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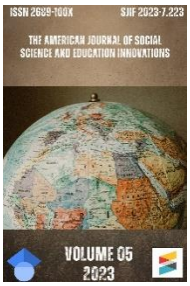

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Research Article

EFFECTS OF HUMAN CAPITAL ON ECONOMIC GROWTH IN BENIN

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ABSTRACT

The development of human capital is a lever for sustainable economic growth. This study analyzes the importance of human capital in the process of economic growth in Benin. It was carried out on time series from 1990 to 2020. The analysis was based on the Toda Yamamoto causality test, and estimates were made using an autoregressive lag-staggered model (ARDL). The causality test reveals that spending on education causes gross domestic product per capita. The estimates show that education spending has a negative influence on the country's economic growth, while health spending and the gross secondary school enrolment rate have a positive influence in both the short and long term. However, these variables do not have a significant effect on gross domestic product per capita in the long term, while in the short term, it is only health spending that does not have a significant effect on Benin's economic growth.

KEYWORDS

Human capital, economic growth, causality test, ARDL.

INTRODUCTION

Human capital plays a crucial role in the economic growth process. A high level of human capital in a society can boost productivity, foster innovation and facilitate adaptation to technological change. Education, vocational training and work experience are all factors that contribute to increasing a population's human capital (Barro & Lee, 2019). Several empirical studies (Becker, 1964 ; Schultz, 1961 ; Barro, 1991) have shown a positive correlation between human capital and economic growth. According to (Barro & Lee, 2019) countries that invest more in the education and training of their population tend to post higher long-term growth rates. (Hanushek & Woessmann, 2018) through studies and research aimed at understanding

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the importance of human capital in economic development are based on the idea that people's knowledge and skills (human capital) are key determinants of long-term economic growth. In 2015, these authors showed that countries with highly educated workforces tend to experience more sustained economic growth. They argue that investment in education and the development of people's skills is key to boosting a nation's innovation, economic efficiency and overall productivity (Hanushek & Woessmann, 2015). Authors such as (Smith, 1776 ; Marshall, 1920 ; Schumpeter, 1950) recognize that the quality of a country's workforce is one of its most important competitive assets. First enunciated by (Schultz, 1961a) whose precursor (Becker, 1964 ; 1975) the theory of human capital has helped explain economic growth and the formation of individual earnings over time. With the new theories of economic growth, human capital emerged as a determining factor in economic growth. (Becker, 1975) points out that investment in human capital requires costs, such as time, tuition, missed work opportunities and other resources, and individuals make investment decisions by weighing up the anticipated costs and benefits. According to him, individuals will choose to invest in their human capital if the expected benefits, such as an increase in future earnings, outweigh the associated costs. The cost of inaction on human capital development is growing. The development of this branch of the public economy plays a decisive role in combating extreme poverty and strengthening social inclusion. In developed countries, investing in human capital is an important aspect of public policy. This action seems to be able to provide solutions to many of the problems faced by policy-makers in recent decades.

In Benin, programs and policies have been put in place to accelerate economic growth in recent years, particularly with regard to investment in human capital. According to the World Bank report, investment in human capital is imperative if we are to make the most of the changing economic outlook, (World Bank, 2019). Despite this recommendation, it has to be said that in 2020, Benin was ranked 147ème out of 174 countries in terms of human capital, according to the World Bank report (Human Capital Index country data). Benin's human capital index is 0.4. This translates into a 60% loss of economic productivity for the country. Given the results of this ranking, we felt it necessary to analyze the interactions between human capital and economic growth in Benin. This study aims to answer the key question: What is the relationship between human capital and economic growth?

The interest of this work can be seen on several levels. From an economic standpoint, we analyze the importance of human capital in the formation of real gross domestic product per capita, and then highlight the influence of human capital expenditure (particularly expenditure on education and health) on economic growth. Finally, we focus on the long-term effect of investment in national education on economic growth, and the impact of economic growth on the financing of Benin's education system.

This article is organized in three parts. The first part presents the literature review and the formulation of the research hypotheses. The second deals with methodological aspects. The third part is devoted to the analysis and discussion of empirical results.

1. Literature review and formulation of research hypotheses

1.1 Concept definitions

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Notion of human capital: the World Bank defines human capital as "the body of knowledge and skills acquired by individuals throughout their life and health that enable them to realize their full potential by becoming productive members of society" (World Bank, 2019). Investing in human resources through nutrition, health services, quality education, skills and jobs, promotes the development of human capital. This is an imperative if we are to end extreme poverty and create more inclusive societies. According to the Organisation for Economic Co-operation and Development (OECD), human capital covers "the body of knowledge, skills, competencies and individual characteristics that facilitate the creation of personal, social and economic well-being". According to the same organization, "Human capital is an intangible asset that can advance or sustain productivity, innovation and employability." (OECD, 2019). Whereas physical capital is one of the classic factors of production along with labor, raw materials, land, etc, that enable production. It is also clear that human capital, unlike other forms of capital, is inseparable from its owner and cannot be transferred. (Becker, 1975) defines human capital as all the knowledge, skills and qualifications a person acquires through education, vocational training and work experience. He argues that human capital plays an essential role in the process of economic growth by increasing individual productivity and promoting innovation and the adoption of new technologies. Investment in human capital is essential to ensure that it doesn't wear out, and to make the most of it, given its contribution to value creation (according to numerous previous studies). Human capital enables its owner to increase his or her productive potential, future productivity and salary. This shows that, long sidelined in analyses of economic growth in favor of physical capital, human capital takes better account of the labor factor employed in a production process, by highlighting the quality of the workforce.

Economic growth: the concept of economic growth refers to a considerable and lasting increase in the production of goods and services. It is measured by the annual evolution of gross domestic product (GDP). When it stagnates, we speak of zero growth or stagnation. And when it contracts for two consecutive quarters, the country is in economic recession. The percentage change in GDP indicates the current level of growth. In reality, a growth rate can be explained by both an increase in the factors of production and an increase in productivity. Growth figures are closely scrutinized by economists, as they are at the origin of income distribution, generate an increase in overall consumption, and are essential for lowering unemployment.

