The Contribution of Education to Economic Growth: Empirical Analysis In The Middle East And North Africa Region

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Abstract: Human capital can be divided into two sectors; education and training. In this paper we will focus on education. Since the early '90s, the empirical literature on human capital and economic growth is full of conflicting results. Indeed, most theoretical analyzes have confirmed that human capital has a positive and significant effect on growth. The paper aims to examine in time series the causality between human capital and growth in countries of MENA region during the period 1960-2011. For this, We carry out our empirical investigation by employing various human capital measures suggested in the literature, than we use cointegration techniques and Granger causality tests. The results show that cointegration between education and economic growth exists only in Tunisia, Turkey, Morocco, Iran and Israel. However, in the other countries the causality does not exist because they don't have effective means (human capital) to improve their growth.

1-Introduction

This work took place in the context of research on "Human Capital and Economic Growth" in particular "Higher Education and Economic Growth". Economic growth as calculated measures only the quantitative variation of an economic aggregate (real GDP per capita, it represents the best indicator), it is not synonymous with the development in the true sense of the term. The development is an abstract concept defining the qualitative evolution of a country it is generally associated with growth, but there may be growth without development. The problem was to find the effect of higher education on economic growth in countries of MENA region in order to compare the results obtained in the estimation of time series data. This allows identifying the importance of state intervention in the field of education in a world marked by privatization more thrust. It should be noted that the concept of human capital and its formulation have evolved from the sixties. However, the importance of human capital has been studied since the seventeenth century. Adam Smith (1776), a classical economist, developed the basic concepts of the theory of growth in his book "The Wealth of Nations" by considering that human beings were a part of the wealth of nations. We will be devoted to the empirical part of which we will try to examine whether the results of recent empirical studies on the effect of education (especially higher education) on economic growth coincide with the theoretical results. It is essential to remember the old basic empirical work before presenting recent works. Economists still refer to the old basic models. These will be summarized in a summary table. Finally, we will examine the causal relationship between higher education and growth for the studied countries. Our analyses are based on the time series data for the period from 1960 to 2011. We will work those estimates on the E-Views econometric software. In other words, we will answer to our problem: Does the effect of higher education on

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economic growth exist? For this, more tests will be done following a certain methodology called "The methodology of causality tests."

2-Empirical investigation : Variables and data

In this study, we chose four indicators of human capital. The first one represents a traditional proxy of human capital, it's *the number of graduates in science and engineering (GRD)*. Second, we have the *openness rate (Trade)*. In fact , it is the sum of exports and imports of goods and services as a % of GDP. The third indicator of human capital is *the secondary school enrolment rate (School)*, refers to Benhabib and Spiegel (1994) this indicator represents a good proxy of the human capital. Finally, the fourth indicator is used to measure the physical capital. We mean the *gross fixed capital formation (GFCF)* as a % of GDP. Concerning the economic growth, the standard literature on the ties between economic growth and human capital generally uses the growth rate of GDP per capita. The data sources are the Word Development Indicators (WDI) of the World Bank. (2011), and all variables are expressed in national currencies. The time span of the variables is 1960-2011. The study focus on only 9 countries because of the non availability of data.

2-1: Unit Root Testing

This test consists to detect the non-stationary variables and then apply the cointegration test on these variables. If the variable is stationary, it called integrated I(0). Besides, the non-stationary variable is integrated I(1). In the table 1, we find the different indicators of human capital and the proxy of economic growth expressed in their natural logarithm. The results of unit root tests are presented in level and in first difference.

Table-1. Unit root tests for the variables in levels and first differences

Variables in level :

Countries •	LGDP per capita	LGDR	LGFCF	LTrade	LSCHOOL
Algeria	-1.946*	-1.333*	-1.541*	-2.030*	-6.218
Egypt	-0.856*	-1.647*	-1.713*	-2.048*	-3.896
Iran	-2.427*	-0.901*	-1.824*	-2.310*	-2.414*
Israel	-2.437*	-2.031*	-2.144*	-3.841	-2.269*
Jordan	-2.209*	-2.047*	-2.674*	-3.793	-0.834*
Morocco	0.185*	-1.033*	-1.550*	-0.885*	-2.217*
Mauritania	-2.838*	-2.601*	-3.721	-2.367*	-2.229*
Tunisia	-1.269*	-2.152*	-1.125*	-1.522*	-0.144*
Turkey	0.395*	1.172*	-2.292*	-1.957*	-2.259*

