The Impact of Human Capital Development on Economic Growth in Morocco: An ARDL Modeling Approach

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Abstract: The following article aims to assess the influence of human capital on the economic growth in Morocco during the period extending from 1990 up till 2019. In order to apprehend this correlation, the GDP is used as an economic growth measuring tool while educational expenses, life expectancy, primary education enrollment rate as well as the labor force participation rate are weighted as human capital indicators. As in for Data used, it is provided mainly from the World Bank.

To analyze the short along with the long term impact of the human capital on the economic growth, ARDL approach of the co-integration along with the error correction model are applied. The outcomes highlight a positive and significant effect of human capital, noticed by some of its components on the economic growth both in the short and long term. Moreover, the estimated models have successfully passed all diagnostic tests.

These theoretical findings have crucial empirical implications, spotlighting the positive aspect of human capital on economic growth, both directly and through variables such as investment in physical capital.

Keywords: Economic growth, human capital, education, health, ARDL.

1. INTRODUCTION:

Since the 1950s, the process of economic growth in industrialized and emerging countries has improved significantly. To overcome the country's economic difficulties, a connection is currently being established with the level of human capital. Therefore, any decision taken at the state level is aimed at partially achieving this goal. In fact, with the emergence of growth models, the factors that drive the growth process are essentially infrastructure, human capital, innovation, research and development, and some other growth factors related to demographic and geographical characteristics. In fact, the debate about the role of human capital in the process of economic growth began very early with the appearance of the founding father of the classical movement, Smith (1795), who argued that education of all kinds helped increase productivity and promote economic progress. Furthermore, over the years, in the 1960s, human capital theory emerged in light of several works that examined the impact of education on individuals and economies (Mincer, 1958, Schultz, 1961).

This doctrine recognizes that investment in education as a lever for economic growth is a factor that stimulates productivity and determines the size and distribution of individual gains. From the same perspective, in the early 1980s, numerous empirical papers criticized the growth model initiated by Solow in 1956, including Romer (1994), Lucas Jr (1993), Benhabib and Spiegel (1994), who adopted the extended Slow model, were able to explain income differences between countries by integrating human capital in its various aspects as a catalyst for economic growth. Well (2007) explores this topic and recently finds that improving citizens' health care can increase a country's output level in several ways.

On the one hand, a family's health has a direct impact on its production. However, in terms of production, health has an indirect impact on production, as people with excellent health are abler to continue their studies. Likewise, students with good health have minimal absenteeism and better cognitive abilities. In addition, reducing the mortality rate and increasing the average life expectancy of the population force the population to save and rationalize their spending to ensure retirement, which determines the dynamics of investment and the level of physical capital per worker.

This article aims to evaluate the influence of human capital development on Morocco's economic growth from 1990 to 2019. It specifically concentrates on three goals: examining how human capital impacts economic growth in Morocco, exploring its short- and long-term consequences, and investigating the causal connection between human capital and economic growth within this timeframe.

2. LITERATURE REVIEW

2.1. Review of Theoretical Literature

Prior to the advent of contemporary human capital theories, the prevailing notion was that an economy relied solely on physical capital (such as land, machinery, and equipment) and labor. The emphasis was primarily on investment in capital goods as the primary driver of production. Classical the-

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orists, for instance, concentrated on the exploitation of labor by capital (Marimuthu, Arokiasamy, & Ismail, 2009). However, since the 1950s, certain modern economists have formally recognized education and health as pivotal factors for enhancing human capital and consequently fostering economic growth (Kern, 2009).

2.1.1. Human Capital and Neoclassical Growth Theories

Schultz (1961) and Becker (1962) are renowned pioneers in the realm of human capital theory. They posit that education enhances individuals' skills, thus boosting their human capital, which in turn contributes to overall production capacity. Moreover, Schultz (1975), suggests that education equips workers with the ability to adapt to changing economic conditions by understanding potential disruptions, analyzing information, and reallocating resources accordingly. In contrast, Spence (1978) regards education as a market signal indicating the potential productivity of workers. Additionally, it functions as a screening tool to identify individuals who can be trained for specific roles more efficiently and economically than others. However, it wasn't until 1992 that these perspectives were practically integrated into economic growth theories, particularly through the revision of the standard neoclassical growth model by Mankiw, Romer, and Weil. These researchers utilized a Cobb-Douglas production function to reassess the Solow 1956 growth model.

In essence, according to neoclassical growth theory, long-term economic growth has traditionally been thought to be determined primarily by factors of production like physical capital and labor. However, research has shown a significant contribution from technological advancement, often seen as an exogenous factor. Solow (1956) and Cass (1965) were among the first to highlight this phenomenon. They introduced the convergence theory of growth, which emphasizes innovation as the principal long-term driver of growth.