1.2 Theoretical review

The classic work of (Becker, 1964) entitled "Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education" made a major contribution to our understanding of the effect of human capital on economic growth, and laid the foundations for much subsequent work in this field. It is worth noting that this article had a significant impact on the subsequent development of human capital theory and its policy implications. It highlighted the importance of investment in education and training for economic development, and influenced much subsequent research in this field. (Becker, 1964) develops an innovative approach to understanding how investment in human capital contributes to economic growth. Becker's work has also contributed to the formulation of education and training policies focused on strengthening human capital in many countries. However, it should be noted that Becker's theory has also been the subject of criticism and

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debate. Some researchers question the ability to accurately measure human capital and its impact on economic growth. Others point to inequalities in access to education and training, which may limit the benefits of human capital for certain populations (Blau & Ferber, 1992a ; Blau & Ferber, 1992b ; Mincer, 1993a ; Mincer, 1993b ; Folbre, 1994a ; Folbre, 1994b ; Sen, 1977 ; O'Neill, 2003a ; O'Neill, 2003b). Despite these criticisms, Becker's article remains a major reference in the study of the effect of human capital on economic growth. It laid the foundations of a solid theory and opened up new perspectives for understanding the mechanisms underlying economic growth and the development of individuals and societies. (Barro, 1991) explores the relationship between human capital accumulation, generally measured by workers' education and skills, and long-term economic growth. He begins by presenting the neoclassical growth model of (Solow, 1956) which considers physical capital (machinery, equipment, etc.) and technological progress as the main determinants of economic growth. However, according to (Barro, 1997) this model does not take into account human capital, which is a key factor in productivity and technological progress. He notes that countries that invest more in the education and training of their population tend to post higher rates of economic growth. Moreover, (Barro, 1997) notes a positive correlation between life expectancy and economic growth, suggesting that health and human capital are also closely linked. He also stresses the importance of the quality of education, rather than simply the number of years spent in school. He argues that effective education systems, which foster skills and knowledge useful to the economy, have a more significant impact on economic growth. However, (Schultz, 1971) points out that results can vary depending on the specific context and the policies implemented to foster human capital development. (Schultz, 1961b) the originator of human capital theory, sees training and education as a focal point for improving worker productivity and performance. He emphasized the impact of education and training on innovation and productivity. For him, measuring investment in human capital using the expenditure approach is not effective, and it would be better to understand the variables that improve individual capabilities and lead to higher wages for individuals on the labor market. He therefore distinguishes five (05) sources of human capital production and improvement: (1) health infrastructures and services, which affect life expectancy and vitality; (2) vocational training (including apprenticeship) organized by companies; (3) the education system, from elementary school to higher education; (4) adult education and training programs not organized by companies; (5) migration of individuals and families to seize job opportunities. He goes further, opposing classical growth models, notably those of researchers (Harrod, 1960 ; Solow, 1956) which link the rate of growth to the accumulation of physical capital. (Schultz, 1997) states that "there is little doubt that investment that improves people's capabilities creates differences in economic growth and consumption satisfaction. We now know that ignoring human capital biases the analysis of economic growth". According to (Becker, 1975) investment in human capital has a positive impact not only on the individual, notably on income and employability, but also on the economy as a whole, given its positive influence on economic growth. (Nelson & Phelps, 1966) identified two factors that play a central role in explaining the rate of growth of productivity and innovation: the development of human capital and increased investment in human capital. They demonstrated that productivity and innovation depend on the number of individuals with secondary and tertiary education. In their view, education is a driving force behind technological catch-

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up. (Lucas, 2015) In this sense, they support the idea that education is at the heart of the growth process, insofar as skills and aptitudes are designed according to a personal logic and are incorporated into individuals as human capital. Taking Solow's model as a starting point (Solow, 1956 ; 1970 ; Mankiw & al., 1992) integrate an additional variable, that of human capital development, to establish a positive relationship between education and economic growth, as these authors examine the compatibility of this model with international differences in growth and living standards. Human capital theories have enriched the traditional vision of work, while considerably renewing development economics. This notion highlights the opportunity to improve the quality of the workforce through the development of individuals' skills and qualities, which would contribute to a more refined analysis of the factors driving economic growth.

In his approach, (Romer, 1994) introduced a factor A (technical progress) into human capital and deduced increasing returns to scale. For him, human capital is the primary input for research and development, generating the technical progress and innovation needed to improve the production of goods and services for consumption. Using data from several countries (1986 to 1990), he concludes that the rate of economic growth is increasing at a greater rate in developed economies than in Third World countries. This difference in growth is attributed to the quality of the workforce in developed countries. Indeed, these countries invest more in the development of human capital. Long before (Romer, 1994), (Barro, 1991) uses the concept of "endogenous technical progress" and arrives at the same conclusions using panel data (he used data from 98 countries from 1960 to 1985). Through this study, he demonstrates a significant positive relationship between human capital (the school enrolment rate is used as an indicator of the level of human capital) and economic growth. He found that the growth rate of real GDP per capita is influenced by the level of education (for primary GER, the elasticity is 0.0181 and 0.0225 for secondary GER). In 1997, using a panel on 114 countries between 1960 and 1990 on the basis of a classical model, (Barro, 1997) analyzes the determinants of economic growth (considered as an endogenous variable). To explain economic growth, he uses real GDP per capita, then tertiary and secondary GER, life expectancy, the government expenditure ratio, the terms of trade and inflation, among many other control variables. In particular, he found a positive relationship between human capital and economic growth (with an elasticity of +0.011) on the one hand, and a positive relationship between life expectancy (elasticity +0.042) and economic growth on the other. In 1988, (Lucas, 1988) demonstrated that an economy starting with a low level of physical and human capital will remain permanently inferior to an economy starting with a better endowment of these two types of capital. He sees this analysis as a step towards explaining income differences between countries. Like (Lucas, 1988), (Becker, 1964 ; Murphy & Tamura, 1995) assumed that the rate of return on human capital grows at a certain rate because of the excess profit on human capital. (Barro, 1991, 1997 ; Benhabib & Spiegel, 1994 , 2019) have also shown that quality education and public spending on education (as a percentage of GDP) have a relatively strong positive impact on growth. (Mankiw et al., 1992) attempted to examine the neoclassical growth model of (Solow, 1956) by including both physical and human capital accumulation. To measure the rate of investment in human capital, they used the ratio of secondary school enrolment to the working population, averaged over the period 1960 to 1985, and explained the per capita income in 1985 or the rate of growth of this income between the two dates. The

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estimates led unambiguously to a positive relationship between economic growth and the measures of human capital used. In particular, the secondary school enrolment rate showed an elasticity of 0.233 over the period considered. Other previous empirical studies (Drèze & Murthy, 2001 ; Bhorat et al., 2016, 2018; Bhorat & Oosthuizen, 2015) have, for the most part, used the average number of years of education as a proxy for human capital. But using this indicator would be an imperfect measure since it might not reflect the actual level of human capital accumulated by an individual, with regard to the quality of training received. Moreover, (Caselli, 2005) makes a distinction between the quality and quantity of education. This distinction makes it easier to measure human capital.

