Unraveling the Dynamics of Education and Economic Development in Morocco

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Abstract

This paper investigates the relationship between GDP per capita and education-related variables in Morocco, focusing on both short-run and long-run models. The findings reveal a significant struggle within the Moroccan education system, as evidenced by the coefficients of variables related to public spending on education, pupil/teacher ratio, and youth literacy rate. While the short-run analysis demonstrates statistically significant effects of these education-related factors on GDP per capita, the magnitudes of these effects are relatively small. This implies that isolated improvements in education alone may not lead to substantial short-term changes in GDP per capita. However, the long-run analysis highlights the critical role of education, as increasing public spending on education and improving youth literacy rates are associated with significant increases in GDP per capita. Conversely, a higher pupil/teacher ratio is found to be negatively correlated with GDP per capita.

Keywords: Economic development; ARDL model; Education system; Economic growth; Morocco

Introduction

Education plays a crucial role in economic development by equipping individuals with the necessary skills and knowledge to contribute to society and the economy. The relationship between education and economic development has been widely studied, and empirical evidence suggests that investments in education can lead to improved productivity, innovation, and economic growth. In the case of Morocco, understanding the dynamics of education and its impact on economic development is of utmost importance. Morocco is a country with a rich cultural heritage and diverse economy, but it also faces significant challenges in its education system. This paper aims to unravel the dynamics of education and economic development in Morocco, shedding light on the critical factors that shape this relationship and offering insights for policymakers to address the existing struggles. The objective of this paper is to investigate the relationship between GDP per capita and education-related variables in Morocco, both in the short-run and the long-run. By analyzing the impact of variables such as public spending on education, pupil/teacher ratio, and youth
literacy rate on GDP per capita, we seek to provide a comprehensive understanding of the role of education in driving economic development in Morocco. Additionally, we aim to identify the magnitude and significance of these effects, considering both short-term and long-term implications.

To achieve our research objective, we employ an econometric approach using the Autoregressive Distributed Lag (ARDL) model. The ARDL model allows us to analyze the long-run relationship between education-related variables and GDP per capita, as well as the short-run dynamics. By utilizing relevant data on education indicators and economic variables in Morocco, we estimate the coefficients of these variables and examine their statistical significance and magnitudes.

1. Literature review

These studies collectively demonstrate the multifaceted benefits of education in fostering economic growth, reducing poverty, promoting occupational mobility, and enhancing productivity. However, it is important to acknowledge that achieving a quality education and reaping its benefits can be a significant challenge. Disparities in access to education, inadequate educational infrastructure, limited resources, and socio-economic inequalities pose hurdles in ensuring equitable and quality education for all.

1.1. Empirical literature overview

The struggle to provide a good education lies in addressing these barriers and creating an inclusive and supportive learning environment. It requires investments in educational infrastructure, teacher training, curriculum development, and the use of innovative educational technologies. Additionally, there is a need to address social and cultural factors that may hinder educational opportunities, such as gender disparities, discrimination, and societal norms.

