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9 February 2015

Online at <https://mpra.ub.uni-muenchen.de/62008/>

MPRA Paper No. 62008, posted 12 Feb 2015 10:19 UTC

Government spending in education and economic growth in Cameroon. A Vector error Correction Model approach

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Abstract: This study aims at assessing the effect of government spending in education on economic growth in Cameroon over the period 1980-2012 using a vector error correction model. The estimated results show that these expenditures had a significant and positive impact on economic growth both in short and long run. The estimated error correction model shows that an increase of 1% of the growth rate of private gross fixed capital formation and government education spending led to increases of 5.03% and 10.145 % respectively in the long-run on economic growth . Education spending thus appears as one of the main driving force of the economic growth process in Cameroon.

Keywords: Economic growth, VECM.

1- Introduction

Education in Cameroon is based on the British and French educational systems. As such, there are two educational systems in the country. In the French speaking regions or areas, the French system of education dominates, while in the English speaking regions or areas, the English pattern of education prevails. The colonial background and the diversity of the Cameroonian society make the Cameroonian educational system unique in Africa (Amin and al, 2005). The dual structure of education creates structural constraints that have made the development of education complicated. For instance, Secondary education is four years in the Francophone sub-system, while it is five years in the Anglophone sub- system. However, at high school, before entry into University, it is three years for the Francophone and two years for the Anglophone student. In addition to the duality of language teaching, in Cameroon, education is provided by public and private sectors. The private sector includes religious and private lay institutions which are usually supported by the government through subvention. The Ministry of Basic Education, the Ministry of Secondary Education, the Ministry of Employment and Vocational Training and the Ministry of Higher Education are the institutions in charge of education in Cameroon(UNESCO, 2011).

According to Ismail (1998), education is considered as a long term investment that leads to a high production for a country in the future. The conviction, that education promotes growth has led governments of many developing countries such as Cameroon to invest in the education sector. Even the theoretical literature also provides support for such a policy. However, the empirical literature has failed to establish a strong relationship between education expenditures and growth. According to the economic theory, it is expected to have a positive causal relationship to exist between education expenditure and economic growth. But different empirical papers investigating the above mentioned relationship in different countries come up with different results. The general objective of this paper is therefore to analyze the effect of public education spending on the economic growth in Cameroon. The structure of the article is as follows: section 2 briefly reviews the existing literature, section 3 discusses the methodological issues, section 4 presents the results and discussion of results and finally section 5 emphasize on conclusion and recommendations.

2- Brief literature review

A number of studies have focused on the relation between government expenditure and economic growth in developed and developing countries like Cameroon. The results varied from one study to another. Azomahou et al. (2009) makes use of generalized additive models and shows that countries which are near the technology frontier have to invest in higher education while those far away from the frontier can enhance their technology level by investing in primary and secondary schooling. The study differs from others as it shows the need of complementarities between education and R & D expenditures that is essential for economic growth. The study takes enrollment ratio to measure education which may not be a very good indicator as it fails to capture the dropout rates or passing ratio.

Otani and Villanueva (1990), in a study carried out on 55 developing countries from 1970 to 1985 found that educational program and human capital investment such as vocational training and health training would increase a country's output and per capita income. Consequently, the countries would achieve high level of economic performances. The research demonstrated that human capital development contributes an annual average of 1% increase in developing countries' growth rate.

Permani (2009) in his study on development strategy in East Asia concluded that this region give greater emphasis to education. His study found that there is positive

relationship between education and economic growth in the East Asia. In the meantime, there is bidirectional causality between education and economic growth. Pradhan (2009) supported this finding and proved that education has high economic value and must be considered as a national capital. He suggested that this capital must be invested and his country, India, must capitalize this human capital development besides the physical capital that contributes to country's economic growth.

Afzal and al. (2010) acknowledged that education has positive long-run and short-run relationships on economic growth in Pakistan. This is in line with findings from Lin (2003), and Tamang (2011) on their studies in Taiwan and India respectively. In addition Baldacci and al. (2004) documentation on 120 developing countries from 1975 – 2000 found that there are positive relationships in the long-run between educational expenses and economic growth.

Nevertheless, finding by Kakar and al., (2011) on their study in Pakistan concluded that there is no significant relationship between education and short-term economic growth but the educational development has impact in the country's long run economic growth. These findings demonstrated that government expenditure in educational sectors does not only have a positive impact on a country's economic growth in a short run but in the long run as well.