According to the (UNCTAD, 2021)the human capital criterion, which involves a composite index, the Human Capital Index (HCI), is based on indicators such as nutrition (percentage of the population that is undernourished), health (infant mortality rate), school enrolment (gross secondary school enrolment rate) and literacy (adult literacy rate). Another indicator that draws attention to the importance of human capabilities for a country's development is the Human Development Index (HDI). This is a synthetic precursor to the HCI, measuring the average level achieved in the essential dimensions of human development. Thus, according to a study conducted by the World Bank, if a child born today in a country has an efficient health structure and an education system ensuring complete, generalized schooling of optimum quality, the human capital index (HCI), which varies between 0 and 1, could reach the value of 1. This means that this child born today will be a worker of tomorrow enjoying 100% of his or her productive capacities, which will fully contribute to sustained economic growth in his or her country (World Bank, 2019).

The following assumptions follow from the above:

Hypothesis 1: There is a significantly positive short-term relationship between public spending on education and economic growth in Benin.

Hypothesis 2: There is a positive relationship between public spending on health and economic growth in Benin over the long term.

Hypothesis 3: Economic growth in Benin drives public spending on education.

2. Research methodology

2.1 Data source

To test the hypotheses, we adopted a quantitative approach using annual data from the World Bank's WDI database. They cover the period from 1985 to 2020. This study uses an autoregressive time lag model (ARDL) to model the dynamic relationships between a number of variables. The various graphical outputs and model estimates were produced using R (ver, 4,0,4) and Microsoft Excel 2016.

2.2 Variable selection and description

2.2.1 The dependent variable

- Real Gross Domestic Product per inhabitant (GDPRH)

Real Gross Domestic Product per capita is the gross domestic product divided by the mid-year population. GDP at purchaser prices is the sum of the gross value added of all resident producers in the economy, plus taxes on products and minus subsidies not included in the value of products. It is calculated without making deductions for the depreciation of manufactured assets or for the depletion and degradation of natural resources. Data in constant local currencies.

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2.2.2 Explanatory variables

- Total population (POP) :

Total population is based on the de facto definition of population, which includes all residents, regardless of legal status or nationality. Values shown are mid-year estimates.

- Public expenditure on education (DEPEDUC) :

Public education expenditure (current capital and transfers) includes education expenditure financed by transfers from international sources to the government. General government generally refers to local, regional and central governments.

- Gross Secondary School Enrolment Rate (TBSSEC) :

The gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education indicated. Secondary education complements the basic education provision begun at primary level, and aims to lay the foundations for lifelong learning and human development, by offering more subject- or skills-based education using more specialized teaching.

- Gross Tertiary School Leaving Rate (TBSSUP) :

The gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the indicated level of education. Higher education, whether an advanced research degree or not, normally requires, as a minimum condition of admission, successful completion of secondary education.

- Les Dépenses Publiques en Santé (DEPSAN) :

This refers to public spending on healthcare, of national origin, as a percentage of the economy measured by GDP.

- Infant Mortality Rate (IMR):

The under-5 mortality rate is the probability per 1000 that a newborn will die before reaching the age of 5, if subjected to the age-specific mortality rate for the specified year.

- Life expectancy at birth (LEB):

Life expectancy at birth indicates the number of years a newborn baby would live if the mortality patterns prevailing at the time of birth remained the same throughout its life.

3. Analysis of empirical results and discussion

3.1 Descriptive analysis

3.1.1 Variable characteristics

The following table gives a description of the variables used, with their main characteristics (mean, standard deviation, minimum, median, maximum).

Table 1: Descriptive statistics for the different variables studied

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Variables	Average	Standard deviation	Minimum	Median	Maximum
GDPRH (F CFA)	555109	7.389890e+04	445519	556502	718121
POP (Inhabitants)	7676119	2.366163e+06	4278502	7407978	12123198
DEPEDUC (% GDP)	2.880	4.617509e-01	1.922	2.880	4.398
TBSSEC (%)	35.02	1.079382e+01	15.13	35.02	59.04
TBSSUP (%)	6.947	4.789307e+00	2.014	5.910	15.965
LIFO (% GDP)	0.6889	8.256743e-02	0.4909	0.6889	0.9271
TMI (‰)	133.1	3.202478e+01	85.9	128.9	192.8
EVN (Years)	56.82	3.239771e+00	50.03	56.23	62.08

Source: Created by the author, using R, based on World Bank data.

These results reveal that spending on education and health (as a percentage of GDP), have a relatively low dispersion over the study period (0.46% and 0.08% respectively). The mortality rate, meanwhile, shows significant variations (32.02‰). The same applies to real gross domestic product per capita and total population, with average dispersions of 73898.9 F CFA and 2366163 inhabitants respectively. The difference between the minimum and maximum values for real gross domestic product per capita and total population testifies to the significant variation in these variables over the study period. From 1985 to 2020, life expectancy at birth averaged around 56.82 years.

3.1.2 Description of variable evolution

The graphs below show the evolution of the various study variables over the period from 1985 to 2020.

Figure 1: Change in real gross domestic product per capita between 1985 and 2020

- Real gross domestic product per capita (F CFA)