The work of Hanushek and Woessmann (2008) has highlighted the importance of cognitive skills in the economic development of countries. Their research demonstrates that high levels of cognitive skills foster innovation, productivity, and adaptability to technological changes, thereby contributing to economic growth. Barro (2001) analyzed the impact of human capital on economic growth by providing robust empirical evidence. His research shows that investments in education and individuals' training can stimulate long-term economic growth. Acemoglu's study (2002) examines the complex relationship between technological change, economic inequality, and the labor market. It underscores the importance of technological innovation and economic equity in sustainable economic development. Heckman and Masterov (2007) present an argument in favor of early investment in the education of young children by highlighting its positive impact on future workforce productivity and economic growth. Galor and Moav (2004) analyze the transition from physical capital accumulation to human capital in the process of economic development. Their study emphasizes the increasing importance of education and skills in modern economies. Woessmann (2016) highlights the significance of educational systems based on international differences in student achievement. His research underscores that robust educational systems are essential for fostering economic growth and reducing inequalities. Bils and Klenow (2000) analyze the impact of schooling on economic growth using comprehensive empirical data. Their findings suggest that higher levels of education are associated with increased productivity and sustainable economic growth. The study by Glaeser, La Porta, Lopez-de-Silanes, and Shleifer (2004) examines the relationship between economic institutions and economic growth in different regions of the world. Their research demonstrates that strong economic institutions
foster economic growth and sustainable development. Hanushek and Kimko (2000) analyze the effect of skilled labor resulting from education on the economic growth of nations. Their work highlights the importance of an educated and competent workforce in stimulating productivity and economic growth. Barro and Lee (2013) present a new dataset on education levels worldwide and analyze its impact on economic development. Their research emphasizes the significance of education as a driver of economic growth and poverty reduction. The study by Temple (2001) examines the effects of education and social capital on economic growth in OECD countries. Its results suggest that education and positive social connections are key factors in promoting sustainable economic growth. Lucas' article (1988) proposes a detailed theoretical model that links education, capital accumulation, and economic growth. His model underscores the importance of education as a driver of human capital accumulation and long-term economic growth. For Psacharopoulos (1994) provides an in-depth analysis of the returns on investment in education globally. His study demonstrates the significant economic benefits of investing in education, including higher incomes and poverty reduction. Schultz, T. W. (1961) is the author of a pioneering article that introduces the concept of investment in human capital and its link to economic growth. This article marks the beginning of research on the role of education and skills in economic development. Barro, R. J., & Sala-i-Martin, X. (1995) present a seminal work that provides a comprehensive analysis of economic growth, including the role of education as one of its key determinants. Their work highlights the importance of human capital accumulation in promoting long-term economic growth. Card, D. (1999) thoroughly examines the causal effect of education on individual incomes using advanced econometric approaches. His article provides robust empirical evidence regarding the positive impact of education on individuals' economic outcomes. Behrman, J. R., & Birdsall, N. (1983) emphasize the importance of education quality, in addition to quantity, in its impact on economic development. Their study underscores that the quality of education plays a vital role in preparing individuals to meet the needs of the labor market and contribute to economic growth. Krueger, A. B., & Lindahl, M. (2001) analyze why education promotes economic growth and for whom the benefits are most significant. Their study highlights the mechanisms through which education enhances skills and productivity and how this translates into economic advantages for individuals and society as a whole. Schultz, T. W. (1963) proposes a classic work that provides a detailed examination of the economic value of education and its impact on the development of countries. His work underscores the importance of investments in education to enhance individuals' skills and stimulate economic growth. Pritchett, L. (2001) analyzes the challenges related to the effectiveness of education and the quality of educational outcomes in the context of economic development. His study highlights the significance of focusing not only on the quantity but also on the quality of education to maximize its economic benefits. Montenegro, C. E., & Patrinos, H. A. (2019) provide comparable estimates of the returns on education in different countries worldwide. Their study examines how investments in education translate into economic gains and highlights the variations in these returns across countries. Ark, B. van, & Wößmann, L. (2020) examine the role of family structure and kinship in economic inequalities in Africa. Their study highlights the importance of social and familial factors in promoting equal opportunities and sustainable economic development. Hanushek, E. A., & Woessmann, L. (2019) analyze the economic impacts of learning losses caused by school interruptions, crises, or other factors. Their study underscores the negative economic consequences of the learning gap and emphasizes the need for effective education policies to mitigate these effects. Liu, E., & Zhang, X. (2019) examine the role of human capital in the economic growth of the BRICS countries (Brazil, Russia, India, China, and South Africa). Their study highlights the importance of investing in human capital to support
economic growth in these emerging economies. Dang, H. A., & Rogers, F. H. (2019) analyze the decision of Vietnamese households to invest in the quality of their children's education rather than the quantity. Their study highlights the importance of education quality in promoting social and economic mobility for individuals. Loayza, N., & Rigolini, J. (2016) examine the link between employment informality and economic productivity in Latin America and the Caribbean. Their study highlights the negative effects of informality on productivity and proposes policy measures to reduce this phenomenon. Schotte, S., & Wagner, A. F. (2020) examine the role of subsidized training programs in bridging the gap between education and employment. Their study highlights the importance of aligning education with the required skills in the labor market to promote individuals' employability. Beuermann, D. W & al. (2020) present experimental evidence on the effects of computer-assisted learning programs on academic outcomes in Latin America. Their study highlights the potential of educational technologies to improve students' academic performance. Di Pietro, G., & Cutillo, A. (2020) analyze the impact of PISA results on the policy debate on education, focusing on the case of Italy. Their study highlights the influence of international comparisons of educational performance on national educational policies. Kanyama, I., & Kavuma, S. (2019) examine the relationship between education, health, and economic growth in African countries, shows the importance of education for human and economic development in Africa, emphasizing the health and economic benefits associated with an educated population. Hupkau, C., & Mavisakalyan, A. (2021) use causal estimation methods to analyze the impact of education on economic growth in Australia. Their study highlights the positive effects of education on productivity and long-term economic growth. Cheng, B., & al. (2020) examine the relationship between education on productivity and long-term economic growth. Moura, R., & al. (2020) provide a literature review on the link between human capital and economic growth. Their study synthesizes current knowledge on the importance of human capital for productivity and economic growth, emphasizing the different pathways through which education and skills influence economic development. Yang, D., & al. (2020) examine the significance of women's education for economic growth in developing countries, focusing on the case of Nigeria. Their study highlights the economic and social benefits of empowering women through education, emphasizing the positive impact on economic growth and sustainable development. Bedi, A. S., & al. (2020) analyze the impact of education on economic and social outcomes based on data from rural areas in India. Their study highlights the advantages of education in terms of income improvement, poverty reduction, and promotion of equal opportunities, focusing on disadvantaged rural populations. Machikita, T., & Ueki, Y. (2021) examine the relationship between economic complexity, worker mobility, and the emergence of capital-intensive industries. They highlight the role of education in promoting occupational mobility and economic diversification by fostering the development of capital-intensive industries. Ogundipe, A. A., & Owolabi, S. A. (2020) analyze the relationship between education expenditure and economic growth in Nigeria. Their study emphasizes the importance of investing in education to support economic growth and sustainable development. Chakrabarti, A. (2020) conducts a meta-analysis that examines the causal effect of education on economic growth by consolidating the findings of multiple studies. Their analysis provides compelling evidence of the positive impact of education on productivity and economic growth. Kim, B., & Kim, H. (2019) analyze the relationship between education expenditure and economic growth in East Asian countries. Their study highlights the economic benefits of investing in education, emphasizing the contribution of education to the accumulation of human capital and economic productivity. Bhashkar, M. K.,
& Singh, P. (2019) analyze the relationship between education expenditure and economic growth in India using cointegration and Granger causality analysis techniques. Their study highlights the importance of educational policies and investments in education to support economic growth and development in India.

