

Macroeconomic impact of education on well-being as measured by real gross domestic product in Senegal between 1988 and 2019

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Abstract: The aim of the paper is to analyse the macroeconomic impact of education on well-being as measured by real gross domestic product in Senegal between 1988 and 2019. The exogenous variables selected are : general secondary education, vocational secondary education, education expenditure, health expenditure and life expectancy at birth. The data are taken from the WDI. A basic Solow augmented human capital model was adopted based on the work of Gebrehiwot 2014. Using Eviews software, the results obtained through the staggered lag autoregressive method (ARDL) showed that general secondary education has a positive impact on economic welfare in both the short and long run, while vocational secondary education has a positive impact in the short run but a negative impact in the long run. Expenditure on education and life expectancy at birth have a positive impact in the short and long run while expenditure on health has a negative impact in the short and long run. The Pesaran et al (2001) cointegration test confirms the existence of a long term relationship between the different series.

Keywords: Secondary level general sector, Secondary level professional education, GDP, ARDL.

INTRODUCTION

Economic theories generally share the idea that there is a positive relationship between education and economic growth. These include the classical theory of Ricardo, the human capital theory of Schultz & Becker and the endogenous growth theory of Lucas, Romer & Aghion and Howitt.

In this paper, we refer to endogenous growth theories, as Lucas' 1988 model of human capital accumulation is one of the most important contributions to the link between education and economic growth. He distinguishes two sectors: the production sector (physical capital and part of human capital) and the training sector (human capital formation). According to him, the level of production necessarily depends on the level of education, and the rate of increase in this production will follow the rate of increase in the stock of human capital. He concludes that economic growth can only be sustainable if human capital can develop without limit.

Understood in this paper in terms of overall production, well-being is defined as a sustained increase over one or more long periods in gross domestic product (GDP) in real terms. It is the macroeconomic variable most widely used by economists to measure and compare how economies are performing from one year to the next, and from one country to the next. Like income and consumption, gross domestic product (GDP) is one of the indicators usually used to quantitatively measure a country's well-being.

In Senegal, as in all other countries, education is a universal right, structured around five levels: pre-school, primary, middle-secondary, general secondary and higher education. Senegal is well aware of the economic and social benefits of education. As such, it is committed, like the international community, to universal access to education for its young population. The government's commitment to the education sector is reflected in the PAQUET-EF (2013-2025) "Programme d'Amélioration de la Qualité, de l'Ethique et de la Transparence du secteur de l'Education et de la Formation", whose fundamental objective is to improve access to and quality of education for all. The end of PAQUET's first phase coincided with the year of adoption of the 2030 agenda of Sustainable Development Goals (SDGs), one of which is SDG4 on education.

In view of this desire to promote well-being through education, we decided to analyze the macroeconomic impact of education on well-being in Senegal, based on the hypothesis that both general-sector secondary education and vocational secondary education contribute positively and significantly to Senegal's GDP in the short and long term. This places our research in the context of development in general and analysis of the impact of education on well-being (GDP) in particular. However, as soon as we talk about well-being through a service such as education, we find ourselves in MDG N°4 "access to quality education" of the 2030 horizon and in axis 2 of the PES "promotion of human capital, social protection and sustainable development". Thus, to differentiate from the work

of Diagne, 2007 and Sow, 2013, the level of general secondary education composed of general education and vocational training is retained as the variable of interest. Through estimation of the model using the staggered lag autoregressive method (ARDL), the impact of education on well-being (GDPr) in Senegal in the short and long term was assessed, along with the degrees of significance.

- **Problem**

Senegal is marked by a low level of development in terms of the quality and quantity of its human capital, as well as a training system that makes it difficult to achieve a competitive GDP growth rate in relation to developed countries. However, one of the major functions of well-being is to satisfy the needs of the population, which is not the case to date due to the difficulties frequently encountered in the education sector, the increase in poverty and the unequal distribution of national wealth, which continues to widen. Despite these limitations, it has been possible to carry out a macroeconomic analysis of the impact of education on Senegal's real gross domestic product. The findings show that the level of education is perfectly correlated with a country's overall production level. In other words, the higher a country's level of education, the higher its level of real gross domestic product, and vice versa. This is especially true in all countries, where the rate of output growth increases with the level of education attained by individuals.

The efforts being made on the education system in general are motivating Senegal to identify a level of education that promotes rapid growth in production, and to refocus its priorities on this. This is not just a question of catching up, but also, and above all, of using education as a catalyst for economic and social development, for a number of reasons: firstly, because education liberates the individual by improving his or her level of knowledge and increasing productivity, income and that of the national economy; secondly, because it is a means of reducing the level of poverty in a developing society and enables high rates of economic growth to be achieved, particularly in terms of well-being, as is the case in South-East Asian countries; thirdly, because it enables gaps to be reduced, technological deficits to be bridged and growth to be promoted through the knowledge economy, thanks to the development of human capital.