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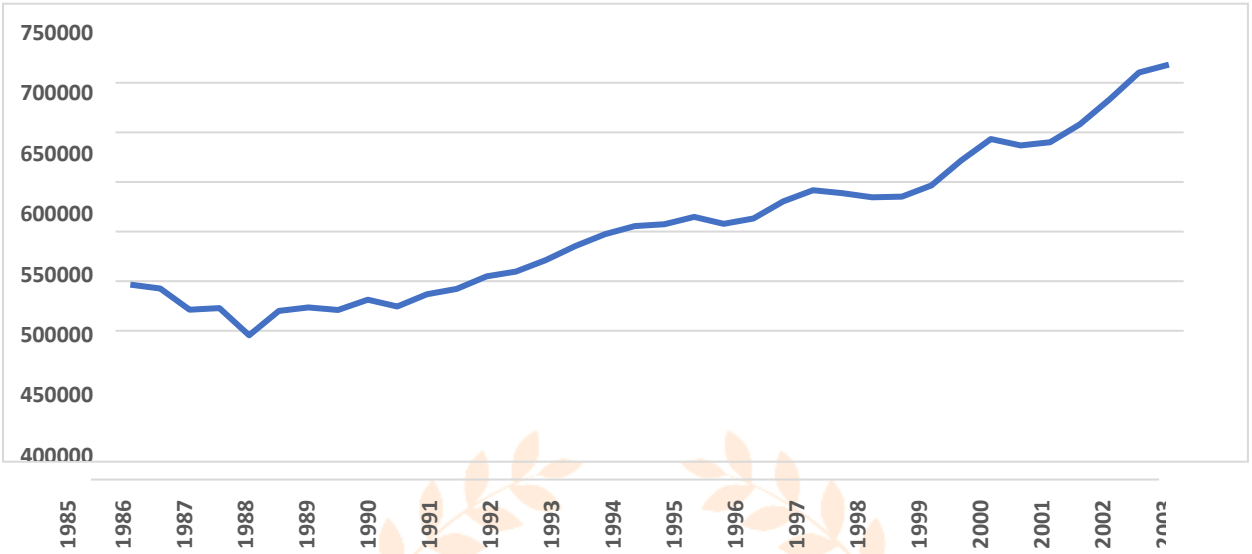
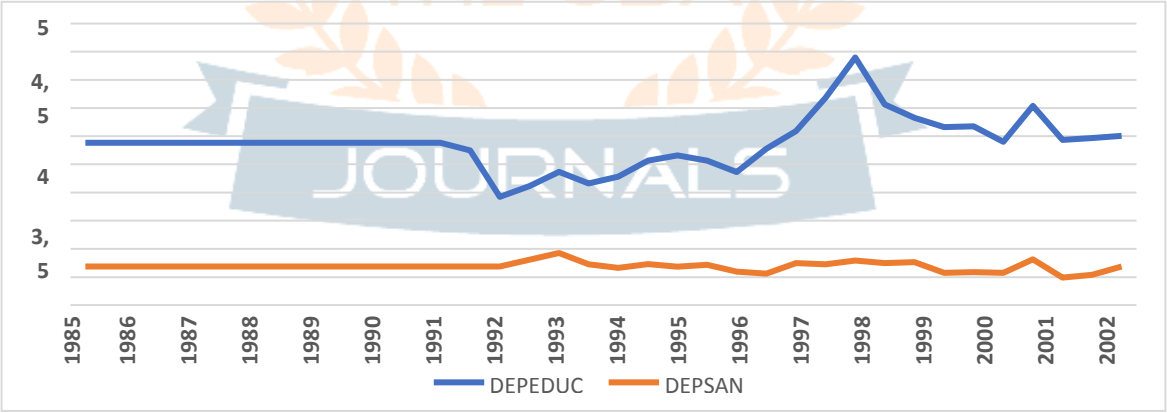


Source: Created by the author, using R, based on World Bank data.

With a value of 496469.3767 F CFA at the start of the period, this figure rises to 718120.9592 F CFA by 2020.

Figure 2: Public spending on education and health between 1985 and 2020

- **Public spending on education and health (% GDP)**



Source: Created by the author, using R, based on World Bank data.

Analysis of the graph above shows that over the entire period, spending on education is higher than on health. Spending on education hovers around 3% over the period from 1999 to 2020, with a peak of 4.39% in 2011. On the other hand, spending on healthcare fluctuates up and down between 2000 and 2020, with small fluctuations of between 0.5% and 1%.

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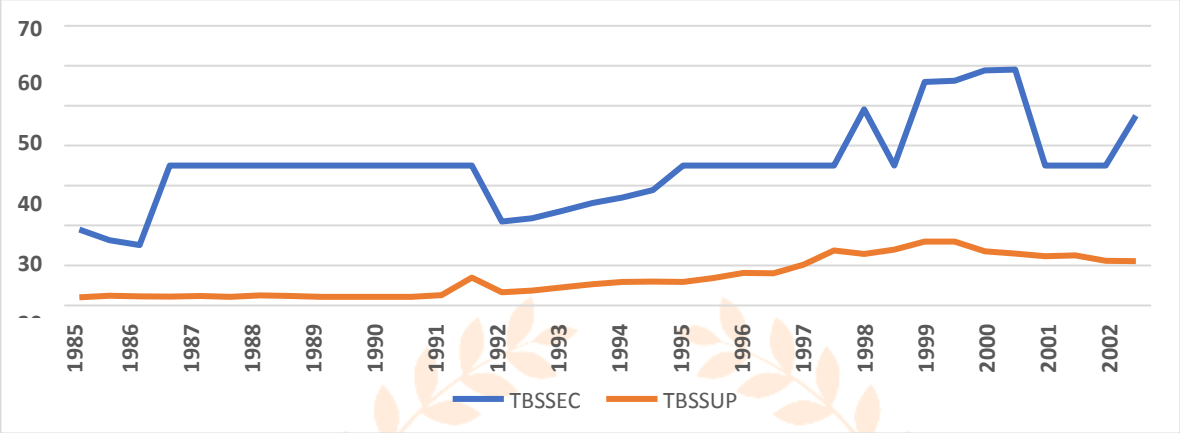
Figure 3: Trends in gross enrolment ratios between 1985 and 2020

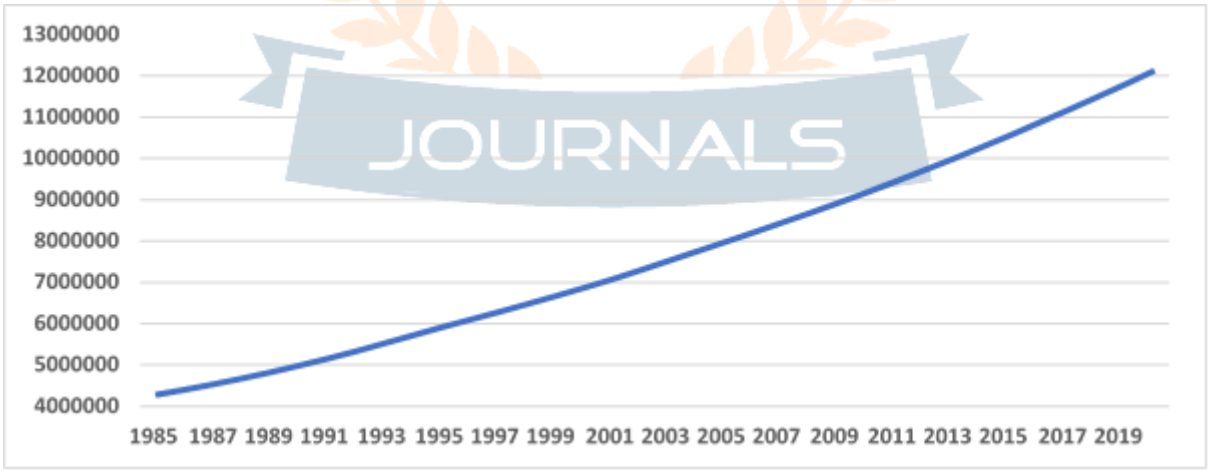
- **Gross secondary and tertiary enrolment rates (%)**



Source: Created by the author, using R, based on World Bank data.