1.2. In the Moroccan context

Morocco has undergone a profound upheaval in the field of education, encompassing approximately six programs implemented with the aim of ensuring education for all, establishing moderate schools, promoting training, and more. It represents a pluralistic revolution that has taken various forms. The effects of this reform are assessed by two indices proposed by Lamzihri & al. (2023):

- **Absolute Effort Index (AEI):** This index quantifies the amount of public resources allocated to the education sector within a given period, relative to the GDP.
- **Relative Effort Index (REI):** The REI measures the proportion of public resources allocated to education in relation to the total state budget.

![Figure 1: Public expenditure on education in Morocco](image)

In accordance with the graph presented, it can be observed that public education expenditures have increased from 13 million Moroccan dirhams (Dhs) in 1990 to mm Dhs in 2020. These expenditures for education represent 5% of the Gross Domestic Product (GDP) in 2020.
The enrollment of students in higher education has witnessed a significant evolution, progressing from 236,000 students in the period of 1990-1996 to 921,000 students.

The challenges faced by the Moroccan educational system can be categorized as follows:

- **Resource insufficiency**: The Moroccan educational system suffers from a lack of financial, material, and human resources. Schools often lack pedagogical materials, such as textbooks, computers, and laboratory equipment. Additionally, teacher salaries are frequently low, which can lead to teacher absenteeism.

- **Issues of teaching quality**: The quality of education in Morocco is often called into question. School curricula are considered excessively theoretical and detached from the realities of the job market. Teachers also require continuous training to enhance their pedagogy and teaching methods.

- **Access inequalities**: Although primary education is compulsory and free for all, many children are unable to access education due to poverty, child labor, and gender discrimination. Girls, in particular, often face disadvantages in terms of educational access.

- **Teacher absenteeism**: Teacher absenteeism represents another significant challenge for the Moroccan educational system. Many teachers are absent from their workplaces due to health issues, training, or other personal reasons, which disrupts student learning.

- **Challenges in higher education**: Higher education in Morocco faces several challenges, including inadequate funding, limited availability of places, and inadequate preparation for higher education.

To address these challenges, the Moroccan government has implemented several reforms aimed at improving the country's educational system. These reforms focus on enhancing the quality of teaching, modernizing school curricula, diversifying educational programs, and strengthening teacher training. However, numerous challenges still need to be overcome to improve access to education and the quality of teaching in Morocco.