The aim of this paper is to analyze the macroeconomic impact of education on well-being in Senegal, as measured by real gross domestic product (rGDP). In other words, to show how secondary education through general and vocational education impacts well-being in Senegal between 1988 and 2019. To achieve this, it is important to answer the following question: what is the impact of secondary education on Senegal's gross domestic product? In addition to the introduction and conclusion, we have retained three (3) sections : the first reviews the literature, the second sets out the methodology adopted, and the third presents the results and interpretations. The aim of this paper is to analyze the macroeconomic impact of education on well-being in Senegal, as measured by real gross domestic product (rGDP). In other words, to show how secondary education through general and vocational education impacts well-being in Senegal between 1988 and 2019. To achieve this, it is important to answer the following question : what is the impact of secondary education on Senegal's gross domestic product? In addition to the introduction and conclusion, we have retained three (3) sections : the first reviews the literature, the second sets out the methodology adopted, and the third presents the results and interpretations.

LITERATURE

Knowing the macroeconomic impact of education on well-being enables us to appreciate and understand how education contributes to the growth rate of production.

- **The relationship between education and economic growth**

Ahmed, 2017 draws on endogenous growth theory, namely the theoretical contributions of Lucas, 1988 and Romer, 1990, to provide insight into the contribution of human capital to economic growth. He also draws on specifications from production functions to determine the impact of human capital on growth. Next, he draws our attention to the fact that human capital viewed from a "learning by doing" perspective refers to the years spent by individuals within educational institutions. He adds that human capital is akin to learning, and its influence in the form of externality also calls on a much broader concept, involving the ability of individuals to adopt new technologies. Finally, echoing Pritchett, 1996, the author took an even more radical stance, arguing that enrolment rates do not correspond to any economic reality and do not constitute flows, since the link between the number of years of education of the population and the percentage of the school-age population actually enrolled in school is not direct. Here, he wanted to show us that there is no consensus on how to measure the stock of human capital : some consider the enrolment rate to be a sufficient indicator, while others propose the number of years of schooling as an alternative. The former see human capital as a third factor in the production function, on a par with physical capital and labor (Mankiw, Romer and Weil). The latter see it as a potential engine of growth, and in this sense a vector for new technologies.

Bellakhdhar, 2019 formulates a theoretical model on the education/growth relationship that integrates both the quality and quantity dimensions of human capital joining Elbousairi et al, 2019. Then, to determine the evolution of school performance on the overall effect of return on investment in human capital, he first took the qualitative dimension through the financial resources committed by public authorities and the quantity dimension (average number of years of education). Finally, he added that to better understand the mechanisms governing the link between education, knowledge accumulation and economic growth in general, it is essential to know at what level correction by the education quality index can improve the significance of the coefficient associated with the average number of years of study. Here, the author has stressed that the qualitative dimension of education is very important for the rate of school performance. More recently, **Issolah et al**, 2020, referring to the human capital theory of Schultz, 1961 and Becker, 1964, inspired by the early theories of Adam Smith, Barro, Mankiw, & Sala-i-martin, consider human capital as the central variable explaining a country's macroeconomic evolution. The pioneering work of Solow (1956), Romer (1989), Barro (1991) and Benhabib & Spigel (1994) highlights the key role played by human capital in the various theories of economic growth and development. Indeed, they show that the fundamental idea is how education and health can be a founding element of economic growth and development in a country with a low level of development. Here, the authors have shown us the need for massive investment in both sectors to overcome the challenges of economic growth.

- **Real gross domestic product, a measure of well-being**

Gebrehiwot, 2015 seeks to investigate over the period 1974 to 2011 the long- and short-term impact of human capital on economic growth using real GDP per capita as an indicator of economic growth. Drawing on Solow's augmented human capital model based on endogenous growth theories: an improvement in human capital (skilled and healthy workers) improves productivity, it used gross fixed capital formation, total labor force, secondary school enrollment, health spending, total government spending and official development assistance as exogenous variables. The results obtained using the ARDL method show that, in the long term, educational human capital and human capital in the form of health contribute to the rise in real GDP. In the short term, education is the main contributor to the variation in real GDP, followed by gross capital formation (lagged one period) and public expenditure (lagged one period). But, unlike its significant long-term impact, health has no significant short-term impact, even its one-period lag having a significant negative impact on the economy.

Ben Samoud et al, 2020 studying the impact of human capital on economic growth between 1990 and 2019, refer to the work of Gebrehiwot, 2015 in Ethiopia; Adeyemi & Ogunsola, 2016 and Toyosi, 2020 in Nigeria. They retained gross domestic product per capita (GDP/h) as the endogenous variable and human resources in elementary school, elementary school completion, secondary school enrolment and tertiary school enrolment as the variables of interest. The empirical results, obtained through the application of a staggered lag autoregressive model (ARDL), highlight the decisive role and positive effect of human capital on economic growth in Morocco, in both the long and short term.