According to this graph, the secondary gross enrolment ratio is higher than the tertiary gross enrolment ratio throughout the period 1985-2020. Compared to the secondary gross enrolment ratio, it evolves in a sawtooth pattern between 1998 and 2020. The gross tertiary enrolment rate shows a slight upward trend between 1999 and 2013, when it peaks at 15.96%.

Figure 4: Change in total population between 1985 and 2020



Source: Created by the author, using R, based on World Bank data.

The graph above shows that the total population evolves progressively over the period from 1985 to 2020, varying between 4278502 and 12123198.

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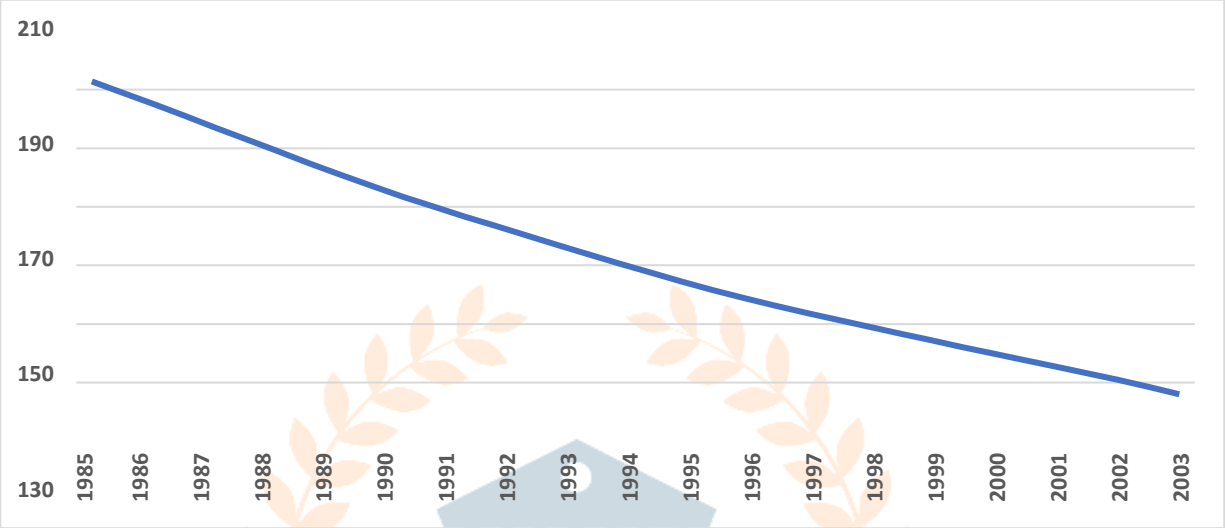
Figure 5: Change in infant mortality rate between 1985 and 2020

- **Infant mortality rate (‰)**

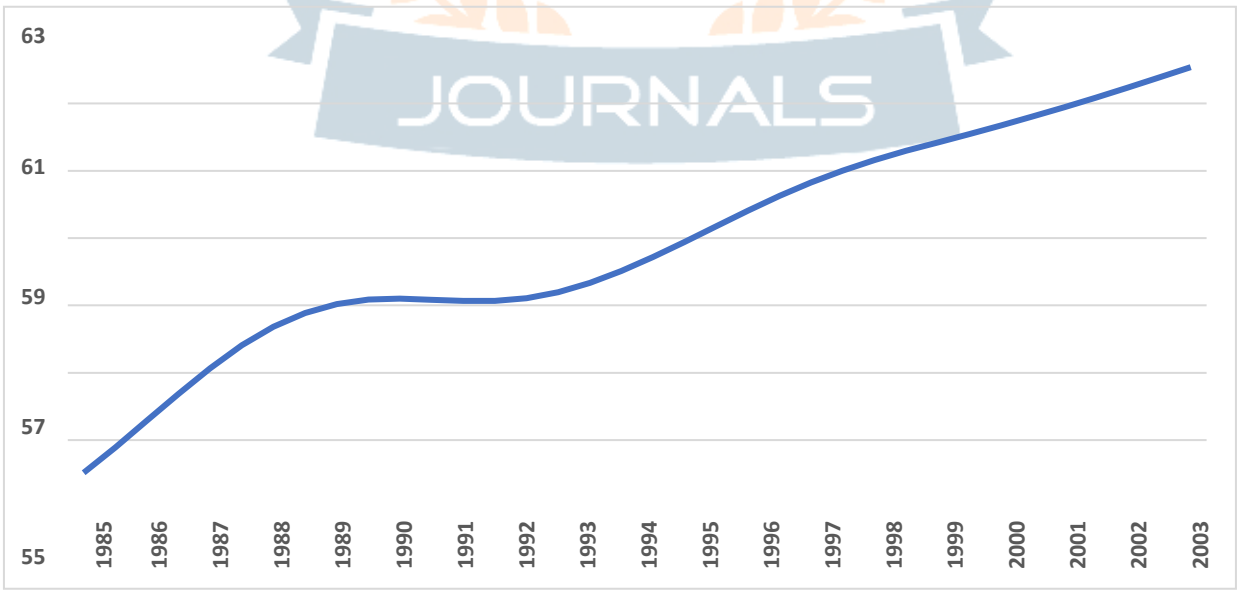


Source: Created by the author, using R, based on World Bank data.

This graph above shows us that the infant mortality rate decreases between 1985 and 2020 and its values fluctuate between 85.90‰ and 192.8‰.

Figure 6: Change in infant mortality rate between 1985 and 2020

- Life expectancy at birth (Years)



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Life expectancy at birth hovered around 55 years between 1985 and 2001. It then rose steadily from 2002 to 2020, reaching 62.077 years, which is still below the world average (73 years).

3.2 Econometric analysis

3.2.1 Presentation of estimation results

3.2.1.1 Stationarity test

The first step in our econometric analysis was to perform stationarity tests on our various variables. The notion of stationarity refers to the fact that a series can evolve over time or remain the same over time. We can use a variety of stationarity tests: the Dickey-Fuller unit root test (ADF), the Phillips-Perron test (PP), the Kwiatkowski, Phillips, Schmidt and Shin test (KPSS). In this study, we will use the Dickey-Fuller test (ADF). Test results are reported in the following table:

Table 2: Augmented Dickey-Fuller stationarity tests

Variables	Statistical value	Critical value	Order of integration
GDPR	2,6006	4,86	I (1)
POP	-5,7699	-3,50	I (2)
DEPEDUC	-4,1368	-1,95	I (1)
TBSSEC	-4,1343	-1,95	I (1)
TBSSUP	-3,9514	-1,95	I (1)
DESSAN	-3,4513	-2,93	I (0)
TMI	-3,5663	-3,50	I (2)
EVN	-4,0911	-3,50	I (0)

Source: Created by the author, using R, based on World Bank data.