Variables in first difference :

Countries •	DLGDP per capita	DLGDR	LGFCF	LTrade	LSCHOOL
Algeria	-2.597*	-6.769	-5.477	-8.204	-2.568*
Egypt	-4.140	-1.830*	-5.372	-6.180	-5.278
Iran	-3.510	-2.642*	-4.347	-2.389*	-1.845*
Israel	-4.053	-4.992	-4.517	-6.791	-3.326

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Jordan	-2.999	-5.436	-6.303	-3.709	-2.346*
Mauritania	-7.745	-4.466	-6.167	-6.278	-5.122
Morocco	-10.830	-8.554	-5.928	-8.341	-1.827*
Tunisia	-6.840	-3.979	-4.759	-6.356	-3.402
Turkey	-7.146	-9.135	-5.861	-7.060	1.344*

(*) The variable is non stationary; rejection of the null hypothesis

§ The order of the lag in the Dickey-Fuller regression is the minimum number ensuring that the residuals are white noise.

The results show that all the variables in level are integrated I(1) except for Algeria and Egypt where the variable *School* is stationary since the unit root hypothesis is strongly rejected. In addition to this, we note that for Jordan and Israel the variable *Trade* is I(0) and for Mauritania the variable *GFCF* is also stationary. When the tests are carried out on the first difference, the hypothesis of unit root is rejected in the case of some countries such as Iran, Egypt , Jordan, Morocco and Turkey.

2-2: Cointegration Testing

The notion of cointegration has been introduced by Granger (1988), then the cointegration tests were appeared with the *VAR* approach established by Johanson (1988). The cointegration tests consist to identify the stationarity of the residue of two linear combinations. If the cointegration is demonstrated, so a long-run relationship of equilibrium exist between the two series. In this paragraph we will study the cointegration tests between the different indicators of human capital and the economic growth. The computations are based on the Johanson procedure trace statistic and the null hypothesis (H_0) is that there is no cointegration vector; the alternative one (H_1) is that there is one cointegrating vector.

Table-2. Johanson cointegration tests *Trace statistic* $-T\sum_{i=r+1}^{p} Ln\ (1-\lambda_i)$

Countries	Variables	Hypotheses H0	H1	Trace	Critical value 5%
Algeria (1965 – 2011)	GDP and GDR	r= 0 r≤1	r≥1 r≥2	15.38 1.43	15.49 3.84
	GDP and GFCF	r= 0 r≤1	r≥1 r≥2	5.01 1.12	15.49 3.84
	GDP and Trade	r= 0 r≤1	r≥1 r≥2	14.53 2.11	15.49 3.84
	GDP and School	–		–	–
Egypt (1962 – 2011)	GDP and GDR	r= 0 r≤1	r≥1 r≥2	9.63 0.10	15.49 3.84
	GDP and GFCF	r= 0 r≤1	r≥1 r≥2	5.24 0.30	15.49 3.84
	GDP and Trade	r= 0 r≤1	r≥1 r≥2	10.90 0.75	15.49 3.84
	GDP and School	–		–	–
	GDP and GDR	r= 0 r≤1	r≥1 r≥2	7.63 3.02	15.49 3.84
	GDP and GFCF*	r= 0 r≤1	r≥1 r≥2	28.96 2.46	15.49 3.84