Issolah et al, 2020, wishing to study the impact of human capital development on economic growth between 1986 and 2017, refer to the work of Doudjidingao, 2009 and Boccanfuso et al, 2009. They use gross domestic product per capita (GDP/h) as an endogenous variable, and gross primary and secondary school enrolment ratios and education and health spending as exogenous variables. The results, obtained by estimating an ARDL model, confirm the existence of a positive relationship between primary and secondary school enrolment rates and economic growth, on the one hand, and the negative effect of health spending on economic growth, on the other.

RESEARCH METHODOLOGY

- **Theoretical framework of the model**

Our approach is identical to that used by Gebrehiwot, 2015 in his research on "the impact of human capital development on

The basic dynamic model can be written as :

$$Y_t = \varphi + a_1 Y_{t-1} + \dots + a_p Y_{t-p} + b_0 X_t + \dots + b_q X_{t-q} + e_t$$

Ou

$$Y_t = \varphi \sum_{i=1}^p a_i Y_{t-i} + \sum_{j=0}^q b_j X_{t-j} + e_t \quad (3)$$

economic growth in Ethiopia". The theoretical framework adopted is the basic Solow model augmented by human capital. Mankiw, Romer and Weil, 1992 introduced and modeled the human capital variable as a determinant of output, using a Cobb-Douglas constant returns specification for economic growth. Its general form is given by the following expression :

$$Y = K^\alpha H^\beta (AL)^{1-\alpha-\beta} \quad (1)$$

Where: Y represents production; K the stock of physical capital, H the stock of human capital, A the total productivity factor and L the labor factor.

The linear logarithm model of endogenous growth can be written as follows:

$$\ln Y = \alpha \ln K + \beta \ln H + (1 - \alpha - \beta) \ln (AL) + \epsilon \quad (2)$$

Where: α , β and $(1-\alpha-\beta)$ the respective shares of K, H, AL and ϵ the error term.

Data are annual and of a macroeconomic nature covering the period from : 1988 à 2019. The lack of data for some variables has been supplemented by averaging the five previous or earlier years.

Model specification

Relying on the article by Toure, 2020, in which he reaffirms the statements of Vandebussche et al, 2006 and McNeil and Silim, 2012, who showed that "the secondary level is more appropriate for intermediate countries", the educational human capital variable chosen here to capture education in Senegal is thus based on the secondary level. To differentiate ourselves from the work of Diagne, 2007 and Sow, 2013, our research is specified firstly through the secondary level variables chosen (general sector secondary education and vocational filial secondary education) and secondly, by the estimation method (ARDL) chosen. As a dynamic model, the staggered lag autoregressive model can help capture the short-term dynamics and long-term effects of one or more independent variables on a dependent variable. Unlike the simple model, it has the particularity of taking into account temporal dynamics (adjustment lag, and expectations) in the explanation of a variable (time series), thus improving forecasts and the effectiveness of policies (decisions, actions etc...). The research question addressed was to see how enrolment in general secondary education (ESESG), enrolment in secondary vocational education (ESEFP), education expenditure (Depedu), health expenditure (Depsante) and life expectancy at birth (EVN) impact on Senegal's real gross domestic product between 1988 and 2019 ?

The final model integrating our variables can then be written as follows:

$$\Delta \ln PIBr = a_0 + \sum_{i=1}^p a_{1i} \Delta \ln PIBr_{t-i} + \sum_{i=0}^q a_{2i} \Delta \ln ESesg_{t-i} + \sum_{i=0}^q a_{3i} \Delta \ln ESefp_{t-i} + \sum_{i=0}^q a_{4i} \Delta Depedu_{t-i} + \sum_{i=0}^q a_{5i} \Delta Depsante_{t-i} + \sum_{i=0}^q a_{6i} \Delta EVN_{t-i} + b_1 PIBr_{t-1} + b_2 ESesg_{t-1} + b_3 ESefp_{t-1} + b_4 Depedu_{t-1} + b_5 Depsante_{t-1} + b_6 EVN_{t-1} + e_t \quad (4)$$

Avec : Δ opérateur de différence première ; a_0 constante ; $a_1 \dots a_6$ les dynamiques de court terme ; $b_1 \dots b_6$ les effets à long terme et e le terme d'erreur.

With : Δ first difference operator ; a_0 constant ; $a_1 \dots a_6$ short-term dynamics ; ; $b_1 \dots b_6$ long-term effects and e the error term.

