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Analyze of the impact of education spending on economic growth in Senegal from 1998 to 2017

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Abstract

The objective of this article is to analyze the impact of education spending on economic growth in Senegal from 1998 to 2017. This study was based on an econometric modeling that showed that spending on Education positively influences economic growth captured by Gross Domestic Product (GDP). In fact, the results of the regression revealed that the increase in public spending on education by 1% leads to a 3% increase in economic growth in Senegal for the period 1998-2017. Education spending has a positive impact on economic growth.

Key words: expenditure, regression, impact, economic growth, modeling

I. Introduction

Pioneers in the economics of education such as Mincer (1958), Schultz (1961) and Becker (1964) have recognized a link between education and growth. Their interrogation led to the emergence of the theory of human capital, which has long elicited deep reflection among economists. These authors have thus hypothesized that gains from human capital positively impact the process of economic growth (Sow, 2013). Becker (1964) considers human capital as investment in the same way as physical capital. According to Schultz (1961), education is the mechanism by which individuals' intellectual abilities act on the macroeconomic scale for economic growth (Sow, 2013). Becker joins this vision and his work has made a significant contribution to the development of human capital theory. An initial way of empirically verifying the link between growth and human capital is to consider it as the explanatory variable for the level of aggregate output. More formally, this approach is highlighted by Schultz et al. (1961) shows that just as the quantitative dimension of the work factor, the qualitative factor is also optimal for estimating the level of overall output. (Sow, 2013). All the empirical work done by Denison (1962), Schultz (1961) and Becker (1962) and Mincer's work proves that spending on education, vocational training and health contributes to quality improvement, manpower and boost productivity. (Sow, 2013)

Vandenbussche, Aghion and Meghir (2006) designed a model that has particularly shown the effect of innovation and imitation on the economic growth process. Indeed, with this model it is found that the more the country moves away from what is called the technology border, the higher the primary and secondary education on the major. This situation reflects that the growth process is more essentially based on imitation because primary and secondary education generates a stock of humans, less human qualified, that is, less with capacity to innovate. In addition, countries that are close to the technology border are those where higher education takes over on other sub-sectors of the educational device. This observation means that in these countries growth is conveyed by innovation because higher education provides a more qualified human capital potential.

The researches of these authors have highlighted two sources that can explain technical progress to know technological innovation and imitation. Because innovation requires more qualified work, a paramount importance should be granted to higher education. We would therefore talk about a quality higher education system. It should be noted that their model is declining a negative influence of unskilled work on growth when you are approaching the technology border. This trend corroborates the fact that the qualification deficit of the human capital stock is a blockage for the emergence of technological progress. This state of fact is often observed in developing countries. According to Savy (2006), this trend is expected to become involved in the relationship between education and technological progress, rather than limited to the simplistic framework for analysis of the economics of education. It is this new approach that Meulemeester (2007) calls for the knowledge economy. It is therefore important to reflect on educational mutations opportunities to focus on the research pane to promote economic development. This vision is developed by some research researchers such as Hanushek and Wossman (2007). The primacy of the quality of the education system including the above-mentioned higher sub-sector, to improve the level of economic growth has been highlighted after the main employee work. Indeed, Duarte and Sumoes (2001) by studying the impact of human capital on the economic growth of 8 Mediterranean riparian countries have shown the lack of effects of the explanatory variable (GDP per worker) on the explanatory variable (human capital) through a neoclassical endogenous growth model. The main factor they have raised to explain this result is the unclear in the quality of education in the human capital proxy (SAVYY, 2007). Similarly Pritchett (2001) using a model of Mankiw et al. (1992) Avail of the three reasons it raised to explain the lack of relationships between education and growth the non-integration of the quality factor in education in the human proxy of proper capital. Thus, it must be recalled that many differences are noted in the proxy used to capture human capital. Several proxy have been proposed (gross school enrollment, literacy rate) ... but the most usual remains the average number of years of study. Wossman (2007) advances that the latter is not optimal because it does not take into account the phenomenon of decreasing returns and the quality of the education system. In fact, to find a positive correlation between education and the growth process, the integration of the qualitative dimension of human capital in estimates is paramount.