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Iran (1967 – 2009)	GDP and Trade	r= 0 r≥1 r≤1 r≥2	12.44 2.82	15.49 3.84
	GDP and School	r= 0 r≥1 r≤1 r≥2	10.79 0.92	15.49 3.84
Israel (1962 – 2011)	GDP and GDR**	r= 0 r≥1 r≤1 r≥2	16.67 3.84	15.49 3.84
	GDP and GFCF	r= 0 r≥1 r≤1 r≥2	14.70 2.72	15.49 3.84
	GDP and Trade	–	–	–
	GDP and School	r= 0 r≥1 r≤1 r≥2	6.22 1.93	15.49 3.84
Jordan (1978 – 2011)	GDP and GDR	r= 0 r≥1 r≤1 r≥2	6.77 1.43	15.49 3.84
	GDP and GFCF	r= 0 r≥1 r≤1 r≥2	14.44 2.91	15.49 3.84
	GDP and Trade	–	–	–
	GDP and School	r= 0 r≥1 r≤1 r≥2	25.12 1.63	15.49 3.84
Mauritania (1964 – 2011)	GDP and GDR	r= 0 r≥1 r≤1 r≥2	6.32 4.15	15.49 3.84
	GDP and GFCF	–	–	–
	GDP and Trade	r= 0 r≥1 r≤1 r≥2	4.41 4.91	15.49 3.84
	GDP and School	r= 0 r≥1 r≤1 r≥2	5.70 1.34	15.49 3.84
Morocco (1962 – 2011)	GDP and GDR	r= 0 r≥1 r≤1 r≥2	6.84 1.94	15.49 3.84
	GDP and GFCF	–	–	–
	GDP and Trade*	r= 0 r≥1 r≤1 r≥2	23.70 0.32	15.49 3.84
	GDP and School	r= 0 r≥1 r≤1 r≥2	12.13 4.80	15.49 3.84
Tunisia (1963 – 2011)	GDP and GDR	r= 0 r≥1 r≤1 r≥2	7.64 0.28	15.49 3.84
	GDP and GFCF*	r= 0 r≥1 r≤1 r≥2	17.56 0.64	15.49 3.84
	GDP and Trade	r= 0 r≥1 r≤1 r≥2	8.01 1.31	15.49 3.84
	GDP and School	r= 0 r≥1 r≤1 r≥2	10.48 3.40	15.49 3.84
Turkey (1962 – 2011)	GDP and GDR*	r= 0 r≥1 r≤1 r≥2	19.14 0.008	15.49 3.84
	GDP and GFCF	r= 0 r≥1 r≤1 r≥2	8.94 1.06	15.49 3.84
	GDP and Trade	r= 0 r≥1 r≤1 r≥2	10.76 0.16	15.49 3.84
	GDP and School	r= 0 r≥1 r≤1 r≥2	4.15 0.93	15.49 3.84

(*) indicates the presence of one relationship of cointegration between the variables at 5% significance level,(**)indicates the presence of two relationships of cointegration between the variables at 5% significance level

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The hypothesis of non-cointegration is rejected for the *GDR* for two countries: Israel and Turkey. With the variable *GFCF*, there are also two cases of cointegration with GDP per capita : Iran and Tunisia. Finally, with the third indicator of human capital *Trade*, the hypothesis of non-cointegration is rejected in the case of Morocco. For the remaining countries (Algeria, Egypt, Jordan and Mauritania) and for the different proxies of human capital, the hypothesis of the absence of coinegration cannot be rejected. Such an outcome rejects, in these countries, any stable relationship between human capital indicators and economic growth. For the countries where cointegration is detected (Iran, Israel, Morocco, Tunisia and Turkey), this means that a long-run relationship between human capital indicators and growth exist. In other words, the variables are in a long-run equilibrium state. Consequently, the short-run dynamics of the variables are seen as fluctuations around this equilibrium. And the Error Correction Model (ECM) indicates how a system adjusts to converge to its long-run equilibrium state. We interpret the effect of the error correction term βX_{t-1} on economic indicator by explaining the sign of βX_{t-1} itself and the sign of the adjustment coefficient. We note that α_1 represents the adjustment coefficient of the human capital indicators and α_2 is the adjustment coefficient of growth.

Table-3. The adjustment coefficients and the error correction term

Countries	The adjustment coefficient Vector α		The error correction term β $X_{t-1}\beta X_{t-1}=y_{t-1}-\beta_1(GDR)_{t-1}-\beta_2$
	α_1	α_2	
Iran	0.167	0.079	$y_{t-1} + 3.347\ (Gfcf)_{t-1} - 1$
(Gfcf)	(2.649)*	(2.448)**	(-4.965)*
Israël	0.015	0.001	$y_{t-1} + 33.103(GDR)_{t-1} - 1$
(GDR)	(2.577)*	(0.666)	(-2.722)*
Morocco	0.530	-0.115	$y_{t-1} + 1.359\ (Trade)_{t-1} - 1$
(Trade)	(4.028)*	(-2.150)**	(13.292)*
Tunisia	-0.007	-0.003	$y_{t-1} - 26.274\ (Gfcf)_{t-1} - 1$
(Gfcf)	(-2.532)**	(-2.249)**	(3.413)*
Turkey	-0.195	0.069	$y_{t-1} - 3.512\ (GRD)_{t-1} - 1$
(GRD)	(-1.527)	(1.707)***	(7.355)*