In the absence of technological advancement, the long-term repercussions of diminishing returns inevitably lead to decreased economic growth. When the production of goods continues to expand without the introduction of new avenues for capital utilization, the surplus goods become redundant, resulting in a decline in the marginal product of capital. This concept is formally encapsulated by the assumption that the marginal product of capital diminishes entirely within the capital stock (Aghion and Howitt, 1998). Essentially, by anticipating diminishing returns to scale, they argue that as capital per worker increases, the pace of economic growth slows down until it reaches a steady state, where the higher the level, the lower the initial per capita income, and the higher the expected growth rate (Weil, 2016). However, this model fails to account for the sustained economic progress observed in developing economies such as those in East Asia (Zarra-Nazhad & Hosainpour, 2011).

2.1.2. Human Capital and Theories of Endogenous Growth

To address the constraints of neoclassical theory and better explain the long-term drivers of economic growth, endogenous growth models emerged in the mid-1980s. Lucas (1988) and Romer (1990), key proponents of this theory, incorporate intentionally created technological changes as an explanatory variable in their growth model. For advocates of endogenous growth, it's not solely technology that shapes a country's growth, but other factors (like human capital) overlooked by the neoclassical growth model.

Lucas (1988) views human capital as a distinct factor in the production function largely influenced by workers through education or on-the-job training. In Lucas's (1988) model, the rate at which human capital accumulates is considered the primary determinant of productivity growth.

Romer (1990), on the other hand, views human capital as a factor influencing innovation, which in turn has a positive impact on the long-term rate of productivity growth, rather than viewing human capital as a direct input into the production of goods. In essence, Romer postulates that endogenous growth arises from the accumulation of technology and knowledge, while Lucas emphasises the non-decreasing marginal returns to human capital as a driver of endogenous growth.

Taken together, they argue that it is not enough to have a large population to generate growth; on the contrary, the stock of human capital and investment in research and development are essential to economic growth. According to these models, the law of diminishing returns to scale may not apply, since the returns to physical and human capital do not necessarily diminish over time. If capital owners employ skilled and healthy workers, the productivity of capital and technology will improve. The diffusion of knowledge among producers and the external benefits of improved human capital provide further support for the possibility of increasing returns to scale (Wilson and Briscoe, 2004).

Furthermore, to reassess the Solow growth model and elucidate variations in per capita income among nations, Mankiw, Romer, and Weil (1992) devised an enhanced Solow model, wherein human capital is regarded as a factor of production alongside physical capital and labor. They determine that disparities in human capital, savings, and population growth delineate differences in per capita income among nations. This suggests that physical capital accumulation and population growth exert greater influences on per capita income when human capital is integrated into the model. As per the aforementioned researchers, omitting human capital from the model may yield biased results.

2.1.3. Return on Investment in Education: what do we Learn from Theories

Time and financial resources allocated to schooling, on-the-job training, and off-the-job training constitute the primary investments in education. These investments encompass direct expenses like tuition fees, foregone earnings during schooling, and reduced salaries during training, all aimed at garnering returns on this investment in the future. Becker (1993), in his book "Human Capital: A Theoretical and Empirical Analysis with special reference to education," underscores various forms of investments in human capital, including education, expenditures on healthcare, and professional training.

In essence, the returns from education primarily hinge on education expenses and employment prospects post-graduation, as highlighted by (Rephann 2002, Fleischhauer, 2007). Similar to investments in physical capital, investments in human capital are undertaken only if the anticipated returns exceed the prevailing market interest rate. Put simply, schooling represents an investment made in anticipation of future income for the individuals involved. The benefits of education materialize through augmented income for the worker, heightened productivity for the firm, and enhanced employment prospects (Fleischhauer, 2007).

As per Mincer (1981, 1989, 1996), a worker's wage or output is shaped by the magnitude of their human capital stock. Consequently, wage disparities among workers primarily stem from variations in the sizes of their human capital stocks rather than disparities in labor itself. Moreover, the returns to education extend beyond individual gains. There may be spill-over effects from education to other individuals, where the societal benefits outweigh the sum of the individual returns for the educated individuals.

McMahon (1998, 2010) classified the returns from education into two main categories: monetary and non-monetary, further dividing them into private and social spheres. Wages represent the direct private and monetary returns of education. Additionally, education can have social monetary benefits such as its impact on GDP growth and on the earnings of others, achieved by enhancing their productivity.

2.1.4. Health and Human Capital

Similar to education, health plays a vital role in human capital development. The health status of individuals can significantly impact both their personal human capital and the overall growth of a nation. Health capital contributes to economic development through various channels, including enhanced productivity, increased life expectancy, improved learning capacity, and heightened creativity (Howitt, 2005). Individuals in good health tend to exhibit greater strength, energy, creativity, and focus, thereby improving their efficiency in the production process. This increased efficiency is achieved even with the same set of skills, physical capital, and technological knowledge. Essentially, better health facilitates the effective and sustainable utilization of the knowledge and skills acquired through education.