RESULTS AND INTERPRETATIONS

- Series stationarity test

To check the stationarity of the variables selected, we used the Dickey Fuller augmented test and the Andrews and Zivot test, in order to highlight the degrees of integration. The table below summarizes the different levels of stationarity for these series

Table 2.2.2 : Résultats series stationarity tests

Variables	Level			Difference 1 st			Observation
	ADF	AZ	Date of terminaison /AZ	ADF	AZ	Date of terminaison /AZ	
Lpibr	-2.82 (0.20)	-3.84 (0.62)	2016	-5.63* (0.0004)	-7.33* (0.01)	2015	I (1)
Lesesg	-3.55* (0.05)	-3.17 (0.93)	2017	-	-6.77* (0.01)	2013	I (1)
Lesefp	-1.75 (0.70)	-6.20* (0.01)	2008	-4.57* (0.005)	-7.98* (0.01)	2007	I (1)
Depedu	-2.47 (0.33)	-4.26 (0.35)	2008	-5.84 (0.0002)	-8.03* (0.01)	2016	I (1)
Depsante	-1.80 (0.67)	-4.74 (0.14)	2004	-7.13* (0.000)	-9.07* (0.01)	2010	I (1)
EvN	-6.10* (0.0001)	-7.29* (0.01)	2016	-	-	-	I (0)

Source : author based on Eviews results

(...) : Probability ; * : stationary

The results of the Augmented Dickey Fuller (ADF) and Andrews and Zivot (AZ) tests show that on the whole the series are integrated at different orders, rendering the earlier cointegration tests ineffective and the bounds cointegration test of Pesaran et al, 2001 timely.

- Pesaran et al. cointegration test (2001)

To test for cointegration between series, the Pesaran et al cointegration test follows two steps:

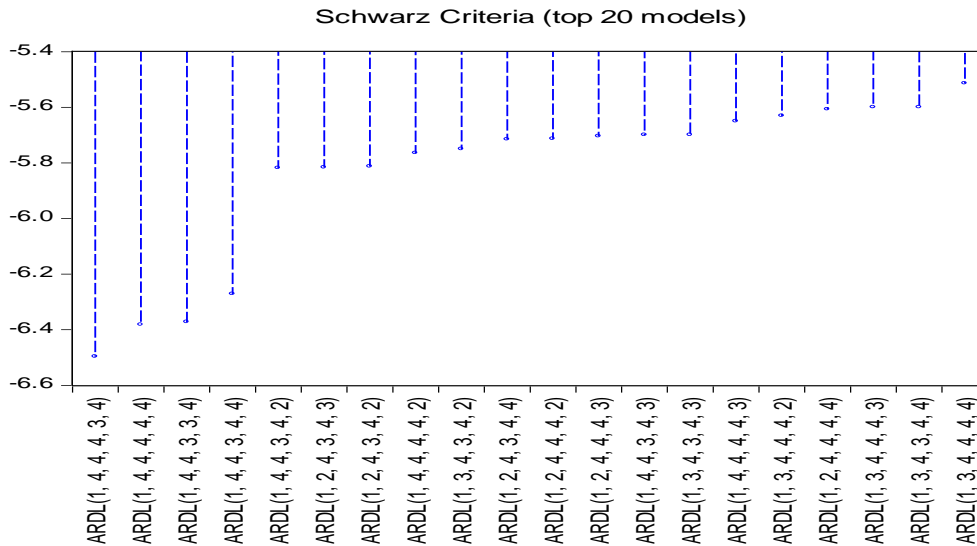
- determining the optimal lag (SIC) ;

- and the Fisher test.

• Determining the optimum offset

The Schwarz Information Criterion (SIC) is used to select the most optimal ARDL model. In other words, the one that offers the most statistically significant results. The following graph shows how to select this model.

Graph 2.2.2 : SIC graphic values



Source : author based on Eviews results

As the graph above shows, the ARDL (1,4,4,4,3,4) model is the most optimal of the twenty (20) represented, as it offers the smallest SIC value.

• **Test of Fisher**

The calculated test statistic (Fisher's F value) will be compared with the critical values that form the bounds. The table below shows the results obtained.

Table3.2.2 : Results of the cointegration test at the bounds of Pesaran et al, (2001)

Critical Value Bounds					
1% level		5% level		10% level	
I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
3.41	4.68	2.62	3.79	2.26	3.35
F-statistic calculé (F) = 56.715					

Source : author based on Eviews results

The results of the bounds test show that the Fisher statistic (F=56.715) is above the upper limit of the various significance levels (1%; 5%; 10%). We therefore reject the H0 hypothesis (of no long-term relationship) and confirm the existence of a long-term relationship between the different series.

- **ARDL model estimation**

Following the automatic procedure on Eviews, the cointegration test of Pesaran et al, 2001 requires the ARDL model to be estimated first. We therefore began by estimating the model, and then proceeded to the boundary cointegration test. The following table shows the estimation results.