Barro (2001) using an endogenous growth model on a sample of a hundred countries covering the period 1960-1995 has observed a positive relationship between human capital and economic growth. It justifies this result by taking into account the qualitative dimension of human capital. It must be recalled that the completion rate of the medium and superior is also a proxy used to assess human capital but its insufficiency lies in that it considers only the quantitative dimension of the latter. Altinok (2006) designed indicators on students' earnings to study correlation between growth and human capital. In his model, education is

considered an endogenous factor. After econometric estimate, it was found that education positively influences the growth process. He referred to international surveys on student achievements incorporating the qualitative and quantitative components of human capital. Creel and Poilon (2006) used a solo model of growth to study the impact of human capital and public investment on economic growth.
Indeed they made the regular education expenditure to capture human capital. In taking into account, the qualitative dimension of the latter, they found a positive correlation between education and growth. Thus in this context, the educational expenditure will be used to proxy to estimate human capital. Senegal is anxious to promote quality in the higher education sub-sector has since defined since 2013 in the higher education development program a set of reforms to improve the qualitative dimension of this sub-sector. It is in this wake that the ANAQ - SUP was created.

This organization is the control body of the delivery of universities. She ensures the accreditation of diplomas. The reforms undertaken by the State of Senegal to improve the quality of the teachings in the Superior summarize as follows:

- Strengthening the ability of libraries and documentation centers ;
- reach a student framework that meets international standards by increasing the recruitment of teachers - research • Strengthen the capacity of universities especially that of UCAD and promote better internal efficiency;
- Promote the development of professional training and popularizate the relationship university-company Operationalization of these different policies requires significant mobilization of financial resources. Of course, the path still remains to be bound by the fact that arbitration exists between budget allocations for education and those reserved for other sectors of the economic tissue.

In 2017, the need for funding for higher education was 196 billion FCFA as the budget envelope allocated to it was $ 179.23 billion, or a FCFA deficit (PDESR), award. Thus great efforts should still be provided to fully cover the financing needs of higher education. In addition, it is necessary to admit that the Senegalese education system benefited from many financial injections in recent years, but the impact of these expenditures on the economic development of the country in other terms on economic growth has not yet been empirically. However, many empirical works on the links between education and growth exist. For example SOW (2013) has shown through its research work that the level of education of the productive unit of the unit has a positive impact on the productivity of companies in Senegal. The purpose of this research is part of this line and is particularly a matter of studying the influence of education spending on the economic growth process. This analysis will be done from a COBB-Douglas (1936) production function with time series. In a precise way, this research aims to estimate the impact of education spending on economic growth in Senegal. Economic growth will be captured by the gross domestic product. In other words, we seek to respond through this modeling to the following question: Are education spending involve improving economic growth? As part of this research, educational expenditure is considered as a proxy of human capital.

Indeed, it must be recalled that human capital has always been a need for a must-grow in the different theories of growth and development. These theories have been subdivided into two branches namely neoclassic growth models and endogenous growth models. All of these models have granted paramount importance to human capital in the growth process. With regard to endogenous growth models, they apply that growth can be sustained and self-interest in the provision of the actors' decisions regarding investment in capital or research and development are registered in an endogenous dimension (SAVY, 2009). According to the interpretation that theorganic growthors are to develop the mechanism through which human capital is linked to growth, endogenous growth models can be classified into two groups: these are the endogenous growth models with neoclassical vision and the endogenous growth models with progressive vision (Savy, 2009). For endogenous growth models with neoclassical vision, human capital as physical capital is an input that accumulates in the production function and it is this accumulation mechanism that takes advantage. Therefore, differences in human capital levels are correlated with those in the overall production levels of countries (SAVY, 2009). With regard to the holders of endogenous growth models with progressive vision, they advance that the increase in the human capital stock is positively affecting economic growth by allowing the development of innovation and technological progress (SAVY, 2009). The empirical work that we intend to be carried out in this context will be inspired by the neoclassical model. This model was designed by SOLOW (1956). The fact has used a COBB-Douglas production function in which he incorporates two inputs to know the workforce and physical capital.

Considering the workforce as a homogeneous factor, physical capital describes an accumulation process that adapted to draw economic growth in the long term. This model known another dimension with Mankiw et al. (1992) which insert the human capital factor and taking the labor, that is to say the factor work as uncommon. Thus, they model the overall production of a given country through the following equation: translated the level of production K is the physical capital representative of the human capital stock has a design of the level of technological progress. As this is the subject of this article, the physical capital will be apprehended by control variables such as exports, imports, the credits to the economy, money supply and external debts while the human capital will estimate through education expenditures and the level of production will be measured by the constant price GDP. In this model the production level is not influenced by the process of accumulation of human capital in the long term as the change in the factors following the increase of a production unit describes a decreasing trajectory. But the increase in human capital leads to the evolution of production along a transient in front of balance (SAVY, 2009). It is in this sense that Mankiw et al. (1992) Model the growth rate of overall production through the following equation: refers to the cost of growth in GDP per capita in Country I represents the growth rate of physical capital and respectively depend on the growth rates of human capital and technological progress.