Similarly to investments in education and training, the quantity and caliber of human capital stock can be augmented through investments in disease prevention and treatment (Gardner, 2002). Consequently, some scholars incorporate health stock into their models and argue that health status determines the total number of work hours an individual is willing to allocate to income generation (Basov, 2002).

Barro (2013) contends that enhanced health can mitigate the depreciation of educational capital, thereby amplifying the positive impact of education on growth. He devised a model incorporating the effect of health on productivity and concludes that: "For given amounts of work hours, physical capital, education, and experience of workers, an improvement in health heightens the productivity of a worker. Additionally, besides this direct effect, enhanced health diminishes the mortality and illness rates, consequently reducing the effective rate of human capital depreciation" (Barro, 2013).

2.1.5. Rational Public Intervention in Terms of Social Sectors, in this Case Education and Health

Traditionally, the quality of education has been assessed using input measures such as teacher-student ratios and total public spending on education. However, a more contemporary approach involves evaluating education quality based on output indicators, which gauge the performance of students and graduates through test scores in subjects like mathematics, reading, and sciences (Boss, 2006).

Public involvement in education and health predominantly stems from the recognition of market failures and equity concerns (Boss, 2006). The notion of education externalities or market failures emerges when the advantages of individual education and health extend beyond the individual to impact others at broader levels of aggregation.

For example, education externalities encompass a range of benefits such as reduced crime rates, improved health outcomes, enhanced household management, and advancements in GDP or productivity (Moretti, 2006; Hanushek and Wobmann, 2007). This suggests that the social returns to education may surpass private returns when considering these non-monetary benefits.

2.2. Review of Empirical Literature

Several researchers have endeavored to explore the link between human capital and economic growth. Mankiw, Romer, and Weil (1992), in their cross-country regression analysis, demonstrated that human capital contributes to the variation in income levels among nations. Their study revealed a positive and statistically significant correlation between human capital and per capita income growth. Similarly, Barro (1991) reached similar conclusions after analyzing data from 98 countries spanning the period from 1960 to 1985. In their investigation utilizing the human capital-augmented Cobb-Douglas production function, they considered school enrollment rates at the primary and secondary levels as proxies for human capital.

Similarly, Barro (1996; 2013) gauged human capital by quantifying the average number of years of schooling in primary and secondary education. He unveiled a positive and noteworthy correlation between per capita income growth and human capital from 1960 to 1990. Barro's straightforward panel regression analysis highlighted the close link between the catch-up process and the advancement of human capital: only economically disadvantaged countries with considerable human capital accumulation relative to their real GDP managed to catch up with wealthier nations.

Benhabib and Spiegel (2002) also recognized a dual-sided relationship between these two macroeconomic variables. Their research suggests that nations with a greater reservoir of human capital experience accelerated technological advancement. Likewise, Bassanini and Scarpetta (2001) delved into the connection between human capital accumulation and economic growth across OECD countries from 1971 to 1998. They posit that each additional year of schooling enhances the average level of production per capita in the long term by roughly 6%.

Sala-i-Martinand Barro (1995), Barroand Sala-i-Martin; (2004) also investigated the impact of primary, secondary, and tertiary education levels (by gender) on economic growth. They found no significant effect of primary education for both men and women on economic growth. However, they observed a significant relationship between men's secondary and tertiary education and economic growth. Additionally, they examined the role of education levels in the convergence theory, revealing that countries with lower initial GDP experience faster growth when they possess higher levels of human capital in the form of educational attainment.

Baldwin and Borrelli (2008) authored a study delving into the relationship between higher education and economic growth in the United States. Their findings suggest that investment in higher education correlates positively with per capita income growth.

Meanwhile, some researchers, such as Barro (1966; 2013), developed a model incorporating physical capital inputs, education level, health capital, and hours worked. The model posits that "individuals are born with initial health endowments that diminish with age and rise with investments in health." Through his analysis, Barro concludes that improvements in health indicators heighten the incentives for investing in education, while an increase in health capital diminishes the rate of health depreciation.

Similarly, Bloom, Canning, and Sevilla (2004) utilized life expectancy as a health indicator and discovered a substantial and statistically significant positive effect on output. They propose that each additional year of life expectancy enhances worker productivity and results in a 4% increase in output.

Gyimah-Brempong and Wilson (2005) and Odior (2011) posited that education constitutes merely one facet of human capital, insufficient to explain variances in school quality and the health dimension of human capital. For instance, drawing from microeconomic evidence, Strauss and Thomas (1998) contend that health accounts for wage disparities to a similar extent as education. Furthermore, Gyimah-Brempong and Wilson (2005) observed that health capital indicators positively impact overall production.