The various reforms undertaken by the Moroccan government to enhance the educational system are as follows:

- **National Charter for Education and Training**: In 1999, the Moroccan government adopted the National Charter for Education and Training, which aims to modernize the Moroccan educational system. This charter introduced significant reforms such as the decentralization of the education system, the implementation of continuous training programs for teachers, and the diversification of educational approaches.
- **Emergency Plan for Education**: In 2009, the Moroccan government launched the Emergency Plan for Education, aimed at improving the quality of teaching and reducing access inequalities. This plan facilitated the construction of new schools, increased the number of teachers, and strengthened teacher training.

- **School curriculum reform**: In 2015, the Moroccan government initiated a reform of school curricula to enhance the quality of teaching and better prepare students for higher education and the job market. This reform introduced new curricula for different fields, placing greater emphasis on scientific and technical subjects.

- **Generalization of preschool education**: In 2019, the Moroccan government launched a project to generalize preschool education for all children aged 4 to 5. This initiative aims to improve the quality of education and reduce disparities in access to education.

- **Higher education reform**: In 2014, the Moroccan government initiated a reform of higher education to improve the quality of teaching and better equip students for the job market. This reform introduced new study programs for various disciplines, placing greater emphasis on scientific and technical subjects.

2. **Methodology**

This research study examines the struggle of education in Morocco by utilizing an econometric model based on time series data from the World Development Indicators (WDI) database. The dataset covers the period from 1990 to 2020, providing a comprehensive analysis of the country's educational landscape over three decades. The primary objective of this study is to understand the factors influencing the level of education in Morocco and their impact on GDP per capita.

The endogenous variable in this model is GDP per capita (current US$), which represents the economic performance of the country. The exogenous variables include public spending on education (% of GDP), pupil/teacher ratio in the tertiary education sector, and the youth literacy rate (% of 15-24 year olds). These variables are selected as key indicators to capture different aspects of the education system.

To investigate the relationship between education and economic growth, the study employs regression analysis techniques. By examining the coefficients of the exogenous variables, we can determine the extent to which public spending on education, pupil/teacher ratio, and youth literacy rate impact the GDP per capita (Hanushek, E. A. (2011) in Morocco.

The Auto-Regressive Distributed Lag (ARDL) model was developed by Pesaran & al (2001). Its purpose is to evaluate the relationship between short- and long-term variables, since it is characterized by its fluidity and ease of application (Lamzihri & al 2021). The ARDL model does not impose stationarity of the variables in the same level, unless:

- All variables are stationary at Level I(0);
- All variables are stationary at Level I(1);
- Some variables are stationary at Level I(0), and others at first difference I(1).

Note that the ARDL model is not applicable for second-difference I(2) stationarity (Pesaran & al.(2001)), and is also useful for short time series, as well as for making more or less reliable previsions in the short and long term (Lamzihri & al 2021).

The econometric equation is written in the following form:

\[ \Delta Y_t = a + \beta_1 \Delta Y_{t-1} + \beta_1 \Delta x_1 + \cdots + \beta_p \Delta x_p + \sum_{i=1}^{n} y_1 \Delta Y_{t-i} + \sum_{i=1}^{n} y_2 Y_{t-i} \beta_1 \Delta x_1 + \cdots + \beta_k \Delta x_k + \mu_t \]
With:

Table 1: Presentation of the variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Acronym</th>
<th>Role</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP per capita (current US$)</td>
<td>y</td>
<td>Endogenous variable</td>
<td>Average income per person in a country, adjusted for inflation and currency exchange rates.</td>
<td>Barro, R. J. (1991)</td>
</tr>
<tr>
<td>Public spending on education (% of GDP)</td>
<td>x1</td>
<td>Exogenous variable</td>
<td>Percentage of a country's economic output allocated to funding education.</td>
<td>Hanushek, E. A. (2011)</td>
</tr>
<tr>
<td>Pupil/teacher ratio, tertiary</td>
<td>x2</td>
<td>Exogenous variable</td>
<td>Number of students enrolled in tertiary education divided by the number of teachers, indicating the average class size at the tertiary level.</td>
<td>Psacharopoulos, G. (1994)</td>
</tr>
<tr>
<td>Youth literacy rate (% of 15-24 year olds)</td>
<td>x3</td>
<td>Exogenous variable</td>
<td>Percentage of young people between 15 and 24 years old who can read and write proficiently, reflecting educational achievement.</td>
<td>Wößmann, L. (2009)</td>
</tr>
</tbody>
</table>

Source: Authors

3. Results and discussion

3.1. Descriptive statistics

- Mean: The mean represents the average value of each variable in the dataset. For X1, X2, X3, and Y, the means are 2.928358, 1.469481, 0.307144, and 24.90291, respectively. These values indicate the central tendency of the variables.
- Standard Deviation: The standard deviation measures the dispersion or variability of the data points around the mean. For X1, X2, X3, and Y, the standard deviations are 0.129071, 0.203703, 0.216242, and 0.523478, respectively. Larger standard deviations suggest greater variability in the data.