According to Blaug (1970) and Sheehan (1971), investment in education is just merely consumption. This is due to the fact that investment in acquiring knowledge or skills is for the individual interests only and does not contribute into the economic growth. To support this argument, empirical study by Devarajan and al., (1996) on 43 developing countries showed that excessive government expenditure in education negatively correlated with the countries' economic growth.

Alexander (1990), applied OLS method for sample of 13 Organization for Economic Cooperation and Development (OECD) countries panel during the period ranging from 1959 to 1984. The results show, among others, that growth of government spending in all sectors has significant negative impact on economic growth.

3- Methodology and data source

In this study, we are interested in testing the effect of government spending in education on economic growth in Cameroon from 1980 to 2012. The secondary data used cover the

period of 1980 to 2012. Data was collected from the World Development Indicators CD-ROM 2013 (WDI).

3.1- Model specification

The model used in this work is based on the Cobb-Douglas production function.

$$Y=A.K^\alpha L^\beta H^\gamma \dots\dots\dots (1)$$

Y is output, "A" is technological progress, "K" is capital stock, "L" is labour force, and "H" is used for Human capital. Human capital can be replaced with "E" where "E" is government expenditure on education. We can replace "H" with "E", and rewrite the equation as,

$$Y= A.K^\alpha L^\beta E^\gamma \dots\dots\dots (2)$$

Equation (2) given above, is modified as follows:

$$Y_t = A.GFCFP_t^\alpha EXP_t^\beta GOVEDU_t^\gamma \dots\dots\dots (3)$$

Where; Y= Output (Real Gross Domestic Product).

GOVEDU= Government Expenditure on Education.

GFCFP =Private Gross Fixed Capital Formation.

EXP = exportation.

t = Times.

Since this equation is a non-linear model, parameter values for A, α , β and γ are not be able to be directly estimated. Therefore, it is suggested to amend the production function into log-linear model as follows:

$$\ln GDP_t = \ln A + \alpha \ln GFCFP_t + \beta \ln EXP_t + \gamma \ln GOVEDU_t + e_t \dots\dots\dots (4)$$

The estimations of this paper will be based on the above equation four.

3.2- Estimation procedure

Research finding from the vector error correction model (VECM) tests will be analyzed accordingly. This begins with unit root test, Lag length test, co- integration test and finally with the Vector Error Correction estimation.

4- Presentation and discussion of results

4.1- Pre-estimation and post estimation test

➤ Unit root test

Before regression, stationarity of the variables is analyzed using the augmented Dickey–Fuller (ADF). The table below is a summary of the stationary test:

Table1: Summary of unit root test

Variables	Dickey-Fuller statistics	p-value	Decision
LGDP	-3.438***	0.0097	I(0)
LGOVEDU	-4.094***	0.0010	I(0)
LEXPORT	-2.583**	0.0266	I(1)
LGFCFP	-2.638**	0.0355	I(1)

SOURCE: Author using Stata 11.0

From the table one above, we noticed that LGDP and LGOVEDU stationary at level at 5% while LEXPORT and LGFBCF are stationary after first difference.

➤ Lag length test

To test for co-integration or fit co-integrating VECM, we must specify how many lags to include. Appropriate lag length selection is important in order to assure the research findings reflect real economic situation and importantly the findings are consistent with economic as well as econometric theories. Based on the likelihood ratio, this study will select lag length of 4. The table below is a summary of the lag length test:

Table2: Summary of lag length test

LAG	LR	FPE	AIC	HQIC	SBIC
0		2.9e-06	-1.39727	-1.3382	-1.20868*
1	53.81	1.4e-06	-2.14934	-1.85401*	-1.20637
2	34.819	1.4e-06*	-2.24654*	-1.71496	0.549211
3	23.559	2.2e-06	-1.95547	-1.18763	0.496233
4	37.139*	2.8e-06	-2.13269	-1.12859	1.07338

SOURCE: Author using Stata 11.0

➤ Co-integration analysis

Having established that the variables are stationary and have the same order of integration, we proceeded to test whether they are co-integrated. To achieve this, Johansen Multivariate Co-integration test is employed. The results of the Johansen's Trace and Max Eigenvalue tests are shown in appendix1. These results show us that there exists one co-integration equation because the maximum rang is 1 ($r = 1$). What means there exists long-run relationships between the variables.

➤ Serial correlation in the residuals and stability test

Using the Lagrange-multiplier test as shown in appendix2 it is possible to note that there no autocorrelation of residual at lag orders. The graph of the eigenvalues (in appendix3) shows that none of the remaining eigenvalues appears close to the unit circle. The stability check does not indicate that our model is misspecified.