Other researchers have explored the relationship between these macroeconomic variables using different indicators of human capital. For instance, Gyimah-Brempong and Wilson (2005) employed the dynamic panel estimator method to demonstrate a positive and robust link between investment in health and education and economic growth in Africa and globally from 1960 to 2000. Similarly, Odior (2011) conducted research in Nigeria to determine whether government spending on health can stimulate economic growth. Utilizing an integrated sequential dynamic computable general equilibrium (CGE) model, the study uncovered a significant relationship between economic growth and government spending in the health sector.

Furthermore, focusing on government recurrent and capital expenditure on education and health, Oluwatobi & Ogunrinola (2011) and Umaru (2011) conducted econometric analyses in Nigeria spanning the periods 1970-2008 and 1977-2007, respectively, to scrutinize the relationship between government spending on education and health and economic growth. Similarly, Kefela (2008), in their study on Northeast African states, demonstrated that 40% to 60% of GDP per capita growth rates were attributable to investment in human capital.

Researchers have extensively investigated the relationship between human capital indicators and macroeconomic variables. Gyimah-Brempong and Wilson (2005) utilized the dynamic panel estimator method, revealing a robust positive link between investments in health and education and economic growth in Africa and globally from 1960 to 2000. Similarly, Odior (2011) focused on Nigeria, employing a dynamic computable general equilibrium model, and established a significant relationship between economic growth and government spending on health.

In the Moroccan context, Achchab and Bennaceur (2021) employed the MCO method, analyzing data from 1980 to 2018. They found that improved health conditions positively influenced GDP per worker, while education, measured by average years of schooling, showed no significant impact. Goumrhar (2017) conducted a study on developing countries, including Morocco, from 1985 to 2010, revealing a positive and significant effect of the average number of years of study on economic growth. Additionally, Guati and Aamoum (2016) explored the impact of human capital on total production using the Barro and Lee method from 1965 to 2010, finding a non-significant relationship, although health was not considered.

3. DATA AND METHODOLOGY

ARDL modeling is a combination between autoregressive models and staggered lag models. An ARDL model isgenerallywritten as follows:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \alpha_0 x_t$$

$$+\alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \cdots + \alpha_q x_{t-q} + \mathcal{E}_t)$$

$y_t,\ x_t et \mathcal{E}_t$Being respectively the endogenous variable, the exogenous variable and the error term.

This econometric technique is used when the variables are cointegrated and integrated at different levels. It makes it possible to estimate the short- and long-term relationships between these variables.

3.1. Cointegration Test

Cointegration is a statistical property of time series introduced into economic analysis, notably by Granger and Newbold (1974). In simple terms, cointegration helps detect the long-term relationship between two or more time series.

One of the noteworthy methods for assessing the cointegration of a set of time series is the maximum likelihood method introduced by Johansen (1988, 1991). This method relies on the Vector Autoregressive (VAR) model and offers the advantage of not being constrained to two series, enabling the examination of multiple cointegrating relationships. However, it's important to note that this test is applicable only when the series are consistently integrated at the same level, which may not always be the case.

Table 1. Variable description.

Variable	Type	Description	Expected Sign
PIB	Endogenous	GDP per capita, ($ current international PPP)	
DPE	Exogenous	Public spending on education (% of GDP)	Positive
EV	Exogenous	Life expectancy at birth, total (years)	Positive
FBCF	Exogenous	Gross capital formation (% of GDP)	Positive
TIEP	Exogenous	primary school enrollment rate (crude rate as a % of the population)	Positive
TPPA	Exogenous	Labor force participation rate, total (% of total population aged 15 and over) (ILO modeled estimate)	Positive

In this case, the test used is that of Pesaran *et al* which is used to verify the existence of one or more cointegration relationships between the variables in an ARDL model.

3.2. Causality Test

We speak of a causal relationship between two variables when knowledge of the previous values of one improves the prediction of the other.

Granger proposed that takes the form of a sequential procedure to test causality. It is applied to stationary series. If these are contegrated, a VECM model will make it possible to test the causality between these series.

3.3. Presentation and Sources of Variables

In this model, five variables were used to verify the relationship between human capital and economic growth in Morocco and which can be summarized in the table below. The data were extracted from the World Bank database, they are of annual frequency and cover the period from 1990 to 2019. The software that will be used for data processing is Eviews in version 10.

3.4. Descriptive Statistics

The descriptive study makes it possible to build an initial idea about the variables being studied and the correlations between them. The descriptive statistics of the variables are presented in the following table.