The numbers in parentheses are t-statistics

(*) (**) (***) indicate that the variables are significant

According to table 3, in the cases of Iran, Israel and Morocco α_1 and the error correction term are positives and significant, this means that the effect of human capital on long-run growth is positive. However, for Tunisia, α_1 and the error correction term are negatives and significant, so we have the same conclusion; the effect on growth is positive. Moreover, α_1 is negative and non-significant in the case of Turkey, which excludes any effect of education on long-run growth. For Iran and Tunisia, the effect of growth (α_2) on human capital is positive. In contrast, for Morocco and Turkey the effect on education is negative. And there is no effect on education in the case of Israel. To check the robustness of these results, one has to see the dynamic interaction between the cointegrated variables in the long-run and how each one is
causing the other. To achieve that aim, we should use the Granger causality tests.

2-3: Granger causality tests

According to Granger (1988), if two variables are cointegrated, then one should test for Granger causation in at least one direction.

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Table-4. Results of Granger causality tests according to the Johanson procedure

	Null Hypothesis			
	HK does not Granger-cause GDP		*GDP does not Granger-cause HK*	
Countries	t_1: $\alpha_1 = 0$	F_1: $\gamma_{12} = 0$	t_2: $\alpha_2 = 0$	F_2: $\gamma_{21} = 0$
Granger causality between Gfcf and GDP				
Iran	(2,649)*	3,478*	(2,448)*	9,045*
Granger causality between GDRand GDP				
Israel	(2,577)*	0,627	(0,666)	1,205
Granger causality between Trade and GDP				
Morocco	(4,028)*	9,792*	(-2,150)*	2,335
Granger causality between Gfcf and GDP				
Tunisia	(-2,532)*	3,600*	(-2,249)*	2,146
Granger causality between GDR and GDP				
Turkey	(-1,527)	0,546	(1,707)*	6,032*

(*) Significant at least at 10%

According to table 4, the results of the tests using the Johanson procedure for the determination of the cointegrating vectors. The results show that for Israel the causality tests are in favor of a unidirectional causality between human capital and economic growth. However, for Turkey, the statistical significance of F- and t-statistics at the 5% level show that the causation is going in other direction. In other words, the causality tests are in favor of a reverse causation running from economic growth to the human capital. In addition, we note that for Iran, Morocco and Tunisia the evidence is in favor of a bidirectional causality between the growth rate of GDP per capita and the proxies of human capital. Indeed, we conclude that in Iran, Morocco and Tunisia t_1 and F_1 statistics are both significant, and in Iran and Turkey t_2 and F_2 statistics are also significant. That means that real growth has two effects on human capital: The first one is coming from the lagged dynamic terms and the second from the error correction term. According to the first effect, each short-term change in the economic growth is responsible to the future change in the growth rate of human capital indicators. For the second effect, given the significance of the error correction term in the second VAR equation, real growth exert an influence on human capital through the error correction term. This means that education is adjusting to the previous period disequilibrium between the growth rate of GDP per capita and human capital.

2-4: Short-run Granger Causality: Tests based on first-differenced VARs

Table-5. Causality tests based on first-differenced *bVAR* framework[§]

Countries and variables	Null hypothesis HK ≠> Growth	Growth≠> HK
Algeria		
(GDP , GRD)	0.435	0.210
(GDP , GFCF)	1.442	0.854
(GDP , Trade)	1.001	0.664
(GDP , School)	0.331	0.008
Egypt.		
(GDP , GRD)	0.526	0.052
(GDP , GFCF)	14.565*	0.025
(GDP , Trade)	4.625*	1.063
(GDP , School)	0.630	1.536
Jordan		
(GDP , GRD)	0.185	0.032
(GDP , GFCF)	0.740	0.027
(GDP , Trade)	1.705	0.236
(GDP , School)	2.506	1.131
Iran		