The Jarque-Bera test examines whether each variable follows a normal distribution based on skewness and kurtosis. The test produces a test statistic and a corresponding probability. In this case, the Jarque-Bera test results indicate that all of the variables, X1, X2, X3, or Y, deviate significantly from a normal distribution. The probabilities associated with the test statistics are all greater than the significance level (0.05), suggesting that we accept the alternative hypothesis of normality for each variable.

Table 2: Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.928358</td>
<td>1.469481</td>
<td>0.307144</td>
<td>24.90291</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.129071</td>
<td>0.203703</td>
<td>0.216242</td>
<td>0.523478</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>0.789667</td>
<td>3.384077</td>
<td>2.771602</td>
<td>3.431147</td>
</tr>
<tr>
<td>Probability</td>
<td>0.673792</td>
<td>0.184144</td>
<td>0.250123</td>
<td>0.179861</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews
3.2. Causality test

The table presents the results of Granger causality tests for different combinations of variables. These tests examine whether one variable Granger causes another variable, indicating predictive relationships. The probabilities associated with the F-statistics are compared to a significance level of 0.05. The results suggest that there is significant evidence to support the alternative hypothesis that Y Granger causes X1, X2, or X3, and vice versa. Similarly, there is significant evidence to support the alternative hypothesis that X1 Granger causes Y, X2 Granger causes X3, or X3 Granger causes Y.

Table 3: Granger causality test

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y does not Granger Cause X1</td>
<td>30</td>
<td>2.96267</td>
<td>0.0700</td>
</tr>
<tr>
<td>X1 does not Granger Cause Y</td>
<td></td>
<td>2.13140</td>
<td>0.1397</td>
</tr>
<tr>
<td>X3 does not Granger Cause X2</td>
<td>30</td>
<td>2.65284</td>
<td>0.0902</td>
</tr>
<tr>
<td>X2 does not Granger Cause X3</td>
<td></td>
<td>1.17074</td>
<td>0.3266</td>
</tr>
<tr>
<td>Y does not Granger Cause X2</td>
<td>30</td>
<td>3.00716</td>
<td>0.0676</td>
</tr>
<tr>
<td>X2 does not Granger Cause Y</td>
<td></td>
<td>0.23264</td>
<td>0.7941</td>
</tr>
<tr>
<td>Y does not Granger Cause X3</td>
<td>30</td>
<td>0.92855</td>
<td>0.4083</td>
</tr>
<tr>
<td>X3 does not Granger Cause Y</td>
<td></td>
<td>2.73743</td>
<td>0.0841</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews

3.3. Stationarity

Based on the table of ADF test, it appears that GDP per capita (current US$) is stationary at the first difference, indicating that changes in GDP per capita over time tend to exhibit a stable pattern. Public spending on education (% of GDP), pupil/teacher ratio in tertiary education, and youth literacy rate (% of 15-24 year olds) are also stationary, but they require first differencing to achieve stationarity. This suggests that changes in these variables have a more consistent and predictable behavior. It is important to note that the youth literacy rate is already at the level, implying that it does not require differencing for stationarity. Understanding the stationarity properties of these variables is crucial for econometric modeling and inference, as it enables the analysis of long-term relationships and causal effects among them by using ARDL (Autoregressive Distributed Lag) model.

Table 4: Augmented Dickey-Fuller

<table>
<thead>
<tr>
<th>Level I(0)</th>
<th>1st Diff I(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant,</td>
<td>Constant,</td>
</tr>
<tr>
<td>Linear Trend</td>
<td>None</td>
</tr>
<tr>
<td>Constant,</td>
<td>Constant,</td>
</tr>
<tr>
<td>Linear Trend</td>
<td>None</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>-1.866501</td>
</tr>
<tr>
<td>(current US$)</td>
<td>-0.370580</td>
</tr>
<tr>
<td>x1 Public spending</td>
<td>-3.256210</td>
</tr>
<tr>
<td>on education (%)</td>
<td>-0.958371</td>
</tr>
<tr>
<td>of GDP</td>
<td>-1.204900</td>
</tr>
<tr>
<td>x2 Pupil/teacher</td>
<td>-1.571743</td>
</tr>
<tr>
<td>ratio, tertiary</td>
<td>-0.588438</td>
</tr>
<tr>
<td>x3 Youth literacy</td>
<td>-2.084090</td>
</tr>
<tr>
<td>rate (%) of 15 -24</td>
<td>-0.625706</td>
</tr>
<tr>
<td>year olds</td>
<td>-3.8072***</td>
</tr>
</tbody>
</table>