Table 2. Descriptive Statistics

	GDP	DPE	EV	FBCF	TPPA	LFPR
Moyenne	5015	5.090	71.37	30.28	49.58	96.74
Médiane	4796	5.118	71.75	30.80	50.64	105.87
Maximum	7865	6.754	76.90	39.09	51.50	115.15
Minimum	2546	4.303	64.73	24.47	43.16	63.94
Ecart-type	1795.538	0.4423	4.0165	3.7820591	2.2623	17.495

Source: Authors calculation.

The descriptive statistics of the variables are presented in the following table. The first 2 rows of the table show that there is minor symmetry because the values of the mean and medians are close. Thus we can say that the public expenditure on education variable is a less dispersed series with a value of 0.4423 and that GDP is the most dispersed variable.

4. RESULTS AND DISCUSSION

4.1. Variable Stationarity Tests

Several tests make it possible to check the stationary nature or not (existence of unit root) of a series, the most commonly used of which are: Augmented Dickey-Fuller/ADF test, Phillippe-Perron/PP test, Andrews and Zivot test/ AZ, *etc*.

In fact, the ADF test is very strong in the case of autocorrelation of errors, the PP test is suitable in the case of heteroscedasticity, and the AZ test is used for a series which suffers from structure breakage or identified regime change of endogenous way. This study is based on the ADF and PP tests and the results are given as follows:

The table presents the unit root test for the selected series, based on a total of 29 observations for the period 1990-2019. The unit root test is used to test the stationarity of all the variables retained in the model, namely: GDP per capita (GDP); the null hypothesis is that there is a unit root in the mechanism for generating the data in the series. These tests are performed with constant only (C) and with constant and trend (C&T).

The results show that all the variables analyzed (except the EV and TIEP variables) are non-stationary in level including the constant as well as the trend and the constant, the null hypothesis cannot be rejected for these variables studied. For the variables Life expectancy at birth and primary school enrollment rate, they are stationary at level, the null hypothesis can be rejected.

However, any series can be made stationary by differentiating the data in the first instance. Using the first difference, the ADF and PP tests indicate that: ΔLnDPE, ΔlnFBCF, ΔlnPIB, ΔlnTPPA, are stationary. Thus, these variables are integrated of order one I(1). Once both variables are made stationary, they can be used in a regression analysis. For the EV and TIEP variables, no differentiation procedure is necessary in this case, this variable is integrated of order 0 I (0).

The series are integrated at different orders I(1) and I(0), which makes it possible to use modeling using the ARDL approach and the terminal cointegration test (Pesaran,Shin and smith 2001).

Table 3. Tests of stationarity of variables.

Variable	ADF		PP		Integration Order
	C	C&T	C	C&T	
LnDPE	-1.680152 (0.4275)	-2.140369 (0.5008)	-1.211607 (0.6556)	-1.613919 (0.7624)	I(1)
ΔLnDPE	-2.145591 (0.0329)	-2.417295 (0.3634)	-2.823681 (0.0678)	-2.743893 (0.2281)	
lnEV	-3.483766 (0.0186)	1.431933 (0.9999)	-1.593606 (0.4730)	-0.436316 (0.9810)	I(0)
lnFBCF	-1.265412 (0.6316)	-2.628175 (0.2715)	-1.232462 (0.6464)	-2.709057 (0.2404)	I(1)
ΔlnFBCF	-5.844579 (0.0000)	-4.254903 (0.0121)	-5.849623 (0.0000)	-5.654920 (0.0004)	
lnPIB	-0.756527 (0.8164)	-3.320473 (0.0879)	-0.814676 (0.7999)	-1.713866 (0.7191)	I(1)
ΔlnPIB	-3.210279 (0.0304)	-3.219670 (0.1018)	-7.972326 (0.0000)	-7.890727 (0.0000)	
lnTIEP	-5.256675 (0.0002)	-2.457543 (0.3447)	-1.586710 (0.4764)	-0.649605 (0.9677)	I(0)
lnTPPA	2.366176 (0.9999)	-0.596671 (0.9716)	2.559324 (1.0000)	-0.338311 (0.9853)	I(1)
ΔlnTPPA	-3.459381 (0.0171)	-3.572062 (0.0516)	-3.459381 (0.0171)	-7.010304 (0.0000)	
The values in parentheses represent the significance (p-value) of the tests					

Source: Authors calculation.

Table 4. Pesaran 2001 cointegration test result.

Estimated model: GDP=f(X), X: designates the independent variables **Chosen ARDL model : ARDL (2, 2, 2, 0, 2, 0)** **Null hypothesis: No long-term relationship**			
Significancelevel	**LowerBound**	**UpperBound**	**F-statistic**
10%	2.26	3.35	7.114890
5%	2.62	3.79	
2.5%	2.96	4.18	
1%	3.41	4.68	

Source: Authors calculation.