Note that the POP and TMI series are integrated of order 2 (stationary in second difference); the PIBRH, DEPEDUC, TBSSEC and TBSSUP series are integrated of order 1 (stationary in first difference), while the DEPSAN and EVN variables remain stationary at level (without differentiation).

3.2.1.2 Correlation analysis and test for multi-colinearity between variables

Figure 7: Correlation matrix

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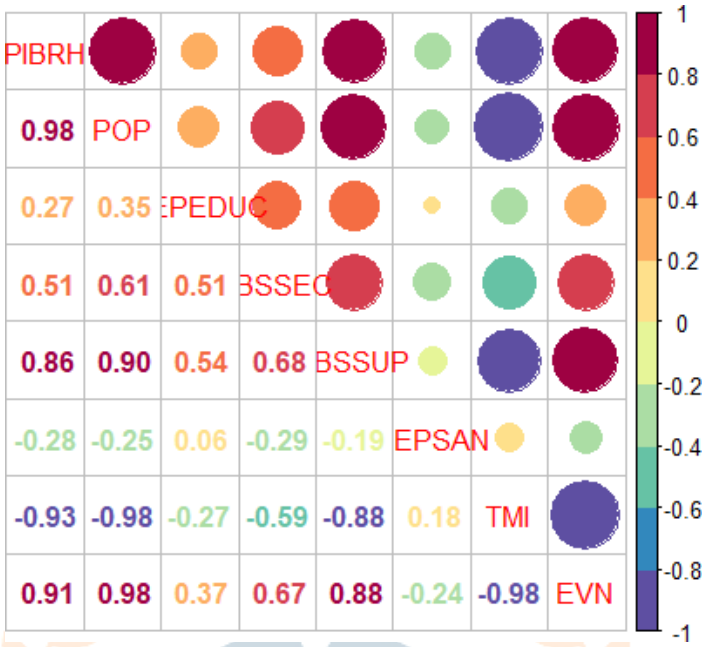

Source: Created by the authors, using R, based on World Bank data.

The figure above shows the degree of correlation between the variables studied. We note, for example, that the variable GDPRH has a very strong positive correlation with the variables TBSSUP (0.86) and POP (0.98). On the other hand, there is a very strong negative correlation between PIBRH and TMI (-0.93).

- Multi-colinearity test

Multi-collinearity refers to the existence of a linear relationship between certain variables. The VIF test used here allows us to test for multi-collinearity between variables, and at the same time identify the variables to be removed from the study. According to this test carried out in R, the variables concerned by multi-collinearity are : POP, TBSSUP and TMI.

In the remainder of this chapter, the following variables will be used: PIBRH, DEPEDUC, TBSSEC, DEPSAN and EVN. These series are integrated at different orders of less than 2. This makes the Engle and Granger cointegration test (multi-variate case) and the Johansen test ineffective. It is therefore appropriate to use the bounds cointegration test (Pesaran et al., 2001).

3.2.1.3 Analysis of Toda Yamamoto causality test results

The results of the causality tests are shown in the following table:

Table 3: Causality tests using Toda and Yamamoto's approach

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Test null hypotheses	Prob (Wald)	Conclusions
DEPEDUC does not cause GDPRH	0,086	Accepted
PIBRH does not cause DEPEDUC	0,5	Accepted
TBSSEC does not cause GDPR	0,23	Accepted
PIBRH does not cause TBSSEC	0,35	Accepted
DEPSAN does not cause GDPRH	0,88	Accepted
PIBRH does not cause DEPSAN	0,92	Accepted
EVN does not cause GDPR	0,88	Accepted
PIBRH does not cause EVN	0,92	Accepted

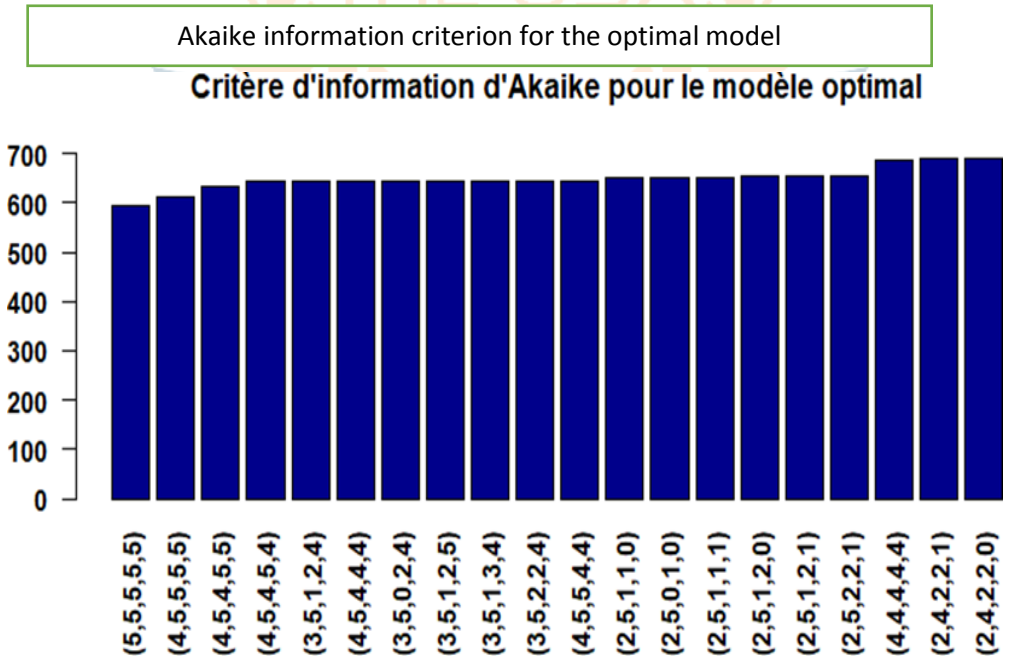
Source: Created by the author, using R, based on World Bank data.

According to the table above, the probabilities associated with the Wald statistic for each causality test are all above the 5% threshold. There is therefore no causal relationship between the variables listed.

3.2.1.4 Determining the optimal ARDL model

To select the optimal ARDL model, we use the Akaike Information Criterion (AIC). The optimal model is the one that provides statistically significant results with the fewest possible parameters. Below is a graph showing the values of the AIC criterion and the results obtained by estimating the optimal model in R :

Figure 8: Optimal offset of the ARDL model



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Source: Created by the author, using R, based on World Bank data.