II. Specification of the regression model

From Smith (1776), the study of relations between education and growth was the subject of deep reflections in economists. Some empirical work showed a positive influence of growth on growth while others reveal a negative correlation between them. As part of this research, it is a question of explicitly exploring the impact of education spending on economic growth in Senegal. This study covers the period 1998-2017 be 20 observations. However, for the bearing the convergence of the statistical distribution, the series was quarterly through the Kahn algorithm.
Thus the economic growth considered as endogenous variable is apprehended by the gross domestic product (PIBC) while the educational variable representing the exogenous variable is captured by the overall education expenditure (DGE). However, in the case of well specified, the model, the use of control variables such as imports (IMP), exports (EXP01), the money supply (mm), external debts (Dext) and the credits to the economy (CRE) seems necessary.

The following table shows the database that served us as a support for econometric modeling.

Table 1: Database expressed in billion

Années	PIB	DGE	EXP	IMP	CRE	MM	DEXT
1998	3901,51	124,8600237	570,9	755,6	458,5	630,2	4095,4
1999	4149,14	130,7576537	632,4	845,3	486,2	714,1	4000,3
2000	4281,87	135,1991889	654,9	951,6	625,1	790,4	3653,5
2001	4478,02	147,5359862	735,3	1047,1	655,5	905,1	3701,0
2002	4507,34	152,8862737	743,4	1117,9	686,4	974,1	4118,8
2003	4808,57	168,7524318	730,6	1200,5	784,6	1280,6	4397,9
2004	5090,88	196,2396731	797,4	1318,5	856,9	1445,8	3940,3
2005	5377,12	276,2205051	832,4	1523,7	1067,0	1564,9	3861,7
2006	5509,48	55,0948	833,5	1669,9	1111,3	1751,2	1936,5
2007	5781,57	275,9138516	802,2	1995,5	1230,3	1972,0	2585,8
2008	5994,48	302,6055438	987,9	2510,4	1439,6	2006,6	2850,9
2009	6134,91	379,9306955	990,1	1947,8	1492,0	2234,6	3720,9
2010	6391,314	415,522968	1066,5	2021,9	1647,0	2540,8	3908,4
2011	6503,873	394,6803718	1236,8	2420,4	1953,0	2718,7	4324,5
2012	6792,719	403,1118832	1402,0	2870,9	2144,8	2894,7	4905,7
2013	7027,441	509,0825672	1422,5	2893,5	2414,3	2795,1	5225,6
2014	7313,814	541,3246359	1472,7	2856,0	2567,7	3109,6	5619,7
2015	7770,938	552,2945606	1669,2	2943,6	2735,1	3708,7	5893,2
2016	8277,192	534,2339212	1637,1	2900,6	2736,1	4219,0	5756,5
2017	8842,115	542,6177059	1593,0	2900,1	2679,6	3679,1	5824,8

Source: BCEAO

1. The study of stationarity

Economic and financial data are often highly dependent on time fluctuations. This is why they frequently describe non-stationary processes. It is important to remember that a variable is said to be stationary when its expected value, variance and covariance do not depend on time. To correct the non-stationarity, it is advisable to use the cointegration theory developed by Granger taking into account error correction models. The use of the Error Correction Model (ECM) is justified by the presence of cointegration relationships. Indeed, the number of cointegrations or the number of delays in the model is detected by the Johansen test. The latter has put in place two tests namely the test of the trace and that of the maximum eigenvalue. The following tables provide information on these two tests.