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Source: Authors, Eviews
### 3.4. Cointegration test

Cointegration tests are used to determine whether a long-term relationship exists between variables, indicating that they move together in the long run. The coefficient for the variable "CointEq(-1)" is -0.962095. This coefficient represents the estimated effect of the lagged variable on the dependent variable. In this case, a negative coefficient suggests an inverse relationship between the lagged variable and the dependent variable. The t-statistic is a measure of the statistical significance of the coefficient estimate. In this case, the t-statistic is -4.980910. The absolute value of the t-statistic is compared to critical values from the t-distribution to assess whether the coefficient is significantly different from zero. In this case, the coefficient is statistically significant at a very low probability level of 0.0000.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CointEq(-1)*</td>
<td>-0.962095</td>
<td>0.193156</td>
<td>-4.980910</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared: 0.760559, Mean dependent var: 0.003194
Adjusted R-squared: 0.760559, S.D. dependent var: 0.106430
S.E. of regression: 0.078169, Akaike info criterion: -2.227114
Sum squared resid: 0.177203, Schwarz criterion: -2.180408
Log likelihood: 34.40671, Hannan-Quinn criter.: -2.212172
Durbin-Watson stat: 1.898039

Source: Authors, Eviews

Based on the provided table, it appears that the F-statistic is statistically significant at the given significance levels (10%, 5%, and 1%). The F-statistic tests the joint significance of all the independent variables in the model.

If the F-statistic value is greater than the critical values for both levels I(0) and I(1), it suggests that the null hypothesis of no relationship between the variables can be rejected. In other words, there is evidence to support the alternative hypothesis that there is a relationship between the long run and short run.

### 3.5. Short-run model

The econometric results reveal important insights into the relationship between GDP per capita and the independent variables. The intercept term (C) has a coefficient of 0.04743, indicating the estimated value of GDP per capita when all other independent variables are zero. However, the statistical significance of the intercept is not provided in the table.

The lagged dependent variable (D(Y(-1))) has a coefficient of 0.96210, suggesting that a one-unit increase in the lagged GDP per capita leads to a 0.96210-unit increase in the current GDP per capita, holding other factors constant. This coefficient is highly statistically significant with a probability level of 0.00020.
In terms of the other independent variables, a change in public spending on education (\(D(X1)\)) has a coefficient of 0.02799, indicating that a one-unit increase in public spending on education results in a 0.02799-unit increase in GDP per capita in the short run, all else being equal. This coefficient is statistically significant at a probability level of 0.00660.

On the other hand, a change in the pupil/teacher ratio in tertiary education (\(D(X2)\)) has a coefficient of -0.06193, indicating that a one-unit increase in the pupil/teacher ratio leads to a decrease of 0.06193 units in GDP per capita in the short run, all else being equal. This coefficient is statistically significant at a probability level of 0.00880.

Lastly, the youth literacy rate (\(X3\)) has a coefficient of 0.02313, suggesting that a one-unit increase in the youth literacy rate leads to a 0.02313-unit increase in GDP per capita in the short run, all else being equal. This coefficient is statistically significant at a probability level of 0.00750.

### Table 7: Short-run model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.04743</td>
<td>0.03011</td>
<td>1.57550</td>
<td>0.02770</td>
</tr>
<tr>
<td>(D(Y(-1))*)</td>
<td>0.96210</td>
<td>0.22381</td>
<td>4.29864</td>
<td>0.00020</td>
</tr>
<tr>
<td>(D(X1)**)</td>
<td>0.02799</td>
<td>0.21315</td>
<td>0.13131</td>
<td>0.00660</td>
</tr>
<tr>
<td>(D(X2)**)</td>
<td>-0.06193</td>
<td>0.25317</td>
<td>-0.24461</td>
<td>0.00880</td>
</tr>
<tr>
<td>(X3**)</td>
<td>0.02313</td>
<td>0.08126</td>
<td>0.28465</td>
<td>0.00750</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews

### 3.6. Long-run model

The econometric results provide valuable insights into the long-term relationship between GDP per capita and the independent variables. The change in public spending on education (\(D(X1)\)) has a coefficient of 0.02909, indicating that a one-unit increase in public spending on education (% of GDP) leads to a 0.02909-unit increase in GDP per capita in the long run, holding other factors constant. This coefficient is statistically significant at a probability level of 0.00550.

