market has soaring levels of unemployment and modest levels of labor force participation. In addition, the economic impacts of the Syrian refugee crisis and the COVID-19 pandemic have intensified these characteristics of the Jordanian economy.

The Jordanian government confronted these hard situations by developing a high-quality human capital strategy. The strategy recognizes crucial involvements needed in young childhood learning, basic and secondary education, career training, and higher education to guarantee Jordan persists to maintain its human capital competitive edge. As a result, the education system in Jordan has experienced rapid growth in the past few decades, although quality concerns remain.

The question remains: *Does education positively affect the productivity of the Jordanian worker to ensure the required growth and development? Or, Does the lack of education in Jordan negatively affect the productivity of Jordanians as a result of the challenges and obstacles it faces?*

This paper investigates the effect of education on labor productivity in Jordan during the period from 1984 to 2018. It is widely accepted that education, as a key component of human capital, plays an essential role in individual and economic prosperity. Education is crucial for individuals to improve their earnings and productivity.

The hypothesis being tested in this paper is that there is a positive relationship between education and labor productivity in Jordan during the period from 1984 to 2018. The autoregressive distributed lag (ARDL) model bounds testing procedure developed by Pesaran, Shin, and Smith (2001) is used to achieve this goal.

The hypothesis of the study is built upon the idea that human resources are a measure of a nation's wealth. It affects the economic and social life of a country. The human element and its efficiency are crucial factors for economic progress. Therefore, it is important to take care of the development of human resources in many aspects; the first aspect is the economic aspect which is represented in qualified and trained human resources, the second aspect is the social aspect, namely, that education develops the intellectual and mental abilities of the individual and acquires him balanced behavioral patterns and values. The third important aspect is security, where education and vocational training provide educational and work opportunities for a scientific and professional staff capable of research, innovation, invention, and development to make a cultural transition and technical progress in the various spheres of life of society.

Education and vocational training is an entry into any development strategy. It is the key that can change the world of work and economy, reduce poverty, and improve the environment and quality of life. Direct preparation is, therefore, a primary goal of vocational education by providing knowledge and skills and linking knowledge to practice. This is an essential part of the individual's training and practical life, and linking the skills to the requirements of the labor market and life is a criterion for the quality of education and vocational training, which is linked to the employment opportunities of graduates and their absorption according to the competitive advantage and ability to provide innovations to improve production, labor productivity and employment of applied knowledge (United Nations Research on Economic Development, 1995).

There is a global consensus on the centrality of education in creating community creativity that can increase productivity, improve employment opportunities, and raise the quality of life in society. The return on education goes beyond the direct material benefit of a learner, reaching all members of the society through the benefit of its various practical applications that cannot be limited to a particular generation or the borders of a particular country (Becker, Murphy, & Tamura, 1990). This interest does not in any way mean that there are no other factors affecting capacity development but also for the ability of education to influence the availability of these factors and their interaction with each other or with the environment by increasing human abilities to co-exist (*to live together*), learn to acquire knowledge (*to know*), learn to apply knowledge in life (*to do*), learn what it should be (*to be*) (Goncz, Skirke, Kleizen, & Barber, 2007).

But the profusion of theories on education-driven productivity is not matched by subsequent empirical literature. Empirical studies on how education affects productivity are poorly supported, inconclusive, and subject to a variety of econometric biases. Accordingly, most estimates regarding the education productivity nexus and the potential for education-driven productivity gaps are inconclusive.

An important aspect of this study is that it is among a few studies that examined the impact of education on economic growth in Jordan, using a new methodology to highlight the most important challenges and obstacles to quality education and presenting recommendations to plan and decide for the future. This study is important to Jordan because it aims to promote itself as a country with a competitive advantage in the availability of qualified human capital, increasing the demand for Jordanian labor abroad and enhancing its attractiveness to foreign investors.

The paper is structured as follows. Section 1, the introduction, gives an overview of the subject and main theme in the research, which is followed by a literature review, Section 2, that presents a range of scholars' thoughts on the subject. After that, brief information about education in Jordan is provided in Section 3. Section 4 describes the data, the used methodology, and the model. Then, the results are discussed in Section 5. The conclusion of the paper is provided in Section 6.

2. LITERATURE REVIEW

All countries are interested in education development as a major source of economic growth, especially those lacking economic resources. The relationship between education development and economic growth has been studied extensively at the international level, but few studies have been conducted at the regional and local levels.