Table 4.2.2 : Model ARDL (1, 4, 4, 4, 3, 4)

Dependent Variable : LPIBR				
Variable	Coefficient	Ecart-type	t-Statistic	Prob.
LPIBR (-1)	0.223403	0.063414	3.522907	0.0720
LESESG	0.442124	0.054359	8.133452	0.0148
LESESG (-1)	-1.049327	0.038409	-27.32003	0.0013
LESESG (-2)	1.261379	0.038831	32.48422	0.0009
LESESG (-3)	0.157768	0.023180	6.806345	0.0209
LESESG (-4)	-0.503749	0.056928	-8.848957	0.0125
LESEFP	0.019065	0.007712	2.472289	0.1320

LESEFP (-1)	-0.042880	0.005176	-8.284372	0.0143
LESEFP (-2)	-0.244908	0.005181	-47.26621	0.0004
LESEFP (-3)	0.095733	0.006412	14.93078	0.0045
LESEFP (-4)	-0.181698	0.010874	-16.70900	0.0036
DEPEDU	0.094914	0.005436	17.45896	0.0033
DEPEDU (-1)	0.202291	0.006182	32.72054	0.0009
DEPEDU (-2)	0.054482	0.005268	10.34193	0.0092
DEPEDU (-3)	0.148067	0.013036	11.35797	0.0077
DEPEDU (-4)	-0.013855	0.004984	-2.779635	0.1087
DEPSANTE	-0.041110	0.001692	-24.29603	0.0017
DEPSANTE (-1)	0.011114	0.000555	20.02746	0.0025
DEPSANTE (-2)	0.006637	0.000630	10.53760	0.0089
DEPSANTE (-3)	-0.055846	0.001682	-33.19889	0.0009
EVN	1.72E-06	5.99E-08	28.72578	0.0012
EVN (-1)	2.04E-06	4.38E-08	46.51520	0.0005
EVN (-2)	1.71E-06	1.31E-07	13.07338	0.0058
EVN (-3)	-1.23E-06	1.85E-07	-6.628099	0.0220
EVN (-4)	-1.05E-06	1.28E-07	-8.221209	0.0145
C	6.364541	0.380290	16.73604	0.0036
R-carrée	0.999960	F-statistic	1988.535	
R-carrée ajusté	0.999457	Prob (F-statistic)	0.000503	
		Durbin-Watson stat	3.114619	

Source : author based on Eviews results

With regard to the tests that help diagnose the estimated model, we note the absence of autocorrelation of errors, there is no heteroscedasticity, there is normality of errors and the model is well specified.

Table 5.2.2 : Estimated ARDL model diagnostic test results

Hypothèse du test	Tests	Valeurs	Probabilités
Autocorrélation	Breusch-Godfrey	3.37	prob (0.317)
Hétéroscédasticité	Breusch-Pagan-Godfrey	0.32	prob (0.934)
	Arch-test	0.48	prob (0.494)
Normalité	Jarque-Bera	1.52	prob (0.46)
Spécification	Ramsey (Fisher)	1.03	prob (0.494)

Source : author based on Eviews results

The probabilities are greater than 5%, so the null hypothesis is accepted for all these tests. Our model is thus statistically validated. The estimated ARDL (1,4,4,4,3,4) model is good overall, explaining 99% of welfare dynamics in Senegal between 1988 and 2019.

- **Short-term dynamics and long-term coefficient**

• **Short-term dynamics (ST)**

The estimated short-term dynamics are shown in the following table :

Table 6.2.2 : Estimated CT dynamics results (ECM)

Dependent Variable : LPIBR			
Variable	Coefficient	t-Statistic	Prob.
D(LESESG)	0.442124	8.133452	0.0148
D (LESESG (-1))	-1.261379	-32.484217	0.0009
D (LESESG (-2))	-0.157768	-6.806345	0.0209
D (LESESG (-3))	0.503749	8.848957	0.0125
D(LESEFP)	0.019065	2.472289	0.1320
D (LESEFP (-1))	0.244908	47.266210	0.0004
D (LESEFP (-2))	-0.095733	-14.930777	0.0045
D (LESEFP (-3))	0.181698	16.708998	0.0036
D(DEPEDU)	0.094914	17.458965	0.0033
D (DEPEDU (-1))	-0.054482	-10.341931	0.0092
D (DEPEDU (-2))	-0.148067	-11.357966	0.0077
D (DEPEDU (-3))	0.013855	2.779635	0.1087
D(DEPSANTE)	-0.041110	-24.296025	0.0017
D (DEPSANTE (-1))	-0.006637	-10.537603	0.0089
D (DEPSANTE (-2))	0.055846	33.198894	0.0009
D(EVN)	0.000002	28.725777	0.0012
D (EVN (-1))	-0.000002	-13.073375	0.0058
D (EVN (-2))	0.000001	6.628099	0.0220
D (EVN (-3))	0.000001	8.221209	0.0145
CointEq (-1)	-0.776597	-12.246405	0.0066

Source : author based on Eviews results

The table shows that the adjustment coefficient (recall force) is statistically negative (-0.77) and significant (0.006) at the 5% threshold. This confirms the existence of a long-term relationship between the variables. This coefficient, with a value of 0.776597, represents the speed at which the imbalance is reabsorbed. Thus, a one-year shock to Senegal's real gross domestic product is fully reabsorbed after 1 year, 3 months and 10 days.