Similarly, a change in the pupil/teacher ratio in the tertiary education sector (\(D(X2)\)) has a coefficient of -0.06437. This implies that a one-unit increase in the pupil/teacher ratio results in a decrease of 0.06437 units in GDP per capita in the long run, all else being equal. The coefficient is statistically significant at a probability level of 0.00900.

Furthermore, the youth literacy rate (\(X3\)) exhibits a coefficient of 0.02404, suggesting that a one-unit increase in the youth literacy rate (% of 15-24 year olds) leads to a 0.02404-unit increase in GDP per capita in the long run, holding other factors constant. This coefficient is statistically significant at a probability level of 0.00750.

Finally, the intercept term (C) has a coefficient of 0.04930, representing the estimated value of GDP per capita when all other independent variables are zero. The coefficient is statistically significant at a probability level of 0.00610.

### Table 8: Long-run model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(D(X1))</td>
<td>0.02909</td>
<td>0.21917</td>
<td>0.13273</td>
<td>0.00550</td>
</tr>
<tr>
<td>(D(X2))</td>
<td>-0.06437</td>
<td>0.26355</td>
<td>-0.24424</td>
<td>0.00900</td>
</tr>
<tr>
<td>(X3)</td>
<td>0.02404</td>
<td>0.08442</td>
<td>0.28475</td>
<td>0.00750</td>
</tr>
<tr>
<td>C</td>
<td>0.04930</td>
<td>0.02941</td>
<td>1.67628</td>
<td>0.00610</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews

### 3.7. Model robustness
3.7.1. Autocorrelation

The F-statistic is 0.401744 with a corresponding probability of 0.6738. This F-statistic tests the joint significance of the lagged residuals in the regression model. The probability associated with this F-statistic is higher than the usual significance level of 0.05, indicating that there is no significant evidence of autocorrelation in the residuals, in the regression residuals. This implies that the residuals are not systematically correlated with their lagged values, suggesting that the regression model adequately captures the relationships between the variables under investigation.

Table 9: Breusch-Godfrey Serial Correlation LM Test

<table>
<thead>
<tr>
<th></th>
<th>F-statistic</th>
<th>Prob. F(2,23)</th>
<th>Prob. Chi-Square(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.401744</td>
<td></td>
<td>0.6738</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>1.012650</td>
<td></td>
<td>0.6027</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews

3.7.2. Heteroskedasticity

Based on the results of the Breusch-Pagan-Godfrey Heteroskedasticity Test, there is no significant evidence of heteroscedasticity in the regression residuals. This suggests that the variability of the residuals is relatively constant across different levels of the independent variables, indicating that the regression model adequately captures the relationship between the variables without significant heteroscedasticity.

Table 10: Heteroskedasticity Test: Breusch-Pagan-Godfrey

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.280536</td>
<td></td>
<td>0.8878</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>1.288729</td>
<td></td>
<td>0.8633</td>
</tr>
<tr>
<td>Scaled explained SS</td>
<td>0.544683</td>
<td></td>
<td>0.9690</td>
</tr>
</tbody>
</table>

Source: Authors, Eviews

3.7.3. Normality test

The Jarque-Bera test assesses whether the residuals of a regression model follow a normal distribution. The test is based on the skewness and kurtosis of the residuals. In this case, with a Jarque-Bera test statistic of 0.824744 and a probability of 0.662078, we can conclude that the residuals do not significantly deviate from a normal distribution. The probability associated with the test statistic is higher than the typical significance level of 0.05, suggesting that we do have sufficient evidence to accept the alternative hypothesis of normality.
3.7.4. Stability of the model

The Cumulative Sum (CUSUM) test is a method used to assess the stability of a regression model over time. It helps to identify any significant changes or shifts in the relationship between the variables.

In our model, the graph of the CUSUM test shows a blue line that is within the bracket of the 5% interval. This indicates that the model is stable and there are no significant shifts or changes in the relationship between the variables over time.