At the local level, according to Al-Tal (1990), who aimed to measure the effect of education on economic growth in Jordan (1971–1988) using Schultz and Denson, education had a positive impact on growth at the primary and secondary levels and a negative impact on growth at the upper levels. Based on the results, education at the basic and higher levels contributed positively, while that at the secondary level contributed negatively. This is primarily due to widespread unemployment among secondary and university graduates, as the economy is unable to absorb the education output. Moreover, Al-Zoubi and Al-Tal (2004) examined the relationship between investment in human capital and growth in Jordan over the 1979–2000 period. The results showed that human capital accumulation supported economic growth, and the study recommended improving the quality of education.

At the international level, and studying 98 countries, Barro and Lee (1994) found a positive

correlation between the number of students enrolled in schools and per capita gross domestic product (GDP). And as demonstrated by Chuang (2000), a study that focuses on the causal relationship between human capital accumulation and exports and economic growth in Taiwan, results show that human capital acquisition and accumulation of exports stimulate economic growth, while exports accelerate capital accumulation. This case study provides evidence for the theory of internal growth based on human capital and the principle of export-led growth.

Bergeaud, Cette, and Lecat (2018) investigate the role of production factor quality in productivity growth, using data from 17 OECD countries over the 1890–2013 period. The paper found that education levels have a large significant effect on growth, while the age of capital has a significant limited effect. Similarly, Priatna (2020) studied the impact of education and training on the employment and productivity of civil servants. The study found that education and training influence the labor productivity of civil servants.

A study by Hanushek (2013) of many developing and developed countries between 1981 and 2008 found that developing countries made significant progress in closing the gap with developed countries in educational attainment and enrollment (educational quantum). However, it has been less successful in bridging the gap with developed countries in the quality of schooling and development of cognitive skills (educational types). The study also showed that developing countries will have a hard time improving their long-term economic performance unless they improve the quality of their education.

The results of the study done by Jozičić and Škare (2016) on the Croatian education system found that human capital quality depends on the quality of the education system instead of quantitative investment in education. and that the investment in human capital is inadequate.

Yao (2019) analyses the relation between higher education expansion and productivity in China. The study argues that educational policy affects labor productivity through its effect on human capital stock and human capital allocation, he found that high education has a negative effect on labor productivity, and he relates that to allocation distortion.

On the other levels of education, Delalibera and Ferreira (2019) study the effect of early childhood education on economic growth and productivity, using data from the US from 1961 to 2008. The paper found that formal education is essential for the increase of labor productivity. In addition, they found that reallocations of public expenditures from formal education to early childhood education would have substantial influences on productivity.

The effect of advanced education on labor productivity was discussed by Belchik (2022). The paper argues that artificial intelligence is an important factor in improving labor productivity. The paper raises the issue of contradiction between the need to increase labor productivity and the development of technological innovations. The main result of the study was that the improvement of artificial intelligence is a component in the growth of labor productivity.

Finally, a summary of the Nobel laureates in economics; Becker, Schultz, and Heckman about human capital investment, was introduced by Krasniqi and Topxhiu (2016). They stress that investing in human capital and training should be a priority for government policies, especially in early childhood age.

Several past studies have demonstrated the positive impact of the human factor on economic growth. Some studies have shown the need for more human development efforts to reach the desired economic growth by focusing on the quality of education and technology transfer, improving qualitative indicators of education, increasing spending on education, and addressing the challenges and obstacles that limit the development of education and the transfer of knowledge. In contrast to other studies, this study examined how the quality of education impacts labor productivity in Jordan.

Based on the above-mentioned literature, this study has labor productivity as a dependent variable and education as an independent variable. It is expected that education will have a positive effect on labor productivity. The effects of other independent variables are also tested. These variables include the labor share of capital, the foreign direct investment (FDI), and a dummy variable that capture the effect of structural adjustment programs. Likewise, all these variables are expected to have a positive effect on labor productivity.

3. EDUCATION IN JORDAN

Jordan's educational system has made significant progress since the 1990s, in terms of quantity. The educational development plan was adopted, which continued in the modernization and renewal until Jordan reached 77th place out of 187 countries according to the index of education in 2014. Since the establishment of the Kingdom in 1921, Jordan has been interested in education because of the belief and awareness of the role of education in development at the level of individuals and society, while the number of schools did not exceed 25 schools in the academic year (1922–1923), there were 7262 schools in the academic year 2017–2018, i.e., doubled by 290 times.