Table 2: Test of the trace and the maximum value

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.423397	124.9941	125.6154	0.0545
At most 1	0.316061	84.24954	95.75366	0.2371
At most 2	0.256648	56.13798	69.81889	0.3725
At most 3	0.184341	34.19069	47.85613	0.4914
At most 4	0.130044	19.11257	29.79707	0.4848
At most 5	0.109531	8.803446	15.49471	0.3839
At most 6	0.002955	0.218958	3.841466	0.6398
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.423397	40.74455	46.23142	0.1722
At most 1	0.316061	28.11156	40.07757	0.5539
At most 2	0.256648	21.94728	33.87687	0.6117
At most 3	0.184341	15.07812	27.58434	0.7420
At most 4	0.130044	10.30913	21.13162	0.7152
At most 5	0.109531	8.584488	14.26460	0.3224
At most 6	0.002955	0.218958	3.841466	0.6398

Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's calculation under Eviews

These tests show the absence of cointegration relationships in the model, which means that the use of the ECM is not optimal. Thus, we will estimate the model by differentiating the integrated variables to make them stationary. It must be remembered that non-stationarity is detected by the presence of a unit root. The following table summarizes the various Dickey-Fuller stationarity tests augmented.

Table 3: Increased Dickey-Fuller stationarity test

Variables	t-statistic	p-value
D(log(PIB))	-1,961045	0,0483
D(log(DGE))	-8,602322	0,000
D(log(IMP))	-8,602325	0,000
D(log(EXP01))	-8,579612	0,000
D(log(CRE))	-7,692714	0,000
D(log(MM),2)	-1,965961	0,0467
D(log(DEXT)	-15,92645	0,000

Source: Our results under Eviews

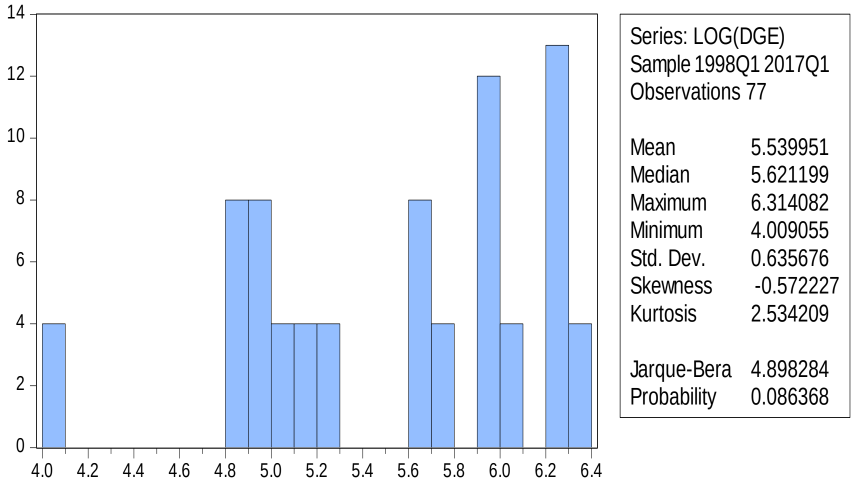
The endogenous variable, that is to say, the GDP displays a p-value (0.0483) which is below the 5% significance threshold, so we reject the null hypothesis of the presence of a unit root. Thus the hypothesis of absence of the unit root is confirmed, which corroborates the stationarity of the endogenous variable at the first degree of integration. . Dicker-Fuller's first-difference test on the "imp" variable reveals a null p-value that is less than the 5% significance threshold, which leads to the nullation of the null hypothesis of root presence. unitary hence the variable "imp" is stationary.

After differentiating the series to the first degree of integration, the increased Dickey-Fuller test on the variable "exp01" displays a p-value of zero less than the significance level of 5%, hence the confirmation of the alternative hypothesis. of absence of the unit root. It is therefore concluded that the variable "exp01" is stationary at the first degree of integration. The p-value obtained from the variable "dext" is less than the significance level of 5%, so it is concluded that it is stationary. The increased Dickey-Fuller test on the "cre" variable shows a p-value equal to 0.0467 below the 5% significance level, so the null hypothesis of the presence of the unit root is invalidated. It is therefore concluded that the latter is stationary with a first difference. After differentiating the series to the second degree of integration, the p-value of the variable "mm" is zero, therefore less than the significance level of 5%. This translates that the null hypothesis of the presence of the unit root is accepted from where the latter is stationary with a second difference.

2. Normality test

The Jarque Béra normality test shows a p-value that is greater than the 5% significance level, which reflects the confirmation of the normality hypothesis of residues. In other words, the errors follow a Gaussian law (normal law).