The graph shows that the ARDL model (5,5,5,5,5) is the most optimal of the 20 models proposed. In fact, it offers the lowest AIC value.

Table 4: ARDL model estimation (5,5,5,5,5)

Variable	*Coefficient*	*Standard error*	*Student statistic*	*Probability*
C	4.889e+05	1.222e+06	0.400	0.758
L(GDPRH,1)	6.473e-02	4.102e-01	0.158	0.900
L(GDPRH,2)	-2.707e-01	9.861e-01	-0.274	0.829
L(GDPRH,3)	-1.284e+00	3.084e+00	-0.416	0.749
L(GDPRH,4)	1.739e-01	3.579e-01	0.486	0.712
L(GDPRH,5)	3.631e-01	3.920e-01	0.926	0.524
DEPEDUC	9.873e+03	2.976e+04	0.332	0.796
L(DEPEDUC,1)	-1.564e+04	1.665e+04	-0.939	0.520
L(DEPEDUC,2)	3.082e+04	8.032e+04	0.384	0.767
L(DEPEDUC,3)	-1.166e+04	3.066e+04	-0.380	0.769
L(DEPEDUC,4)	1.110e+04	4.386e+04	0.253	0.842
L(DEPEDUC,5)	-7.563e+04	1.431e+05	-0.529	0.690
TBSSEC	3.508e+03	6.740e+03	0.520	0.694
L(TBSSEC,1)	3.466e+03	6.810e+03	0.509	0.700
L(TBSSEC,2)	1.092e+03	2.503e+03	0.436	0.738
L(TBSSEC,3)	2.935e+03	4.666e+03	0.629	0.642
L(TBSSEC,4)	3.440e+03	5.162e+03	0.666	0.626
L(TBSSEC,5)	5.477e+03	1.058e+04	0.518	0.696
DEPSAN	1.531e+05	3.442e+05	0.445	0.734
L(DEPSAN,1)	2.471e+04	7.134e+04	0.346	0.788
L(DEPSAN,2)	-1.197e+05	3.369e+05	-0.355	0.783
L(DEPSAN,3)	8.427e+04	1.003e+05	0.840	0.555
L(DEPSAN,4)	3.984e+04	6.712e+04	0.594	0.659
L(DEPSAN,5)	-1.090e+05	1.591e+05	-0.685	0.618
EVN	-2.954e+06	7.005e+06	-0.422	0.746
L(EVN,1)	4.651e+06	1.150e+07	0.405	0.755
L(EVN,2)	-2.032e+05	3.620e+06	-0.056	0.964
L(EVN,3)	-4.160e+06	6.307e+06	-0.660	0.629
L(EVN,4)	2.993e+06	3.804e+06	0.787	0.576
L(EVN,5)	-8.575e+05	1.016e+06	-0.844	0.554

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R-square: 0.9997	F-statistic: 100.1
Adjusted R-squared: 0.9897	Prob(F-statistic) : 0.07894

Source: Created by the author, using R, based on World Bank data.

Once the model has been estimated, it is important to carry out a number of tests. This validation stage consists of carrying out the following diagnostic tests: residual autocorrelation test, residual heteroscedasticity test, residual normality test and model stability and specification test.

Table 5: Estimated model robustness tests

Test null hypothesis	Test	Test statistics (Probability)
No autocorrelation	Breusch-Godfrey	LM test = 2.0376 (0.389)
Homoscedasticity	Breusch-Pagan-Godfrey	BP = 30.607 (0.3842)
Normality	Shapiro-Wilk	W =0.96755 (0,4544)
Good specification	Ramsey	RESET = 8.6296 (0.05698)
Stability	CUSUM	f(efp) = 1.3448 (0.8093)

Source: Created by the author, using R, based on World Bank data.

According to Table 5, all the probabilities derived from these tests are above the 5% threshold. This indicates that the residuals are non-autocorrelated, homoscedastic and follow a normal distribution. The model is therefore well specified and stable.

3.2.1.6 Cointegration test by Pesaran et al, (2001)

Before proceeding to the test, we must first identify the optimal model and give an estimate of the model thus chosen.

Once this has been done, we can implement the test procedure. For this test, when the Fisher statistic is below the lower bound I (0) for a given threshold, we accept the null hypothesis of no cointegration. When the Fisher statistic is above the upper bound, however, the null hypothesis is rejected, and the existence of cointegration, i.e. a long-term relationship, is assumed. On the other hand, when the Fisher statistic lies between the two limits, no conclusion can be drawn. The results of the cointegration test are shown in the following table.

Table 6: Pesaran, Shin and Smith cointegration test

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Variables :	PIBRH, DEPEDUC, TBSSEC, DEPSAN, EVN	
F-stat calculated :	4.069	
Critical threshold	Lower terminal	Upper terminal
1%	3.07	4.44
5%	2.26	3.48
10%	1.9	3.01

Source: Created by the author, using R, based on World Bank data.

From these results, we note that the Fisher statistic associated with the test is above the upper bound (4.069>3.48), at the 5% threshold. We therefore conclude that a cointegrating relationship exists.

3.2.1.7 Short-term dynamics and long-term coefficients

- Short-term dynamics

Table 7: Error Correction Model (ECM) estimation results

Variable	Coefficient	Standard error	Student statistic	Probability
C	4.889e+05	6.344e+04	7.707	0.000587***
d(L(GDPRH,1))	1.018e+00	2.286e-01	4.453	0.006686**
d(L(GDPRH,2))	7.471e-01	1.820e-01	4.105	0.009314**
d(L(GDPRH,3))	-5.370e-01	1.285e-01	-4.178	0.008672**
d(L(GDPRH,4))	-3.631e-01	9.434e-02	-3.848	0.012021*
d(DEPEDUC)	9.873e+03	3.567e+03	2.768	0.039476*
d(L(DEPEDUC,1))	4.538e+04	8.450e+03	5.370	0.003014**
d(L(DEPEDUC,2))	7.620e+04	1.135e+04	6.715	0.001109**
d(L(DEPEDUC,3))	6.454e+04	8.641e+03	7.469	0.000679***
d(L(DEPEDUC,4))	7.563e+04	1.131e+04	6.688	0.001130**
d(TBSSEC)	3.508e+03	5.375e+02	6.527	0.001263**
d(L(TBSSEC,1))	-1.294e+04	1.642e+03	-7.883	0.000528***
d(L(TBSSEC,2))	-1.185e+04	1.489e+03	-7.962	0.000504***
d(L(TBSSEC,3))	-8.917e+03	1.153e+03	-7.734	0.000578***
d(L(TBSSEC,4))	-5.477e+03	8.179e+02	-6.696	0.001123**
d(DEPSAN)	1.531e+05	3.246e+04	4.715	0.005266**
d(L(DEPSAN,1))	1.045e+05	2.374e+04	4.403	0.007003**
d(L(DEPSAN,2))	-1.515e+04	1.861e+04	-0.814	0.452578
d(L(DEPSAN,3))	6.912e+04	1.700e+04	4.065	0.009679**
d(L(DEPSAN,4))	1.090e+05	1.990e+04	5.475	0.002770**