Jordan's primary education rate was 98.2% in 2010, higher than the average in the region (93%), and Jordan ranked 18th in achieving gender parity in education including rural and urban areas (United Nation of Education, Science and Culture Organization [UNESCO], 2010). The educational statistics for 2017 indicate that the average number of students in the class section (25.3 students per class section) and the number of students to the number of teachers (16 students per teacher) are advanced educational indicators. In the field of scientific research, Jordan achieved the highest percentage of researchers in the Organization of Islamic Cooperation (OIC) countries, which includes 57 Islamic countries, the report pointed out that the rate of researchers per million of the population has reached 2000 Jordanian researchers compared to 500 researchers per million of OIC population. However, this level remains below the aspiration of Jordan's higher education strategy compared with that level of developed countries (Economic & Social Council of Jordan, 2012).

Although education in Jordan has reached quantitative achievements, it faces some problems and challenges, the most important of which is the large growth in the population of young people, which imposes on the educational system ensuring the quality and level of skills provided which can help the new generation to compete effectively at different levels, and the lack of conformity between the skills that are taught and the skills required by the labor market, which led to high unemployment rates that reach 18.7% in 2018. Table 1 shows the high rate of unemployment in the last ten years.

Table 1. The Jordanian unemployment rate for 2009–2018

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Unemployment rate (%)	12.9	12.5	12.9	12.2	12.2	12.6	11.9	13.0	15.0	18.7

Note: The table is based on data from the Jordanian Ministry of Labor (https://portal.jordan.gov.jo/).

Among the most important challenges facing the education sector in Jordan is the low rate of enrollment in the vocational education track in all its specialties, and the low correlation between these professional disciplines in higher education, production institutions, and the labor market. The rate of enrollment in vocational education dropped from 33% in 2000 to 26% in 2005 and 13% in 2012, to reach less than 11% in 2018 (Ministry of Education [MOE], 2018). Table 2 shows the figures and percentages among successful students in vocational education compared to academic education for the last ten years.

**Table 2.** Vocational education versus academic education

Year	No. of successful students in vocational education (1)	No. of successful students in academic education (2)	(1)/(2)
2008	3611	47232	7.6%
2009	4100	51414	7.9%
2010	5260	50707	10.3%
2011	6968	56169	12.4%
2012	6843	55241	12.3%
2013	8181	59935	13.6%
2014	5056	27539	18.3%
2015	6137	26070	23.5%
2016	7847	23450	30%
2017	7293	26223	27.8%
2018	5367	57406	9.3%

Note: The table is based on data from the Jordanian Ministry of Education (https://moe.gov.jo/en).

One of the most critical tasks confronting the education system in Jordan is the proportion of public spending on education. Education expenditure as a percentage of GDP is relatively low compared to middle-class countries. Jordan's level of education spending is 3.4% of GDP, which is only 10% of the national budget in 2018, which is lower than the United Nations (UN) recommendations for achieving the millennium development goals (UNESCO, 2018). Figure 1 shows the percentage of spending on education as a share of GDP and as a percentage of total public expenditure.

Figure 1. Expenditure on education
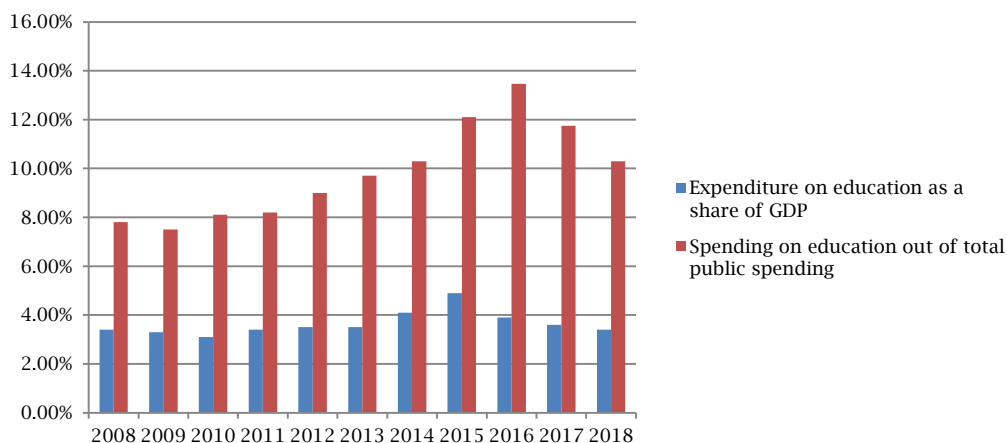
Note: This figure is based on data from the Jordanian Ministry of Finance (https://portal.jordan.gov.jo/).