Chart 1: Jarque Béra normality test



3. Heteroscedasticity test

One of the main assumptions for ordinary least squares regression is the homogeneity of the variance of the residues. If the model fits well, there should be no link between the residue and the predictor. The test of heteroscedasticity of White thus informs on the constancy of the variance. Using this test with null hypothesis: constant variance, we conclude that the residues are homoscedastic because of the p-value Obs * R-squared (Prob = 0.7537) greater than 0.05 so significant at the threshold of 5%.

Table 3: White Heteroscedasticity Test

Heteroskedasticity Test: White			
F-statistic	0,542635	Prob. F(6,68)	0.7739
Obs*R-squared	3,426891	Prob. ChiSquare(6)	0.7537

4. Autocorrelation test for residues

This test is of capital importance because it makes it possible to detect a possible autocorrelation of the errors. There is a multitude of statistical processes developed to verify the autocorrelation of residues. In this analysis, the autocorrelation of residues was verified using the Breusch-Godfrey test with a p-value equal to 0.5112 greater than the significance level of 5 % = 0.05 hence the null hypothesis of no autocorrelation of errors is accepted.

Table 4: Autocorrelation test for Breusch-Godfrey errors

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.142543	Prob. F(2,66)	0.0497
Obs*R-squared	6.521145	Prob. Chi-Square(2)	0.0384

Source: results of the author under eviews

The p-value of Obs * R-squared is less than 0.05, the null hypothesis of no autocorrelation of the residues is rejected. To correct the autocorrelation, we used the iterative method of Cochrane-Orcutt which consists in introducing into the equation a self-regressive variable denoted AR (1). The following table shows the equation after the introduction of the variable AR (1).

Table 5: Correction of autocorrelation

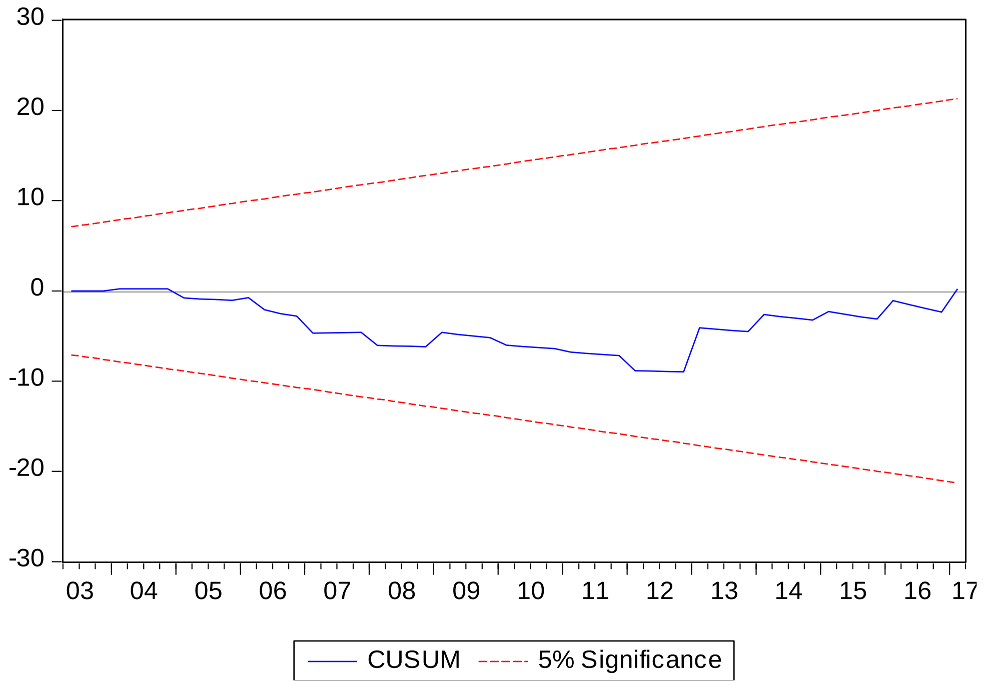
Dependent Variable: D(LOG(PIB))				
Method: ARMA Maximum Likelihood (OPG - BHHH)				
Included observations: 75				
Failure to improve objective (non-zero gradients) after 9 iterations				
Coefficient covariance computed using outer product of gradients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006695	0.004598	1.456050	0.1501
D(LOG(IMP))	-0.038475	0.076989	-0.499751	0.6189
D(LOG(EXP01))	0.145339	0.074996	1.937947	0.0569
D(LOG(CRE))	0.118611	0.061042	1.943102	0.0563
D(LOG(DGE))	0.032102	0.023326	1.376253	0.1734
D(LOG(DEXT))	-0.073066	0.044781	-1.631627	0.1075
D(LOG(MM),2)	0.085632	0.018427	4.647194	0.0000
AR(1)	0.006137	0.388230	0.015809	0.9874
SIGMASQ	0.000185	4.61E-05	4.021457	0.0002
R-squared	0.562058	Mean dependent var		0.010909
F-statistic	10.58810	Durbin-Watson stat		1.557508
Prob(F-statistic)	0.000000			