4.2. ARDL Bound Test

The condition for using the ARDL is satisfied. Therefore, bound tests of cointegration will be used and the F statistic will determine whether the variables have a long-term relationship. The ARDL approach integrates long-term and short-term dynamics without losing long-term information. The evidence indicates that the calculated F statistic, (GDP/X) =7.1148. X: designates all the explanatory variables. Since (GDP / X) > the upper limits of the critical F at the 2.5%, 5% and 10% significance levels. This leads to the rejection of the null hypothesis of no cointegration and a conclusion that there is a long-term relationship between the variables of the estimated model is drawn.

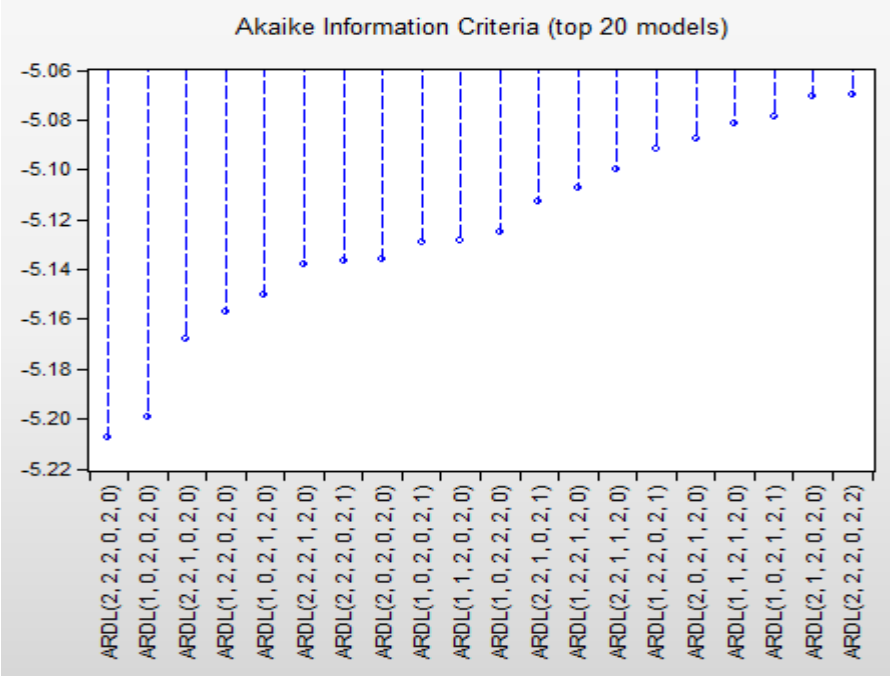

Fig. (1). Akaike Information Criteria (Top 20 models).
Source: authors calculation.

Table 5. Estimated ARDL diagnostic test results.

Test Type	Diagnostic	Test Statistics	P-value	Decision
Errors Auto-correlation	Breusch Godfrey LM test	3.039065	0.2188	No errorAuto-correlation
Heteroskedasticity	Breusch-Pagan Godfrey	14.38736	0.3471	Homoscedasticity
Normality of residuals	Jarque-Bera	1.516777	0.468421	Normal distribution of errors
Functionalform	Ramsey's RESET	0.080216	0.7815	No mis-specifications

Source: Authors calculation.

4.3. Optimal Model Choice

The next step to estimate the ARDL model, the bounds testing technique requires a suitable delay for all variables. The best model has a different lag order for each variable. Lütkepohl, (2006) found that the dynamic link between series can be captured if appropriate lags are used. The optimal offsets must be chosen by the model itself. The model minimizing the AIC criterion is: ARDL (2,2,2,0,2,0).

4.4. Post-Regression Testing

To check the robustness of the model, several diagnostic tests were carried out on the residuals, namely:

- Test of autocorrelation of residuals (LM-Breusch-Godfrey test);
- Homoscedasticity test (Breusch-Pagan-Godfrey);
- Test of normality of residuals (Jarque Bera);
- Ramsey functional form test (RESET);
- Coefficient stability tests (CUSUM and CUSUM_SQ test);

The Breusch-Godfrey LM test p-value (0.2188) for error autocorrelation indicates that there is no error autocorrelation in the model at the 5% significance level.

The p-value of heteroskedasticity (0.3471) and functional form (0.7815) indicate the presence of homoskedasticity and the absence of model misspecification.

The Jarque-Bera test makes it possible to identify the normal distribution of errors, the p-value of this test is well above 5% (0.468421) indicating acceptance of the null hypothesis, *i.e.* the errors are distributed according to the normal law.

The stability tests (CUSUM and CUSUM SQ) indicate the stability of the coefficients in the model, as the plots fall between the lower and upper critical limits of 5% (see previous figures).

The CUSUM results indicate that there is sufficient evidence that the settings are not structurally unstable.