Also, one of the crucial challenges that cannot be ignored is the burdens borne by the education sector due to forced migrations and the Syrian asylum crisis, which caused massive pressure on the infrastructure and educational facilities.

4. RESEARCH METHODOLOGY

The data used in this study were obtained from statistical databases provided by the Department of Statistics (DOS), the Central Bank of Jordan (CBJ), the Jordanian Ministry of Labor (MOL), the Jordanian

Ministry of Education (MOE), the Ministry of Planning (MOP), as well as World Bank (WB) publications and the United Nations Development Programme (UNDP).

Based on diagnostic tests conducted during the period under study (1984–2018), we used the ARDL model bounds testing method to analyze the data as it is a powerful tool for estimating level relationships when I(0) and I(1) time series are jointly co-integrated. In addition, the ARDL model is used to examine the short-run and long-run association between variables.

This study used the average income criterion for measuring economic growth by dividing the real GDP by the number of workers in Jordan (*RAPL*) as a proxy of worker productivity (Ajamieh, 2003), and the education index is similar to the one used to calculate the human development index (HDI) as a proxy of education. It is measured by the average of years of schooling for adults aged 25 years and older and expected years of schooling upon entering the education system (UNDP, 2014)[1]. Moreover, the modified SOLO model with Mankiw, Romer, and Weil (MRW) methodology to calculate the joint effect among education and labor productivity in Jordan. This technique was used since it depends on the hypothesis that human capital is accumulated using the same physical capital accumulation techniques, so it can be expressed in physical units rather than time units. So, education accumulates through a similar capital accumulation technique.

According to the SOLO model, the amount of production (*Y*) is determined by the labor (*L*) and capital (*K*) according to the equation:

$$Y = F(L, K) \qquad (1)$$

Then, by dividing equation (1) by *L*, the resulting equation becomes as follows:

$$Y/L = F(1, K/L) \qquad (2)$$

where, *Y/L* is Jordanian average productivity of labor (*APL*). *K/L* is Jordanian labor share of capital.

The education index (*EI*) will be included in equation (3) in order to analyze the impact of education on labor productivity built on the hypothesis that education and physical capital accumulate in the same way and as follows:

$$APL = Y/L = F(K/L, EI) \qquad (3)$$

As many studies and researchers have highlighted, foreign direct investment (FDI) is a crucial factor in economic growth. It increases the rehabilitation and productivity of the worker. Simultaneously, it helps create an ideal economic environment, diffusion of technology, moves of expertise from developed countries, and capital accumulation (Dutt, 1998). FDI will be introduced as an independent variable that affects the productivity of the worker, so equation (3) will be as follows:

$$APL = Y/L = F(K/L, FDI, EI) \qquad (4)$$

The real values of all variables are taken for equation (4). The consumer price index (CPI) is used to transfer nominal variables to real variables. So, equation (4) becomes as follows:

$$RAPL = F(RK/L, RFDI, EI)^2 \qquad (5)$$

To know the impact of the change in the education index on the change in the productivity of the Jordanian worker, we will take the variables in terms of growth. The previous equation becomes as follows:

$$GRAPL = F(GRK/L, GRFDI, EI) \qquad (6)$$

Finally, the following mathematical formula will be used:

$$GRAPL = \beta_0 + \beta_1 GRK/L_t + \beta_2 GRFDI_t + \\ + \beta_3 EI_t + U_t \qquad (7)$$

where, *GRAPL* is the growth rate of real average product of labor, *GRK/L* is the growth rate of the real labor share of capital, *GRFDI* is the growth rate of real foreign direct investment, *EI* is the education index, $\beta_0, \beta_1, \beta_2, \beta_3$ are parameters of the model and *U* is random error.