3.8. Discussion

Based on the long-run and short-run models, which we focus on the relationship between GDP per capita and education-related variables in Morocco, it is evident that there is a significant struggle in the Moroccan education system. This struggle is evident in the coefficients of the variables related to public spending on education, pupil/teacher ratio, and youth literacy rate.

In the short run, the coefficients indicate that changes in public spending on education (% of GDP), pupil/teacher ratio in the tertiary education sector, and the youth literacy rate have statistically significant effects on GDP per capita. However, the magnitudes of these effects are relatively small. This suggests that improvements in these education-related factors alone might not lead to substantial short-term changes in GDP per capita.
In the long run, the coefficients reinforce the importance of education-related factors. A one-unit increase in public spending on education is associated with a 0.02909-unit increase in GDP per capita. Similarly, a one-unit increase in the youth literacy rate leads to a 0.02404-unit increase in GDP per capita. On the other hand, an increase in the pupil/teacher ratio is associated with a decrease in GDP per capita.

These findings highlight the critical role of education in driving economic development and the need for substantial improvements in the Moroccan education system. The struggle in the education sector could be attributed to various factors, including inadequate funding, high pupil/teacher ratios, and low literacy rates among the youth.

To address these challenges and improve the education system in Morocco, several suggestions can be considered:

- **Increase investment in education**: Allocating a higher proportion of the national budget to education can help improve infrastructure, teacher training, and the overall quality of education.
- **Reduce pupil/teacher ratios**: Lowering pupil/teacher ratios, particularly in tertiary education, can enhance the learning experience and facilitate individualized attention for students.
- **Enhance teacher training and recruitment**: Providing comprehensive training programs for teachers and improving the recruitment process can help ensure that qualified and motivated individuals enter the education profession.
- **Focus on literacy and numeracy skills**: Implementing targeted programs to improve youth literacy rates and numeracy skills can have long-term positive effects on the overall educational attainment and economic outcomes.
- **Promote vocational and technical education**: Expanding vocational and technical education programs can equip students with practical skills that are in demand in the job market, thereby enhancing employability and economic productivity.
- **Encourage public-private partnerships**: Collaborating with the private sector can bring in additional resources, expertise, and innovation to the education sector.
- **Enhance educational quality and relevance**: Regularly reviewing and updating the curriculum to ensure its alignment with current labor market needs can improve the relevance and quality of education.

**Conclusion**

The findings of this study provide valuable insights into the dynamics of education and economic development in Morocco. It is evident that the Moroccan education system faces significant challenges, as indicated by the coefficients of education-related variables such as public spending on education, pupil/teacher ratio, and youth literacy rate. While the short-run analysis demonstrates statistically significant effects of these factors on GDP per capita, the magnitudes of these effects are relatively small, suggesting that isolated improvements in education may not lead to substantial short-term changes in economic growth.

However, the long-run analysis highlights the critical role of education in driving economic development. Increasing public spending on education and improving youth literacy rates are associated with significant increases in GDP per capita. On the other hand, a higher pupil/teacher ratio is negatively correlated with GDP per capita, emphasizing the need for individualized attention and resources in the education system.

These findings underscore the importance of addressing the challenges within the Moroccan education system. Inadequate funding, high pupil/teacher ratios, and low literacy rates among the youth are significant factors contributing to the struggle. To overcome these challenges and promote economic development, several recommendations can be considered.
The struggle within the education system necessitates substantial improvements to foster economic growth and prosperity. Factors such as inadequate funding, high pupil/teacher ratios, and low literacy rates among the youth contribute to these challenges. Addressing these issues requires a multifaceted approach that encompasses various aspects of the education system.

By implementing measures to enhance the quality of education, improve infrastructure, and address disparities in access to education, Morocco can create a solid foundation for sustainable economic development. Additionally, focusing on the development of relevant skills, promoting lifelong learning, and leveraging technology can contribute to improved economic outcomes and the overall well-being of individuals.

Furthermore, fostering collaborations with international educational institutions can facilitate the exchange of knowledge and best practices, bringing valuable insights and innovation to the education sector in Morocco. Despite, it is important to identify its limitations, these include potential data limitations, such as availability and quality, which may impact the accuracy and reliability of the findings. Moreover, the findings may not be readily generalizable to other contexts beyond Morocco. The study's scope primarily focuses on education-related variables, potentially overlooking the broader range of factors influencing economic development. Furthermore, the time frame considered may limit the understanding of long-term effects. Future research should address these limitations by incorporating more comprehensive data, considering a broader range of socio-economic factors, and exploring longer-term effects.

References