4.2- Estimation results

Table3: Long-term coefficients

Dependent variable (lnGDP)	Independent Variables			
	ln Education	ln Exportation	Ln GFCFP	C
Coefficient	10.14482	-5.036161	5.036161	-9.135593
p-value	0.00	0.00	0.00	-
SOURCE: Author using Stata 11.0				

These coefficients represent long-term elasticity measures. The long-term equation shows that the GDP values are positively and significant related with the GFCFP variable in long-run. That is an increase of 1% of GFCFP leads to 5.036 % of GDP in long-run. This finding is consistent with Ali et al., (2009) which found that capital has positive relationship with GDP variable in Malaysia. This is due to the readiness of big capital amount that would lead into positive injection in economic growth (Solow, 1957). In addition, the abovementioned long term equation showed that there is a significant and negative relationship between long term export and GDP. The increase of 1% of export leads to reduce the GDP by 5.036% in long-run. This research proved that there is positive and significant relationship between educational expenditure and GDP in long-run as suggested by previous studies such as Tamang (2011) which demonstrated that education plays a vital role in a country's economic growth by

producing skilled and knowledge work force. In our study, the increase of 1% of GOVEDU leads to an increase of 10.145% of GDP in long-run.

Table4: Short-run coefficients

Variables	Equation1 (LGDP)	Equation2 (LGovedu)	Equation3 (Lexport)	Equation4 (Lgfcfp)
ECT-1	-0.214**(0.087)	-0.589(0.046)	0.049 (1.09)	-0.107 (0.041)
LGDP(-1)	-0.861*(0.202)	-0.128(0.180)	-0.116(106)	0.180*** (0.95)
LGDP(-2)	- 0.457(0.303)	0.135(0.161)	-0.210(0.159)	0.137(0.143)
LGDP(-3)	-0.229(0.187)	0.149(0.1000)	-0.145(0.98)	0.47(0.89)
LGovedu(-1)	2.506**(0.881)	0.788(.470)	0.019(0.462)	0.621(0.416)
LGovedu(-2)	1.900**(0.848)	0.296(.452)	0.041(0.444)	0.372(0.401)
LGovedu(-3)	0.820(0.601)	0.289(0.2608)	-0.112(0.314)	0.381(0.284)
Lexport(-1)	0.390(0.571)	0.157(0.205)	-0.406(0.300)	-0.379(0.270)
Lexport(-2)	0.261(0.514)	-0.41(0.213)	0.067(0.269)	-0.364(0.243)
Lexport(-3)	-0.78*** (0.456)	0.036(0.244)	0.087(0.239)	-0.293(0.216)
Lgfcfp(-1)	0.151(0.577)	0.329 (0.308)	0.014(0.302)	0.108(0.273)
Lgfcfp(-2)	1.485**(0.454)	0.117(0.242)	0.0885(0.237)	0.085(0.215)
Lgfcfp(-3)	-0.21(0.593)	0.205(0.240)	0.278(0.234)	0.086(0.212)
R-2	0.8500	0.3944	0.5162	0.5553
P>Chi-2	0.0000	0.7789	0.3129	0.1755

SOURCE: Author using Stata.

*Significant at 1%, **Significant at 5%, ***Significant at 10%, () is standard error.

Based on the data used, the table shows that in the VECM equation 1, we can observe that the previous GDP are negatively related to the current GDP, only the first one of them is significant. This reflects some shocks that Cameroon's economies faced over our period of study. The first two year lagged of govedu (Govedu(-1) and Govedu(-2) have positive and significant impact on gross domestic product (GDP). That is the two last previous years of government education expenditure (Govedu(-1) and govedu (-2) increase the GDP of current

year of 2.50 and 1.900 respectively. The increases of 1% of the government education expenditure of these two lagged years increase the current GDP of 2.50% and 1.90% respectively. This result confirms the theory of Ejiogu (2013), that government education expenditure gives a boost to economic growth.

From this first equation again, we also observe that the first two lagged year of exportation (export (-1) and export (-2)) are positively related to current GDP but none of their coefficient is statically significant. But the third lagged year of exportation is negatively and significantly related to the GDP. That is 1% of the increase of the exportations three years before reduce the current GDP of 0.78%. We also observe that the second lag year of gross private fixed capital formation (GFCFP) is positively and significantly related to GDP. An increase of 1% of GFCFP two years before leads to 1.48% of increasing of the current GDP. The error correction term (ECT) for this first equation has the expected negative sign and indicates that 21.4% of the drift from the long equilibrium value will be restored within a year and the coefficient is equally statically significant at 5% (p-value < 0.05). The R-Square and the p-value of this equation are significant which means that the model fits well and we can say that at all the variables explain the GDP even if some previous variables explain the current GDP. What is normal because the GDP is often calculated at the end of a given period. The R-2 value stipulates that the variables here contribute to explain around 85% of variations of GDP.