Source: Our results under Eviews

5. Stability testing of the model

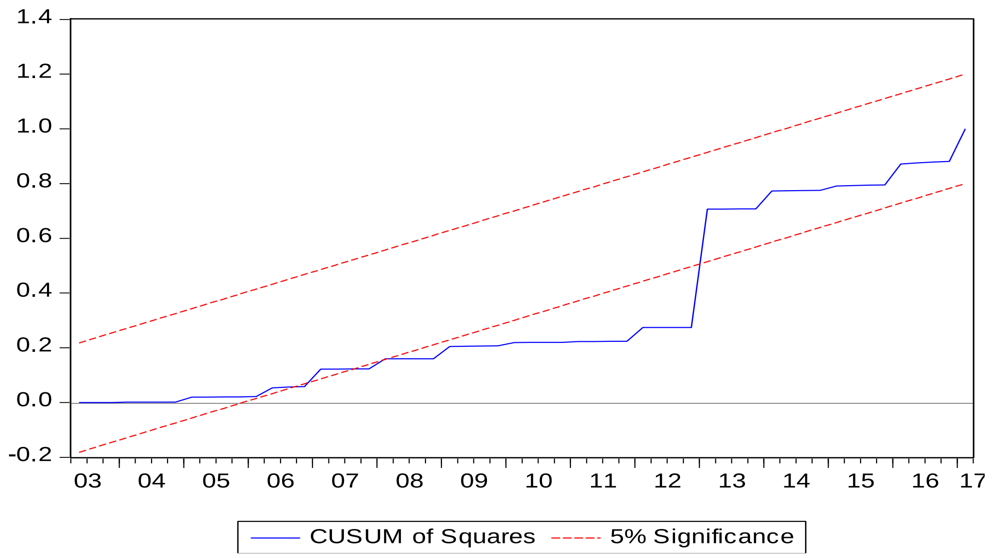
To study the stability of a model, one can use the Chow test, the Cusum test or the square Cusum test. The use of Chow's test requires a year of rupture to capture instability. As for the Cusum test, it confirms the hypothesis of structural stability of the model if the curve does not leave the corridor while that of the square Cusum confirms the assumption of point stability of the model if the curve does not leave the corridor.

Chart 2: Cusum Test



Source: Our results under Eviews

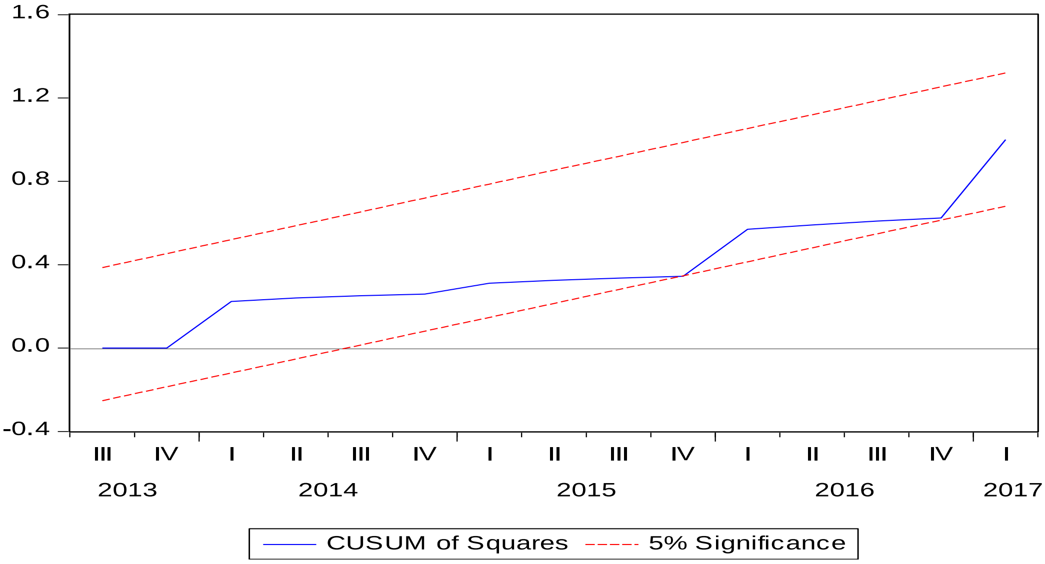
Chart 3: Square Cusum Test with Indicator Variable