A dummy variable is used to capture the effect of structural adjustment programs (SAP). These programs were adopted in the Jordanian economy in 1989 and 1990 because of the 1988 financial crisis, which led to the devaluation of the Jordanian Dinar. Moreover, was adopted again in 2000 and 2001 due to the rapid privatization and was adopted again in the years 2008 and 2009 because of the global financial crisis and its repercussions on Jordan and the region, and finally in 2013 after the Syrian asylum crisis.

The final form of the mathematical expression to be subjected to statistical estimation is as follows:

$$GRAPL = \beta_0 + \beta_1 GRK/L_t + \beta_2 GRFDI_t + \\ + \beta_3 EI_t + Dum + U_t \qquad (8)$$

5. RESULTS AND DISCUSSION

The appropriate standard model to analyze the data during the study period (1984–2018) was carried out after performing the needed diagnostic tests. These tests include the augmented Dickey-Fuller (ADF) unit root test, autocorrelation test, heteroscedasticity test, normal distribution test, and bounds test. Additionally, the autoregressive distributed lag bounds testing (ARDLBT) approach was utilized as a statistical analysis tool (Pesaran, Shin, & Smith, 1999).

We first test the model variables for a unit root. The ADF unit root test (Dickey & Fuller, 1981) was performed. The results of the unit root test are shown in Table 3. Knowing that two is the maximum lag order and *K* is the optimal lag order based on the Schwarz criterion.

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[1] According to UNDP (2014), education index $(EI) = \frac{MYSI + EYSI}{2}$, where the simple *MYSI* refer to mean year of schooling index $= \frac{MYS}{15}$, given that 15 is the estimated maximum. In addition, *EYSI* refer to expected years of schooling index $= \frac{EYS}{18}$, given that 18 is corresponding to attaining a master's degree in majority of countries.

[2] The incremental capital output ratio (ICOR) method was used to calculate capital (K). This was done by dividing the total net real gross capital formation by the difference in real GDP between the last year of the study and its first year, and then multiplying by GDP for the first year. The estimated capital is produced during the first year, and by adding the net capital formation for the first year to its estimated capital, the estimated capital for the second year is generated. This procedure continues in the subsequent year, and so on.

$$ICOR = \frac{\sum_r^n NI_t}{GDP_n - GDP_r}$$

where, NI_t: net fixed capital formation gross per year (t); *GDP*: real GDP; *n, r*: beginning and end of study period in order.

Table 3. The ADF unit root test

Variables	Level	First difference	Results
GRAPL	-5.5281***		I(0)
GRK/L	-5.5291***		I(0)
GRFDI	-1.943	-4.298***	I(1)
EI	-1.329	-3.497***	I(1)

*Note: *, **, and *** accordingly indicate rejection of the null hypothesis at 10%, 5%, and 1% significance levels.*

The variable of *GRAPL* and *GRK/L* are static at the level, and the variable of *GRFDI* and *EI* become static after the first difference, and for the possibility of a long-term equilibrium relationship, ARDLBT was adopted by using the bound test proposed by Pesaran et al. (2001).

Table 4. The results of cointegration test for ARDL (0, 0, 0, 1, 0)

F-statistic	Significance level	Lower bound	Upper bound
FW = 44.425	10%	2.45	3.52
	5%	2.86	4.01
	2.5%	3.25	4.49
	1%	3.74	5.06

Note: The null hypothesis states that no long-run relationship exists.

We reject the null hypotheses since the value of F-statistic = 44.425 is greater than the upper bound at a 1% significant level. So, there is a long-term common integration among the variables. this suggests a long-term equilibrium relationship between these variables, therefore ARDL model was then used to estimate the long-term relationship and the results were as follows.

Table 5. The long-run results

Dependent variable: *GRAPL*			
Selected model: ARDL (0, 0, 0, 1, 0)			
Sample: 1988–2018			
Included observations: 31 after adjustment			
Variables	**Coefficient**	**St. Error**	**t-statistic**
GRK/L [L.R]	1.271***	0.1320	9.62
GRFDI [L.R]	0.005*	0.0027	1.84
Et [L.R]	1.151*	0.6053	1.9
Et [S.R]	-1.249**	0.6051	-2.06
Dum [L.R]	0.014	0.0288	0.49
Intercept	0.019	0.0917	0.21
Residual diagnostics and misspecification test results for ARDL (0, 0, 0, 1, 0). X^2_{SC} (1) = 1.023 [0.3118], X^2_{ARCH} (1) = 29.56 [0.2861], JB_N = 3.761 [0.156], $F_{statistic}$ = 6.280 [0.0000], R-squared = 0.8058, adjusted R-squared = 0.7573.			