From the equation 2, we notice that the first previous GDP (GDP-1) is negatively related to government education spending but the second and the third previous GDP are positive related to the govedu. This may explain the fact that the level of GDP does not explain the current's government education expenditure since none of their coefficients is significant. The government educations spending of the third previous year are positive related with the current's government education spending even if their coefficients are non-significant. The exportations of the first previous year and that of the third previous year are positively related to government education spending whereas that of the second previous year is negatively related to current government education spending. None of their coefficient is significant. The three previous year of private fixed capital formation are positive related to government education spending but none of their coefficient is significant. Their R-Square is not significant.

From the third equation, we observe that the third previous year's GDP are negatively related to the exportation. None of their coefficients are significant. The first two previous year of government education expenditure are positively related to exportations and the third previous year is negatively related to exportations. The first and third previous year's

exportations ((export(-1) and export (-3) are positively related to current export whereas that of the second previous year is negatively related to the current exportation. All the first three previous year's private fixed capital formation ((gfcfp(-1),gfcfp(-2) and gfcfp(-3)) are positively related to the current exportations.

From the fourth equation, we observe that all the first three previous year's GDP ((GDP-1), GDP (-2) and GDP (-3)) are positively related to the private fixed capital formation. But only the first of them is significant at 10%. That is, increase of 1% of the first previous year's GDP everything being equal leads to 0.180% increase of private fixed capital formation at 10%.

5- Conclusion and recommendations

In this study, we were evaluating the role of public education spending on economic growth in Cameroon from the period 1980 to 2012. In this study, it was therefore found out that there is a significant relationship between public education spending and economic growth in long-run in Cameroon since the result obtained was positive and statically significant. We therefore say that public education spending is an essential factor that affects economic growth in Cameroon, as such for any policy measures aimed at ameliorating the economic growth of Cameroon, public education spending must be taken into consideration. Meanwhile, investigating into other factors that influence economic growth, we found out that private fixed capital formation of two years before were statically significant to explain the current GDP but in long-run private fixed capital formation positively influence the GDP. We therefore, say private fixed capital formation is a major determinant of economic growth in Cameroon, and must be considered for any policy measures to improve the economic growth of Cameroon.

Based on the above results, the Cameroonian authorities have to proceed to the quantitative and qualitative amelioration of supply of educational services. The authorities are invited to pursue their policies of building classroom in all the regions of the country, develop the technical and scientific education and increase the teaching system in the basic and secondary education. In the higher education, authorities need to develop engineering domains in order to be a competitive economy. Efforts should be made to increase government funding on education to curtail the level of strike in our education sector.

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Appendices

Appendix1: Co-integration test

. vecrank Lgdp Lgovedu Lexpor Lgfcfp, trend(constant) lags(4)

Johansen tests for cointegration
Trend: constant Number of obs = 29
Sample: 1984 - 2012 Lags = 4

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	52	72.458986	.	52.9301	47.21
1	59	86.371825	0.61692	25.1044*	29.68
2	64	94.791822	0.44049	8.2644	15.41
3	67	98.546521	0.22813	0.7550	3.76
4	68	98.924043	0.02570		

Appendix2: LM test

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	11.0099	16	0.80887
2	20.7870	16	0.18685
3	12.6387	16	0.69897
4	10.6247	16	0.83204

H0: no autocorrelation at lag order

Appendix3: Stability test

Eigenvalue stability condition

Eigenvalue	Modulus
1	1
1	1
1	1
.4957206 + .6971363 <i>i</i>	.855417
.4957206 - .6971363 <i>i</i>	.855417
-.3162733 + .7203375 <i>i</i>	.786711
-.3162733 - .7203375 <i>i</i>	.786711
-.7856905	.78569
-.6570676 + .4232397 <i>i</i>	.781582
-.6570676 - .4232397 <i>i</i>	.781582
.1883479 + .7472945 <i>i</i>	.770665
.1883479 - .7472945 <i>i</i>	.770665
.5019357 + .527441 <i>i</i>	.728103
.5019357 - .527441 <i>i</i>	.728103
-.4102206	.410221
-.1052806	.105281

The VECM specification imposes 3 unit moduli.