4.5. Estimation of the Long-term Model

Recognizing the existence of a long-term cointegration relationship between the variables of interest and economic growth, the study estimated the long-term coefficients of the

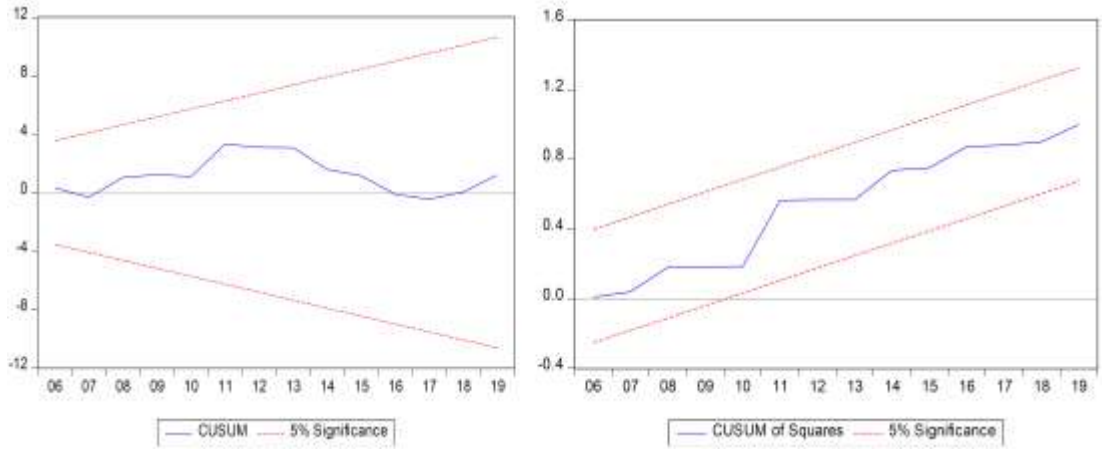

Fig. (2). Stability tests of the CUSUM and CUSUM_SQ coefficients.
Source: Authors calculation.

ARDL (2, 2, 2, 0, 2, 0) selected on the basis of the Akaike criterion.

All the variables retained in the model are significant at the 5% threshold, and since all the variables have undergone a logarithmic transformation, the coefficients are interpreted in terms of elasticities. The coefficients associated with the model variables are positive with the exception of the TPPA variable, which shows the positive effect of gross fixed capital formation, public education expenditure, EV, TIEP on economic growth. On the other hand, the TPPA variable has a negative effect on economic growth.

Table 6. Estimated long-term relationship.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFBCF	0.212147	0.060875	3.484943	0.0036
LDPE	0.112159	0.046353	2.419691	0.0297
LEV	4.106623	0.608647	6.747133	0.0000
LTIEP	0.456479	0.146655	3.112600	0.0076
LTPPA	-0.477221	0.193933	-2.460756	0.0275
C	-10.099537	2.738368	-3.688160	0.0024

Source: Authors Calculation.

In fact, an increase of 1% in gross fixed capital formation leads to an increase in economic growth of 0.21% ceteris-paribus. The 1% increase in the variable public spending on education increases economic growth by 0.11% ceteris-paribus.

To estimate the short-run effects of independent variables on economic growth, an error correction model will be used.

4.6. Short-term Model Estimation

The short-term relationship between the dependent variable GDP and the independent variables is explained by the estimation of the ARDL error correction model. The following table summarizes the short-term effects of changes in independent variables on Moroccan GDP.

The Error Correction Model integrates short-term dynamics with long-term dynamics. The error correction term $ECMt$-1 indicates the speed of adjustment from a short-term deviation to long-term equilibrium. The coefficient of $ECMt$-1 is negative (-2.153040), which confirms the result of the ARDL cointegration bounds test.

This coefficient is significant at the 1% level.

In the short term, gross fixed capital formation has a positive effect on economic growth; the associated coefficient is significant at the 5% threshold. Likewise, public spending on education has a positive effect on economic growth, with significance at the 5% threshold.

Table 7. Estimated short-term relationship.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPIB(-1))	0.264276	0.195887	1.349129	0.1987
D(LFBCF)	0.275545	0.096697	2.849570	0.0129
D(LFBCF(-1))	-0.146036	0.081013	-1.802615	0.0930
D(LDPE)	0.241483	0.103877	2.324713	0.0356
D(LEV)	-56.119355	24.670920	-2.274717	0.0392
D(LEV(-1))	28.492422	22.204473	1.283184	0.2203
D(LTIEP)	0.127534	0.333374	0.382555	0.7078
D(LTIEP(-1))	-0.952017	0.317493	-2.998544	0.0096
D(LTPPA)	-1.027476	0.395407	-2.598525	0.0210
CointEq(-1)	-2.153040	0.372469	-5.780460	0.0000

Source: Authors calculation.