*Note: *, **, and *** indicate significance levels at 10%, 5%, and 1%, X^2_{SC}, X^2_{ARCH} denote Chi-squared statistics to test the null hypotheses of no serial correlation, no autoregressive conditioned heteroscedasticity, and; JB_N and $F_{statistic}$ indicate Jarque-Bera and F-statistic to test the null hypotheses of normal distribution and the significance probability of the model respectively, and; R-squared and adjusted R-squared to indicate the ability of independent variables to interpret the dependent variable change.*

Table 5 illustrates the estimated coefficients of the independent and long-term variables. The results show that the adjusted R-squared was equal to 75.7%. This means the independent variables combined explain 75.7% of the change in the growth rate of labor productivity. Moreover, the results indicate that most of the parameters in the model are statistically significant at a 10% significant level.

We note that growth in the capital-labor ratio (*GRK/L*) is positive and significant, and this result is consistent with the economic theory if *GRK/L* increases by 1%, growth in the worker's share of GDP (*GRAPL*) will increase by 1.27%, other variables remain constant.

For the growth of the FDI (*GRFDI*) coefficient, we note that it is positive and significant. So, if the *GRFDI* increases by 1%, the growth in the worker's share of GDP (*GRAPL*) will increase by 0.005%, and other variables remain constant.

According to the education index (*EI*) coefficient, we note that it is positive in the long run with a 10% significant level, if *EI* increases by 1%, the growth in labor productivity (*GRAPL*) will increase by 1.15%, other variables remain constant. On contrary, education in the long run has a negative and significant effect in the short run, if *EI* increases

by 1% the growth in labor productivity (*GRAPL*) will decrease by 1.25%. Here the alarm should be sounded, and this is what has been confirmed in the descriptive aspect of the study. The continuous increase in the unemployment rate, the weak enrollment in vocational education, and the drop in expenditure on education, both as a percentage of GDP or as a proportion of total public expenditure. And this explains why the ranking of Jordan according to the index of education is declining even though the index is increasing (Jordan's ranking in 2014 was 77, and in 2018 reached 95).

6. CONCLUSION

This paper estimates the impact of education on the productivity of workers in Jordan from 1984 to 2018, and thus evaluates the education in Jordan in quantitative and qualitative terms. It basically contributes to the existing literature as it is one of the first studies that links the relationship between education and labor productivity at the local level. The study concludes that there is a long-term common integrative relationship between the independent variables (*GRK/L*, *FDI*, *EI*) and the dependent variable (*GRAPL*). Moreover, we find

that there is a positive and statistically significant relationship between the growth in the labor share of capital (*GRK/L*) to the growth in the worker's share of GDP (*GRAPL*); the higher *GRK/L* by 1%, the higher *GRAPL* by 1.27%, other variables remain constant. In addition, there is a positive and statistically significant relationship between the growth in FDI (*GRFDI*) and the growth in labor productivity (*GRAPL*); the higher *GRFDI* by 1%, the higher *GRAPL* by 0.005%, other variables remain constant. Additionally, the study shows that there is a positive and weakly statistically significant relationship in the long run between the education index (*EI*) and the growth in labor productivity (*GRAPL*); the higher *EI* by 1%, the higher *GRAPL* by 1.15%, other variables remain constant. Finally, the results indicate that there is a negative and statistically significant relationship in the short run between the education index (*EI*) and the growth in labor productivity (*GRAPL*); the higher EI by 1%, the lower *GRAPL* by 1.25%, other variables remain constant.

The results of this study are in accordance with those of previous studies conducted internationally and locally. According to Hanushek (2013), developing countries have been less successful in bridging the gap between developed and developing countries in the quality of education and the development of cognitive skills (educational type). In addition, the study concluded that developing countries will have a hard time improving their long-term economic performance if they fail to improve the quality of education. As Al-Tal (1990) showed, the contribution of secondary classes to economic growth is negative due to the increasing numbers of unemployment among secondary and university graduates due to

an inability of the economy to absorb the outputs of education.