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(GDP , GRD)	0.489	1.004
(GDP , Trade)	0.617	0.029
(GDP , School)	0.317	0.360
Israel		
(GDP , GFCF)	5.525*	3.441*
(GDP , Trade)	0.216	6.114*
(GDP , School)	1.523	0.364
Mauritania		
(GDP , GRD)	0.277	0.407
(GDP , FBCF)	0.119	0.017
(GDP , Ouv)	1.204	1.454
(GDP , School)	2.172	8.596*
Morocco		
(GDP , GRD)	4.555*	2.142
(GDP , GFCF)	5.719*	2.562
(GDP , School)	2.203	0.556
Tunisia		
(GDP , GRD)	1.587	0.602
(GDP , Trade)	0.051	1.444
(GDP , School)	0.826	2.947*
Turkey		
(GDP , GFCF)	0.980	0.588
(GDP , Trade)	2.726	2.997*
(GDP , School)	0.825	1.252

All estimates are achieved using first differences of integrated variables

[§] *The order of the lag is determined using the Akaike information criterion (AIC) on the unrestricted bVAR,*

(*) The Fischer statistics are significant at the 5% level.

We remember that according to the table 2, there are 5 countries where cointegration is detected. For the remaining countries, we applied the causality tests using the first differenced VARs. The evidence presented is not far from the results obtained from the ECMs. The causation turns out to be bidirectional in the case of Israel. Indeed, in Mauritania, Tunisia and Turkey the evidence is in favor of a reverse causation going from economic growth to human capital, with at least one education proxy at 5% level. That is, not only education shows to Granger-cause growth in the short-run (cases of Egypt and Morocco), but also the real growth appears to Granger-cause the education too.

3- Conclusion

This study has examined empirically the causality between human capital and economic growth in a bivariate VAR structure for a sample covering 9 countries of MENA region over the period 1960-2011. Johanson cointegration analysis provides that human capital does not seem to affect positively the long-run economic growth. Indeed, the results of this paper clearly indicate that a strong evidence exist in favor of a reverse causation running from growth to education for 4 countries. For countries where education and economic indicators are not cointegrated, Granger causality tests were carried out with first-differenced VARs to check the causality problem in the short-run. The results display that an evidence was found of bidirectional causality between growth and education. The empirical evidence presented above has important implications for the conduct economic policies in these countries

References

[1] Aghion, P et Cohen, E (2004), *Conseil d'Analyse Economique*

ISBN: 978-605-64453-0-9

[2] Barro, R. (1991), Economic Growth in a Cross Section of Countries, Quarterly Journal of Economics, 106, pp. 407-443.

[3] Barro, R.J et Sala-i-Martin, Xavier (1994), Quality Improvements in Models of Growth, *NBER Working papers* n°4610.

[4] Becker G.S (1964) Investment in human capital: A Theoretical Analysis, *Journal of Political Economy* 70 pp, 9-49.

[5] Benhabib J. & Spiegel M.M (1994) The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Countries Data, *Journal of Monetary Economics*, vol 34, n°2, pp. 143-173.

[6] Benhabib Jess. & Spiegel Mark.M (2005) Human Capital and Technology Diffusion, in : [7]Philippe Aghion & Steven Durlauf (ed.), *Handbook of Economic Growth*, edition 1, volume 1, chapter 13, pages 935-966 Elsevier.

[8] Granger, C.W.J., 1988. Some recent developments in a concept of causality. Journal of Economitrics, 39: 199-211.

[9] Johanson., 1988. Hypothesis testing for cointegration vectors : With application to the demand for money in denmark and finland. Discussion papers 88-05, University of Copenhagen. Department of Economics.

[10] Lucas R.E. (1988) On the Mechanics of Economic Development, *Journal of Monetary Economics*, n°22 (1), pp. 3-42.

[11] Mankiw, N.G., Romer, D., Weil, D.N. (1992) A Contribution to the Empirics of Economic Growth, *Quarterly Journal of Economics*, n° 107 (2), pp. 407-437.

[12] Nelson, Richard R et Phelps, Edmund S (1966) Investment in Humans, Technological Diffusion, and Economic Growth, *American Economic Review*, 56, pp. 69-75.

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