4.7. Causality Results

In the previous sections, this study provided empirical evidence to examine the short- and long-term relationship between human capital and economic growth in Morocco. At this point, this study follows the common expression in statistics that "correlation does not imply causation" to provide additional empirical evidence for this study.

In this regard, this study performed Wald tests of Granger causality to determine the direction of causality between variables. The following table presents the results of the Granger test. The hypotheses tested are specified as follows:

H_0 (Null Hypothesis): There is no causality between human capital and economic growth in Morocco.

H_1 (Alternative hypothesis): There is a causal link between human capital and economic growth in Morocco.

Table 8. Causality test results.

Dependent Variable: D(LPIB)			-
Excluded	**Chi-sq**	**Df**	**Prob.**
D(LFBCF)	1.190263	2	0.5515
D(LDPE)	3.453896	2	0.1778
LEV	4.088920	2	0.1295
LTIEP	3.191885	2	0.2027
D(LTPPA)	1.782701	2	0.4101
All	20.64783	10	0.0237

Source: Authors calculation.

The Granger causality results show that the p-values of the Chi-square estimates of the economic growth regressors are not statistically significant. Therefore, we cannot reject the null hypothesis, which implies that there is no causality between human capital and economic growth in Morocco.

During our empirical study, an important question is raised: Does the development of human capital help boost economic growth? The objective of this study was to answer this question. To verify the relationship that exists between human capital through its variables and economic growth in Morocco, we used an ARDL model (Auto Regressive Distributed Lag model).

The latter represents a creative approach addressing this issue for the case of Morocco. It allows temporal effects to be taken into account in the explanation of a variable. As part of our study, the estimated model made it possible to capture the impact of human capital on economic growth (GDP: dependent variable) in Morocco.

The results showed that the human capital and economic growth series are stationary at different (I (1) and I (0)). Our results argue in favor of a long-term relationship between human capital and economic growth in Morocco. Indeed, the study showed that human capital, through some of its components, has a positive and significant effect on economic growth in the short and long term. The estimated model successfully passes all diagnostic tests.

CONCLUSION

Morocco has made considerable progress in terms of health and education indicators, as well as various other aspects of human development, particularly over the past 20 years.

For this reason, Morocco currently receives an estimated score of 0.50 on the World Bank's Human Development Index. The country is ranked 98th out of 157 countries, with an ICH score below the MENA average but above the average of other countries in its income classification. Given that its HCI score increased from 0.46 to 0.50 between 2012 and 2017, the country has clearly made solid progress.

Morocco ranks higher than its neighboring countries on the ICH in terms of adult life expectancy, but ranks lower, for example, in years of schooling suitable for learning.

However, Morocco is still far from closing the gaps that separate it from developed countries.

Several gaps remain, and many areas need to be addressed to address challenges in the health and education sectors in particular, as these are the two main drivers of human development. Morocco's HCI score of 0.50 indicates that half of the country's human capital potential is unrealized.

When it comes to education, the extraordinary deficit in early childhood education has only recently been recognized or seriously addressed. As preschool education is still not an integral part of compulsory basic education, it is characterized by considerable heterogeneity due to the many actors involved. The measures taken by the government at this level aim to reduce school dropout rates and inequalities in access to and success in schooling.

When it comes to health, Morocco has had to act on several fronts. The government has launched efforts to combat infant and maternal mortality while controlling fertility rates through intensive and sustained family planning programs. Similar efforts have significantly increased life expectancy at birth.

Morocco has thus succeeded in effectively curbing the spread of communicable diseases and, increasingly, non-communicable diseases, which has improved the nutritional status of children and enabled the development and better geographical distribution of health services. Access to health services has been significantly improved through the expansion of health insurance coverage and the establishment of the system of providing subsidized care to disadvantaged groups, among other initiatives.

The study also showed that many gaps and challenges remain. It appears that mitigating these challenges as much as possible will require continued political will and even stronger coordination, particularly in the areas of health and education, the two main drivers of human development.

However, it will also be necessary to take into account all other aspects of human development to ensure that efforts to build Morocco's human capital are as effective as possible. In summary, it is recommended that the government develop a more integrated multi-sectoral policy for human capital development. For example, a national early childhood development and investment strategy appears to hold both great promise and an indispensable part of the country's approach to human capital development across the life cycle.

Morocco has a certain number of assets to develop its human capital and prepare future generations for the rapid transformations occurring in the labor market. In particular, it has benefited from strong political will at the top of government for its recent reforms in education and health. These strategies, initiatives and reforms should be subject to rigorous

and regular evaluation in order to be able to make the necessary adjustments to ensure that they remain effective. It would then be appropriate to accelerate the pace and carry out these reforms in a more coherent and coordinated manner.

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