The results show that secondary education in the general sector (ESESG) and secondary education in the vocational sector (ESEFP) each exert positive effects on economic well-being in the short term. A 1% increase in the number of students in the general sector accelerates growth by 0.44%, while a similar increase in the number of students in the vocational sector boosts growth by 0.019%.

The results also show that these effects reverse over time. Thus, the ESESG delayed by one (1) to two (2) years is a brake on well-being, whereas it becomes a gas pedal, having a positive and significant impact in the third (3) year of delay. However, we observe increasing effects, from a coefficient of 0.44 to 0.50 after a delay of three (3) years.

On the other hand, the ESEFP delayed by one (1) year is a gas pedal for well-being in Senegal, delayed by two (2) years it becomes a brake, and in the third (3) year of delay it becomes a gas pedal again. However, we note increasing effects, from a coefficient of 0.01 to 0.18 after a delay of three (3) years.

However, the temporal dimension is important not to ignore, as over time the effects of the variables are mixed. Unlike the Depedu and EVN variables, a lag of at least two (2) years is required to expect to see the positive impact of health spending (Depsante) on economic well-being in Senegal in the short term.

- **Long-term coefficients (LT)**

The estimated long-term coefficients are shown in the following table :

Table 7.2.2 : LT coefficient estimation results

Dependent Variable : LPIBR			
Variable	Coefficient	t-Statistic	Prob.
LESESG	0.396852	20.204837	0.0024
LESEFP	-0.456721	-24.745545	0.0016
DEPEDU	0.625677	15.126940	0.0043
DEPSANTE	-0.101990	-11.780595	0.0071
EVN	0.000004	11.329100	0.0077
C	8.195420	23.690995	0.0018

Source : author based on Eviews results

As in the short term, the effect of the ESESG on long-term well-being is positive, but that of the ESEFP is negative. Thus, a 1% increase in the number of employees in the general sector increases output by 0.39%, while a 1% increase in the number of employees in the vocational sector decreases it by 0.45%. Similarly, the control variables showed positive long-term effects, except for the "Depsante" variable, which was always negative.

- Discussion of results

• **Short-term dynamics**

Apart from the constant, which is significant, the results show that general secondary education, vocational secondary education, public spending on education and life expectancy at birth had a positive impact on well-being in Senegal between 1988 and 2019. Current spending on health, on the other hand, had a negative impact. The two variables of interest selected to show the impact of education on well-being in Senegal show positive effects in the short term and are discussed as follows:

In the case of the ESESG, when enrolments increase by 1%, Senegal's economic well-being increases by 0.44%. This is because an increase in enrolment in the general secondary sector has a positive influence on educational human capital, thereby increasing the gross enrolment rate and the number of years of study that are effective in measuring economic growth. The finding shows that increasing enrolment in the short term can have a positive impact on economic well-being in Senegal. Our result is in line with human capital theory and is confirmed by the work of Barrett and O'Connell, 2001 ; d'Almeida and Carneiro, 2006, all of whom have shown that general education has a positive effect on growth.

In the case of the ESEFP, it can be seen that when enrolment rises by 1%, Senegal's real gross domestic product increases by 0.019%. This low contribution can be explained by the low level of enrolment in the vocational training sector. In fact, vocational training could be a real lever for strengthening economic growth in Senegal, especially in this period of crisis (COVID-19), when the situation shows that people with vocational training are the most active. Our findings show that increasing the workforce in the short term can have a positive impact on Senegal's economic well-being. Our result is in line with human capital theory and is confirmed by the work of Berger, 2017 where he shows that a 1% growth in the rate of access to vocational training increases productivity by 0.66%.

The fact that returns from the general sector are higher than those from vocational training is, on the one hand, justified by the work of Houssein, 2013 in Djibouti, where he shows profitability by education cycle, finding that general secondary education contributes 11% and vocational education 0.07%. On the other hand, in international comparative studies, Psacharopoulos, 1994 compares the returns from vocational training with those from general education. The results seem to indicate that the returns to general education are higher than those to vocational training (15.5% per additional year of education versus 11.7%). In the same vein, the results of Blundell et al, 2003 indicate that general training generates higher returns than vocational training.

• **Long-term dynamics**

In terms of long-term estimation, the results show that general secondary education, public spending on education and life expectancy at birth have a positive impact on well-being in Senegal. On the other hand, secondary vocational education and health spending have a negative impact on well-being. The results are discussed as follows:

In the case of ESESG, we note that when enrolments increase by 1%, Senegal's economic well-being rises by 0.39%. There is therefore a positive correlation between general secondary education and GDP_r in Senegal. This positive impact, also confirmed in CT, can be explained on the one hand by the presence of a greater number of general secondary schools in the distribution of educational structures. On the other hand, the greater number of students enrolled in this sector leads to a greater number of graduates, thus reinforcing the stock of available human capital. This positive impact of general secondary education on GDP_r is justified by recruitment policies that favor graduates from this sector in terms of obtaining employment and a better career, to the detriment of graduates from other sectors. This result, in line with welfare theory, is confirmed by Buechtemann et al, 1995, who show that employers prefer graduates from the general sector when recruiting. This explains why, as in other countries, more and more British young people are entering general education rather than vocational training. This is also the case in Senegal, where the integration rate for graduates from the general sector is higher than for those from other sectors.