As we pointed out before, Jordan has the world's second-highest share of refugees in comparison to its population. This fact outlines the main challenges facing efforts to provide quality education to Jordanian citizens and refugees in order to stimulate the productivity gains that would generate long-term growth. Therefore, this study is important because it can shed light on further research avenues; which, finding out the impact of education on productivity in the light of a huge refugees influx to Jordan in recent years. Also, we suggest estimating the relationship between education and productivity at the micro-sectoral level. The main limitation of the paper is the lack of data availability on alternative measures of education during the study period.

A substantial number of measures and policies have been adopted by the Government of Jordan (i.e., heavy investment in education by paying great attention to education, training programs, and the official attention to the reputation of education services, especially in the Gulf region) are already implemented in Jordan. Yet, our results suggest these policies should be continued and strengthened. Moreover, in light of the findings of the study, some recommendations can be identified, including education reform should be linked to national development projects and reform plans for different sectors, and provide a national information system and a national database on the labor market and employment. Finally, encouraging youth towards vocational education and training through a long-term educational policy and strategy, in which incentives are a key element.

REFERENCES

1. Ajamieh, M. (2003). *Economic development: Theoretical and applied studies.* Alexandria, Egypt: Alexandria University.
2. Al-Tal, K. (1990). *The impact of education on economic growth in Jordan* (Unpublished Master's thesis, Yarmouk University).
3. Al-Zoubi, B., & Al-Tal, Q. (2004). The impact of human capital and exports on economic growth in Jordan. *Abhath Al-Yarmouk: Human and Social Sciences Series, 20*(3), 1795–1824.
4. Barro, R., & Lee, J.-W. (1994). Sources of economic growth. *Carnegie-Rochester Conference Series on Public Policy, 40,* 1–46. https://doi.org/10.1016/0167-2231(94)90002-7
5. Becker, G. S., Murphy, K. M., & Tamura, R. (1990). Human capital, fertility, and economic growth. *Journal of Political Economy, 98*(5), 512–537. https://doi.org/10.1086/261723
6. Belchik, T. A. (2022). Artificial intelligence as a factor in labor productivity. In A. Z. Bogoviz, A. E. Suglobov, A.N. Maloletko, & O. V. Kaurova (Eds.), *Cooperation and sustainable development. Lecture notes in networks and systems* (vol. 245, pp. 525–535). https://doi.org/10.1007/978-3-030-77000-6_62
7. Bergeaud, A., Cette, G., & Lecat, R. (2018). The role of production factor quality and technology diffusion in twentieth-century productivity growth. *Cliometrica, 12*(1), 61–97. https://doi.org/10.1007/s11698-016-0149-2
8. Central Bank of Jordan. (2019). *Annual report 2018.* Retrieved from https://www.cbj.gov.jo/EchoBusV3.0/SystemAssets/c1e184ab-ad4e-4ed8-a24e-0fb908dd46e8.pdf
9. Central Bank of Jordan. (2020). *Annual report 2019.* Retrieved from https://www.cbj.gov.jo/EchoBusV3.0/SystemAssets/193be58a-0aa5-41d8-b1dc-57f3715805f4.pdf
10. Chopra, K. (2001). *The role of formal and informal institutions in a developing country.* Retrieved from https://www.yumpu.com/en/document/read/22576994/the-role-of-formal-and-informal-institutions-in-a-developing-country-
11. Chuang, Y. (2000). Human capital, export and economics: A causality analysis for Taiwan (1952–1995). *Review of International Economics, 8*(4), 712–720. https://doi.org/10.1111/1467-9396.00252
12. Delalibera, B. R., & Ferreira, P. C. (2019). Early childhood education and economic growth. *Journal of Economic Dynamics and Control, 98*, 82–104. https://doi.org/10.1016/j.jedc.2018.10.002
13. Department of Statistics. (2011). *Employment and unemployment survey.* Retrieved from http://dosweb.dos.gov.jo/ar/product-category/emp-unemp-ar/
14. Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica, 49*(4), 1057–1072. https://doi.org/10.2307/1912517