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d(EVN)	-2.954e+06	5.344e+05	-5.529	0.002654**
d(L(EVN,1))	2.228e+06	6.478e+05	3.439	0.018460*
d(L(EVN,2))	2.024e+06	6.110e+05	3.313	0.021167*
d(L(EVN,3))	-2.135e+06	5.131e+05	-4.162	0.008809**
d(L(EVN,4))	8.575e+05	1.917e+05	4.473	0.006563**
ect	-1.953e+00	2.605e-01	-7.498	0.000667***
R-square: 0.9819			F-statistic: 10.84	
Adjusted R-squared: 0.8414			Prob(F-statistic) : 0.007289	

Significance levels: 0.001(***) ; 0.01(**) ; 0.05(*) ; 0.1(.) ; 1()

Source: Created by the author, using R, based on World Bank data.

The error-correction model thus estimated is globally significant at the 5% level, and is 84% effective in explaining the dynamics of real gross domestic product per capita. Table 7 above shows that the adjustment coefficient or restoring force is statistically significant and negative (-1.953), guaranteeing the existence of a restoring force towards long-term equilibrium. In other words, in the long term, the imbalances between GDPRH and its aforementioned determinants offset each other. When a shock occurs to real GDP per capita, its effects are absorbed at 195.3% in the following year. This shock is fully absorbed after 6 months 4 days. In addition, we note the following:

- Public spending on education has a significant positive (+) effect on economic growth in the short term: isolating the effect of other explanatory variables, a 1% increase in education spending leads to an increase in real GDP per capita of around 9873 F CFA in the short term. Likewise, all other things being equal, a 1% increase in education spending 4 years ago leads to an increase in GDPRH of 75630 F CFA. We therefore need at least one year to see public spending on education stimulate economic growth.

- The other control variables show both positive (+) and negative (-) significant short-term effects on economic growth. The gross secondary school enrolment rate of one, two, three and four years ago has a negative effect on economic growth. For public spending on health, the effects on economic growth are significantly negative (-) after two years and positive (+) after one, three and four years. It should be noted that a 1% increase in public spending on health, leads to an increase of around 109,000 F CFA in GDPRH after four years. Furthermore, life expectancy at birth has a significant positive effect on economic growth after one, two and four years. Thus, an increase of one year in life expectancy at birth will lead to an increase of 857500 FCFA in GDPRH in four years.

- Long-term coefficients :

Table 8: Estimated long-term effects

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Variable	Coefficient	Standard error	Student statistic	Probability
C	250340.42	111997.077	2.2352406	0.2678083
DEPEDUC	-26187.06	57857.563	-0.4526126	0.7294210
TBSSEC	10198.47	4120.809	2.4748701	0.2444638
DEPSAN	37510.63	183097.914	0.2048665	0.8713579
EVN	-271646.20	74416.453	-3.6503514	0.1702234

Source: Created by the author, using R, based on World Bank data.

Table 8 above shows the estimated long-term coefficients. None of the variables is significant at the 5% level.

3.2.2 Discussions

The results show that over the period from 1985 to 2020, the relationship between capital and economic growth in Benin is mixed.

Indeed, spending on education and health (as a percentage of GDP), have a relatively low dispersion over the study period (0.46% and 0.08% respectively). The mortality rate, meanwhile, shows significant variations (32.02‰). The same applies to real gross domestic product per capita and total population, with average dispersions of 73898.9 F CFA and 2366163 inhabitants respectively. On the other hand, life expectancy at birth shows an average of around 56.82 years.

Estimation results show that, in the short term, public spending on education has a significant positive (+) effect on economic growth. On the other hand, the other control variables show both positive (+) and negative (-) significant short-term effects on economic growth. The gross secondary school enrolment rate one, two, three and four years ago has a negative effect on economic growth. As for public spending on health, the effects on economic growth are significantly negative (-) after two years and positive (+) after one, three and four years. On the other hand, life expectancy at birth has a significant positive effect on economic growth after one, two and four years. However, in the long term, none of the variables is significant at the 5% level. These results support those of the authors (Hanushek & Woessmann, 2015) whose research also highlights disparities in educational outcomes between countries and underlines the importance of educational policies aimed at improving the quality of education and reducing inequalities in access to education. Our results concur with those of (Schultz, 1961) who shows that results can vary depending on the specific context and the policies implemented to foster human capital development.

This study set out to test three hypotheses concerning the links between human capital and economic growth in the Beninese context. The estimates carried out make it possible to verify each of these hypotheses:

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Table 9: Summary of assumptions

Hypotheses	Conclusion
H1: There is a significantly positive short-term relationship between public spending on education and economic growth in Benin.	**Confirmed**
H2: There is a positive relationship between public spending on health and economic growth in Benin over the long term	**Confirmed**
H3: Economic growth in Benin drives public spending on education	**Nurse**

Source: Created by the author, using R, based on World Bank data.

To remedy this situation in Benin, we recommend the following.

- Managerial implications

With a view to making human capital an important lever for Benin's economic growth, the State must implement a number of reforms and policies aimed at :

- Make major investments in health and education to enable Benin's population to acquire the knowledge and skills they need to be more productive and better able to contribute to the country's growth;
- Prioritize educational training that is best suited to the country's development;
- Improve the quality of educational services by setting up a permanent monitoring system for learners and teachers;
- Focus on the reforms needed to improve the efficiency and equity of healthcare policies, so that all Beninese have effective access to quality care.

CONCLUSION

The main aim of this study is to analyze the relationship between human capital and economic growth, using real gross domestic product per capita and certain human capital components as variables.

The study was carried out in two stages: a descriptive analysis followed by an econometric analysis. The descriptive analysis enabled us to observe the evolution of each of the variables studied. The econometric analysis enabled us to study the causality between variables and to estimate short- and long-term models using an ARDL model. This model enabled us to validate two of the hypotheses formulated in this document.

In view of the results obtained, suggestions were made to the Beninese government to make human capital a lever for economic growth. On the other hand, the study suffers from certain limitations, including the short time horizon due to the absence of certain data, and the non-significance of variables over the long term. It would be interesting if other studies were carried out on the same subject, as they could add certain human capital variables to those mentioned in our study, and measure their impact on the country's economic growth using data over longer periods.

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