In the case of ESEFP, we note that when enrolments increase by 1%, real gross domestic product falls by 0.45%. There is therefore a negative correlation between secondary vocational education and

economic well-being in Senegal. This situation can be explained by two phenomena: firstly, the poor structuring of the labor market, in this case a segmented labor market with a low insertion rate and virtually non-existent job opportunities for graduates of this sector, could be a brake on LT's growth. Secondly, the ever-increasing unemployment rate, which has a greater impact on the professional sector with few recruitment outlets, could also act as a brake on LT. Graduates of this system have minimal opportunities to find a suitable job, enjoy adequate remuneration and hope for a good career. That's why most of them make more use of financing to start their own business, and those who don't benefit from it will remain unemployed, which reduces and/or makes negative the share of their contribution over time. Our result is in line with labour market segmentation theory, but is contradicted by those of Hanhart and Falter, 2006, who show that in a developing economy, vocational training is probably more appropriate than general training, as it avoids problems of overqualification or mismatch between employment and training.

Overall, our results also showed a positive impact of education spending (Depedu) on rGDP in Senegal in both the short (0.09) and long term (0.62). An increase in public spending on education encourages the population to enter and continue their studies. This reduces drop-out and repetition rates, and improves success. The direct effect is a faster increase in the supply of skilled labor, compared to the supply of unskilled labor. Our result is in line with that of Coulibaly, 2013 where he shows that education spending significantly has a positive impact on economic growth in Côte d'Ivoire and with those of Hanushek and Kimko, 2000, Baldacci et al, 2005 and Diallo, 2007 on which they find that education and the spending allocated to it generally improves the rate of economic growth.

Health expenditure (Depsante) has a negative impact on Senegal's rGDP in both the short (-0.04) and long term (-0.10). Well-being (GDPr) generally contributes to improving living conditions in society (healthy, balanced diet, better health, hygiene, safety, self-fulfilment, etc.). If a population doesn't fall ill often because their standard of living is influenced by the country's level of economic well-being, this implies that they spend less on healthcare. Our result is supported by those of Issolah et al, 2020, in which they show the negative effect of health spending on economic growth. In the same vein, Bouziane et al, 2018 show that health spending has negative impacts on growth due to inefficiency, corruption and under-investment. This result is contradicted by those of Vettori et al, 2011 where they show that health spending has rather positive effects on economic growth.

Life expectancy at birth (LEB) has an almost identical positive impact on rGDP in the short (0.000002) and long term (0.000004). This result is not surprising, as its positive sign, albeit significant at 5%, is in line with our expectations. Thus, a longer life expectancy constitutes an incentive to invest more in the education sector, whose returns are mechanically higher. The direct effect is an increase in enrolment rates for further education, which guarantees a better future with higher incomes and lower unemployment. Our results are in line with those of Dudjo et al, 2020 in Cameroon, where they show that a one-unit increase in life expectancy also leads to an increase in economic growth.

CONCLUSION

The aim of this paper is to analyze the macroeconomic impact of education on well-being in Senegal between 1988 and 2019. This is a sector that contributes to the production of human capital corresponding to the needs of the labor market in terms of quantity and quality to improve well-being. In economics, the word "well-being" is closely associated with the expression "welfare economics", which measures the satisfaction of an individual or a community. Its theory studies the conditions under which the state should intervene, looking for ways to achieve situations considered to be the best possible. Understanding well-being in terms of real gross domestic product (rGDP) does not seek to replace more traditional forms of assessing the level of well-being, but rather offers a complementary form of assessment, focusing on general and vocational secondary education and the advantages they offer Senegal in terms of improving its economic well-being.

To achieve this, we began by defining the concepts around the notion of well-being and education. We then turned our attention to analyzing the theoretical link between education and economic growth. Finally, we carried out a selective review of the literature. The main conclusions drawn from the theoretical review underline the fact that it is now impossible to speak of a country's economic growth (well-being) without referring to the quality and quantity of its population's education. Most empirical studies confirm the existence of a positive relationship between education and economic growth. From this review, we decided to adopt an endogenous growth model. Our research on the macroeconomic impact of education on well-being in Senegal is based on the work of Gebrehiwot, 2015, in which he retained real gross domestic product as the dependent variable, gross fixed capital formation, the total working population, secondary school enrolment, health spending, total government spending and official development assistance as exogenous variables. In order to distinguish ourselves from earlier work by Diagne and Sow, which used gross enrolment rates or years of schooling as proxies for education, our research is distinguished by the stratification of secondary education into two groups: general secondary education pupils (EESG) and vocational secondary education pupils (ESEFP), and by the ARDL staggered lag autoregressive method used.