15. Dutt, A. K. (1998). Direct foreign investment, transnational corporations and growth: Some empirical evidence and a North-South model. In R. Kozul-Wright, & R. Rowthorn (Eds.), *Transnational corporations and the global economy* (pp. 164–191). https://doi.org/10.1007/978-1-349-26523-7_6
16. Economic & Social Council of Jordan. (2012). *The economic and social report*. Retrieved from http://www.esc.jo/Documents/ea7da524-7aa0-44d2-8e4a-0360050bab41.pdf
17. Granger, C. W. T. (1969). Investing causal relation by econometric models and cross-spectral methods. *Econometrica, 37*(3), 424–438. Retrieved from https://www.mimuw.edu.pl/~noble/courses/TimeSeries/RESOURCES/69EconometricaGrangerCausality.pdf
18. Goncz, E., Skirke, U., Kleizen, H., & Barber, M. (2007). Increasing the rate of sustainable change: A call for a redefinition of the concept and the model for its implementation. *Journal of Cleaner Production, 15*(6), 525–537. https://doi.org/10.1016/j.jclepro.2006.05.018
19. Griffin, K., & McKinley, T. (1992). *Towards a human development strategy* (UNDP-HDRO Occasional Paper No. 1992/2). https://doi.org/10.2139/ssrn.2273858
20. Gujarati, D. N. (2003). *Basic econometrics* (4th ed.). Retrieved from http://zalamsyah.staff.unja.ac.id/wp-content/uploads/sites/286/2019/11/7-Basic-Econometrics-4th-Ed.-Gujarati.pdf
21. Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). Retrieved from https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf
22. Hanushek, E. A. (2013). Economic growth in developing countries: The role of human capital. *Economics of Education Review, 37*, 204–212. https://doi.org/10.1016/j.econedurev.2013.04.005
23. Jozičić, K. J., & Škare, M. (2016). A review of theoretical and empirical research on human capital quality Croatia. *Review of Innovation and Competitiveness: A Journal of Economic and Social Research, 2*(2), 67–96. https://doi.org/10.32728/ric.2016.22/2
24. Krasniqi, F. X., & Topxhiu, R. M. (2016). The importance of investment in human capital: Becker, Schultz, and Heckman. *Journal of Knowledge Management, Economics and Information Technology, 6*(4), 1–18. Retrieved from https://www.scientificpapers.org/wp-content/files/1569_KrasniqiTopxhiu-The_Importance_of_Investment_in_Human_Capital.pdf
25. Ministry of Education (MOE). (2018). *Statistical report for the academic year 2017/2018.* Retrieved from https://moe.gov.jo/ar/node/60145
26. Ministry of Labour. (2019). *Annual report.* Retrieved from https://cutt.ly/hF8ZXAE
27. Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association, 94*(446), 621–634. https://doi.org/10.1080/01621459.1999.10474156
28. Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289–326. https://doi.org/10.1002/jae.616
29. Priatna, D. K. (2020). Evaluation of education and training program for civil servants: A new approach to improving employee productivity. *Sosiohumaniora, 22*(3), 274–280. https://doi.org/10.24198/sosiohumaniora.v22i3.28500
30. Talafah, H. (1989). The role of expatriate workers in the Jordanian economy. *Yarmouk Research Journal of Human and Social Sciences Series, 5*(1).
31. Todaro, M. P. (1997). *Economic development* (6th ed.). London, the UK: Longman.
32. Todaro, M. P., & Smith, S. C. (2015). *Economic development* (11th ed.). Boston, MA: Pearson.
33. United Nation of Education, Science and Culture Organization (UNESCO). (2018). *UNESCO index of human development of Jordan for 1984–2018.*
34. United Nation of Education, Science and Culture Organization (UNESCO). (2010).*UNESCO science report 2010: The current status of science around the world.* Retrieved from http://uis.unesco.org/sites/default/files/documents/unesco-science-report-2010-the-current-status-of-science-around-the-world-en.pdf
35. United Nations Development Programme (UNDP). (2014). *Technical notes: Calculating the human development indices — graphical presentation* (Human Development Report 2014). Retrieved from https://hdr.undp.org/sites/default/files/hdr14_technical_notes.pdf
36. United Nations Development Programme (UNDP). (n.d.). *Human development data in Jordan for 1984–2018.* Retrieved from http://hdr.undp.org/en/data
37. United Nations. (2011). *Population, environment and development* (The concise report). Retrieved from http://www.tanzaniagateway.org/docs/Population_Environment_and_Development.pdf
38. World Bank. (n.d.). *National accounts data in Jordan for 1984–2018.* Retrieved from https://data.worldbank.org/country/jordan
39. Yao, Y. (2019). Does higher education expansion enhance productivity? *Journal of Macroeconomics, 59*, 169–194. https://doi.org/10.1016/j.jmacro.2018.11.009