Source: Our results under Eviews

The curve obtained comes out of the corridor so we conclude to a point instability observed during the years 2010, 2011 and 2012. Indeed this situation is explained by the fact that during these years, the country was in an election period. Thus to correct this instability, an indicator variable is introduced into the model and the return to stability is illustrated by the graph below.

Graph: Square Cusum Test within indicator variable



Source: Author's calculation

The following table gives the results of the Fisher regression and overall significance test and the individual significance test of Student coefficients.

Table 6: Least Squares Regression Results

Dependent Variable: D(LOG(PIB))				
Method: Least Squares				
Sample (adjusted): 1998Q3 2017Q1				
Included observations: 75 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006219	0.002451	2.537625	0.0135
D(LOG(IMP))	-0.050498	0.046627	-1.083011	0.2827
D(LOG(EXP01))	0.167158	0.064180	2.604528	0.0114
D(LOG(CRE))	0.124279	0.045308	2.742987	0.0078
D(LOG(DGE))	0.036009	0.013924	2.586161	0.0119
D(LOG(DEXT))	-0.085325	0.038486	-2.217011	0.0301
D(LOG(MM),2)	0.091016	0.020824	4.370736	0.0000
INDI	-0.001382	0.003236	-0.427109	0.6707
INDI1	0.036820	0.009637	3.820831	0.0003
R-squared	0.647314	Mean dependent var		0.010909
Adjusted R-squared	0.604564	S.D. dependent var		0.020707
F-statistic	15.14190	Durbin-Watson stat		2.022272
Prob(F-statistic)	0.000000			

Source: Our results under Eviews

III. Results interpretation

The model is globally significant at the 5% threshold with respect to the p-value (Prob> F = 0.0000) of the Fisher test, well below this threshold. This means that the coefficients of the explanatory variables are not all statistically zero and that there is at least one explanatory variable whose coefficient is significant. Moreover, nearly 64% of the variability is explained by the model because of the value of the (see results of the regression).

The interpretation of the influence of a variable is only possible at the 5% threshold when its coefficient is statistically non-zero. In practice, the coefficients of the statistical variables are significant when its student (t) statistic is larger than the theoretical student statistic () read on the student table at 13 degrees of freedom and at the 5% threshold, or when its p-value of the student test (P> t) is smaller than 0.05. Thus, the variables "exp01" (exports), DGE (education expenditure), MM (money supply), CRE (loans to the economy) and DEXT (external debts) show p-values of less than 5% (cf. at the regression table). This means that these variables have a significant influence on the endogenous variable, namely economic growth. However, the variable "IMP" is not significant because of its p-value which is greater than 0.05. Indeed the educational variable displays a coefficient that is equal to 0.03. This result is of capital importance because it shows that the 1% increase in spending on education leads to a 3% increase in the estimated domestic product. In turn, it follows that educational spending has a positive impact on economic growth in Senegal.

IV. CONCLUSION

The State of Senegal has made many efforts in recent years to redress its educational system. These efforts are materialized by the many expenses noted in this sector. The results of the econometric estimates revealed a positive and significant correlation at the 5% threshold between these expenditures and economic growth for the period 1998-2017. In spite of the importance of these expenses, it is noted today that many trained from the Senegalese education system and more particularly the superior face difficulties of professional insertion after their formation. It is therefore necessary to review the types of training delivered to improve external effectiveness in order to align training with the need of the labor market. The state has an interest in studying the structure of the labor market to adapt the training to the human resources needs of companies. In certain sectors, there are plethoric numbers of learners who generate significant expenses because the State allocates them social benefits (scholarships). So, it is necessary to limit these flows by putting in place projection policies.

At the level of each branch of activity, the government must anticipate the need for human capital. Thus, it will be able to channel the level of demand for training at the level of each sector.

The establishment of a conceptual framework for the production (computer application) of statistical data within educational institutions is a necessity because there is a certain disorganization of the latter in these structures. A good statistical organization of educational data within each educational institution would facilitate subsequent quantitative studies.

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