The results show that both general secondary education (0.44) and vocational secondary education (0.019) have a positive impact on Senegal's rGDP in the short term. In the long term, the impact of EESG remains positive (0.39), but that of ESEFP is negative (-0.45). The initial hypothesis, i.e.: "both general and vocational secondary education contribute positively and significantly to GDPr in Senegal in the short and long term", is only verified for general secondary education.

Far from claiming to provide all the solutions for analyzing the impact of education on well-being in Senegal, this research aims more modestly to show the impact of secondary education on real gross domestic product, and then to identify which of the two components (EESG, ESEFP) is the most profitable sector in which the State should focus its priorities.

Despite the efforts made across the board on the education system, we recommend that the Senegalese state increase spending on secondary education, and on all levels without privilege, because as we know, the education system is a bottom-up process, and any level neglected will have repercussions on the next level. However,

a significant proportion of this expenditure should be distributed equitably to correct inter-regional disparities in terms of the number of structures, facilitate access to early enrolment for vulnerable populations, and reinforce the promotion of general secondary education by increasing enrolment and raising awareness of the ease of access to employment and better careers. To achieve this, the State, development structures and organizations must, in addition to programs to improve the education system, define and map out real routes to ensure that every Senegalese has access to quality general secondary education, and that it is maintained until graduation.

In short, the gross domestic product recognized as an important macroeconomic component in measuring economic well-being suffers from significant limitations. It incorporates the current production of consumer and investment goods and services represented in national public accounts, but leaves out activities such as the preservation of natural resources that contribute to future well-being through net contributions to society's equity. One perspective to this research would be to analyze the impact of higher education on the economic well-being of UEMOA countries.

References

1. Bernier, A. (2014). Possible effects of training on productivity: contribution of longitudinal data/Les effets possibles de la formation sur la productivite: l'apport de donnees longitudinales/Los efectos posibles de la formacion sobre la productividad: el aporte de los datos longitudinales. *Relations Industrielles/Industrial Relations*, 69(2), 366-388. <https://doi.org/10.7202/1025033ar>
2. BOUZIANE Mohammed, BENLAIB Boubakeur.2018. The impact of health on economic growth in Algeria: a model-based approach ARDL. [online]. *Journal of Applied Economics and Statistics*,
3. Mamadou, C. (2013). IMPACT DES DEPENSES PUBLIQUES D'EDUCATION SUR LACROISSANCE ECONOMIQUE EN CÔTE D'IVOIRE. *European Scientific Journal*, 9(25). <https://doi.org/10.19044/esj.2021.v17n38p160>
4. Diagne, A. (2007). Invest in human capital: education and health. *AFRICAN DEVELOPMENT REVIEW-REVUE AFRICAINE DE DEVELOPPEMENT*, 19(1), 163-199. <https://doi.org/10.1111/j.1467-8268.2007.00159.x>
5. DIALLO, Moussa A.2007. The Contribution of Education to Economic Growth : An analysis of the allocation of public resources in Mali's education system. *Thesis in Economics and Management*. Strasbourg: University Louis Pasteur, 313p
6. Gebrehiwo, K. G. (2016). The impact of human capital development on economic growth in Ethiopia: Evidence from ARDL approach to co-integration. *Bahir Dar journal of education*, 16(1). Available at <https://core.ac.uk/download/pdf/234647132.pdf>
7. HANHART Siegfried, FALTER Jean-M.2006. General and continuing vocational training and economic growth: The current state of the issue and proposed avenues for research in Switzerland. [online]. Available at https://nanopdf.com/download/formation-professionnelle-generale-et-continue-et-croissance_pdf
8. Hanushek, E. A., & Kimko, D. D. (2000). Schooling, labor-force quality, and the growth of nations. *American economic review*, 90(5), 1184-1208. <https://DOI: 10.1257/aer.90.5.1184>
9. HOUSSEIN Mahamoud.2013. *Concepts, Measures and Economic Values of Education: Issues and Debates*. [online]. Available at <https://ruor.uottawa.ca/bitstream/10393/41310/1/1307E.pdf>
10. SOW Abdramane.2013. Contribution of education to economic growth in Senegal. *Thèse Sciences Economiques*. Saint Louis: UGB, 408p.
11. TOURÉ Drissa.2020. Higher education, human capital and economic growth: A causal analysis approach. [online]. *European Scientific Journal*, n° 16, pp. 255-280. <https://doi.org/10.19044/esj.2020.v16n16p255>
12. VETTORI Anna, TRAGESER Judith, PETER Martin.2011. The economic effects of rising healthcare costs. [online]. *Economic Policy Review*, n°4, pp. 55-58. Available at https://dievolkswirtschaft.ch/content/uploads/legacy/posts/15F_Peter-1.pdf.